IBM

VSE – Looking back over the last 40 years

Dr. Klaus Goebel
z/VSE Systems Manager

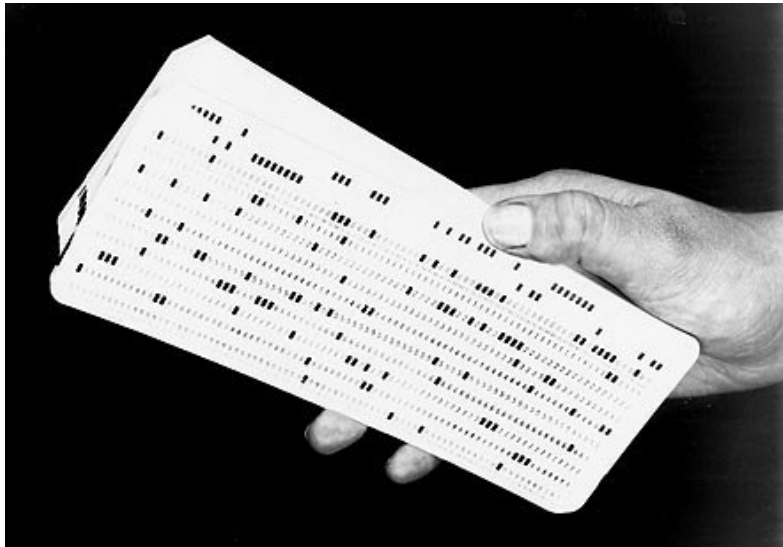**GSE z/VM und z/VSE Frühjahrstagung**
Berlin, April 2005

"The further backward you look, the further forward you can see….."

…..*Sir Winston Churchill*

In the beginning was the card…..



the key punch ….

and the Hollerith Tabulator ….

The 1950's
….. OK - no VSE yet, but one must start somewhere

The IBM family tree – 1952 to 1964

- Several mainframe families, each uniquely designed for different applications
- Each family had a different, incompatible architecture
- Even within families, moving from one generation to the next involved a migration
  - although the advent of 'common' compilers (i.e. COBOL and FORTRAN) made migration a bit easier
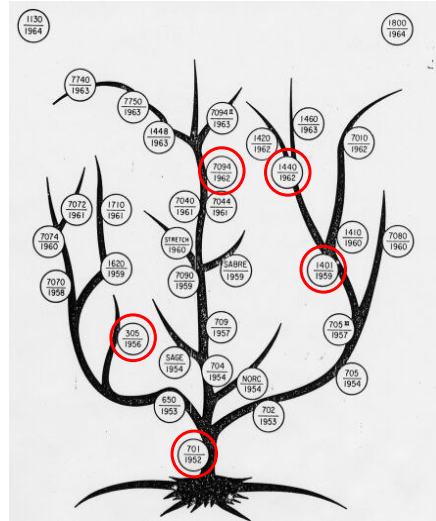
IBM 701 – 1952
1ˢᵗ generation

- *First* IBM large-scale electronic computer manufactured in quantity
- IBM's *first* commercially available scientific computer
- The *first* IBM machine in which programs were stored in an internal, addressable, electronic memory
- Key to IBM's transition from punched card machines to electronic computers
- The beginning of the pioneering line of IBM 700 series computers, including the 702, 704, 705 and 709

IBM 1401 – 1959
2nd generation

- The all-transistorized IBM 1401 Data Processing System offered features found in electronic data processing systems to ***smaller businesses***, previously limited to the use of conventional punched card equipment.
- Features included: high speed card punching and reading, magnetic tape input and output, high speed printing, stored program, and arithmetic and logical ability

The 1960's
……a mainframe revolution begins with IBM System/360 *and* IBM System/360 Disk Operating System (DOS/360)

