SOFTWARE STRATEGIES

White Paper

On Mainframe's 50th Anniversary, IBM's z/OS® Problem Determination Tools Suite Holds Lead Again as ISVs Strive Harder

2014 Strategic Competitive Analysis

About this White Paper

*On April 7th 2014, IBM celebrated the **50th Anniversary** of the **IBM System/360™** – the first IBM mainframes – announced that day in 1964, starting half a century's IT industry-changing growth and success, a dramatic 1990s near-death, and strong technology-led resurgence again since. Mid-2014 finds current generation IBM zEnterprise® mainframes again clearly pre-eminent large-medium enterprise IT platforms, powered there by IBM's $55B+ mainframe hardware and software investments to date, including 7 new generations since 2000 alone.*

*As economic recovery spreads, stock markets, business confidence – new investment, and mergers & acquisition (M&A) activity, are all sharply up in many advanced nations, whilst cooled emerging economies still post gross domestic product (GDP) growth several-fold higher. A majority of new businesses investment is IT-enabled or dependent, and the exceptional capabilities, highest-performance, unrivalled software stack, rock-solid security and reliability, and lowest total cost of ownership (TCO) economics, of the zEnterprise® System mainframe ensure it will power a large proportion of these. Many vital new applications – enabling **mobile device access, adding advanced analytics, handling big data**, integrating **social media**, exploiting **cloud computing**, and **consolidating distributed workloads** – are today all best deployed on IBM's outstanding mainframe software stack, and leadership zEnterprise® System hybrid hardware.*

*With these growth workloads in mind, in 2014 all mainframe sites – who have not yet done so – should review their mainframe Application Development (AD) tooling. Recent years saw sharp improvements in host AD tools, to better support the new business applications above (and existing portfolios), making this **the right time to re-equip** the enterprise with the best modern AD products available today.*

***Problem Determination Tools (PD tools) for z/OS®** suites are one such vitally important host AD tool category. These help host developers debug, test, and tune mainframe applications **better, faster, and cheaper**, and are thus a crucial foundation for every host site's AD toolbox. Independent Software Vendors (ISVs) earlier dominated this segment, but IBM's 2000-on entry – and extensive advances since – changed everything.*

*A top PD tools suite raises host application quality and performance, cuts MIPS use, supports new Service Oriented Architecture (SOA) (plus traditional) host software technologies, raises **DevOps productivity**, and speeds new/modernized applications time to value. Top PD tools suites now also provide modern Graphical User Interface (GUI) access that provides better support for younger host staff too.*

*After 15 years of intense development, IBM today offers an **again-updated, compact** suite of **modern, well-featured**, and **fully-integrated**, PD tools in its latest V13.1 releases. IBM's fast-advancing suite first fiercely challenged, then caught, and since overtook prior dominant ISV PD tools suite vendors (Compuware, CA Technologies, etc.) with **better currency, deeper SOA support, improved features/functionality, broader inclusive coverage, good integration, outstanding GUI support, lower software costs**, excellent vendor service/support, and **sound strategic direction**. IBM's suite also offers this segment's strongest support for the now-widespread, fast-growing, and crucial host Java™ EE-based workloads (e.g. Web, SOA, mobile...).*

*Software Strategies estimates ~2,300 System z™ customers (each with several tools) have now moved to this IBM® PD Tools for z/OS® suite, gaining **large software cost savings, better currency** with fast-advancing z/OS® software stacks, and latterly superior functionality, together with the now most fully developed and extensive modern workstation GUI access options for main suite tools.*

After many requests, Software Strategies now publishes this completely updated 5th Edition White Paper – in July 2014 – assessing all segment changes over the last 3+ years. All new mainframe customers – and existing System sites yet to migrate their PD tools suite – will again find this latest comparative PD tools suites study invaluable and definitive.

We first recap the mainframe's 50th Anniversary and sketch IBM's leading-edge mainframe software stack advances, for proper context. We explain mainframe PD tools suite functions, products, roles, and benefits, introduce IBM's latest PD tools suite with V13.1 releases, and identify and profile the four main ISV segment competitors.

*Our **seven strategic criteria** for selecting a new PD tools suite are detailed – and used to compare/assess – the five vendor suites covered. For 2014, we found IBM – with the fastest-advancing PD tools suite – remained ahead, slightly extending its strategic lead over its main competitor over our Review Period, despite three active competitors also strongly enhancing their PD tools suites. Read on for our findings.*

1. Executive Summary

This Executive Summary summarizes our main findings, assessments, and conclusions from this new 2014 5th Edition of our White Paper following:

1. **Mainframe's 50th Anniversary Party:** IBM celebrated the **mainframe's 50th anniversary** on April 7th 2014, the day of the 1964 IBM System/360™ first generation announcement. The S/360 family – and **always fully-compatible successor generations** – were **incredibly successful** with enterprises in every sector, and with government bodies, worldwide. They brought IBM three decades of **unparalleled growth and success** as the **far-dominant enterprise IT platform** that changed our world, and pioneered scores of new technologies. After its dramatic 1990s near-death, IBM slowly revived the mainframe by 2000. Since then, **7 new generations of 64-bit z/Architecture™ hardware**, and an avalanche of **leading-edge IBM System z™ software**, brought **IBM's host investment to date to $55B** and powered a mainframe resurgence to again **unquestioned enterprise platform leadership** today. Figure 1 illustrates highlights from this amazing journey.

...brought IBM's host investment to date to $55B and powered a mainframe resurgence to again unquestioned enterprise platform leadership today.

Taking its own medicine, IBM runs the world's largest private cloud on the IBM mainframe...

2. **World's Largest Private Cloud:** Taking its own medicine, IBM runs the **world's largest private cloud** on the **IBM mainframe**, providing **analytic insights** from **<100 data warehouses**, enabling **300,000+ IBM employees** to make better decisions, achieving **$20M+ in savings** and **$300M+ of business value** over 5 years. *(Source: IBM Blue Insight Project.)*

3. **New Mainframe Tools Needed, Justified:** The growing mainframe user base – most also growing MIPS capacity to power their new zEnterprise® System workloads – can readily justify investment in more productive, modern, and more affordable, tools for the platform's flagship z/OS® operating environment. **z/OS® Problem Determination tools** – encompassing mainframe **application debugging, fault analysis, file management**, and **application performance management**, software tools – this White Paper's topic – are one such vital tool category.

50 Years of Innovation & Leadership

IBM's Mainframe Investment Has Exceeded $55B...

Constant Evolution Driven Through Co-creation With Mainframe Customers

Source: IBM 4.2014 Rosamilia

Figure 1: 50 Years of Innovation & Leadership – IBM's Mainframe Investment Has Exceeded $55B

Competitor-inspired scare-stories of looming mainframe skills shortages were more urban myth than fact.

4. **Mainframe Workforce in Good Shape, Productive:** Competitor-inspired scare-stories of looming mainframe skills shortages were **more urban myth than fact**. Many 100,000s of expert host professionals still provide loyal service **at ~11,000 System z™ sites worldwide**, with such skills reportedly **readily hired** in most developed nations. Indeed, since 1998, most host sites **recruited/trained** their own new staff, first for Year 2000 *(Y2K)*, and later for workloads growth. Meanwhile, several 100,000-strong mainframe-skilled staff pools were created at **outsourcing/offshore AD firms** in India, China, Brazil, Russia, Mexico, and Ukraine, etc., most performing host AD projects for Western users. The many-fold host operations staff productivity advances – realized via scores of System z™ software/automation improvement – also meant that far bigger workloads could now be run by the same size *(or even smaller)* teams.

5. **Academic Initiative Delivers Young "zNextGen" Staff:** IBM invested heavily in its now 1,000+ university/school **Academic Initiative for System z™**, reaching **180,000+ students in over 70 countries** since 2003. Initiative graduates were snapped up by System z™ customers, already schooled in mainframe basics plus new z technologies like Java Enterprise Edition™ *(Java EE™)*, SOA, and Linux, etc. Today's z/OS® Problem Determination, and many other host tools today, now also provide modern GUI access, easing on boarding for such younger new System z™ staff. *(We cover points 1 to 5 above in Section 2.)*

6. **Why z/OS® PD Tools are so Important:** z/OS® PD tools provide *(at least)* five essential services to mainframe development, testing, and operations support teams, each vital for quality and availability of both "SOA, etc." new, and traditional, applications alike. These are:
   - Mainframe **application program interactive debugging**.
   - Analyzing/fixing mainframe applications failures – **abend/dump and fault analysis**.
   - **Mainframe file/data management**, to fix production and test file/data issues, and to create test data, etc.
   - **Monitoring the performance of** – **and tuning up** – mainframe applications.
   - **Workload generation, testing, and quality assurance** – for mainframe applications.

   Important supporting functions like **application time simulation** and testing, and **file extraction/export/migration** – also widely needed – are also included in our PD tools category.

7. **Compelling PD Tools Suite Benefits:** Today's best PD tools suites offer compelling benefits, including **increased developer productivity, faster application delivery, better application quality-availability, faster repair time** to fix application issues, **improved runtime performance**, and **lower mainframe MIPS usage**. These valuable benefits provide a **high Return on Investment** *(ROI)* on migrating/upgrading to the "best-of-breed" PD tools suite, and *(for new host sites)* buying their first suite.

8. **MIPS Savings – A Big PD Tools Suite Plus:** Despite this decade's dramatic hardware/software price drops, System z™ **MIPS remain precious**, must always be optimally used and **never wasted**, to attain the lowest TCO provided by a well-run host site. Cutting host application failures and tuning-up production performance **both cut mainframe MIPS use**. The best PD tools suites rapidly pay off their initial costs in such MIPS savings alone, their other valuable benefits above are added bonuses.

9. **PD Tools Suites vs. Point Products:** The main PD tool products above **must interoperate/integrate** with adjacent host tools to best support **DevOps** lifecycle processes. So **well-integrated, compatible PD tool suites** are far preferable to mixes of point products from several ISVs, provided that full suite integration is built-in, and suite alignment kept close *(not always so)*. Competitive PD tool suites today must now also provide modern *(Eclipse Rich Client Platform – RCP)*-based workbench tooling, for easier access to main PD tool host services. These PD tool GUI facilities must also integrate well *(via plug-ins)* with other important IBM z/OS®-focused GUI workbench tools, the well-established **IBM® Rational® Developer for System z™** *(RDz™)* host Integrated Development Environment *(IDE)*, the **IBM® CICS® Explorer** for CICS® users, and now also the **IBM® IMS™ Enterprise Suite Explorer** for IMS™ developers, etc.

10. **PD Tools Suites for z/OS® – Replacement Due?** After Year 2000, this **long-ISV-dominated segment** was stagnant. It has since been rejuvenated by **IBM's 15-year-sustained build-out** of its now-leadership IBM® PD Tools for z/OS® suite – this "market challenger" today holding a **muscular, still steadily growing # 2 revenue share** position. IBM's foundation **host software stack advances, speeded greatly** since the mid-2000s, and the IBM® PD Tools for z/OS® suite has most quickly/fully supported and exploited it all. Intense 2008-2012 recession cost pressures triggered many further replacements of costly older ISV PD tools suites. So should users now retire their existing, older PD tool products and adopt IBM's now-leadership suite in its latest V13.1 2014 incarnation? This White Paper's 5th Edition assesses the main z/OS® PD tools suites and their vendors in 2014, and reviews the case for migration/replacement today.

11. **IBM's PD Tools Suite Again Extends Lead:** After those **15 years of intense development** – plus strategic acquisitions – the 2014 **IBM® PD Tools for z/OS® suite** is now **richly-functional, deeply modern GUI-equipped, well-integrated**, and **fully-current** – yet **compact**. Our research here showed IBM's latest *(October 2013)* suite releases *(V13.1)* again hold a **clear technology, usability, features/functionality**, and **value, lead**. Since our 4th Ed. White Paper *(published in March 2011)*, IBM's suite has again advanced broadly – tightly aligning with, and fully exploiting, IBM's fast-changing z/OS® foundation software, and **greatly enhancing its modern GUI options**, whilst still offering **attractive prices/terms** now including **two new Solution Pack value bundles**. Main competitors were again also active with development advances, but overall we found IBM's suite again offers this segment's top blend of functionality, usability, and value, remaining the best proposition for 2014 and beyond.

...further economic recovery, new business investments... will further increase mainframe installed capacity, & add new footprints, worldwide as more new workloads/applications are deployed.

12. **Brighter 2014-16 PD Tool Suites Market:** Replacing older *(or too costly)* PD tool/suites with a better/newer alternative was long the **prime dynamic** in this now **<$700M revenue software segment**. As charted in 2 above, further economic recovery, new business investments, plus the next new mainframe generation when it arrives, will further increase **mainframe installed capacity, & add new footprints, worldwide** as more new workloads/applications are deployed. This much brighter outlook means new host sites to win, site extension opportunities, as well as replacement/migration hopes, for the successful PD tool suite vendor.

13. **PD Tool Suites Complement System z™ "SOA, etc.":** Since 2005, "SOA, etc."# new application models – open standards-based – were widely adopted by enterprise IT users, IBM mainframes are now hosting thousands of "SOA, etc." applications. IBM is the dominant leader in "SOA, etc." middleware software, with an outstanding "SOA, etc." stack optimized for System z™. Winning PD tools suites must offer full integration with/support for the latest IBM "SOA, etc." runtime and tooling foundations. *(Points 6 to 13 are covered in Section 3.)*

14. **Main Competitors Upped Their Games:** In today's consolidated z/OS® PD tools suites market, **Compuware** *(still segment $ revenue share leader)*, **CA Technologies**, **Macro 4** *(UNICOM® Group)*, and **Serena Software**, are IBM's *(# 2 in segment $ revenue share)* suite competitors. This White Paper again compares these four other PD tools suites against IBM's offering as at May 1st 2014. Its own rapid-fire PD tools suite developments, and continuing strong market challenge, had won IBM increasing market shares in recent years. As our prior 2009, and especially 2011, Reviews found, IBM's main active competitors *(Compuware, CA Technologies, and Macro 4)* had each somewhat **"raised their games"** with increased suite development. This 2014 Review found these active competitors and IBM have largely maintained those higher R&D levels again. IBM's long-sustained advances thus forced faster product advances market-wide, these greatly benefitted customers who stayed with their vendors, as well as all who migrated.

15. **Lower PD Tool Software Costs/Better Terms:** IBM's sustained challenge **drove lower software prices**, and **better mainframe license models**, across this segment, further refining/improving these since. Older suite vendors were forced to ease early harsh models, impacting their vital "annuity" revenues, most now declining. These competitors then **sought multi-year renewals** or **many-product enterprise deals**, to defend their "PD tools suite annuities" – users beware lock-in! But the **substantial software cost savings** still available to **PD tools suite movers** remain a prime migration motivator today. This Review saw IBM again "up the ante" here, by introducing **two PD tools suite "Solution Pack" bundles** *(of 5 & 3 suite products)*, at favorable rates, to encourage user migration. *(Points 14 and 15 are covered in Sections 3 to 6, plus all Appendices.)*

Existing PD tools are easily replaceable...

16. **PD Tools Suites Easily Replaceable:** All PD tools suites must integrate with the same core IBM z/OS® software subsystems, compilers, & data sources, etc., the main suites each providing roughly similar capabilities. Existing PD tools are therefore **relatively easily replaceable**, with **cross-suite migration effort relatively low**, and migrations fairly fast. Far harder to replace are other old mainframe AD tool classes *(e.g. Fourth-Generation Languages (4GLs), Computer Aided Software Engineering (CASE) tools, and code generators)*, because of their deeply locked-in, dependent user application assets.

17. **PD Tools Suite Migration Triggers:** PD tools suite migration decisions are often triggered by mainframe **software asset reviews** and/or **software cost reduction efforts**, by cloud, mobile, or "SOA, etc." **new host tooling needs**, by **current vendor pain-points**, by **lagging currency** of some ISV PD tools suites, or **by combinations** of these.

Footnote:

We use the shorthand term "SOA, etc." in this Paper to denote the cluster of related, SOA-based new application models that emerged over the last decade. We define these more fully in the thus-titled subsection on page 8.

...our seven most important strategic PD tools suite/vendor selection-comparison criteria.

18. **Seven Strategic Criteria for New PD Tools Suite Selection:** Our analysis defines and explains the seven most important strategic PD tools suite/vendor selection-comparison criteria. These are:
    - **Suite Currency, IBM Advances Exploitation, Release Frequency.**
    - **Multiple Subsystems Coverage, Not Multiple Versions/Main Product.**
    - **Suite Licensing Model, Software TCO, and Value.**
    - **Suite Breadth, Depth, Functionality, and Features.**
    - **Modern GUI Support, Suite Integration, and Installation.**
    - **Vendor Service/Support Capability and Coverage.**
    - **Vendor PD Tools Business Strategic Focus.**

    We used these seven strategic criteria to compare and contrast the five suites reviewed here on a fair and consistent basis, but with revised 2014 factor-weighting *(see Appendix A on page 48)* reflecting changed customer priorities since our previous 4th Ed. WP of 03.11 *(see point 23 below)*.

19. **Newer System z™ Staff Need Modern User Interfaces *(UIs)*:** Since 2000, many tens of thousands of younger staff joined System z™ sites *(see point 5 above)*. These "z Next-Gen" staffs **absolutely required** more familiar, intuitive, **modern GUI workbenches/web tools** to **rapidly learn**, and most **productively use**, the host **PD suite tools**, as well as the **basic z/OS® host services**, their roles require. Such modern GUI workbench facilities compliment standard System z™ 3270/ISPF *(Interactive System Productivity Facility)* interfaces all PD tools long provided. Quick and efficient for longer-experienced mainframe staff, ISPF-style UIs can deter younger staff brought up on Windows GUIs, etc.

...four vendors each delivering major developments broadly extending, enhancing, and/or completing their PD tools suite GUI workbenches...

20. **Extensive Further PD Suite GUI/Workbench Advances:** This Review Period's biggest advances were four vendors each delivering major developments broadly extending, enhancing, and/or completing their PD tools suite GUI workbenches *(for the needs in point 19 above)*. Each is based on the **open, extensible Eclipse RCP platform**, also providing valuable **PD suite integration** at GUI-workbench level. Briefly, these offerings now include:
    - The updated **IBM® Problem Determination Studio for z/OS® *(IBM PD Studio)* V13.1** now provides, comprehensive, unified Eclipse workbench access to prime select host services of five main IBM host PD tools, via IBM Eclipse plug-ins for each. The same host PD suite services can also be accessed by CICS® users from within widely-used **IBM® CICS® Explorer**, for professional host developers from within **IBM RDz™** *(IBM's unified, mainframe IDE flagship)*, and for IMS™ users from within **IBM IMS™ Enterprise Suite Explorer**, Eclipse-based workbenches, via the same five IBM Plug-ins. These IBM z/OS®-user focused workbenches also each now include **the new IBM® z/OS® Explorer** *(with standardized secure z/OS® connectivity and basic task support)*.
    - **Compuware Workbench V4.0** *(first launched in 2011)* has now been substantially extended and enhanced to provide modern, Eclipse-based GUI workbench access to select principal host services from each main Compuware PD tool family – **Abend-AID**, **File-AID**, **Xpediter**, **Hiperstation**, and **Strobe** – product line. Compuware Workbench also provides desktop access to common z/OS® services, and to feature-rich source code editing, within one common framework, and is now an easy-to-learn and use, comprehensive GUI solution for this major PD tools suite.
    - In our Review Period, CA Technologies completed a full, cross-suite set of seven Eclipse-based GUIs to main select host services for, and supported by the latest releases of, its main host PD and APM suite family – **CA InterTest™** *(2)*, **CA SymDump®** *(3)*, **CA FileMaster™ Plus** *(1)*, and **CA Mainframe Application Tuner** *(1)* – products. Major further developments, combining core PD products and these GUIs, are now near delivery. These GUIs will also plug into the firm's planned end-to-end, full-lifecycle **Application Workbench** currently under development. Both CA InterTest™ product GUIs are also IBM-certified to work well with the IBM RDz™ standard host IDE.
    - Macro 4 first launched its **M4Workbench** Eclipse-based GUI solution for modern desktop access to its mainframe PD tools in mid-2011. It has now expanded and enhanced this into a comprehensive, suite-wide GUI access solution for its primary host PD tools – **FreezeFrame**, **InSync**, **DumpMaster**, **TraceMaster**, & **Tubes** – via Eclipse plug-ins. Also included is its **z/Explorer** z/OS® host services access and 3270 emulation tool. An option is the powerful **M4SlickEdit** advanced source code editor. Macro 4 also offers its alternative, earlier **web-browser-based web portal GUI access** to/integration for its host fault analysis and performance management tools – DumpMaster, InSync, TraceMaster, FreezeFrame – for "thin-client", off-site, and mobile, browser access.

Providing rich GUI access – with suitable functionality and breath – is a now a vitally important PD tools suite requirement.

Four suites of modern GUI workbenches/facilities thus **advanced very substantially** over this Review Period *(40 months to 05.01.14)*. Only Serena Software *(among our five PD suite vendors)* still offers no GUI options. Providing rich GUI access – with suitable functionality and breath – is a now a **vitally important PD tools suite requirement**. These workbenches also improve cross-suite and external world integration into broader IDEs. Our **fifth strategic criterion** *(as per point 18)* reflects these needs in our 2014 assessments.

21. **IBM Tops in Vital Java™ Support:** The last decade brought **huge growth in enterprise-scale Java™ EE workloads** under z/OS® on System z™ mainframes worldwide, supporting SOA, web enablement, and the more recent wave of mobile device enablement *(now set to leap further as July 2014-announced, **game-changing, new Apple-IBM alliance** ramps up)*. IBM's core SOA host middleware stack that supports these Java™ applications **clearly leads the industry** after major, sustained R&D investments. Thus, modern PD tool suites today must offer strong and broad support for these vital Java™ host workloads. IBM has most strenuously and broadly enhanced its **IBM® PD Tools for z/OS® suite** to provide **the leading Java™ support available**, whilst its competitors proved slower, or delivered weaker support, for these burgeoning host workloads.

22. **Vendor/Suite Scores Increase:** This 2014 White Paper again rank ordered our five PD tool suites and vendors by Total Weighted Scores *(TWS)* summed for our seven strategic criteria in point 18 above, summarized in Figure 2 *(column three)*. **IBM *(# 1)*** was again well ahead *(by 2,007 TWS or 17.6% ahead)* of incumbent segment $ revenue share leader **Compuware *(# 2)***, itself some way *(569 TWS or 5.2% ahead)* of **CA Technologies *(# 3)***, closely followed by **Macro 4 *(# 4)***, with **Serena Software *(# 5)*** again far behind. We were again glad to find the four first-named vendors above had each continued strong development/innovation deliveries – especially their GUI advances highlighted in point 20 above – over our 40-month Review Period. *(The assessments in points 14 -22 are developed in Sections 5 & 6 and Appendices B & C.)*

IBM (# 1) was again well ahead... of incumbent segment $ revenue share leader Compuware (# 2), itself some way...

23. **White Paper Editions:** This is the newest, 5th Edition of our White Paper on this topic. The four previous Editions, their publication dates, and the abbreviations we refer to each by here, are:
    - **4th Edition White Paper – March 2011 = 4th Ed. WP 03.11**, with Review Date 01.01.11.
    - **3rd Edition White Paper – January 2009 = 3rd Ed. WP 01.09**
    - **2nd Edition White Paper – July 2007 = 2nd Ed. WP 07.07**
    - **1st Edition White Paper – August 2006 = 1st Ed. WP 08.06**

24. **Review Date, Review Period:** All current vendor and product details in this new 5th Edition WP are at our May 1st 2014 Review Date, unless otherwise stated. This 5th Edition's Review Period, referred to when discussing product changes since our previous 4th Ed. WP 03.11, is therefore the 40 months from January 1st 2011 to May 1st 2014.

Software Strategies z/OS® PD Tools Suites/Vendors Strategic Comparison Rankings May 1st 2014 – 5th Edition WP

May 1st 2014 Results				January 1st 2011 4th Edition WP Rank*
Rank Order	z/OS® PD Tools Suite Vendor	Total Weighted Score *(TWS)*+	% Increase¬ in TWS 1.1.2011 to 05.01.14	
# 1	IBM	13,432	+16.7%	# 1
# 2	Compuware	11,425	+19.9%	# 2
# 3	CA Technologies	10,856	+22.0%	# 3=
# 4	Macro 4	10,799	+21.6%	# 3=
# 5	Serena Software	5,075	+7.8%	# 5

See Section 4 vendor profiles, Sections 5 & 6 vendor/suite assessments, & Figure A1 *(page 48)* for scoring, details.
+ Factors weightings *(& vendor scores)* all updated to May 1st 2014, reflecting evolving user needs *(& vendor suite advances)* over Review Period.
* From our 4th Edition White Paper 03.01.2011.
¬ Weighting for 2014 WP increased by 18.5% overall.
Review Period is 01.01.2011 to 05.01.2014.

Figure 2: z/OS® PD Tool Suites/Vendors Strategic Comparison Ranking – May 1st 2014

2. On 50th Anniversary, IBM's Major Mainframe Software Advances Impressive Lead

IBM Celebrates Mainframe's 50th Anniversary

On April 7th 1964, IBM's Tom Watson launched the firm's ground-breaking **IBM System/360 mainframe family**, a comprehensive range of **compatible computers and peripherals** for all sizes of enterprise, and for both commercial and scientific computing workloads. System/360 was the hugely-successful result of a **then-vast $5B IBM "bet-the-business" investment** *($38B in 2014 money)* that replaced IBM's earlier, diverse but incompatible, computer ranges.

The System/360, and its always fully-compatible successors, were incredibly successful...

The System/360, and its **always fully-compatible successors**, were incredibly successful with enterprises in every major industry, and with government bodies, across the world. They pioneered scores of fundamental computing technologies *(solid logic technology hardware, separate operating systems, dedicated processors, subsystems, compilers, virtualization, transaction processing, database technology, etc.)*. Over the next three decades, the mainframe, and IBM as a company, enjoyed **quite unparalleled growth and success**, bringing out many successive generations of the IBM mainframe that reshaped the whole IT industry and that made it the **far-dominant enterprise IT platform**. *(See Figure 3 on page 8.)*

The success of the IBM mainframe created growing needs for more productive **programming languages, operating systems, networking**, and core **middleware software**, to harness the rapid expansion/spread of mainframe computing, and to help better support the **ever-multiplying range of business applications** customers were, by then, deploying on the platform.

IBM thus devoted considerable R&D investment into extending its core mainframe software products, and updating these in parallel with its mainframe hardware advances, setting many **industry de facto standards** in the process.

Big IBM Host Software Advances

IBM's major System z™ software R&D, and ISV acquisitions investments, brought **fast-rolling deliveries** of **much-enhanced versions** of the established foundation System z™ subsystems, including DB2®, IMS™, CICS®, WebSphere® Application Server, WebSphere® MQ, language compilers, and other traditional tools. It also brought to the platform

IBM's major System z™ software R&D, and ISV acquisitions investments brought fast-rolling deliveries of much-enhanced versions of the established foundation System z™ subsystems...

a **broad range** of **other new, leading-edge middleware, infrastructure software, advanced GUI host AD tooling**, and many **other solution enablers**, that now support the widest range of modern workloads on the mainframe platform, and which have also been continually advanced.

This greatly expanded IBM System z™ software portfolio has deeply embedded **open standards**, supported vital **modern "SOA, etc."** application technologies, **embraced DevOps** for enhanced development/production integration, and brought **efficient virtualization/cloud management** capabilities offering improved Qualities of Service *(QoS)*. These major advances support not only **the flagship z/OS®**, but with the ever more **popular zLinux, often with z/VM host**, environments that combined to power the burgeoning range of **new mainframe workloads** seen.

Java™ EE Now Central on Host

Probably the **most important host software advance/change** over the last decade has been large-scale adoption/deployment of the **open, community-driven Java™ EE platform/language** on the System z™ mainframe's primary z/OS® environment. IBM strongly championed, and continually invested in, building, enhancing, and optimizing its **host middleware and AD tools software**, and the **actual System z™ hardware**, to comprehensively and efficiently support **modern Java™ EE applications** in open SOA-standards-based approaches. Thousands of host customers today now run their modern, business-critical Java-based workloads on z/OS® on the flagship **IBM® WebSphere® Application Server for z/OS®** *(WAS- currently V8.5)*. WAS for z/OS® *(Standard Profile)* fully exploits the **unique QoS capabilities** of the IBM® System z™ hardware and the z/OS® operating system, to deliver prioritized workload management, advanced transactional integrity, horizontal and vertical scalability, and data and workload co-location, with **outstanding availability and security**. Such host Java™ applications access **host data sources** including **DB2®, IMS™ DB, and VSAM**, and operate with CICS® or IMS™ TP subsystems. Their full SOA support readily enabled the large-scale web reuse of traditional mainframe software assets seen today in customer's modern, SAO-based, online and batch host Java applications. WAS for z/OS® today now also includes the lightweight, fast-starting **WAS Liberty Profile z/OS® Connect** gateway solution, providing fast, scalable, secure, and easy enablement of web, cloud, and **especially mobile, access to z/OS® assets** using simple **RESTful API** services and **JavaScript Object Notation *(JSON)***. Optimized Adapters provide bi-directional calling to/from Liberty and traditional z/OS® applications.

IBM zEnterprise® System – Major Advances Again

Enhanced — Optimized — Expanded

Figure 3: IBM® zEnterprise® System – Major Advances Again

"SOA, etc." Transforming Enterprise Software Architectures

Here, our term "SOA, etc." concisely labels the related set of modern, open standards-based, application software models, including:

- **SOA**, today's primary software as services-based application model.
- **Business Process Management *(BPM)***, model directly mirroring business process workflows in a BPM software suite.
- **Complex or Business Events Processing *(CEP/BEP)***, business events-processing-centered application model.
- **Business Rules Management System *(BRMS)***, an SOA application model centered on executable business rules.
- **Web 2.0**, 2nd-generation, rich client, web-orientated, social-enabled, application approaches.

SOA views application software as **sets of loosely-coupled, self-describing "services"** interacting through **standardized, open interfaces**. Widely adopted and major vendor-supported since the mid-2000s, SOA today is the accepted business application software development & deployment model. Other **complementary application models** listed above, each offering useful perspectives and advantages for certain business problems/situations, also emerged and have been adopted where useful. Integrated, complementary runtime middleware servers, and unified comprehensive development tooling, must today encompass/support all these "SOA, etc." application models in a combined, integrated stack.

...SOA today is the accepted business application software development & deployment model.

Leadership IBM Mainframe Software Portfolio – 7 Main 2014 Focuses

In many earlier studies, we extensively researched these fast-evolving IBM System z™ software portfolio advances since the mid-2000s. Right up to 2014, the breadth, depth, pace, and level of innovation of IBM's host software advances have been formidable. The result of its extensive R&D investments, and the scores of ISV acquisitions, is the richest, most advanced enterprise platform middleware and tools software portfolio, today heavily focused on the following seven principal areas:

- **Big Data Analytics & Data Warehousing:** Providing deeper insight from faster, simpler, **host-based real-time analytics**, business intelligence, and data warehousing with Cognos, SPSS, InfoSphere™, IBM® DB2® Analytics Accelerator for z/OS®, etc., leveraging the core mainframe data serving strengths below.

- **Industry-leading Data Management:** Encompassing classic mainframe database serving roles using **IMS™** and **DB2®** databases for transactional and informational applications, plus enterprise content management, and related data management tools, now all SOA open standards enabled. Mainframes today host ~80% of enterprise structured data!
- **DevOps Applications Development & Deployment:** To develop, modernize, and deploy all types of System z™-based applications − modern "SOA, etc." and traditional − and new workloads, on both z/OS® and zLinux. The comprehensive Eclipse-based **IBM Rational® Developer for System z™** IDE, advanced compilers, and integrated IBM® Rational® collaborative development, test, and deployment, tools bring improved DevOps processes to mainframe sites.
- **Leadership "SOA, etc." Infrastructure, Connectivity, & BPM:** Applications infrastructure, connectivity, and BPM, **runtime servers/tooling**, that enable and support new front-office endpoints *(mobile, web, etc.)* and their engagements with new "SOA, etc." applications. Includes CICS®, WebSphere® Application Server, WMQ, and more.
- **Cloud and Service Management:** To effectively manage host availability, workloads, software assets, virtual server provisioning, network connectivity, **and private clouds**, with OMEGAMON, ITCAM, and other IBM systems and service management offerings.
- **Security and Privacy:** Minimizing risks and ensuring **maximum protection** for host information, applications, and infrastructure with legendary, baked-in System z™ multi-level security, complemented by IBM® InfoSphere™ Gardium, IBM® Security zSecure™ suite, RACF, and other, IBM mainframe security software.
- **Mobile to Mainframe:** Supporting the now-ubiquitous smart mobile phone or tablet clients, back to the mainframe's transactions, databases, and applications. New IBM tools to build, engage, transform, and optimize, mobile support from enterprise mainframe-based resources include **IBM® Worklight, IBM® Endpoint Manager, CICS® with Mobile Extensions**, and JSON Support in DB2® & IMS™. IBM has introduced IBM Mobile Workload Pricing *(MWP)* for z/OS® to mitigate costs associated with growth in mobile transactions processed by programs such as CICS®, IMS™, and DB2® for z/OS®.

Select IBM Enterprise Middleware & Tools for z/OS® – 2014

Software for System z™, zEnterprise® Mainframes

Big data analytics & data warehousing
- IBM® DB2® for z/OS®
- IBM® DB2® Analytics Accelerator for z/OS®+
- IBM® zEnterprise® Analytics System 9700/9710#
- IBM® Cognos® Business Intelligence family
- IBM® InfoSphere® Optim™ family
- IBM® SPSS family *(zLinux)*

Data management
- IBM® DB2® for z/OS®
- IBM® IMS™
- IBM® DB2® Tools
- IBM® IMS™ Tools
- IBM® Enterprise Content Management...

DevOps application development & deployment
- IBM® UrbanCode Deploy
- IBM® UrbanCode Release
- IBM® Rational® Developer for System z™
- IBM® Rational® Test Automation Solution
- Enterprise COBOL for z/OS® Compiler
- Enterprise PL/I for z/OS® Compiler
- z/OS® XL C/C++ Compiler...

Cloud & service management
- IBM® OMEGAMON product family
- Tivoli Workload Automation for z/OS®
- IBM® Automation Control for z/OS®
- IBM® Netview...

Infrastructure, connectivity, & business process management
- IBM® CICS® Transaction Server for z/OS®
- IBM® WebSphere MQ for z/OS®
- IBM® Business Process Manager Adv. for z/OS®
- IBM® Operational Decision Manager for z/OS®
- IBM® Business Rules for z/OS®
- IBM® Integration Bus for z/OS®
- IBM® WebSphere Application Server for z/OS®

Security & privacy solutions
- IBM Security zSecure™ suite
- InfoSphere Guardium®
- .....

Mobile to mainframe
- IBM® Worklight®
- IBM® Rational® Developer IDEs for Mobile
- IBM® Mobile Messaging Client
- IBM® Cognos® Mobile
- IBM® CICS® TS Feature Pack for Mobile
- IBM® Endpoint Manager

+= zBX hardware + software appliance solution
= zEnterprise server + appliance + software solution

Figure 4: Select IBM Enterprise Middleware & Tools for z/OS® 2014 − Software for System z™, zEnterprise® Mainframe

Further discussion of these is outside our scope, but to illustrate the strength of IBM's 2014 mainframe software portfolio, a selection of IBM's leading-edge offerings in each focus area above are listed in Figure 4 on the previous page 9.

IBM Dominates "SOA, etc.", System z™ Ideal Enterprise Private Cloud Host

IBM has **long dominated the global "SOA, etc."** infrastructure software market, now worth an estimated **$5.7B per year** *(2014, per Wintergreen Research)*, with over 10,000 SOA client engagements completed. As noted above, IBM invested heavily to successfully deliver on, and optimize for, its premier "SOA, etc." software technology **on the flagship zEnterprise®** mainframe platform since ~2005, for compelling reasons. These are that the **world's <11,000 IBM mainframes** support enterprise **customer applications worth $3T**, including with many millions of proven business transactions, and scores of thousands of enterprise databases managing **~80% of global structured data**. Today, these are at the heart of convergence of **mobile**, **social**, **cloud**, and **big data analytics**, making SOA more important than ever before to gain the maximum insight and to integrate systems from end to end.

Over the last decade, System z™ mainframes came to host thousands of new or modernized, "SOA, etc." based applications – in their varied shades – exploiting the **high transaction throughput, unrivalled QoS levels, uninterrupted availability**, and unique security, of their mainframe environments that made them **perfect enterprise private cloud hosts**.

...by using open-standards-based SOA models, mainframe customer enterprises can best deliver and control differentiating business and IT transformation...

So, by using open-standards-based SOA models, mainframe customer enterprises can best deliver and control differentiating business and IT transformation, and benefit from **seamless integration, cloud-enabled solutions, more holistic business insight, much greater agility**, and much-improved integration between **front offices**, **back offices** and the emerging **Internet of Things**.

IBM's System z™ AD Tools Now Industry Leadership – RDz™ Flagship

The giant's centerpiece host AD offering is the **IBM® Rational® Developer for System z™ *(RDz™)* V9.0.1** Integrated Development Environment *(IDE)*, which spans all types of host development and all main development roles. This latest RDz™ release now supports AD for cloud computing, the "SOA, etc." models mentioned above, plus traditional host AD in COBOL, PL/I, C/C++, or Assembler, for all System z™ runtime environments. RDz™ now also supports AD for/on the zEnterprise™ System zBX-based hybrid environments, as well as modernization of existing host assets. RDz™ is built on the extremely successful open industry standard Eclipse platform, and supports all levels of developer skills. RDz™ is closely-integrated with, and supports the latest releases of all, central IBM System z™ subsystems, servers, and related tools. It is also fully supported by other key IBM® Rational® collaborative development tools, including IBM® Rational® Team Concert *(agile application lifecycle management (ALM) solution)* and IBM® Rational® Quality Manager *(quality and test management)*, and others *(based on the Rational® Jazz collaboration platform)*. Now honed by over a decade of continuous IBM advance, RDz™ today offers **heavy-duty functionality, unrivalled extensibility, moderate footprint**, and **good performance** – making it the universal standard IDE for System z™ today.

IBM has since continually advanced and extended its PD tools suite rapidly, to now hold robust leadership capabilities today...

Mainframe PD Tools a Deep IBM Focus

An important mainframe software tool segment is **Problem Determination tools** for the flagship z/OS® mainframe operating environment; this White Paper's subject. These AD tools help/support mainframe application developers, testers, and operations staff, **to isolate and identify bugs, resolve performance issues, & test and tune enterprise applications** running in complex mainframe hardware and software environments. These are well-complementary to, and must integrate with, RDz™ for self-evident reasons. We define/categorize PD tool products and review IBM's PD tools suite in Section 3, introduce the competing market players in Section 4, then set out and explain our seven essential criteria for best PD tools suite selection today in Section 5. Our overall assessments, scoring, and ranking of five PD tool suites/vendors are presented in Section 6. The detailed scores, and criteria weighting, supporting those assessments and rankings, are presented next in Appendix A. The **z/OS® PD tool market is substantial, with ~$700M spent** on this software category in 2013, so it is a significant cost item for mainframe users worldwide. IBM entered this segment in 2000 and has since continually advanced and extended its PD tools suite rapidly, to now **offer robust leadership capabilities** today, reflecting deep focus on this important mainframe tooling segment.

Our Analysis – New Mainframe Growth Ahead

The mainframe's 50th Anniversary year brought IBM's cumulative **mainframe R&D investments to $55B+** *(hardware & software)* and – as a result – the zEnterprise® platform in 2014 is in the best of health, again the pre-eminent large and medium enterprise strategic IT platform.

...the IBM mainframe remains the strategically central, vital core platform for many thousands of these major enterprises...

There is now a rising global wave of new business investments/ new developments, most IT-based or IT-enabled, with **mobile enablement, social media exploitation, business analytics and "Big Data", efficient Cloud computing infrastructures**, and the **"Internet of Things"**, amongst the major enterprise IT growth hotspots foreseen. Since the IBM mainframe remains the strategically central, vital core platform for many thousands of these major enterprises, and because the IBM mainframe *(and its software stack)* are today superbly equipped to best handle such new workloads, we expect **further healthy growth in mainframe hardware and software revenue** in the next few years from these business developments.

Leading enterprises in many emerging growth markets, such as **China**, **India**, **Brazil** and **Russia**, have widely adopted the System z™ mainframe as they built-out new enterprise IT infrastructures for their large companies and public enterprises. Such all-new mainframe customers in those growth markets, plus renewed new-name victories in the developed world, are now adding an average of **75-100 all-new mainframe footprints** to the System z™ customer base per mainframe generation cycle.

These mainframe megatrends all point towards a healthy outlook...

These mainframe megatrends all point towards a healthy outlook of **enhanced revenue and growth opportunities** for successful z/OS® PD tools suite vendors during the next several years, after long focusing mainly on competitor replacement.

3. Introducing z/OS® Problem Determination Tools, the IBM® PD Tools for z/OS® Suite

What Are PD Tools For z/OS®?

z/OS® is IBM's advanced, sophisticated, flagship production operating system for System z™ and – of course – also for the current z Enterprise™ zEC12 high-end and zBC12 mid-range mainframes. z/OS® PD tools deliver productive capabilities for **mainframe application developers, testers, operations** and **support staff** to perform application source code debugging, carry out application and system fault or abend analysis, perform file and data management, and analyze and improve application performance. PD tools software vendors describe this important mainframe tool segment using various terms, including: mainframe testing and fault management; mainframe application testing, implementation and problem analysis; and mainframe application performance and availability management. The main types of tool we consider within this White Paper's PD tools segment scope thus include:

- Mainframe **application performance monitoring, measurement, and tuning** tools focused upon development, and recognizing that the mainframe also often hosts data serving for multi-platform applications.
- Mainframe **interactive application debugging** tools.
- Analyzing and fixing mainframe application failures with **abend/dump analysis**.
- Mainframe **files extraction and export** capabilities, to create test data and/or to migrate files.
- Mainframe **file and data management**, to correct, amend, or extend, files/data in production, and/or during test/development.
- Mainframe **applications testing, workload generation**, and **quality assurance**.
- **Application time simulation**, to enable non-disruptive testing of time-sensitive host applications.
- **Data migration tools**, to move legacy assets to more modern, efficient host platforms, and to prepare test data.
- Workstation-based **mainframe IDEs**, and other **integration-point GUI tools**, that provide modern GUI access to *(some/most)* core host services of the PD tool above, and to frequently needed foundation mainframe z/OS® services.

