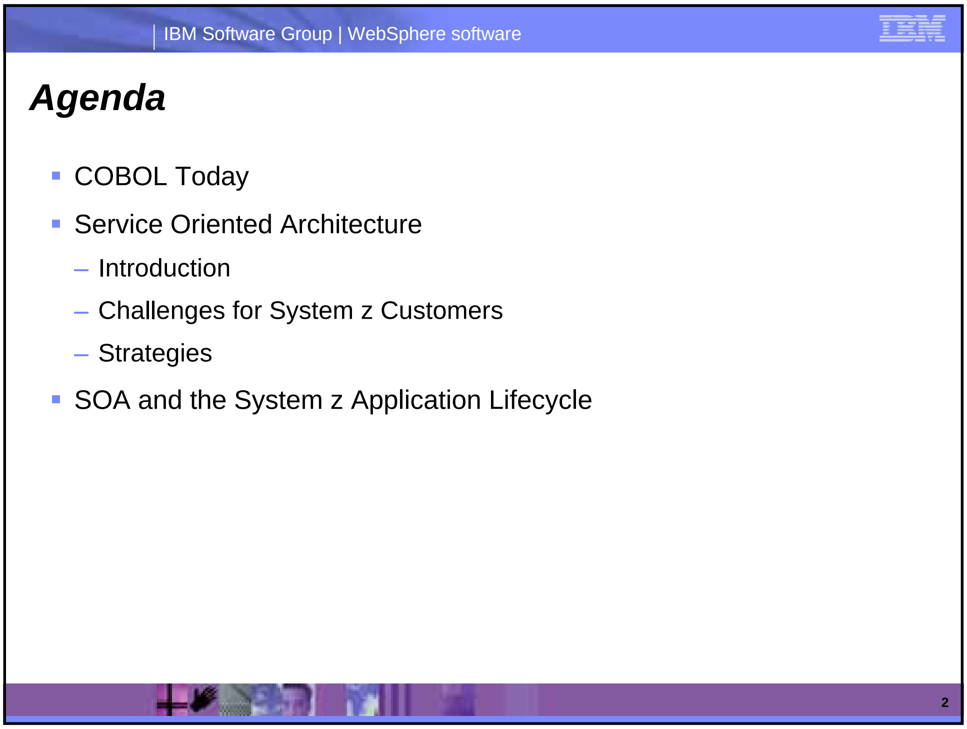
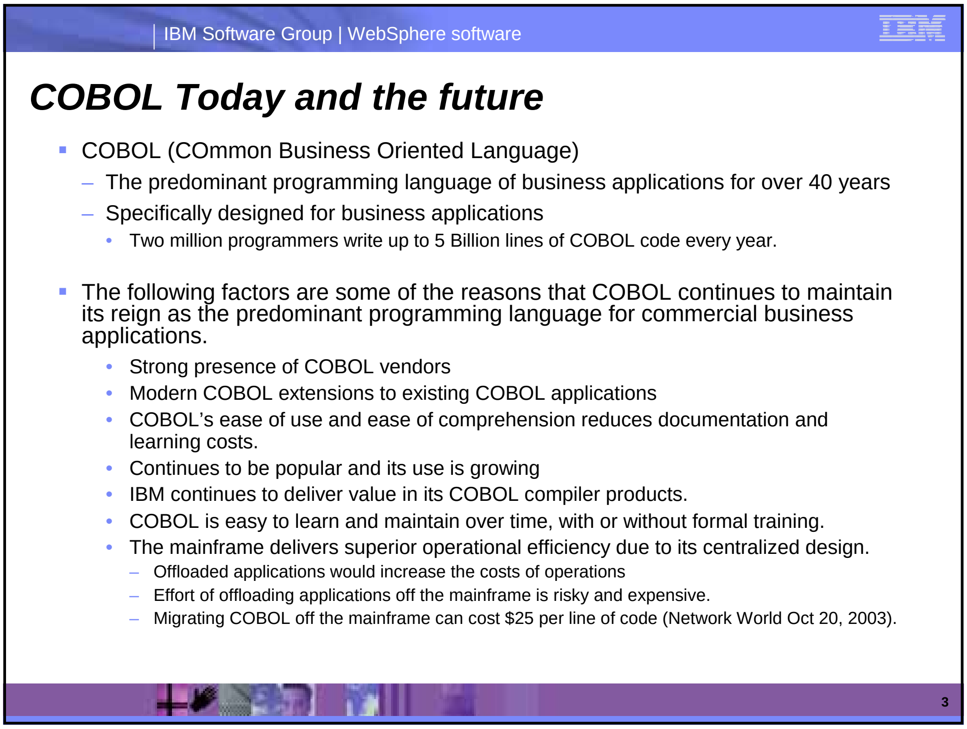
# Modern Application Architectures for COBOL Developers - An Introduction

WebSphere software



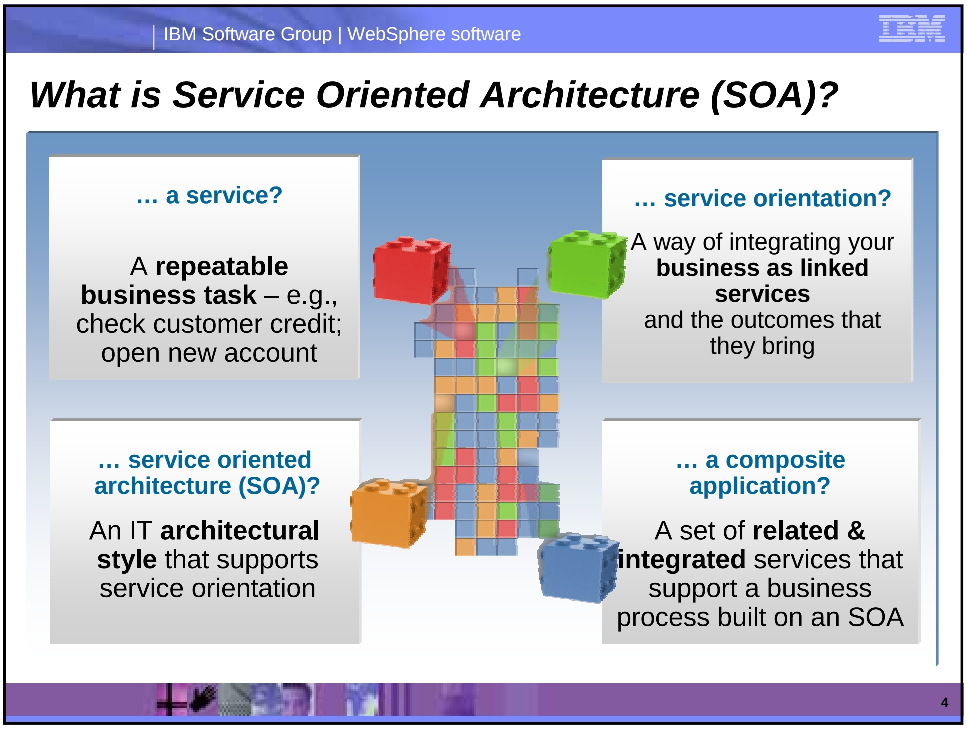
## Agenda

- COBOL Today
- Service Oriented Architecture
  - Introduction
  - Challenges for System z Customers
  - Strategies
- SOA and the System z Application Lifecycle



# COBOL Today and the future

- COBOL (COmmon Business Oriented Language)
  - The predominant programming language of business applications for over 40 years
  - Specifically designed for business applications
    - Two million programmers write up to 5 Billion lines of COBOL code every year.
- The following factors are some of the reasons that COBOL continues to maintain its reign as the predominant programming language for commercial business applications.
  - Strong presence of COBOL vendors
  - Modern COBOL extensions to existing COBOL applications
  - COBOL's ease of use and ease of comprehension reduces documentation and learning costs.
  - Continues to be popular and its use is growing
  - IBM continues to deliver value in its COBOL compiler products.
  - COBOL is easy to learn and maintain over time, with or without formal training.
  - The mainframe delivers superior operational efficiency due to its centralized design.
    - Offloaded applications would increase the costs of operations
    - Effort of offloading applications off the mainframe is risky and expensive.
    - Migrating COBOL off the mainframe can cost $25 per line of code (Network World Oct 20, 2003).



# What is Service Oriented Architecture (SOA)?

**… a service?**

A **repeatable business task** – e.g., check customer credit; open new account

**… service orientation?**

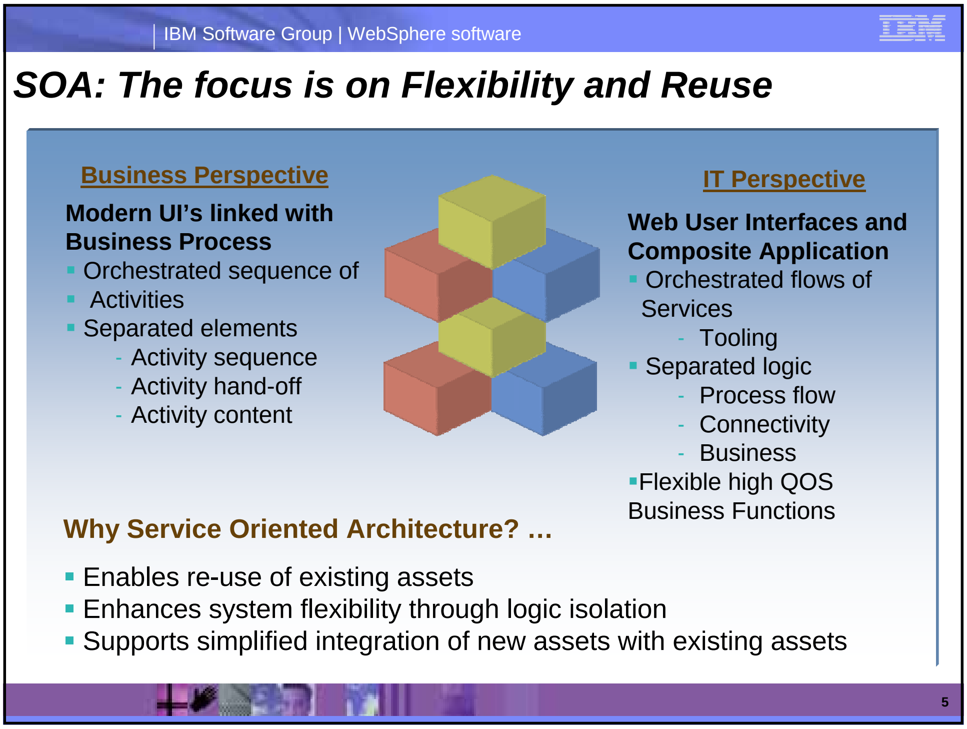
A way of integrating your **business as linked services** and the outcomes that they bring