IBM System/360 – 1964
3rd generation

- Customers were frustrated with the migration costs that came with each processor upgrade
- IBM developed a family of processors using the same durable architecture
  - published in the S/360 Principles of Operations
  - 24-bit addressing (32-bit architecture)
- Solid logic circuit cards
- Common peripheral devices
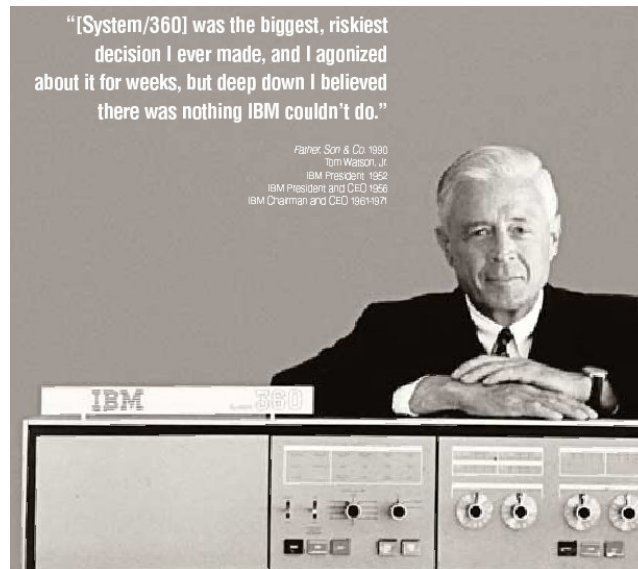- One operating system - *initially*
 - Operating System/360 (OS/360)

S/360 Family

Model	Announced	First Shipped	
30	April 7, 1964	June, 1965	
40	April 7, 1964	April, 1965	
50	April 7, 1964	August, 1965	
20*	November 18, 1964	April, 1966	
65	April 22, 1965	November, 1965	
75	April 22, 1965	January, 1966	
44	August 16, 1965	June, 1966	focused on scientific
67	August 16, 1965	May, 1966	early Virtual Storage
91	January 18, 1966	October, 1967	
25	January 3, 1968	October, 1968	
85	January 30, 1968	December, 1969	
195	August 20, 1969	March, 1971	

Fortune Magazine called S/360 a '$5 Billion Gamble'

"[System/360] was the biggest, riskiest decision I ever made, and I agonized about it for weeks, but deep down I believed there was nothing IBM couldn't do."

Father, Son & Co. 1990
Tom Watson, Jr.
IBM President 1952
IBM President and CEO 1956
IBM Chairman and CEO 1961-1971

1965

- **S/360 - Model 30 System**
  - Approx. 30-35 KIPS (.03 MIPS)
  - Solid Logic Technology
  - 8 to 64 KB main storage
    - ferrite core memory technology
  - 2311 Disk Storage Drive
    - 7.25 MB/removable pack
    - 75 ms average access time
  - 2401 Magnetic Tape Unit
    - 9 track, 1600 bpi
    - Up to 180,000 bps
  - 2540 Card Read/Punch
    - 1000 cpm read
    - 300 cpm punch
  - 1403-N1 Line Printer
    - up to 1100 lpm

- **Disk Operating System/360**
  - Releases 1 => 27
    - designed for 16-32 KB systems
    - disk used for program libraries, transient supervisor functions, etc.
  - 1 partition
    - up to 3 beginning in Release 3
    - batch multiprogramming in R16
  - BTAM for telecommunications
    - added in Release 3
  - User programming in Macro Assembler, COBOL, Fortran, PL/1, and RPG
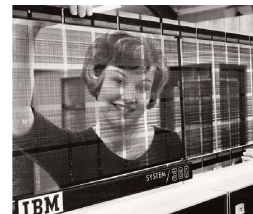
What were things like in 1965?