Main PD tools must interoperate/integrate with the other main suite tools...

Main PD tools must **interoperate/integrate** with the other main suite tools, to **support all stages** of host application development, testing, deployment, production, and maintenance lifecycles. For this reason, **integrated PD tool suites with fully-compatible, well-integrated tools** are far preferable to unlinked "point" PD products from different vendors. Suite integration and alignment can be *(but not always is where products were acquired)* built-in by today's PD suite vendors. Customer mainframe software environments today have become complex, multi-layered, and include customer-specific assortments of IBM's core System z™ software products, depending on each customer's workload needs.

PD tools must... stay fully compatible and aligned with, and should fully exploit new advances of, the latest releases of the IBM System z™ subsystems, programming language compilers, and other adjacent host tool categories...

PD tools must also **interoperate closely with, stay fully compatible and aligned with**, and **should fully exploit new advances of**, the latest releases of the IBM System z™ subsystems, programming language compilers, and other adjacent host tool categories – such as CICS® tools, that each PD tool touches. Consequently, winning modern PD tool suites must support all *(or most)* of the IBM System z™ software combinations encountered at real customer sites *(to have broadest value)*, preferably with **fewest chargeable PD tool products**. Full PD tool suites must support scores of such "touch points", **requiring regular new PD tool releases/updates to stay fully current** with IBM's latest host software releases. In addition, **PD suite tools must also remain fully aligned with each other**, so linked suite products must be advanced via **synchronized new suite releases** to preserve inter-product alignment, **with extensive regression testing required** to validate cross-suite compatibility and interoperability.

Because IBM had developed & advanced its **host software range much faster since 2000**, competing PD tools vendors faced increased challenges in keeping their PD tools current with IBM's System z™ core software advances. Some PD tools vendors clearly fell short on keeping this vital currency, the result of earlier cutbacks in their PD tools R&D efforts. We ourselves heard many customer reports of ISV PD tool vendor currency or new feature exploitation shortcomings since we began researching this segment in 2006. IBM's continuing, broad development advances with its IBM® PD Tools for z/OS® Suite, together with many ISV customer complaints, forced the competing ISVs to re-invest at higher levels again starting from 2006-08 to keep their PD tools better updated, and more closely aligned with, IBM's faster host foundation software developments, else fall ever-further behind.

PD Tool Suites and Adjacent Mainframe Tool Categories

z/OS® PD tool suite products are used alongside a number of established adjacent host tool categories. These include **database tools** supporting DB2® and IMS™, CICS® tools, **asset discovery tools** *(e.g. IBM® Rational® Asset Analyzer)*, **AD tools and IDEs** *(e.g. IBM Rational® Developer for System z™)*, and **applications testing tools** *(e.g. IBM® Rational® Functional Tester, and IBM® Rational® Performance Tester)*. Most closely adjacent are **CICS® tools**, because CICS® is near-universally used as the runtime environment for a large majority of host transaction processing. *(For those reasons, we review IBM's latest CICS® tools suite in/around Figure B2 on page 65)*

The IBM® PD Tools for z/OS® Suite, and the IBM® CICS® Tools Suite, each now also provide their own, similar modern workstation GUI tools for easy access to each suite's main host tool's select services. These are the newer **IBM® Problem Determination Studio for z/OS®**, and the well-established **IBM® CICS® Explorer**, Eclipse workbenches respectively. Each of these IBM z/OS®-focused GUI workbench products incorporates the new **IBM® Explorer for z/OS®** Eclipse workbench and host integration point that provides secure connectivity from the workstation to the z/OS® host, giving simple GUI and secure access to z/OS® datasets, IBM zSeries™ File System *(zFS)* files, and Job Entry Subsystem *(JES)* jobs and output.

Application performance management software overall is a much larger, still-growing, and technology-changing software market today dominated by IBM *(# 1 by $ revenue)*, CA Technologies *(# 2)*, Compuware *(# 3)*, and HP *(# 4)*. In this Paper's PD tools context, one APM sub category, **cross-platform Java EE™ Application Performance Management/Monitoring *(APM)* tools** *(offering mainframe support)* are another important, near-adjacent tool category. These tools address the serious challenges that multi-platform/multi-tier APM has long presented for the majority of IT teams that today support such applications/environments, both in the development/debugging, and in the live production monitoring or troubleshooting, lifecycle stages.

IBM plays strongly here with its **IBM Tivoli Composite Application Manager *(ITCAM)*** family *(and other Tivoli products)* as well as dominating in mainframe APM *(with the **OMEGAMON** performance monitor family acquired with Candle)*.

Compuware brought a strong new entrant to this sub-market in September 2012, with its **Compuware APM for Mainframe** solutions family. This was an integration of its acquired dynaTrace Software leading-edge PurePath™ APM technology, with its well-established Strobe host APM software, and which enjoyed a good first full year to market in the firm's FY14.

CA Technologies – # 2 overall APM market player – today offers its **CA Cross Platform Application Performance Management**, and **CA Mainframe Application Tuner** products, each evolved from earlier acquisitions and further in-house development, in this sub-market and which we review in this White Paper.

To be fair to all vendors, we do assess, from a mainframe viewpoint, the cross-platform-to-host application performance offerings above in this 5th Edition's assessments/rankings. Otherwise, we limit our depth coverage to the mainframe PD tools definition set out above, excluding other related tool categories from our scoring. We do, however, comment on vendors' adjacent offerings where relevant *(e.g. where complementing, or integrating, with their vendor's PD tools suite solutions)*.

...PD tools took on renewed importance in todays faster-changing, more dynamic mainframe AD environment...

Why are PD Tools so Important for Mainframe Users?

PD tools for z/OS® are an important, longstanding mainframe tools segment. They took on renewed importance in todays faster-changing, more dynamic mainframe AD environment as the platform hosts major growth in **mobile support, business social, cloud computing**, and **big data analytics**. PD tool suites for z/OS® are again our central focus in this White Paper's 5th Edition, written early summer 2014. Accelerating new mainframe applications development across such areas now means new software tool investments/replacements can be readily justified. In this landscape, we expect hundreds more mainframe users will now replace their older existing *(ISV-supplied)* mainframe suite with a more modern, broadest coverage, better value, more current, alternative over the next several years, and we researched/wrote this updated White Paper specifically to help them successfully choose and migrate.

Compelling PD Tools Suite Benefits

The customer benefits that flow from using the best modern PD tools suites include:

- **Increased staff productivity** in mainframe development, quality assurance *(QA)*, and in operations, reducing AD, test, rollout, and production support, time/cost.
- **Faster application deployment**, enabling "faster-to-market", more agile host applications solution delivery.
- **Increased mainframe application quality**, attaining higher availability in production.
- **Faster, easier applications problem diagnosis/resolution**, both in development/test and in full production.

- **Reduced mainframe MIPS usage**, from elimination of errors and by performance optimization.
- **Improving application performance** whilst reducing mainframe system resources used *("MIPS savings")*.
- **Supporting/exploiting newer host software technologies**, including mainframe Java EE™/ WebSphere® Application Server *(WAS®)*, WebSphere® MQ *(WMQ®)*, and the latest DB2® releases, etc.
- **Exploiting new mainframe technologies**, including new hardware generation's new processors/instructions, new z/OS® operating system advances, specialty processor engine improvements *(IFLs, zIIPs, and zAAPs)*, new IBM subsystems, new compiler releases, etc.
- **Improving application portfolio health** for mainframe customers.
- **Enabling & empowering new-generation, younger staff** to more quickly and easily become proficient with mainframe PD tools, and with basic host operations, via more familiar, modern workstation-based GUIs.

Despite major mainframe hardware/software price reductions since 2000, System z™ and zEnterprise® **MIPS still remain precious**, always to be optimally used and never wasted, to attain the lowest TCO levels. Preventing host application failure/and rerun MIPS wastage, trimming production application resource use, and eliminating any other wasted test/development cycles, all cut MIPS and are greatly facilitated by a good PD tools suite. Such MIPS savings alone usually pays for a new PD tool suite, with the other benefits mentioned as welcome bonuses. Performing more host development/test processes offline using workstation IDEs such as IBM's full-function RDz™, also contributes further MIPS savings here.

These PD tools suite benefits combined thus make a compelling case for adoption of/ migration to the best PD tools suite.

These PD tools suite benefits combined thus make a compelling case for adoption of/migration to the best PD tools suite. They deliver large financial savings, making an excellent ROI case. However, the PD tools suites marketed in 2014 are **far from equal**, with different levels of category coverage, currency, completeness of subsystems, programming language support, software licensing and maintenance costs, GUI access facilities, vendor support, rate of development, and long-term vendor/product credibility.

With the hard years of the 2008-2011 recession now thankfully past, and **most major economies growing again**, 2014s worldwide **business climate is far more positive, expansion-minded**, and growth-focused. Most enterprises finally returned to making **new investments, expanding their portfolios, making acquisitions**, and **generally moving forward**, often after years of retrenchment, cost-cutting and caution. High proportions of their new investments and developments are IT-based or enabled, and the vibrant IBM mainframe platform is clearly playing a central part in many of these. **Enterprise business intelligence/analytics, mobile applications** linked to corporate data/systems, **social media exploitation/big data, enterprise cloud computing**, and a wide range of other, new enterprise **"SOA, etc."-based Java applications**, are the principal new IT workloads these business investments will generate, and that the IBM mainframe can now often best host.

In this far more positive business environment of growth and investment... choosing and using the best PD tools suite is more important than ever...

In this far more positive business environment of growth and investment, with so many new mainframe projects likely, and with IBM's continuing fast advances in its System z™ software stack, choosing and using the best PD tools suite is more important than ever today. New-to-mainframe customers *(with no legacy)*, should **clearly choose/buy the best available PD tools suite from day one**, with strategic futures high of mind. Existing mainframe sites using a mixture of "point" PD tool products from several vendors **should definitely now consolidate/replace** with today's best unified PD tools suite, for the reasons, and to gain the benefits, cited above. Most other established mainframe sites currently using an older, third-party ISV PD tools suite, and often facing too-steep costs, should now also **seriously evaluate replacement**.

An important consideration here is **total PD tool software license costs of ownership**, comprised of both initial acquisition costs for new buyers and – more importantly – of the **recurrent annual maintenance/support service fees** which dominate software TCO over time – the main concern for long-standing users. With such rapid core mainframe software advances, frequent updating and enhancement of PD tool products is again absolutely essential in 2014 and beyond. Big Blue's muscular post-2000 PD tool's market challenge brought its lower price options/fairer pricing models, to this mainframe software segment. This allowed customers using other PD tools suites to **gain major migration savings by migrating to IBM's suite**. Through the 2000-decade and since, IBM's continuing, solid PD tools functional advances and price competition forced other ISVs to offer less onerous prices/models for new licenses. However, many long-standing users of older PD tools suites have continued to pay more than needed for their maintenance/support.

We firmly advise PD tool users to carefully revisit and evaluate their choice of PD tools suite...

We firmly advise PD tool users to carefully revisit and evaluate their choice of PD tools suite before committing, or recommitting, to multi-year renewals, or enterprise-wide licenses with lengthy lock-ins, which their vendors may be eager to secure for obvious reasons. Our findings, with advice on how best to evaluate/decide upon the best PD tools suite choice, are set out in Sections 5 and 6.

Our other research *(examples on page 77)* found IBM today offers real leadership tools/servers in almost all host software categories, today. Major ISV CA Technologies and mid-sized Serena Software *(both covered here, see Section 4 on)* also each have substantial offerings in other host software categories. We note these where relevant to, or complementing, their PD tool offerings, in our review of those vendors here.

IBM's Modern Mainframe PD Tools Suite for z/OS® Ploughs Well Ahead

Since 2000, IBM has created, refined, and fully market-established, its **now widely-successful suite** of PD tools software for the System z™/zEnterprise® mainframe's flagship z/OS® environment under the firm's extensive and wide-ranging, 2000-decade-long and since, mainframe software initiatives.

The IBM® PD Tool for z/OS® Suite products, and the roles each plays in the **mainframe discover-develop-deploy** lifecycle, are shown in Figure 5. This names the suite products and shows *(via black dotted links)* which lifecycle stages each tool supports. The chart also depicts the three broad areas of PD tool functional benefits, **quality-performance-simplified management**, which each suite product delivers *(via dark red dotted links)*.

Figure 5 also shows another crucial advantage of the IBM PD Tool for z/OS® suite. Its main products each **inclusively support** all main host application runtimes shown chart center – including CICS®, WAS®, DB2®, IMS™, batch, and WMQ®. We amplify this vital factor in more detail on Figure 7 on page 19. The now-extensive May 2014 integration links IBM has engineered between suite products are also shown *(as green lines)*. This chart usefully introduces and positions the IBM suite products, their roles, and the integration between them.

IBM Problem Determination Tools for z/OS® V13.1 – May '14

Host PD Tools Support Mainframe Applications Lifecycle

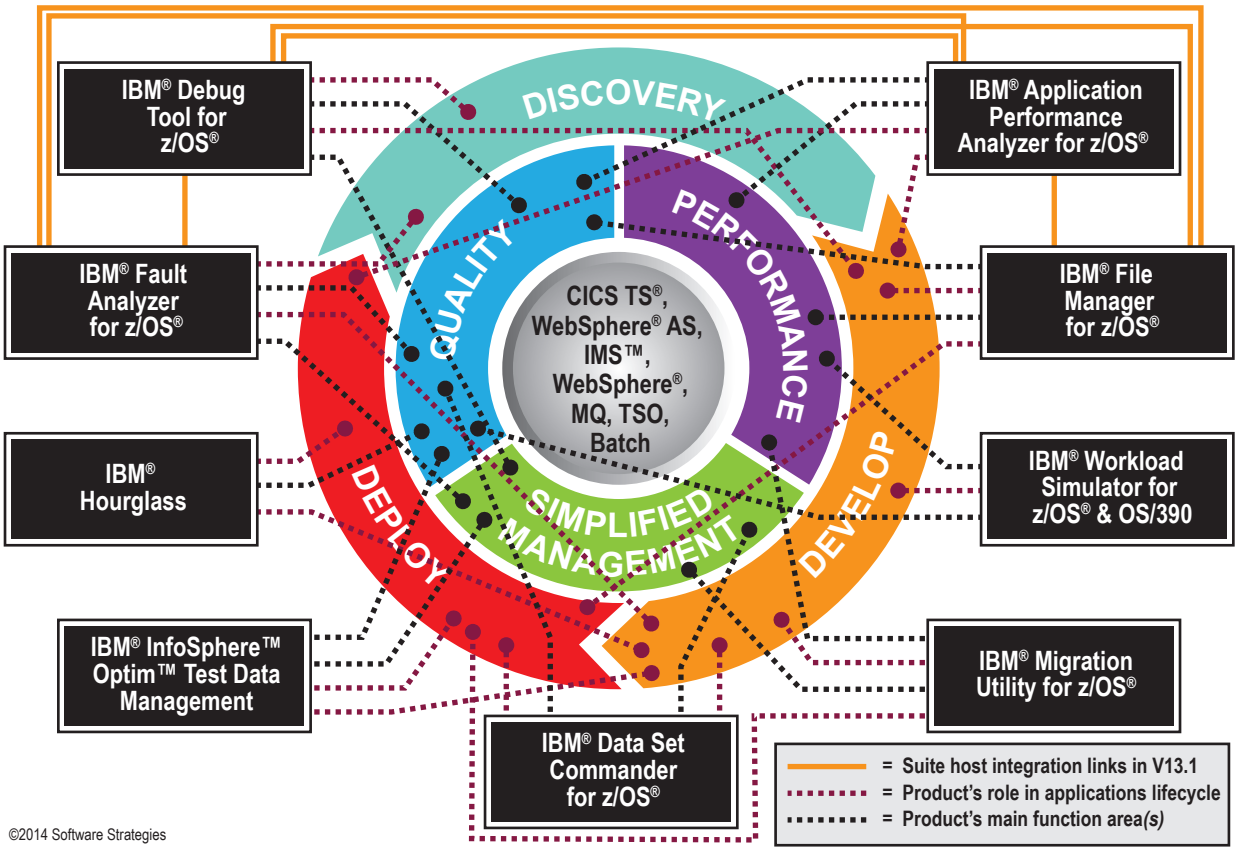

Figure 5: IBM PD Tools for z/OS® V13.1 Suite May 2014 – Supports Mainframe Applications Lifecycle

As the first IBM® PD Tools for z/OS® products emerged from 2000 on, and the suite steadily broadened and rapidly advanced since then, it was warmly welcomed by mainframe IT executives and Chief Information Officers *(CIOs)*, because it finally gave them a modern, current, affordable IBM alternative to older ISV PD tools suites at sky-high costs.

Today, we estimate **~2,300 IBM mainframe customers** have now gratefully switched to, or bought into, the IBM® PD Tools for z/OS® Suite, and are **now deploying ~6,750 IBM PD host tool products**, on average just under 3 products per customer. Many users transitioned to the IBM suite with experienced help and training from Big Blue's active PD tools migration support program/services. IBM's more realistic pricing metrics/models and lower rates delivered much more affordable PD tools suite software TCO, giving large cost savings that were major migration motivators.

This success of IBM's fast-advancing host PD tools suite market challenge, and such better pricing, also gave thousands of PD tool customers of older ISV tools **enough leverage to demand, and often to win, better prices/terms** from their incumbent vendors.

IBM's fast-paced development, and ultra-competitive pricing, also provided not only **the attractive migration escape route** above, but also **forced incumbent vendors to sometimes reduce their pricing**, and also to **improve their suite's currency**, new development rate, and support levels, which had run down to low levels over the first half of the 2000 decade.

IBM Problem Determination Tools *(PDT)* for z/OS® Suite Overview – May 1st 2014

Product *(Alphabetical order by section)*	**Description** *(Month/year first introduced)*	**Current GA Release**	**GA Date**
IBM PD Tools *(PDT)* for z/OS® Suite Products – May 1st 2014			
IBM® Application Performance Analyzer for z/OS® *(APA)*	APA monitors, analyzes, & reports on, z/OS® application *(new & existing)* resource use, to pinpoint bottlenecks & improve performance. Spans all main z/OS® applications, including CICS®, Assembler, COBOL, PL/I, C/C++, DB2®, IMS™, WAS Java™, batch, & WebSphere® MQ®. Samples monitored address space & analyses all host CPU, DASD, & I/O use – system & application. Online analysis/reports in PDF or XML files enable workstation viewing & provide fast transfer. APA is integrated directly with fellow IBM PD suite FA, DT, & FM host tools. The included IBM® Application Performance Analyzer for z/OS® Plug-in for Eclipse provides GUI workstation access to select APA host services from within the IBM® Problem Determination Tools Studio *(PD Studio)*, IBM® CICS® Explorer, IBM® IMS™ Enterprise Suite Explorer, & IBM® Rational Developer for System z™, etc. Eclipse workbenches. *(06.2005)*.	**V13.1**	**10.18.2013**
IBM® Debug Tool for z/OS® *(DT)*	Advanced, high-function interactive source level debugging tool examines, monitors, & controls execution of, z/OS® complied applications – in C, C++, COBOL, & PL/I, or mixed languages. Provides multiple conditional and unconditional break point, step mode debugging, & can monitor/update variables & storage. One unified tool supports batch, TSO, CICS®, IMS™, DB2®, DB2® Stored Procedures, & UNIX® System Services, subsystems. This feature-rich tool *(with its utilities)* is integrated directly with fellow IBM PD suite APA, FA, & FM host tools. The included IBM® Debug Tool for z/OS® Plug-in for Eclipse provides GUI workstation access to select DT host services from within the IBM® Problem Determination Tools Studio *(PD Studio)*, IBM® CICS® Explorer, IBM® IMS™ Enterprise Suite Explorer, & IBM® Rational Developer for System z™, etc. Eclipse workbenches. *(11.2001)*.	**V13.1**	**10.18.2013**
IBM® Data Set Commander for z/OS® *(DSC)*	Provides an integrated, more productive interface to Interactive System Productivity Facility® *(ISPF, the standard IBM System z™ editor)* with extended interactive & batch capabilities for operating on partitioned data sets *(PDSs)*, partitioned data set extended *(PDSEs)* & their members. It integrates & automates access to VSAM files, CA Panvalet® libraries, Librarian files, IBM DB2® tables, HFS files, PC files, catalog levels, etc. DSC also exploits new z/OS® support for PDSE member generations. *(Previously named IBM ISPF Productivity Tool for z/OS®). (05.2005 – IBM)*.	**V8.1**	**12.06.2013**
IBM® Fault Analyzer for z/OS® *(FA)*	This automated tool helps analyze, diagnose, and fix applications & system failures, pinpointing causes of failures *(abends)*, & guiding on their resolution. It analyzes abends from both modern WAS® for z/OS® *(Java EE™)* & WebSphere MQ® environments, & from traditional CICS® *(apps. & system)*, z/OS® JES/Batch & TSO, IMS™, DB2®, UNIX® System Services, subsystems. FA analyzes abends from applications written in Java™, Enterprise COBOL, Enterprise PL/I, Assembler, C/C++, & Language Environment *(LE)*, within this powerful single product. FA creates a fault history file to track/manage application failures & fault reports. FA integrates directly with fellow IBM PD suite APA, DT, & FM host tools. The included IBM® Fault Analyzer for z/OS® Plug-in for Eclipse provides GUI workstation access to select FA host services from within the IBM® Problem Determination Tools Studio *(PD Studio)*, IBM® CICS® Explorer, IBM® IMS™ Enterprise Suite Explorer, & IBM® Rational Developer for System z™, etc. IBM Eclipse workbenches. *(12.2000)*.	**V13.1**	**10.18.2013**
IBM® File Manager for z/OS® *(FM)*	This comprehensive, high function, easy-to-use file/data management tool creates finds, copies, edits, prints, compares, and displays/formats most z/OS® file formats *(VSAM, QSAM, PDS, IAM, OAM, & HFS/zFS)*, and DB2®, IMS™, CICS®, and WebSphere® MQ® data, quickly and easily. Extensive editing, browsing, print, batch & interactive functions support both development & production roles, extending ISPF. Uses COBOL and PL/I copybooks from PDS or library files to efficiently define data-set records. Integrates directly with fellow IBM PD suite APA, DT, & FM host tools. The included IBM® File Manager for z/OS® Plug-in for Eclipse provides GUI workstation access to select FM host services from within the IBM® Problem Determination Tools Studio *(PD Studio)*, IBM® CICS® IMS™ Enterprise Suite Explorer, and IBM® Rational Developer for System z™, etc. IBM Eclipse workbenches. *(12.2000)*.	**V13.1**	**10.18.2013**
IBM® HourGlass	Leading, widely-used z/OS® clock simulator that accurately simulates date & date processing for thorough pre-testing of time-dependent mainframe applications. Rich features/flexibility enable HourGlass to simulate past, present or future dates & times without changing application code or computing environments *(e.g. System z™ time/date settings)* ensuring accuracy & reliability of time-sensitive *(timing, time zones, time & date formatting)* applications. It coordinates reporting & data transfers across time zones, & also identifies applications requesting system date/time, to avoid time call problems in advance. From IBM's Princeton Softech acquisition. *(9.2007– IBM)*.	**V7.1**	**12.06.2013**

Continued on next page...

...continued from previous page.

IBM Problem Determination Tools *(PDT)* for z/OS® Suite Overview – May 1st 2014			
Product *(Alphabetical order by section)*	**Description** *(Month/year first introduced)*	**Current GA Release**	**GA Date**
IBM® InfoSphere™ Optim™ Test Data Management	Streamlines creation/management of test files/databases, supporting DB2®, IMS™, VSAM, and z/OS® sequential data, within this single product. Quickly, easily identifies/migrates related subsets of DB2/other above data into test/other environments, with powerful data extraction, selection criteria, data sampling, data partitioning, data manipulation, and sophisticated identity hiding facilities. The tool's Optim Directory supplements the DB2® Catalog to support the operations above. Also part of the IBM® InfoSphere™ Optim™ family. From IBM's Princeton Softech acquisition. *(09.2007 – IBM).*	V7.2	05.24.2013
IBM® Migration Utility for z/OS® *(MU)*	Generates IBM COBOL reports from CA Easytrieve® Classic Plus programs, preserving those investments while aiding smooth migration off. Converted programs can be run and enhanced in either IBM COBOL or in Easytrieve® programs, without needing CA Easytrieve® products, since source is maintained in the original library. Can easily modernize into HTML or CSV reports with auto-deployment to the web server. Enhanced Dynamic SQL improves performance/reduces resource usage, and batch-convert programs process more efficiently. File types supported: VSAM, QSAM, SAM, DB2® *(various)*, CA IDMS™, IMS™ *(DL1)*, tape files, & unit record devices. *(04.2002).*	V4.1	10.03.2012
IBM® Problem Determination Tools Studio *(PD Studio)*	Standalone Eclipse-based brings easy workstation GUI access to the select host PD Tool functionality provided in the five individual host product plug-ins named in each description of this Figure *(for APA, DT, FA , FM & WS).* PD Studio provides developers and systems programmers with a more productive alternative to the standard z/OS® ISPF host interface. It also provides a shorter learning curve for new-to- z/OS® developers & new hires, making them productive more quickly. PD Studio is built upon, and incorporates the core z/OS® services of, the IBM z/OS® Explorer workbench, IBM's Eclipse-based integration platform for z/OS® users *(see page 21). (08.2012).*	V13.1	10.18.2013
IBM® Workload Simulator for z/OS® & OS/390® *(WS)*	Simulates a network of terminals and associated messages, enabling stress, performance, regression, function and capacity planning, tests, without needing quantities of terminals or operators. Provides versatile, comprehensive, realistic terminal/network workload generation/simulation across a wide range of z/OS®, OS/390® TP & network environments in one product . The included IBM® Workload Simulator for z/OS® & OS/390 Plug-in for Eclipse provides GUI workstation access to select WS host services from within the IBM® Problem Determination Tools Studio *(PD Studio)*, IBM® CICS® Explorer, IBM® IMS™ Enterprise Suite Explorer, and IBM® Rational Developer for System z™, etc. IBM Eclipse workbenches. *(07.2002).*	V1.1	08.16.2002
IBM PD Tools Solution Packs – Two Extra Value PD Tools Bundles			
IBM® Problem Determination Solution Pack for z/OS®	Provides the full, robust, all-in-one suite of the latest IBM PD tool product releases above, offering all available functionality at a reduced, inclusive pricing reflecting any previously purchased. This Solution Pack comprises the FA, DT, FM, IBM Hourglass, DSC, PD Studio, and WS products, plus the Eclipse plug-ins for FA, DT, FM & WS. This Solution Pack reduces IT costs whilst enabling faster mainframe AD, improved application performance and reliability, & quicker fault diagnosis/repair.	V1.1	12.06.2013
IBM® Problem Determination Te Solution Pack for z/OS®	Provides latest IBM PD testing product releases an all-in-one z/OS® testing package, at a reduced, inclusive pricing reflecting any already purchased. It supports debugging, code coverage, time change simulations, & generation & execution of simulated workloads. This Solution pack comprises the DT, IBM Hourglass, PD Studio, & WS products, plus the Eclipse plug-ins for DT & WS. This Solution Pack reduces overall test time & cost, by improving both diagnosis ability & final application reliability, & via improving z/OS® testing processes.	V1.1	12.06.2013
Other IBM® z/OS®-focused Eclipse Workbenches Supporting IBM® PD Tool Plug-Ins *(For APA, FA, DT, FM, & WS)*			
IBM® CICS® Explorer	This IBM® CICS® Tools suite product provides a common, intuitive, low-footprint, Eclipse-based integration point/ RCP tool, for architects, developers, system administrators, system programmers, and administrators, working with CICS®. Offers unified, integrated GUI workstation access to CICS® runtimes, tools, & connectors. A wide variety of Eclipse plug-ins for the main IBM® CICS® Tools, the IBM® PD Tools for z/OS® suites, & other IBM/third-party software can be installed into IBM® CICS® Explorer. In our context, new IBM PDT V13.1 suite release plug-ins for APA, DT, FA, FM, & WS provide CICS® users with easy access to select host PD product services through this easy-to-use IBM® CICS® Explorer GUI. Incorporates IBM® z/OS® Explorer, see page 21. *(06.2009).*	V5.1.1	06.14.2014
IBM® IMS™ Enterprise Suite Explorer for Development	Built on the Eclipse platform, this IMS™ Enterprise Suite tool provides a GUI integrated development environment *(IDE)* simplifying & speeding creation & maintenance of IBM IMS™ applications. It minimizes IMS™ programming effort, improves IMS™ development productivity, & reduces the need for IMS-specific skills. It integrates with other Eclipse-based tools *(especially including the IBM PD Tools Suite product above via their plug-ins, and RDz)* to support the IMS™ development cycle above. Software is available at no cost to IMS™ users. Incorporates IBM® z/OS® Explorer.	V3.1	10.25.2013
IBM® Rational Developer for System z™ *(RDz™)* **Note:** RDz™ is not a member of the IBM z/ OS® PD Tools suite, but is deeply integrated with it.	RDz™ is IBM's comprehensive, Eclipse-based, System z™/zEnterprise™ System Integrated Development Environment *(IDE)*, today's de facto standard for quickly & efficiently creating & maintaining z/OS® applications. RDz™ accelerates development of traditional COBOL, PL/I, C/C++, & Assembler, as well as new Java, applications. RDz™ fully supports the batch, IBM® CICS®, IBM® IMS™, DB2®, & WAS® host run-time environments with optimized tooling. RDz™ source control & collaborative ALM support streamlines AD processes, & the IDE increases developer productivity whilst also improving application quality. RDz now includes fully integrated, workstation-based, source-level debugging. In our context, new IBM PD Tools V13.1 suite release plug-ins for APA, DT, FA, FM, & WS provide RDz developers with easy access to select host PD product services through their familiar RDz™ Explorer GUI. Incorporates IBM® z/OS® Explorer. *(02.2003 – Forerunner).*	V9.0.1	12.11.2013

Figure 6: IBM Problem Determination Tools for z/OS® Overviews – May 1st 2014

The IBM® PD Tools for z/OS® Suite was much extended through **numerous new releases** of core products, plus range extensions. This broad, rapid, and sustained, IBM development effort resulted in the current ten-core product, V13.1-generation suite line-up reviewed here at May 1st 2014. Each of these is briefly introduced and described here in Figure 6 on pages 16-17.

IBM's intensively developed, most recent V13.1 suite releases were *(mostly)* shipped from October 18th 2013, and provide the suite's now-large user base with more **advanced functionality, performance enhancements, new commands and options, absolute currency** with, and exploitation of, the latest fast-evolving IBM host software stack *(including CICS® Transaction Server V5, IMS™ V13, DB2® V11, and Enterprise COBOL V5)*, **exploitation of new hardware technology** *(e.g. zEC12 & zBC12)* and z/OS® *(e.g. z/OS® V2.R1)* advances, plus the **extensive GUI-workstation-enablement** described below.

PD Studio has represented a major advance for the IBM suite...

The updated **IBM® Problem Determination Studio for z/OS® *(IBM® PD Studio)* V13.1** Eclipse GUI workbench release now provides unified workstation access to select services of the five main host IBM® PD tools of z/OS® *(APA, DT, FA, FM, WS)*, via the Eclipse plug-ins now offered by IBM for each of those tools in their V13.1 releases, outlined in Figure 6. PD Studio has represented a major advance for the IBM suite since first released as V12.1 in October 2012. **IBM® PD Studio** provides IBM's premier GUI access and integration point for primary users of the supported IBM® PD Tools for z/OS® Suite host products who prefer to work via its **modern workstation GUI** rather than with the suite tool's traditional host 3270 "green-screen" ISPF interfaces. We discuss this, and other now available IBM GUI mainframe interface options for IBM PD tool users, more fully in a later subsection below.

Shipped from December 2013, and also outlined in Figure 6, were **two new IBM PD tools "Solution Packs"**. Each now provides a convenient, easily-orderable single package subset of the latest IBM® PD Tools for z/OS® Suite tools, at a favorable inclusive price that also reflects prior customer investments in any previously-purchased PD products included when trading up. These two Solution Packs are:

- **IBM® Problem Determination Solution Pack for z/OS® V1.1:** Provides problem analysis capabilities for all z/OS® subsystems and languages, from both 3270 or workstation GUIs, comprising the Suite's DT, FA, FM, WS, IBM® HourGlass, and DSC, products.
- **IBM® Problem Determination Testing Solution Pack for z/OS® V1.1:** Provides a testing package addressing mainframe application testing needs, comprising the Suite's DT, WS, and IBM® HourGlass, products.

Always **affordably priced**, with **flexible terms and conditions**, and requiring no troublesome license keys, the IBM® PD Tools for z/OS® Suite has long offered **outstanding value for money**, and these new Solution Packs offer **further value improvements**, for both new customers as well as for existing customers trading up to a broader set of IBM® PD Tools for z/OS® Suite products. These new offerings will also help IBM increase the average number of PD tool products licensed per customer over time.

The IBM® PD Tools for z/OS® suite has been heavily developed to offer the PD tool market segment's most extensive and advanced Java™ support for problem diagnosis and resolution...

IBM PD Tool's Unrivalled Java™ Support

As discussed in Section 2, the last decade saw **massively increased deployment of Java™ EE workloads** on the System z™/zEnterprise® mainframe z/OS® platform, enabled by IBM's continuous heavy R&D investment into its **world-leadership level mainframe SOA middleware** software stack *(centred round IBM® WebSphere® Application Server for z/OS®)*. The IBM® PD Tools for z/OS® suite has been heavily developed to offer the PD tool market segment's **most extensive and advanced Java™ support** for problem diagnosis and resolution for these now-widespread, usually mission-critical, host Java™ workloads based on SOA open standards. The rapid rise over recent years of large-scale corporate **mobile device app. enablement** connecting them through *(over SOA)* to back-end host database and transaction assets continues to accelerate – host Java™ providing crucial underpinning for these – as one of the top enterprise IT growth areas today. Rapid debugging and problem resolution of these often complex – nearly all multi-tiered – host-powered SOA and mobile enablement applications is thus essential today, and the IBM® PD Tools for z/OS® claims to **offer the strongest Java™ support** amongst its PD tool competitors. We examine/assess the IBM® PD Tools for z/OS® suite Java™ support strengths in our Appendix B reviews of these IBM products.

Inclusive Support For All Mainframe Subsystems, Languages, Data Sources – A Vital IBM® PD Tools Suite for z/OS® Advantage

As we mentioned above, the IBM System z™ mainframe z/OS® software environment comprises the numerous important run-time subsystems, the considerable range of programming languages, and a set of central data sources/servers that we picture in Figure 7 on page 19.

z/OS® PD Tool Suites Must Support
All IBM z/OS® Subsystems, Languages, Data Sources

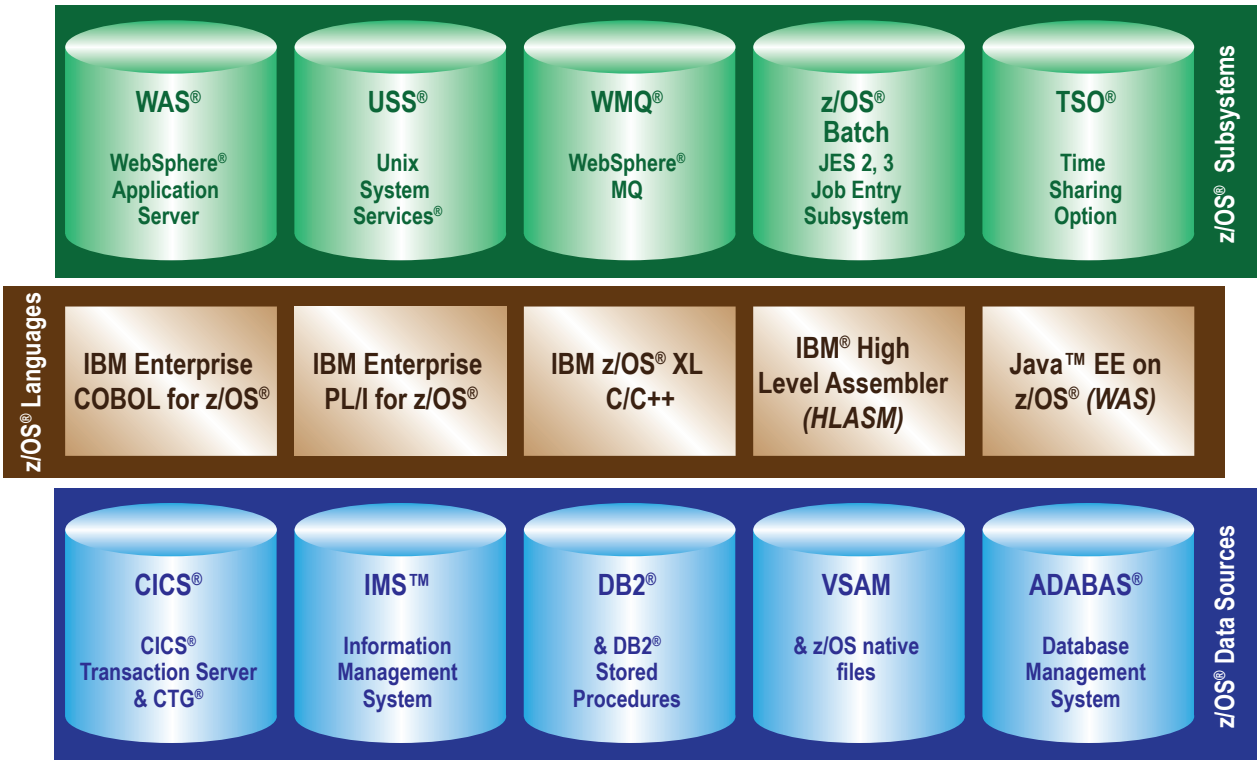

Figure 7: z/OS® PD Tool Suites Must Support All IBM z/OS® Subsystems, Languages, Data Sources

Each main IBM® PD Tool for z/OS® Suite product **inclusively supports all subsystems, programming languages, and data sources**, that are relevant to that product's functions, always including their latest releases, **within the single comprehensive product**. This excellent approach allows IBM to offer a compact, but comprehensive and inclusive, IBM® PD Tools for z/OS® Suite, offering the excellent value noted above.

Some other PD tool vendors, by contrast, sell multiple chargeable product versions for each subsystem, language, and/or data source, an approach resulting in larger product suites.

Some other PD tool vendors, by contrast, **sell multiple chargeable product versions**, or options, for each subsystem, language, and/or data source, an approach resulting in **larger product suites**. This often leaves user sites lacking newly-required capabilities of sub-system, languages, or data source support, incurring greater software costs to add those options, and also requiring more complex, time-consuming product installation and maintenance support effort by their customers.

Optimum exploitation by the IBM® PD Tools for z/OS® Suite products of **key advances and new features** in other core parts of IBM's z/OS® software and mainframe hardware infrastructure, is another **deep strength**. Full support for the latest IBM Enterprise COBOL, PL/I & C/C++ mainframe compilers, shown in Figure 7, is one prime example. With the major mainframe microprocessor advances IBM has delivered in each recent new mainframe generation, each adding many new instructions, new cache designs, enhanced pipelines, improved coprocessors, etc., significant parallel advances in the z/OS® operating system, in the IBM Java Virtual Machine *(JVM)*, and especially in the language compilers, were needed and delivered to fully liberate the enhance performance potential each new mainframe generation enabled. *(For example, the z196™ mainframe MPU added 100+ new hardware instructions.)*

Our more detailed assessments of each IBM PD® Tools for z/OS® Suite product and their latest advances, and the above related products, are given in Appendix B. Our Figure B1 *(on page 54)* details the 2000-2014 year-by-year evolution by new releases of the IBM PD Tools for z/OS® Suite products, confirming their consistent, rapid, decade-and-a-half long advancement path.

Three Other IBM z/OS®-aimed Eclipse Workbenches Now Also Offer IBM® PD Tools GUI Access

IBM has made major further developments in the range, scope, depth, and breadth, of its zEnterprise® mainframe workstation GUI offerings since our 4th Ed. W.P. 03.11, of which **IBM® PD Studio** – already described above – is the most central and relevant here. However, three other important other IBM mainframe Eclipse-based GUI workstation products, which we named and described in Figure 6 on pages 16-17, also now support the IBM® PD Tools for z/OS® Suite. These are:

- **IBM® CICS® Explorer V5.1.1:** IBM's well-established, fast-extending Eclipse GUI workbench and integration point, providing simplified access to select host services of main IBM® CICS® Tools for z/OS® Suite products *(see Figure B2 on page 65)* and CICS® native facilities, via IBM product plug-ins provided. Primarily for CICS® developers, system programmers, and administrators, requiring simpler GUI access than the traditional 3270 host facilities provides, this tool is therefore ideal to support newer, younger CICS® staff.
- **IBM® Rational® Developer for System z™ V9.0.1:** IBM's flagship integrated development environment for all types of mainframe applications development. The latest generation of IBM's comprehensive, modern Eclipse-workstation GUI-based IDE that fully supports all types/styles of mainframe applications, for all host runtime environments. RDz™ workstations are usually provided *(only)* to full-time professional host developers requiring the comprehensive IDE feature-sets RDz™ offers – but which are chargeable. RDz™ today dominates as the modern de facto standard System z™ IDE. Of course there clearly must be close links between the comprehensive RDz™ IDE used to build host applications and the IBM® PD Tools for z/OS® Suite products used to debug, troubleshoot, performance tune, and test host applications, and these are provided by their close integration as below.
- **IBM® IMS™ Enterprise Suite Explorer for Development:** Provides a GUI IDE platform that speeds up and simplifies creating and maintaining IMS™ applications, reducing effort, and requiring less IMS™-specific skills. It provides access to select core IMS™ component functionality, and to that of other IMS™ Enterprise Suite, IMS™ tool products.

