z/VSE: A Roadmap For Cost savings and Exploiting Technology

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1 Introduction and Preface

"With its announcement of z/VSE 4, IBM has executed a hat trick. It has brought new technical life to an operating system that has not been part of the swift flow of mainstream computing. It has brought the usage-based pricing model used by z/OS mainframe shops to the VSE users who had previously been neglected. And it has set the stage for fresh hardware initiatives by speeding the exit of users with older machines." Hesh Wiener, Big Iron

The intent of this document is to provide those responsible for making the long-term decisions on the nature and direction of their company's IT strategy with the information and arguments to continue with their investment with z/VSE.

This white paper illustrates the value of upgrading hardware and software portfolios to VSE customers currently running pre- z/VSE 4.1 systems on pre System z9 processors. For those running a standard portfolio of z/VSE products on Multiprise, 9672 or z8xx/z9xx classes of machine, there are significant TCO savings to be realized.

1.1 Executive Summary

Tracings its heritage back to the days of S/360, z/VSE continues to meet its users business requirements with a robust, lean, and efficient environment. Sine Nomine Associates' own experiences with z/VSE date back over twenty years to an organization that had been a VSE customer since the DOS Rel 16 days. It was the backbone of an organization that turned over $4 billion per year and did so with great reliability.

Subsystems such as VTAM, CICS, POWER, and TCP/IP provide the infrastructure that satisfies most of the VSE customer requirements. To VSE customers like these it is no wonder why the question of "Why are you still running VSE?" is one that is usually answered with "Because it works and works very well."

Increasingly, however, there are business requirements and cost pressures that cause those running VSE to look at how their investment can be maximized and the needs of their users satisfied. With the introduction of the System z9 family and the availability of z/VSE 4.1 IBM has attempted to help the VSE community address these concerns.

Today, for those customers facing end of life on their existing hardware there are compelling technical and financial reasons to look at upgrading both the operating system and the hardware on which it belongs. The combination of z/VSE and z9 address the questions of:

- How can value be most efficiently generated to maximize ROI?
- How can modernization of technology be applied to preserve the best of the existing applications and enable developing services to rapidly adapt to new demand?

z/VSE 4.1 provides a strong foundation and enabling services to allow organizations to adapt without risking the farm through:

- Technology enablement:

- 64-bit VSE constraint relief
- z/Architecture
- z/VSE connector strategy which is part of the “Protect, Integrate and Extend” (PIE) strategy described later in this document
- Companion Operating System to server consolidation strategy
- Operational coordination benefits
- Security features

- Pricing and ROI improvements:
    - Mid-Range Workload License Charge (MWLC) Pricing
    - z9 hardware pricing
    - Lower operational costs resulting from coordinated management
        - Environmentals
        - Personnel optimization

VSE brings all those features into a focused coherent solution that provides strong ROI today, and room to grow for tomorrow.

2 The z/VSE PIE Strategy

The IBM VSE team have coined the acronym “PIE” to scribe a strategy of “Protect, Integrate, and Extend” for z/VSE:

- Protect existing customer investments in core z/VSE programs, data, equipment, business and IT skills, plus business processes, and end user training. This is achieved by modernizing applications by extending z/VSE resources to the web; exploiting the latest in IBM servers and storage; and enhanced z/OS affinity.

- Integrate z/VSE with the rest of IT, based on open and industry standards via the use of VSE connectors, SOA Web Services, and IBM middleware.

- Extend solutions by using Linux on System z to exploit existing core VSE investments and introducing new applications and workloads in a low cost, low risk, fast time-to-market manner.

2.1 Pieces of the PIE

The following sections describe how the PIE strategy can be used to future-proof z/VSE-based systems.

2.1.1 Protect

On facet of the protection part of the z/VSE PIE comes in the form of subsystems such as CICS Transaction Server (TS), TCP/IP, and VTAM which facilitates the interoperation and affinity with z/OS. Another facet is the enhanced hardware support that z/VSE provides which enables the exploitation of devices such as the DS8000 or the encryption capabilities of the TS1120 tape subsystem.

2.1.2 Integrate

Connectors enable the integration of VSE systems with other network-enabled systems and provide real-time access to VSE resources (like VSAM, POWER, DL/I, Librarian, ICCF, console) from remote platforms. VSE programs can also access remote data like databases or flat files. In addition there are a set of utilities for download, that helps you to manage your VSE system. Table 4 in the appendices describes these connectors and utilities.

Connectors are the building blocks used to connect different applications on heterogeneous platforms and operating systems. z/VSE connectors are based on J2EE standards and use WebSphere Common Connector Framework. They consist of:

- Client components written in Java: meaning they can run on any Java-compatible platform, such as Linux running on the IBM System z

- Server components that run on the VSE host

2.1.3 Extend

The extend slice of the PIE can be implemented by a Linux system acting as both a gateway to the Internet and as a host for new e-business applications. Running in an IFL the Linux system will not affect the MSU rating of the System z and thus the software bill for the z/VSE portfolio. It also allows its applications to be accessed from z/VSE at memory-to-memory speeds via the use of hipersockets. Linux is able to exploit the z/VSE connectors to extend the reach of the existing z/VSE applications and to promote the growth of new ones.