**… service oriented architecture (SOA)?**

An IT **architectural style** that supports service orientation

**… a composite application?**

A set of **related & integrated** services that support a business process built on an SOA



# SOA: The focus is on Flexibility and Reuse

**Business Perspective**

**Modern UI's linked with Business Process**

- Orchestrated sequence of
- Activities
- Separated elements
  - Activity sequence
  - Activity hand-off
  - Activity content

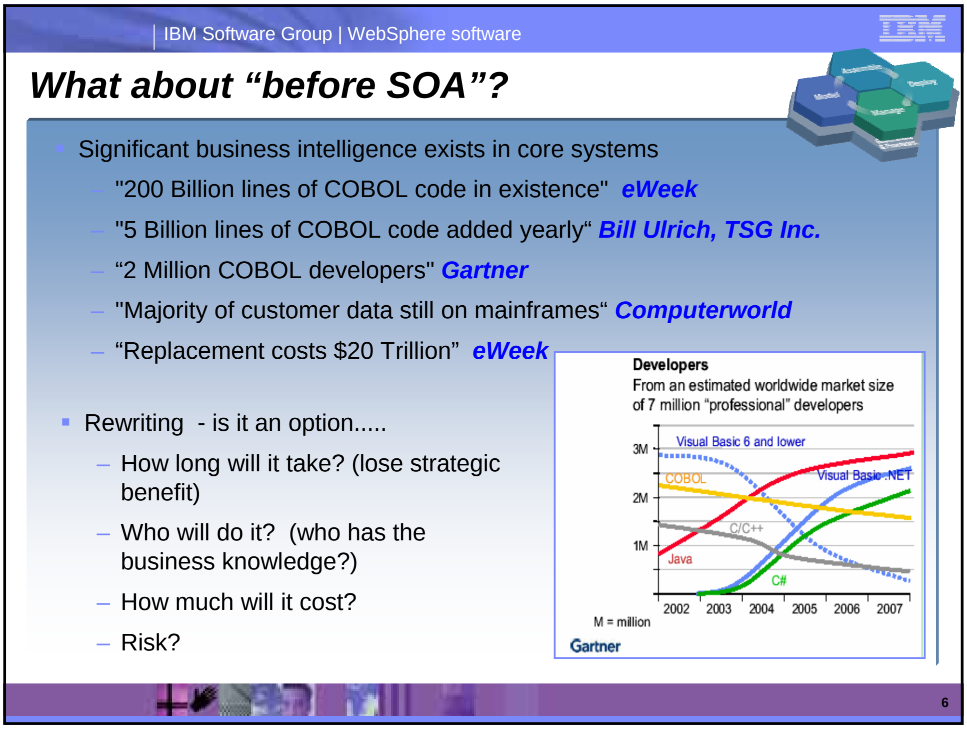
**IT Perspective**

**Web User Interfaces and Composite Application**

- Orchestrated flows of Services
  - Tooling
- Separated logic
  - Process flow
  - Connectivity
  - Business
- Flexible high QOS Business Functions

**Why Service Oriented Architecture? …**

- Enables re-use of existing assets
- Enhances system flexibility through logic isolation
- Supports simplified integration of new assets with existing assets



# What about "before SOA"?

- Significant business intelligence exists in core systems
  - "200 Billion lines of COBOL code in existence" ***eWeek***
  - "5 Billion lines of COBOL code added yearly" ***Bill Ulrich, TSG Inc.***
  - "2 Million COBOL developers" ***Gartner***
  - "Majority of customer data still on mainframes" ***Computerworld***
  - "Replacement costs $20 Trillion" ***eWeek***
- Rewriting - is it an option.....
  - How long will it take? (lose strategic benefit)
  - Who will do it? (who has the business knowledge?)
  - How much will it cost?
  - Risk?

**Developers**

From an estimated worldwide market size of 7 million "professional" developers

# Three Styles of Application Transformation

**Transform User Experience**

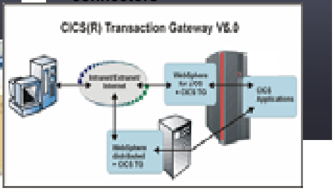
Enhance user interface and workflow for quick return on investment

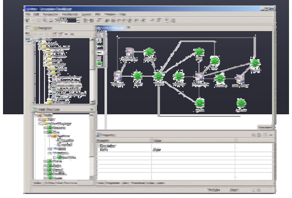
**Transform Application Connectivity**

Improve business processes and develop customer, partner and supplier relationships using Web services and Java connectors

**Transform Application Architecture**

Update and extend mission-critical applications as services, leveraging their core value in new ways


CICS(R) Transaction Gateway V6.0
Intranet/Extranet Internet
WebSphere for z/OS + CICS TG
CICS Applications
WebSphere distributed + CICS TG



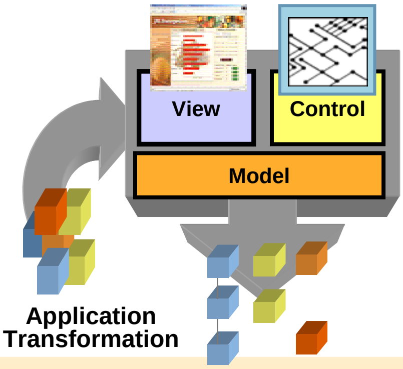
*Single integrated delivery vehicle across application transformation styles*

# Three styles of Application Transformation

**Transform User Experience**

**Transform Application Connectivity**

**Transform Application Architecture**



*Single integrated delivery vehicle across application transformation styles*

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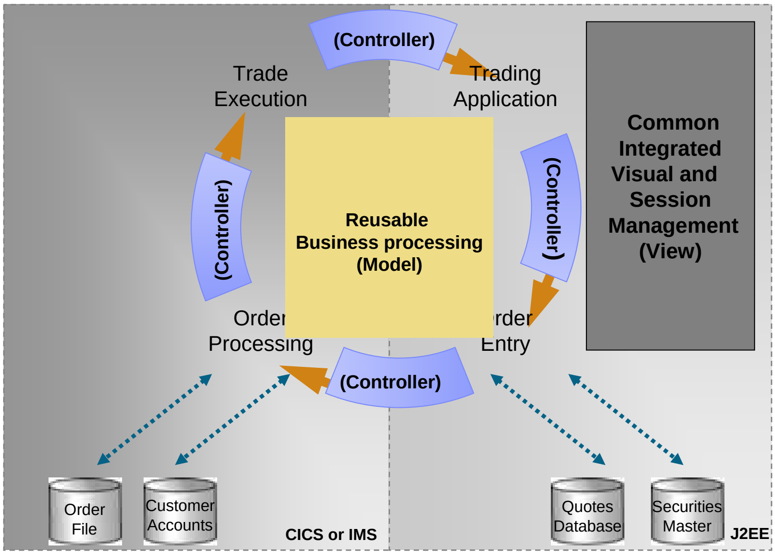
## Composite Workload *Application Components*



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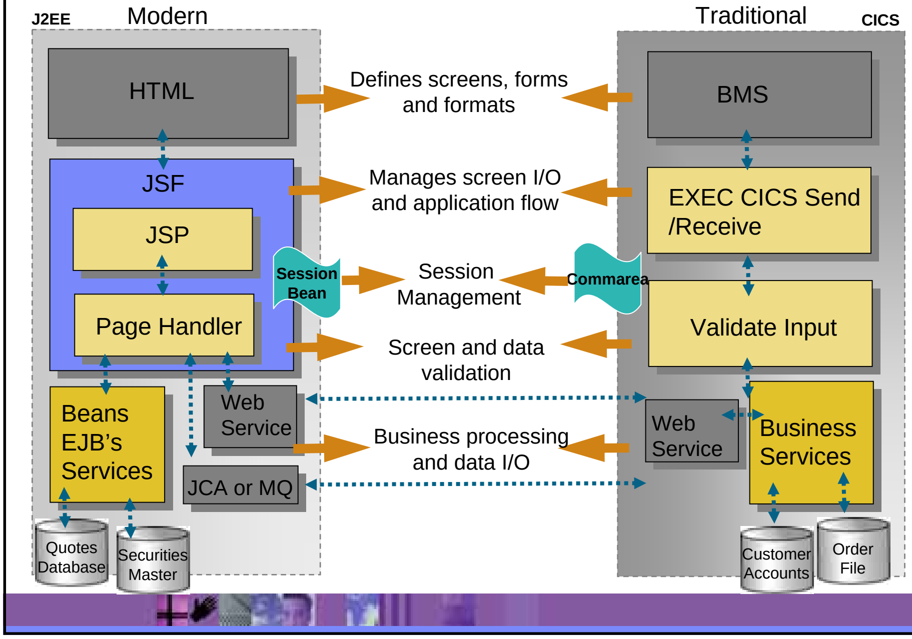
## *It's not that different*



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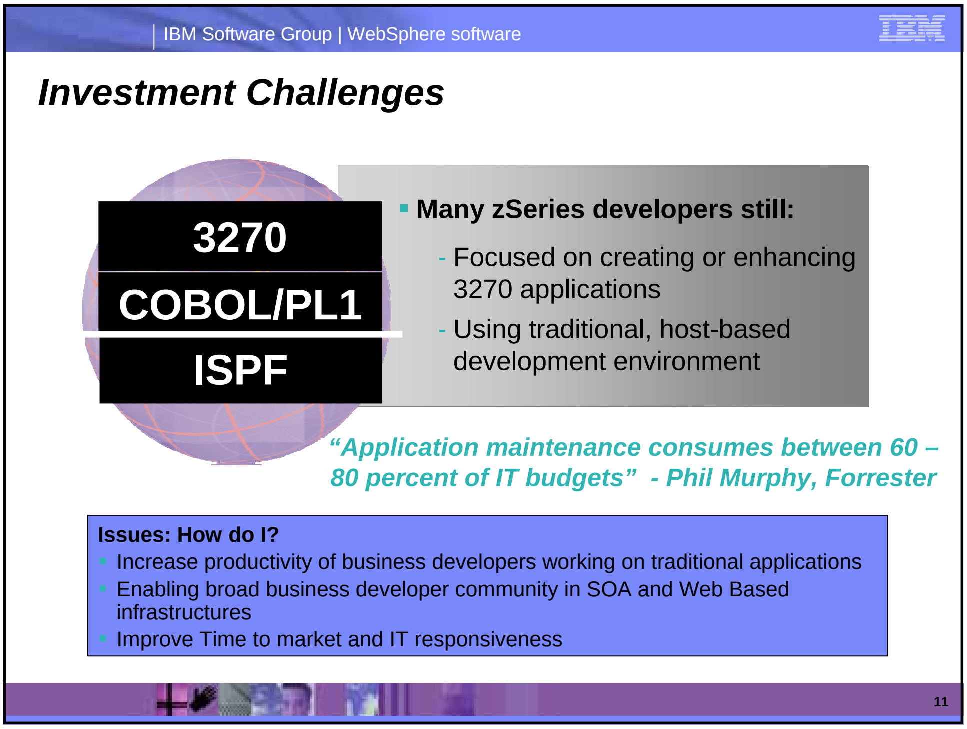