IBM® PD Tools for z/OS® suite – May 1st 2014

Multiple Workstation GUI Options by Role

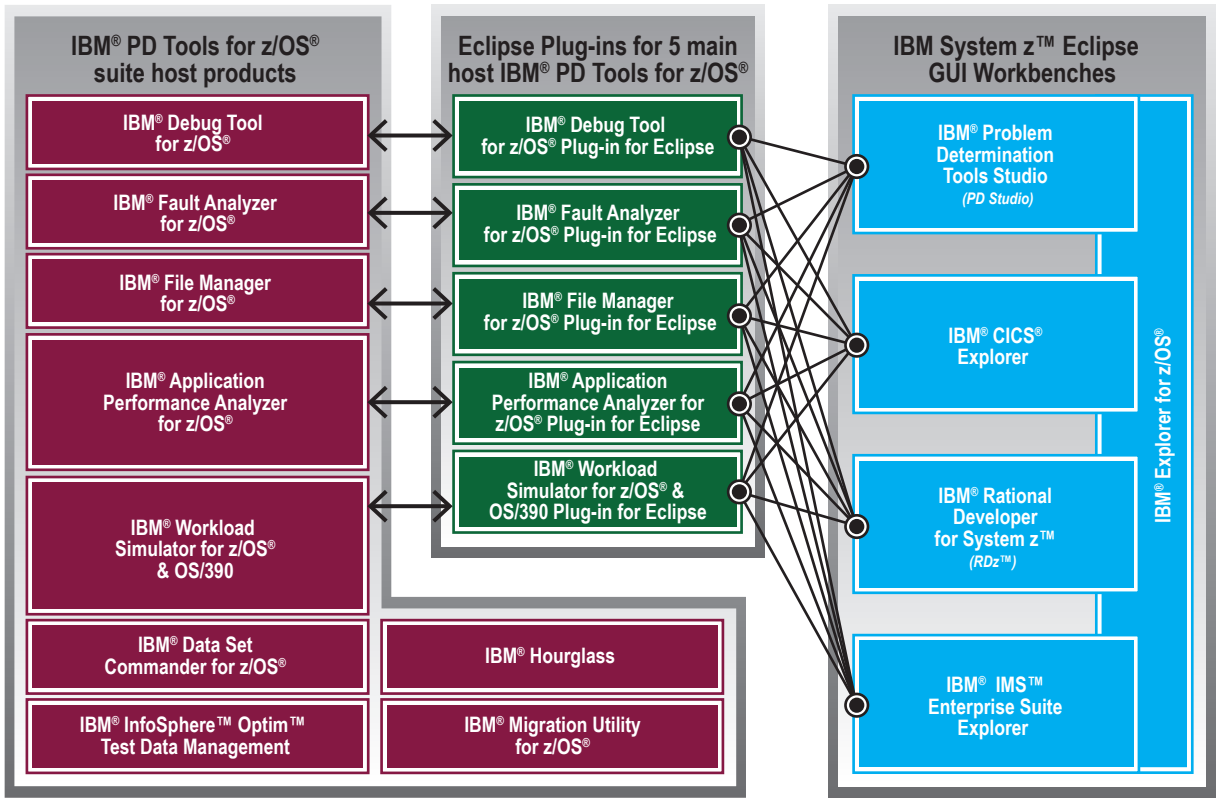

Figure 8: IBM® PD Tool for z/OS® Suite V 13.1 – May 1st 2014 – Multiple Workstation GUI Options by Role

We can best explain and illustrate these Eclipse GUI tools and their integration with the IBM® PD Tools for z/OS® Suite with the graphic in Figure 8 on page 20. The L-shaped area on the LHS names the nine host-based IBM PD tools. In the center of the chart, we show the five Eclipse Plug-ins IBM now provides for each of the five main host IBM® PD Tools for z/OS® Suite products *(DT, FA, FM, APA, & ES)* each linked to their respective host products. On the RHS of Figure 8 are the four IBM System z™ Eclipse GUI workbenches described above. These five PD tool plug-ins can be installed in each/any of the four IBM GUI workbenches shown on the RHS, to give their respective user's workstation GUI access to the select host PD tool services that each tool's plug-in supports.

...customer sites can therefore now easily, flexibly, and economically equip their mainframe workforce with the most appropriate combination of Eclipse GUI workbench facilities...

The **IBM® PD Studio**, **IBM® CICS® Explorer**, and **IBM® IMS™ Enterprise Suite Explorer for Development**, workbenches are currently provided free of charge for download/installation by sites/users already licensed for the respective host products concerned. The PD tool plug-ins are similarly provided free of charge for download/installation by sites/users licensed for their respective host products. This cost-free availability, their low footprint, simple installs, and intuitive ease of use, mean customer sites can therefore now easily, flexibly, and economically equip their mainframe workforce with the most appropriate combination of Eclipse GUI workbench facilities that best supports their role in the mainframe applications lifecycle, **without major costs**. This is particularly helpful to the many mainframe sites now bringing on younger, new-to-mainframe staff into their mainframe workforces, making it easy for the site to equip the newcomers with the fullest mainframe GUI workbench facilities available, helping them get up-to-speed and be productive more quickly. The same applies to less frequent/occasional users of all experience levels needing periodic access only.

IBM® Explorer for z/OS®

Also shown far right on Figure 8 is a final, important new foundation component of IBM's mainframe GUI workbench architecture, the **IBM® Explorer for z/OS®** Eclipse-based integration platform for z/OS® users and tools, which is incorporated pre-packaged within − and underpins − each of the four other workbenches. IBM® Explorer for z/OS® delivers **extensible workstation connectivity to key z/OS® functions**. It enables integration of many z/OS® solutions using IBM, vendors, or customer, plug-ins extendable via **IBM's repository of compatible product plug-ins**. It thus provides customized functionality to meet each user's role/responsibilities, and is available free for all supported z/OS® licensee users. It offers extensible workstation connectivity to key z/OS® functions, by providing simple and secure access to z/OS® datasets, IBM zSeries® File System *(zFS)* files, and Job Entry Subsystem *(JES)* jobs, and output, providing rich views and functionality on these. A **host connections framework** is part of IBM® Explorer for z/OS®, which manages system connections *(including FTP and z/OSMF)* and user credentials. These capabilities are also available as a set of APIs that users or ISVs can use to develop their own Eclipse plug-ins. IBM® Explorer for z/OS® is available as an Eclipse-based Rich Client Platform *(RCP)* executable, as a plug-in for inclusion in compatible RCPs, and is pre-packaged into the IBM z/OS® workbench products shown on the RHS of Figure 8.

IBM PD Tools CICS® TS V5.2 Support

The latest CICS® TS V2.1 release became Generally Available on June 13, 2014 whilst this Paper was being written *(and outside its Review Period)*. However, all relevant IBM® PD Tools of z/OS® suite products *(V13.1)* supported CICS® TS V5.2 since that GA date, via a timely and rigorously cross-tested IBM RSU *(PTF set)* issued. In addition, IBM made available new, V5.2-supportive/tagged new releases of five of the IBM CICS® Tools suite products as shown in Figure B2 on page 65.

Extensive GUI Functionality From Five Host IBM® PD Tools for z/OS® V13.1 Products

The plug-ins for the five main IBM® PD Tools for z/OS® Suite products shown in Figure 8 now provide easy, fast, simple and visual workstation access to a now-extensive set of host tool services from the IBM® PD Studio *(and/or the other mentioned above)* IBM z/OS® Eclipse GUI workbenches, further enriched/extended with the latest V13.1 releases of the IBM® PD Tools for z/OS® Suite. We summarize these host tool services for all five products in Figure 9 on page 22.

This shows the now-broad range of core host product functions and services that can be accessed via their plug-ins from the suite's IBM® PD Studio *(or other IBM z/OS®)* workbenches above. From the above, IBM's substantial advancement of its now comprehensive range of GUI options and capabilities are clear.

How The IBM® PD Tools for z/OS® Suite Evolved To Leadership

The mainframe PD tools category emerged from the late 1970s then grew rapidly as the global host installed base and software market multiplied many-fold for nearly two decades. Those years till the late-1990s delivered high sales/revenue growth, combined with high profit margins, to early PD tools vendors, notably **PD tools pioneer Compuware**, and **leading mainframe ISV CA Technologies**, both building out their PD tools portfolios with numerous acquisitions plus in-house R&D, whilst a few smaller ISVs were also attracted into this then-rich segment. But their growth ended after the Year 2000 sales spurt. Many mainframe user enterprises now switched investment into then-fashionable distributed platforms, some reducing their host developments and thus new host tool purchases.

Eclipse Plug-ins for 5 main host IBM® PD Tools for z/OS®

Functionality Provided in V13.1

IBM® Application Performance Analyzer for z/OS® Plug-in for Eclipse

- Can submit new observation requests & navigate their APA analysis reports.
- Shows R02 screens list, detail views, edit functions & reports for an observation.
- GUI displays/offers function to multiple APA components concurrently. Main views include:
  - STC View, listing all active started tasks.
  - Observations List View, listing all observations.
  - Observation Detail View, giving observations details.
  - Reports List View, listing all an observation's reports.
  - Report View, displaying an individual report.

IBM® Debug Tool for z/OS® Plug-in for Eclipse

- Helps debug z/OS® load modules running in MVS, CICS®, DB2®, IMS™, etc.
- GUI debug capability similar as under ISPF, including:
  - Set & clear breakpoints at a specific line, & for an error or warning-level error based on LE severities.
  - Run to a breakpoint, step into, or step over, a procedure.
  - View & change variable values while stepping thru code.
  - View variable values in context of larger storage area, & view call stack.

IBM® Fault Analyzer for z/OS® Plug-in for Eclipse

- Accesses problem report to diagnose host application errors & abends.
- Interface manages views & multiple fault history files.
- Can browse fault entries created in real-time analysis of abending programs.
- Can browse dump storage from a fault entry.
- Shows source listing of abending programs using side files.

IBM® File Manager for z/OS® Plug-in for Eclipse

- Offers tools to manipulate & browse z/OS® data resources including data sets, USS files, & WMQ queues.
- Can create, modify, & update, File Manager templates from COBOL, PL/I & HLASM copybooks directly.
- Or create dynamic templates on the fly where no copybook.
- File Manager editor data manipulation & browsing, aka:
  - Formatted/Table display using a template.
  - Character display *(text-based data presentation)*.
  - Single display using template *(focussed on display fields defined in a record)*.
- Allocate, compare, & copy z/OS® data sets, & create data File Manager utility functions.

IBM® Workload Simulator for z/OS® & OS/390 Plug-in for Eclipse

- Offers functionality to help manage test processes.
- Automatically generates Workload Simulator scripts & networks from VTAM® & CPI-C trace data.

Figure 9: Eclipse Plug-ins for 5 main Host IBM® PD Tools for z/OS® – GUI Functionality Provided in V13.1

The IBM® PD Tools for z/OS® Suite thus provided these customers with an escape route from that stranglehold...

Because new mainframe footprint sales, and so their new software license sales prospects, were now low, these competitors sought to raise PD software maintenance/support revenue from what they saw then as their "captive" user bases. As these competitors struggled to adjust, **they cut back their PD tools R&D, new releases, and support efforts, to economize**, just as IBM accelerated its whole mainframe software stack developments. The result was that these competitors' PD products began to lag well behind in their currency with IBM's System z™ host stack. Their tools were indeed now essential components at most mainframe shops, but **mainframe customers bitterly resented their high prices**, and the perception of being "gouged", by those long-established vendors who, at the same time were not keeping up with all needed developments.

When **IBM came into this segment in 2000**, for the first several years it wisely positioned its early core PD product suite modern tools of decent base functionality, excellent currency with the System z™ host software stack, with capable vendor support, and offered at prices 50% or more below competitors' then extremely high levels. Back then, long-established competitors, notably segment leader Compuware, but also Computer Associates *(CA Technologies today)*, could still claim superior functionality and usability, but were by this time **treating this segment as a "cash cow"**.

The IBM® PD Tools for z/OS® Suite thus provided these customers with an escape route from that stranglehold with its high-pressure tactics, and a way to make substantial cost savings. **Sales of IBM's suite grew steadily through the decade**, releasing those customers from the grip of competitor ISVs.

Eclipse Platform Footnote:

Underpinning all the IBM z/OS® GUI workbenches above is the dramatically successful Eclipse AD & IDE platform, donated by IBM to the open AD community *(now supported by The Eclipse Foundation – see eclipse.org)*. Eclipse contains a base workspace and an extensible plug-in system for customizing the environment, written mostly in Java. The open-standard Eclipse platform has burgeoned hugely and is today the industry-standard platform for IDEs, add-on tools, and rich clients *(RCPs)*, adopted by *(most of)* the AD software tools industry *(except Microsoft)*. Eclipse has been so successful because it provided a common, open, extensible, shared, interoperable, open standards platform with which vendors and users could more easily build and integrate all types of RCP tools, from all vendors.

This process was helped because the IBM® PD Tools for z/OS® Suite was continually developed, refined, broadened, and extended, across the 2000 decade to 2014 today, by **regular and frequent major new suite releases**, achieved via sustained high rates of extensive in-house IBM development and innovation, plus several ISV tool acquisitions incorporated. IBM consistently maintained far the highest development pace in this segment over that period, details clear from the Suite's 2000-2014 releases history shown in our Figure B1 on page 54.

For example, over the nine-year period spanned by our White Paper series, IBM's V8.1 suite generation shipped in September 2007, the V9.1 generation in September 2008, the V10.1 generation in November 2009, the V11.1 generation in November 2010, the V12.1 generation in May 2012, and the latest V13.1 in October 2013 *(which this 5th Ed. WP assesses)*. For an established mainframe software segment, this was an extremely fast drumbeat, delivering an impressive set of major releases/advancements which further extended IBM's **now compelling advantages and leadership**.

Our Analysis

Our 2nd Ed. WP 07.07 found then-market challenger IBM's suite had caught up with its main competitors on core functionality by mid-2006 *(V7.1)*, and **had edged ahead by 2008** *(V8.1)*. Our 3rd Ed. WP 01.09 assessed IBM had **opened up a solid lead by 2009** with its broad further advances *(in V9.1 & V10.1)*. Our 4th Ed. WP 03.11 showed IBM had **further extended** its overall feature/function/usability/value lead *(with V11.1)* latest releases, despite main competitors clearly having "upped their games". Many years of rapid IBM suite advances had finally forced competitors back to higher development efforts on their PD tools suites, as we first noted in our 3rd Ed. WP in 01.09, and again in our 4th Ed. WP in 03.11. Now, main competitors must invest in more active R&D to avoid IBM widening its lead further. As well as now-established feature/functional leadership, IBM continues to offer excellent product currency, GUI access, software costs, vendor support, and future roadmap strategic advantages; these combined presenting a compelling alternative to older incumbent PD tool suites.

PD tool suites remain a crucial component of IBM mainframe AD tooling portfolios, providing a wide range of vital functionality for **mainframe developers, testers, system programmers, performance analysts, operations**, and **production support** staff. The benefits of using good PD tool suites remain compelling and well-proven over many years. These benefits include **faster development, improved application quality and performance, higher application availability, faster problem resolution**, and **lower mainframe MIPS consumption**, all crucial advantages that generate a fast ROI for new purchasers.

The main PD tools suites provide roughly similar services, functions and capabilities, and each plug-into the same core IBM mainframe software subsystems and middleware components. This **makes older PD tools quite easily replaceable** at a customer site. The cost, effort, and elapsed time, of PD tool migration are far lower than for other host software segments, e.g. 4GL AD/Database *(DB)* environments, where user applications assets locked into the tool prevent easy migration. PD tools suite features, vendor training, documentation, and cross-product migration tools and services to help minimize customer migration costs and effort are available, and again yield **good ROIs** with the large software cost savings migrating users can usually attain.

Mainframe-hosted new "SOA, etc." applications saw broad adoption over the last five years, and now mainframe-based **enterprise business analytics, mobile device support, infrastructure consolidation**, and **cloud computing**, are all expected to grow strongly through 2014 and over the next several years. It is thus certain that these drivers will increase the levels of mainframe AD over this timescale. We therefore consider it essential every mainframe site has a full PD tools suite, and all should adopt the best available today.

IBM has sustained an unrivalled PD tools suite development pace, delivering extensive advances via regular suite releases throughout 2000 to 2014.

IBM has sustained an unrivalled PD tools suite development pace, delivering extensive advances via regular suite releases throughout 2000 to 2014. Over recent years, these were the IBM® PD Tools for z/OS® Suite V8.1 releases in September 2007, the V9.1 releases in September 2008, the V10.1 releases in September 2009, the V11.1 releases in November 2010, the V12.1 releases in March 2012, and the latest V13.1 releases in October 2013. These rapid and substantial releases have piled increasing competitive pressures on competing vendors.

Based both on this compelling IBM® PD tools for z/OS® Suite enhancement track record, and on the firm's publicly-stated intentions, its customers can expect continuing robust advances here out of the IBM software labs. As usual, few forward roadmap details of its PD tools plans are disclosed, IBM "keeping its powder dry" about these product plans until their announcement.

The overall result has been widespread uptake of IBM PD tools products *(we estimate IBM now has ~2,300 PD tool customers, with ~6,750 individual products installed at end-2013)* and continued steady IBM market-share gains. IBM's fierce competitive twin pressures, for more/faster development, but also for lower license/maintenance fees and fewer/smaller MIPS upgrade fees, challenged the other vendors by now suffering declining PD tools revenues.

4. Competing Mainframe PD Tools Suite Vendors

Introduction

PD tools are among the **longest-established host software segments**, the first product dating from 1977 *(Compuware Abend-AID)*. For two and a half decades, until **IBM's PD tools market challenge** ramped up from 2000, third-party ISVs "owned" the PD tools segment with their by-then long-running product suites. Years of host ISV acquisitions had swelled the PD tool suites of leading consolidators, leaving the **handful of existing suite vendors today**. Therefore, this White Paper's competitive assessments focus on the **IBM® PD Tools for z/OS® Suite** and those of its **four nearest competing vendors**. These five competing firms, their logos, and their own current headline PD tools suite descriptions, are shown in Figure 10.

Here, we briefly introduce and overview the four main competing PD tools suite vendor firms *(in alphabetical order)* below.

CA Technologies *(NASDAQ – CA)*

CA Technologies remains **world-largest mainframe ISV** – sixth largest by revenue – now* with **~12,700 staff** *(down 900 Year on Year (YoY))*. The NYC-headquartered firm had **$4.515B total revenue** *(down 2.1% YoY)* and **$914M net income** *(down 4.3% YoY)* for Fiscal Year *(FY)* 2014 *(ending 03.31.2014*)*. FY14 brought positive changes under a new CEO, as noted below. Revenue came 59% from the US, and 41% from international operations – CA Technologies has global presence in 45 countries via ~100 offices.

For FY14, **Mainframe Software** *(including PD tools)* revenue was **$2.478B** *(down 0.44% YoY)*, **54.9%** of firm revenue, **Enterprise Solutions** *(ES – software for distributed platforms)* revenue was **$1.658B** *(down 4.7% YoY)*, at 36.7% of revenue, and a small Services unit made $0.379 *(down 0.78% YoY)* the rest. **Mainframe Software** earned **$1.491B unit profit at 60.0% margin** *(up on 59% in FY13)* and **89.9% of firm unit profits**, still a vitally important majority, while Enterprise Solutions made $0.144B unit profit at 9.0% margin *(up on 8% in FY13)*.

Figure 10: z/OS® Problem Determination *(& APA)* Tool Suites – Principal Competitors Reviewed – May 2014

Software R&D was a healthy 13.0% of revenue *(up from 11% in FY13)*, with 5,800 staff *(at 03.13.14)* now in software development, research, and support, after significant changes *(facilities/R&D consolidation, rebalancing skills mix, etc.)* One such radical step was the firm's adoption of modern **agile software development approaches**, to speed incremental deliveries yet reduce costs. Rewarding its shareholders, CA Technologies also delivered $453M of dividends, and $505M of share buybacks, in FY14. *(Source: Full Year Results, 05.15.14.)*

Long-established *(38 years, founded 1976)* foremost host ISV consolidator, CA Technologies original business was mainframe software for two decades, adding distributed platforms products from the early-1990s.

New **CEO Michael P Gregoire** *(Jan 2013 on; ex-CEO Taleo Corp, ex-PeopleSoft & EDS.)* set 3 priorities – **more in-house innovation, better execution, and greater speed/urgency**. In FY14, new strategy was set, new hired executives, marketing boosted, and sales structures changed, redirecting resources – including 900 new skills hires and R&D cash – to chosen high-growth areas where the firm now differentiates itself, notably: **DevOps, Management Cloud, and Security**. Offerings are now branded under **ca DevCenter & ca OpsCenter; ca IntelliCenter; ca SecureCenter**; names respectively, with a multi-platform focus on **cloud computing**, **mobile**, and **mainframe** *(our interest here)*.

This White Paper reviews CA Technologies **"Mainframe Application Quality & Testing Tools; & Performance Management Solutions"** suite for z/OS®, a long-standing, major mainframe PD and APM suite in our subject segment. CA Technologies 2014-on AD solution advances, covered below, are rapidly evolving these *(and other CA Technologies AD)* offering, so are introduced below.

CA's new Dynamic Data Center (DDC) strategic vision describes an infinitely scalable computing environment, that can dynamically expand and contract in response to business needs...

The firm's new **Dynamic Data Center *(DDC)*** strategic vision describes an **infinitely scalable** computing environment, that can **dynamically expand and contract** in response to business needs, and that spans across **mainframe, distributed, cloud** and **mobile** platforms. **IBM® System z™ & zEnterprise® System** mainframes are at **the heart** of the Dynamic Data Center, providing central management of **security, governance, cloud services, big data**, and **predictive analytics**. CA Technologies extensive software portfolio already actively supports many of these roles, with major R&D efforts now directed to simplify, integrate, unify, and extend these cross-platform for the DDC era.

Major **new AD directions** from the firm's new **Application Development** Business Line were previewed *(in March 2014)* at SHARE Anaheim. These support the **Dynamic Data Center** vision *(above)*, with IBM **mainframes at its heart** in most large enterprises. Developers today are largely extending outwards access *(to mobile, to Web, to social, with analytics, with big data)* to host databases and transactions. Most enterprise applications today are multi-platform, combining a client tier, and a distributed mid-tier, with a mainframe back-end, plus now with private or public cloud computing a further platform. CA Technologies is **proactively updating its AD line-up** to better address this DDC scenario, extending from mobile to mainframe, balancing spends over new and existing offerings, leveraging customer's CA Technologies AD product investments, and opening up its AD suite to complementary third-party elements.

Under this new **CA Application Development Solution** architecture, the firm will first deliver three major elements:

- **New AppDev PRIME "Maintain" Offerings:** New **CA FileMaster™ PRIME** and **CA InterTest™ PRIME** data and applications maintenance, quality and testing tools. These combine the functions of, and further extend, two groups of the traditional CA Technologies PD suite tools above, for extended DDC roles developing and maintaining back-end host applications logic. *(Our interest here.)*
- **Application Constructor:** AD capabilities from the established CA Technologies **CA Gen** and **CA Plex** tool lines, with extended DDC vision application development support.
- **New AppDev PRIME "Manage" Offerings: CA Endevor® Software Change Manager PRIME** *(mainframe)* and CA **Harvest Software Change Manager PRIME** *(distributed)* SCM/ALM capabilities extending these classic CA Technologies products for DDC.

In work – and yet to be delivered – are three other major elements of this new layered CA Technologies AppDev architecture: the *(codename)* **Application Workbench** *(supporting all DevOps lifecycle stages)*, **Unified SCM** (common multiplatform SCM/ALM), and **Applications Services** *(common application services underpinnings)* layers, first arrivals expected within 2014 – 2015.

We assess this to be a radical, powerful, and compelling new CA Technologies AD strategy, with new software element first arrivals due within 2014, that positions the company strongly for **DevOps success** with its wide customer base, and with familiar traditional CA Technologies products becoming evolved key components in this new, SOA-based solution.

Footnote:

* CA financials understate its real strength. They exclude substantial deferred future license fee revenues contracted in multi-year customers deals not yet recognized in its accounts.

Compuware Corporation *(NASDAQ CPWR)*

Compuware remains a large, publicly-quoted software company, now well through its **strategic transformations** that begun 15 months ago. In its latest FY14 *(ending 03.31.14)*, Compuware **posted $721M revenue** *(down $223.5M or 23.7% YoY thru divestures, -0.4% from continuing operations – FCO)*, but swung to a healthy **+$68.1M net income** *(from a $17.25M net income loss in FY13)*, with major divestitures and large cost reductions previously pledged both fully achieved. FY14 FCO revenue above came **80.9% from software** *($583.3M, down 2.8% YoY)*, **13.5% from applications services** *($97.1M, up 7.1% YoY from Covisint unit)*, and **4.2% from professional services** *($30.2M, down 8.2% YoY)*. Compuware's FY14 R&D spending was **$86.2M**, **12.0%** of FY14 revenue *(was 10.9% in FY13)*.

FY14 actual *(post divestitures)* revenues came **$296.3M** from the **Mainframe Solutions** business unit *(BU) (at **75% contribution margin**, up from 73% YoY)*, and **$327.4M** from the **Application Performance Management** *(APM)* BU *(at **10% contribution margin**)* from their respective software and professional services.

...Compuware pioneered mainframe PD tools (Abend-AID – 1977 – was first), was long this segment revenue share leader, and remains a widely-entrenched incumbent.

Long-established *(41 years)*, Detroit MI-based Compuware has been a leading ISV and IT Service Provider consolidator, with >44 acquisitions to date, and at FY14 year-end had **4,363 employees**. Founded in 1973, Compuware **pioneered mainframe PD tools** *(Abend-AID – 1977 – was first)*, was long this **segment revenue share leader**, and remains a widely-entrenched incumbent. Compuware currently sells/supports its software directly into 30 main countries, through 55 own/subsidiary offices *(some also support nearby nations)*, plus via distributors elsewhere.

Compuware **has actively transformed itself**, to win higher growth and profitability that better rewards shareholders. From FY12, it faced loud activist investor *(Elliott Management, Starboard Value, Dodge & Cox, Black Rock, et al)* pressures for change. Elliot Management even offered a $2.3B buyout *(Dec 2012)*, rejected by Compuware's board to pursue their own strategy.

In FY13, this strategy's **radical transforming actions** included **part spin-off of the Covisint** applications services subsidiary in an October 2013 IPO, a multi-year **comprehensive cost-reduction program** *($100M+ by end-FY15 aim)*, and a $160M 01.31.2014 deal with Marlin Equity Partners *($3B+ LA-based global investment firm)* to buy Compuware's non-core **Changepoint, Professional Services**, and **Uniface AD tools**, units *(with combined $220.7M FY13 revenues)*. Marlin quickly re-launched the Professional Service unit as a standalone company, **CW Professional Services**, on 02.03.14.

Compuware's original APM solutions were first boosted by its November 2009 $295M cash buy of web application experience management leader, MA-based Gomez *(272 staff)*, and again by its July 2011 $256M deal for **Boston-based dynaTrace software** *(180 staff)*. The latter's PurePath® continuous APM technology claimed to address enterprise APM challenges in a different, better way. Compuware then energetically combined these three elements into today's APM Business Unit and product line-up, which operated through FY14.

In Sept. 2012, the firm launched **Compuware APM for Mainframe**, combining the **dynaTrace PurePath® technology** with its mainframe **Strobe for Java™** and **CICS®** APM capabilities, claiming to be *"the first and only 24*7 continuous transaction management APM solution to span both distributed and mainframe environments"*. Compuware APM for Mainframe won 21 deals with $6.4M FY14 revenue, a healthy start to market. Confusingly, this mainframe-centered *(cross-platform)* APM product family was transferred into the APM Business Unit for FY15 on!

The firm also revealed... (clearly well-advanced) plans to split itself into two separate, self-contained, companies of similar size were under review. One the Mainframe Solutions BU, the other the APM BU...

Compuware's FY14 earning call/presentation *(05.22.14)* confirmed completion of its spin-off of Covisint is expected in FY15. The firm also revealed that *(clearly well-advanced)* plans to split itself into two separate, self-contained, companies of similar size were under review. One would be the **Mainframe Solutions BU**, the other **the APM BU**, each upgraded into freestanding companies, each serving quite different market segments, with very distinct financial ratios, and thus completely different investor profiles! Indicators suggest this split will proceed, with a mid-FY15 timing likely. Capital will be returned to shareholders from those operations, if concluded. The call also reported "consolidation opportunities" had opened up for the Mainframe Solutions BU, unspecified!

This was **impressive progress** with a **radical company transformation**. The implications of these plans for Compuware's host PD tool customers and the PD tools market segment are discussed in the "Our Analysis" subsection below, and in our Section 6 Compuware suite and vendors assessment summary.

Macro 4, Division of UNICOM® Global

Macro 4 is a long-established *(46 years, founded 1968)*, energetic, smaller ISV, offering its well-established suite of host **Fault Analysis & Testing; Data Manipulation**, and newer **Performance Management** *(mainframe and multi-platform APM)* z/OS® software solutions in this White Paper's domain. It also offers the successful Columbus enterprise document management solution, and its IBM System i™ tools portfolio. Previously a London-listed UK Plc, Macro 4 was **acquired in January 2009 by UNICOM® Global**, the acquisitive, privately-held Los Angeles-based IT software, hardware, services, outsourcing, and properties, group built via many US and international acquisitions *(now has 34 entities, founded 1981 so 33 years old)* – including complementary IBM System z™ and System i™ software lines − led by founder Corry S. Hong.

After acquisition, Macro 4 continued trading under its known brand as a UNICOM® Global division, developing, selling and supporting its **principal System z™ mainframe tools** *(our interest here)*, document management solutions, and successful IBM System i/i Series tools − now rebranded under **SoftLanding Systems** *(the other UNICOM® Global IBM System i software tools division)*. To date, UNICOM® Global has **acquired ~15 software/IT service** firms or **product sets**, several bringing **valuable synergies** with Macro 4 – product-related or services-related – and adding extra group locations *(total now 26)* Macro 4 can leverage. Through its IBM software and IT services interests, UNICOM® Global was long an IBM business partner, extended by its recent *(12.31.2013)* purchase of the Cognos Applications Development tools business *(PowerHouse 4GL, etc.)* from the IT giant.

Post-acquisition, moving from UK public to private ownership alone **cut Macro 4's costs by several £100,000/year**, whilst substantial headcount reductions yielded larger cost savings. But, during our Review Period, Macro 4 has continued to **invest in product R&D**, delivering many **new releases**, and several **important advances**, for its mainframe PD tools suite, whilst maintaining **close support links** with its customers.

The Macro 4 group *(UK parent and its own subsidiaries)* reported **revenues of £23.1M** *(up 3.7% YoY)*, and healthy net **after tax profits of £12.2M** *(52.8% of revenue, & up 17.3% YoY)* from continuing operations, for its 2013 financial year *(ending 31.12.2013)*. The geographical spread of this revenue was 39.7% USA, 26.1% UK, 10.2% Germany, 7.6% France, 12.2% other Europe, and 4.2% rest of the world.2013. R&D costs totaled £3.46M, a **high 14.8% of revenue**, reflecting the firm's continuing commitment to maintaining and improving the functionality, quality, and competitiveness of its software solutions. Year-end staffing was 107 employees, with averages of 49% in R& D and 16.7% in user support, during 2013. OEM royalties also contributed strongly to the firm's high profits.

Macro 4's System z™ mainframe *(and other)* **product management, development-R&D team, and support** operations, **remain UK-based** at its Crawley HQ. Those core teams have been slightly increased over recent times, with some younger additions included. The firm's latest **IBM z114 mainframe** onsite supports all Macro 4 host product development/testing workloads, and also powers the UNICOM® Global host data center serving the whole group.

Macro 4's products are sold/supported directly from its **own 11 offices in 9 main countries**, via established **distributors in 14 more** countries, with extended coverage via other UNICOM® Global locations. **Technical Account Managers**, who provide **regular contact, help, and support** to mainframe PD tool customers, but who also capture users' development requests/needs, have proved successful in retaining the firm's customer base, deploying newer solutions, and steering the firm's R&D to meet their customer's needs.

The firm's stable mainframe PD tools customer base is **mostly long-standing**, and their continued satisfaction brings Macro 4 high **license renewal rates**. These maintenance/support renewal fees comprise a large majority of this unit's revenue, the rest from some new PD tools sales.

This active mainframe PD tools suite provider again showed strong R&D, customer support emphasis, with exceptional financial strength...

This active mainframe PD tools suite provider again **showed strong R&D**, customer **support emphasis**, with **exceptional financial strength**, favorable factors for its enterprise customers, in our Review Period. We estimate the firm held a ~2% share of 2013 worldwide z/OS® PD tools revenue.

It thus seems their acquisition was successful, extending Macro 4's reach/locations, enabling the solid R&D above, with valuable product synergies from the parent's later ISV acquisitions now being exploited.

Serena Software

San Mateo, CA-headquartered Serena Software is a medium-sized ISV **posting $183.0M revenue** *(down $20.4M and 10.0% YoY)* and a **-$3.25M net income loss** *(down $5.73M YoY)* for FY14 *(to 01.31.14, unaudited)*, now focusing on **orchestrated application development** and **release management DevOps solutions** for Global 2000 companies, with 2,500 enterprise customers. This long-established *(34 years, founded 1980)* firm earlier specialized in **Application Lifecycle Management *(ALM)*** and **Software Change Management *(SCM)*** for the mainframe, later adding distributed platform, solutions. Today, Serena Software labels itself *"the largest independent ALM vendor, and **unique in orchestrating DevOps**, the processes that brings together application development and IT operations"*.

Earlier a NASDAQ-listed public firm for many years, Serena was first taken private in 2006 *(for $1.2B by Silver Lake Partners private equity group)*, made several acquisitions then stumbled, latterly suffering declining revenues and financial losses, and **piling up huge debts**. Serena's **~400 employees** *(April 2014, website)* were **sharply down** from 547 *(at 01.31.13 per FY13 10K)* as a result of falling revenues and losses. **Total debt was $410M** at 01.31.13! But Serena still spent **$24.80M on software R&D** in FY14, a decent 13.6 % of that year's revenue although ~$3.3M down on FY13. Serena now operates directly/via subsidiaries in 16 countries, with 13 additional smaller market countries covered by resellers/distributors.

In March 2014, Serena became a **portfolio company of HGGC**, a middle-market private equity group *(reportedly paid ~$450M price)*, teamed with the firm's founder, and is now bidding for new growth – and to win a good position – in the **expanding DevOps** market space.

Serena holds a small, <3% share of PD tools segment revenue putting it into fourth place by $ revenue in this market...

Serena also offers its popular Comparex® tool, and Serena® StarTool® suite for z/OS® – a compact suite of mainframe PD tools products acquired/built-out up to the early-2000s – this White Paper's interest. These are the **Serena® StarTool® IT Ops. and App. Dev. Productivity Improvement Tools; & Comparex®** for z/OS®. Comparex® *(a host data file comparison tool)* was the firm's first product, written by founder/long-time CEO, Doug Troxell, again an active director and big shareholder today. The same PD tools suite products remain Serena website listed/offered – with no additions or deletions – since our prior 4th WP 03.11 review. Serena holds a **small, <3% share** of PD tools segment revenue putting it into fourth place **by $ revenue** in this market, but with – we estimate – declining share, user base, and revenues.

Prior public financial reports did not break down Serena Software revenue by product group, but showed total license sales and total maintenance revenues both declined in each recent year. We estimate the Serena PD tools suite above now provides <10% of current firm revenue. With such **high debts**, non-core asset disposals – to reduce debt or reinvest into DevOps – are possible.

Others Excluded

A few other mainframe ISVs offer products in this z/OS® PD tools space. ASG *(Allen Systems Group)* offers its ASG Application Problem Determination and Debug Suite, mainly rebadged Serena® StarTool® products. BMC Software *(better known for database tools)* has mainframe APM tools. Smaller ISV firms offer point PD products but not suites. For those reasons, we again excluded these ISVs in this z/OS® PD tool suites-focused comparative White Paper.

Our Analysis – Host PD Tool Suites, Consolidated Segment

All mainframe tool segments underwent **vendor consolidation** thru the 1990s to early 2000s, as the host software market first slowed, then went "ex-growth". The early host ISV consolidators *(including CA Technologies and Compuware)* were motivated both to capture high-margin host tool user base maintenance/renewal revenues, but also to widen product portfolios with the acquired offerings. **All these PD tools suite vendors above, and IBM itself**, each first put together their PD tools suite through varied mixes of smaller ISV or product acquisitions, and in-house R&D development efforts.

Because PD tool products must work together across host AD lifecycle processes, integrated PD tool suites from a single vendor usually provide superior integration/interoperation that multi-vendor product mixes cannot offer.

Because PD tool products must work together across host AD lifecycle processes, **integrated PD tool suites from a single vendor usually provide superior integration**/interoperation that multi-vendor product mixes cannot offer. Vendor consolidation allowed faster assembly of a fuller suite, another reason today's PD tools segment is dominated by this handful of PD tools suite vendors and IBM. Today, further segment vendor consolidation again seems likely.

Such mainframe software tools **were prized acquisitions** *(a)* because most host customers renewed licenses, generating high and stable revenue streams, and *(b)* for the **exceptional unit profit margins** they generated at scale for new owners, margins amplified by large cost cuts often made to the ISV firms bought. Host software **gross/unit margins still remain high today**, for example, **60% at CA Technologies**, and **75% at Compuware**, in their latest FY14 results listed above. IBM Software, the largest mainframe software provider, achieved a **still higher 86.8%** average gross margin in 2013 across both its mainframe *(about 40%)* and distributed systems *(about 60%)* software!

Earlier in the 2000 decade, established host PD suite vendors reduced product R&D efforts, while reaping high maintenance/support revenues, and taking big MIPS upgrade fees, so enjoying fat margins. They also invested less in product currency or feature/function development *("cash cow" model)*, diverting high host software profits to fund distributed product developments *(hoping for new growth)* or into shareholders' pockets. From their investors' viewpoint, the exceptionally profitable mainframe software business was great for earnings but was essentially ex-growth, but much of the $B invested into distributed solutions often failed to pay off since.

Such ISVs did grow now-large **distributed software units**, but margins on these were often poor, for example just **9% at CA Technologies**, and **8.7% at Compuware**, in their FY14 results listed above, despite many $Bs of mainframe software profits so invested/diverted. This was partly because too few of their distributed solutions became high-growth, profitable segment leaders: more proved average performers and not always fully competitive against newer specialist ISVs, dragging down average margins.

Compuware – as per our profile above – hopes it has decisively resolved such problems by selling off its lower-performing distributed solutions, and professional services, units completely, will spin off its SaaS Covisint unit, and has invested heavily into its higher-growth APM business unit. It is now reviewing a split into two firms during FY15, one a **pure-play Mainframe Solutions** *(high margins, declining revenues)* firm, and the other a **purely APM business** *(high-growth, segment leader candidate)*. CA Technologies also recently substantially rebalanced its R&D resources/investments into fewer, higher-growth distributed solutions segments and away from poorer performers, whilst **sustaining to retain** its 55% of firm revenue mainframe software business.

But – ramping up since mid-2000 decade – IBM's **extensive, faster-paced mainframe software stack advances** now demanded higher levels of new feature/function/compliance/exploitation development from all PD tools vendors.

This formidable IBM drive forced the main competitors above (from around ~2006 on) to invest more in host product R&D again, as three have since done.

Meanwhile, **IBM's own PD tools suite saw rapid, sustained, development of** product strengths and span from 2000 to date, under the firm's heavy R&D investments *(analyzed in Section 3)*, which delivered the stream of major new releases and advances to the suite we noted. This fast-growing suite strength, and better value, saw IBM win a steadily-rising customer base, and segment market share *(now # 2 by revenue)* today. This formidable IBM drive forced the main competitors above *(from around ~2006 on)* to invest more in host product R&D again, as three have since done.

IBM's vigorous charge into this segment also **forced down competitors' prices**, as IBM's more customer-friendly PD tool license-fee models, rates, & terms were widely appreciated by mainframe sites. Incumbent PD tool vendors since struggled harder to hold onto steadily declining user bases/revenues. For example, leader Compuware's host *(all PD tool)* software revenues have fallen steeply, from $762M in FY01 to $296.3M in FY14, a 61.1% overall decline *(a 7.1% CADR over that period)* it says "was arrested" in FY14.

...global host PD tools segment's software revenue we estimate was ~$700M in 2013.

The four diverse competitors above, plus challenger IBM, now **command nearly all *(95%+)*** of the global host PD tools segment's software revenue **we estimate was ~$700M in 2013**. Compuware remains # 1, still with a near-50% revenue share after the years of decline above, whilst **# 2 IBM's share, user base, and momentum continue to steadily rise**. Over many years, challengers *(notably IBM)* won most of their new PD tool software revenue by replacing incumbent PD tool products *(mainly Compuware, also Serena, some CA Technologies)*.

CA Technologies *($4.515B FY14)*, Compuware *($721M FY14)*, and IBM *($99.75B 2013)* are major, large, and giant public companies respectively. Both previously public, mid-sized Serena Software *($183.0M FY14)* has been private since 2006, as has smallest Macro 4 *(£23.1M CY13)* since early 2009 *(now a UNICOM® Global division)*. Only Compuware – alone amongst our five vendors – breaks out its System z™ PD tools product revenues as quoted above. Each faces the different challenges we noted above, and **further consolidation** in this segment is now more likely.

We review each vendor's PD tool suites for z/OS® in Appendices B *(IBM)* and C *(other 4 vendors)*. Our strategic comparison assessment summaries, scoring, and ranking of each vendor/suite are presented in Section 6. These are based on our scoring model presented in Appendix A and Figure A1.

5. Our Seven Strategic 2014 PD Tool Suite Selection Criteria

Introduction

This Paper already highlighted the **renewed importance of mainframe PD tool suites** for z/OS® to support and streamline the broad range of important **new mainframe workloads and applications** now being built, as well as to help the widespread modernization of existing host applications. We also defined main PD tool product categories, and **assessed the generic benefits** these tool suites broadly offer. We introduced and overviewed the now-comprehensive, modern-technology *(e.g. Eclipse GUI support)*, fully-current, and good value **IBM® PD Tools for z/OS® Suite** *(now in latest Version 13.1 form)* that reinvigorated this market segment during the 2000 decade and since. In Section 4, we also introduced the four main, long-established, competing PD tools suite vendors *(with their product suites profiled more fully in Appendix C)*, and discussed further important considerations in this market.

...most relevant high-level, strategic comparison factors that should guide customer PD tools replacement, migration, or new purchase, decisions...