There are several ways people are using Linux on System z to extend their existing applications.

2.1.3.1 Exploiting Connectors

Java-based connector provide connectivity to z/VSE via TCP/IP. They provide access to, for example a Web Application Server, VSAM, POWER, the Librarian, ICCF and the z/VSE console.

The DB2-based connector uses DRDA over TCP/IP to provide JDBC/ODBC access to z/VSE-based DB2 systems as well as VSAM and DL/I based data.

Tools such as the z/VSE navigator provide a face to z/VSE that is intuitive to today's workstation users which means they can be immediately productive when using the system: there is no requirement to train them how to use the older 3270 mechanisms.

2.1.3.2 Web Serving

One simple strategy is the serving of z/VSE data exported via NFS through an Apache webserver. This can be done via a z/VSE-based webserver but using Apache allows access to a greater pool of programmers are familiar with Apache's way of doing things.

A more complex strategy is to run WebSphere on the Linux system and using facilities like the MQ client, DB2 Connect and the CICS Transaction Gateway to serve data and transactions to and from the z/VSE system.

2.1.3.3 DB2 Connect

DB2 Connect enables a Linux system, and the clients that connect to it, to access z/VSE-based DB2 instances.

2.1.3.4 CICS Transaction Gateway

The CICS Transaction Gateway enables Java applications running on another server or workstation to access a CICS system running on z/VSE via the Java Daemon gateway. This technology enables the serving of Java applets from a webserver.

Impact: The PIE strategy is a roadmap for maintaining and enhancing the viability of z/VSE based systems into the future. The connectors and utilities are not “vaporware” and are available now to facilitate the extension of z/VSE systems and applications. Access to strategic middleware such as WebSphere and thus to a range of new applications is also a key to enhancing the value of z/VSE.

3 Technology Enablement

When it comes to z/VSE one side of the business driver coin is the advances in technology that come with the new processors and z/VSE 4.1. The advances in technology translate into improved application delivery, the integration of existing applications to the web, and secured extension of data visibility to new applications.

3.1 System z9

The latest in the mainframe family of processors are the System z9 Business Class (z9 BC) and Enterprise Class (z9 EC) series.

The z9 BC is designed as a midrange mainframe and promises extensive growth options and excellent price/performance for those customers requiring a lower-capacity entry point and more granular growth options than offered with the System z9 Enterprise Class. There are two models: R07and S07, each capable of running from 1 to 7 processors. The full range of speciality engines (IFL, CF, ZIIP and ZAAP) and an extensive range of cryptographic assists are available.

The z9 EC is designed as a large mainframe solution that is highly scalable and has greater cryptographic capabilities and a higher capacity entry point than the z9 BC. It also supports the full range of speciality engines. Five models are available: S08, S18, S28, S38 and S54, which provides from 1-54 n-way processors.

Impact: The z9 provides a range of processors with improved performance with enough granularity for users to choose an entry level appropriate to their needs and to grow when required. The speciality engines enable collaborative processing with the introduction of Linux. The cryptographic facilities enable rapid security services to be implemented which are needed when extending z/VSE to the network.

3.2 z/VSE 4.1

Version 4.1 of z/VSE was announced on January 9, 2007 and made generally available on March 16. There are some significant features described in the announcement that may have both technical and financial implications to a VSE-based IT operation.

3.2.1 z/Architecture

z/VSE works in z/Architecture mode only and thus requires a processor capable of operating in this mode. It exploits z/Architecture's ability to address 64-bit real storage although it only uses 31-bit virtual addresses. Candidates for exploiting this feature include “data-in-memory” techniques such as CICS Shared Data Tables, VSE Virtual Disk, or more and larger buffer pools.

z/VSE is supported on the IBM System z9 EC and z9 BC servers as well as the IBM eServer zSeries z990, z890, z900 and z800 servers.

Impact: Selected system functions of z/VSE are able to exploit 64-bit real addressing which means the below 2GB requirements for these functions is relieved and the space available for other purposes. The 64-bit real addressing mode may mean that the VSE system is able to run without a page data set.

3.2.2 Storage Constraint Relief

z/VSE supports up to 8GB of real storage compared to the previous level of 2GB.

Impact: In conjunction with the 64-bit real addressing support, machines with larger physical memory may be more effectively used by the operating system.

3.2.3 New Pricing Metrics

As part of the announcement a Capacity Measurement Tool was described. It's purpose is to facilitate the introduction of a new pricing mechanism known as Midrange Workload License Charges (MWLC). This scheme is available on the IBM System z9 EC and z9 BC processors only and provides for improved price performance with both full-capacity and sub-capacity modes of operation.