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## Investment Challenges

3270

COBOL/PL1

ISPF

- **Many zSeries developers still:**
  - Focused on creating or enhancing 3270 applications
  - Using traditional, host-based development environment

*"Application maintenance consumes between 60 – 80 percent of IT budgets" - Phil Murphy, Forrester*

**Issues: How do I?**
- Increase productivity of business developers working on traditional applications
- Enabling broad business developer community in SOA and Web Based infrastructures
- Improve Time to market and IT responsiveness

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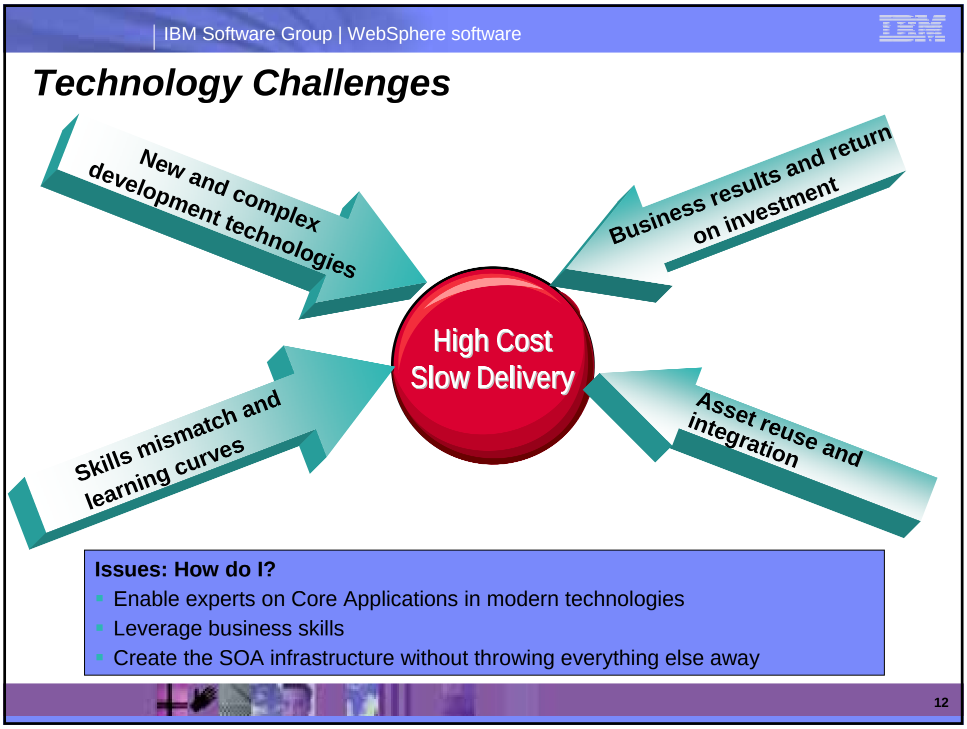

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## Technology Challenges

New and complex development technologies

Business results and return on investment

High Cost Slow Delivery

Skills mismatch and learning curves

Asset reuse and integration

**Issues: How do I?**
- Enable experts on Core Applications in modern technologies
- Leverage business skills
- Create the SOA infrastructure without throwing everything else away

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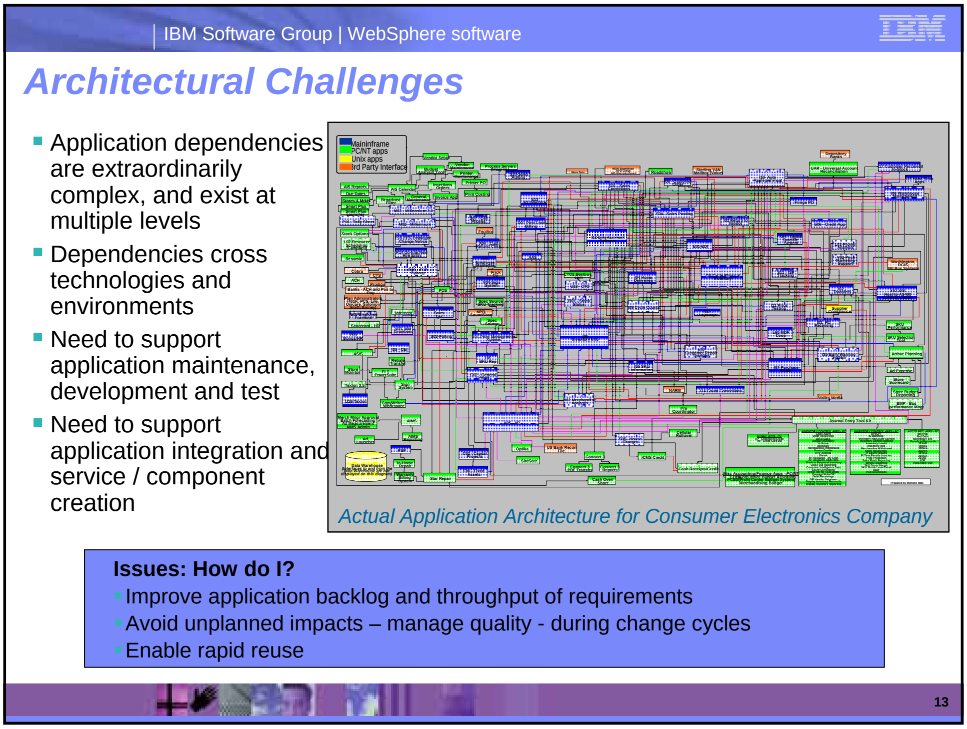

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## Architectural Challenges

- Application dependencies are extraordinarily complex, and exist at multiple levels
- Dependencies cross technologies and environments
- Need to support application maintenance, development and test
- Need to support application integration and service / component creation

Maininframe
PC/NT apps
Unix apps
3rd Party Interface

*Actual Application Architecture for Consumer Electronics Company*

**Issues: How do I?**
- Improve application backlog and throughput of requirements
- Avoid unplanned impacts – manage quality - during change cycles
- Enable rapid reuse

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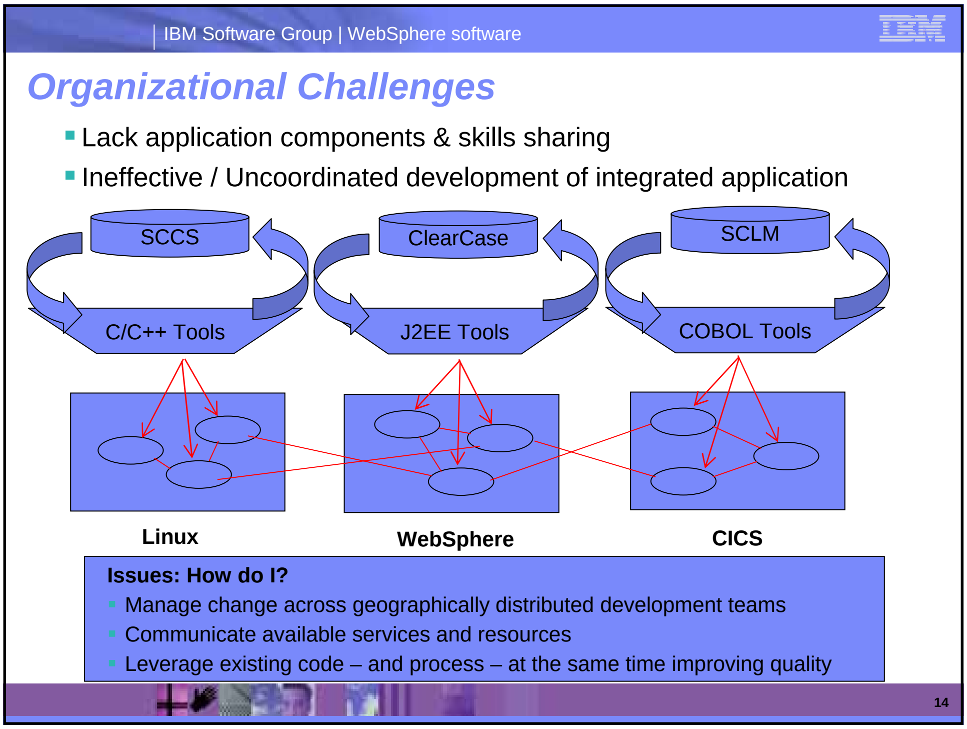

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## Organizational Challenges

- Lack application components & skills sharing
- Ineffective / Uncoordinated development of integrated application

SCCS
ClearCase
SCLM
C/C++ Tools
J2EE Tools
COBOL Tools
Linux
WebSphere
CICS

**Issues: How do I?**
- Manage change across geographically distributed development teams
- Communicate available services and resources
- Leverage existing code – and process – at the same time improving quality

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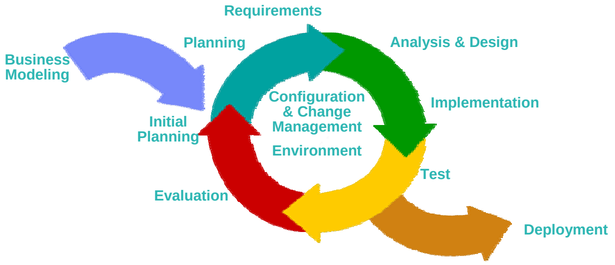
## *Strategy 1 - Bring iterative model driven development paradigms to composite applications*

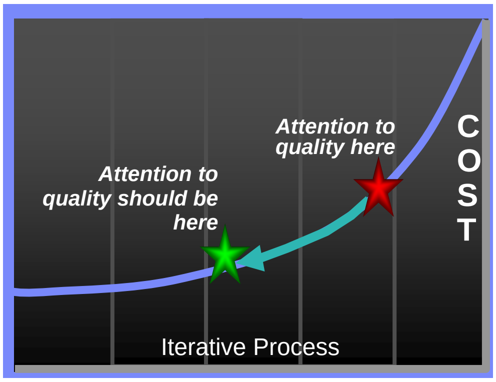


- Adopt a flexible process for both J2EE & traditional z/Series applications
- Tools integration across the lifecycle (Model and Discover, Develop and Assemble, & Deploy and Manage)
- Manage mixed workload requirements

