zPL3222 – Fifty Years of z/VSE – Still going strong

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2015

IBM Systems Technical University

IBM z Systems • IBM Power Systems • IBM Storage

October 5–9 | Hilton Orlando, Florida

The VSE history

- **DOS/360 – How it begun**
- **DOS/VS – Added virtual storage capability**
- **DOS/VSE – Extended version of DOS/VS**
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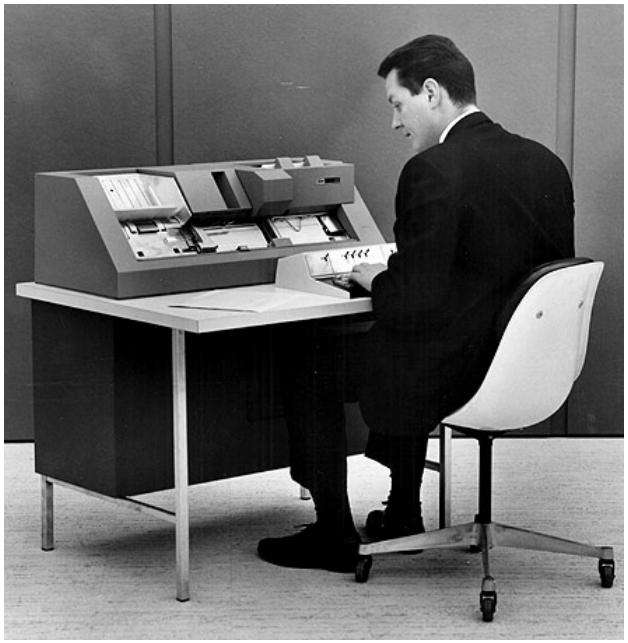
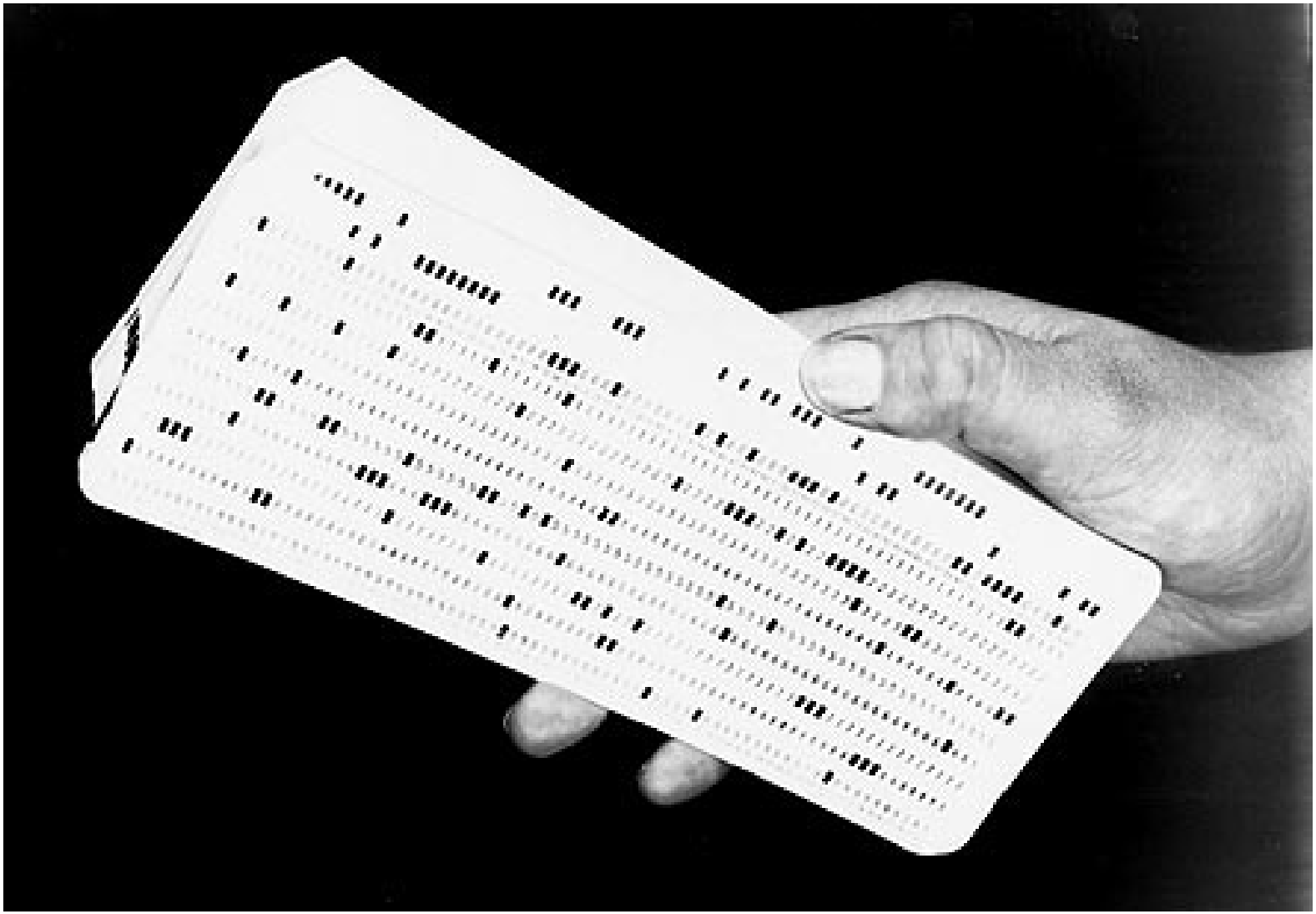
- **VSE/ESA – 31-bit VSE version**
- **z/VSE – Today's VSE**