Impact: The ability to "pay for what you use" rather than pay for what *might* be used presents a major opportunity for z/VSE sites to reduce their monthly software bill. A detailed analysis is provided in the next section of this document.

3.2.4 Network Connectivity

Since z/VSE 3.1 there has been support for the Open Systems Adapter-Express2 1000BASE-T Ethernet card that enables a larger network load to be supported compared to the previous options.

Impact: High-speed network support will enable VSE-based systems to ship data to and from the network at gigabit speeds and facilitate faster response times to the end-users.

3.2.5 Security Enhancements

z/VSE 4.1 has implemented significant enhancements to its encryption support. z/VSE V4.1 is designed to support 2048-bit RSA keys in addition to 512-bit and 1024-bit RSA keys. z/VSE now supports the CP Assist for Cryptographic Functions (CPACF) for using Advanced Encryption Standard (AES) for 128-bit keys.

TCP/IP is designed to use 512-bit and 1024-bit RSA keys transparently. TCP/IP will support 2048-bit RSA key with a Crypto Express2 adapter in either coprocessor or accelerator mode. Similarly, z/VSE V4.1 e-business Connectors are designed to support 2048-bit RSA keys in addition to 512-bit and 1024-bit RSA keys. TCP/IP also supports AES.

In addition z/VSE now supports the IBM System Storage TS1120 encrypting tape drive which will encrypt data using the 256-bit AES algorithm. Management of keys is performed using IBM Encryption Key Manager (EKVM) which is a Java-based application running on z/OS, AIX, Linux, i5/OS, HP, Sun, and Windows systems.

Impact: As the reliance on the Internet and network-enabled applications continues to increase it is important that any platform providing such applications can be confidently secured. The features of z9 and their exploitation by z/VSE provides this confidence.

3.2.6 SCSI Disk Support

z/VSE 3.1 introduced support of SCSI-based devices through an FBA-emulation layer that provides transparent access to these devices by existing, unmodified, applications. Facilities such as N_Port ID Virtualization (NPIV) allows secure access to SCSI end-points.

z/VSE 4.1 has introduced support of directly connected SCSI devices instead of mandating the presence of a switched fabric environment.

Impact: z/VSE may now participate in a SAN environment which may improve the management of the storage environment of the site. Direct connection allows a site to "put their toe in the water" when it comes to SCSI without the expense of a complete switched fabric.

3.3 Overall Technology Impact

The impact of the technologies described in the previous sections is two-fold:

1. More effective integration with other mainframe and non-mainframe systems.
2. Provides the building blocks which positions z/VSE to fully participate in enterprise-wide SOA strategies.

4 Pricing and ROI

In his “z/VSE 4.1 Virtual Class” Klaus Goebel, the z/VSE Systems Manager, lists the five top concerns of z/VSE customers as:

1. Cost
2. Cost
3. Cost
4. Applications
5. Applications

Historically, people have run z/VSE because it's lean and mean as well as having a portfolio of applications that facilitated doing business. Today's challenge is to maintain the platform’s efficiency while integrating modern computing networks and applications.

IBM has attempted to address these top concerns by a three pronged attack:

1. The introduction of MWLC Pricing.
2. The z9 family of processors.
3. A “Protect, Integrate, and Extend” strategy to software and inter-operability.

4.1 The Introduction of MWLC Pricing

Midrange Workload License Charges (MWLC) is a monthly license charge price metric on the IBM System z9 Business Class (z9 BC) and the IBM System z9 Enterprise Class (z9 EC) servers that applies to z/VSE V4 and 12 key VSE middleware programs. The exception is for the z9-BC A01 which is subject to the zELC pricing mechanism.

Similar to Workload License Charges and Entry Workload License Charges, you may implement MWLC in full-capacity or sub-capacity mode.

- Full-Capacity: Programs are licensed and paid based on the IBM rated capacity of the z9 Server.
- Sub-Capacity: Programs are licensed and paid for based on the utilization of the Logical Partitions (LPARs) where the program executes. z/VSE may run under z/VM 5.2 or higher.

4.1.1 What counts as Full-Capacity?

Full-Capacity pricing metric relies on the total rated capacity (measured in MSUs) of the machine where a product executes.

4.1.2 What counts as Sub-Capacity?

Sub-Capacity pricing metric relies on the utilization (based on peak 4-hour rolling average each month) of the LPAR(s) or guest Virtual Machines where a product executes. Note it is a peak of a rolling average, not the absolute peak of utilization.

4.1.3 Why MWLC?

In his June 2006 article in the z/Systems Journal, Pete Clark gives the following example that illustrates why MWLC may be of benefit to sites running z/VSE: “In the past, the software pricing for every month would have been for full processor power. Now for 10 or 11 months of the year, software pricing will be at one-third full processor power, and for the one to two-month holiday rush actual utilization up to full power price.”