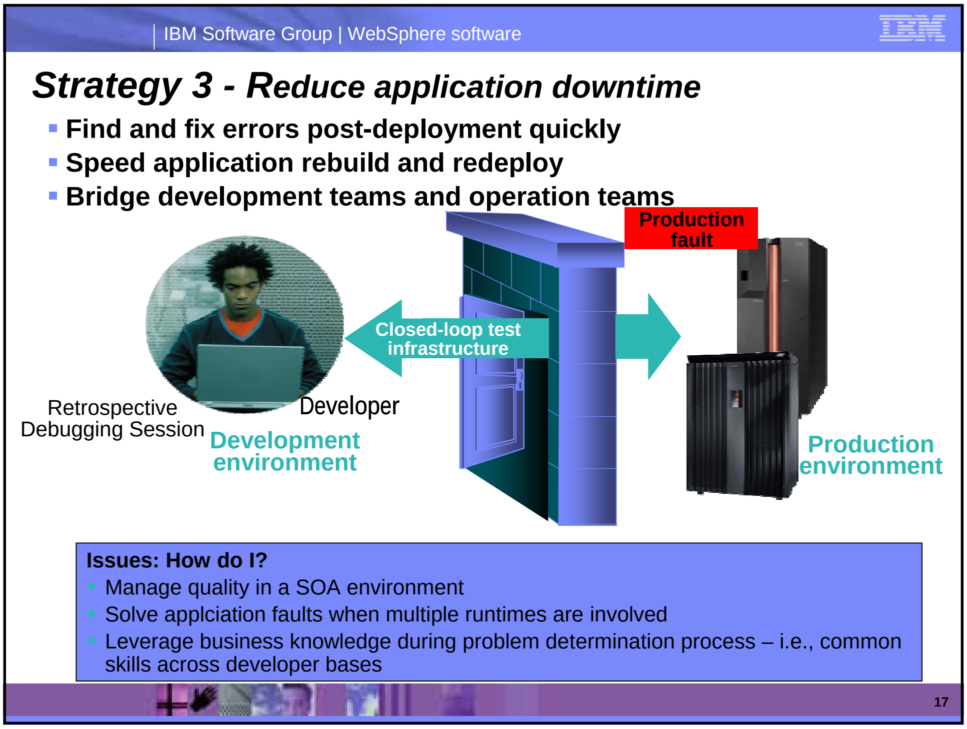
**Issues: How do I?**
- Leverage modern development techniques across broad developer organizations
- Generate complex SOA architectures, versus hand coding
- Improve documentation and speed the development to test cycle

## *Strategy 2 -Prevent, detect, diagnose and remove defects*

- Improve application quality and test process
- Provide early warnings of activities susceptible to failure
- Analyze across disciplines to understand root causes



**Issues: How do I?**
- Find problems in development, before system test and production
- Debug SOA applications cross programs, platforms, languages, etc.
- Perform risk analysis on quality of deliverables



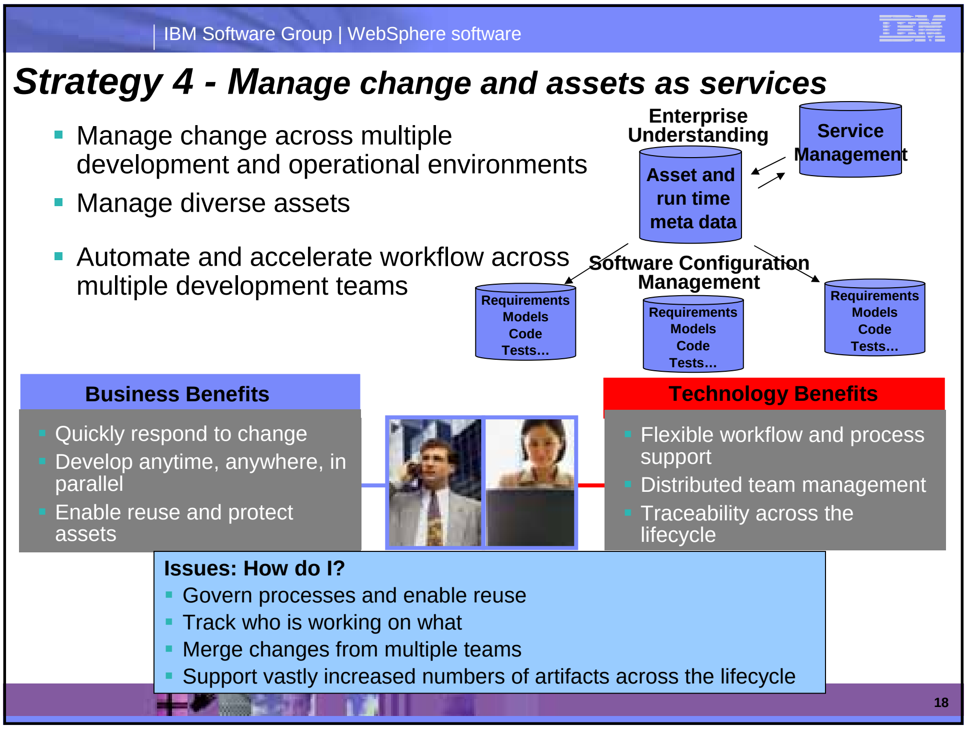
## *Strategy 3 - Reduce application downtime*

- **Find and fix errors post-deployment quickly**
- **Speed application rebuild and redeploy**
- **Bridge development teams and operation teams**

Production fault
Closed-loop test infrastructure
Retrospective Debugging Session
Developer
Development environment
Production environment

**Issues: How do I?**

- Manage quality in a SOA environment
- Solve applciation faults when multiple runtimes are involved
- Leverage business knowledge during problem determination process – i.e., common skills across developer bases



## *Strategy 4 - Manage change and assets as services*

- Manage change across multiple development and operational environments
- Manage diverse assets
- Automate and accelerate workflow across multiple development teams

Enterprise Understanding
Asset and run time meta data
Service Management
Software Configuration Management
Requirements Models Code Tests…
Requirements Models Code Tests…
Requirements Models Code Tests…

**Business Benefits**

- Quickly respond to change
- Develop anytime, anywhere, in parallel
- Enable reuse and protect assets

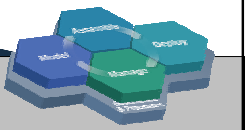
**Technology Benefits**

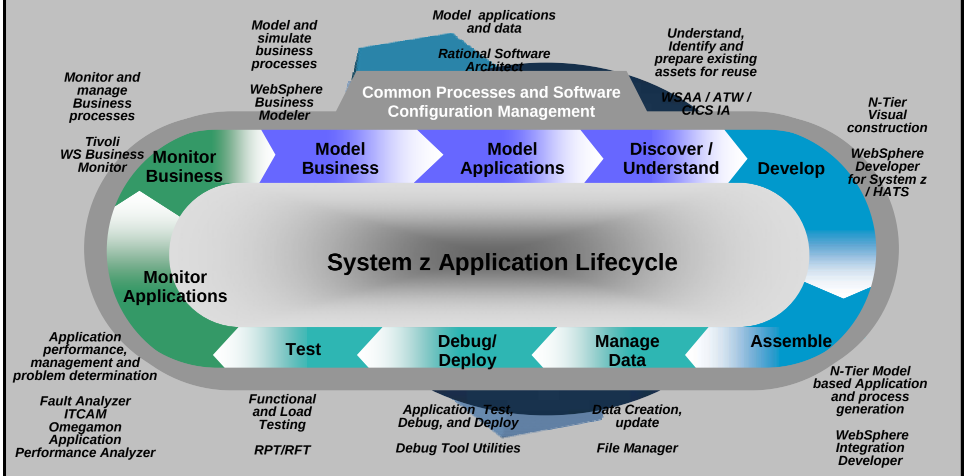
- Flexible workflow and process support
- Distributed team management
- Traceability across the lifecycle

**Issues: How do I?**

- Govern processes and enable reuse
- Track who is working on what
- Merge changes from multiple teams
- Support vastly increased numbers of artifacts across the lifecycle

# System z Application Lifecycle





System z Application Lifecycle

Common Processes and Software Configuration Management

Monitor Business — *Monitor and manage Business processes* — *Tivoli WS Business Monitor*

Model Business — *Model and simulate business processes* — *WebSphere Business Modeler*

Model Applications — *Model applications and data* — *Rational Software Architect*

Discover / Understand — *Understand, Identify and prepare existing assets for reuse* — *WSAA / ATW / CICS IA*

Develop — *N-Tier Visual construction* — *WebSphere Developer for System z / HATS*

Assemble — *N-Tier Model based Application and process generation* — *WebSphere Integration Developer*

Manage Data — *Data Creation, update* — *File Manager*

Debug/ Deploy — *Application Test, Debug, and Deploy* — *Debug Tool Utilities*

Test — *Functional and Load Testing* — *RPT/RFT*

Monitor Applications — *Application performance, management and problem determination* — *Fault Analyzer ITCAM Omegamon Application Performance Analyzer*

# Enabling a robust, flexible SOA runtime environment

*While maximizing the value of existing assets*

*Fully SOA capable!*

### WebSphere Application Server V6

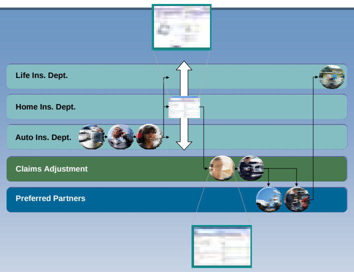
- Extend existing Java assets with support for Web Services standards and standards-based messaging
- Help ensure 24x7 availability of business-critical applications with clustering and high availability
- Build and deploy Web Services quickly and easily with rapid development and deployment features

### CICS Transaction Server V3.1

- Exploit provider/requestor Web service support for CICS assets, based on full Web service standards
- Extend the value of CICS transactions in a mixed language environment
- Build Web services from CICS transactions with no change to existing applications.