It all started with Herman Hollerith‘s punch cards



System/360 – Announced April 7, 1964

In the most important product announcement in company history to date, IBM introduces the IBM System/360 - a new concept in computers which creates a "family" of small to large computers incorporating IBM-designed Solid Logic Technology (SLT) microelectronics and uses the same programming instructions. The concept of a compatible "family" of computers transforms the industry.

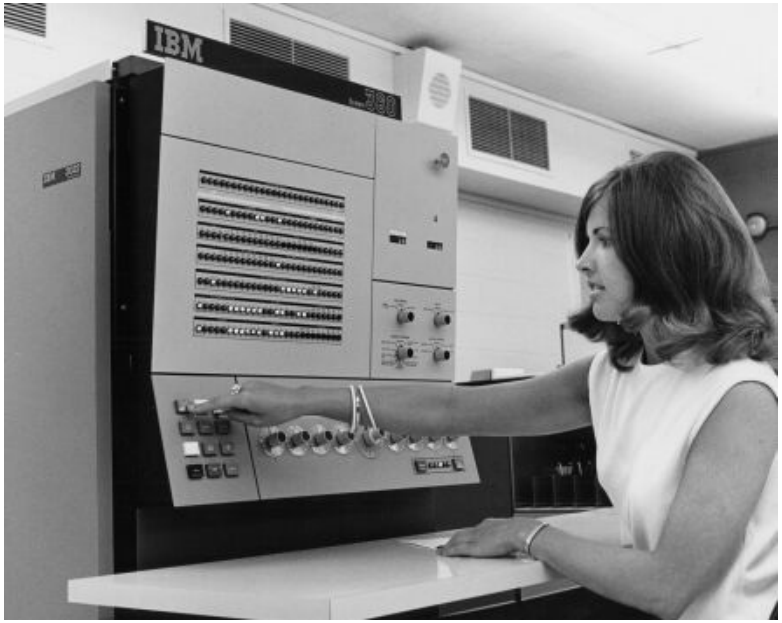
Fortune Magazine called S/360 a “$5 Billion Gamble“