The effect of MWLC is two-fold: it allows software to be paid for based on what is used rather than what capacity is available, and it provides a type of “capacity on demand” facility for those short periods when greater processing power is required.

4.1.4 Applicability

MWLC pricing applies only to the z/VSE V4 operating system and 12 key VSE middleware programs. On a z9 BC, all other VSE programs will be priced according to Tiered Entry Workload License Charges (TWLC). On a z9 EC, all other VSE programs will be priced according to Flat Workload License Charges, Graduated Monthly License Charges, or Extended License Charges. In the event that one of these three pricing metrics is not available for a particular VSE program, other applicable pricing metrics may be used. Tables 1, 2, and 3 in the appendices describe these pricing mechanisms and program product applicability.

4.2 ISV Support

Several ISVs have announced support for the MWLC model including the following. For those not listed check with the vendor to see if they offer some form of sub-capacity pricing.

4.2.1 CSI International

On March 16, 2007, CSI International,announced support for IBM’s Midrange Workload License Charge (MWLC) licensing model. “CSI will support the full-capacity and sub-capacity MWLC options for customers running z/VSE V4 on IBM z9 Business Class and z9 Enterprise Class servers. The CSI implementation will result in lower licensing fees for full-capacity licenses and additional savings may be achieved by moving to the sub-capacity licensing option. Customers choosing the sub-capacity licensing model will submit their utilization rates to CSI via the IBM Sub Capacity Reporting Tool (SCRT) report.”

4.2.2 CA

In their March 16, 2007, press release CA announced that they will “accept usage reports generated by IBM's reporting facility for use with CA's own Measured Workload Pricing program, which bases licensing costs on measured system usage--rather than total potential hardware capacity--enabling customers to more closely align IT spending with changing business requirements."

Solutions supporting z/VSE 4.1 include CA Explore Performance Management, CA Dynam storage management solutions, the CA Datacom and CA IDMS families of database products, CA FAQS automation solutions, and CA Top Secret for security management.

4.3 Reporting Sub-Capacity Utilization

There is a tool from IBM called the Capacity Management Tool (CMT), also known as the sub-capacity monitoring tool, which collects data from LPARs and/or guests running under z/VM (5.2 or later). This data is used by the Sub-Capacity Reporting Tool (SCRT) analyses to produce a Sub-Capacity Report. The Capacity Measurement Tool, which ships with z/VSE, must be run to enable z/VSE V4 to generate the SCRT data. The Capacity Measurement Tool must be run for an entire month to generate a month of records before a valid Sub-Capacity Report can be created.

z/VSE is able to generate the SCRT records but the SCRT tool itself only runs on z/OS. For those customers with both z/VSE and z/OS the SCRT reports may be run on site. For those who do not, then the records produced by z/VSE are sent to IBM which will return a Sub-Capacity Report within two business days.

4.4 Does it work?

It's one thing to read through the announcements; construct configuration models; and speculate on what savings may be possible. It's another thing to hear stories from people at the coal face to see if the potential savings are being realized.

The listservers provide one of the best publicly accessible resources for getting this type of information.

One government z/VSE user reports on their experience with the full-capacity option of MWLC (of course, your mileage may vary):

"I just got our April software bill from IBM for the first month on our z9 under z/VSE 4.1 and MWLC. We were paying $22,965 per month on our z800 under z/VSE 3.1.2. The April bill is for the same software and it is $12,318: a difference of $10,647 per month. The z9 increased our monthly processor payment by $4,450 so we have a net a savings of $6,197 per month.

"Looks like all the talk about the z9 and MWLC pricing for z/VSE is the real deal."

It is not unreasonable to project that the software bill for sub-capacity pricing would realize even greater savings. For example, in the above case by using the full-capacity option the assumption is that the site is running at 100% at all times during the year. By evaluating their actual requirements they may find their 4-hour rolling average is significantly less than this. If they were to implement the sub-capacity option of MWLC their monthly software bill could drop equally significantly.

Another factor that should be considered when determining potential savings is that of hardware maintenance. For organizations moving from 9672 equipment may realize significant savings by reducing monthly maintenance and environmental expenses.

4.5 z9 Hardware

For those moving from older hardware, the new z9 family of processors provides a substantial increase in computing power. This equipment is also rated as being amongst the most "environmentally friendly" processors ever produced. What this should translate to is lower power and air conditioning requirements, lower maintenance requirements, and ultimately a better TCO. In previous times the jump in MSU rating would translate to higher software bills that would all but obliterate any other savings. However, with the introduction of MWLC environmental, maintenance, and software savings can all be realized simultaneously.

A full TCO analysis of these chances is predicated on accurate pricing, and thus the actual TCO results will differ greatly by customer, as IBM prices their solutions on a custom basis according to the customer's portfolio of applications and hardware.

The following table illustrates a comparison of the different pricing models based on running a software stack which includes z/VSE, LE, HLAS, DITTO, and COBOL and uses 32 MSUs. The data for this table is sourced from the presentation "What's new in zSubcapacity Pricing" and prices are as of January 2007 in $US.