- US President: Lyndon B. Johnson
- Value (in 2005$) of $1 = $6.01
- Average income = $7,704
- Average price of a car = $2,350
- Average price of a house = $21,500
- Dow Jones Industrial Average = 969
- Some Top Songs
  - Beatles 'Help'
  - Sonny & Cher 'I Got You Babe'
  - Rolling Stones 'Satisfaction'
- Some Top TV Shows
  - I Dream of Jennie
  - Batman
  - Daniel Boone
- Best Picture
  - The Sound of Music

The 1970's
……introduction of System/370 and DOS/VS

S/370 family

Model	Announced	First Shipped	
155	**June 30, 1970**	**January, 1971**	
165	**June 30, 1970**	**April, 1971**	
195	**June 30, 1970**	**August, 1973**	
145	**September 23, 1970**	**June, 1971**	
135	**March 8, 1971**	**April, 1972**	
158	**August 2, 1972**	**April, 1973**	Virtual storage capable models
168	**August 2, 1972**	**May, 1973**	
125	**October 4, 1972**	**April, 1973**	
115	**March 13, 1973**	**March, 1974**	
138	**June 30, 1976**	**November, 1976**	
148	**June 30, 1976**	**January, 1977**	

VSE Moved from Endicott to Boeblingen
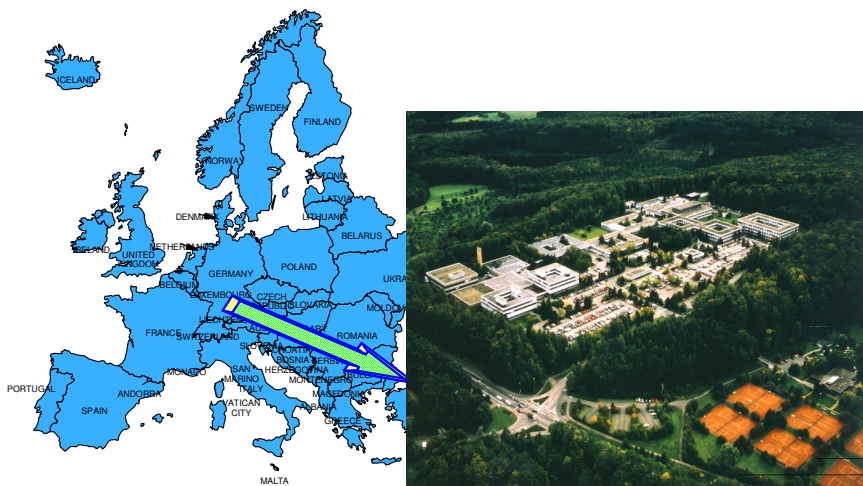
1972

- S/370 - Model 135 System
  - Compatible upgrade from S/360
  - Integrated Circuit technology
  - 96 to 256 KB Processor Storage
    - 'monolithic' storage technology
    - virtual storage
  - 3330 Direct Access Storage
    - 100 MB/removable pack
  - 3420 Magnetic Tape Subsystem
    - 9 track, 1600 bpi
    - up to 320,000 bps
  - 3505 Card Reader/3525 Card Punch
    - 1200 cpm read
    - 300 cpm punch
  - 3211 Printer
    - up to 2000 lpm

- DOS/VS
  - Releases 28 => 34
  - up to 16 MB virtual storage
  - 5 partitions (up to 7 in R34)
  - Linkage Editor, Relocating Loader
  - VSAM
    - balanced sequential/random
  - POWER (first a Type III in 1968)
    - short for "**P**riority **O**utput **W**riters, **E**xception Processors, and Input **R**eaders"
 - 'DBDC' => CICS and DL/I

> Starting to look like something that's recognizable as VSE

What were things like in 1972?