“(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

DOS/360 – How it begun

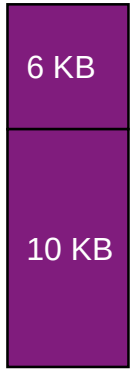
- **IBM's plan was to deliver**
  - a durable hardware architecture, S/360
  - a single operating system, OS/360
- **OS/360 project falling behind schedule**
  - When finally released, a year late, it required a minimum of 64 KB of memory
- **IBM System/360 Model 30**
  - Announced April 7, 1964
  - Approx. 30-35 KIPS (.03 MIPS)
  - Solid Logic Technology
  - 8 to 64 KB main storage
    - ferrite core memory technology
- **DOS/360 created as interims only**
  - Designed for 16-32 KB systems
  - Developed at IBM Endicott, NY

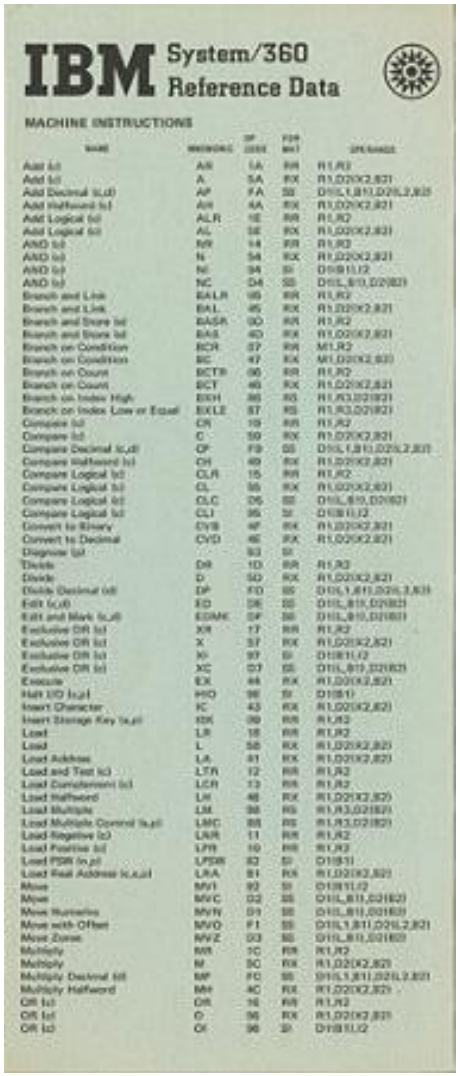


DOS/360 Release 1 – The first S/360 operating system in 1965

- **Required approx 6 KB for system residence**
  - Supervisor
- **Required approx 10 KB for dynamically loadable system programs and user applications**
  - JCL, Sort,…
- **Storage overlays**
- **One batch partition**
  - Up to three with Release 3
- **IOCS (Input/Output Control System) access methods**
  - Sequential (DTFSD), Direct (DAM), Index-Sequential (ISAM)
- **BTAM for telecommunications**
  - Added with Release 3
- **User programming in**
  - Macro Assembler
  - RPG (Report Program Generator)
  - COBOL
  - Fortran
  - PL/I

- **A typical minimum configuration would consist of**
  - S/360 Model 30 with 16 KB memory, IBM 1052 printer keyboard, printer, card reader, card punch, one IBM 2311 disk drive (7.25 MB removable pack)




IBM System/360 Reference Data

MACHINE INSTRUCTIONS

How were things back in 1965

- **Relative worth of $ 1.00 from 1965 to 2014 is $ 7.50**
  - According to Consumer Price Index
- **Dow Jones Industrial Average = 969**
- **Average cost of new house = $ 13,600**
- **Average income per year = $ 6,450**
- **Average cost of a new car = $ 2,650**
  - Gas per gallon = 31 Cent

Ladies High Fashion
mid 1960's Boots
From $9.77 to $13.70

Sixties Pocket
Transistor Radios
$14.95

- **The Mary Quant designed Mini Skirt appears in London**

- **Popular films**
  - Mary Poppins
  - The Sound of Music
  - Goldfinger
  - My Fair Lady
- **Popular songs**
  - Beatles “Help“
  - Rolling Stones “Satisfaction“