9672 GMLC	z800 ELC	z890 TWLC	z9 BC MWLC	z9 BC MWLC at 70% 4-hour rolling average
$240K/year	$120K/year	$96K/year	$76K/year	$71K/year

Table 1: Sample Comparative Pricing

4.6 Human Resources

By extending VSE's reach within an organization through the use of the "PIE" strategy the other IT resources within that organization that have web, SOA, and/or open systems skills are able to use the services of the VSE system. In this way staff may be more effectively used and the systems under VSE's control increase their utility to the business.

4.7 Environmental Savings

As part of IBM's "Green" strategy, the System z9 is the most energy efficient processors yet produced. Depending on the equipment currently being used migration to the z9 platform can yield significant savings in power, air conditioning, and footprint. Even coming from an MP3000 configuration where internal disk is used there would be savings from moving to a z9 and DS6000 combination.

Sine Nomine Associates provides an extended discussion of the impact of power and cooling facilities and the strengths of System z in this area, in its white paper "Avoiding the $25 million Server". One of the conclusions from that paper is directly relevant to running z/VSE on System z:

"Power distribution units (PDUs), computer room air conditioners (CRACs), and the network and SAN infrastructure components all require periodic maintenance and occasional repairs,

none of which are free. The mainframe requires significantly less of each of these resources and thus one expects that the maintenance and repair costs would decrease proportionally. Even in an existing facility with pre-existing power and cooling systems one could argue that running these systems at a lower-than-maximum load level would prolong their useful life. It is certain that doing so provides greater capacity headroom to handle temporary overloads from other sources."

5 Summary and Recommendations

While many pundits continue to indicate that VSE is non-viable, the influx of investment and new function provides both a strong foundation and a base for continued expansion by assimilating new workloads and optimizing existing workloads as consolidation occurs. This combination of "something old, something new, something borrowed, something blue" returns the best of both worlds: a bridge between the status quo and the status futura.

The opportunity being presented to z/VSE customers today is one that should be closely examined. It is based on addressing the top concerns of the z/VSE community: cost and applications.

The attack on cost is based on:

- z/VSE MWLC pricing
- Potential savings from reduction in environmental requirements
- Lower hardware maintenance

z/VSE facilitates the protection, integration and extension of applications via:

- z/VSE connectors
- Exploitation of new hardware such as the new processors, cryptographic equipment, network hardware, and
- Introduction of Linux to extend the range of applications that can access and manipulate data under the control of the z/VSE system.

Those running z/VSE prior to 4.1 or running older hardware should seize upon this opportunity to investigate the potential savings in TCO and the enhanced functionality that would be realized by a migration to z/VSE 4.1 running on z9 hardware.

There are several categories of customer where savings are a function of one or more of the financial or technological factors described in this paper:

- Those where savings achieved by moving to MWLC pricing will be sufficient to justify a migration to z/VSE 4.1 and the z9.
- Those where the reduction in maintenance and environmentals by migrating to the z9 in conjunction with the new software pricing model will be the tipping point.
- Those, for example running MP3000 equipment, where a migration to z9 and to modern, efficient, and higher-capacity disks such as the DS6000, will be the driver.

- For the remainder it is the combination of the above savings plus the increased value of the data and systems being managed by the z/VSE system as a result of implementing the connector and/or Linux strategy.

It is important that a thorough assessment of not just the program products to be run on a given configuration be undertaken but of the full hardware and software configuration in order to determine the true amount of savings possible. The appendices contain tables that may be used as a starting point for estimating the savings in environmental and operational costs.

Appendix A - Pricing Schemes

A.1 MWLC Levels

Level	*Range (MSUs)*
Base MWLC	3
Level 1	4 - 17
Level 2	18 - 30
Level 3	31 - 45
Level 4	46 - 87
Level 5	88 - 175
Level 6	176 - 260
Level 7	261+

Table 2: MWLC Levels

A.2 TWLC Tiers

For programs that are not eligible for MWLC, but are eligible for TWLC pricing, the tiers are as follows:

Tier	*Machine Capacity (MSUs)*
Tier A	1 - 11
Tier B	12 - 15
Tier C	16 - 40
Tier D	41 - 75
Tier E	76 - 1500
Tier F	1501+

Table 3: TWLC Tiers

A.3 MWLC Eligible Program Products

The IBM program products eligible for MWLC pricing are shown in the following table.