- US President: Richard Nixon
- Value (in 2005$) of $1 = $4.53
- Average income = $12,625
- Average price of a car = $3,879
- Average price of a house = $30,500
- Dow Jones Industrial Average = 1020
- Some Top Songs
  - Don McLean 'American Pie'
  - Sammy Davis, Jr. 'The Candy Man'
  - Johnny Nash 'I Can See Clearly Now'
- Some Top TV Shows
  - Bob Newhart Show
  - The Waltons
  - Monday Night Football
- Best Picture
  - The Godfather
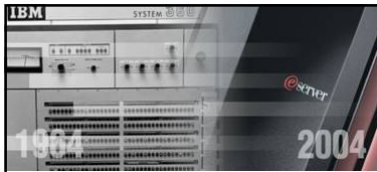
The 1980's

……decade began with the successful 4300 and DOS/VSE
……later, the pace picked up with the 9370 and VSE/SP

1979

- **IBM 4331 System**
  - Large Scale Integration (LSI) technology
  - 512 and 1024 KB Processor Storage
    - 64K bit memory chip technology
    - Integrated I/O adapters
    - optional ECPS ('e' mode)
  - 3310 Direct Access Storage
    - Fixed Block Architecture (FBA)
    - 64.5 MB/fixed (non-removable) media
  - 8809 Magnetic Tape Subsystem
    - 9 track, 1600 bpi
    - up to 160,000 bps
  - 3505 Card Reader/3525 Card Punch
    - 1200 cpm read
    - 300 cpm punch
  - 3262 Printer
    - up to 650 lpm

- **DOS/VSE**
  - 7 partitions
    - up to 12 in Release 2
  - Fixed Block Architecture (FBA)
  - Misc. Enhancements
    - ASI procedures, channel switching, DASD sharing, add statements, missing interrupt handler, etc.
  - MSHP
  - ICCF (based on ETSS Type III)
 - ACF/VTAM
  - Priced Components

What were things like in 1979?

- US President: Jimmy Carter
- Value (in 2005$) of $1 = $2.61
- Average income = $22,316
- Average price of a car = $6,847
- Average price of a house = $71,800
- Dow Jones Industrial Average = 839
- Some Top Songs
  - Rupert Holmes 'Escape' (Pina Colada song)
  - Donna Summer 'Hot Stuff'
  - Rod Stewart 'Do Ya Think I'm Sexy'
- Some Top TV Shows
  - Dallas
  - All in the Family (Archie Bunker)
  - Knot's Landing
- Best Picture
  - Kramer vs. Kramer

1987

- **IBM 9375 – Model 60 System**
  - Modular, 19" rack-mounted
  - 8 or 16 MB Processor Storage
    - Integrated I/O adapters
    - office environment
  - 9332 Direct Access Storage
    - Fixed Block Architecture (FBA)
    - 400 MB/2 actuator fixed media
  - 9347 Magnetic Tape Subsystem
    - 9 track, 1600 bpi
    - up to 160,000 bps

- **VSE/SP V3**
  - 12 partitions
  - Virtual Address Extensions (VAE)
    - up to 9 address spaces
  - New Librarian
  - Interactive User Interface (IUI)
  - Conditional JCL
  - Packaging
    - base and optional products
    - base was designed, developed, tested, shipped, and serviced as if it were a single integrated system
 - Capacity-based Pricing
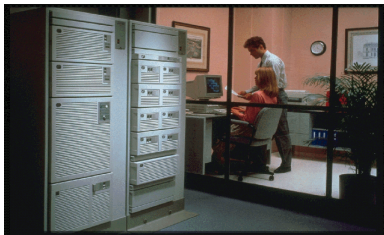
What were things like in 1987?

- US President: Ronald Reagan
- Value (in 2005$) of $1 = $1.67
- Average income = $36,884
- Average price of a car = $13,386
- Average price of a house = $127,200
- Dow Jones Industrial Average = 1939
- Some Top Songs
    - Los Lobos 'La Bamba'
    - Starship 'Nothing's Gonna Stop Us Now'
    - U2 'With or Without You'
- Some Top TV Shows
    - ALF
    - The Wonder Years
    - In the Heat of the Night
- Best Picture
    - The Last Emperor