### IMS Transaction and Database V9

- Exploit Web service support for IMS assets, based on full Web service standards
- Extend the value of IMS transactions in a mixed language environment
- Build Web services from IMS transactions with no change to existing applications

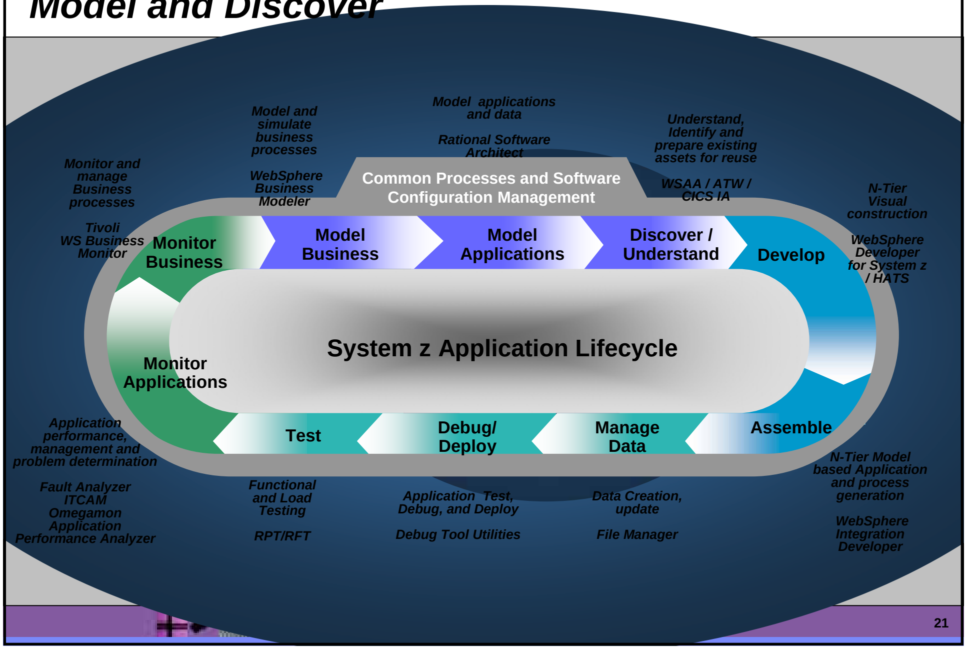


**#1 in market share for Application Server software**

**IBM WebSphere Application Server comes out on top**

**35+ years of maturity and innovation in transaction and data systems**

## Model and Discover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WebSphere Business Modeler
Model applications and data
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Understand, Identify and prepare existing assets for reuse
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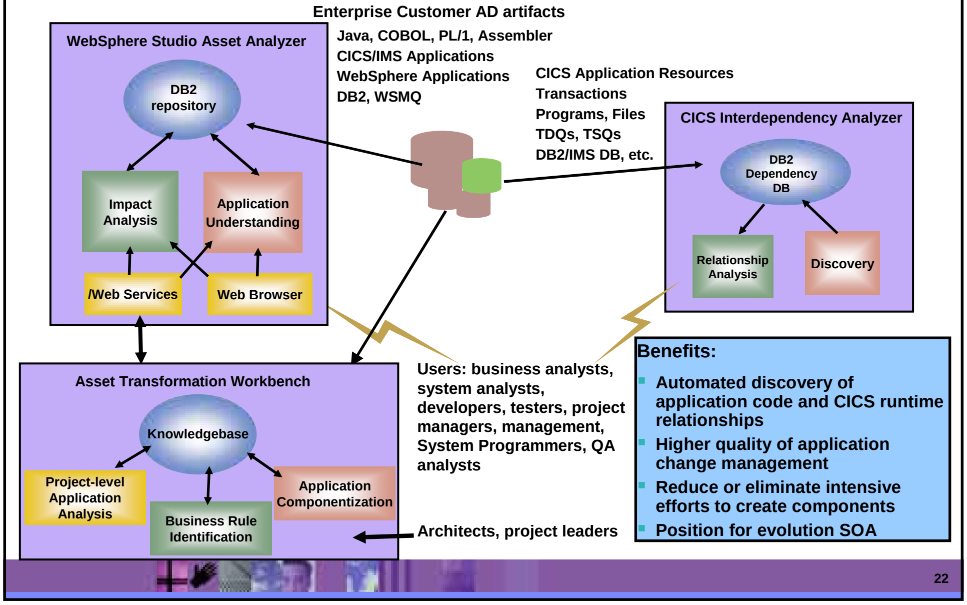
## Enterprise Access to Assets

### Speed application discovery, understanding and asset reuse


Enterprise Customer AD artifacts
WebSphere Studio Asset Analyzer
DB2 repository
Impact Analysis
Application Understanding
/Web Services
Web Browser
Java, COBOL, PL/1, Assembler
CICS/IMS Applications
WebSphere Applications
DB2, WSMQ
CICS Application Resources
Transactions
Programs, Files
TDQs, TSQs
DB2/IMS DB, etc.
CICS Interdependency Analyzer
DB2 Dependency DB
Relationship Analysis
Discovery
Asset Transformation Workbench
Knowledgebase
Project-level Application Analysis
Business Rule Identification
Application Componentization
Architects, project leaders

Users: business analysts, system analysts, developers, testers, project managers, management, System Programmers, QA analysts

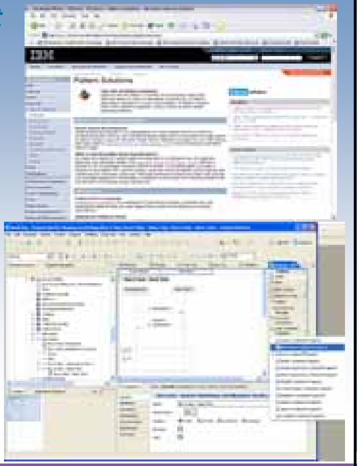
Benefits:

- Automated discovery of application code and CICS runtime relationships
- Higher quality of application change management
- Reduce or eliminate intensive efforts to create components
- Position for evolution SOA

# *Model - For The IT Architect and Developer*

*Using patterns to speed up the process*

***Model using industry standard UML 2, integrating the architecture into development***



**Rational Software Architect V7.0**

- Model in UML and transform to Web service
- Use patterns to help automate development of applications and promote reuse
- Use Process and best practices ensure repeatable success
- Integrates with business process modeling to ensure business needs drive development

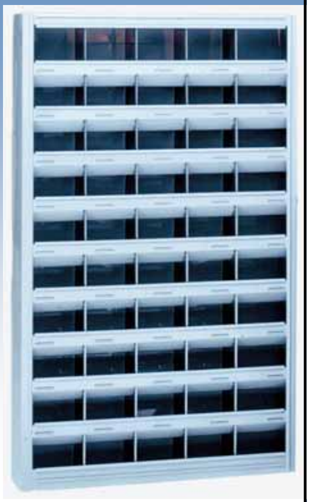
**Rational Software Architect Pattern Solutions**

- Improve productivity with reusable assets
- Rapidly build and configure the Enterprise Service Bus (ESB) with the WebSphere Platform Messaging Patterns

# *Identify Assets*

**WebSphere Service Registry and Repository**

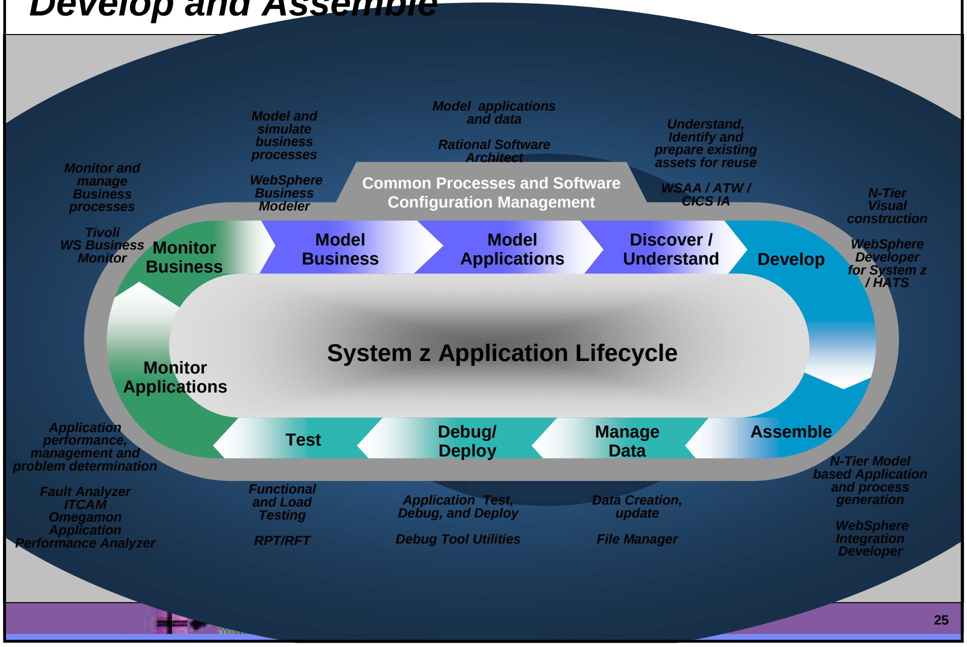
*An enterprise-wide service registry and repository improves visibility, reusability, adaptability, and manageability of services*



The WebSphere Service Registry and Repository …

- **A repository for service metadata**
  - for example, WSDL and XSD
- **For publication of services**
  - to advertise their capabilities
- **For finding suitable services**
  - for reuse and runtime agility
- **For capturing service dependencies**
  - to support change management
- **An extensible framework**
  - to support validation and notification

## Develop and Assemble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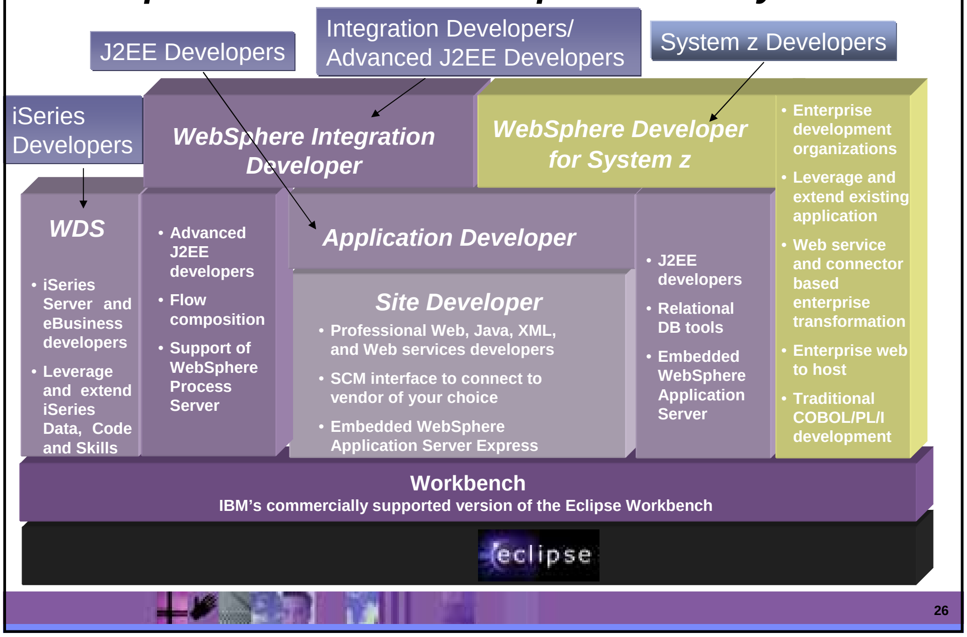
## WebSphere/Rational Development Family