Program Number	*Description*

Base	
5686-CF8	VSE Central Functions
5696-234	HLASM
5648-054	CICS TS for VSE/ESA V1
5686-065	ACF/VTAM VSE/ESA V4
5686-A04	TCP/IP for VSE/ESA V1.5
5648-099	DITTO/ESA for VSE
5697-F42	DB2 Server for VSE & VM
Optional Products	
5686-068	IBM COBOL for VSE/ESA
5686-A01	IBM C for VSE/ESA
5686-069	IBM PL/1 for VSE/ESA
5746-SM3	IBM DFSORT/VSE V3
5746-XX1	DL/I VSE
5686-A06	MQSeries for VSE/ESA

Table 4: Program Products eligible for MWLC

Appendix B - z/VSE Utilities and IBM Connectors

Connector	*Description*
VSE Connector Client	This includes a JDBC driver for VSAM and enables the writing of Java applications that access VSE data and functionality
WebServices (SOAP) with VSE	The implementation allows a VSE system to act as a WebService provider (server) and as a WebService requestor (client).
CICS2WS Toolkit	A development tool that enables the exploitation of WebServices with existing CICS programs. The tool reads WSDL files and Copybooks and creates proxy code that you use as a layer between existing programs and the VSE SOAP engine
VSAM Redirector	Redirects all accesses to a certain VSAM file into any other file system or database on any other (Java-enabled) platform.
VSE Script Server	Provides access to VSE resources using the Java based connectors, but without writing Java programs. VSE scripts can use various script commands to access VSE resources.
VSAM Maptool	Create, import or export a data map for a given VSAM file. The resulting map may be an XML file or Java code. The tool can create a map from parsing a COBOL or PL/I copy book
VSE Navigator	Provides a graphical user interface (GUI) for the VSE operating system, which behaves very much like file managers from other platforms, such as Windows Explorer. It includes host based VSE file systems (VSE Librarian, POWER queues, ICCF, VSAM) and provides host specific functions.
TCP/IP Configuration utility	A workstation-based tool to help configure TCP/IP for VSE. It is part of the TCP/IP for VSE product.
VSEPrint utility	Facilitates the printing of VSE/POWER list queue entries on any locally or LAN-attached printer.
Keyman/VSE	A tool to manage the VSE specific public key infrastructure. It can create RSA key pairs, create and sign certificates, and upload them to a VSE system. It can also read and write PKCS#12 keyring files.
VSE Health Checker	A Java-based system diagnosis utility to retrieve, display, and analyze performance relevant data from a VSE system.
VSE System class library	Provides a Java API to access general VSE system parameters. The API includes access to data from VSE components, like CICS, POWER, VTAM, or TCP/IP, but also output from basic commands like SIR, GETVIS, MAP, PRTY, and others.
VSE Virtual Tape Server	Provides the server part of the VSE Virtual Tape functionality in which a tape is represented by a file in AWSTAPE format. This file can be either a VSE/VSAM file or a file on any Java-enabled platform.

Connector	*Description*
IBM CICS Transaction Gateway	Delivers high-performing, security-rich and scalable J2EE standards-based access to CICS applications for rapid deployment of existing CICS applications into an SOA.
IBM DB2 Connect	Makes DB2 host data directly available to Personal Computer and LAN-based workstations.
IBM WebSphere MQ Server and Client	Enables rapid and simple connectivity into messaging backbone across virtually any commercial IT system.
IBM WebSphere Host Access Transformation Services	Used to create Web and rich client applications that provides a graphical user interface (GUI) for character-based 3270 and 5250 host applications.
IBM WebSphere Host On-Demand	Provides secure access to 3270, 5250, and DEC/UNIX-based applications and data from a Java-enabled Web browser.

Table 5: z/VSE Utilities and IBM Connectors

Appendix C - Raw Data

The following tables may be used to help calculate and compare the Total Cost of Ownership when moving from one processor type to another. The first table shows the estimated monthly maintenance and the second shows the environmental characteristics. These values may be combined with costs of the software portfolio to obtain an overall monthly or yearly cost of ownership:

Hardware maintenance + Floor space cost + Air Conditioning cost + Power cost + Software eligible for MWLC (full-capacity or sub-capacity) + Software eligible for TWLC + Other Software

C.1 Maintenance Costs

Note: Maintenance prices are those quoted at the time a system was first delivered.

Source: Technology News

Model	*Estimated Monthly Maintenance ($US)*	*MSU*
z9 BC		
A01	$1,103	4
B01	$1,156	7
C01	$1,265	8
A02	$1,319	9
D01	$1,336	10
E01	$1,386	12
A03	$1,442	13
B02	$1,442	12
F01	$1,632	15
C02	$1,684	15
B03	$1,970	18
G01	$1,986	19
D02	$2,070	20
H01	$2,265	22
C03	$2,297	23

Model	*Estimated Monthly Maintenance ($US)*	*MSU*
E02	$2,339	23
I01	$2,540	26
D03	$2,817	29
F02	$2,830	29
J01	$2,836	29
R01	$3,127	33
L03	$3,200	34
N02	$3,420	37
S01	$3,450	37
K04	$3,482	38
T01	$3,666	41
M03	$3,693	42
O02	$3,742	43
L04	$3,835	45
U01	$3,969	46
P02	$4,281	50
V01	$4,430	52
N03	$4,578	54
M04	$4,693	55
Q02	$4,854	57
W01	$4,913	58
O03	$5,361	64
R02	$5,399	64
X01	$5,442	64
N04	$5,841	70
S02	$5,970	72
Y01	$5,980	72