How many lives does a Cat have?
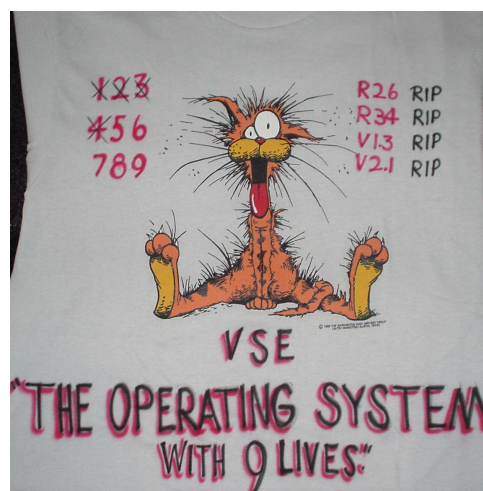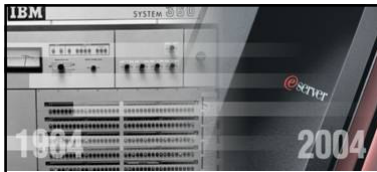
The 1990's – revitalization of VSE!

……the decade began with ES/9000 and VSE/ESA V1
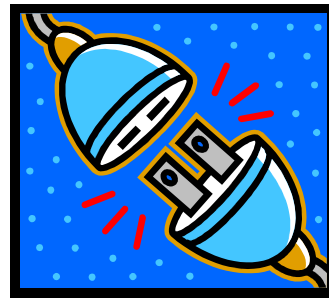……followed by IBM's CMOS Transition and VSE/ESA V2

The 1990's –

. . . . However, many industry 'experts' ridiculed the mainframe.
They said PCs and 'client/server' alone represent the future of IT.

One well known example….

- "I predict that the last mainframe will be unplugged on March 15, 1996."
  - Stewart Alsop, March 1991

1993

- ES/9221 – Model 150 System
  - 16 to 256 MB Processor Storage
    - Modular, 19" rack-mounted
    - Integrated I/O adapters
    - PR/SM
    - Parallel and ESCON Channels
  - 9336 Direct Access Storage
    - Fixed Block Architecture (FBA)
    - 857 MB/fixed media
  - 3490 Magnetic Tape Subsystem
    - 200 MB cartridges
    - up to 4.5M bps

- VSE/ESA V1.3
  - 31-bit real and virtual addressing
  - Dynamic partitions
    - number limited only by tasks
    - 1 partition per address space
  - Access Registers
  - Data Spaces
  - Virtual Disk
  - Virtual Storage Constraint Relief
  - Dynamic (XA) Channel Subsystem
  - ESCON Channels

What were things like in 1993?

- US President: William Jefferson Clinton
- Value (in 2005$) of $1 = $1.31
- Average income = $47,221
- Average price of a car = $17,698
- Average price of a house = $147,700
- Dow Jones Industrial Average = 3754
- Some Top Songs
  - Mariah Carey 'Hero'
  - Meat Loaf 'I'd Do Anything for Love'
  - Janet Jackson 'That's the Way Love Goes'
- Some Top TV Shows
  - Frasier
  - Homicide: Life on the Streets
  - N.Y.P.D. Blues
- Best Picture
  - Schindler's List

1998

- ## Multiprise 2000 System
  - based on G3 CMOS technology
  - 1 to 5-way Processing Units
  - 128 MB to 4 GB Processor Storage
  - Parallel and ESCON Channels
  - Integrated DASD
    - a portion of main memory for cache
    - emulate 3380/3390 ECKD
    - up to 288 GB capacity
  - and/or RAMAC External DASD
  - Open Systems Adapter (OSA)
  - 3490E Magnetic Tape Subsystem
    - 2.4 GB/cartridge with IDRC

- ## VSE/ESA V2.3
  - Year 2000 ready
  - optional Turbo dispatcher
    - support for n-way processors
  - VSAM KSDS > 4GB
  - set timezone/daylight savings time
  - TCP/IP for VSE/ESA (native)
    - offered under agreement with CSI
  - ACF/VTAM V4.2
  - LE and LE-based languages
    - COBOL for VSE/ESA
    - PL/1 for VSE/ESA
    - C for VSE/ESA
 - Improved console support

What were things like in 1998?