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System/370

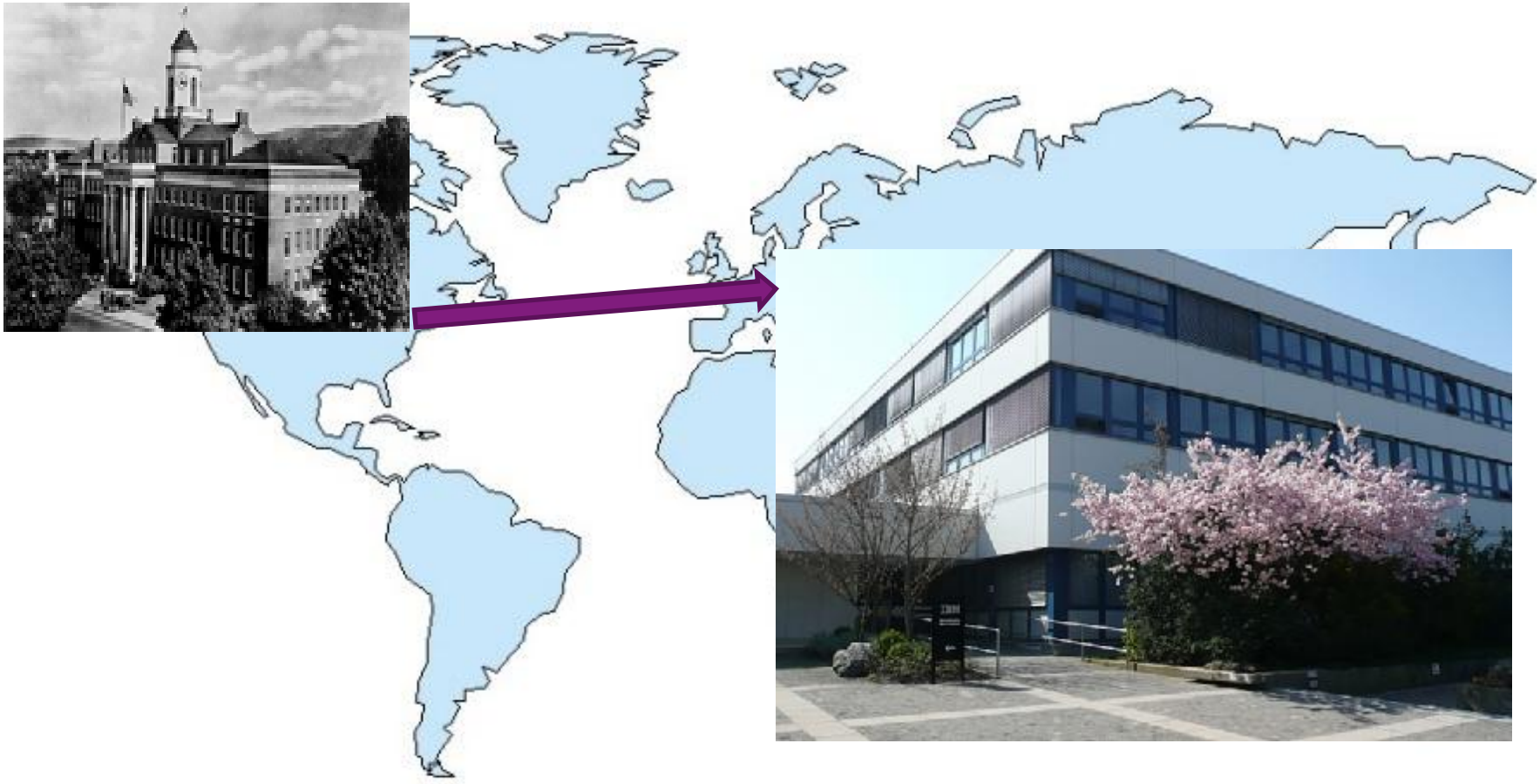
- **Virtual storage**
  - Translation of virtual to real addresses using Dynamic Address Translation (DAT) logic
- **Compatible upgrade from S/360**
- **Fully integrated monolithic memory**
- **New I/O devices**
  - 3330 Direct Access Storage (100 MB removable disk pack)
  - 3420 Magnetic Tape Subsystem
  - 3505 Card Reader & 3525 Card Punch