J2EE Developers
Integration Developers/ Advanced J2EE Developers
System z Developers
iSeries Developers
WebSphere Integration Developer
WebSphere Developer for System z
WDS
Application Developer
Site Developer
Workbench
IBM's commercially supported version of the Eclipse Workbench
eclipse

WDS

- iSeries Server and eBusiness developers
- Leverage and extend iSeries Data, Code and Skills

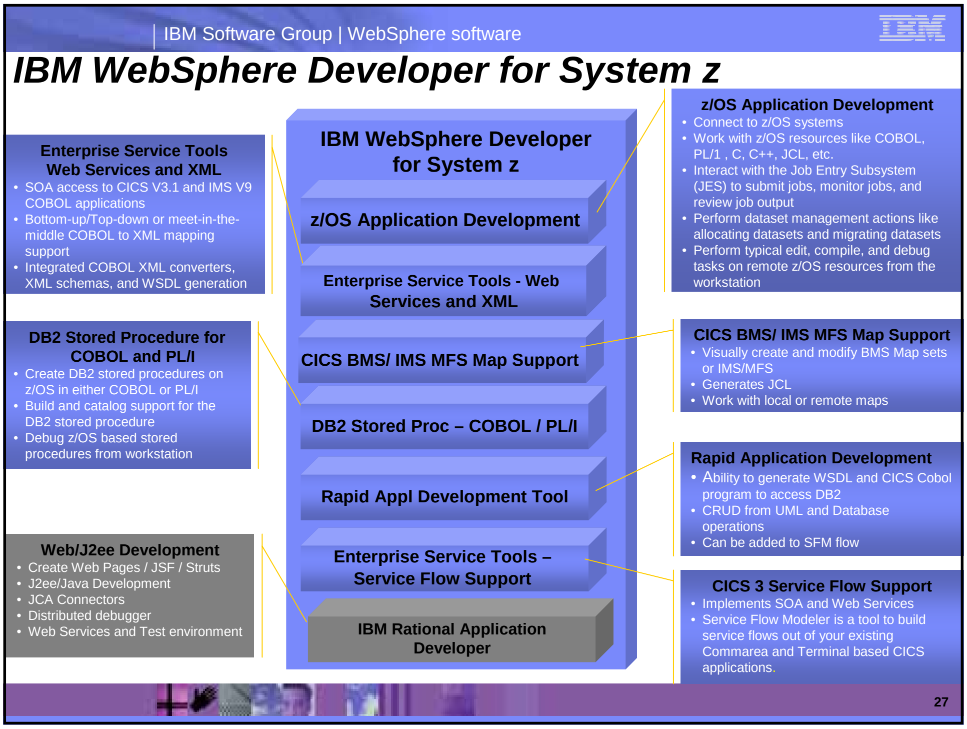
- Advanced J2EE developers
- Flow composition
- Support of WebSphere Process Server

Site Developer

- Professional Web, Java, XML, and Web services developers
- SCM interface to connect to vendor of your choice
- Embedded WebSphere Application Server Express

- J2EE developers
- Relational DB tools
- Embedded WebSphere Application Server

- Enterprise development organizations
- Leverage and extend existing application
- Web service and connector based enterprise transformation
- Enterprise web to host
- Traditional COBOL/PL/I development



## IBM WebSphere Developer for System z

**Enterprise Service Tools Web Services and XML**
- SOA access to CICS V3.1 and IMS V9 COBOL applications
- Bottom-up/Top-down or meet-in-the-middle COBOL to XML mapping support
- Integrated COBOL XML converters, XML schemas, and WSDL generation

**DB2 Stored Procedure for COBOL and PL/I**
- Create DB2 stored procedures on z/OS in either COBOL or PL/I
- Build and catalog support for the DB2 stored procedure
- Debug z/OS based stored procedures from workstation

**Web/J2ee Development**
- Create Web Pages / JSF / Struts
- J2ee/Java Development
- JCA Connectors
- Distributed debugger
- Web Services and Test environment

**IBM WebSphere Developer for System z**

z/OS Application Development

Enterprise Service Tools - Web Services and XML

CICS BMS/ IMS MFS Map Support

DB2 Stored Proc – COBOL / PL/I

Rapid Appl Development Tool

Enterprise Service Tools – Service Flow Support

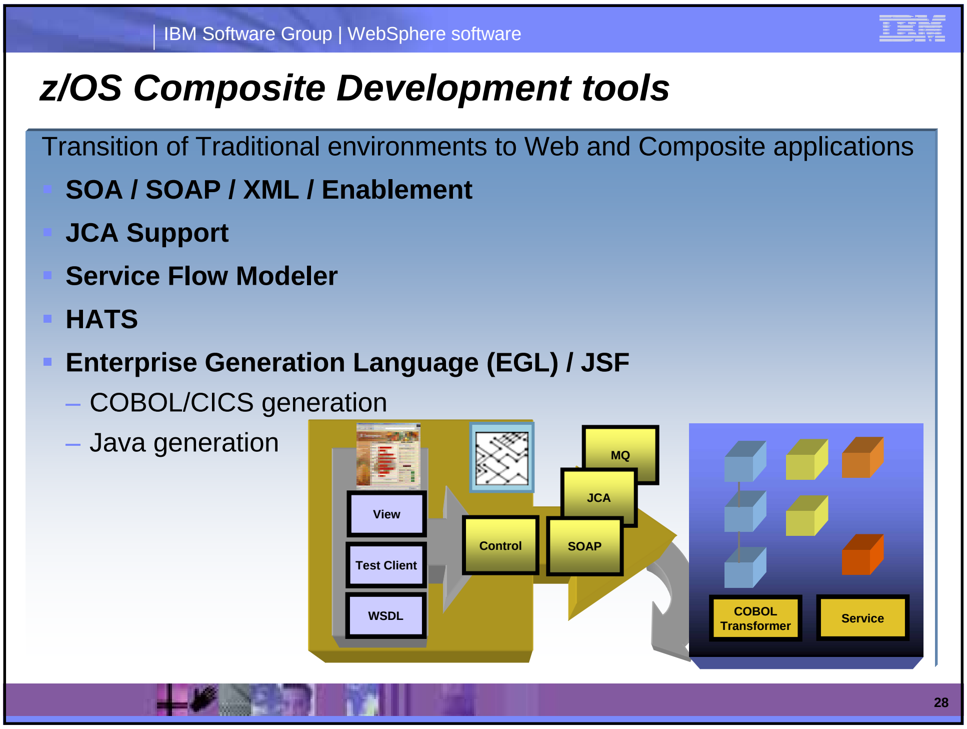
IBM Rational Application Developer

**z/OS Application Development**
- Connect to z/OS systems
- Work with z/OS resources like COBOL, PL/1 , C, C++, JCL, etc.
- Interact with the Job Entry Subsystem (JES) to submit jobs, monitor jobs, and review job output
- Perform dataset management actions like allocating datasets and migrating datasets
- Perform typical edit, compile, and debug tasks on remote z/OS resources from the workstation

**CICS BMS/ IMS MFS Map Support**
- Visually create and modify BMS Map sets or IMS/MFS
- Generates JCL
- Work with local or remote maps

**Rapid Application Development**
- Ability to generate WSDL and CICS Cobol program to access DB2
- CRUD from UML and Database operations
- Can be added to SFM flow

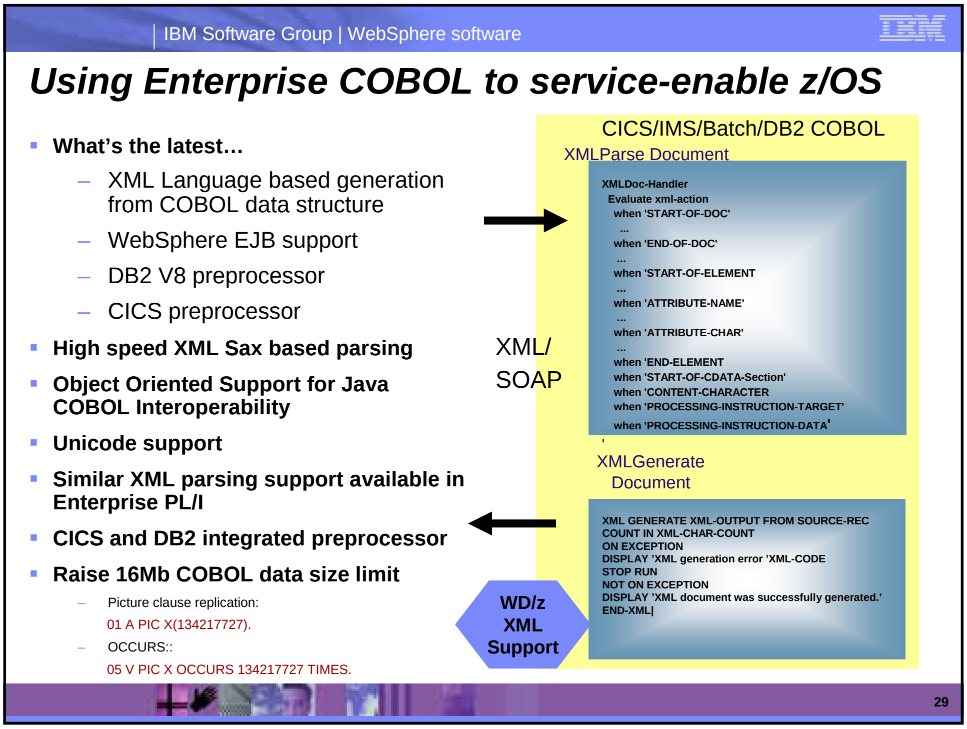
**CICS 3 Service Flow Support**
- Implements SOA and Web Services
- Service Flow Modeler is a tool to build service flows out of your existing Commarea and Terminal based CICS applications.