- US President: Bill Clinton
- Value (in 2005$) of $1 = $1.16
- Average income = $59,589
- Average price of a car = $19,560
- Average price of a house = $181,900
- Dow Jones Industrial Average = 9027
- Some Top Songs
  - Shania Twain 'You're Still the One'
  - Destiny's Child 'No, No, No'
  - Third Eye Blind 'How's It Going to Be?'
- Some Top TV Shows
  - Ally McBeal
  - Everybody Loves Raymond
  - 60 Minutes II
- Best Picture
  - Shakespeare In Love

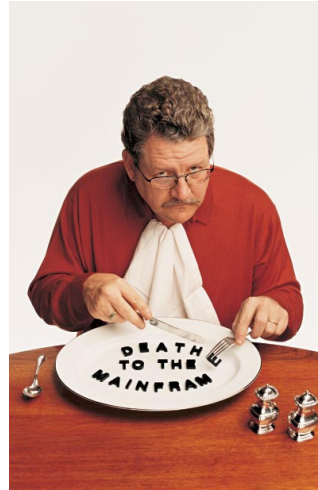# The 2000's

…a new century begins with Multiprise 3000 and VSE/ESA V2

…looking to the present with IBM @**server** zSeries and z/VSE V3

IBM TotalStorage®

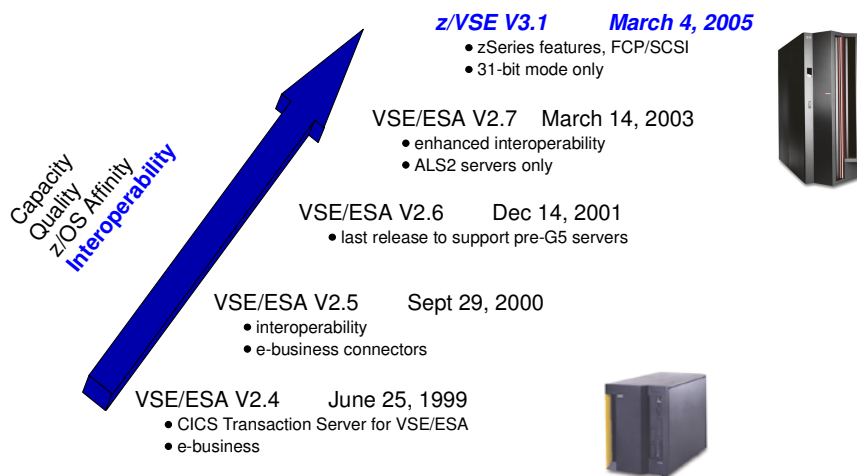Linux on zSeries

Integration

z/VSE

IBM @server **zSeries**
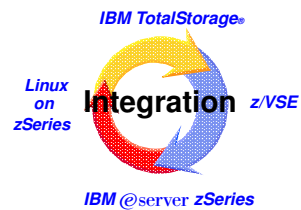
Reports of the death of the mainframe ….were premature

- "I predict that the last mainframe will be unplugged on March 15, 1996."
  – Stewart Alsop, March 1991
- "It's clear that corporate customers still like to have centrally controlled, very predictable, reliable computing systems— exactly the kind of systems that IBM specializes in."
  – Stewart Alsop, February 2002