Model	Memory size	Announced	First Shipped
145	112K – 512KB	September 23, 1970	June, 1971
135	96K – 256KB	March 8, 1971	April, 1972
125	96K / 128KB	October 4, 1972	April, 1973
115	64K / 96KB	March 13, 1973	March 1974
138	512K – 1MB	June 30, 1976	November 1976
148	1MB – 2 MB	June 30, 1976	January 1977

DOS/VS = DOS/360 with Virtual Storage support (early 70's)

- **Releases 28 à 34**
- **Up to 16 MB virtual storage**
  - Later known as "the line"
- **5 partitions**
  - Up to 7 partitions in Release 34
- **Linkage Editor**
  - Relocation Loader for effective multiprogramming
- **POWER for I/O spooling**
  - (Priority Output Writers, Execution Processors, and Input Readers)
- **New VSAM file system**
- **'DBDC' à CICS and DL/I**

VSE mission transferred from Endicott, NY to Böblingen, Germany



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DOS/VSE = “Extended” version of DOS/VS

- **Up to 12 partitions**
- **ICCF - Interactive Interface as an integral part of DOS/VSE**
- **ACF/VTAM became a component of DOS/VSE**
- **Maintain System History Program (MSHP)** to install programming packages, APAR/local fixes, and service tapes
- **Support of FBA disk devices**
- **Last free version of DOS/VSE**

- **In 1979, an imaginary DOS/VSE customer might have**
  - a 4331 system with 512 KB main memory
  - 6 IBM 3310 FBA disk drives (65 MB per drive) or
  - 4 IBM 3340 CKD disk drives (35/70 MB removable packs)
  - 2 IBM 8809 reel-to-reel tape drives
  - 1 IBM 3203 line printer

- **Use of punched cards began to fade**

April 11, 1980

Hard Wait of all DOS/VSE systems, worldwide

Can‘t be us. We didn‘t change anything!

TOD max field length = X‘8FFFFFFFFFFF‘

Fix: modify ‘8‘ into ‘F‘

Be prepared for reoccurance on
September 17, 2042,
11:53:47 MET

SSX/VSE – Small System Executive

- **A pre-generated, pre-configured VSE operating system for the 4321, 4331, 4341, and 4361 systems**
- **Designed for ease of installation, operation and use**
- **SSX/VSE consists of VSE components and unique prompters and aids**
- **Tested as a single product including**
  - Assembler, POWER, CICS/VS, ICCF, IPF, ACF/VTAM, VSE/VSAM, Sort/Merge, DITTO, Fast Copy, OCCF, IPCS, COBOL
  - plus optional products
- **SSX integration approach was too rigid for most customers**
- **VSE/SP refined the concept – and got overwhelmingly successful**

VSE/SP = VSE System Package

- **Integrated, pre-packaged VSE system**
- **'SIPO' concept (System Installation Productivity Option)**
- **Fast Service Upgrade (FSU)**
  - § Making release-to-release migration simpler

VSE/SP V3 (1987)

- **§ Packaging concept of 'Base' and 'Optional' products**
  - – 'Base' = integrated package containing commonly used core products
  - – 'Optional' = coordinated and shipped and serviced with the base
- **12 partitions**
- **Virtual Address Extensions (VAE)**
  - Supporting up to 9 address spaces
- **New Librarian**
- **Interactive User Interface (IUI)**
- **Conditional JCL**
- **Capacity based software pricing**

```
BG 0000 * STEP 0 EXECUTED
BG 0000 * STEP 1 EXECUTED
BG 0000 * STEP 2 EXECUTED
BG 0000 * STEP 1 EXECUTED
BG 0000 * STEP 2 EXECUTED
BG 0000 * STEP 3 EXECUTED
BG 0000 EOJ DPPETE
```