Model	*Estimated Monthly Maintenance ($US)*	*MSU*
P03	$6,070	73
T02	$6,617	80
Z01	$6,720	82
O04	$6,752	83
Q03	$6,775	84
U02	$7,059	91
R03	$7,358	94
P04	$7,427	96
V02	$7,483	101
S03	$8,163	106
Q04	$8,442	110
W02	$8,718	113
T03	$9,072	118
R04	$9,384	123
X02	$9,655	126
U03	$10,136	132
S04	$10,423	138
Y02	$10,658	140
V03	$11,337	148
T04	$11,520	155
Z02	$11,929	160
W03	$12,325	166
U04	$12,681	172
X03	$13,466	186
V04	$13,918	193
Y03	$14,629	207
W04	$15,282	217

Model	Estimated Monthly Maintenance ($US)	MSU
Z03	$16,293	235
X04	$16,546	242
Y04	$17,337	269
Z04	$19,444	307
z9 EC		
401	$6,151	28
402	$6,253	55
501	$6,230	53
601	$6,825	65
403	$8,041	80
701	$8,173	81
404	$10,204	103
502	$10,366	104
405	$12,270	126
602	$12,397	127
406	$14,252	147
503	$14,820	152
702	$15,177	158
407	$16,111	166
603	$17,831	184
408	$17,899	185
504	$19,038	197
703	$21,918	229
604	$22,957	240
505	$23,054	240
506	$26,960	279
605	$27,843	292

Model	*Estimated Monthly Maintenance ($US)*	*MSU*
704	$28,159	298
507	$30,394	317
606	$32,211	339
508	$33,647	352
705	$33,831	363
607	$36,163	385
706	$36,626	422
608	$38,948	428
707	$38,988	479
708	$42,943	532
709	$47,136	584
710	$49,239	640
711	$51,711	690
712	$53,585	742
713	$55,171	795
714	$56,654	843
715	$58,379	893
716	$59,373	938
717	$62,764	985
718	$63,819	1032
719	$64,851	1077
720	$66,000	1127
721	$67,078	1177
722	$68,147	1226
723	$69,199	1274
724	$70,234	1314
725	$73,520	1353

Model	*Estimated Monthly Maintenance ($US)*	*MSU*
726	$74,493	1400
727	$75,422	1436
728	$76,290	1481
729	$76,952	1524
730	$77,508	1567
731	$77,922	1609
732	$78,144	1650
733	$81,077	1691
734	$81,745	1732
735	82,478	1772
736	$83,302	1811
737	$84,227	1850
738	$85,092	1889
739	$85,893	1927
740	$86,632	1963
741	$87,309	1998
742	$87,918	2033
743	$88,473	2067
744	$88,962	2101
745	$89,398	2135
746	$89,950	2168
747	$90,458	2201
748	$90,914	2233
749	$91,320	2265
750	$91,683	2295
751	$91,996	2324
752	$92,260	2353

Model	*Estimated Monthly Maintenance ($US)*	*MSU*
753	$92,483	2381
754	$92,659	2409
z890		
110	$1,531	4
120	$1,755	7
210	$1,794	8
310	$2,004	11
130	$2,290	13
220	$2,312	13
410	$2,487	15
140	$2,757	17
320	$3,164	20
230	$3,931	26
150	$3,936	26
420	$3,935	26
160	$4,619	32
240	$3,655	32
330	$5,145	38
340	$6,345	47
430	$6,605	39
250	$6,669	50
170	$7,110	56
260	$7,837	62
440	$7,899	62
350	$9,098	74
360	$10,908	91
450	$11,567	97

Model	***Estimated Monthly Maintenance ($US)***	***MSU***
270	$12,502	107
460	$13,488	119
370	$17,124	158
470	$20,649	208
z990		
301	$7,461	70
302	$13,456	132
303	$19,332	191
304	$24,871	248
305	$29,976	302
306	$34,626	352
307	$38,988	402
308	$42,943	448
309	$47,136	492
310	$49,239	538
311	$51,711	580
312	$53,585	620
313	$55,171	661
314	$56,654	696
315	$58,379	730
316	$59,373	761
317	$62,764	799
318	$63,819	837
319	$64,851	858
320	$66,000	919
321	$67,078	959
322	$68,147	999

Model	***Estimated Monthly Maintenance ($US)***	***MSU***
323	$69,199	1037
324	$70,234	1076
325	$73,520	1114
326	$74,493	1151
327	$75,422	1188
328	$76,290	1225
329	$76,952	1261
330	$77,508	1296
331	$77,922	1332
332	$78,144	1365
z800		
0E1	$1,875	7
0A1	$2,315	13
0B1	$3,276	20
0C1	$3,790	25
0X2	$4,413	28
001	$4,822	32
0A2	$5,706	44
002	$7,461	60
003	$10,032	84
004	$12,861	108
z900		
101	$5,916	4
102	$10,278	78
103	$14,723	112
104	$18,902	143
105	$22,722	173