Source: IBM Annual Report 2001

Recent VSE Innovation

z/VSE V3.1   March 4, 2005
- zSeries features, FCP/SCSI
- 31-bit mode only

VSE/ESA V2.7   March 14, 2003
- enhanced interoperability
- ALS2 servers only

VSE/ESA V2.6   Dec 14, 2001
- last release to support pre-G5 servers

VSE/ESA V2.5   Sept 29, 2000
- interoperability
- e-business connectors

VSE/ESA V2.4   June 25, 1999
- CICS Transaction Server for VSE/ESA
- e-business

Capacity
Quality
z/OS Affinity
Interoperability

VSE Strategy – easy as

- **Protect** your existing investments in core VSE programs, data, equipment, IT skills, *plus* business processes, end user training, etc.
    - modernize, i.e. extend VSE resources to Web
    - exploit IBM servers, storage, and software
- **Integrate** VSE with the rest of your IT based on open and industry standards
    - IBM middleware
    - VSE connectors and web services
- **Extend** with Linux, and in particular with Linux on zSeries
    - infrastructure consolidation and simplification
    - add new infrastructure and/or line-of-business applications

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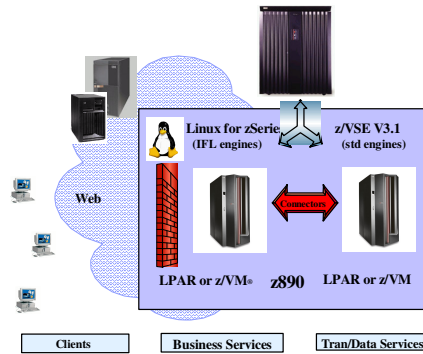
z/VSE V3.1

- **Protect** investments in your core VSE assets
    - **Fibre Channel Protocol (FCP) Channel attached SCSI disk**
    - HiperSockets, incl spanned HiperSockets
    - PCICA hardware encryption assist
    - Adapter interrupts for OSA-Express
    - OSA-Express, incl Ethernet and Token Ring
    - OSA-Integrated Console Controller
    - Up to 30 LPARs
    - Up to 2 LCSSs on z890 - 4 on z990
    - FICON-Express
- **Integrate** VSE with the rest of your IT
    - VSE Connectors (e.g. VSAM Redirector)
    - Web Services (e.g. SOAP, XML)
- **Extend** with Linux on zSeries
    - DB2 UDB, WebSphere Application Server, WebSphere Portal, etc. etc.

Note 1: z/VSE can operate in 31-bit mode only. It does not implement z/Architecture and specifically does not implement 64-bit mode capabilities. z/VSE is designed to support selected features of IBM zSeries hardware

VSE Server Support

IBM zSeries Servers	z/VSE V3.1	VSE/ESA V2.7	VSE/ESA V2.6	Hdwr EoS
zSeries 800, 890, 900, 990 (31-bit only)	Yes	Yes	Yes	tbd
S/390 Parallel Enterprise Server™ G5/G6	Yes	Yes	Yes	tbd
S/390® Multiprise® 3000	Yes	Yes	Yes	tbd
S/390 Parallel Enterprise Server™ G3/G4	No	No	Yes	tbd
S/390® Multiprise® 2000	No	No	Yes	tbd
S/390 Integrated Server	No	No	Yes	tbd
S/390 Parallel Enterprise Server™ G2	No	No	Yes	12/2004
P/390 and R/390	No	No	Yes	12/2004
S/390 Parallel Enterprise Server™ G1	No	No	Yes	12/2003
ES/9000® − 9221	No	No	Yes	12/2003
ES/9000® − 9121, 9021	No	No	Yes	06/2003

2005

- IBM @server zSeries 890
  - based on innovative z990 technology
  - 1 model, 28 capacity settings
    - 1 to 4 Processing Units (PUs)
  - 8 to 32 GB Processor Storage
  - up to 30 LPARs, up to 2 LCSSs
  - Hipersockets
  - ESCON, FICON Express, FCP Channels
  - PCICA encryption assist
  - OSA Express & OSA-ICC
  - Integrated Facility for Linux (IFL)
  - IBM Enterprise Storage Server (Shark)
    - high availability, high performance
    - Flashcopy and PPRC
    - 1 to 55.9 TB capacity
  - IBM 3592 TotalStorage Enterprise Tape
    - 900 GB/cartridge at 3:1 compression
    - up to 40 MB transfer rates