Figure 3: Console Listing Showing the Order of Program Execution

```
CATALOG PROC2.PROC REPLACE=YES DATA=YES
// GOTO &STEP
/. STEP0
* STEP 0 EXECUTED
/. STEP1
* STEP 1 EXECUTED
/. STEP2
* STEP 2 EXECUTED
// IF $RC EQ '0000' THEN
// SETPARM STEP=STEP5
// IF $RC EQ '0000' THEN
// GOTO END
/. STEP3
* STEP 3 EXECUTED
/. END
/+
CATALOG PROC3.PROC REPLACE=YES DATA=YES
// GOTO &STEP
/. STEP4
* STEP 4 EXECUTED
/. STEP5
* STEP 5 EXECUTED
/. STEP6
* STEP 6 EXECUTED
/. END
/+
```

Figure 4: Branch Forward Procedure

IBM ES/9370 – My first involvement with VSE in 1985

- **Designed to operate in an office environment**
- **Packaged for 19-inch racks**
- **Main memory ranged from 4 MB to 16 MB**
- **Different models with 0.5 to 1.4 MIPS**
- **New rack mounted devices**
  - IBM 9332 or 9335 FBA disk
  - IBM 9347 Tape
- **In 1987 new CMOS technology based IBM ES/9370 models were announced**
  - 0.7 MIPS to 1.3 MIPS
  - Replacing bipolar technology with CMOS at the low-end
- **First CMOS implementation on mainframe**

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The begin of the VSE crisis

- **IBM introduced Extended Architecture (XA) to S/370 in early 1983**
  - 31-bit architecture expanding address range to 2 GB
  - Delivered first with the IBM 3081
  - IBM 4381 supported XA
  - MVS/XA and VM/XA

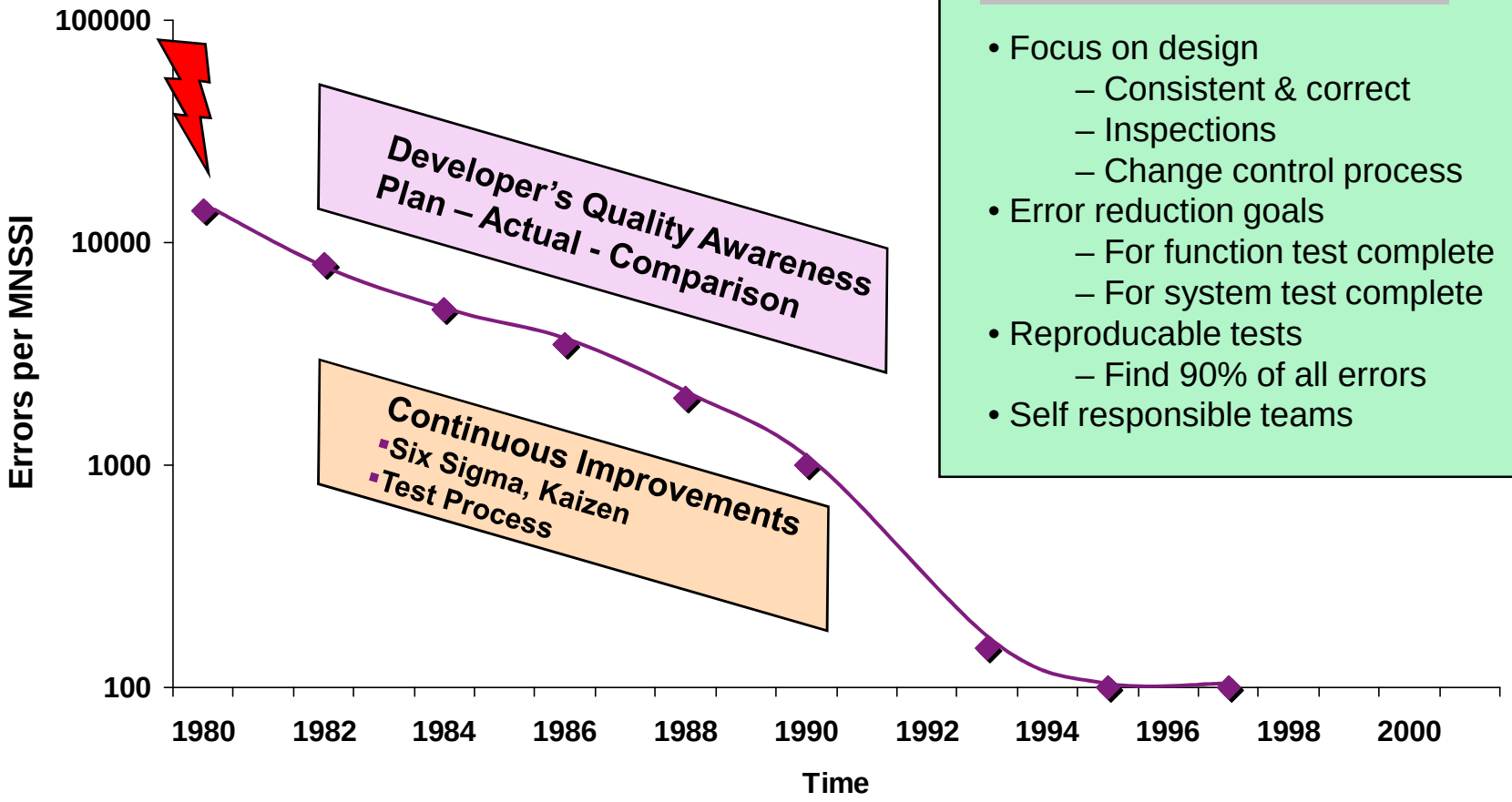
- **VSE/SP was still S/370 mode only (24-bit architecture)**
  - Customer concerns: ***Is VSE left behind by IBM ?***