Below we report on what our analysis found are today's most relevant **high-level, strategic comparison factors** that should guide customer **PD tools replacement, migration, or new purchase, decisions** through 2014 and beyond. We also review the customer situations most frequently triggering PD tools suite replacement. We then present our latest 2014 strategic comparative assessments of our five vendors, and their 2014 PD tools suite offerings, against these strategic factors in our next Section 6 following.

PD Tool Suites Now Not Only Replacement Market

Other analysts still categorize z/OS® PD tools as a **replacement market segment**, where replacing older *(or too costly suites)* with better options has been the main action *(aka ex-growth)*. We already highlighted the important case for such replacements, which were widespread over the 2000 decade and since. The 2008-12 recession forced extensive IT cost savings, and this drove **many further PD tools suite replacements** to capture the large cost savings these usually delivered.

2014 already saw **economic recovery** in many parts of the world, with **renewed business confidence** driving a significant wave of **new business investments, developments, and acquisitions**, etc. The emerging economies continue to post GDP growth rates several-fold higher than the average of developed nations; although below earlier peaks. The majority of those new business investments are IT-dependent or IT-enabled, so **many hundreds of enterprises** can be expected to replace, **upgrade and/or expand their IBM mainframe hardware** capacity, and their **host software**, to efficiently and securely accommodate these new workloads. We therefore forecast the next new generation of IBM mainframes *(expected from 1H 2015 on the usual 2.5-year host generation cycle)* will attract particularly broad **uptake, capacity growth**, and **new workloads** worldwide.

Over each of the last 3 generations of System z™ mainframe, IBM **won to 75-100 new-to-mainframe enterprises per generation**, and new PD tool license sales to these sites increasingly followed. With the improved economic climate mentioned, IBM may even exceed these substantial footprint gains over the next host cycle.

Consolidation and migration of enterprise workloads, both from **inefficient, wasteful distributed platforms**, but also to replace **other vendors' obsolete large systems** *(including HP Integrity, HP Integrity NonStop. Sun Enterprise, and Unisys, etc.)*, onto current and next IBM mainframe generations, will increase in established markets, boosted by the platform's now well-proven zBX hybrid technology that **enables multi-architecture consolidations** onto one zEnterprise® system.

These trends now present a healthier revenue opportunities outlook for the successful z/OS® PD tools suite vendor, this segment now again offering some growth prospects for winners.

Triggers for PD Tool Migrations

A handful of common events/issues triggered most host PD tools suite re-considerations, and fresh investments, notably:

- **Major new host applications/workloads & SOA:** From the mid-2000s, **many major new applications** have been built/deployed on the mainframe, again widely recognized as the premier enterprise platform for mission-critical workloads, including **database serving, real-time business analytics and data warehousing, web enablement** – and more recently – **mobile enablement, big data, private cloud hosting**, etc. The Java™ EE language platform, combined with the open-standards "SOA, etc." model of **reusable services-based software** development and deployment, has been widely adopted as the core open-standards and interoperability underpinnings of this wave of new mainframe applications. The explosion of new applications/workload development on the mainframe demanded **new-generation, better, modern host AD and PD tooling** IBM has successfully provided, as well as its now extensive, well-proven, rapidly-advanced **stack of IBM SOA-enabled host runtime middleware** that extended established favorites with SOA support, and added important newcomers.

These have today combined to provide a **leadership enterprise-class software environment** for serious SOA applications. Many such customer projects have exploited, reused, repurposed, and modernized the wealth *(over $3T worth)* of existing host applications assets *(transactions, databases, data, processes, etc.)*. IBM's comprehensive, open standards-based, modern GUI AD tooling *(RDz™)* for z/OS®, as well as for the now widely-used zLinux environment, and for the co-hosted zBX-based, hybrid architecture platforms that run aboard zEnterprise® + zBX complexes as one system-of-systems. Tens of thousands of younger IT staff joined mainframe development/support teams to work on these newer host-based developments since the mid-2000s. IBM's new-generation mainframe AD & PD tools today **empower and enable these younger staff**, with **their familiar, modern, Windows-GUIs** for mainframe development and support, without need the traditional mainframe 3270/ISPF green-screen UIs skills which some younger staff find unfamiliar.

- **Mainframe software cost reduction initiatives**, driven by senior IT management/CIOs. **Traditionally high costs** for established ISV mainframe software products, tools, and utilities were long **painfully visible to System z™** site IT managements. Frequent ISV pricing/business practice issues, unfair MIPS upgrade fees, steep maintenance/support costs, and pressure for long-term contracts *(lock-in)*, often led to deeply unpopular budget overruns and **angry customer CIO resentment**. During the 2008-12 recession, mainframe software cost reduction projects, to **reduce or eliminate such ISV software costs**, thus became widespread among PD tools suite users *(and in other mainframe software segments)*, since 2000. Compuware, the established PD tools suite segment leader – with traditionally the highest prices – was the principal target for such customer cost-saving efforts.
- **Mainframe software asset reviews**, highlighting high cost, duplicated, and/or low-use, licensed products. To reduce large and visible mainframe software costs, many host sites regularly review their software licenses portfolios, an especially relevant process after mergers and/or acquisitions. Such asset reviews determine if all products licensed/paid for are still used enough to justify their ongoing costs, and to **identify where more modern, and/or lower-cost alternatives, are now available**. Switching to such new alternatives often provided **large software cost saving**. Alternatives often also offer **superior productivity, performance, currency**, and **integration, benefits** that strengthened the migration business case further. These reviews often also evaluate if the enhanced host software licensing models now available are financially advantageous and should be adopted. We commend such reviews as an often much-needed, vital, periodic "house-cleaning" software asset management process for enterprise IT shops.

...most sites today will no longer tolerate ongoing, unresolved vendor issues, which they rightly see as inhibiting optimum use of their valued host platforms.

- **Customer pain-points with incumbent software vendor(s), licensed product(s).** Most common were **high costs** and **tough license term** issues *(as above)*. However, close behind were **poor currency** with the fast-advancing IBM host software stack, **too little functional enhancement** such as weak modern "SOA, etc." support, **other product quality**, and ISV support service, issues. In the past with fewer options, customers had little alternative but to stay with their incumbent vendor. But today in 2014 **excellent alternative choice is now available**, this segment again enjoys higher vendor R&D levels, and pricing issues have now been partly moderated. With the host platform again strategically central, and with numerous new mainframe workloads being added, most sites today will no longer tolerate ongoing, unresolved vendor issues *(such as those mentioned above)*, which they rightly see as inhibiting optimum use of their valued host platforms.

Four Main Customer Situations for Migration

There are four mainframe customer situations in which choosing and adopting the best-available new PD tools suite is advantageous, usually triggered by one/several of the events/issues discussed above:

- **New Mainframe Customer Sites, No Existing PD Tools:** Some **750 new mainframe sites** have been installed since 2000, particularly in emerging growth markets, as the platform's resurgence captured new footprints/customers, **latterly at ~75-100 new sites won** per new mainframe generation. With widespread economic recovery, renewed business confidence, and much new business investment, emerging in many parts of the globe over many industries, we expect more such new sites, especially after the next generation IBM mainframes ships *(maybe from ~1H 2015, 2.5 years after the current zEC12 first arrived)*. This case will therefore clearly become more frequent in future. With these new "green field" mainframe sites, no installed PD tool legacy constrains "best tools" choice, and no migration costs need be faced. These sites should **make a "once-and-for-all" selection** of best PD tools suite-vendor to fully depend upon for the next 2 decades of development on their new mainframe platform. The IBM® PD Tools for z/OS® offerings have an in-built, head-start of "prime vendor" strategic advantage, to win most of these sites.

- **Established Mainframe Sites Using a Mixture of Point PD Tools:** Some current mainframe sites acquired **assorted point PD tools from multiple vendors** over time, sometime through uncoordinated buying, more often **through business/IT mergers**, and now demanding review. Today, some of these products may be past their "use-by-dates". Some from smaller, "below-scale" providers may now **present high vendor risks**. Most importantly, such "point product mixes" **cannot meet the full needs** of today's mainframe shop. Because important mainframe development, test and troubleshooting, lifecycle processes must be supported by multiple PD tools, it is **vital each main PD product be well-integrated** to interoperate easily and smoothly together with compatible suite-mates. All PD tools suite members also need to **stay tightly "release-aligned"** with each other, to retain this good integration through the faster new releases now required to remain current with IBM's rapid-fire host software advances. Only well-integrated PD tools suites from a single source provide this vital integration, but today also need regular, coordinated releases to remain so aligned. For all these sites, the key question is **which new PD tools suite they should migrate to/consolidate on** for the longer term. Motivating migrations are customers' compelling needs to **secure the integrated suite benefits** above, **to re-equip their workforces** better for SOA *(and other new host)* workload AD needs, and to **reduce maintenance costs**. Most also seek the benefits of dealing with a single PD tools vendor strategically committed to this segment for the long haul. These compelling benefits, summed over say five years, heavily outweigh new software acquisition costs, and *(the modest)* migration/retraining costs of moving from their "point product mix" to their newly-chosen, best modern PD tools suite.

...many hundreds of mainframe PD tool users in this category have secured and enjoyed compelling ROI benefits from such migrations.

- **Mainframe Sites Using Older PD Tool Suites:** Where an established site selected, and/or standardized on, a vendor's PD tools suite long ago *(often 10, 15, or 20 years ago)* one or more of the trigger events/above now often spark reconsideration. The purchase costs of such software were long ago fully depreciated. The question then becomes which *(newer/better)* PD tools suite to adopt for the next 1-2 decades. **Seeking lower maintenance costs/fairer terms** remains the most widespread migration driver here, but users have also sought **superiority in functionality, currency, GUIs**, new applications support, or higher-quality vendor support service, etc. These benefits usually rapidly out-weigh new software acquisition fees, and the relatively low migration effort/retraining costs of moving to the newer suite. Many, many hundreds of mainframe PD tool users in this category have secured and enjoyed compelling ROI benefits from such migrations.
- **Mainframe Outsourcing Service Providers:** Mainframe outsourcing providers take over hardware, software licenses, and staff, from numerous end-customers. Most thus acquired **diverse PD tool licenses** from different ISVs with the customer mainframes taken over. Some ISVs demanded **high outsourcing license fees** to allow transfers of end-customer licenses to the outsourcer, a frequent trigger for review. Outsourcers are always greatly **motivated to consolidate** their hardware, software, and support skills resource, portfolios wherever possible, so that they can use all these most efficiently across their multiple customers to cut costs. Some ISVs resist the multi-customer outsourcer licensing required for this, or price it too high. Outsourcers who succeed in simplifying/standardizing software tool portfolios, and who can make the most efficient shared use of all resources *(hardware, software, and people)* win big cost savings that fall **straight to their bottom lines**. Standardizing **onto one best PD tools suite** allows all an outsourcer's host development and operation support staff to deploy common skills over all the firm's customer accounts. This **increases staffing flexibility, raises productivity**, and **saves software cost/support effort**. IBM itself was long the world's largest IT outsourcer, especially of enterprises running mainframes. It is thus no surprise that IBM has often consolidated other ISV PD tool licenses acquired with outsourcing customers onto its own PD tools suite, as soon as it could.

Our advice is to use our seven strategic product suite and vendor criterion to guide new PD tools suite selection.

Strategic, New PD tools Suite Selection Criteria

Our advice to all mainframe customers in one of the situations, and/or facing one of the trigger events, above is **to use our seven strategic product suite and vendor criterion**, listed in Figure 11 on page 33, to guide new PD tools suite selection.

We detail and explain these criteria below.

1. **Suite Currency, Advances/Exploitation Depth, Release Frequency, etc.:** With now-faster-paced IBM System z™ software subsystems, operating system, middleware, and tools advances over recent years, **PD tool suite currency**, plus new host feature and functionality advance exploitation, are a **crucial suite selection factor**. Mainframe customers are also adopting

today's faster-advancing, core IBM software subsystems and z/OS® advances more swiftly, so the PD tools they use must equally support these quickly. Their customers also rightly expect PD tool suites to exploit the latest mainframe advances, today including **mobile computing, cloud computing, host business analytics, Dev/Ops, SOA**, and other new workloads, features and capabilities, delivered in IBM's host stack. Mere tolerance testing is far from enough anymore; full new feature exploitation is also required today. Complete PD tool alignment/support **with all main IBM subsystem products** from their General Availability *(GA)* dates *(so-called **First Day support**)*, with full tool exploitation of their key advances, is the ideal. The number of IBM host foundation software "touch points" with PD tool suite products is already high *(see Figure 7 on page 19)*, and may continue to grow.

To keep their PD tools suites **fully current** with all such IBM release advances, and to **exploit major relevant new features** in a timely fashion, therefore now requires substantial, continued, and timely **vendor re-investment in each main product** in their PD tools suite. They must ensure support for all the above changing "touch point" new releases, and must also thoroughly cross-test the many combinations. This requires well before GA release *(beta or Early Support Programs – ESPs)* access to IBM's newest foundation software, for the ISV to design, build, and test their new PD tool releases, with enough vendor resources committed for this every time. Although all IBM subsystem and middleware software beta customers *(including ISVs)* can take advantage of IBM ESPs for their development efforts, **IBM itself has made especially determined efforts** to fully align its PD tools suite developments with all major System z™ mainframe subsystem and operating system releases.

Earlier in the 2000s, complacent incumbent ISVs used host PD tool suites as "cash cows", cutting R&D whilst "farming" their installed bases for high maintenance/upgrade revenues, earning high margins then diverted elsewhere. Their PD tools suite currency thus lagged, just as IBM's own host software advances accelerated, which became increasingly unacceptable to customers. Such vendors suffered revenue erosion by migrations away, and/or by IBM-competition-induced price cuts, just when higher R&D spending was now needed to keep up, a serious financial crunch.

And the constraints were not only financial, since some vendors had cut back, or suffered retirements from, long-experienced host PD tool developers, so now lacked enough of the deep mainframe subsystems knowledge and technical skills that remain prerequisites for effective PD tool R&D.

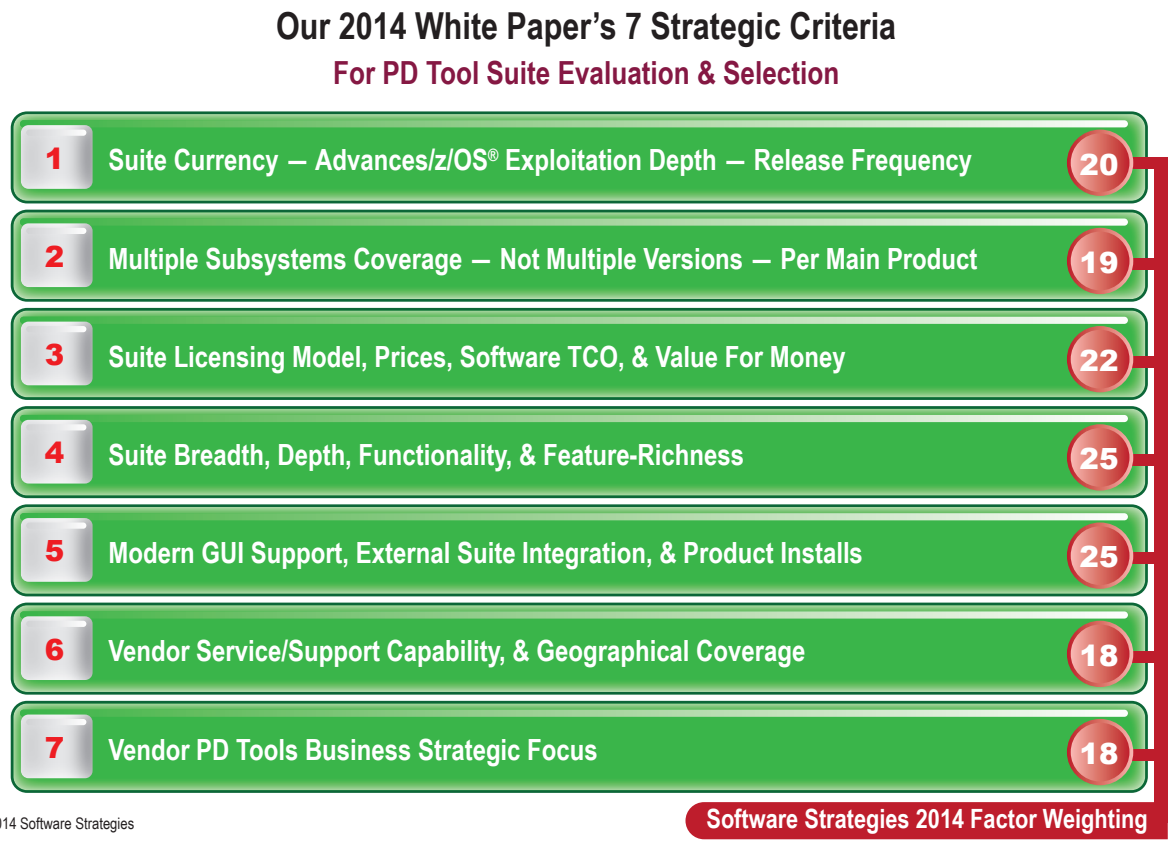

Figure 11: Our 2014 White Paper's 7 Strategic Criteria for PD Tool Suite Evaluation & Selection

Wisely, three of four competing PD suite vendors recognized this during the 2006-2009 period, and increased their PD tools suite R&D again, showing improved rates of new releases reported in our prior 3rd Ed. WP 01.09 and 4th Ed. WP 03.11 reviews.

PD suite vendors now must show consistent delivery of excellent currency support for all required z/OS® subsystems, and related IBM tool, releases.

PD suite vendors now must show **consistent delivery** of **excellent currency support** for all required **z/OS® subsystems**, and related **IBM tool, releases**. At mid-2014 writing, this means support for the current z/OS® *(V2.1)*, and major z/OS® subsystems releases, including CICS® TS *(V5.1, V5.2)*, DB2® *(V11)*, IMS™ *(V13)*, WAS® *(V8.5)*, and WebSphere® MQ *(V8.0 GA 06.13.14)*. These have all shipped after/for current generation high-end zEC12 *(from 09.2012)* and mid-range zBC12 *(from 09.2013)* mainframes, along with other IBM host advances *(some reviewed in Section 2)*.

These provide an excellent "acid test" of how fast a PD tools suite vendor introduced support for, and exploitation of, the major IBM host platform stack advances. We advise prospective buyers to carefully check currency/support for all host foundation software their site uses before any proposed PD tools suite purchase. Such PD tool product advances may be distributed in:

- **Major Product Releases:** New version/generation release offering substantial currency, exploitation, and major product functional, advances.
- **Minor Product Releases:** Incremental new version release, offering smaller currency, and numbers of more minor product functional, advances.
- **Maintenance Roll-Ups *(MRUs)*:** Smaller, incremental update sets combining a few fixes − or Program Temporary Fixes *(PTFs)* for Authorized Program Analysis Reports *(APARs) (in IBM parlance)* − of bugs or minor currency issues. IBM RSUs, CA RS, and Macro 4 increments are examples.

No rigorous standard definition of what constitutes a "major" or "minor" release, or a lesser MRU, exists in the software industry, each vendor applying their own, although the terms are widely-used and broadly understood. However, IBM's model carries weight/influence in the mainframe software market. Vendors' version/release numbering schemes normally indicate the approach used. Vx.Ry, or Vx.Ry.Mz, version/release numbering structures are most frequent. Our benchmark for the main z/OS® PD tools products is that **each now needs a minor release each year** to maintain toleration and basic currency with the host IBM software environment's rapid changes, and also **needs a major release about two yearly** if they are to claim good-to-excellent currency and functional advance/new capability exploitation rates. Exceptions can be accepted for tools addressing older, specific, and unchanging host environments, or for narrower, point-function products within a PD suite. We suggest sites obtain/review their vendor's product releases history table with all PD products covering the last 10 years *(such as Figure B1 on page 54)* which will fully clarify their actual releases track-record.

2. **Multiple Environments-Subsystem Coverage/Main Product vs. Multiple Versions:** In the mainframe z/OS® software environment, a number of runtime subsystems are fundamental, some newer. These include CICS®, IMS™, DB2®, DB2® Stored Procedures, UNIX® System Services, TSO, Batch/Job Entry System *(JES)*, WebSphere® Application Server, and WebSphere® MQ. File and database support for all the various types of z/OS® PDS files, VSAM, and sequential files, DB2®, and IMS™ databases, CICS® data, and WMQ® queue data, are another major requirement. Support for the full range of both traditional, and more modern, host programming languages *(COBOL, PL/I, Assembler, C/C++ and Java EE™)* that are all in wide mainframe use today, is another. Networking, communications and integration subsystems are a fourth requirement. Two different PD tools suite vendor approaches to supporting this diversity are found:
   a. **Broader Coverage, Single Tools per Main Category:** Vendors using this approach provide in-built support within a broader, single tool within each main PD tool category, for all or some relevant IBM subsystem/teleprocessing environments, programming languages, etc., needed. The result is a **much more compact PD tools suite** of fewer, but much broader coverage, products. This means fewer tools to buy, install, support and maintain for the customer, and more commonality and integration within such tools. However, this approach obviously means some customers buy, but do not use, all the functionality their more unified products provides. *(IBM's PD suite successfully uses this approach.)*
   b. **Multiple Tool Versions/Features:** Vendors using this approach offer several versions/features/options of their tool within each category, one for each *(or a subset of)* relevant mainframe environments. This "XYZ for CICS®" style approach **requires customers to purchase multiple versions/features** of the same basic product to support the mix of subsystems they use, and to buy additional ones – or add-on options – when new subsystems come into use, good business for the vendor but **costly for the customer**. This approach also requires more installation and product support effort. *(Compuware most extreme, others slightly.)*

Practically, technically and commercially, the former approach offers big advantages to most customers. Many naturally resist buying the same basic product several times, just to gain additional subsystem/language, etc., support. Competitors using approach b. counter-argue that it allows their customers to purchase only the specific versions/features or optional components currently needed, and those only when they actually need them.

Whilst the range of new license prices has narrowed somewhat since IBM's market entry, wide differences remain, especially on maintenance costs, between comparable products from different vendors.

3. **PD Tool Suite Licensing Option, Prices, Software TCO, & Value:** Software purchase prices and annual maintenance/support fee costs are the **main software TCO elements** for PD tool products. *(Both customer installation effort/cost, and internal product support effort/cost, are relatively low in this tool category once established at a site.)* Whilst the range of new license prices has narrowed somewhat since IBM's market entry, wide differences remain, especially on maintenance costs, between comparable products from different vendors. There are also **considerable differences in license models and terms**. Some vendors now offer **workload/sub-capacity licensing**, relating license fees better to actual runtime environment *(LPAR)* capacity, and not whole system capacity. However, many existing customers doubtless remain on older-style licenses/pricing. IBM has also now introduced two **"Solution Packs"** containing 5 and 3 of its PD tools respectively, in **favorably-priced, all-in-one bundles**. *(See Appendix B, page 50)*. Discounting also became more frequent in this now-competitive market, so direct pricing tabulation here was neither possible, nor of great use. We advise especially careful evaluation before committing to long, multi-year suite license renewal terms or enterprise license. Customers should **seek "best offer" vendor quotations**, and carefully **assess overall five-year software costs** and license terms, for their strategically-selected new product PD tools suite candidate versus any existing suite's equivalent costs.

4. **PD Tools Suite Breadth, Depth, Functionality, Feature-richness, Performance:** Feature, function, usability, and performance, are naturally always important in any strategic software suite selection. At macro level, four of our five PD tool suites cover roughly similar base functional ground; some much more fully, deeply, and widely, others more selectively/narrowly. Extensive product feature-function information is usually available from the vendor's websites, and in their technical documentation, changing with their releases. We recommend customers chose their new PD tools suite using these seven strategic criteria *(and our broad comparisons of Section 6)*, and then verify that their choice indeed offers all essential features/functions needed within their specific IT environment, including from the viewpoints of:

   - **Breadth and depth of functionality of each main suite product**, self-evidently important.
   - **Suite completeness**, products covering the full range of PD tool requirements set out in Section 3.
   - **Performance and efficiency**, especially important for production-use host tools, as wide variations have been reported.
   - **Level and quality of within-suite integration between main tools**, which need to smoothly exchange/share common information over the application development – **test – debug – tune – deploy – monitor – remediate** lifecycle.
   - **The level of SOA-specific support offered**, because so much new mainframe development is now SOA-based, and the core IBM "SOA, etc." software stack for z/OS® has advanced so rapidly and broadly over recent years.
   - **Automation, and other staff productivity-enhancing** capabilities, offered by the PD tool suite, including key job roles support, in-built expert guidance, error message libraries, help facilities, wizards, health checkers, and the like.

   …with these all well-designed and optimized for the current System z™ flagship z/OS® operating environment release level.

...modern GUI access facilities are now essential for the tens of thousands of younger staff joining System z™ sites in recent years, making this factor now a crucially-important criterion for PD tools suite selection.

5. **Modern GUI Support, External Suite Integration, Installs, etc.:** All PD tool products traditionally used standard mainframe online ISPF-style 3270 full-screen host interfaces *(see ISPF bullet below)*, fast in the hands of experienced host staff. But modern GUI access facilities are now essential for the tens of thousands of younger staff joining System z™ sites in recent years, making this factor now a crucially-important criterion for PD tools suite selection. And, of course, most mainframe AD itself is also now performed on workstations off-host, with just testing/deployment on-host. The GUI support requirements are:

- **Modern UIs for better ease-of-learning/ease-of-use.** Workstation GUI access and integration for host PD tools are now hugely important, per above. Eclipse-based workstation GUI access *(now from IBM, Compuware, CA Technologies, and Macro 4)* or thin-client web-browser UI/portal integration *(Macro 4 and others)*, approaches are offered, with Eclipse-based RCP solutions now the norm in this segment. We review and discuss the recent major GUI developments from these vendors throughout this Paper.
- **Additional workbench-level tool integration.** This is another important requirement that such modern GUI front-end tools can provide, enabling better coordinated workflows that link, access, and display, several host PD tool products at once on the workbench. This also enables integration of PD tools with other adjacent mainframe tool categories *(e.g. CICS® tools, IBM® CICS® Explorer, database tools, software lifecycle management tools, message queuing software, etc.)*, into more productive task and role-based workflows at the workbench level.
- **Integration with main System z™ IDE – IBM® RDz™.** To support host PD tool use during z/OS® applications development – both new Java EE™ and traditional – from within this de facto standard mainframe IDE. IBM has developed this combination vigorously for some years now, with the current IBM® PD tool for z/OS® and RDz™ releases offering excellent integration/GUI access capabilities. These allow professional host developers to access IBM PD tools while performing host development, testing, and diagnostic processes, seamlessly combined within RDz™ on the developer's workstation. CA Technologies has Eclipse GUI access facilities for two PD suite tools certified to operate correctly with IBM RDz™.
- **Tool software installation and maintenance application.** Should be simplified, standardized, made faster/easier, and be more automated, because today's busy mainframe sites often now run with lean staffing. Since many PD tools suite products came from different acquisitions, such products often lacked the needed install consistency. At a minimum, a standardized installation/update process common across all suite products – preferably using the IBM SMP/E standard/facility – is required. CA Technology now goes far further with its innovative **CA Chorus™ Software Manager**, discussed below.
- **ISPF User Interfaces.** All z/OS® PD tool products *(and other host tools)* traditionally use IBM 3270 full-screen, ISPF-like *(standard mainframe editor)* UIs offering dense, information-packed displays, with many function keys/shortcuts, and command-line support. These still provide **fast, easy navigation and usage**, and today are usually run from **PC workstations under 3270 emulation**. All experienced mainframe developers, testers, operations analysts, and system programmers, are long familiar with this mainframe UI, which is well-suited to traditional host development – when coding, editing, compilation and testing were all normally done online to the host through this style of UI. However, such "green-screen" UIs are unfamiliar to, and often a real deterrent for, "zNext Generation" younger staff brought up on Windows GUIs/web browsers.

6. **Vendor Service and Support Capabilities, Geographical Coverage:** Adopting and migrating to a new PD tools suite should be seen as **a long-term *(10-year plus)* customer commitment**, and so that vendor's ability to service and support new customers long-term is crucial. The vendor's support services, documentation, training offerings, consulting and migration services, and the geographical support availability of these relative to customer locations, are all crucial for rapid, successful implementation and secure, long-term product usage at all customer locations, which may be worldwide. **Vendor scale and geographical coverage** come into play here. Vendor **financial strength**, business and **team stability**, together with mainframe innovation skills, experience, and resources, are also clearly essential underpinnings for new customer confidence that suite developments will be actively continued over the long-term service life of their new suite. For this reason, our reviews here profile vendor financials/strength, as well as product details.
7. **Vendor PD Tool Suite Business Strategic Focus:** We recommend customers only re-invest in a PD tools suite from a vendor with **clearly-demonstrable strategic business focus** on continuing, long-term, active presence in the z/OS® PD tools market segment. By this, we mean a vendor for which PD tools remains **of high, continuing strategic importance**, either for the significant proportion of their revenue/profit it earns, and/or for other equally compelling reasons. Several ISVs clearly diverted high PD suite customer base profit margins into other product areas or into dividends. Some competing vendors have reported fewer maintenance renewals, falling license revenue, and reduced profit margins, from shrinking user bases for their mainframe software, as IBM gained share whilst driving segment prices downwards. The challenge

Footnote:

Vitally important as Eclipse GUI interfaces are to PD tool suites today, their general "look and feel" is similar to that of most modern Windows tools, which most readers will be well familiar with. For that reason, and because such screens do not reproduce well at small sizes, we deliberately excluded all Eclipse GUI screenshot illustrations in this White Paper. Also, since four PD suite vendors now each provide multiple Eclipse GUI plug-ins for the suites, showing all was impractical but showing samples unfair.

these ISVs face today is that PD tools suites now again require higher re-investment in R&D, per above. Indeed, four of the five vendors we covered clearly increased *(or for IBM maintained)* PD tools suite development efforts over recent years, some from static or declining customer revenue bases. Where vendor strategies seek the firm's future revenue growth **from other, higher-strategic priority product lines** *(applies to three competing vendors)*, they risk falling behind on future PD tools suite advances vitally needed today. In this Review Period, we saw two competing vendors had fallen into "hands round the throat" grip of activist investors and/or private equity firm shareholders, typically seeking higher and faster returns on their investment, a direct conflict with the user needs above.

These seven strategic factors are all crucially important for successful PD tool selection/migration, and sharply differentiate between the competing suite/vendors considered.

...staff may naturally champion tools already most familiar, and so may exhibit reluctance to embrace a tools suite change.

PD Tool Product "Internal Champions" Caution

Where mainframe sites already have PD tool products installed, the site's AD, testing and operations staff will usually be skilled and experienced in the use/exploitation of those tools, sometimes having also helped select them in the far past. Such staff may naturally champion tools already most familiar, and so may exhibit reluctance to embrace a tools suite change. Sometimes, such teams resisted migration by raising apparent feature/function objections, hoping to avert the "threat". As we note elsewhere, and as many hundreds of customer migrations attest, **migration is relatively straightforward and rapid** in this segment, and advantages compelling both financially and functionally. We advise IT management to stay focused on the strategic case for change, and its financial ROI benefits, to consult and involve their tool users, but to carefully distinguish any "genuine" from more spurious "preference/familiarity" objections.

Other Significant Considerations

Other relevant factors merit additional consideration during PD tools suite selection:

- **Other Mainframe Tool Categories from Vendor:** Using PD tools products to facilitate host application development, deployment, troubleshooting, and operations, runs closely alongside, and touches upon, a number of other important areas of mainframe software tooling. These include:
  - **COBOL, PL/I, and Java EE™ application development tools/IDEs**.
  - **CICS® TS, IMS™, and WAS® tools and utilities**, for these crucial mainframe transaction processing environments. For example, IBM's newer CICS® Explorer GUI tool is an important addition here now closely integrated with/linked with IBM's AD and PD tools.
  - **DB2® and IMS™ database tools and utilities**.
  - **System z™ application modernization/renovation tools**, to bring mainframe software assets into SOA reuse.
  - **Mainframe software lifecycle management** tools *(including source code management, requirements management, change management, team development, and collaboration software, etc.)*.
  - **Mainframe, and multi-platform, applications performance monitoring/management *(APM)*** tools of various types.
  - **System z™ security software tools**, e.g. zSecure, Resource Access Control Facility *(RACF)*, etc.

  Customers gain real advantages where a single vendor provides both their new PD tools suite, and such other tools categories above, are well-integrated to work together, and/or share common styles/services. Provided the vendor's other category tools are also top-class, it makes obvious sense for the same vendor to provide both. Now as we write in mid-2014, **IBM is much the strongest provider** – with leadership offerings – in all the above host tools categories. We examine one example of this in Appendix B, Figure B2 *(on page 65)* – IBM's CICS® tools suite – which has now attained high coverage, functional strength, and maturity. Of our other PD tool vendors, CA Technologies also offers mainframe tools in several of the above segments, Compuware is now well-placed in cross-platform and host APM, and Serena Software in ALM/SCM, the latter two offering both host and distributed solutions in those domains.
- **Host Stack Concurrent Release, Cross-product Regression Testing:** Minimizing customer site time/effort to update/maintain their System z™ host software stack – with its numerous vital subsystems and tools – is important for all mainframe users. For the last nine years now, IBM delivered new z/OS® releases each September, many other IBM host products – including our subject z/OS® PD tools – organizing their own testing and releases in line, as have some ISVs. IBM also has long heavily tested, and cross-product regression tested, core IBM System z™ software full releases, ensuring all are pre-integrated and tested together for supported pre-requisite levels.

But IBM now goes further to minimize host customer software service effort. It runs an extensive **Consolidated System Test *(CST)*** process. This additionally cross-tests available PTF *(Program Temporary Fix)* levels for the core host stack products together, providing a Recommended Service Upgrade *(RSU)* defining advised IBM PTF service for all core stack products as a single deliverable. CTG, CICS® TS, DB2®, DB2® Connect, GDPS®, IMS™, IRLM, Java™, WAS®, WMQ®, IBM Tivoli OMEGAMON, **and our subject IBM z/OS® PD tools suite**, are the core host stack currently covered by this CST process, with its quarterly RSU report outputs. With these, customers need only apply RSU-recommended PTF service in a single quarterly process, ensuring pre-integrated, cross-tested, and most up-to-date, alignment of their core IBM software stack service. This valuable extra IBM service rightly proved very popular with System z™ customers.

A few years ago, CA Technologies introduced its own synchronized, cross-testing process for new releases of its **CA Technologies Mainframe Stack for z/OS®** products *(currently ~275+ host products)* to support all IBM z/OS® and subsystem release advances. 11 of the CA Technologies host PD tools suite products are included in this process/group. CA Technologies also tests its host products at its Integrated System Test lab, to deliver **CA Recommended Service** *(CA RS – patterned on IBM RSU above)*, identifying PTF sets that have passed additional quality validation criteria that are now shipped monthly. For these, it continuously cross-tests all Stack product PTFs of highest levels, for supported IBM host software stack releases maintained to IBM quarterly RSU level. The firm also offers its impressive **CA Chorus™ Software Manager** *(now in V5.1)* that automates product installation and service application for its host Stack, see page 67.

As well as its major and minor releases, Macro 4 also issues numerous, more frequent MRU increments when ready and as needed for faster delivery, all extensively cross-tested on supported IBM z/OS® and subsystem releases, via electronic software distribution.

Compuware issues new suite releases as each is completed, and selectively supports IBM PFTs deemed of suite impact. Twice yearly, it extensively regression tests all latest suite GA releases against a **current IBM RSU level** for the latest z/OS® release, a lower overall level of software service than those above. Many of Compuware's numerous minor releases are nearer akin to IBM RSU, and CA RC upgrades.

- **PD Tool Product Pricing Strategies/Trends:** IBM publicly pledged *(via its 2003 Mainframe Charter)* to continue driving down its System z™ hardware and software costs. It relentlessly trod this path from 1997 to date, **posting substantial percentage-point reductions yearly** on both. This was vital to spark the 2000 decade's climbing mainframe platform resurgence, reversing the decline part-caused by the platform's overly-high earlier software and hardware costs until the late 1990s. While not all its products enjoyed equal reductions, multiple new 2000-decade host software segments entrant IBM took lower per-product revenues/margins *(than competitors)* on its new host software offerings to secure the far bigger prize of global mainframe capacity/usage growth as well as for the healthy and growing new host software revenue stream it created. Indeed, the PD tools for z/OS® software business has been **a profitable segment for IBM** throughout, another compelling strategic reason that it will – with absolute certainty – continue investing here. By contrast, some established PD tool vendors *(who enjoyed high segment prices in earlier years)* depended heavily on their "annuity revenue" from **now-shrinking installed bases**, so were reluctant/slower to concede needed price reductions when they saw few compensating revenue gain opportunities. It is not hard to see which PD tool product vendors are more likely, and are most able, to offer best prices in future.

An eternal software industry view rates younger – but mature – software products often superior to far older, long-established equivalents.

- **"Youthful Beauty" vs. "Mature Age":** An eternal software industry view rates younger – but mature – software products often superior to far older, long-established equivalents. Much experience has shown software product **code-base quality often deteriorates** over many years, as scores of successive changes are made, bugs are fixed, extensions are added, as documentation lags, and as the original AD team change *("spaghetti code syndrome")*. Here, it becomes harder and harder – and/or takes longer – to implement further new advances. Rigorous architecture, plus best-practice AD processes, can slow/limit such software quality degradation. However, these take consistent, decades-long, disciplined enforcement few product software groups manage in practice. New software technologies, new/better algorithms, better host methods/techniques, newer programming languages, new open standard Application Programming Interfaces *(APIs)*, etc., supersede/improve upon older approaches used many years before in the original product. "Youthful Beauty" products earlier in their lifecycle often embed many such better software technologies, methods and techniques, UI innovations, new subsystems, and open standards support. But their first **few releases are often less functionally rich**, and come **with more bugs**. By their third major release and beyond *(where actively developed)* such younger products gain fuller-function capabilities with good stability. From that point, their prime condition can usually ensure good service for the next decade or two, and make a robust platform for further advances, provided they are well maintained.

Renewing a product code-base is a major effort/cost.

Good architectures, cleanly-**layered structures, stable interfaces**, and deeply-**disciplined vendor** development processes, **mitigate this code base decay** tendency, and some top product vendors firmly apply such approaches. As large software products track towards or beyond their second decade, squeezing all changes/advances needed into an original codebase "straightjacket", can become too difficult *(a.k.a. too slow and costly)*, their base often needing to be heavily or largely rewritten. Renewing a product code-base is a major effort/cost. Only vendors enjoying healthy, positive revenues/growth, and strategically focused on that segment long-term, can afford this.

Many well-known mainframe software "brand names" have been successfully kept current, fresh, and vibrant for 25, 35, or 40 years+ *(IMS™, CICS®, DB2®, SAS, and WMQ®, for example)*. To maintain such decades-long software engine success, intense and careful continued development – using the best techniques/disciplines above – is vital. But periodic partial or complete **code-base renewals**, are often still required *(roughly each 15 years or so)*, to recreate a clean, reliable, maintainable code base again, updated to the latest standards. For example, IBM's mainframe flagship database DB2® *(first introduced in 1983)*, underwent its most significant rewrite ever to create DB2® V8, completing full exploitation of 64-bit mainframe z/Architecture™. That substantial rewrite provided the sound, renewed, fully-64-bit exploitative code-base on which IBM's next DB2® V9.0 major functionality release of 2007 *(and subsequent V10, V11, & V12 releases)* was soundly built/founded. SAS also underwent a major code-base renewal about 15 years into its long life.

...competitors must be able to prove their ability to keep up with host advances, with an appropriate architecture, firm disciplines, and/or a good code-base renewal record.

Any new PD tools suite investment should be able to support an enterprise's host AD for a full decade, probably two, ahead. Customers must carefully **consider the trade-offs** between "youthful beauty" options, and longest-established names. IBM, in the former camp, has long convincingly demonstrated functional maturity and stability of its PD tools suite. The competitors must be able to prove their ability to keep up with host advances, with an appropriate architecture, firm disciplines, and/or a good code-base renewal record.

Cross-PD Tools Suite Migration

Because all PD tool products of each type "plug-in" to the **same IBM foundation host software** touch points, to provide broadly similar functional services, **cross-tool migration is relatively straightforward** in the PD tools segment. On a migration difficulty scale of 1 *(easiest)* to 10 *(most difficult)*, cross-PD tools suite migration effort and complexity generally ranks in the low 2/2.5 range. Debugging and fault management is often an easy 2. Similarly, IBM states that moving to the IBM Application Performance Analyzer tool is a quick and painless process, rated at an often "below 2" score.

In another example, migration from Compuware's File-AID batch to IBM's File Manager has also proved extremely quick and straightforward, requiring only minimal education and low customer effort. Migration costs, which must be set against the benefits of the new suite selected, include staff retraining and the time/effort of converting such infrastructure, are therefore relatively rather low. IBM offer extensive migration help, guidance, and services, based on many years of practical real-world migration experience, to further speed up, and minimize user costs and risks, in such migrations.

Our Analysis

We **strongly recommend** all enterprise IT shops evaluating migration to a superior PD tools suite, as well as those planning to acquire a first suite, should carefully review, absorb, adopt and apply our **seven strategic criteria** presented above in their comparison and selection process. These criteria together **comprehensively differentiate** between suites and vendors and – when combined – cover the important considerations needed for a **rational, enduring decision**. Whichever combination of triggering factors for migration – discussed fully above – initiated the PD tools suite replacement/purchase process, and whichever of the four customer situations we described above apply, these seven criteria – used correctly – ensure a sound comparison.

Our scoring of the five PD tool suites/vendors studied on each of **these seven criteria**, our **2014 criteria weightings** applied, the resulting **Total Weighted Scores**, and **their ranking**, are all presented in Section 6 following, with our overall assessments of each suite/vendor.

6. Five PD Tool Suites – Our 2014 Strategic Comparison

Introduction

To summarize our overall comparative assessment, we again present our **unique relative positioning chart** in Figure 12. This clearly shows the areas of difference, on the above seven strategic comparison factors, between the z/OS® PD tools suites of the five vendors considered. In this chart, the relative position of each vendor's symbol reflects where our scored ratings placed each vendor for that factor, within the range of the highest-rated to lowest-rated factor scores attained by all five. These ratings were assigned as at May1st 2014. This format shows vendor differences **more clearly** than conventional total scores rating charts, helpful in a segment with five suites of some commonality. Lowest ranking here merely implies lowest relative position, which may, or may not, still be a respectable absolute score.