## z/OS Composite Development tools

Transition of Traditional environments to Web and Composite applications

- **SOA / SOAP / XML / Enablement**
- **JCA Support**
- **Service Flow Modeler**
- **HATS**
- **Enterprise Generation Language (EGL) / JSF**
  - COBOL/CICS generation
  - Java generation



## Using Enterprise COBOL to service-enable z/OS

- **What's the latest…**
  - XML Language based generation from COBOL data structure
  - WebSphere EJB support
  - DB2 V8 preprocessor
  - CICS preprocessor
- **High speed XML Sax based parsing**
- **Object Oriented Support for Java COBOL Interoperability**
- **Unicode support**
- **Similar XML parsing support available in Enterprise PL/I**
- **CICS and DB2 integrated preprocessor**
- **Raise 16Mb COBOL data size limit**
  - Picture clause replication:

    01 A PIC X(134217727).
  - OCCURS::

    05 V PIC X OCCURS 134217727 TIMES.

XML/ SOAP

CICS/IMS/Batch/DB2 COBOL

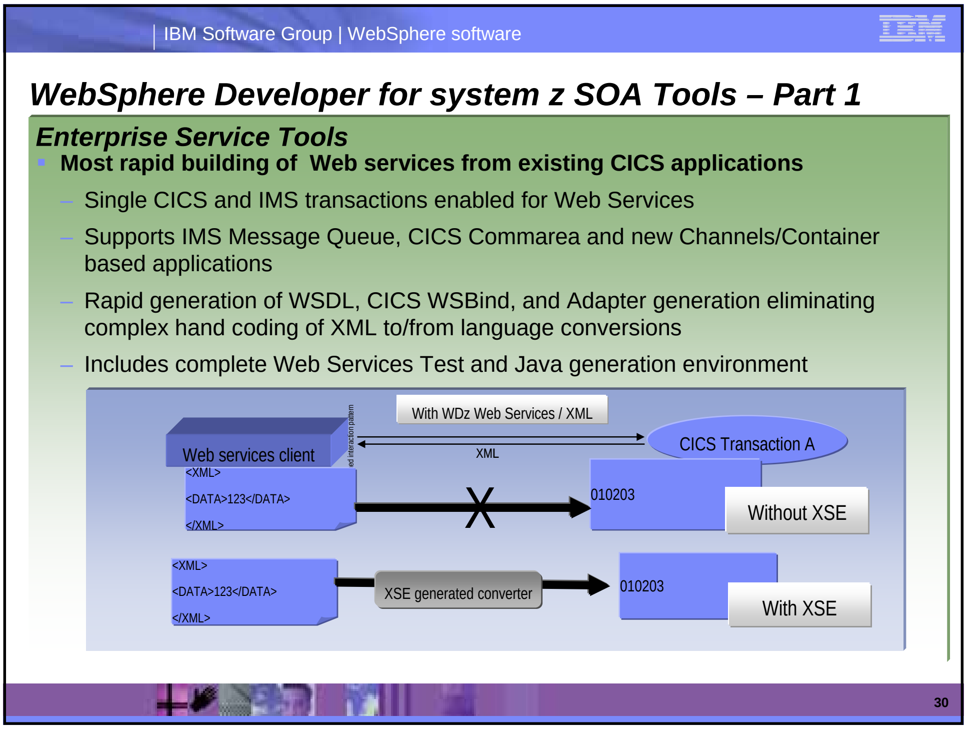
XMLParse Document

```
XMLDoc-Handler
 Evaluate xml-action
   when 'START-OF-DOC'
    …
   when 'END-OF-DOC'
    …
   when 'START-OF-ELEMENT
    …
   when 'ATTRIBUTE-NAME'
    …
   when 'ATTRIBUTE-CHAR'
    …
   when 'END-ELEMENT
   when 'START-OF-CDATA-Section'
   when 'CONTENT-CHARACTER
   when 'PROCESSING-INSTRUCTION-TARGET'
   when 'PROCESSING-INSTRUCTION-DATA'
'
```

XMLGenerate Document

```
XML GENERATE XML-OUTPUT FROM SOURCE-REC
COUNT IN XML-CHAR-COUNT
ON EXCEPTION
DISPLAY 'XML generation error 'XML-CODE
STOP RUN
NOT ON EXCEPTION
DISPLAY 'XML document was successfully generated.'
END-XML|
```

**WD/z XML Support**



## WebSphere Developer for system z SOA Tools – Part 1

### Enterprise Service Tools

- **Most rapid building of Web services from existing CICS applications**
  - Single CICS and IMS transactions enabled for Web Services
  - Supports IMS Message Queue, CICS Commarea and new Channels/Container based applications
  - Rapid generation of WSDL, CICS WSBind, and Adapter generation eliminating complex hand coding of XML to/from language conversions
  - Includes complete Web Services Test and Java generation environment

With WDz Web Services / XML

Web services client

ed interaction pattern

XML

CICS Transaction A

```
<XML>
<DATA>123</DATA>
</XML>
```

010203

Without XSE

```
<XML>
<DATA>123</DATA>
</XML>
```

XSE generated converter

010203

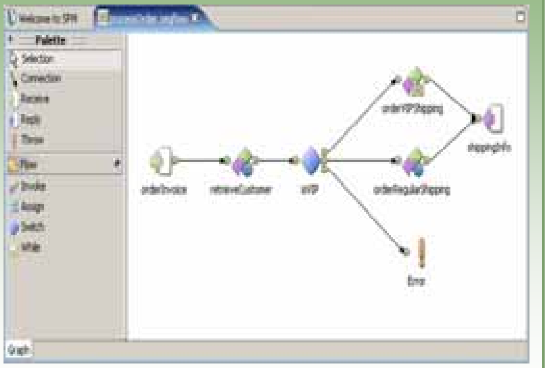
With XSE

IBM Software Group | WebSphere software

## WebSphere Developer for System z SOA Tools – Part 2

### *Enterprise Service Tools - Service Flow Modeler*

- **Builds Web services from existing CICS applications**
  - Aggregates multiple CICS transactions into high-level business processes through visual modeling
  - Supports CICS BMS (terminal-based) applications & CICS commarea applications
  - Highly optimized CICS runtime supporting Web services and XML interfaces



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## WebSphere Host Access Transformation Server

*Extend business processing through existing interfaces*

- Automatically transforms 3270 & 5250 green screen applications into HTML interfaces
- Extends terminal applications as Web Services
- Low skills requirement – no System z skills required
- Rules-based, highly customizable
- Iterative, eclipse-based development environment

Host Access Transformation Server - Application Developer
File Edit Perspective Project Window Help
Welcome to HATS
Host Access Transformation Server (HATS)
Project Settings
Screen Customizations
Transformations
Templates
Screen Captures
Macros
Source
Common
Images
JK Enterprises

**Benefits:**
- Increase productivity and reduce training costs.
- Extend existing applications to new users
- Integrate traditional applications into enterprise portals
- Reduce development costs by avoiding rewrite of legacy applications.

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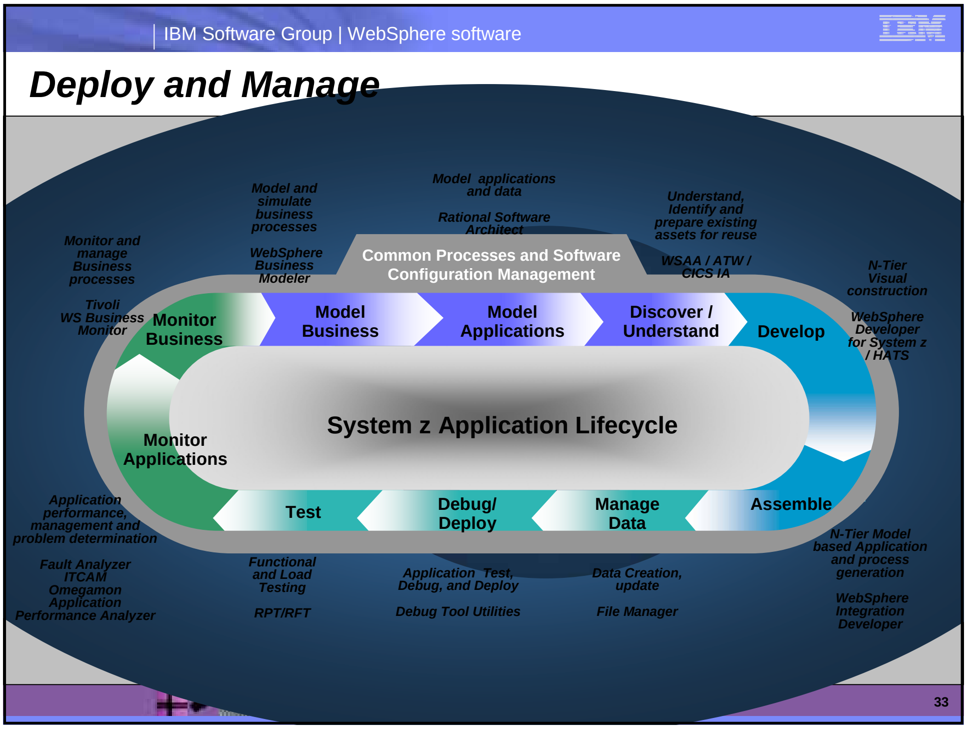