Model	Estimated Monthly Maintenance ($US)	MSU
106	$26,188	199
107	$29,366	225
108	$32,186	245
109	$34,718	265
110	$39,611	327
111	$41,581	350
112	$43,186	372
210	$43,177	392
113	$44,485	392
114	$45,492	410
211	$45,324	420
115	$46,270	426
116	$46,692	441
212	$47,074	445
213	$48,489	475
214	$49,588	497
215	$50,434	517
216	$50,894	535
9672-G6		
X17	$5,536	30
X27	$10,528	57
X37	$14,752	80
X47	$19,552	103
X57	$24,160	126
X67	$28,224	148
X77	$31,360	169
X87	$34,496	188

Model	***Estimated Monthly Maintenance ($US)***	***MSU***
X97	$37,248	205
XX7	$39,840	221
XY7	$42,048	235
XZ7	$44,650	248
Z17	$6,464	35
Z27	$12,000	67
Z37	$17,536	95
Z47	$23,072	123
Z57	$27,840	149
Z67	$32,640	174
Z77	$36,352	197
Z87	$40,032	217
Z97	$43,360	236
ZX7	$46,304	254
ZY7	$49,440	270
ZZ7	$51,648	285
9672-G5		
RA6	$2,403	15
R16	$3,176	20
T16	$3,452	22
Y16	$4,197	26
RB6	$4,667	28
R26	$5,827	37
T26	$6,434	41
Y26	$7,843	48
RC6	$8,395	55
R36	$9,279	59

Model	Estimated Monthly Maintenance ($US)	MSU
Y36	$11,295	70
RD6	$10,549	71
R46	$12,013	76
Y46	$14,581	90
R56	$14,636	93
R66	$17,232	109
Y56	$17,729	109
R76	$19,441	124
Y66	$20,739	128
R86	$21,734	136
Y76	$22,920	146
R96	$22,976	146
RX6	$24,218	156
Y86	$25,268	161
Y96	$27,284	174
YX6	$35,000	186
Multiprise 3000		
H30	$1,050	11
H50	$1,810	20
H70	$2,975	37

Table 6: Maintenance Data

C.2 Environmental Data

Source: Technology News

Model	Power KVA	Heat KBTU/hour	Air CFM	Footprint m^2	Weight Kg
z9 BC – All Models	5.4	18.4	880	1.24	699 – 785

z9 EC S08/401 - S38/738	6.3 – 18.3	21.5 – 62.4	905 – 1965	2.49	1212 – 2003
z890 – All Models	1.5 – 4.7	5.12 – 16.05	640	1.24	674 – 785
z990 - A08/301 – D32/332	5.3 – 15.8	18.0 – 53.7	500 – 1450	2.49	1174 – 2007
z800 – All Models	3.2	10.0	400	0.83	545
z900 – 101 – 216	5.3 – 12.4	18.1 – 42.1	800 – 2223	1.32 – 2.81	917 – 1866
9672 G6	1 – 5.5	2.5 – 18.8		1 – 1.8	612 – 938
9672 G5	0.6 – 5.5	2 – 18.8		1 – 1.8	612 – 938
Multiprise 3000	1.32 – 3.96	1.02 – 3.06		0.54 – 1.62	100 – 465

Table 7: Environmental Characteristics

Conversion: 1 BTU/sec == 1055 W; 12000 BTU/hr == 1 "ton" HVAC

Appendix D - References

1. “MWLC for z/VSE 4.1: Can It Save You Software Costs?”, John Lawson, z/Systems Journal, April/May 2007.

2. “z/VSE V4.1 Live Virtual Class – Part 1: z/VSE and MWLC Announcement Overview”, G. M. Johnston, IBM.

3. “z/VSE V4.1 Live Virtual Class – Part 2: Midrange Workload License Charged”, Klaus Goebel, IBM.

4. “Pete Clark on z/VSE: z/VSE 4.1”, Pete Clark, z/Systems Journal, June/July 2006.

5. “VSE Becomes an Instrument of Strategy”, Hesh Wiener, Big Iron Volume 3 Number 2, January 16, 2007.

6. “Technology News Public Library”, http://www.tech-news.com/publib

7. “What’s New in zSubCapacity Pricing”, Kay Elizabeth Adams, IBM, April 2007

8. “VSE Connectors and Utilities”,

   http://www.ibm.com/servers/eserver/zseries/zvse/products/connectors.html

Glossary

GMLC	Graduated Monthly License Charges
MSU	Million Service Units
MWLC	Midrange Workload License Charges
TWLC	Tiered Workload License Charges
zELC	System z Entry Level Licence Charges