We note all five sets of **tools are long-established** in this market. All have proved more or less capable of their designated jobs/tasks for hundreds, and sometimes thousands, of customers, and have been supported and updated to varying degrees by their vendors, for many years. Since they built *(or bought-in through acquisition)* and supported PD tools suite products for many years, all five vendors clearly each had deep mainframe software experience earlier; part retained to support/enhance their tools for the two-plus decades since. However, **earlier staff cuts or turnover** weakened some vendors' skill-bases more than others – where original authors of some products here have now retired – for example. While there are similarities in broad functions/capabilities between suites from a high-level helicopter view, our closer examination reveals wide differences in capability, and even wider differences between the vendors.

Our scoring model – from which these summary findings were drawn – is shown in Appendix A's Figure A1 *(page 48)*. That table shows our recommended 2014 weightings for each strategic factor for our "general case" weighted score comparison. These were updated for 2014 to reflect current priorities.

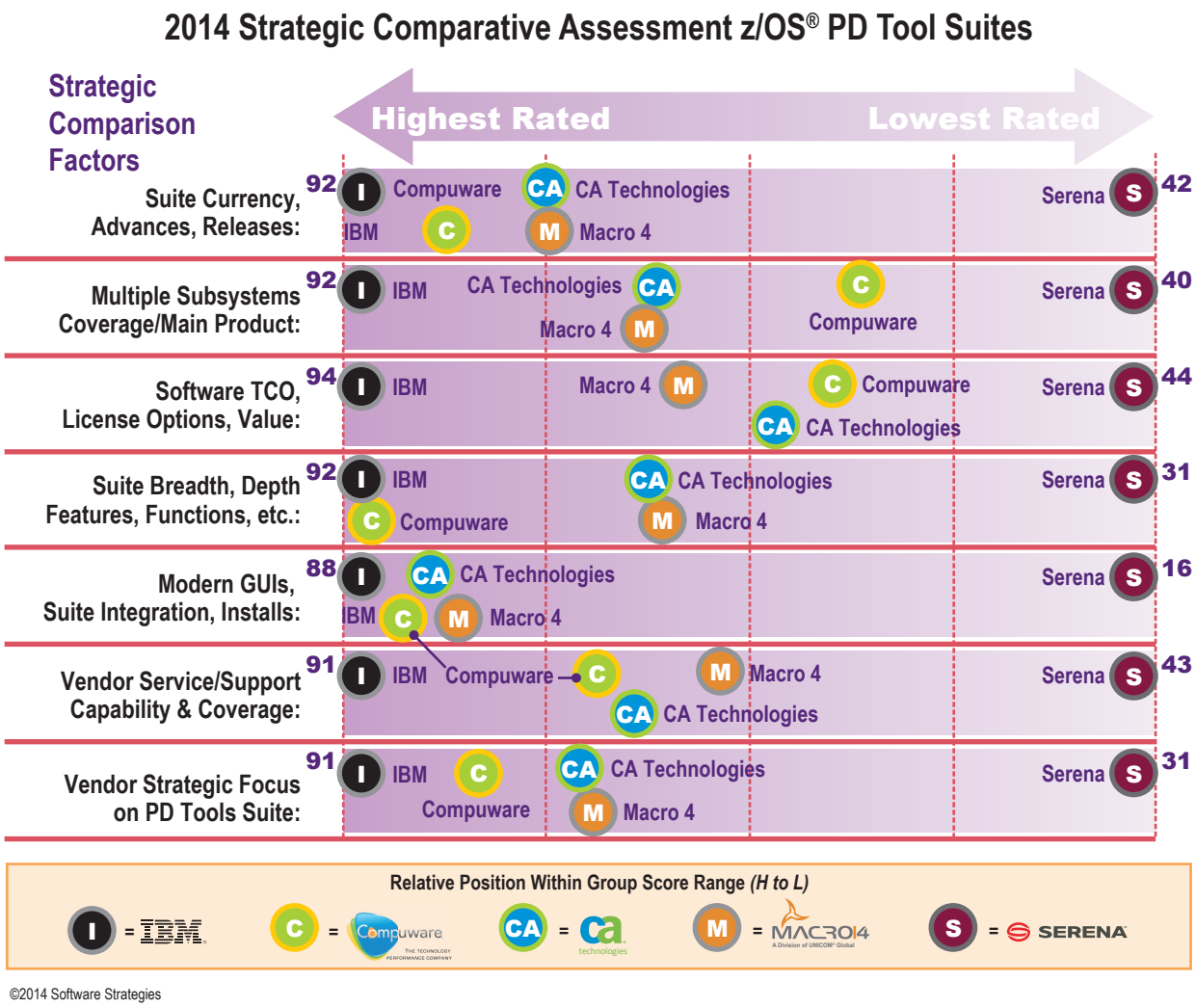

Figure 12: Strategic Comparative Assessment of z/OS® PD Tool Suites – May 1st 2014

Individual customer factor weightings may differ, depending on unique situations, histories, and priorities. For these, our Figure A1 data can easily be reworked in a spreadsheet, with customer chosen-weighting but using our scores, for a more customer-specific tailored analysis.

PD Tool Vendor & Suite Rankings 2014

Figure 12 on page 40 concisely shows our overall 2014 findings on the **relative competitive positioning** of the five z/OS® PD tools suites this White Paper assessed. These are based on our detailed assessment of IBM's tools products per Appendix B, and of four competing vendors' PD tools suites per Appendix C, using **our scoring model** set out in Appendix A. The changes we describe below are those over our 40-month Review Period from 01.01.11 to 05.01.14. We now add the following vendor-by-vendor commentary/analysis in lowest-to-highest TWS ranking order to summarize and comment upon those findings:

- **# 5 Serena Software:** In our context, Serena offers its **"Serena™ StarTool® IT Ops. & App. Dev. Productivity Improvement Tools" suite; & Comparex® for z/OS®**. Serena holds a <3.0% share of host PD tools segment $ revenues, placing it fourth of our vendors on that measure. Comparex® is the firm's leading, long widely-used, mainframe file comparison tool – Serena's first software product – written by founder Doug Troxell, now back as part-owner and director. Today, these provide a basic suite of four main lines with seven Stock Keeping Unit *(SKU)* products. Serena positions these as complementary tools integrated with its popular host ALM/Software Change Management *(SCM)* solutions *(ChangeMan® zMF, and ChangeMan® SSM)*. Serena bought-in most StarTool® suite products, with a last buy-in in 2002. Two suite products listed in our first two reviews were dropped before our third, for reasons unknown. No new products were added, nor existing ones dropped, since our prior 4th Ed. WP 03.11. Suite coverage/functionality is incomplete, **again weakest** of the five suites compared. Public web product information remains limited, but slightly improved. Our research noted no major, seven minor releases, plus four increments, **eleven advances** across the suite's seven products, an average of **1.57 advances per suite product** over our Review Period, a moderate level maintaining currency.

  No modern GUI support of any type is offered for this suite. Figure C3 on page 73 – and our Serena discussion there – amplifies details behind our summary product comments above. Our Serena company assessment – in Section 4 on pages 27 and 28 – showing FY14 revenue down $20.4M *(10.0% YoY)* at $183M, a net income loss of $3.25M, and total debts of $410M, may concern the firm's customers. Divestment of this PD tools suite to raise cash is now logical possibility, although profit margins doubtless remain high.

  Our May 1st 2014 **total weighted score *(TWS)* of 5,075** again ranked the firm's Serena® StarTool® suite **lowest # 5 overall** in our study group based on its TWS across our seven strategic comparison factors. The firm's score **increased by 7.8%**, reflecting its modest new software releases during this Review Period, a **well below-average increase**.

- **# 4 Macro 4:** Today offers fourteen products in its **"Mainframe Fault Analysis & Testing; Data Manipulation; & Performance Management Solutions"** for z/OS® suite *(including cross-platform APM)*, from our host z/OS® PD tools perspective. 3 new products were added *(1 major)*. The firm shipped **25 significant releases** for 12 products over our 40-month Review Period, a **good average of ~1.8 significant releases** per updated suite product. 128 increment advances were also delivered for 14 suite products, an average of 9.1/suite product. *(Increments are maintenance roll-ups (MRUs) consolidating smaller updates and fixes.)*

  Figure C4 on pages 74-75 – and our Macro 4 PD tools suite product discussion there – reviews and assesses these developments more fully, detailing specific advances by product, and suite-wide. We again found Macro 4 had **delivered substantial advances**, and **major innovations, rapidly** through that strong set of enhanced releases, and frequent increments, over this Review Period. These PD tools have again maintained **good currency** with IBM host software subsystems, compilers, and in exploiting new hardware. The firm clearly met its goals of providing major releases ~two-yearly, and minor releases at least yearly, for the main suite products, whilst also providing many needed increments rapidly.

  Excellent information on the current features and functionality of each suite product is available via product data sheets we found to be **crisp, clear, and up-to-date**. Release compatibility details for all Macro 4 PD products, with each main IBM subsystem, are also publicly available on its Web site, a good feature. *(Some hide release details behind password protection.)*

  Since our 4th Ed. WP 1.11, Macro 4 developed, launched *(mid-2011)*, and since much-enhanced, its **M4Workbench offering**, now-extensive Eclipse-based GUI tooling providing modern Windows GUI access to key services of primary host PD suite tools *(including FreezeFrame, InSync, DumpMaster, TraceMaster, & Tubes)* via Eclipse plug-ins for each. Additionally it now offers, also as Eclipse plug-ins, the powerful **M4SlickEdit** advanced program editor which runs under the firm's **z/Explorer** z/OS® host services access and 3270 emulation tool. M4Workbench is normally supplied with the M4 plug-ins all installed, free of charge *(FOC, except M4 SlickEdit plug-in)* to Macro 4 host tool licensees. The same plug-ins are also compatible with, and can be installed into, other Eclipse RCP workbenches, including IBM® RDz™ and IBM® CICS® Explorer that many host site now also use.

This **now-strong Eclipse GUI line-up** complement the firm's **alternative 'Web browser/portal'** modern "thin-client" GUI solutions for access to host fault and performance information produced by mainframe Macro 4 tools.

We assess Macro 4 suite developments were **again strong** in our Review Period to 05.01.14. Macro 4's investment in an IBM z114 mainframe for development/testing underlines the vendor's continued full commitment to the mainframe segment.

Macro 4 strives to **maintain close customer relationships** with its host tool user base, providing **quality support** and rapid suite advancement. As a result, Macro 4's **customer base remains loyal**, with **high license renewal rates** *(above 90%)*. Customer maintenance revenues alone deliver healthy profit on this business for the firm, with new license sales − from add-on product sales and migration wins − on top. *(Macro 4 sometimes replaces high-cost Compuware, and Serena Software, suites.)*

Macro 4's PD tool segment positioning is as a **stable**, **experienced**, but **nimble** specialist ISV, with a **full but compact suite** of well-proven PD tools, now with **excellent GUI interface** support for ease-of-use, offering a **lower-priced** alternative to the competition, with **strong development** *(per above)* and helpful customer support, providing good currency and value to its users.

Smallest – but **second-longest established** after IBM – of our five PD tools suite vendors, Macro 4 has clearly benefited from being a division of larger, privately held parent, UNICOM® Global during the last five years, sheltered from public markets pains.

Macro 4 gained a **total weighted score of 10,799** in this 2014 Review, **up a healthy 21.6%** from our 2011 study, reflecting its **strong M4Workbench Eclipse** *(& web browser)* GUI solutions, other **useful new suite products**, its **excellent new releases/increments flow**, and its post-acquisition sound company financial, R&D, and customer support, positions.

- **# 3 CA Technologies:** The largest mainframe ISV *(FY14 revenues $4.515B, ~12,700 staff)* made 54.9% of FY14 revenue from its highly-profitable *(60% margin)*, and extensive mainframe software portfolio *(~300 host products)*.

  In our context, these include the firm's long-established **"Mainframe Application Quality & Testing Tools; & Performance Management, Solutions"** suite for z/OS®, now of **7 product families** with **17 products**/SKUs at our Review Date. *(Appendix C, page 67, gives our review of product details, releases, & developments)*.

  Major developments implementing the new **CA Technologies Application Development Solution *(AppDev)***, overviewed in our Section 4 CA Technologies vendor profile *(pages 25-25)*, delivered two strategic new AppDev PRIME "MAINTAIN" offerings central within the firm's new AD solution architecture, each with functionality grouped from traditional CA Technologies PD suite tools, extended as follows:

  - **CA FileMaster™ PRIME:** Offers host file management, data manipulation, and data creation. This solution will combine the proven functionality of CA FileMaster™ Plus with its modern Eclipse GUI interface, for access to main host data sources, now including DB2® in a friendly interface directly in CA FileMaster™ PRIME. In the future, CA FileMaster™ PRIME will extend support to Oracle and SQL Server, and will add integrated data masking capabilities.
  - **CA InterTest™ Prime:** Offers applications analysis and debugging for most System z™ applications. This solution combines the proven functionality of CA InterTest™ for CICS, CA InterTest™ Batch, CA SymDump® for CICS®, CA SymDump® Batch, and CA SymDump® System, with modern Eclipse-based GUI access/integration facilities.

  First releases are targeting CA World *(November 2014)* announcement, with enhanced features being delivered as incremental releases through 2015.

  In our 40-Month Review Period to 05.01.14, CA Technologies delivered a **solid 17 new releases**, comprising **9 major** and **8 minor** releases for the suite's now-17 traditional product offerings. Also in this period, CA Technologies launched and refined **CA Recommended Service** *(CA RS)*, advised maintenance update sets *(now monthly)* for its mainframe portfolio – including the CA Technologies PD tools – which provide fully-and cross tested, and IBM-stack aligned, software updates frequently. This fine-grain, rapid delivery of assured fixes/enhancements up to 12 times yearly is major advance now benefiting CA Technologies customers between traditional major & minor releases.

A welcome and major cross-suite advance was delivery of modern, CA Eclipse-based GUI interfaces with/for newest releases of seven main CA Technologies host PD and APM suite family products.

A welcome and major cross-suite advance was delivery of **modern, CA Eclipse-based GUI interfaces** with/for newest releases of seven main CA Technologies **host PD and APM suite** family products. These new GUIs make time-consuming host test/debug tasks faster and easier, both for experienced – and especially for younger – mainframe staff, and represented a **milestone advance for this CA Technologies suite**.

...CA has also successfully automated how its customers now receive, install, configure, deploy, and manage, (nearly) all their CA Technologies products...

CA Technologies other big **advances** in how it builds, tests, and delivers, z/OS® host products and their maintenance have achieved higher quality, better alignment, and greater IBM host stack-currency, over recent years. It has also **successfully automated** how its customers now **receive, install, configure, deploy, and manage**, *(nearly)* all their CA Technologies products, and also introduced powerful GUI access tools supporting key IT job roles. These advances already delivered sizeable benefits to the firm's host customers – including CA Technologies PD suite users – and were:

- **CA Technologies Mainframe Stack for z/OS®:** Unified, standardized, CA Technologies software sharing common lifecycle management, extensively tested for interoperability with other CA Stack products, with the IBM z/OS® stack, and with CA RS below.
- **CA Recommended Service *(CA RS)*:** As above, highly-tested preventive maintenance PTF sets, now issued monthly.
- **CA Integrated System Test Laboratories:** 2 Parallel Sysplex clusters *(of 6 & 3 mainframes)* continuously testing Stack products against CA RS levels across all supported IBM z/OS® and subsystem levels.
- **CA Chorus™ Software Manager:** Powerful Web-based GUI tool *(now V6.0)* automates customer onsite installs/support of all CA Stack products, giving major time/effort savings, now widely adopted by several hundred CA Technologies customers.
- **4 CA Chorus™ GUI access solutions:** Each a modern workbench GUI interface tool for a key IT job role, integrating GUI access to multiple CA Technologies host tools within that role's *(e.g. DBA, security analyst, storage admin., network & systems analyst/infrastructure)* domain.

CA Technologies holds a long-standing third place for PD tools segment $ revenue *(after Compuware and IBM)*, each far ahead of other vendors.

Delivery of the full set of *(7)* Eclipse GUI interfaces, solid **suite full releases**, the firm's **new AD strategy/ offerings**, and **software process** improvements *(e.g. CA RS, CA SM, etc.)*, above *(with our 2014 factor weightings)* give the CA Technologies PD tool suite a substantially improved **TWS rating of 10,856, up 22.0%** from our 2011 study score, which placed the firm in third place for 2014.

- **# 2. Compuware:** Mainframe PD tools pioneer – still segment $ revenue share leader today – underwent radical corporate transformation *(including large divestitures, cost-cuts, board changes, etc.)* over its FY13 and FY14, described in our Section 4 vendor profile. In our context, Compuware's **Mainframe Solutions business unit**, comprising its well-established, widely-used host PD tools suite business, is our prime interest, but we also cover its flagship **Compuware APM for Mainframe** solution. Compuware's other business unit, **Application Performance Management**, combined the firm's own prior distributed system APM offerings, its Gomez acquisition web APM SaaS operations, and latest acquisition dynaTrace Software's advanced APM technology/solutions.

  Mainframe Solutions BU *(Compuware's wide mainframe z/OS® PD tools portfolio)* actual FY14 revenue was **$296.3M*** – down $36.5M *(or 11.0%)* YoY – with contribution margins up 2% points YoY to *(a high)* **75%**, but with slower **revenue falls of 8% and 7%** projected for FY15 & FY16. Such revenue declines *(averaging 7.0% CADR 2001-14)* continued due to Compuware's early start, long-held market share lead, and high PD tools prices, that long made it the **prime target** for active PD tool segment competitors *(large and small)*. These exerted continuing downward price pressures and forced customer migration losses. Investors were told that Mainframe Solution's FY14 renewal rates were the highest of the last five years. If morphed into a standalone firm, these high margins *(but falling revenues expected)* should appeal to yield-focused investors, provided "the numbers are right". Host customers will expect a post-separation company's exclusive focus on their host PD tool suite – and associated GUI tools – will deliver them stability, improved R&D, and enhanced service and support – with a single, clearer vendor role.

  The **APM BU** *(Compuware's expanded, growth-focused BU)* actual FY14 revenue was $338.8M* – up $34.0M or 11.1% – with a contribution margin of 10%, and Compuware projecting revenue growth rates of 11% and 13% for FY15 and FY16. These would secure the firm's current # 3 position *(by $ share)* in a briskly growing APM segment with a now leading-edge *(if narrow)* solution set, lending an APM BU-alone firm appeal for growth-oriented investors. Doubtless to boost such APM BU growth hopes and investor appeal, the firm transferred its attractive **Compuware APM for Mainframe** product family/business into the APM BU unit from its former, more logical Mainframe BU home at end-FY14.

Footnote:

*BU FY14 results above include each unit's shares of retained professional services revenue *(after main Compuware PS unit divesture)*.

...high Compuware costs motivated many hundreds of its customers to migrate to competing PD tools suite vendors (notably IBM)...

Compuware's mainframe PD tool products **remain well-rated**, but long commanded this sector's **steepest total costs** for the vendor's extensive, now 38 main products *(plus add-on options)* suite. Those high Compuware costs motivated many hundreds of its customers to migrate to competing PD tools suite vendors *(notably IBM)* for their lower-cost, more compact, and previously more current, suites, as the revenue declines above show.

Over our Review Period, Compuware data showed 21 major, 62 minor, and so 83 total, software releases for its 38-product suite *(at May 1st 2014)* were issued, a good average 2.2 total releases per suite product. *(See Figure C2 on pages 70-72.)*

Compuware Workbench is now a comprehensive, mature, and well-integrated part of its extensive PD tools suite that greatly helps staff to be more productive with the firm's host tools.

A main Review Period development was further broadening and functional extension of the **Compuware Workbench *(CW)***, now in V4.0 release. This is Compuware's modern Eclipse-platform/GUI-based launch, common framework, and integration point, for its host PD tool product suite, first launched in September 2010 *(as Compuware Mainframe Workbench)*. Compuware Workbench V4.0 now provides an easy-to-learn/use suite GUI access workbench, giving friendly access to key services of its **Abend-AID** *(host fault diagnosis)*, **Xpediter** *(host COBOL, PL/I, C language, and Assembler debugging)*, **File-AID** *(host data browse/edit functions)*, **Hiperstation** *(host applications testing)*, and **Strobe** *(mainframe application performance management)* host PD product families. CW also offers modern GUI support for source code editing *(embedding the feature-rich SlickEdit OEM editor)*, host compiler invocation, JES job submission and output review, and dataset management, as well as other common ISPF tasks needed daily by System z™ developers, supported by extensive embedded help and user guidance. Compuware Workbench is now a comprehensive, mature, and well-integrated part of its extensive PD tools suite that greatly helps new-to-mainframe staff, as well as experienced host staff, to be more productive with the firm's host tools.

With its good flow of new releases, and sound Compuware Workbench advances above, Compuware's mainframe PD tools suite has strengthened its position over this review period, but still lost share. Corporate changes radically simplified the firm, the Mainframe Solutions BU, now a very profitable half of the current Compuware portfolio, is set to become a standalone company this FY15 on stated directions. With the firm's projections of Mainframe Solutions BU revenue declines at 7% and 8% for FY15 & FY16, customers and investors will want to receive positive benefits from this split to settle their concerns.

Our increased May 1st 2014 TWS for Compuware was **11,425, up 19.9%** from our 2011 study which again gave the firm a **continuing # 2 position** in this 2014 strategic comparison ranking. Compuware's good TWS score increase came from the completion/maturity of the **Compuware Workbench GUI solution**, its **good new product releases rate** *(mainly minor)*, and the **firm's refocus** upon its mainframe PD tools business, during our Review Period.

- **# 1 IBM:** Far our largest vendor here, IBM reported FY=CY2013 revenues of $99.75B *(down 4.55% YoY)*, net income was a record $16.48B *(down 0.73% YoY)*, net cash from operating activities was $17.49B *(down 10.7% YoY)*, and diluted earnings per share *(non-GAAP)* were $16.28 *(up 6.75% YoY)*. Segment YoY revenue changes were: Software *(+1.9%)*, Global Finance *(+0.4%)*, Global Business Services *(-0.9%)*, Global Technology Services *(-4.2%)*, and Systems and Technology *(-18.7%)*. In 2013, IBM also invested $3.1B for 10 acquisitions, invested $3.8B in net capital expenditures, invested $6.2B in R&D *(6.22% of revenue)*, and was granted the most US patents for the 21st year in a row. IBM and subsidiaries had 431,212 employees worldwide at the end of 2013 *(down 0.7%)*.

IBM's strategic motive was to speed and facilitate mainframe platform revival by providing modern, affordable, IBM tool alternatives to over-costly, third-party ISV PD suites.

IBM entered the PD tool suites segment in 2000, for compelling strategic reasons. Its strategic motive was to speed and facilitate mainframe platform revival by **providing modern, affordable, IBM tool alternatives** to over-costly, third-party ISV PD suites. Ever since, IBM has systematically built out, broadened, and briskly advanced, what is today its complete, compact, functionally-rich, fully-current, well-integrated, fully-Eclipse GUI-enabled, good value **IBM® PD Tools for z/OS® Suite**, mainly via continuous in-house labs development, aided by several ISV tool acquisitions.

Today, IBM's compact PD tools **suite consists of ten products**. Consistently developed through regular new releases, the IBM® PD Tools for z/OS® Suite **boasts the highest currency** with all IBM System z™ and z/OS® subsystems/middleware/tool PD tool "touch points". At date of writing *(05.01.14)*, we estimate **IBM now has ~2,300 PD tools suite customers**, with a **combined ~6,750 IBM host PD tool products** now installed, all won since 2000 and continuing on a path of healthy and profitable growth.

IBM® PD Tools for z/OS® Suite major product upgrades have, for many years now, been simultaneously released, with the latest V13.1 shipped from 10.18.13 *(supporting the latest z/OS® V2.R1)*, and the previous cross-suite V12.1 releases shipped 17 months earlier from 05.11.12. These quite rapid, simultaneous major releases **give excellent alignment between** the main IBM® PD Tool for z/OS® Suite products themselves, and with all foundation IBM host software releases. *(Figure B1 on page 54 shows the detailed IBM® PD Tool for z/OS® Suite releases track-record)*. Today, after a decade-and-a-half of intense, ongoing IBM R&D, IBM® PD Tools for z/OS® Suite product functionality and features are now first-class across the board, with clear leadership held or extended in many areas.

A major strength is that each main IBM tool supports multiple subsystems/languages, etc. *(in the same main product)*, so customers have fewer to buy to gain full coverage. The latest cross-suite new releases *(V13.1, delivered in October 2013)* extended the suite's features, functionality, performance and value robustly again, our detailed examination in Appendix B found. Suite tool robustness has been solid over recent years, due to the heavy regression-testing regime IBM applies in development. Software prices and license terms remain extremely competitive by design, which also greatly encouraged the widespread migration to the IBM suite seen to date. Two new **IBM PD Tools "Solution Packs"**, each offering a multiple PD product package, now offer further cost savings.

The IBM® PD Tools for z/OS® Suite also now offers the comprehensive GUI access, integration and launch point – the **IBM® Problem Determination Studio** – providing modern, easy-to-use, Eclipse-based, GUI workstation access to a broad range of selected services of five main IBM® PD Tools for z/OS® Suite host products, via Eclipse Plug-ins for each. These are the IBM® Application Performance Analyzer for z/OS®, the IBM® Debug Tool for z/OS®, and the IBM® Fault Analyzer for z/OS®, the IBM® File Manager for z/OS®, and the IBM Workload Simulator for z/OS® and OS/390®. This low-footprint, easy-to-install, easy-to-learn, and free-of-charge *(to host PD tool licensee users)* Eclipse tool with these plug-ins, can therefore readily/affordably be deployed for all host staff needing regular workstation GUI access to host IBM® PD Tools for z/OS® Suite tool services.

The same five IBM® PD Tools for z/OS® Suite Eclipse Plug-ins above can also now all be installed within three other major IBM z/OS® workstation GUI tools, each targeted at other key mainframe staff groups, the now well-established IBM® CICS® Explorer *(primarily for CICS® developers/administrators)*, the long-standing de facto standard IBM® Rational Developer for System z™ mainframe IDE family *(for professional mainframe developers)*, and the newer IBM® IMS™ Enterprise Suite Explorer for Development *(for IMS™ developers, administrators, etc.)* giving these users GUI access to the same select host PD tool services from within their favored IBM z/OS® Eclipse workbench tool. The first and last of these workbench tools, and the five PD Plug-ins, are both free of charge *(FOC)* for users at licensed sites of respective host products. RDz™ itself is a chargeable IDE product, but the five PD Eclipse Plug-ins are FOC to RDz® licensed users at sites licensed for those host PD tools.

Recent, extensive April 7th 2014 celebrations of the 50th Anniversary of the IBM mainframe, marked its earlier industry-changing success, 2000s resurgence, and continued central enterprise platform role at most major enterprises today. During its 50th Anniversary events, IBM revealed its total investment to date in the platform's hardware and software had topped an astounding $55B, and high investments in mainframe technology, hardware, and software are continuing apace today. *(7 all-new 64-bit z/Architecture mainframe generations since 2000, with the next expected from 2015, for example.)* The IT giant's absolute commitment to its flagship enterprise platform remains unquestionable. Financially, the resurgent mainframe still makes a major contribution to IBM total revenue, and net income. *(Not only System z™ hardware itself but also IBM's mainframe-associated host storage, major System z™ software, extensive business and technology services, and financing, revenues combined – we estimate these total ~35% of IBM revenue and ~45% of net income.)*

IBM's full commitment to further long-term development of its IBM PD Tools for z/OS® Suite is without question.

IBM's full commitment to further long-term development of its IBM PD Tools for z/OS® Suite is thus without question. Over its PD tools segment challenger years, IBM also developed extensive documentation, guidelines, Red Books, learning materials, user training courseware, tools, and a well-honed set of migration assistance services. With many hundreds of migrations to the IBM PD tools suite smoothly accomplished, its experienced staffs are well-equipped to help customers migrate quickly, easily, and at low risk. IBM's mainframe hardware and software support is also of legendary quality, and is delivered to almost all parts of the globe with mainframes.

Our May 1st 2014 TWS for IBM was 11,432 again placing it in the # 1 leader position in our overall strategic comparison, up 16.7% since 2011, and 17.6% ahead of the nearest competitor on our TWS metric.

Our May 1st 2014 TWS **for IBM was 11,432 again placing it in the # 1 leader** position in our overall strategic comparison, **up 16.7% since 2011**, and 17.6% ahead of the nearest competitor on our TWS metric. IBM's increased score was driven by its **extensive Eclipse GUI workbenches** advances, **strong major releases flow**, and the **new Solution Pack value** offerings.

Our Analysis

The 40 months since our prior 4th Ed. WP 03.11 saw slow but welcome recovery from the deep 2008-11 recession, bringing improving business climates in many nations, with enterprises and their IT organizations moving away from that period's retrenchment-focus towards a more **positive growth/new investment/innovation stance**. For these IT groups, the years of "do more with less" cost reduction emphasis ended by 2012, attention turning to **new IT-enabled business initiatives**, such as **big data analytics, mobile device enablement, social business**, and the **DevOps** agile/continuous development and faster deployment approach. Enterprise IT also restarted often long-overdue IT infrastructure upgrades, including spreading cloud computing adoption. Indeed, IBM's new-generation zEnterprise® System mainframes *(high-end zEC12 and mid-range zBC12)*, shipped from October 2012, **reaped record revenues and MIPS capacity shipments** over their first 3-4 quarters on the market, for just those reasons, as well for their own compelling advances.

Segment challenger IBM again continued a pace of innovation/advances, and with favorable pricing, won further PD tools suite competitor migrations and new footprint site sales, driving its PD tools suite customer base up to the 2,300 mark today, and strengthening its number two in segment $ revenue share position. These continued, relentless IBM developments in/around its PD tools suite had clearly again "upped the ante", forcing active z/OS® PD tools suite competitors to **work harder on** delivering **better currency, new GUIs** for younger staff, and **other enhancements** – sometimes reducing still-high maintenance/support fees – to match IBM's R&D pace and stem threats to their customer base's high margins, difficult on static or declining revenues.

Over this Review Period, four vendors *(as noted above)* had broadly continued or increased the higher R&D and innovation rates noted in our last 4th Ed. WP 03.11 to remain competitive.

Three competitors *(Compuware, CA Technologies, and Serena Software)* each underwent big **strategic changes** during our Review Period – noted in our Section 4 profiles and above – some to yet fully play out. Each had long faced **similar challenges**, with mainframe software revenues declining or flat *(under relentless IBM competition in all segments)*, but with their host software unit profit margins remaining extremely high *(60-70%)*. Each had long invested host software profits into newer distributed software domains, each growing substantial distributed software businesses since the late-1990s, but most of these earn far lower – sometimes negative – unit profit margins still today. This contradiction finally **forced varied but radical actions** at three competitor firms over our Review Period. These featured the full panoply of modern corporate actions: **activist investor actions, private equity takeover, executive management changes, divestitures** of non-strategic units, **headcount reductions, "rebalancing actions"**, new focused **growth strategies**, key **growth acquisitions**, even debt loading. All three now aim to build real new revenue growth from investments in other different targeted high-growth segments, as noted in our profiles.

...now aim to build real new revenue growth from investments in other different targeted high-growth segments...

The larger two firms above each clearly more strongly reinvested into their mainframe tool products over this Review Period, seeking to retain valuable user bases, or at least to stem revenue declines, as long as possible.

The third, Serena Software, now seeks new growth in DevOps under new private equity and founder ownership, delivering the minimum updating of its PD tool suite over our Review Period, **clearly a non-strategic** – but no doubt profitable – cash source unit. Serena alone has still not delivered any form of GUI access to any of its host PD tools, for example. The firm **could potentially divest** its small PD tools unit/base.

Fourth competitor, Macro 4, had wisely moved in 2009 from exposed UK public company life, to more sympathetic private ownership by the larger, clearly compatible, UNICOM® Global software/services consolidator parent. Macro 4 posted **strong suite new releases** and GUI development advances over our Review Period, and seems in robust health. Acquisitive parent UNICOM® Global seem most unlikely to sell, but could acquire assets in this segment to add scale/base.

We reported on **Compuware's transformation progress** in our Section 4 profile and above. The firm shipped a healthy 2.2 new releases per PD suite product, also rounding out and advancing its now-extensive Compuware Workbench suite GUI access solution, over our Review Period. Other vendors, and all segment customers, will now wait with interest whether, when, and how Compuware follows through with the likely FY15 split into separate Mainframe Solutions *(all PD tools)* and APM software/service companies mentioned above.

The former could again become a buyer: but the standalone spin-off itself could be a large target more easily bought.

Mainframe software remains the largest **core business at CA Technologies**, now mid-way through actively restructuring, integrating, and modernizing its primary application development architecture and solutions, unifying these across mainframe, distributed, and cloud platforms, for the first time. Main CA Technologies PD suite tools are a central component of these AD plans, and will restructure suite offerings as noted in our Appendix C assessment.

Mid-sized software consolidator ASG could also divest its OEM PD tools suite or unit, or augment this with another buy.

With it's excellent modern PD tools suite steadily gaining share, IBM has little need to acquire technology or products. However, the giant has deep pockets, and an extensive software acquisitions track-record, and so could potentially acquire for user base expansion!

Further change and **consolidation** now seems probable in this **PD tools segment**.

...IBM again offers the most compelling all-round strategic value-proposition...

On our strategic total weighted score *(TWS)* 2014 assessment IBM again remains in the # 1 segment leadership position, holding its lead against now more-active nearest competitors. With its current, latest IBM PD Tools for z/OS® Suite V13.1, IBM again offers the most compelling all-round strategic value-proposition – based on our seven strategic criterion weighted scoring. We expect IBM will thus continue gaining market share through 2014, 2015 and beyond, as more mainframe users migrate to this leadership PD solution, saving considerable money on the way!

Appendix A: z/OS® PD Tool Suites, Vendors Strategic Comparison Factor Scores and Vendor Ranking – May 2014

Introduction

Our strategic relative May 2014 comparison of the five PD tools suites/vendors assessed here was summarized in Section 5 and Section 6, where we:

- Considered the events most likely to trigger choice of a new PD tools suite for z/OS®.
- Reviewed four main customer situations where replacement by, or equipping with, a new PD tools suite are appropriate.
- Refined and updated our seven strategic comparison criteria we now consider most fully guide selection of best suite/vendor, and the weighting now applicable to each, as at May 1st 2014.
- Presented our overall relative position findings for each vendor/comparison factor visually in Figure 12 on page 40.
- Discussed our analysis findings on each vendor/suite.

The foundation for that analysis was our absolute competitor scorings and score-weighting table in Figure A1.

Methodology

1. Our research found those seven reviewed and updated strategic comparison factors most completely and compactly represent what a prospective customer planning a 10-year-plus investment in/replacement of PD tools suite products for z/OS® should focus on, to narrow the field down to the most suitable vendor/suite. These factors were identified – and each fully explained – in Section 5.

2. We again conducted wide research on each vendor company *(reported in Section 4)*, into their 2014 PD tools suite products *(findings detailed in Appendix B (IBM) and Appendix C (competitors))*, and presented our scored, ranked, overall findings on IBM and its four competitors, based on this research, in Section 6. Our multi-source research included reviewing vendor histories, corporate changes, financials and annual reports, news releases and Securities & Exchange Commission *(SEC)* filings. We examined suite structure, product functionality and currency, pricing/license policy, product releases, market reputation, user opinions, and vendor-stated strategic

Strategic Comparison Factor	z/OS® PD Tool Suites/Vendors Strategic Comparison Scores and Vendor Rankings May 1st 2014					Highest, Lowest Scores & Range	Software Strategies 2014 Factor Weighting
	CA Technologies	Compuware	IBM	Macro 4	Serena Software		
Suite Currency, Advances, IBM Stack Exploitation, Release Frequency & Depth:	80/100 # 3=	86/100 # 2	92/100 # 1	80/100 # 3=	42/100 # 5	42-92, 50	20
Multiple Environment Coverage/ Main Product:	72/100 # 3	59/100 # 4	92/100 # 1	73/100 # 2	40/100 # 5	40-92, 52	19
Software TCO, Licensing Options, Value:	67/100 # 3	64/100 # 4	94/100 # 1	73/100 # 2	44/100 # 5	44-94, 50	22
Suite Breadth, Depth, Core Functions, Features:	69/100 # 3	91/100 # 2	92/100 # 1	68/100 # 4	31/100 # 5	31-92, 61	25
Modern GUI Interfaces, Suite Integration, Installs:	81/100 # 3	83/100 # 2	88/100 # 1	78/100 # 4	16/100 # 5	16-88, 72	25
Vendor Service/Support Capability & Coverage:	74/100 # 3	76/100 # 2	91/100 # 1	73/100 # 4	43/100 # 5	43-91, 48	18
Vendor Strategic Focus on PD Tools Suite:	74/100 # 3	81/100 # 2	91/100 # 1	73/100 # 4	31/100 # 5	31-91, 60	18
Total Weighted Score Overall Rank on TWS:	10,856 # 3	11,425 # 2	13,432 # 1	10,799 # 4	5,075 # 5	– –	– –

Each score is out of 100 maximum, ranking is by highest score — from # 1 downwards.
Vendors shown above in alphabetic order across this table.
Score ranges, and individual vendor scores, above are the sources for our Summary Relative Positioning Figure 12 on page 40.
Each score above constructed from 5-8 sub-factor per strategic factor.
Weightings *(RH column)* adjusted to reflect 2014 z/OS® customer priorities/needs, total weight up 18.5% from our prior 4th Ed. WP 03.01.14.
2014 score comparisons with our prior Edition should consider increased 2014 total weight above.

Figure A1: z/OS® PD Tool Suites/Vendors Strategic Comparison – Scores & Vendor Rankings – May 1st 2014

business focuses, etc. Vendor data, briefings, comments, and other inputs were a valued source of study information. Final scores assigned, and vendor rankings, within each strategic comparison factor and in total, are shown in Figure A1 on page 48. We used 5-8 contributing sub-factors per main strategic factor *(mentioned above)* to calculate the factor scores shown.

3. Each factor for each vendor/suite was scored out of a maximum 100 points, with the deciles meaning:

100s	Perfect
90s	Outstanding
80s	Excellent
70s	Very Good
60s	Good
50s	Above Average
40s	Below Average
30s	Inferior
20s	Very Inferior
10s	Negligible
0	No Capacity

4. The right-hand column of Figure A1 shows the general importance weighting we assigned at May 1st 2014 to each strategic comparison factor. Based on these weightings and our individual vendor-factor scores, the Total Weighted Scores *(TWS)* and Overall Vendor Rankings shown were calculated. Prospective customers whose different situations require alternate weightings can easily recalculate their specific TWS using their own unique weightings together with our assessment ratings.

Appendix B: IBM's z/OS® PD Tools Suite for 2014

IBM PD tools for z/OS® Suite, V13.1 in 2014 Overview

The IBM PD Tools for z/OS® Suite now provides application developers, testers, and operations staff with a **complete, functionally-rich, modern**, and **advanced set of PD tools**. These improve mainframe application delivery throughout the application lifecycle by providing increased user productivity and IT effectiveness across source code debugging, application abend analysis, file and data management, application performance analysis, and other related functions. The tools are easy to use and learn, and yet now offer extensive functionality. The strategic themes guiding IBM's intense development of the further advances delivered in the current *(V13.1 – November 2013)* generation of the IBM® PD Tools for z/OS® Suite were to:

- **Enhance GUI Support with IBM® Problem Determination Tool Studio**, providing no-cost, low-footprint Eclipse workstation GUI access to a now-broad range of select services of the host IBM® Application Performance Analyzer for z/OS®, IBM® Debug Tool for z/OS®, IBM® Fault Analyzer for z/OS®, IBM File Manager for z/OS®, and IBM Workload Simulator for z/OS® & OS/390®, all included today.
- **Fully exploit IBM's latest mainframe hardware & OS software**, including the current zEC12 & zBC12 mainframe hardware, and latest new z/OS® V2.1 flagship operating system release.
- **Continue IBM PD suite currency lead**, supporting all latest IBM System z™ subsystems, middleware, and programming language software releases. In the V13.1 releases, subsystem support includes new DB2® V11, IMS™ V13, CICS® TS V5.1, WebSphere® MQ V7.5, & WASz V8.5 releases support, whilst new language support includes COBOL V5.1, PL/I V4.4, C/C++ for z/OS® V2.1, Java V7, and HLASM.
- **Optimization and modernization focus**, enhancing suite capabilities to fully support the full range of problem diagnosis scenarios for traditional, modern, and new emerging, mainframe operating environments.
- **Continuing simplification**, of the deployment and use of the IBM® PD Tools for z/OS® Suite, including speeding GUI deployment of IBM® PD Tools Studio with a PD Tools common server, easier XML template preparation in IBM® File Manager for z/OS®, and side-file mismatch reporting in IBM® Fault Analyzer for z/OS® to help quickly pinpoint errors, are just a few examples.
- **Other IBM GUI workbenches PD tools enabled**, giving access to the same select five host IBM® PD Tools for z/OS® Suite services as with IBM® PD Studio above, via installing the same 5 Eclipse PD Tool Plug-ins into IBM® CICS® Explorer, IBM® RDz™, and/or IBM® IMS™ Enterprise Suite Explorer workbenches, now used by other groups of mainframe staff.
- **Adding two new suite "Solution Packs"**, each providing an all-in-one package of several IBM PD tools at a money-saving inclusive price, providing increased business value, easier ordering, and enabling easier migration.
- **Customer-specific requested advances**, numerous advances requested/needed by specific IBM® PD Tools for z/OS® Suite customers.
- **Maintains IBM's robust track-record** of development and investment, sustained now for fifteen years.

The recent IBM suite V13.1 releases (shipped October 2013) therefore delivered another significant sweep of advances... continuing IBM's sustained high development pace in this segment since 2000...

The recent IBM suite V13.1 releases *(shipped October 2013)* therefore delivered another significant sweep of advances *(summarized above and detailed below)*, continuing IBM's sustained high development pace in this segment since 2000, that can be clearly seen in Figure B1 *(on page 54)*.