- z/VSE V3.1
  - Turbo dispatcher
    - support for n-way processors
  - CICS TS for VSE/ESA
    - availability and z/OS affinity
  - TCP/IP for VSE/ESA
    - offered under agreement with CSI
  - VSE e-business connectors
  - Web services
  - Hipersockets
  - PCICA encryption assist
  - Shark Flashcopy and PPRC
  - FCP-attached SCSI disks

40 Years of Progress in Hardware

- S/360 - Model 30 System
  - Approx. 30-35 KIPS (.03 MIPS)
    - Solid Logic Technology
    - 8 to 64 KB main storage
    - ferrite core memory technology
  - 2311 Disk Storage Drive
    - 7.25 MB/removable pack
    - 75 ms average access time
  - 2401 Magnetic Tape Unit
    - 9 track, 1600 bpi
    - Up to 180,000 bps
  - 2540 Card Read/Punch
    - 1000 cpm read
    - 300 cpm punch
  - 1403-N1 Line Printer
    - up to 1100 lpm

- IBM @server zSeries 890
  - based on innovative z990 technology
    - 1 to 4 Processing Units (PUs)
    - 8 to 32 GB Processor Storage
    - up to 30 LPARs, up to 2 LCSSs
    - Hipersockets
    - ESCON, FICON Express, FCP
    - PCICA encryption assist
    - OSA Express & OSA-ICC
    - Integrated Facility for Linux (IFL)
  - IBM ESS (Shark)
    - high availability, high performance
    - Flashcopy and PPRC
    - 1 to 55.9 TB capacity
  - 3592 TotalStorage Enterprise Tape
    - 900 GB/cartridge at 3:1 compression
    - up to 40 MB transfer rates

40 Years of Progress in Software

- Disk Operating System/360
  - Releases 1 => 27
    - designed for 16-32 KB systems
    - disk used for program libraries, transient supervisor functions, etc.
  - 1 partition
    - up to 3 beginning in Release 3
    - batch multiprogramming in R16
  - BTAM for telecommunications
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  - TCP/IP for VSE/ESA
    - offered under agreement with CSI
  - VSE e-business connectors
  - VSE Web services SOAP/XML
  - Hipersockets
  - PCICA encryption assist
  - Shark Flashcopy and PPRC
  - FCP-attached SCSI disks
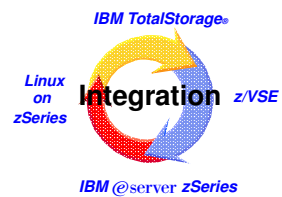
Two lessons can be drawn from history...

1. The revolution that begun 40 years ago <u>never ended</u>
2. Legacy systems are systems that work!

"Never prophesy, especially about the future…"

…..Sam Goldwyn

For more information…..

Much of the product information in this presentation, plus much more, can be found on the IBM Archives web site. If you are interested, simply use this URL:

http://www-1.ibm.com/ibm/history/index.html

Also see 'The 360 Revolution', by Chuck Boyer. Available in .pdf format at:

ftp://ftp.software.ibm.com/eserver/zseries/misc/bookoffer/download/360revolution_040704.pdf

Other information can be found on the VSE web site:

http://www-1.ibm.com/servers/eserver/zseries/os/vse/

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e-business logo*	HiperSockets	pSeries*
CICS*	IBM*	S/390*
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DB2 Connect	IBM eServer	Server
DB2 Universal Database	IBM e(logo)server*	TotalStorage*
Domino	iSeries	VM/ESA*
DRDA*	Lotus*	VSE/ESA
Enterprise Storage	Multiprise*	z/VSE
Server*	MQSeries*	WebSphere*
ES/9000*		xSeries*
		z/VM*
		zSeries*

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