## *Deploy and Manage*

Common Processes and Software Configuration Management

System z Application Lifecycle

Monitor Business

Model Business

Model Applications

Discover / Understand

Develop

Assemble

Manage Data

Debug/ Deploy

Test

Monitor Applications

*Monitor and manage Business processes*

*Tivoli WS Business Monitor*

*Model and simulate business processes*

*WebSphere Business Modeler*

*Model applications and data*

*Rational Software Architect*

*Understand, Identify and prepare existing assets for reuse*

*WSAA / ATW / CICS IA*

*N-Tier Visual construction*

*WebSphere Developer for System z / HATS*

*N-Tier Model based Application and process generation*

*WebSphere Integration Developer*

*Data Creation, update*

*File Manager*

*Application Test, Debug, and Deploy*

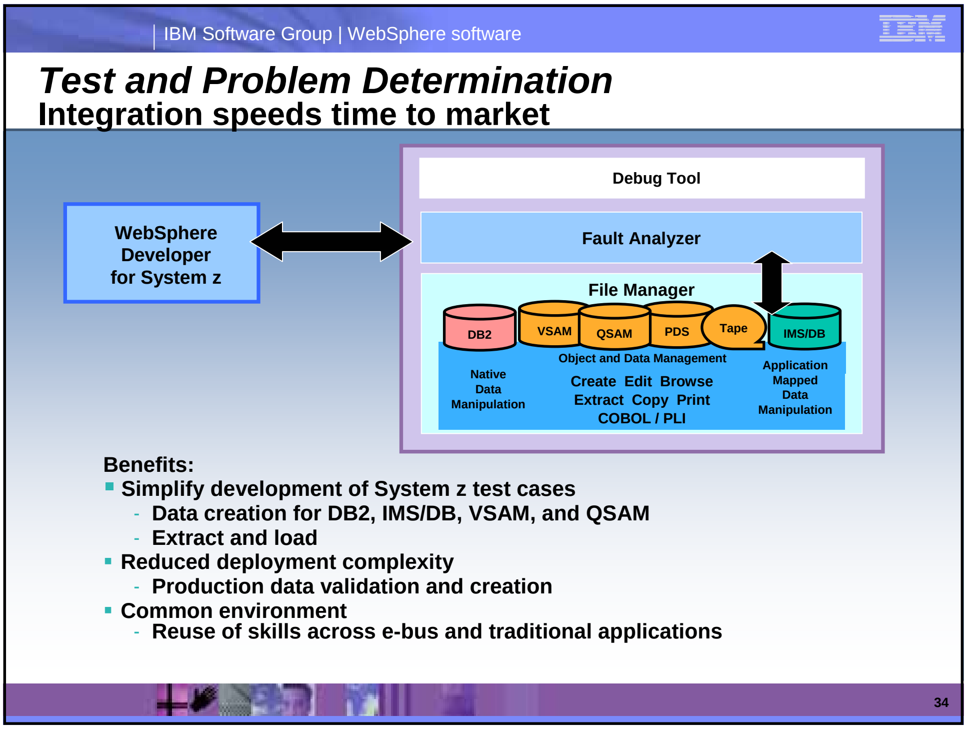
*Debug Tool Utilities*

*Functional and Load Testing*

*RPT/RFT*

*Application performance, management and problem determination*

*Fault Analyzer*
*ITCAM*
*Omegamon*
*Application Performance Analyzer*



## *Test and Problem Determination*

### Integration speeds time to market

WebSphere Developer for System z

Debug Tool

Fault Analyzer

File Manager

DB2

VSAM

QSAM

PDS

Tape

IMS/DB

Native Data Manipulation

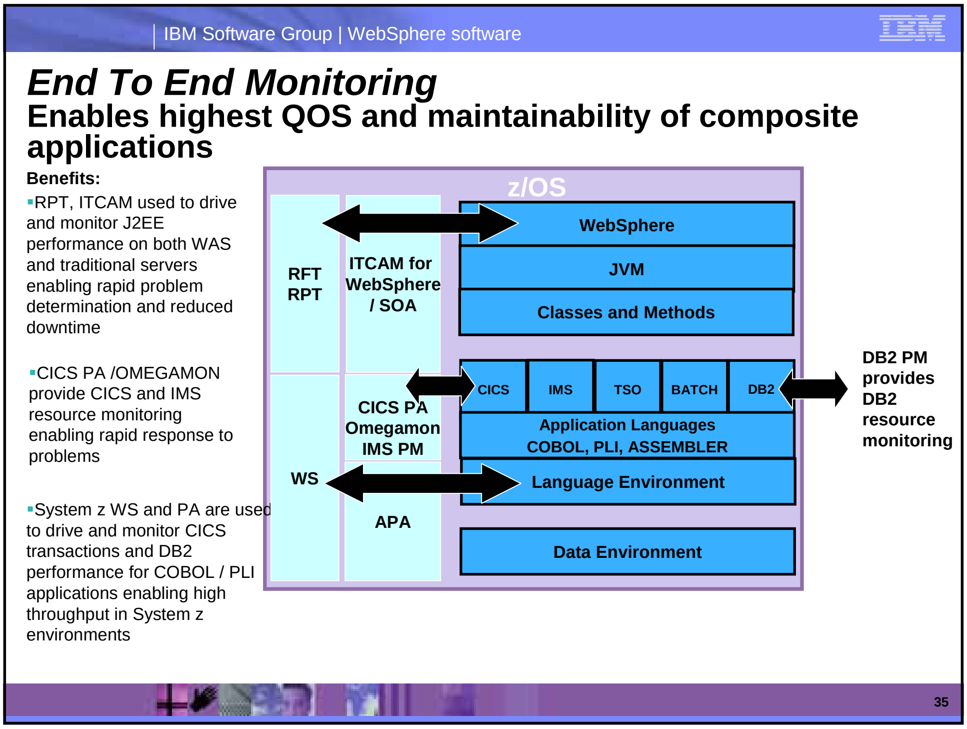
Object and Data Management

Create Edit Browse
Extract Copy Print
COBOL / PLI

Application Mapped Data Manipulation

Benefits:

- Simplify development of System z test cases
  - Data creation for DB2, IMS/DB, VSAM, and QSAM
  - Extract and load
- Reduced deployment complexity
  - Production data validation and creation
- Common environment
  - Reuse of skills across e-bus and traditional applications



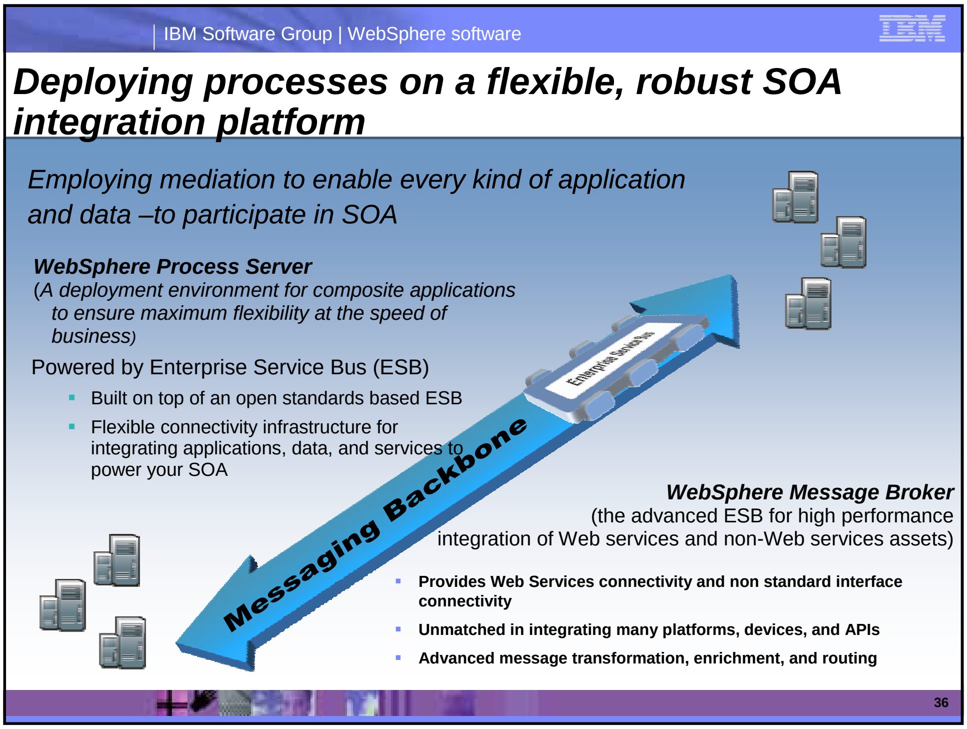
## End To End Monitoring

### Enables highest QOS and maintainability of composite applications

**Benefits:**

- RPT, ITCAM used to drive and monitor J2EE performance on both WAS and traditional servers enabling rapid problem determination and reduced downtime
- CICS PA /OMEGAMON provide CICS and IMS resource monitoring enabling rapid response to problems
- System z WS and PA are used to drive and monitor CICS transactions and DB2 performance for COBOL / PLI applications enabling high throughput in System z environments

DB2 PM provides DB2 resource monitoring



## *Deploying processes on a flexible, robust SOA integration platform*

*Employing mediation to enable every kind of application and data –to participate in SOA*

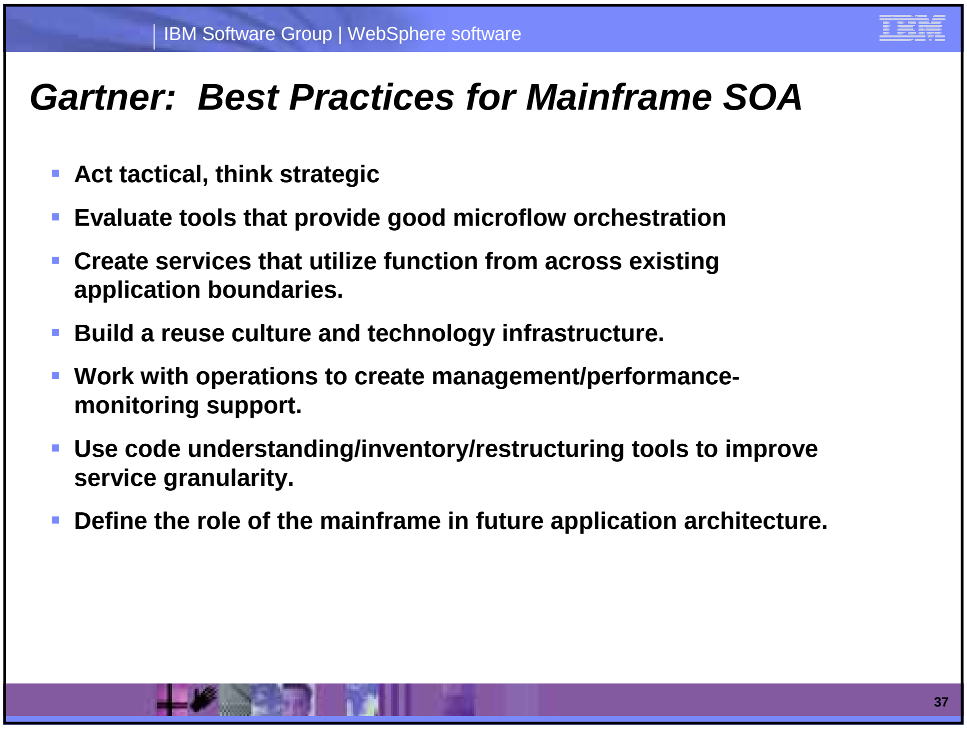
***WebSphere Process Server***
(*A deployment environment for composite applications to ensure maximum flexibility at the speed of business*)

Powered by Enterprise Service Bus (ESB)

- Built on top of an open standards based ESB
- Flexible connectivity infrastructure for integrating applications, data, and services to power your SOA

***WebSphere Message Broker***
(the advanced ESB for high performance integration of Web services and non-Web services assets)

- **Provides Web Services connectivity and non standard interface connectivity**
- **Unmatched in integrating many platforms, devices, and APIs**
- **Advanced message transformation, enrichment, and routing**



# *Gartner: Best Practices for Mainframe SOA*

- **Act tactical, think strategic**
- **Evaluate tools that provide good microflow orchestration**
- **Create services that utilize function from across existing application boundaries.**
- **Build a reuse culture and technology infrastructure.**
- **Work with operations to create management/performance-monitoring support.**
- **Use code understanding/inventory/restructuring tools to improve service granularity.**
- **Define the role of the mainframe in future application architecture.**