The V13.1 suite again continues IBM's popular approach of offering **inclusive support for all latest IBM subsystems/languages releases** in a single, comprehensive product in each category, whilst greatly expanding/extending the suite's **modern GUI access options**, enhancing ease of use simplicity, and extending functionality. IBM has again kept to its long-standing policy of **competitive and more affordable suite pricing**, with flexible terms and conditions, and requiring no license keys, but has also added two inclusive Solution Packs offering still more favorable prices for these two bundles of suite products.

This proven IBM PD Tools for z/OS® Suite value-proposition of wide-ranging, continued, and innovative advances offered at **competitive prices** continues to provide convincing incentives for customers to migrate across, offering them **excellent relative value** versus the established segment leader's famously high prices.

We expect IBM's fifteen-year-sustained, strong PD tools suite development will continue steadily, with the next V14.1 suite releases doubtless well into development at their IBM software labs homes in Perth, Western Australia, and Silicon Valley, CA, with many direct customer enhancement suggestions and requests again incorporated as always.

IBM® PD Tools for z/OS® Suite cornerstone APA monitors, analyzes, & reports on, resource use for all main z/OS® applications, to help performance analysts/developers pinpoint bottlenecks & improve performance...

IBM® PD Tools for z/OS® products are also used alongside several important, adjacent categories of IBM mainframe software tools, described later in this Appendix, with one example – CICS® tools – explored more fully. Our overview of each IBM® PD Tools for z/OS® Suite products within this V13.1 generation of the IBM suite – all available at time of writing *(May 2014)*, with their latest enhancement and our comments, are:

- **IBM® Application Performance Analyzer *(APA)* for z/OS® V13.1:** IBM® PD Tools for z/OS® Suite cornerstone APA monitors, analyzes, & reports on, resource use for all main z/OS® applications, to help performance analysts/developers pinpoint bottlenecks & improve performance – for faster online transaction responses and reduced batch turnaround times. It enables sites to obtain peak performance from their mainframe applications and meet demanding SLAs whilst reducing host resource use. This easy-to-use APM tool is non-disruptive, can be run live online in real time, be run scheduled, or run in batch. It is often used to isolate/resolve performance constraints, and also to test for impacts of higher workloads during development, stress, and regression, testing. APA online displays overall system activity, allowing job execution to be checked, and the active job for monitoring to be selected. The tool supports all main z/OS® applications written in **CICS®, Assembler, COBOL, PL/I, C/C++, Java™, Natural, DB2®, IMS™, WebSphere® Application Server, and WebSphere® MQ®**, environments, running in batch or under TSO. APA samples the monitored address space, analyzing its CPU, DASD *(Direct Access Storage Device)*, & I/O use – for both the application and system.

  APA provides **wide flexibility** on what to monitor, monitoring duration, and the number of samples, to fit all situations. Job performance monitoring begins automatically when the specified job or program becomes active. It also provides an online monitoring feature displaying overall system activity enabling checks on running jobs, or to select a specific job to monitor. APA supports the monitoring of DB2®, IMS™, MQ®, and CICS® in combination. A batch command interface allows programmatic monitoring invocation. APA delivers fine-grain performance analysis data, including CPU usage by procedure/module, Control SECTion *(CSECT)* usage, referred attribution, wait time by task, category and module, as well as multiple DASD statistics, including Execute Channel Program *(EXCP)*, VSAM statistics, and I/O wait times, etc.

Additional specific metrics for the z/OS® subsystems also include:

- **WebSphere® Application Server for z/OS®:** APA WAS observation reports various activities by servlets, JSPs and EJBs, plus the **important service times** for **CICS® Distributed Program Link calls** and **SQL processing time for DB2® calls**.
- **WebSphere MQ® queues:** CPU usage by queue, by request, and by transaction, plus service time and wait time.
- **DB2® *(inc. V11)* databases:** Monitors SQL statements, DB2® Stored Procedures, & DDF *(Distributed Data Facility)* calls. Provides SQL statements usage and CPU by SQL statement analysis, and DB2® delay statistics, for DB2® performance analysis/tuning.
- **IMS™ *(inc. V13)* transactions & database:** IMS™ call time and service-call time for DL/1, with IMS™+ able to trace all IMS™ calls if wished, now with over 20 IMS™ analysis reports available.
- **CICS® *(inc. V5)* transactions & relationships:** Specific CICS® transaction, or transaction prefix with wildcard, with CICS®+ providing tracing support *(not sampling)* in critical situations.

Support for Assembler, COBOL, and PL/I source language applications, and optimized code support for COBOL and PL/I production applications, is included. The tool delivers **multiple summary reports**, pinpointing areas of performance challenges to analyze. These are all available **online via ISPF** *(with drill-down to detail)*, as printed reports, in Adobe Portable Document Format ***(PDF)* files**, and as **XML files** for further processing *(and for IBM® PD Studio, IBM® CICS® Explorer, or IBM® RDz™ workstation viewing)*. The tool also **supports System z™ z/OS® Parallel Sysplex** clusters, enabling jobs and transactions to be monitored on any LPAR image in a z/OS® Parallel Sysplex cluster.

APA V13.1 on the host is directly integrated with **IBM Fault Analyzer for z/OS® V13.1** and **IBM Debug Tool for z/OS® V13.1** *(both reviewed below)* sharing common side files, and also supporting C/C++ Executable and Linkable Format *(ELF)* and Debugging With Attribute Record Format *(DWARF)* side files with them. It is also integrated with the **IBM® Problem Determination Tools Studio**, the suite's comprehensive Eclipse-based GUI workbench and integration point *(reviewed in Section 3 and illustrated by Figures 8 & 9)*, through the **IBM® Application Performance Analyzer for z/OS® Plug-In for Eclipse** provided inclusive to APA licensees.

This **IBM® Application Performance Analyzer for z/OS® Plug-In for Eclipse** provides Eclipse GUI-based observation request submission, and APA analysis reports navigation capabilities. These include R02 screens list, detail views, edit functions, and reports for an observation.

Users can submit new observation requests, navigate the performance analysis reports those requests generate, and to display/provide functions to multiple components of APA at once. It also provides a Started Tasks *(all STCs list)* view, an Observations List view *(giving observation details)*, a Reports List View *(listing all an observation's reports)*, and an individual Report View.

V13.1 release improvements were numerous, and included:

- **Enhanced currency/compatibility:** Now supports Enterprise COBOL V5, CICS® TS V5.1, DB2® V11, IMS™ V13, z/OS® V2.1, & Adabas V8.2.4.
- **Started tasks, sampling, exits, & intercepts enhancements:** Recognizes LE mode switch for CPU attribution; shows SMS classes for APA-created files; repeat observations of batch jobs supported; automatically measures WAS® servant regions and reports Java and DB2® activity; now preloads JVMTI agent; CICS+ recognizes CICS® filtering criteria; DB2® V10 compressed records supported in IEFU84 SMF exit program; DB2® V10 bind option for DB2® Explain supported; can now clear APA exits when started task ends; allows dynamic change of select CONFIG settings; provides Export file name configuration setting; and allowing Export and Import of a hierarchy of sample files, with Import checking for duplicate sample file names.
- **Reporting capability enhancements:** Observation List now displays setup filters, allows sort by owner, and flags an ErrMsg when a non-critical error happens during sampling; JobID is now added to observation details pop-up; shows separate counts of general and special MPUs in the Measurement Profile report; can now attribute CPU usage to system modules in CPU Referred Attribution report; now provides report statistics for multi-volume datasets in the DASD I/O Analysis report; now identifies CICS® remote files in DASD EXCP Summary report; new WebSphere® report shows CICS® distributed program link calls initiated from servant regions; new WebSphere® report correlates WAS® activity with DB2® activity; can now create XML report files as variable block by default; and finally supports SYSDEBUG source files created by Enterprise PL/I for z/OS® V4.
- **Enhancements to the listener and plug-in:** Offers a dialog replacing report options view; adds report options & report download to each reports toolbar; shows procedure names in CPU Usage by Procedure report; lets user select local reports repository location; allows local reports access for inactive started tasks; and can now connect to APA instances on different z/OS® systems.

These are an extensive, fine-grained, and valuable set of further improvements delivered again in APA V13.1, strengthening IBM's effective z/OS® APM solution.

These are an extensive, fine-grained, and valuable set of further improvements delivered again in APA V13.1, strengthening IBM's effective z/OS® APM solution.

- **IBM® Debug Tool *(DT)* for z/OS® V13.1:** Advanced, high-function, **unified IBM suite interactive source-level debugging tool** examines, monitors, and controls the execution of, z/OS® complied applications written in COBOL, PL/I, C, and C++ consistently, and also seamlessly handles mixed language composite applications within one session. This single, comprehensive debugging engine and interface product **debugs compiled applications** running in System z™ **z/OS® batch, Time Sharing Option *(TSO)*, ISPF®, CICS®, IMS™, DB2®, DB2® Stored Procedures, UNIX® System Services**, and **WebSphere® Application Server**, runtime environments. It provides a robust, simple-to-use, set of tools, and utilities, to compile, test, and debug all the above mainframe applications.

  This sophisticated source-level program debugger provides **multiple conditional** and **unconditional breakpoints** in application programs, **offers step-mode debugging**, can **monitor and update variables** and **storage**, and can watch for specified program execution exceptions. The set of **interpreted commands** provided *(for each programming language)* allow developers to specify the breakpoint actions that are to be taken *(and are themselves subsets of their language)*.

  The IBM® Debug Tool for z/OS® gives developers a **choice of debugging interface** to suit their preferences, either DT's classic ISPF/3270 4-window *(Monitor, Source, Log, & Memory)* interactive host full-screen interface, or the Eclipse-based **IBM® PD Tools Studio** GUI suite workbench interface detailed below *(or other IBM z/OS® workbench options also noted below)*.

  The enhanced Debug Tool V13.1 enables seamless debugging of **Java™ applications** and **interconnected legacy applications** from PD Tools Studio. This feature enables debugging of legacy applications as well as Java™ applications from the common Eclipse debug perspective, along with other debugging session developers may require on distributed platforms.

  DT offers a flexible choice on how to display monitored variables, and also allows direct updates of large or small variable in the Monitor window. It also includes **interactive debugging capabilities** such as "auto-monitor" support

for COBOL, PL/I, and Assembler programs, **interactive "Playback" support** for all programs; **programmable command scripts** for background execution; and object-level "disassembly" debug support. Support for terminal and background CICS® and IMS™ DC transactions is also offered. **Command logging** of the DT session, and **dynamic program source logic patching**, are both also supported. Statement frequencies counting, and the ability to log and re-run command scripts, are other features.

A **Load Module Analyzer Utility** identifies and report on which versions of IBM z/OS® language compilers or assemblers – PL/I, COBOL, C/C++, PLX, assembler, and others – were used to generate the object for each Control SECTions *(CSECTs)* in a load module, gives their compile dates, and reports CSECTs sizes and offsets. It provides extensive load module information to support COBOL and PL/I compiler upgrades, and Language Environment *(LE)* runtime migrations. The utility can run interactively from ISPF® panels, or be submitted to run in batch. Configurable report options, including utility report features to filter compiler versions reported, filter CSECTs that are part of the LE runtime, to filter CSECTs that are part of the compiler, and to provide flexible analysis.

The DT **COBOL Modernization Utility** aids consistent conversion from OS/VS COBOL, COBOL II, COBOL for VM & MVS, OS/390® COBOL, z/OS® COBOL, to Enterprise COBOL. The utility converts COBOL 68 and 74 to equivalents in the target language *(via ANSI 85 COBOL)*, generating converted COBOL program source and COBOL copybook files. It identifies, reports on, sizes, and upgrades all older COBOL source programs, thus enabling migration to the modern compiler & CICS® TS version, pinpointing source COBOL elements and CICS® commands unsupported *(or differently supported)* in the target language.

The **Code Coverage Utility** for z/OS® measures test coverage in applications programs written in COBOL, PL/I, C/C++, and Assembler, languages, compiled with certain IBM® COBOL, PL/I, and C/C++ compilers, or assembled by the High Level Assembler or Assembler H.

This efficient, low-overhead Utility monitors running test programs, and reports statement coverage, frequency, and branch execution...

This efficient, low-overhead Utility monitors running test programs, and reports statement coverage, frequency, and branch execution, and thus supports regression and unit testing, plus enables Sarbanes-Oxley compliance. It supports all z/OS® runtimes – including applications in CICS®, TSO, JES/Batch, IMS™ including IMS™/DC, and DB2® including DB2® Stored Procedures – accumulating coverage statistics across multiple executions by any number of testers. The utility uses an ISPF-panel driven interface, requires no updates to the test case runtimes, provides browser HTML reports for Enterprise COBOL for z/OS® coverage, and can generate XML output for further coverage analysis.

IBM Debug Tool for z/OS® is directly integrated on the host with **IBM Fault Analyzer for z/OS®** *(producing a formatted dump and supporting that product's side files)*, can directly invoke **IBM File Manager for z/OS®** *(for file and data management tasks while debugging)*, and is directly integrated with **IBM® Application Performance Analyzer for z/OS®** *(reviewed above)*.

The tool is closely-integrated with the **IBM® Problem Determination Tools Studio**, the suite's comprehensive Eclipse-based GUI workbench and integration point *(see Section 3 and Figures 8 & 9)*, through the **IBM® Debug Tool for z/OS® Plug-In for Eclipse** provided inclusive to DT licensees. Integration with the flagship **IBM® RDz™** enables GUI-based debugging of host applications within this integrated mainframe application development, debug and test workbench combined environment.

This DT Plug-in **enables GUI-based debugging of host z/OS® load modules** running in MVS, CICS®, DB2®, IMS™, etc., with similar debug capabilities as those under ISPF above. The Plug-in GUI lets developers set and clear breakpoints at specific lines and for an error or warning-level error based on LE severities. It also allows execution to run to a breakpoint, step into or step over a procedure, view/change variable values whilst stepping through code in a larger storage area context, and to view the call stack.

IBM® Debug Tool for z/OS® V13.1 offers currency/compatibility with latest IBM host software releases, including Enterprise COBOL for z/OS® V5.1; Enterprise PL/I for z/OS® V4.4, CICS® TS V5.1, DB2® V11, IMS™ V13, z/OS® V2.1, and C/C++ V2.1. Other V13.1 advances include:

- New code coverage mode for Enterprise COBOL and Enterprise PLI applications *(compiled with TEST compile option and sub-option SEPARATE)* for the generation, viewing, and reporting of code coverage using DT mainframe interface *(MFI)* as the engine, via 3 new commands.
- New command in DT MFI mode enables breakpoints, current line, and the line with found text, to be identified with a character indicator, improving ease-of-use. DT now supports JCL for Batch Debugging in the DTSP plug-in, used to instrument JCL to initiate a debug session from the DTSP plug-in.

IBM PD Tools for z/OS® Suite – Rapid Development Trajectory/Momentum – To May 1st 2014														
PDT Product Name *(Today)*	**2000**	**2001**	**2002**	**2003**	**2004GA**	**2005GA**	**2006GA**	**2007GA**	**2008GA**	**2009GA**	**2010GA**	**2011GA**	**2012GA**	**2013GA**
IBM PD Tools *(PDT)* for z/OS Suite Product Releases − 2000 to 2014														
IBM® Application Performance Analyzer for z/OS® [1]	–	–	–	–	–	V1.R1 06.14.05	V7.R1 09.29.06	V8.R1 09.28.07	V9.R1 09.26.08	V10.R1 11.06.09	V11.R1 11.05.10	V11.R1 11.05.10	V12.R1 05.11.12	V13.R1 10.18.13
IBM® Debug Tool for z/OS®	V1.R1	V1.R3 11.27.01	V3.R1 8.20.02	V4.R1 9.16.03	V5.R1 9.21.04	V6.R1 09.13.05	V7.R1 09.29.06	V8.R1 09.28.07	V9.R1 09.26.08	V10.R1 11.06.09	V11.R1 11.05.10	V11.R1 11.05.10	V12.R1 05.11.12	V13.R1 10.18.13
IBM® Fault Analyzer for z/OS®	V1.R3 8.01.00	V2.R1 5.29.01	V3.R1 8.20.02	V4.R1 9.16.03	V5.R1 9.21.04	V6.R1 09.13.05	V7.R1 09.29.06	V8.R1 09.28.07	V9.R1 09.26.08	V10.R1 11.06.09	V11.R1 11.05.10	V11.R1 11.05.10	V12.R1 05.11.12	V13.R1 10.18.13
IBM® File Export for z/OS® [3]	–	–	–	–	V1.R1 11.30.04	V1.R1 11.30.04	V1.R2 09.06	V2.R1 12.07	–	–	–	–	–	–
IBM® File Manager for z/OS®	V1.R1 12.00	V2.R1 5.29.01	V3.R1 8.20.02	V4.R1 9.16.03	V5.R1 9.21.04	V6.R1 09.13.05	V7.R1 09.29.06	V8.R1 09.28.07	V9.R1 09.26.08	V10.R1 11.06.09	V11.R1 11.05.10	V11.R1 11.05.10	V12.R1 05.11.12	V13.R1 10.18.13
IBM® HourGlass [5]	–	–	–	–	–	–	–	–	V5.R2 3.07.08	V6.R1 02.13.09	V6.R1 02.13.09	V6.R1 02.13.09	V6.R1 02.13.09	V7.R1 12.06.13
IBM® Data Set Commander for z/OS® [6]	–	–	–	–	–	–	–	V5.R9 03.23.07	V5.R10 03.07.08	V6.R1 02.13.09	V6.R1 02.13.09	V6.R1 02.13.09	V6.R1 02.13.09	V8.R1 12.06.13
IBM® Migration Utility for z/OS® [7]	–	–	V1.R1 4.19.02	V1.R1 4.19.02	V2.R1 4.30.04	V2.R1 4.30.04	V3.R1 2.24.06	V3.R1 2.24.06	V3.R1 2.24.06	V3.R2 27.24.09	V3.R2 27.24.09	V3.R2 27.24.09	V4.R1 10.12.12	V4.R1 10.12.12
IBM® InfoSphere™ Optim™ Test Data Management [2]	–	–	–	–	–	–	–	V5.R5.1 9.07	V5.R5.2 02.19.08	V6.R1 11.14.08 V6.R1.1 11.14.08	V6.R1.1 11.14.08	V7.R1 02.25.11	V7.R1 02.25.11	V7.R2 05.24.13
IBM® Problem Determination Tools Studio *(PD Studio)*	–	–	–	–	–	–	–	–	–	–	–	–	V12.R1 08.31.12	V13.R1 10.18.13
IBM® Workload Simulator for z/OS® and OS/390®	–	–	–	V1.R1 9.24.02	V1.R1 08.16.02	V1.R1 08.16.02	V1.R1 08.16.02	V1.R1 08.16.02	V1.R1 08.16.02	V1.R1 08.16.02	V1.R1 08.16.02	V1.R1 08.16.02	V1.R1 08.16.02	V1.R1 08.16.02
Other IBM® z/OS®-focused Eclipse Workbenches Supporting IBM® PD Tool Plug-ins *(for APA, FA, DT, FM, & WS)*														
IBM® CICS® Explorer	–	–	–	–	–	–	–	–	–	V1.R0 06.06.09	V1.R0.1 11.05.10	V1.R1 06.24.11	V5.R1 12.14.12	V5.R1.1 06.14.13
IBM® Rational Developer for System z™ *(+Forerunners.)*	–	–	–	V5.0 02.28.03	V5.1.1 4.23.04	V6.0.1 11.22.05	V7.R0 12.15.06	V7.R1 09.27.07	V7.R5 10.31.08	V7.R6 10.08.09	V8.R0 12.03.10	V8.R0 12.03.10	V8.R5 06.15.12	V9.R0 06.13.13
IBM® IMS Enterprise Suite Explorer for Development	–	–	–	–	–	–	–	–	–	–	V1.R1 11.06.09	V2.R1 10.28.11	V2.R2 10.26.12	V3.R1 10.25.13

- IBM® PD Tools for z/OS® suite now comprises 10 current products at our May 1st 2014 review date.
- Latest PD Tools for z/OS® V13.1 versions of core suite products − APA, DT, FA, & FM − shipped GA October 18th, 2013, soon after z/OS® V2.1
- New *(12.06.2013)* IBM® PD Tools for z/OS® suite Solution Packs offer inclusive, value priced bundles *(a)* of 7 suite products, *(b)* suite testing products only *(DT, WS, HourGlass, & PD Studio)*.
- IBM® CICS® Explorer & RDz™, & IBM® IMS Enterprise Suite Explorer for Development Eclipse workbenches, are not IBM® PD Tools for z/OS® suite members, but are each closely integrated with IBM® PD Tools for z/OS® suite tools APA, DT, FA, FM, & WS via the provided Eclipse plug-ins for each of those suite tools.
- Current PD Tools for z/OS® suite, & forerunners above, had 74 releases 2000-2013, 7.4 releases/current product, 5.3 new releases/year average over 14 years. *(Excluding CICS® Explorer, IBM® RDz™, IBM® IMS™ Explorer workbenches)*.
- 2000-2003 dates above are announcement dates. 2004-2013 dates – in columns marked GA – are general availability dates.

[1] = Replaced previous IBM® Application Monitor for z/OS® from 2005.
[2] = Renamed, was previously "IBM® InfoSphere™ Optim™ Data Move for DB2®".
[3] = IBM® File Export for z/OS® replaced Sept 2007 by IBM® InfoSphere™ Optim™ Data Move for DB2® from IBM's Princeton Softech buy.
[5] = Also added to IBM® PD Tools for z/OS® suite with IBM's Princeton Softech acquisition of 09.13.2007.
[6] = Added to IBM® PD Tools for z/OS® suite with IBM's Isogon Corporation acquisition of 07.27.2005. Previously called IBM® ISPF Productivity Facility for z/OS®.
[7] = Included as a IBM® PD Tools for z/OS® suite product from our 4th Edition *(2011)* on – longstanding IBM utility.

Figure B1: IBM® PD Tools for z/OS® Suite − Rapid Development Trajectory/Momentum – To May 1st 2014

DT now provides automatic start of IMS™ message processing program *(MPP)* regions and dynamic routing of transactions, so a developer can now dynamically start an MPP region, route a transaction to that MPP region, then shut down that MPP region at the end of the transaction, reducing system resources. Support is also added for an IMS™ transaction that is associated with a generic ID, via a new feature in the consolidated LE user exit *(EQAD3CXT)*, which enables DT to debug IMS™ transactions that started from the web and that use a generic ID. DT now also adds IMS™ information to start and stop messages generated by the EQAOPTS STARTSTOPMSG command. Other advances include:

- Three new commands in DT MFI the developer to request tracing of the load modules loaded by an application; the commands, with self-evident use, are TRACE LOAD START, LIST TRACE LOAD, and TRACE LOAD END.
- Can now terminate idle DT sessions which are using either the Terminal Interface Manager, or a dedicated terminal, via a new time-out command option that sets a maximum session wait-time; after which, where no user interactions occurred, the session is terminated.
- The DT Coverage Utility 'Create HTML Targeted Coverage Report' was enhanced so a user can select COBOL Program-Ids from a list, ignore changes to non-executable code, and produce a summary of targeted lines with selectable HTML links.
- Adds new command *(and new DT Utilities option)* to collect and view DT debugger session start and stop information.
- A confirmation message is added to DT Utilities option 6 *('Debug Tool User Exit Data Set')* to show updates were saved into the EQAUOPTS data set.
- The ON and AT OCCURRENCE commands are enhanced for Enterprise PL/I to support qualifying data.
- Two new commands display and remove LDD commands known to DT Tool, and two others tell DT Tool debugger to gather and display code coverage data.
- Enhanced delay debug mode with a new EQAOPTS DLAYDBGCND command to control CONDITION trapping. In addition, a new EQAOPTS DLAYDBGXRF command is added so that delay debug mode can use the 'IMS Transaction and User ID Cross Reference Table'. Further, NOTEST is now handled in delay debug mode.
- Two new EQAOPTS commands are added for remote debug mode. One specifies the host port number *(or range of host port numbers)* to use on the host for a TCP/IP connection to the workstation in remote debug mode. Another provides a data set name for TCPIP.DATA *(via the SYSTCPD DD NAME)* when no GLOBALTCPIPDATA statement is configured.
- A timestamp is added to TIM EQAY999* messages TIM issues if the +T trace flag is on.
- DT now allows for GOTO or JUMPTO for programs compiled with Enterprise COBOL TEST compile option when SET WARNING setting is OFF, and the OPT and the NOEJPD sub option are set.
- An updated DTST transaction now writes messages to operator log when a user changes storage, to provide an audit trail of DTST storage changes.
- Support is added for remote Playback through the Playback Toolbar in the Debug View.

- **IBM® Fault Analyzer *(FA)* for z/OS® V13.1:** This cornerstone IBM® PD Tools for z/OS® Suite product helps developers analyze and rapidly fix application and system failure abnormal endings *(abends)*, both during the application development/test process, and throughout their production lives. When an application program abends, FA helps developers rapidly identify the cause, gathering and analyzing all needed information about that application – and its environment – at the moment the abend occurred, and producing a detailed abend report. This gathered information includes a view of storage contents, trace tables, and terminal screen images at the moment of failure.

  The tool starts automatically whenever an application fails, providing **real-time fault analysis**, and recording failure details in its fault history file. This means the FA tool uses zero processing resources when the application is operating normally. No program recompiles, or JCL changes, are needed.

  FA's comprehensive fault analysis engine provides analysis reports on the problem at application source code level – with easy-to-understand failure error messages and codes – so that low-level dumps/system-level messages need not be painfully decoded, speeding resolution and saving much effort. The tool also provides **"after-the-fact" batch re-analysis** of failure events recorded in its fault history file, providing accurate information on failure causes, as well as providing help on best problem resolutions. FA creates a fault history file *(extended partitioned data set)*, containing information about all the faults analyzed – with an interactive display – enabling developers to track and manage application failures. It also supports an alternative **interactive re-analysis** of fault history file-recorded faults, giving further deeper guidance, in an easy-to-use interactive ISPF analysis mode under TSO.

FA offers enhanced support for analyzing abends in **legacy programs and Java™ workloads** in batch, IMS™ and CICS®, making FA a **"must-have" PD tool** for newer-generation host application developers – because it facilitates **quicker, more effective analysis** of abending applications on z/OS® for them. Some highly-experienced host developers – if proficient in reading/interpreting mainframe dumps themselves – sometimes *(we say wrongly)* consider such abend analysis tools less useful for them. However, this analyst considers powerful abend analysis tools *(such as FA)* are even more important today, and will be still more widely used in future, because of the big-increases in Java™ workloads seen on z/OS® over recent years. These Java™ workloads are more complex, as well as less familiar – even to experienced mainframe developers – who thus now also benefit greatly from unparalleled support for analyzing abends in Java™ workload IBM® Fault Analyzer for z/OS® provides – and which IBM's competitors do not offer today.

Customers can add/incorporate application-specific messages and codes, to supplement those supplied as standard by IBM. FA includes softcopy versions of selected IBM z/OS® Online Library manuals and extracts messages and failure-code descriptions from these manual before inserting the applicable ones into the fault analysis reports, saving much time researching message and failure explanation. FA also allows flexibility to set criteria to exclude specified jobs from problem determination. FA provides additional flexibility by support for user-written exits coded in several languages *(Assembler, C, COBOL, PL/I or REXX)* for many purposed. *(E.g. to override FA options; access compiler listings; notify specific staff about a system failure; and to add a user section in the analysis report, etc.)*

Users may produce a side file, available from several key sources, which identifies the failure source statement *(using less DASD space than usual compiler listings)*. If kept, side files can be used to produce a readable listing file from them. Without a side file, FA uses the compiler listing.

...supporting almost every type of fault analysis over all main System z™ subsystems, and for all host languages, within this single, comprehensive product.

IBM® Fault Analyzer for z/OS® provides inclusive coverage of applications running on all major z/OS® and OS/390® runtime environments – CICS®, IMS™, DB2®, UNIX® System Services, z/OS® JES/batch, and WebSphere® MQ. Applications written in COBOL, PL/I, Assembler, C/C++, Language Environment, Java™, and in WebSphere® MQ, are all supported. With this comprehensive coverage of all modern/traditional host applications, IBM® Fault Analyzer for z/OS® now provides broad capabilities supporting almost every type of fault analysis over all main System z™ subsystems, and for all host languages, within this single, comprehensive product.

At the heart of IBM® Fault Analyzer for z/OS® is its comprehensive fault analysis engine.

At the heart of IBM® Fault Analyzer for z/OS® is its **comprehensive fault analysis** engine. This was built from the collective mainframe applications debugging experience *(acquired over decades)* of many leading IBM software architects, developers and testers. This engine provides the automatic analysis when the application fails, application-initiated analysis for the program Sub-Network Access Protocol *(SNAP)* interface, and user-initiated fault re-analysis.

FA is directly host-integrated with **IBM® Application Performance Analyzer for z/OS®**, **IBM® File Manager for z/OS®**, and **IBM® Debug Tool for z/OS®**. FA is also closely-integrated with the **IBM® Problem Determination Tools Studio**, the suite's comprehensive Eclipse-based GUI workbench and integration point *(see Section 3 and Figures 8 & 9)*, through the **IBM® Fault Analyzer for z/OS® Plug-In for Eclipse** provided inclusive to FA licensees.

This FA Plug-in enables: problem report access to diagnose host application errors and abends; this Plug-in GUI manages views and multiple fault history files; it can browse fault entries created in the real-time analysis of abending programs; it enables browsing of dump storage from a fault entry; and its shows source listing of abending programs using side files.

The most recent **IBM Fault Analyzer for z/OS® V13.1** release added a great many enhancements. These were: adding currency support for Enterprise COBOL V5.1, CICS® TS V5.1, IMS™ V13, and DB2® V11; more consistent mismatch side file reporting now gives precise details on which tests passed and failed; selective side file processing lets users list programs *(including a generic suffix)*, to be skipped/excluded; and new exit enables automatic forced use of a side file where the only failing side file test is last 12 instructions check. Other enhancements include: better storage use where one Fault Entry is picked for interactive reanalysis from ISPF Fault Entry display; the FA web interface is redesigned, with similar look, feel, and functionality, as in the FA Eclipse plug-in; user-written abend codes and module descriptions can now be automatically included in FA reports; the MATCH command has new TODAY keyword for easier management of fault entries; a new CICS®

trace entries exclude option added to existing include option; a new SHOWFREE command lets users see FA's TSO/ISPF storage usage; improved, more consistent sharing of history file data sets across LPARs is added; FA now allows transaction abend analysis on CICS® OPEN TCBs; side file processing is enhanced to use DWARF information from IBM Enterprise COBOL V5.1 compiler; the analysis of abends, which include Java™, is improved; a new ISPF option consolidates three prior ones; and updated/expanded LOOKUP messages now include JES2 and JES3 messages. New utility for bulk program and side file matching helps find programs without a matching side file, so needing a recompile to create one. Finally, in CICS® transaction abend analysis, extra data is now gathered on concurrent CICS® tasks and storage allocations, to aid storage overlay analysis.

...broad set of improvements to this comprehensive repository of IBM's encapsulated mainframe fault analysis expertise and experience...

This was a broad set of improvements to this comprehensive repository of IBM's encapsulated mainframe fault analysis expertise and experience, further extending its ease of use, flexibility, and configurability in numerous areas. FA's integration with **Rational® Developer for System z™ V9.0 via the FA Plug-in above** enables host developers working in IBM's flagship mainframe IDE to diagnose application problems without changing UI.

- **IBM® File Manager *(FM)* for z/OS® V13.1:** Comprehensive, flexible, easy-to-use **file and data management tool** for working with z/OS® data sets, DB2®, IMS™, CICS®, and WebSphere® MQ data, gives mainframe developers facilities to display and browse, edit, update, create, copy, compare, print, or erase, data files in all popular z/OS® file formats quickly and easily. This unified, broad file/data management tool provides comprehensive, user-friendly ISPF-like facilities *(that extend the familiar IBM® ISPF for z/OS® browse/find, edit, copy, batch, and print utilities)* enhanced for application developers working with structured host files, speeding up their projects with quicker and easier working with z/OS® data sets. It thus offers extensive editing, browsing and batch and interactive capabilities that support all DevOps development and production processes.

  FM supports VSAM, QSAM *(Queued Sequential Access Method)*, PDS, IAM *(Innovation Access Method)*, UNIX® System Services *(USS)* HFS *(Hierarchical File System)*, DB2® data, IMS™ data, CICS® data, and WebSphere® MQ queues. IBM® File Manager for z/OS® is delivered as one product with four included parts – the **File Manager Base**, **DB2®** *(utilities for editing, browsing, printing, copying, & maintaining DB2® data)*, **IMS™** *(manages & manipulates IMS™ database stored data)*, and **CICS®** components. For example, the latter allows FM to run inside CICS® itself, giving access to CICS® data resources – VSAM files, temporary storage queues, and transient data queues – through the user-friendly, ISPF-like FM interface.

  With FM, developers can efficiently manipulate data using COBOL and PL/I record layouts *(from copybooks stored in PDS or library management systems)* interactively or in batch. It enhances usability by allowing customization of the fields to display, copy or print. FM also supports **templates**, each defining and saving one logical view developers can use to view and manipulate data in records as discrete fields, enabling particular interpretations of a data set. FM templates can be generated from existing COBOL copybooks PL/I DECLARE statements or HLASM defined data. Record-selection criteria can also be added to a template, extending versatility.

Such extensive support for... all base z/OS® file types, and DB2®, IMS™, CICS®, and WMQ® data, inclusively in one comprehensive product, is a major IBM® File Manager for z/OS® strength.

Such extensive support for editing, browsing, printing, copying, and maintaining all base z/OS® file types, and DB2®, IMS™, CICS®, and WMQ® data, inclusively in one comprehensive product, is a major IBM® File Manager for z/OS® strength. The tools not only support all host application development, but also production support-related, DevOps roles.

Host **IBM® File Manager for z/OS® V13.1** is directly integrated with the suite's **IBM® Debug Tool for z/OS® V13.1**, with **IBM® Fault Analyzer for z/OS® V13.1**, and with **IBM®Application Performance Analyzer for z/OS® V13.1**, mainframe products. FM is also closely-integrated with the **IBM® Problem Determination Tools Studio**, the suite's comprehensive Eclipse-based GUI workbench and integration point *(see Section 3 and Figures 8 & 9)*, through the **IBM® File Manager for z/OS® Plug-In for Eclipse** provided inclusive to FM licensees.

This FM Plug-in provides: GUI tools to manipulate & browse z/OS® data resources including data sets, USS files, & WMQ® queues; GUI facilities to create, modify, & update, File Manager templates from COBOL, PL/I & HLASM copybooks directly; or to create dynamic templates on-the-fly where no copybook is available; it also supports FM editor data manipulation & browsing *(e.g. formatted/table display using a template)*, character display *(text-based data presentation)*, and single display using template *(focused on display fields defined in a record)*; and can also allocate, compare, & copy z/OS® data sets, as well as create data File Manager utility functions.

New in **IBM® File Manager for z/OS® V13.1** are: added currency support for DB2® V11, IMS™ V13, and Enterprise COBOL V5.1; new ability to create File Manager templates in XML format; can now specify character encoding *(CCSID)* of text fields in a template; can now map SMF record types; the File Manager Plug-in above was enhanced to work with IMS™ databases; IMS™ extract and print utility functions were enhanced with performance gains and extra parameters; now supports DB2® LOB columns, including XML type; FM DB2 export utility function now accepts user-specified SELECT statement; new DB2® installation options to control uncommitted read added.

These V13.1 current release enhancements were **another solid set of useful advances** in this all-inclusive, broadly capable, and easy-to-use file and data management IBM® PD Tools for z/OS® Suite cornerstone tool. The Eclipse GUI IMS™ support above means the FM GUI Plug-in now supports the complete host data sources set of standard z/OS® files *(base)*, DB2® and IMS™. FM can interpret data in EBCDIC and Unicode *(and other encodings too)*. New CCISD support – of great importance for new Java™/mobile workloads – enables FM to translate/convert data from one CCSID to another during copy operations *(e.g. converting EBCDIC data to UNICODE data stored in a VSAM file)*.

IBM® HourGlass is the most widely-used System z™ z/OS® date and time simulation tool...

- **IBM® HourGlass V7.1: Time-dimensional testing** is vital to ensuring reliable enterprise applications – and most mission-critical enterprise applications are sensitive to date and time processing. In banking, financial, healthcare, inventory, insurance, utility, retail, government, and transportation sectors, all host online transaction processing applications thus demand 100% accurate time and date handling, the impacts of any failings usually serious. IBM® HourGlass is the **most widely-used System z™ z/OS® date and time simulation tool**, well-proven over many years. It helps developers to ensure mainframe applications perform correctly via **virtual date and time testing**. IBM® HourGlass can thus simulate past, present, or future dates and times, with no application code or computing environment changes needed.

  IBM® HourGlass allows applications dependent on **timing, time zones, or time and date formatting**, to be thoroughly pre-tested by time simulation, without changing application code, or the actual System z™ machine date/time settings, and without re-IPLing the CPU or LPAR, on the production machine. The tool also identifies applications requesting system date and/or time, **pinpointing possible time/date issues** for advance resolution before real problems occur.

Product features/flexibility ensures easy, accurate, reliable, and comprehensive application **time-dimensional testing**. The tool can coordinate full functionality for reporting and data transfers across time zones, shifting online region time zones whilst showing users' local time, so dated application file updates have local time. IBM® HourGlass **supports common host languages** *(including IBM LE)*, environments *(CICS®, IMS™, etc.)*, can handle **all 64-bit MVS clock formats** *(including decimal, binary, timer units, microseconds and Time of Dispatch (TOD))*, and also supports requests for dates. IBM® HourGlass' flexibility lets users limit where the tool alters returned date/time information, by patterns or to specific applications, transactions, users, and address space names. IBM® HourGlass enables testing at **end-of-period, week, month, quarter, or year-end**, processing as well as testing across midnight, or over any **other critical time period**. IBM® HourGlass can handle SVC 11 system time requests, PC Time system service, and MVS™ STCKSYNC system service time requests on z/OS®.

With IBM® HourGlass, many developers can run tests simultaneously, each with different system dates...

With IBM® HourGlass, many developers can run tests simultaneously, each with different system dates, whilst the product maintains each user's system date view without affecting the other users. In addition, IBM® HourGlass adds **almost no extra system load**, either for applications running the tool, or for other programs using normal system time.

The tool is accessed and used via its **simple, online ISPF interface**, the **HourGlass Control Center** *(HGCX)*, via which developers can specify testing on specific application jobs, or create "wildcard" testing scenarios over groups of programs. This interface, plus **comprehensive online help**, makes IBM® HourGlass intuitive and easy-to-use, so minimal developer training is needed. The **HourGlass Repository** permanently saves/manages unlimited date & time settings for all environments *(including MVS™ Batch/STC, TSO/ISPF, IMS™ Online, and DB2® Batch, SPUFI, & DDF)*. The product also offers **needed security/integrity features**, including authentication, and group and class usage restrictions, to minimize time/date setting error risks.

New features with the IBM HourGlass V7.1 release are:

- Support for CICS® Transaction Server V5.1 included in release V7.1.
- New option to set HourGlass date-time for a CICS® region using the HourGlass CICS® Batch Time Management process.

- Validation of user date/time specifications input via JCL added.
- New and improved HourGlass messages, enhancing usability and control.
- Can now dynamically refresh the HourGlass active control element set to match current state of control elements held in the HourGlass Repository.
- Administer job schedule control elements using the HGCX interface or a batch program, with updates coordinated to maintain data integrity.
- Can now create and maintain IMS™ time settings from an IMS™ application using HGCX for IMS™.
- Support for job schedule control elements with DB2® time requests.

IBM® HourGlass is the most widely used clock simulator for date/time testing of host applications in the flagship z/OS® mainframe environment. *(IBM® HourGlass has been a member of the IBM PD Tools for z/OS® Suite since IBM's 09.2007 Princeton Softech acquisition.)*

- **IBM® Data Set Commander *(DSC)* for z/OS® V8.1:** This suite tool extends interactive and batch capabilities for performing operations on **partitioned data sets** *(PDSs)* and **partitioned data set extended** *(PDSEs)* and their members, and was previously called IBM ISPF Productivity Tool for z/OS®. The tool provides a more productive, better-integrated interface to Interactive System Productivity Facility *(ISPF)*, the standard System z™ editor, for all types of host user. Mainframe developers, system programmers, technical support, operations and production control personnel, all benefit from the **faster navigation via far fewer panels** that DSC provides, and require no training. It offers **simple "dashboard" panel access** to all the user's data sets, and allows them to invoke virtually any function needed, from their single dashboard panel, cutting out frequent panel switches so saving time and speeding projects. DSC offers **more extensive, faster, and more intuitive search facilities** than ISPF, including searches for volumes, data sets, members, and text within members, plus automatic drill-down system navigation to pinpoint volumes, data sets and members. It also includes automatic PDS compression and directory expansion.

  DSC also offers **intuitive command shortcuts** to more quickly invoke most of its functions from the panel display, but which can be user renamed or disabled if needed. DSC integrates, adds new, and improves on the existing capabilities of, the standard ISPF Browse, Edit, View and DSLIST *(Dataset List)* functions, so they perform more intelligently. It adds an **object browser OLIST** *(Object List)* that can reference many object classes in one list, for editing, viewing, or browsing by a single command from one screen. The tool provides automated, integrated ISPF-style change access to a wider range of key host resources, including VSAM files, z/OS® UNIX® System Services files, IBM DB2® tables, Hierarchical File System *(HFS)* files, PC files, catalog levels, and other object classes. It also **supports files held in source-code library systems**, like IBM SCLM, CA-Librarian and CA-Panvalet, bringing DSC extended functions to source code management. An expanded TSO commands handling option, and helpful action prompting upon cursor selection, are both also included.

  This product runs "above the line", and is Link Pack Area *(LPA)* resident for enhanced performance and storage utilization efficiency, allowing it to handle many more and much larger directories reliably.

  IBM® Data Set Commander for z/OS® V8.1 improvements include: a batch utility component fully replacing IEBCOPY offering greatly enhanced PDS and PDSE manipulation functions; a new Library Lookaside *(LLA)* monitor component for automating cache synchronization for updated LLA-managed PDS and PDSE members directory entries across a Sysplex cluster; support for z/OS® V2.1 PDSE member generations; new command shortcuts; and an interactive component providing a menu-driven front end to ISPF.

...IBM® Data Set Commander for z/OS® V8.1 boosts productivity of all experience levels of mainframe user...

With these further enhanced capabilities, IBM® Data Set Commander for z/OS® V8.1 boosts productivity of all experience levels of mainframe user – from host novices to the most experienced ISPF user – offering substantial time-saving and productivity advantages. *(DSC joined the IBM® PD Tools for z/OS® Suite on IBM's 2005 acquisition of Isogon Corporation, and has been heavily enhanced since. Previously sold as Isogon SPIFFY). (May 2005 – IBM.)*

- **IBM® Migration Utility *(MU)* for z/OS® V4.1:** This IBM suite tool generates **IBM COBOL applications** from **CA Easytrieve® Classic and Plus** programs, preserving those user code investments whilst easing **smooth migration** off Easytrieve® products from CA Technologies. MU allows the converted CA Easytrieve® programs to be run/enhanced/maintained as either COBOL, or as CA Easytrieve®, programs without needing either the CA Easytrieve® or CA Easytrieve® Plus licensed products installed, because source code is maintained in the original library. Developers can generate IBM COBOL reports from CA Easytrieve® projects, or continue to update existing, or create new CA Easytrieve® applications. MU effectively performs **like a replacement compiler** for CA Easytrieve® and CA Easytrieve® Plus programs, while adding additional capabilities.

MU delivers more efficient COBOL I/O handling and memory management... giving improved performance.

MU also delivers more efficient COBOL I/O handling and memory management, and COBOL sorting and searching, giving **improved performance**. The **enhanced Dynamic SQL options** also improve performance as well as reducing CPU and memory usage. A **batch-convert utility** automatically converts, and another parallel tests, CA Easytrieve® programs more efficiently. Another MU tool utility **analyzes program abends**, pinpointing the failing original Easytrieve® code for correction. By converting such Easytrieve® language programs into COBOL, their otherwise inaccessible business logic can now easily be reused in "SOA, etc." scenarios. With MU, the generated IBM COBOL programs can also be ported to any distributed platform *(with a supported COBOL)*. Other major tool features are:

- **Easy HTML reports creation:** New/existing CA Easytrieve® programs can easily create reports in HTML, including single-step creation of linked multi-level HTML "Drill Down" reports with intelligent navigation, with automatic z/OS® web server deployment.
- **Easy .CSV output creation:** New/existing CA Easytrieve® programs can easily and directly generate .CSV *(character separated values)* files for office applications.
- **Multiple file types support:** Host VSAM, QSAM, SAM, DB2® *(Native & CA Easytrieve® SQL syntax, and Dynamic SQL mode)*, IDMS, IMS™ *(DL1)*, tape files, and unit-record devices, all supported by this single tool.
- **Report Modernization Utility:** This converts mainframe printer files *(reports)* to HTML and CSV format files without changing the original program. A script language can optionally further customize/enhance output, e.g. fonts, colors, background, and adding/placing images and graphics.

IBM® Migration Utility for z/OS® V4.1 delivered enhancements and new functions that make migration easier and more efficient...

IBM® Migration Utility for z/OS® V4.1 delivered enhancements and new functions that make migration easier and more efficient, including: a new process to verify the user's system has been correctly tailored; adding a new **Discovery Utility** to locate jobs using linked Easytrieve® Plus programs; improving the Parallel Test Utility for improved process efficiency; further improving performance with arrays, reducing CPU and memory usage; extending MU coverage with CA Easytrieve® Plus V11.0 support; supporting IDMS – specifically its SUBSCHEMA, RECORD and RETRIEVE statements; and 20+ new macros added, replacing many oft-used CA PanAudit macros, improving its support.

IBM® InfoSphere™ Optim™ Test Data Management... quickly, easily identifies and migrates related subsets of DB2® application data, and other key host data sources into different environments...

- **IBM® InfoSphere™ Optim™ Test Data Management *(IOTDM)* V7.2:** This IBM® PD Tools for z/OS® Suite tool **streamlines the creation and management of test files and databases**, and speeds the exporting and importing of related sets of DB2®, IMS™, VSAM, or z/OS® sequential data, in this single, fast and easy-to-use tool. IBM® InfoSphere™ Optim™ Test Data Management for z/OS® quickly, easily identifies and migrates related subsets of DB2® application data, and other key host data sources *(above)* into different environments *(which can be test or migration targets)*.

  IOTDM offers simple **"point-and-shoot" data extraction**, with **optional selection criteria, data sampling, data partitioning**, and **data manipulation** facilities. The tool can extract all the data, or just a slice of data in a related set of database/file objects, with point-and-shoot simplicity. It also offers **intelligent masking** and **key propagation**, so developers can de-identify *(anonomize)* test data – whilst preserving DB2® referential integrity and application-defined relationships across multiple file and database types. IOTDM can support **one-to-one**, **one-to-many**, and **many-to-one** data creation, and is also able to alter/transform data content during the copy process, whilst maintaining application-defined relationships. The tool's **Optim Directory** also supplements DB2® catalog repository capabilities, **adding repository management services**, including maintaining data definitions, tracking request processing, and by storing database connection information and user-defined relationships. The flexible **Related Data Extract Facility** can extract data or object definitions from DB2® source tables using dynamic SQL or batch UNLOAD *(including DB2® Image Copies and High Performance Unload)*.

  The latest release of IBM® InfoSphere™ Optim™ Test Data Management for z/OS®, V 7.2 offers the following enhancements to the native support for z/OS® data sources from V7.1:

  - It raises the limit for native z/OS® archives and TDM *(Test Data Management)* extracts to 4B rows per table.

- Now includes toleration support for IMS™ V13.1 and for DB2® for z/OS® V11.
- More flexible relationships can now be defined between data sources *(user provides user-written relationship exit that transforms Optim-defined key columns of one table to and from corresponding key columns of the related table)*.
- In extract & archive processing, Optim now keeps an internal record of extracted keys. Lab and user tests showed key memory use reduced <40% when the keys are processed in ascending or descending order.
- Column map transformations, including data masking, can be done to all array elements in fixed-length arrays in z/OS® data sources.

IBM® InfoSphere™ Optim™ Test Data Management for z/OS® V 7.2 is an impressive member of the IBM® PD Tools for z/OS® suite...

IBM® InfoSphere™ Optim™ Test Data Management for z/OS® V 7.2 is an impressive member of the IBM® PD Tools for z/OS® suite, but is also a member of the IBM® InfoSphere™ Optim™ solutions family. *(IBM® InfoSphere™ Optim™ Test Data Management for z/OS®, came in from IBM's 09.2007 Princeton Softech acquisition.)*

- **IBM® Problem Determination Studio for z/OS® *(IBM® PD Studio)* V13.1:** This easy-to-use **Eclipse *(V4.2.2)* GUI workbench**, enhanced in the latest V13.1 release, is now a **core member** of the IBM® PD Tools for z/OS® Suite. **IBM® PD Studio** provides **IBM's premier GUI access and integration point** for primary users of the supported *(currently five)* IBM® PD Tools for z/OS® Suite host products who prefer to work via its **modern workstation GUI** rather than with the suite tool's traditional host 3270 "green-screen" ISPF interfaces. In Section 3, we overviewed the broad capabilities of this extensible workbench, and our Figure 8 *(on page 20)* showed how IBM® PD Studio provides workbench GUI access to **select services of five main host products** of the IBM® PD Tools for z/OS® Suite *(APA, DT, FA, FM, WS)*, via the **Eclipse plug-ins** now provided by IBM for each. Our Figure 9 on page 22 showed the specific host tool select services currently available through the IBM® PD Studio V13.1 workbench for the five enabled IBM® PD Tools for z/OS® V13.1 Suite releases. These we thus need not repeat here.

  IBM® PD Studio represented a **major advance for the IBM suite** since first released as V12.1 in October 2012. The IBM® PD Studio workbench itself, and the five Eclipse Plug-ins for APA, DT, FA, FM, WS above *(which come pre-installed with the main IBM® PD Studio V13.1 workbench Plug-in)* are all **available free of charge**, for download/installation for users at mainframe z/OS® sites licensed for *(their respective)* host IBM® PD Tools for z/OS® Suite products. This is extremely helpful, because it allows Suite licensees to deploy IBM® PD Studio GUI workbench access not only to their core host PD tool users, but to all other roles *(application developers, testers, QA staff, systems programmers, and administrators)* needing periodic or occasional access.

The five IBM® PD Studio tool plug-ins can also be installed into other IBM RCPs... giving these workbench user groups consistent IBM PD tool services GUI access experiences...

IBM® PD Studio V13.1 now embeds **IBM® z/OS® Explorer V2.1** – IBM's common connection management/single sign-on component that simplifies z/OS®-based sub-systems access, and provides intuitive, secure viewing, editing, and management of z/OS® datasets and zFS files, submission of Job Control Language *(JCL)*, and viewing of JES output and job logs. The five **IBM® PD Studio** tool plug-ins can also be installed into other IBM RCPs, including **IBM® CICS® Explorer**, the **IBM® IMS™ Enterprise Suite Explorer for Development, IBM® Data Studio**, and **IBM® Rational Developer for System z™**, giving these workbench user groups consistent IBM PD tool services GUI access experiences, whichever IBM Eclipse workbench platform they normally use. The three most relevant of these other IBM RCPs are reviewed below.

- **IBM® Workload Simulator *(WS)* for z/OS® and OS/390®:** Simulates a host terminal network and associated message traffic, speeding and simplifying stress, performance, regression, function, and capacity planning testing without needing quantities of terminals or live end-users, and providing helpful analysis with log list, log compare and response time utilities. Using WS, host developers/testers can readily test/evaluate terminal-based host TP applications realistically, up to full user load scale. The tool's **Workload Simulator Test Manager *(WSTM)* utility** guides users through test processes like building test cases, automating test runs, and analyzing test results.

  WS simulates Systems Network Architecture *(SNA)*, CPIC *(LU 6.2)*: TCP/IP; Telnet 3270, 3270E, and 5250 clients; Telnet line mode network virtual terminal clients; simple TCP and User Datagram Protocol *(UDP)* clients; File Transfer Protocol *(FTP)* clients; and multiple client applications that run on top of TCP/IP. Developers/testers can evaluate/compare alternate network designs, and simulate different terminals, terminal features, and/or terminal actions. The tool offers extensive runtime

utilities that include the Workload Simulator/ISPF interface *(which also provides easy set up)*, a display monitor utility, runtime reports, and ITPECHO *(a Virtual Telecommunications Access Method (VTAM®) application that echoes received data)*. It simulates SNA logical units while running an IBM VTAM® application program.

WS provides flexible test script generating utilities that include **Structured Translator Language** *(STL – that defines Workload Simulator actions scripts)*, **Interactive Data Capture** *(IDC – easy, fast 3270 session traffic capture for use in replay scripts for WS)*, a **Network Processor Module** *(NPM)*/LU2 re-formatter *(converts IBM VTAM® buffer traces or NPM VTAM® logs to WS format)* and a script generator.

The tool also offers extensive runtime and post-test analysis that includes log list, log compare, and response time utilities. Runtime reports *(including date sent and received, message rates, terminal status and inactive terminals)* can be displayed during, and at simulation run end. A **Display Monitor Facility** also presents simulated 3270 screen images and data streams during the simulation run.

WS is also now integrated with IBM® Problem Determination Tools Studio, the suite's comprehensive Eclipse-based GUI workbench and integration point...

WS is also now integrated with **IBM® Problem Determination Tools Studio**, the suite's comprehensive Eclipse-based GUI workbench and integration point *(see Section 3, Figures 8 & 9)*, through the **IBM® Workload Simulator *(WS)* for z/OS® and OS/390® Plug-In for Eclipse** provided inclusive to WS licensees.

This WT Plug-in offers GUI functionality to help manage the test process. It also automatically generates WS scripts and networks from VTAM and CPI-C trace data.

The IBM® Workload Simulator for z/OS® and OS/390® provides versatile, comprehensive, realistic terminal/network workload generation/simulation across a wide range of z/OS®, OS/390® TP & network environments within a single product.

Other Problem Determination Tool-enabled IBM z/OS® Workbenches

IBM now also offers three other relevant z/OS®-focused Eclipse GUI workbench tools, each targeted to other specific groups of mainframe users, that can also support the five IBM® PD Tools for z/OS® Plug-ins for Eclipse, and can thus now be used by their user groups to gain GUI access to the select services of the five host PD tools: APA, DT, FA, FM, & WS. We review these easy-to-use workbenches below:

- **IBM® CICS® Explorer V5.1.1:** Latest release of IBM's globally successful, intuitive, common, low-footprint, and usually no-cost, Eclipse-based *(V4.2.2)* rich client platform *(RCP)* built for host CICS® architects, developers, system administrators, system programmers, and operators, which we first introduced/positioned in Section 3 and Figure 5. **IBM® CICS® Explorer** provides GUI workstation visibility into, access to, and control over **CICS® Transaction** and **CICS® Transaction Gateway** runtimes and their resource definitions, via one consistent user interface. It also serves as a unified **workbench integration point** via the now-wide range of **five IBM® CICS® Tools, and five IBM® Problem Determination tool Plug-ins for Eclipse** *(currently available for APA, DT, FA, FM, & WS)* that can be installed into IBM® CICS® Explorer from the IBM web-based Plug-ins repository, each giving GUI workbench access to select host services of that Plug-in's host product. *(Also for other IBM host tools.)*

These capabilities combined help both novice and experienced CICS® users get more from CICS® faster...

IBM® CICS® Explorer provides a **lightweight, extensible framework**, with a **small disk footprint** and **quick start-up**. The tool's helpful task-oriented views, context-sensitive smart resource editors, online context-sensitive help, and wizards provide integrated access to a broad range of CICS® and z/OS® data and control capabilities with full Eclipse RCP capabilities. It enables users to define, install, and manipulate **CICS® runtime resources and their definitions**, including Events, Atom feeds, Policies, Applications, Platforms, and Dynamic Web Bundle Projects. It also offers **flexible deployment**, with support for the CICSPlex® SM repository and CICS® System Definition *(CSD)* files. Easy point-and-click navigation, with **dynamic perspectives** for multiple CICS® views, speeds up CICS® resource creation and editing. **Many standard queries** are built-in, helping understand resource relationships, but which can also be easily edited. IBM® CICS® Explorer V5.1 also now supports new Application and Platform definitions introduced in CICS® TS V5.1, along with Policies, and Dynamic Web Bundle Projects. These capabilities combined help both novice and experienced CICS® users get more from CICS® faster, and accelerates knowledge, skills and best practice, transfers to the next generation.

The tool embeds **IBM® z/OS® Explorer V2.1** – IBM's common connection management and single sign-on component, that simplifies access to z/OS®-based sub-systems, and delivers an intuitive and secure way to view, edit, and manage z/OS® datasets and zFS files, submit Job Control Language *(JCL)*, and view JES output and job logs. IBM CICS® Explorer® is a core member of

the IBM® CICS® Tools suite, which we show in Figure B2 on page 65. The IBM® CICS® Explorer plug-in itself can also be installed into other RCPs, including IBM® Problem Determination Tools Studio for z/OS®, the IBM® IMS™ Enterprise Suite Explorer for Development, IBM® Data Studio, and IBM® Rational Developer for System z™, giving their users a consistent CICS® experience, regardless of their choice of workbench platform.

- **IBM® Rational® Developer for System z™ V9.0.01:** RDz™ provides **modern, interactive, Eclipse-workstation-GUI-based**, high-function development tooling for **all types of mainframe application development** on all System z™ and zEnterprise® System mainframes. This comprehensive but easy-to-use IDE is firmly established as the **de facto standard** for modern host mainframe AD today. We described RDz™ in Section 3 *(on page 20)*, but we also include this review here because RDz™ is such an important component of IBM's mainframe AD portfolio, and because the development roles of RDz™ are so closely inter-related with those the IBM® PD Tools for z/OS® Suite addresses. The latest RDz™ V9.0.01 provides a **further enhanced, tightly-integrated toolset** for creating and maintaining high-quality z/OS® applications quickly and efficiently and with high developer productivity. RDz™ provides a rich set of COBOL, PL/I, C++, assembler and Java™ development tools, designed and optimized for best operation in the mainframe batch, IBM CICS®, IBM IMS™ and IBM DB2® and WebSphere® Application Server, runtime environments. This comprehensive RDz™ coverage of all types of mainframe applications, spanning all traditional host application types, all modern "SOA, etc." application models, and the now-widespread composite applications that blend both, is a major advantage.

Intense IBM developments of RDz™ over the last 15 years brought the current RDz™ V9.0.1 release to its present "world-leadership class" level, with large-scale enterprise deployments now widespread and still accelerating.

The IDE supports and speeds the **design, creation, deployment, testing**, and **maintenance** stages of the mainframe applications lifecycle. RDz™ also includes **application structural and quality analysis tools** that help to produce high quality code more quickly, and is fully integrated with the **IBM® Rational® source control and collaborative lifecycle management systems** to streamline the whole development process for mainframe sites. This newest RDz™ release now includes a new, **fully-integrated source level debugger** that enables users to step through their z/OS® application, monitor and modify variables, set breakpoints during or before a debug session and inspect program memory from their GUI workbench *(embedding proven core IBM® Debug Tool subset technology)*, using a z/OS™ server component. Not a member of the IBM® PD tools for z/OS® suite, RDz™ is **tightly-integrated** with the current latest suite V13.1 cornerstone releases. As we showed in Figure 8 *(page 20)*, and discussed fully in Section 3 nearby, RDz™ also now supports the five IBM® PD tools for z/OS® **Suite Plug-ins for Eclipse** *(supporting the suite's APA, DT, FA, FM, & WS host tools respectively)*. This provides modern, within-IDE-workstation GUI access to the **now-broad range** of IBM® PD tools for z/OS® Suite **host tool services** *(shown in Figure 9 on page 22)* for the full-time professional developers *(licenses are chargeable at $5,570 in the USA)* who are principal RDz™ users. This also enables RDz™ to serve as a unifying **workbench integration point** for the IBM® PD Tools for z/OS® Suite *(plus to other IBM host tools also linked with RDz™)* for these professional developer users. Other RDz™ enhancements in V9.0.1 included improved SCM integration with Rational Team Concert™ *(with user build capability and CARMA-CA Endevor interfaces)*; updated JES support *(job submission and output processing)*, improved language editors for COBOL, JCL and PL/I; and expanded PL/I code quality rules in the tool's Code Review feature. Intense IBM developments of RDz™ *(and its forerunners)* over the last 15 years *(including IBM's spectacularly successful creation and donation to open source of the Eclipse platform itself)* brought the current RDz™ V9.0.1 release to its present **"world-leadership class" level**, with large-scale enterprise deployments now widespread and still accelerating.

- **IBM® IMS™ Enterprise Suite Explorer V3.1:** This Eclipse RCP platform-based workbench simplifies creation and maintenance of **IBM® IMS™ applications** with a graphical framework. It **greatly reduces the IMS-specific skills needed, speeds up key tasks**, and thus increases development productivity. The tool is designed for all IMS™ developers and administrators, and is especially helpful for younger, newer-to-IMS staff. Like the other workbenches above, it provides a **modern GUI** within an **IDE** that helps build and visualize **IMS™ database description** *(DBD)* and **program specification block** *(PSB)* resource definitions, reducing IMS™ programming effort. Users can also **import COBOL and PL/I data structures** to an IMS™ database by using the importers of, and shell-sharing with, IBM® RDz™, to generate PSB source, and to import and export DBD and PSB source from or to a z/OS® remote system. It offers a relational view of IMS™ data *(exploiting the IMS™ Universal drivers)*, and gives graphical assistance to **build SQL statements**. The tool can also populate the IMS™ catalog. It also provides front-end mobile server administration, enabling developers to model, deploy and test IMS™ transactions and data as services **supporting mobile access**.

The software is available at no cost to users at IMS™ licensed sites.

IBM® IMS™ Enterprise Suite Explorer V3.1 also now supports the five IBM® PD tools for z/OS® **Suite Plug-ins for Eclipse** *(for that suite's APA, DT, FA, FM, & WS host tools respectively)*, providing modern, within-IDE-workstation GUI access to main IBM® PD tools for z/OS® **host tool services** for IMS™ developers and administrators. This tool also thus provides a **workbench integration point** for the IBM® PD Tools for z/OS® Suite *(and other IBM host tools)* for IMS™ users. The software is available at no cost to users at IMS™ licensed sites. As above, this tool also embeds **IBM® z/OS® Explorer V2.1** – IBM's common connection management and single sign-on component, that provides simplified access to z/OS®-based sub-systems, offering intuitive, secure viewing, editing, and management of z/OS® datasets and zFS files, submission of JCL, and viewing of JES output and job logs. **IBM® IMS™ Enterprise Suite Explorer** is a member of the **IBM® IMS™ Enterprise Suite**, a set of independent components that enhance IMS™ connectivity, expand application development, and extend standards and tools to ease integration with existing assets or other IBM® solutions. New in V3.1 are: an IMS™ Catalog Navigation view/search *(view/search IMS™ resources & import into IMS™ Explorer projects)*; a Problems view of IMS™ Explorer workspace *(shows resource problems and missing files)*; and unit testing support *(to create transaction test cases that easily exercise different code paths in an IMS™ transaction)*.

Adjacent Mainframe Tool Categories – Rapid IBM® CICS® Tool Suite Evolution Good Example

In parallel with its fifteen years of intense IBM® PD Tool for z/OS® Suite development on the assessed above, IBM has been similarly proactive in building-out adjacent tool suites for other important, closely-related, host tools segments. **CICS® tools, DB2® tools, IMS™ tools**, host performance management, mainframe security management, and host ITSM, are amongst those IBM System z™ R&D investment focus areas. The most closely aligned and relevant example here is **the IBM® CICS® Tool suite** supporting the near universally-used CICS® TS transaction processing subsystem – and its popular, companion CICS® Transaction Gateway server that provides external client access to CICS® transactions and data. Through the 1990s, as with PD tools, the CICS® tools segment was also an ISV stronghold where IBM was essentially absent.

The IBM® PD Tools Suite for z/OS® products today are **more closely aligned** with the **IBM® CICS® Tools for z/OS®** suite described here. Their respective Eclipse GUI access tools *(IBM® CICS® Explorer for CICS® users, PD Tools Studio for PD tools users)* are both built on top of the **same IBM z/OS® Explorer** technology, and now allow both groups of end users to easily install and run both sets of products together from the user workbenches of each group. These two suites are also **highly-complementary** to each other. The IBM® CICS® Tools for z/OS® suite products are often used for CICS application modernization *(e.g. SOA, mobile enablement, Web etc.)* and optimization *(e.g. performance enhancement, thread-safe analysis, and CICS® region consolidation)*. Even with the best of intentions and these excellent CICS tools, things can still go wrong and problems can occur. At this point, these complementary PD tools greatly assist rapid problem diagnosis and repair; both suites thus are integral parts of IBM's overall host DevOps story today.

IBM's now-leadership strength CICS® tools suite reflects the giant's deep strategic commitment to the mainframe platform, and its determination to itself support core host IBM software infrastructure with comprehensive, state-of-the-art, modern IBM tooling at reasonable prices...

At writing in May 2014, IBM now offers the twelve-strong CICS® tool suite shown in Figure B2, each CICS® tool briefly described there. This chart makes our point that **IBM's now-leadership strength CICS® tools suite** *(including many recent new releases labeled "NR")* reflects the giant's deep strategic commitment to the mainframe platform, and its determination to itself support core host IBM software infrastructure with comprehensive, state-of-the-art, modern IBM tooling at reasonable prices in all major host tool segments. Not shown on the chart are IBM's two recent *(Oct. 2013)* CICS® tools enhanced value bundles, the **CICS® Optimization Solution Pack for z/OS®** *(4 CICS® products included)* and the IBM **CICS® Modernization Solution Pack for z/OS®** *(3 CICS® products included)* both V5.1 releases.

Now, a decade-and-a-half of intense IBM development and investments have clearly brought its mainframe CICS®, PD, database, and other tool category product portfolios, to a high point of strength by mid-2014, with continued solid IBM development efforts pledged in each area over future years. Leadership in mobile, cloud, and SOA functionality, excellent currency, solid and regular advances, and excellent value, can thus be confidently expected from IBM in each of these important mainframe tooling domains in the years ahead.

IBM® CICS® Transaction Gateway V9.1 Now GA

On July 1st 2014, as this Paper went to press, a new IBM® CICS® Transaction Gateway V9.1 release was announced by IBM, with General Availability *(GA)* from September 12th 2014. The new release further updates IBM's important, widely-used, scalable, CICS® gateway enterprise server that delivers fast, secure enterprise-wide access to host CICS® transactions and data from most other remote client platforms. Extensive new/extended support for mobile device enablement is the central release theme. Related CTG family offerings similarly updated.

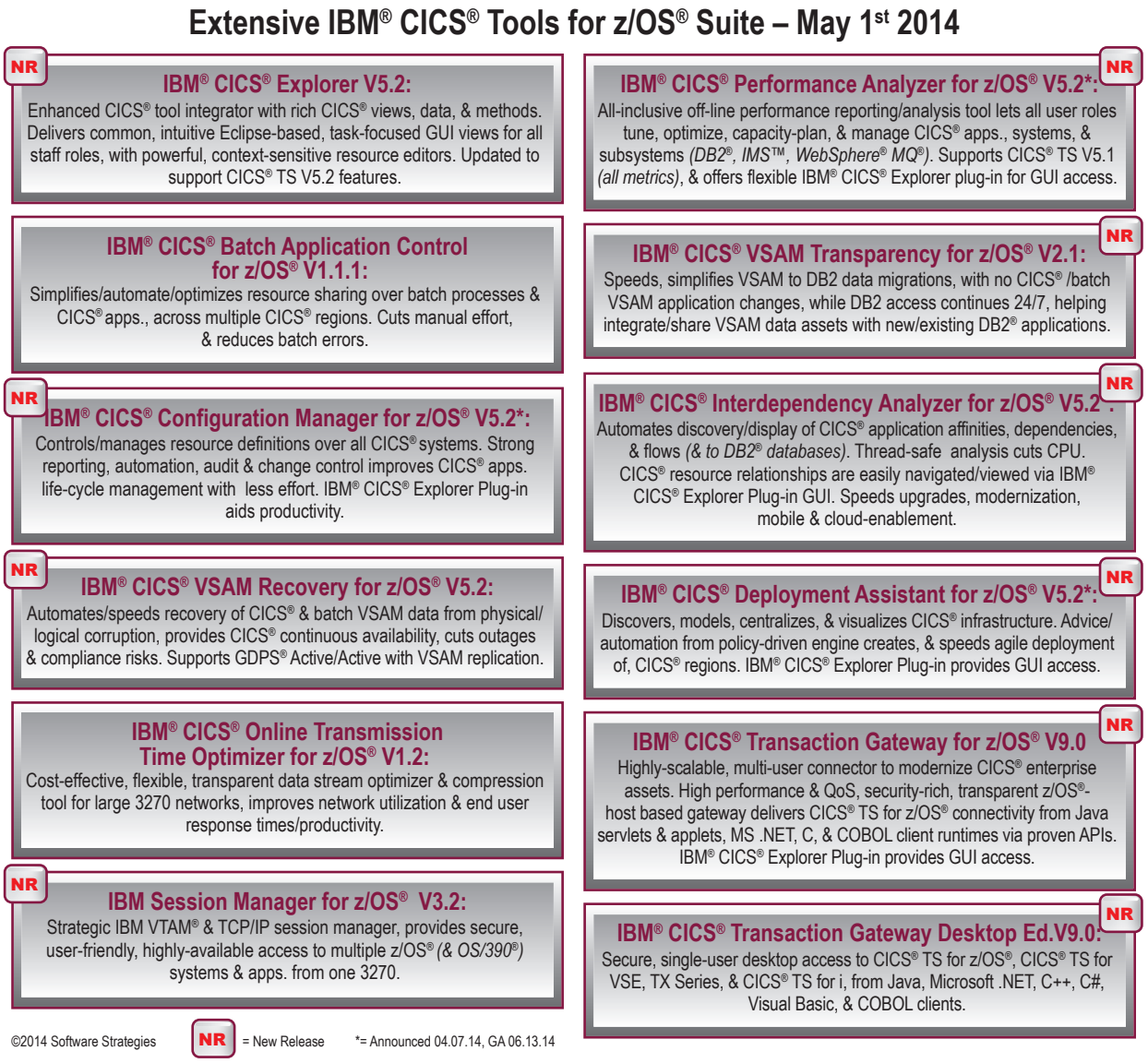

Figure B2: Extensive IBM® CICS® Tools for z/OS® Suite – May 1st 2014

IBM® PD Tools for z/OS® V13.1 Suite releases brought users another large step forward in breadth, functionality, coverage, capability, integration, extended GUI support, and a full currency slate...

Our Analysis

From availability in October 2013, the IBM® PD Tools for z/OS® V13.1 Suite releases brought users another large step forward in breadth, functionality, coverage, capability, integration, extended GUI support, and a full currency slate supporting the latest test host stack advances. These releases also supported the hardware advances of current generation zEnterprise® System *(zEC12 high-end and zBC12 mid-range)*, and support the latest z/OS® V2.1 release that became available end-September 2013, providing further exploitation support for these mainframe systems. Further development for the next-generation V14.1 releases of the IBM PD Tools for z/OS® Suite products are now well under way *(as of writing)* for *(we estimate)* delivery around Q2 2015. As usual, IBM has given out no details of the advances planned, preferring keep competitors guessing. Figure B1 on page 54 strikingly showed, product-by-product *(one life-expired, replaced product not shown)*, the rapid, continuing pace of IBM PD Tools for z/OS® Suite development advances delivered since year 2000.

The IBM suite saw **74 product releases** from 2000 to 2014, an average of **7.4 releases/current products** in this 14-year period, an average of **5.3 new product releases per year**, with an impressive 82.4% designated as major releases, and only 17.6% minor releases or increments. This has been a first-rate, excellent releases development track-record for IBM's compact, **now-10 product** suite.

These V13.1 releases **extend** the **feature/functionality lead** we previously found the IBM® PD Tools for z/OS® V11.1 Suite held in our last 4th Ed. WP 03.11 Review. When these are combined with the IBM V13.1 suite's **superior inclusive subsystem coverage, latest host software currency support, now-comprehensive and mature Eclipse GUI access options** and **suite integration**, first-class SOA enablement, good **value/lower prices** with two new inclusive multi-product "Solution Packs", IBM's suite in 2014 again commands the overall segment leader position, but against competitors striving harder.

However, PD tools suite for z/OS® segment **competitive efforts were high** since our 4th Ed. WP 03.11 Review. Readers will note that, in our detailed competitor reviews and assessments that follow in Appendix C, **IBM's three more active competitors** have each again delivered **sturdy development advances** over this **Paper's 40-month Review Period**, which our overall scoring weighs with IBM's above. That Review Period began late in the worst global economic recession within memory, but has more recently seen recovery, renewed growth, and business investment in many markets worldwide. This continued development progress is **greatly to the credit** of these PD suite contenders, bringing real benefits to all their existing customers. It also reflects their **renewed commitments** to the **ever-strengthening IBM mainframe enterprise platform** again.

In 2014-on's brighter economic and business climate, with many new workloads being deployed on the mainframe platform, and IBM's strong heavy R&D-powered platform technology advances continuing apace, further solid growth in both existing user installed *(MIPS)* capacity, and in the number of mainframe customers/sites *(averaged 75-100 all-new mainframe sites per new mainframe generation over the last three generations)* is now certain. These factors will continue generating higher interest in enhanced host AD tooling; including for such vital foundation products as PD tools suites for z/OS®. We also expect IBM to win nearly all PD tools suite sales made to all-new customer zEnterprise® System footprints sold.

In this 5th Ed. WP 07.14, **we** again rated **IBM the # 1 PD tools suite-vendor** on our combined strategic criteria ranking. The strong developments IBM has clearly delivered again since then maintained an **IBM lead** over its competitors. However, its opponents have not stood still either, with substantial development investment and activity again clearly apparent from three of IBM's four competitors, each discussed/assessed in Appendix C following.

Appendix C: Competing z/OS® PD Tool Vendors' Suites

The latest product suites from the four competing vendors – with relevant corporate news – are profiled and assessed in alphabetic order below.

CA Technologies, Inc.

In our context, CA Technologies offers its **"Application Quality & Testing Tools, and Application Performance Management"** suite for z/OS®, detailed – at May 1st 2014 – in Figure C1 *(on page 68)*, and discussed below. This mid-sized tools suite had **7 main product families**, with **17 products/offerings**, at our 05.01.14 Review Date. Over our 40-month Review Period, line-up changes added one major new offering *(see below)*, saw one product retirement, one renamed product *(combined/rewrote functionality of 2 prior products)*, and one other product renamed.

Over the Review Period, CA Technologies *(again)* delivered a solid **17 full new releases** for this now-17-product/offerings suite, a respectable average of 1 full release per suite product. Of those, **9 were designated major** and **8 minor**, releases. The current General Availability *(GA)* release of each product is shown in Figure C1's RHS column. Additionally, CA Technologies now also provides **CA Recommended Service** *(CA RS)* maintenance update sets *(now monthly)* for its Mainframe Stack – including most CA PD suite products – rapidly delivering fully-tested & aligned **increments/MRU** drops between product releases.

Major news was the cross-suite offering of **modern, CA Eclipse-based GUIs** for **seven main CA Technologies PD tools suite products**. These were: **CA InterTest™ for CICS®** and **CA InterTest™ Batch** *(first shipped in 2011 with r8.5, & "Ready for RDz certified)*; **CA FileMaster™ Plus**; **CA SymDump® Batch**, **CA SymDump® for CICS®**, **CA SymDump® System**; and **CA Mainframe Application Tuner**, as noted in Figure C1. These new CA Technologies GUIs make time-consuming host test/debug tasks faster and easier, both for experienced – and especially for younger – mainframe staff; and **represented a major advance** for this PD suite. The CA Common User Interfaces *(GUIs)* for both CA InterTest™ products are also IBM RDz™ "Ready for IBM Rational" validated *(with Best Practice Compliant status)* assuring smooth integration with the widely-used standard host RDz™ IDE.

These CA Technologies host debugging and fault analysis suite tools have also long integrated directly with its popular mainframe change and configuration management products, including **CA Endevor® Software Change Manager**, **CA Librarian®** and **CA Panvalet®**. That close integration ensures developers always work with latest source code versions.

As discussed in earlier Section 4 and Section 5 CA Technologies sub-sections, the firm's impressive new Application Development Solutions architecture is rapidly embracing, consolidating, and enhancing many of the above tools as its central components, with two major new PD tool suit-based solutions, **CA FileMaster™ PRIME** and **CA InterTest™ PRIME** targeting CA World *(November 2014)* first releases announcement. These will clearly bring a **more compact**, more all-inclusive CA Technologies PD tools suite, as well as enhanced future functionality, when fully delivered.

The CA Technologies Mainframe Stack for z/OS® provides a common lifecycle, pre-integration, and coordinated pre-testing, of all stack host product releases.

The **CA Technologies Mainframe Stack for z/OS®** – now ~275 of the firm's *(~300)* host products – provides a common lifecycle, pre-integration, and coordinated pre-testing, of all stack host product releases. Stack products all have standardized SMP/E installs, can be installed/configured/deployed with **CA CSM** below, have relevant **health checks**, and deliver maintenance via **CA RS above**. This assures validated interoperability between CA Technologies host products, with high currency and tight alignment with IBM's host stack releases and RSU levels, greatly simplifying support for customers. Testing runs continuously on CA Technologies **Integrated System Test** *(IST)* laboratory on two Parallel Sysplex clusters *(of 6 and 3 IBM mainframes)*.

A highly-successful, related CA Technologies mainframe advance has been **CA Chorus™ Software Manager *(CA CSM)*** – now in V6.0 release – an **intelligent Web GUI** tool that **standardizes**, **automates**, and **dramatically simplifies**, CA Technologies **product installs** and **software maintenance**, for customers onsite. CA CSM services can now **acquire, install, find and apply correct maintenance, deploy**, and **configure**, stack products. Several hundred CA Technologies customers have already successfully adopted CA SM.

11 of 16 suite host products – as noted in Figure C1 – are **fully CA CSM supported** *(Figure C1 footnote defines "fully CA CSM supported")*. Tests on CA SymDump® for CICS® showed a mainframe expert could install it in 3 minutes with CA CSM versus 38 minutes for a standard Electronic Software Distribution *(ESD)* install, 1267% faster. A mainframe novice took just 6 minutes, versus 4 hours 3 minutes ditto above, 4050% faster!

These advances **improved currency, regression testing, delivery, installation**, and **maintenance processes**, for most host CA Technologies PD tools *(and other mainframe stack products)*, and combined to bring good customer benefits in managing/supporting their CA Technologies host software better, faster, and more economically, in line with new IBM subsystem and z/OS® advances /RSUs.

CA Technologies Application Quality & Testing Tools; Performance & Automations Solutions for z/OS® suite – May 1st 2014		
Product Family/Product*:	**Product Description**	**Current Release**
CA Eclipse GUI Interfaces set	CA Technologies now delivers a set of seven CA Eclipse GUIs providing simple-to-learn, and easy-to-use modern GUI access to key functionality of seven main CA Technologies host suite products. These are noted under host family or product descriptions below, and come with the host releases in the RHS column. This major suite GUI advance enables younger, newer mainframe staff to rapidly become productive with the so-GUI-supported CA Technologies host PD tools.	–
CA Application Performance Management:	Proactively detect, triage and diagnose performance problems in enterprise web applications running in z/OS® environments.	r9.5.3+
CA Application Performance Management Change Detector™	Detects changes in web application configurations; correlates with web application performance.	r9.5.3+
CA Cross Enterprise Application Performance Management	Enables CA APM users to monitor the performance of business transactions that span distributed and mainframe environments. Includes the ability to trace transactions from distributed applications to mainframe applications running on CICS®.	r9.3.06+
CA Mainframe Application Tuner	Advanced application performance analysis and tuning tool that uncovers system, database, and application performance inefficiencies across z/OS® and automates processes of measuring applications and prioritizing tuning efforts. Now offers an Eclipse-based GUI for analysis, including analysis of all major subsystems like IBM CICS®, IMS™, DB2®, and CA IDMS. CA Mainframe Application Tuner fully supports CA Chorus™ Software Manager.	r9.0+
CA File Master™ Plus Family:	Powerful file management, data manipulation, file editing and test data creation on z/OS®. The CA FileMaster™ family of products fully supports CA Chorus Software Manager.	–
CA File Master™ Plus	Powerful file management, data manipulation and file editing tool for VSAM, sequential and PDS files on z/OS®. Helps create test files, fix production file errors, etc. Eclipse-based interfaces simplify usage.	r9.0+
CA File Master™ Plus for IMS™	Powerful file management, data manipulation and file editing tool for IMS™ files on z/OS®. Helps create test files and fix production file errors, etc., in IMS™ environments.	r8.5
CA InterTest™ Family:	Intuitive, interactive testing and debugging for COBOL, PL/1 and Assembler applications. Eclipse-based interfaces simplify usage. Integration with IBM Rational Developer for System z™ *(IBM RDz™)* and other IDEs based on Eclipse. The CA InterTest™ family of products fully supports CA Chorus™ Software Manager.	–
CA InterTest™ for CICS®	Intuitive, interactive testing and debugging for COBOL, PL/1 and Assembler CICS® applications.	r8.5
CA InterTest™ Batch	Intuitive, interactive testing and debugging for COBOL, PL/1, and Assembler Batch and TSO applications.	r8.5
CA Optimizer® Family:	Comprehensive abend diagnostic solutions for mainframe COBOL. The CA Optimizer family of products fully supports CA Chorus™ Software Manager.	–
CA Optimizer®/II	Batch abend diagnostics, test code coverage, and code optimization for more recent COBOL versions, including: COBOL II; COBOL/370; IBM COBOL for MVS; IBM COBOL for OS/390®; and IBM Enterprise COBOL for z/OS® and OS/390®.	r8.5
CA SymDump® Family:	Testing and fault-management tools. Eclipse-based interfaces simplify usage. The CA SymDump family of products fully supports CA Chorus™ Software Manager.	–
CA SymDump® for CICS®	Abend detection, analysis and resolution for IBM CICS® TS transactions.	r9.0+
CA SymDump® Batch	Abend detection, analysis and resolution for Batch and TSO abends in test and production for all languages *(special support for COBOL, PL/1 and Assembler)*, and for abending IMS™, DB2® & CA IDMS®/DB applications.	r9.0+
CA SymDump® System	Abend detection, analysis and resolution for z/OS® System and CICS® Region abends in test and production. Specific support for z/OS®, IBM CICS® TS, IBM MQSeries, JES2, DB2®, IMS™, CA Datacom®/DB and CA Roscoe® Interactive Environment.	r9.0+
CA Verify® Family:	Automated regression testing and fault management. The CA Verify® family of products fully supports CA Chorus™ Software Manager.	–
CA Verify® for CICS®	Automated testing tool, including unit, regression, stress, concurrency, migration and system testing, for IBM CICS® TS environment.	r9.0+
CA Verify® for VTAM	Automated testing tool, including unit, regression, stress, concurrency, migration and system testing, for VTAM environments.	r9.0+
CA Datamacs® Test Data Generator:	Automated test data generation tool, for fast and accurate test data creation.	r1.2
CA Date Simulator:	Automated system clock simulation for sensitive date/time testing.	r2.0
CA FileAge:	Rules-based financial and date-driven logic testing tool.	r2.3

Notes:
CA Technologies PD tools suite shown above now comprises 7 product families, and 17 products/offerings at 05.01.2014.
CA Technologies reports delivery of 17 total full releases – 9 major, and 8 minor releases, during our 40-month Review Period to 05.01.14.
+= Products with one or more new releases during our 40-month Review Period to 05.01.14
CA RS now additionally delivers coordinated, pre-tested monthly lists of preventive maintenance for 126 CA Technologies product releases.
The CA Technologies labs run about 7,500 automated, integrated tests against the products and newly published PTFs before releasing a new CA RS list.
The CA Technologies labs run atop all supported releases of IBM's z/OS®, CICS®, DB2®, and IMS™.
Since the first CA RS release in 2010, the CA RS lists have recommended about 27,000 PTFs.
All CA Technologies products above support all IBM-supported z/OS® and CICS® TS versions. *(Also available for all IBM supported VSE/ESA versions.)*
CA Technologies now achieves "day one" support for new z/OS® releases for all its PD tool suite products above.
Full support for CA Chorus™ Software Manager includes standardized acquisition, installation, configuration, deployment and maintenance.

Figure C1: CA Technologies "Application Quality & Testing Tools; & Application Performance Management" Suite for z/OS® – May1st 2014

In our assessment these give CA Technologies clear... leadership in host tool installation, deployment, and maintenance application, productivity and speed.

In our assessment these give CA Technologies clear PD tools segment *(and mainframe software market-wide)* leadership in host tool installation, deployment, and maintenance application, productivity and speed.

Outside our scope, another major advance – also indicative of CA Technologies strong commitment to mainframe R&D/ innovation – merits mention. This was delivery – over the last several years – of now-four **CA Chorus™** advanced role-based, workflow-driven, GUI-host integration products. Each offers a modern GUI workspace supporting key host job role processes with easy desktop access to multiple host CA Technologies domain product services. Domain/job roles to date are database management, infrastructure management, security & compliance, and storage management. These impressively researched/engineered GUI capabilities offer strong productivity, training, & knowledge-sharing benefits to **CA Chorus™ customers**.

Compuware Corporation, Inc.

Detroit-MI-headquartered Compuware Corporation remains a substantial ISV after two years of radical changes and large further divestitures, and is now focused solely on its **Mainframe Solutions** *(all PD tools suite)*, and its growth **Application Performance Management** *(APM)*, business units.

Compuware had **pioneered mainframe PD tools**, building out the segment's largest suite via acquisitions, was its dominant $ revenue share leader through the 1990s, and is still the $ share leader today. Its mainframe PD tool families ***(Abend-AID, File-AID, Xpediter, Strobe, and Hiperstation)*** are **widely known**, and had traditionally **well-rated functionality**.

But its **sector highest-pricing**, tough licensing terms, **many-product suite structure**, high and visible host tool profit margins, and earlier years host tool **R&D under-investment**, combined to upset many customers, making the firm a prime target for the other PD suite vendors since Year 2000. As a result, Compuware's Mainframe Solutions revenue has **shrunk at a steep 7% CADR rate** from FY01 to FY14, and the firm projects similar fall rates over the next two years. We estimate some 2,750 earlier customers have migrated to other PD tools vendors, notably to IBM, over that period.

From the late 1990s, Compuware had heavily invested those high mainframe profits into several distributed software product lines, into building a large professional services operation, and into an application service business, most now divested again after recent activist investor demands, leaving two similar sized business units above.

Figure C2 on pages 70-72 shows the **Compuware Mainframe Solutions** suite's **7 main product families**, comprising **38 products** as at our May 1st 2014 Review Date, down by 2 products. Figure C2 also shows these seven families comprise 7, 1, 6, 3, 12, 2, & 7 products/features, the multiple products/features from each family covering different IBM host subsystems, data sources, and/or languages. Because they fall within our host PD tools and APM suite definition, Figure C2 includes the **Compuware APM for Mainframe** family *(2 products)* relevant to this Paper's remit. Originally *(and logically)* this flagship product family was launched, and run by the Mainframe Solutions BU for FY14, but moved to the APM BU for FY15 on.

...delivery of 21 major and 62 minor releases... for this 38-product host PD tools suite, averaging 2.2 total releases/product...

Competing PD tools suites use rather fewer, each more inclusive products – IBM now with 10 products, Macro 4 now using 14 and CA Technologies now with 17, products in their suites that cover broadly similar functionality to Compuware's.

Over our current 40-month Review Period, Compuware data showed delivery of **21 major and 62 minor releases**, 83 product release/updates for this 3**8-product host PD tools suite**, averaging **2.2 total releases/product**, and 24.9 per year total suite releases. *(See Figure C2 for details.)* Although 75% minor releases, this was still a **creditable** and higher **product advancement rate** than found in our last 4th Ed. WP 03.11 *(32 total releases/updates shipped in our prior 26-month Review Period, an average of 15.4 total suite releases per year)*. This clearly reflected redoubled Compuware Mainframe Solutions R&D efforts as it strove to hang onto its still-largest user base and segment revenue market share lead.

One primary area of further development *(1 major plus 2 minor releases)* was broadening host tool coverage, and extended functionality, delivered in the **Compuware Workbench**, now in **V4.0 release**. This is the firm's common Eclipse-based GUI development environment, providing easy-to-learn and use access to the now-wide range of host Compuware PD tools services, together with high-function **source code editing** *(using SlickEdit OEM)*, **code analysis, compilation**, host **file and data manipulation**, job submission and output review, for z/OS®. Compuware Workbench also provides a desktop integration and launch point for the suite's familiar host PD tools. Compuware Workbench now supports access to services from *(and integration with)* host **Abend-AID** *(fault diagnosis and dump analysis)*, **File-AID** *(host data and file management)*, **Hiperstation** *(mainframe application testing)*, **Xpediter** *(interactive debugging)*, & **Strobe** *(application performance tuning)* via the Eclipse plug-ins provided for each.

Compuware "Mainframe Solutions, & Application Performance Management" suite – May 1st 2014.		
Product Family/ Product/Feature:	**Product Description**	**Current Release**
Abend-AID family:	Assist IT professionals to quickly diagnose & resolve application & system failures *(1977)*. Now V12.3, was V12.1	
Abend-AID	Fault management & dump analysis tool provides right information to enable quick resolution of faults & abends for MVS, z/OS®. 2 minor releases.	**V12.3**
Abend-AID for CICS®	Fault detection/diagnosis for fast resolution of faults & abends in CICS® transactions/regions. 2 minor releases.	**V12.3**
Abend-AID for DB2®	Notifies of DB2® faults, prioritizes problems, & helps resolve issues in host DB2® environments. 2 minor releases.	**V12.3**
Abend-AID Fault Manager	Archives data from Abend-AID, providing real-time & historical reports offering a high-level view of fault activity, allowing developers & managers to analyze, pinpoint, & resolve recurring problems, including WebSphere MQ. *(z/OS®, Unix, & Windows covered, server based/priced.)*	**V12.1**
Abend-AID for IDMS	Fault detection & diagnosis for quick resolution of faults & abends in CA-IDMS environments. 2 minor releases.	**V12.3**
Abend-AID for IMS™	Fault detection & diagnosis for quick resolution of faults & abends in an IMS™ environment. 2 minor releases.	**V12.3**
Compuware Program Analyzer:	Helps developers using Xpediter, Abend-AID, & Strobe perform powerful yet understandable analyses of complex COBOL &PL/I programs, through views of the program's structure, paragraphs, data items, & data flow logic. *(Comes within XpediterDevEnterprise, user-priced.)* 2 minor releases.	**V5.3**
Compuware Mainframe Workbench *(CMW)*:	Open-source Eclipse-platform-based launch/integration point & IDE speeds & simplifies working with Compuware's mainframe tools here *(& others)*. Modern workstation GUI provides friendlier, more productive access for new "zNext generation", & for experienced mainframe staff alike. It offers a common framework & desktop GUI support for common mainframe tasks – source code editing, code analysis, file & data manipulation, creating & masking test data, program compilation, job submission, output review, application testing, interactive debugging, fault diagnosis, & applications performance tuning. These functions access & integrate host Abend-AID, File-AID, Hiperstation, Xpediter, & Strobe product services via plug-ins for each. Significant CMW advances delivered now fairly comprehensive, open, & extensible capability today, available FOC to Compuware host tool licensees. 1 major & 2 minor releases.	**V4.0**
File-AID family:	Data & file management tools family enabling IT professionals to securely & consistently access, analyze, edit, compare, move, & transform data across all environments enterprise-wide, in development, for test data preparation, & during production. Also assists data privacy compliance. *(1983)*.	
File-AID for IMS™	View, analyze and change IMS™ data quickly & securely. 1 major & 2 minor releases.	**V10.1**
File-AID/MVS	View, analyze & change MVS data & files *(including VSAM)* quickly & easily, for test & production, either interactively or in batch. 1 major & 2 minor releases.	**V10.1**
File-AID/Data Solutions	Multi-function data analysis/management tool enables efficient creation of accurate test data, & data conversion. 1 major & 2 minor releases.	**V10.1**
File-AID/Related Data Extract *(RDX)*	Efficiently extracts, loads, & protects synchronized subsets of related DB2® & MVS data for application test environments. 2 major & 2 minor releases.	**V10.1**
File-AID for DB2®	Comprehensive DB2® data management & testing tool on z/OS®. 1 major & 2 minor releases.	**V10.1**
File-AID/EX Enterprise Edition	Offers complete test data management/data privacy workbench, where direct access/extracts from/to z/OS® host sources VSAM, QSAM, IMS™, &/or DB2®, are needed. 1 major & 3 minor releases.	**V5.3**
Hiperstation family:	Tests mainframe applications quickly, accurately, cost-effectively, & helps audit host applications.	**–**
Hiperstation for Mainframe Servers	Measures, manages, & minimizes risk, by providing thorough testing of critical System z™ host applications in SOA & multi-tier environments over APPC or TCP/IP protocols like HTTP, HTTPS, DB2 Connect, IMS Connect, CTG, & CICS External Call Interface over TCP/IP.	**V8.0**
Hiperstation for VTAM	Comprehensive automated test management & QA solution for any host VTAM green screen applications, including those running in CICS®, IMS™/DC, IDMS/DC, or TSO, run-time subsystems. Also aids auditing.	**V8.0**
Hiperstation for WebSphere® MQ	Automated mainframe testing & QA for all host back-end IBM WebSphere® MQ applications, plus WMQ message auditing, & issue support. Assures quality, minimize risks in critical WMQ-based applications.	**V8.0**
Strobe family:	Improves performance of mission-critical z/OS® applications – reducing CPU consumption, batch runtimes &online transaction response times, for improved application performance management.	**–**
Strobe MVS for Sysplex	Enables analysts to find where/how time is spent in an online subsystem or a batch-processing program. Measures z/OS® online & batch applications for all major subsystems *(see Strobe product/features below for details)*. Languages supported include Java™, COBOL, PL/I, C/C++, Assembler, ADS/O, Natural, & CA Technologies CA Gen *(some extra cost options)*. 1 major & 2 minor releases.	**V5.1**

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Compuware "Mainframe Solutions, & Application Performance Management" suite – May 1st 2014.		
Product Family/ Product/Feature:	**Product Description**	**Current Release**
Strobe for CICS®	Enables analysts to pinpoint CICS® transactions using excessive CPU time, or with poor response times *(including CICS® & subsystem API commands)*, & by detecting inefficient CICS® system services usage & I/O. Used with iStrobe, analysts can improve CICS® transaction response times, increase transaction throughput, & consistently meet SLA. 1 major & 2 minor releases.	**V5.1**
Strobe for DB2®	Enables analysts to identify/report on host SQL statements *(& DB2® system services)* with excessive CPU or wait times, or poor response times, for online & batch processing host DB2® applications. When used with iStrobe, further analysis of the SQL statements can be done providing access paths, catalog statistics, & change recommendations. 1 major & 2 minor releases.	**V5.1**
Strobe for DB2® DDF	Enables analysts to identify/report on SQL statements coming into DB2 via DB2® Distributed Data Facility *(DDF)* using significant CPU &/or with poor response times. Used with iStrobe, further SQL statements analysis can be done, including access paths, catalog statistics, & change recommendations. 1 major & 2 minor releases.	**V5.1**
Strobe for IMS™	Enables analysts to pinpoint IMS™ transactions in all DB & DC regions needing improvement, by reporting on individual DL/1 call CPU & response times. IMS™ system modules are also reported on. 1 major & 2 minor releases.	**V5.1**
Strobe for WebSphere® MQ	Enables analysts to improve WebSphere® MQ resource performance by reporting on CPU & wait time caused by MQ API calls & system modules, & by providing summary information on MQ call options & message attributes. 1 major & 2 minor releases.	**V5.1**
Strobe for Advantage CA-IDMS	Enables analysts to improve efficiency & responsiveness of z/OS®-based Advantage CA-IDMS database online & batch applications. 1 major & 2 minor releases.	**V5.1**
Strobe for ADABAS/Natural	Enables analysts to improve efficiency, performance, & response times, of z/OS®-based Natural *(or 3GL)* applications accessing Software AG's ADABAS database, with detailed performance data. 1 major & 2 minor releases.	**V5.1**
Strobe for UNIX® System Services	Enables analysts to measure, analyze, & improve performance of, applications using z/OS® UNIX® Systems Services, including WebSphere®. 1 major & 2 minor releases.	**V5.1**
Strobe for CA Gen	Enables analysts to improve the performance of applications created by the CA Technologies CA Gen AD product family. 1 major & 2 minor releases.	**V5.1**
iStrobe	Analyzes Strobe application performance data via a web browser GUI & quickly pinpoints sources of application inefficiencies. 1 major & 2 minor releases.	**V5.1**
AutoStrobe	Proactively measures application performance, to improve performance analysis with more predictable, repeatable measurements, by providing historical application performance data, & by automatically identifying measurement sessions with usage outside set resource bounds. 1 major & 2 minor releases.	**V5.1**
Compuware APM® for Mainframe family:	New mainframe monitoring solution brand *(announced 10.09.2012)* claimed as only continuous transaction-based APM solution, offering unprecedented transaction visibility spanning mainframe, CICS® gateway, & distributed systems, applications, to quickly pin-pointing problem root causes in any tier, & to improve/optimize mainframe performance. Brand combines long-established Strobe family above with two new products below, each based on Compuware's patented PurePath™ Technology from its dynaTrace software acquisition.	**–**
PurePath™ for z/OS® CICS®	Enables full visibility into IBM® CICS® environments, with the first APM solution providing continuous, real-time transaction monitoring for every transaction flowing through a CICS® region, wherever originated, and including DB2® interactions. Part of the Compuware APM® for Mainframe solution family. New.	**–**
PurePath™ for z/OS® Java™	Also part of the Compuware APM® for Mainframe solution family, enables full transactional visibility into mainframe Java™ environments, including batch and WebSphere® Application Server. New.	**–**
Xpediter family:	Interactive mainframe application analysis, testing & debugging tools family. *(1990, from Centura acquisition.)*	**–**
Xpediter/CICS®	Enhances CICS® application quality with powerful testing & de-bugging of CICS® COBOL, PL/I, Assembler & C language application code. 3 minor releases.	**V9.3**
Xpediter/TSO	Interactive online debugging, with complete control, for batch COBOL, PL/I, Assembler & C language application code testing. 3 minor releases.	**V9.3**
Xpediter/DB2®	Helps developers prototype SQL, manipulate DB2® data, & analyze DB2® programs during an Xpediter/TSO session. 3 minor releases.	**V9.0**
Xpediter/IMS™	Provides complete control of IMS™ application code execution for debugging applications in an IMS™/DC environment. 3 minor releases.	**V9.3**
Xpediter/Code Coverage	Validate analysis & testing thoroughness through collection, analysis, & reporting of runtime code coverage statistics. Support for batch, CICS®, IMS™, & DB2® Stored Procedure applications.	**V3.1**
DevEnterprise	Provides automated application analysis to help AD teams identify true impacts of changes, better enhance, extend, & test applications, & improve code quality for COBOL & PL/I programs. Includes Compuware Program Analyzer. *(Server-based, user priced.)* 1 minor release.	**V5.3**

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Compuware "Mainframe Solutions, & Application Performance Management" suite – May 1st 2014.		
Product Family/ Product/Feature:	**Product Description**	**Current Release**
Xpediter/Xchange	Simulates system dates & times for Batch, CICS®, DB2® or IMS™ applications, helping to identify, simulate & test date & time-sensitive applications, without needing program module or JCL changes. *(Server hosted, user priced.)* 1 major release.	**V5.0**

Notes:
Compuware's Mainframe Solutions suite at 1st May 2014 has 6 main product families, now with 38 products/SKUs/features above *(down 2)*.
Table above covers main products/primary options only, other secondary options, add-on, etc., exist.
In our 40-month Review Period, Compuware data recorded 83 new releases for Mainframe Solutions product above shipped. Of those, 21 were major *(25.3%)*, & 62 minor *(74.7%)* releases, averaging 2.18 releases/product above, & 24.9 releases/year.
Some host products above need Compuware Common Services *(CSS)* &/or License Management System *(LMS)* software services, not shown/included above.
All products above in Compuware's Mainframe Business Unit thru FY14
Strobe, iStrobe, & AutoStrobe were long used together as a complete host Application Performance Management *(APM)* suite, but are now also in Compuware APM for Mainframe brand family above.
Compuware APM for Mainframe products above moved to Compuware APM Business Unit for FY15 on!
Firm sold off most of Quality Solutions products, base, & ~320 staff to Micro Focus mid-2009 *(for $80M)* so not shown.
Compuware retained HiperStation mainframe testing tools, the 3-product HiperStation family shown above.

Figure C2: Compuware "Mainframe Solutions; & Application Performance Management" Suite for z/OS® – May 1st 2014

Compuware Workbench V4.0 is now a comprehensive, open standards-based, extensible, environment streamlining these common mainframe tasks with its modern, intuitive GUI support, inbuilt help, and low footprint, and is offered FOC to Compuware host tool licensees. Especially helpful for newer and younger mainframe staff, Compuware Workbench also helps experienced host developers get more done faster.

This Review Period thus saw a stronger, broader set of advances across Compuware's Mainframe Solutions portfolio, with creditable new release numbers, and effective completion of this now-comprehensive Compuware Workbench Eclipse GUI solution.

Compuware's Mainframe Solutions customers will now, no doubt, anxiously await details of what impacts the now under-review split of the company *(into two companies)* will have on them, their tool investments, and staff relationships, etc. If the transition is well-handled, the result could be a positive outcome for this major group of enterprise customers.

Serena Software

In our PD tools context, Serena long offered its compact **Serena StarTool® suite** of PD tools for z/OS® along with its popular **Comparex®** host file comparison product. It describes and positions these as "mainframe IT operations and application development productivity tools". The suite's products are named and described in our Figure C3 table on page 73.

This is a compact, **four-family, seven-product** SKU partial mainframe PD tools suite of **file and data management** *(VSAM, DB2®, IMS™)*, **dump analysis and problem diagnosis** *(CICS® & Batch)*, **mainframe I/O optimization**, and **host file comparison**, tools for z/OS®. These were *(mainly)* rebranded products first introduced from 1981 to 2000 *(by original developers and later acquired by Serena)*.

Again, **no new products** have been added, nor any deleted, since our since our prior 4th Ed. WP 03.11 review. These products offer only traditional ISPF-style, 3270-green screen interfaces, with **no modern GUI options** provided.

The tools suite products are integrated with Serena's flagship **Serena® ChangeMan® ZMF** mainframe software change and configuration management ***(SCMM)*** host development infrastructure tool, fairly widely-used at large mainframe sites. Serena's PD suite products above were often sold as complementary add-on tools around primarily ChangeMan® ZMF sales.

...no modern GUIs have been offered for this PD tools suite, placing it now far behind all the four other competitors reviewed on this vital factor.

As shown in our Figure C3 footnotes, Serena Software shipped **7 minor releases** and **4 MRU increments**, for this PD suite over our 40-month Review Period, **totaling 11 advances** – 1.6 advances/suite product, none major releases – and so providing moderate, primarily suite currency advances and fixes. As noted above, **no modern GUIs** *(neither Eclipse-based nor web-browser based)* have yet been offered for this PD tools suite, nor announced, placing it now **far behind** all the four other competitors reviewed on this now-vital factor. *(Serena does now offer an Eclipse-GUI workbench or RDz™ plug-in, plus a native Windows (ZDD) UI tool, interface for host ChangeMan® zMF functions in its Serena® ChangeMan® ZMF Client Pack, so has some relevant experience.)*

Serena website PD suite product information, and available fact sheets, were slightly improved since our last Review, but remain relatively sparse versus its competitors' equivalents, and all release/support information is hidden – for customers only!

...this remaining small Serena PD suite must be deemed a basic offering and not comparable in suite breadth, functionality, or depth, with the other four reviewed here...

After earlier product removals *(see Figure C3 footnotes)*, this remaining small Serena PD suite above must – in 2014 – be deemed a **basic offering** and not comparable in suite breadth, functionality, or depth, with the other four reviewed here, reflected in our low **Section 6 score and ranking**. It is also evident that vendor R&D investment into this suite has again been modest over our Review Period. This PD suite undoubtedly still generates high profit margins and is a useful **"cash cow"**, funding Serena's more core focuses.

Macro 4 division, UNICOM Global

Macro 4's mainframe **Application Availability tools** provide application fault analysis, application debugging, its **Data Manipulation** tools offer file/data management for mainframe z/OS® environments, and its **Performance Management** line offers modern cross-platform Java™ application and infrastructure performance management, including mainframe back-end APM *(our focus here)*. The suite's products are listed and described in Figure C4 *(on pages 74 & 75)*. This table also included main enhancements, and the numbers of "significant release" and "increments" advances shipped, for each product over our 40-month Review Period. *(See also Figure C4 footnotes)*. This Macro 4 PD tools suite today comprises an expanded **14-product line-up** with **3 new products added** *(one major)* since our 4th Ed. WP 03.11.

"Serena™ StarTool® " IT Ops & App. Dev. Productivity Improvement Tools; & Comparex" for z/OS® – May 1st 2014

Product Family/Product:	Product Description *(Year first introduced)*	Current Release
Serena™ StarTool® FDM	Mainframe file and data management tool line that offers easy editing, safe test data generation, copybook editing, and simplified data security. Improves developer productivity by automating many previously manual tasks *(1989.)*	
FDM Comprehensive VSAM Editing Base Product	Serena® StarTool® FDM file editing and data management for VSAM, PDS, SDSE, IAM, and sequential/flat-file z/OS® data sets, with comprehensive editing. Can create test files without programming. # V7.R7.2, V7.R8 *(GA 7.14)*	V7R8
FDM Option for DB2®	Serena® StarTool® FDM comprehensive file and data management for DB2®, with powerful editing, an SQL builder, data extraction into subset tables for test data creation, an interactive SQL process, and a full range of catalog reporting options. # V7.R7.2, V7.R8 *(GA 7.14)*	V7R8
FDM Option for IMS™	Serena® StarTool® FDM comprehensive file and data management for IMS™, with powerful editing, a simple ISPF-like interface, ease-of-use, and improved productivity in the complex IMS™ environment. # V7.R7.2, V7.R8 *(GA 5.8.14)*	V7R8
Serena™ StarTool® DA	Full-featured dump analysis, diagnosis & management capabilities for mainframe system and transaction abends with extensive analytical and diagnostic capabilities. *(1995.)*	
Serena™ StarTool® DA CICS®	Helps analysts find cause of a CICS® abend, automating dump reading & analysis process, displaying failing instruction, & presenting all failure-relevant information. Cuts time needed to solve even complex CICS® problems. *(1995.)* # V5.R7.1,V5.R7.2.1	V5R7.2.1
Serena™StarTool® DA Batch	Batch dump management capabilities for system and batch application abends, supporting COBOL or Assembler programs, helping reduce application downtime. Also supports dump analysis for applications using DB2® or IMS™ databases *(1995.)* # V5.R7.1, V5.R7.2.1	V5R7.2.1
Serena™® StarTool® IOO	Automatically tunes z/OS® application I/O operations for maximum throughput, using intelligent, industry-accepted tuning rules-of-thumb. Supports VSAM, QSAM, BSAM, and EXCP datasets. Claims to reduce application run times by up to 50%. *(1987.)* # V3.2	V3R2
Serena™® Comparex®	Popular, powerful, any-to-any mainframe files comparison tool. Compares contents of any two libraries, directories, files, or databases – across all file types and all mainframe database systems. Makes design changes faster/easier, frees up developers. Often used in conjunction with Serena® StarTool® FDM. *(1981.)* # V8.R7, V8.R7.1, V8.7.1.01 *(GA 05.08.14)*	V8R7.1.01

Notes:
4 product families, 7 products/SKUs, 1 more than in our 4th Ed. WP 03.11.
Three or four-level release naming, e.g: Vw *(Major)* .Rx *(Minor)* .ly *(Increment)*, or adding .Mz *(Maintainence roll-up)*.
Two new product releases in Beta at our 5.01.14 Review Date were included, GA dates noted.
Over our 40-month Review Period, Serena shipped 7 minor releases, 4 increments, & some maintenance roll-ups, a suite total 11 releases or increments, on average 1.57 per product.
Serena® StarTool® products also distributed by ASG under OEM deal, in ASG's "PD Tools" line.
Serena® StarTool® ADT *(mainframe debugging tool)* website-offered Aug. 2006, no longer shown since our 2nd Ed. WP 07.07.
Serena® StarTool® APM *(host application performance management)* website-offered Aug 2006, no longer shown since our 2nd Ed. WP 07.07.

Figure C3: "Serena® StarTool® IT Ops. & App. Dev. Productivity; & Data Comparison" Suite for z/OS® – May 1st 2014

Macro 4 Mainframe "Fault Analysis & Testing, Data Manipulation; & Performance Management Solutions" Suite – May 1st 2014		
Product Family/ Product	**Product Description**	**Current@ Version**
	z/OS® Fault Analysis	
DumpMaster	Quickly identifies & resolves z/OS® application errors via automated, high-performance dump analysis for Assembler, COBOL, Enterprise COBOL, PL/I, Enterprise PL/I, C and C++. DumpMaster supports Batch, CICS® Transaction and System Dumps, WebSphere® MQ abends, IMS™ abends, & DB2® abends. Enhanced by new Eclipse interface and advanced web interface, C and C++ support, zIIP enablement, 64 bit storage support, zEC12™ hardware – z/OS® 2.1, CICS® TS V5.1, COBOL 5.1 support. 2 significant releases, 11 increments.	**8.100J**
TraceMaster	Interactive source-level code tracing, debugging & program error testing/fixing tool. Tracing environments supported are Batch programs *(foreground & background)*, IMS™/DC, BTS, and DB2® Stored Procedures. Languages supported are Assembler, COBOL, Enterprise COBOL, PL/I, & Enterprise PL/I. Enhanced by new Eclipse interface and advanced web interface, significant usability improvements, CICS OPENAPI/OTE support, SMF usage stats, zEC12™ hardware – z/OS® 2.1, CICS® S V5.2, COBOL 5.1 support. 2 significant releases, 8 increments.	**6.500C**
TraceMaster CodeTrack	TraceMaster family member providing CICS® storage violation detection/management & CICS® path analysis. The latter shows how often each CICS® instruction is executed, the former advance detects any attempts to store data outside that owned by the application. Easy upkeep, accurate reporting, inclusion & exclusion list functions, & redundant code detection, are features. Enhanced by AMODE 64 tracking, zEC12™ hardware – CICS® TS V5.1, COBOL 5.1 support. 2 significant releases, 10 increments.	**1.600F**
M4Explorer	Web interface-productivity tool for Macro 4 Application Availability suite. Allows easy, intuitive, faster web browser-based application abend & application fault tracing with a common look & feel across both disciplines. Enhanced by usability improvements, zEC12™ hardware – z/OS® 2.1, CICS® TS V5.2, COBOL 5.1 support. 3 significant releases, 14 increments.	**3.700B**
	z/OS® Data Manipulation	
InSync	A comprehensive, flexible file & data management solution, providing fast, easy access to key mainframe applications data. It helps users correct data errors, create test data from multiple sources *(including DB2® & IMS™ data)*, & enables users to create, move, convert, reformat & validate the data with an ISPF-like interface. Enhanced by new Eclipse interface, usability improvements, Data Privacy improvements, zEC12™ hardware – z/OS® 2.1, COBOL 5.1, DB2® V10 and IMS™ V12 support. 2 significant releases, 18 increments.	**6.500F**
InSync for IMS™ Online	General-purpose data manipulation utility, offering standalone edit & browse capabilities for/from the IMS™/DC environment *(without TSO use)*. Enhanced by usability improvements, zEC12™ hardware - z/OS® 2.1 support. 2 increments.	**4.200G**
InSync DBA	DB2® catalog management tool providing easy, precise navigation around DB2® catalog tables, with online help and intuitive point-and-shoot facilities for plan, package and DBRM management services. Generates DB2® utility control statements and JCL, and performs detailed object management. Enhanced by usability and performance improvements, enhanced DB2® capabilities, generation of DDL for hierarchy of objects, zEC12™ hardware – z/OS® 2.1 support. 1 significant release, 5 increments.	**2.800D**
	Application Performance Management *(APM)*	
FreezeFrame	Comprehensive, easy to use & understand, cost-effective, APM solution for z/OS®. Measures & reports on application performance and system resources in z/OS® Sysplex environments. Supports Batch, CICS®, DB2®, IMS™, Adabas, WebSphere® MQ, and UNIX System Services subsystems, plus Assembler, COBOL, Enterprise COBOL, PL/I, Enterprise PL/I, C, C++ and Java languages. Enhanced by new Eclipse interface, usability improvements, zEC12™ hardware – z/OS® 2.1, CICS® TS V5.2, COBOL 5.1 support. 3 significant releases, 19 increments.	**5.300D**
ExpeTune*	ExpeTune complements FreezeFrame, using its output. ExpeTune provides extensive performance analyses, highlights system, application & transaction areas where tuning would be beneficial, and gives guidance on best solutions. Uses rules-based expert systems technology. Supports main z/OS® – MVS subsystems, e.g. DB2®, CICS®, IMS™, COBOL, PL/I and VSAM, and has improved zIIP & zAAP support. Enhanced by usability improvements, zEC12™ hardware – z/OS® 2.1, CICS® TS V5.2 support. 1 significant release, 10 increments.	**4.100F**
ExpeTune DB	DB2® performance management solution to help users understand & explain DB2® performance. Shows current Dynamic SQL performance statistics, with low impact, so can be used in production and development. Allows "what if" to highlight effect of rebinding static SQL. Enhanced integration with FreezeFrame & DB2® subsystem improvements added. Enhanced by usability improvements, zEC12™ hardware – z/OS® 2.1support. 1 significant release, 6 increments.	**4.100L**
SUPERMON® for Java	A newer-generation, cross-platform Java EE™ APM solution. Adds cross-platform capabilities to the System z™-focused FreezeFrame & ExpeTune. Fault analysis portal/browser approach enables role-based perspectives, & collaborative team working. Supports IBM WebSphere® Application Server *(WAS)*, Oracle WebLogic Server, JBoss Application Server, & Apache Tomcat. Enhanced by 64-bit z/OS® JVM Extractor, EJB 3, JBoss 5 and 6, and Java 7 support, native LDAP authentication support, Trend-lines capability for charting, and usability improvements. 2 significant releases, 7 increments.	**1.200B**

Continued on next page...

...continued from previous page.

Macro 4 Mainframe "Fault Analysis & Testing, Data Manipulation; & Performance Management Solutions" Suite – May 1st 2014		
Product Family/ Product	**Product Description**	**Current@ Version**
	Eclipse Environment Products	
M4WorkBench New product	M4Workbench is a ready-to-go Eclipse framework for managing the entire System z™ application lifecycle, from code editing, through testing and performance tuning, to fault analysis and recovery in the live production environment. All Macro 4 Eclipse functionality is available through standardized graphical interfaces that are integrated within M4Workbench. They are also fully compatible with other Eclipse frameworks. Macro 4's Eclipse interfaces offer a new way to access powerful, long-established mainframe applications: DumpMaster, TraceMaster, InSync, FreezeFrame and Tubes. These are complemented by M4SlickEdit, for code editing, and z/Explorer, which offers a range of JES and dataset administration functions plus 3270 terminal emulation. 3 significant releases, 12 increments.	**2.1.0**
z/Explorer New product	z/Explorer saves users time by accessing mainframe datasets and members directly from Eclipse. Files can also be downloaded to the user's desktop – for emailing to colleagues, for example. On file selection, z/Explorer automatically launches M4SlickEdit *(or users' chosen text editor)*, for convenient browsing and editing. z/Explorer provides direct JES spool access, allowing submission of mainframe jobs from Eclipse – like application compilations, test jobs and deployment tasks – and the viewing of resulting output. JCL output can be edited, modified and resubmitted directly to JES. z/Explorer users can also view the JES2 and JES3 system logs to monitor active jobs, while system activity can be managed by monitoring the console log and issuing console commands. For Eclipse users needing access to mainframe 3270 applications, z/Explorer provides a 3270 terminal emulator, allowing users to log into their 3270 mainframe applications within Eclipse. This eliminates additional 3270 emulation software, reducing software license and maintenance costs significantly. This 3270 terminal emulator is fully configurable, allowing user-defined keyboard mapping, code page, font, color and screen size, and can be used alongside Macro 4's powerful 3270 session management product, Tubes, enabling single sign-on, centralized administration and mainframe security. 2 significant releases, 3 increments.	**1.1.0**
M4SlickEdit New product	M4SlickEdit is an intelligent code editor supporting over 40 different programming languages, including COBOL, PL/1, Assembler, JCL, REXX and other mainframe languages. M4SlickEdit is fully integrated into the z/Explorer interface to allow seamless editing of mainframe source code and JCL without the need for direct access to the mainframe environment. When you select a program, z/Explorer invokes M4SlickEdit, ready to start editing the code in the correct language. M4SlickEdit has many time-saving features to help busy developers write code faster, and with fewer errors, directly from Eclipse. Bookmarks can be used to navigate your code base faster; automated syntax expansion, auto-completions and code templates minimize typing and a built-in beautifier helps you produce more readable code with better spacing. 2 significant releases, 3 increments.	**3.7.1**
Macro 4's suite above had 14 products at May 1st 2014, in 4 domains, as shown above. 3 products *(Eclipse Environment Products above)* added new since our prior 4th Ed. WP 03.01.11. Macro 4 Tubes popular host multi-session manager product is a complementary offering to this PD suite. Main enhancements added in our Review Period *(01.01.2011 to 05.01.2014)* are noted. Numbers of "significant" & "increment" releases shipped in our Review Period shown for each product. 25 "significant" releases shipped for 12 products, a 1.8/suite product average, shipped in Review Period. Also shipped 128 "increments" for 14 products in our Review Period, 9.1 increments/suite product. "Significant releases" are GA releases, equivalent to other vendors' "major and minor" releases together. Macro 4 "increments" are finer-grain, rolling updates *(MRUs)*, often advancing by 1+ IBM subsystem release. Macro 4 "Increments" are thus of similar level to IBM RSU, CA RS, and other vendor MRU, inter-release updates. Macro 4 tests its above product releases/increments against the IBM GA , and any Early Availability, releases. Fully electronic software and documentation distribution enables this granular approach.		

Figure C4: Macro 4 Application Availability & Application Performance Solutions for z/OS® – May 1st 2014

Over our Review Period, Macro 4 delivered **25 significant releases** *(major plus minor)*, **plus 128 increment** *(MRU)* advances across this now-14-product suite. This gave an average of **1.8 significant releases**/suite product, plus an average of **9.1 increments**/suite product in our Review Period, healthy rates of advance for this suite.

Macro 4 had implemented **standardized installation processes** *(to the IBM standard SMP/E mainframe install)* in most suite products *(except ExpeTune family)* by our Review Date. These, combined with its Electronic Software Distribution *(ESD)*, save Macro 4 customers support time and effort, yet provide fast delivery of its new releases and MRU increments *(for product fixes, currency updates, etc.)*

In our Review Period, Macro 4 made **major GUI interface advances** by introducing *(mid-2011)*, and since greatly expanding, the **M4Workbench**. This product now provides **modern**, **easy-to-use**, secure, **Eclipse-based GUI workbench access** to core services of the primary Macro 4 host PD tools, via Eclipse plug-ins for each of those host products. The M4Workbench Eclipse GUI plug-ins now offered are:

- **For DumpMaster**, Macro 4's **host dump analysis** – application **program fault analysis** tool services, improving productivity and usability.
- **For TraceMaster**, the Macro 4 **source-level code tracing, debugging**, and program testing/fixing tool, speeding and simplifying batch tracing.

- **For FreezeFrame**, Macro's z/OS® **application performance measurement** and reporting tool for host APM, enabling the rapid emailing, and/or export of host performance reports and extracts – with note annotations – for better communication.
- **For InSync**, the Macro 4 **data management and manipulation tool**, offering easier and faster host file and dataset browsing and editing.
- **M4SlickEdit**, providing **smart program source code editing** with the well-rated, advanced SlickEdit editing functionality *(chargeable)*.
- **z/Explorer**, delivering secure GUI workbench access to **z/OS® host datasets and members, JES job submission** and results output viewing, and zero-cost 3270 terminal emulation.
- **For Tubes:** Macro 4's secure and flexible multiple host session management tool. *(Not a PD Tool suite member.)*

M4Workbench is shipped with these plug-ins ready installed, and is provided free of charge *(except for M4SlickEdit option)* to Macro 4 licensed customers running the Eclipse-enabled host product versions. The plug-ins are also compatible with, and can be supplied for installation into, other Eclipse RCP workbenches that Macro 4 customers may also be using, e.g. IBM RDz™, IBM CICS® Explorer, etc.

This **now broad Eclipse GUI workbench support** across the Macro 4 host suite is a **welcome major advance** for the suite's users, now offering broad GUI support over primary PD suite tools. The inclusion of GUI support for basic z/OS® services access with inclusive *(FOC)* 3270 emulation, GUI support for the firm's popular Tubes multiple host session manager companion tool, and the option of zExplorer-integrated, high function program editing with the M4 SlickEdit option, round out this full GUI solution for all developers, etc. using PC workstations for their host PD tools access.

Macro 4 also offers its well-proven Web-portal-based, modern browser UI functionality with **M4Explorer** and fault analysis portal host functionality, and **SUPERMON® for Java™** *(previously known as Application Performance Portal)*, described in Figure C4, which have built-in role knowledge and support, plus intelligent diagnostics. This low footprint, **"thin-client" approach** requires no desktop software downloads/installs, and allows developers to work from any location, PC, **or mobile device**, onto their firm's System z™ host itself over the Web, via their Hypertext Transfer Protocol *(HTTP)* Server for z/OS® support.

Macro 4 enabled both modern UI solutions above by refashioning its primary host PD tool functions to become SOA services...

Macro 4 enabled both modern UI solutions above by – a few years ago – refashioning its primary host PD tool functions to become **SOA services**, callable from either a M4 Workbench Eclipse RCP "fat-client", or from the Web portal "thin-client", UI solutions. Combined, these approaches provide **comprehensive, economical, modern GUI access** and support for the firm's host PD tools suite that support younger 'zNext generation' staff unfamiliar with mainframe ISPF/3270. They also offer higher productivity – by speeding host fault event resolution and performance management – for experienced staff too.

Overall, Macro 4 has **delivered an impressive slate** product new releases and MRU increments, as well as the **full Eclipse GUI solution** detailed above, for its z/OS® PD tools suite over our 40-month Review Period. It has again **maintained high currency** levels with advancing IBM host subsystem releases and hardware changes, and added other usability, functionality, and performance, enhancements.

Joining still-growing UNICOM® Global five years ago seems to have worked well for Macro 4... from these findings, we consider the outlook for the company is thus a firmly positive picture.

Joining still-growing UNICOM® Global five years ago seems to have worked well for Macro 4, private status bringing cost savings, enabling strong R&D delivery performance above, also offering new UNICOM® Global locations along with several valuable acquired product synergies. From these findings, we consider the outlook for Macro 4 is thus a firmly positive picture.

Help from Vendors and Users Much Appreciated

Software Strategies again thanks all staff involved from CA Technologies, Macro 4 *(UNICOM® Group)*, and IBM Corporation, for their active participation – and timely inputs/responses – that greatly aided our research for this new 2014-outlook 5th Edition White Paper. These vendor's experts kindly provided in-depth briefings and information on their latest PD tools suite advances/new releases. They also shared their z/OS® tools market insight and experience, which we reflected throughout this new Edition. As in every such competitive software market segment, we found much consensus but some opinions naturally divergent. This Paper's final contents, assessments, and recommendations are thus those of Software Strategies alone.

Related Software Strategies IBM Mainframe Research

Our four prior Editions of this White Paper were cited in point 23 on page 6. Our previous *(2011)* 4th Editions are detailed below with a couple of other examples of our System z™ mainframe research:

1. **"In New zEnterprise® System Era, IBM z/OS® Problem Determination Tool Suite Leads Again – as ISVs Up Games – 2011 Strategic Competitive Analysis"** – Executive Summary, March 2011, 8 p.p., 5 charts/tables.
2. **"In New zEnterprise® System Era, IBM z/OS® Problem Determination Tool Suite Leads Again – as ISVs Up Games – 2011 Strategic Competitive Analysis"** – Full White Paper, March 2011, 68 p.p., 18 charts.
3. **"IBM zEnterprise™ System Redefines Enterprise Computing – System-of-Systems Flagship Adds New Dimension"** – Executive Overview, July 2010, 28 p.p., 12 charts/tables.
4. **"Lean, Efficient IBM System z™ Mainframes Powered Caixa Galicia's Dramatic Growth, National Success – Bank's Transaction Costs 30% Below Spain's Average!"** – System z™ customer case study, February 2010, 16 p.p., 7 charts/tables.

About Software Strategies

Our firm specializes in research/analysis into enterprise systems hardware and software technologies, and their related economics. Best known are our widely-read, authoritative papers about the resurgent IBM mainframe, published between 2000 and 2014 – this our latest. Focused research underpins in-depth expertise on mainframes, servers, middleware software/tools platforms, and banking/financial applications – our main research areas. Since 1997, we have worked closely with industry-leader vendors, including: IBM; Unisys; Microsoft; Intel; Misys; FIS; CA Technologies; BMC; Stratus Computers; ICL *(Fujitsu)*; and others. Many tens of thousands of enterprise IT users worldwide have benefited from our scores of authoritative reports/white papers, and from our dozens of presentations at IT industry events, across many countries, since the firm was founded in 1997.

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This 5th Edition 2014 White Paper, published in August 2014, was again researched/written by Ian Bramley, Managing Director at Software Strategies, a respected enterprise IT infrastructure analyst. This new Edition was again based on Software Strategies' proprietary z/OS® PD tools research and mainframe, enterprise middleware software, and operating systems, expertise. Before starting this firm, Ian was Director of Enterprise Platforms at Butler Group *(later absorbed into Ovum)*. Earlier, he held executive roles with four international software/services firms over a successful prior 28-year IT industry sell-side career. His unusual mix – 1.5 decades of in-depth IT analysis after ~3 decades at large IT vendors – adds unique perspectives, and deeper insight, to his firm's research.

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