- **Many "industry experts" ridiculed the mainframe**
  - The PC and client / server represent the future

Stewart Alsop

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

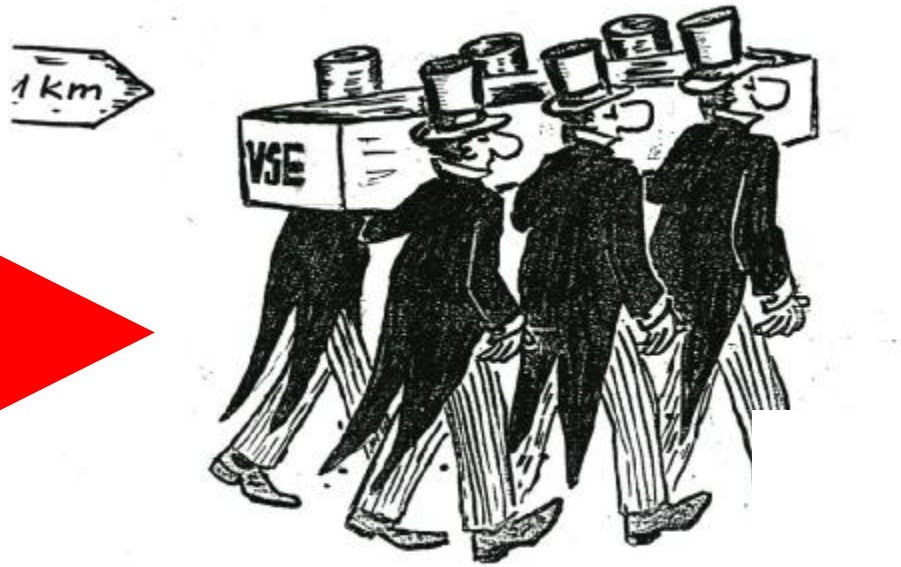
VSE code quality was not acceptable



Critical Success Factors:

- Focus on design
  - Consistent & correct
  - Inspections
  - Change control process
- Error reduction goals
  - For function test complete
  - For system test complete
- Reproducable tests
  - Find 90% of all errors
- Self responsible teams

The VSE crisis at its peak in late 80‘s

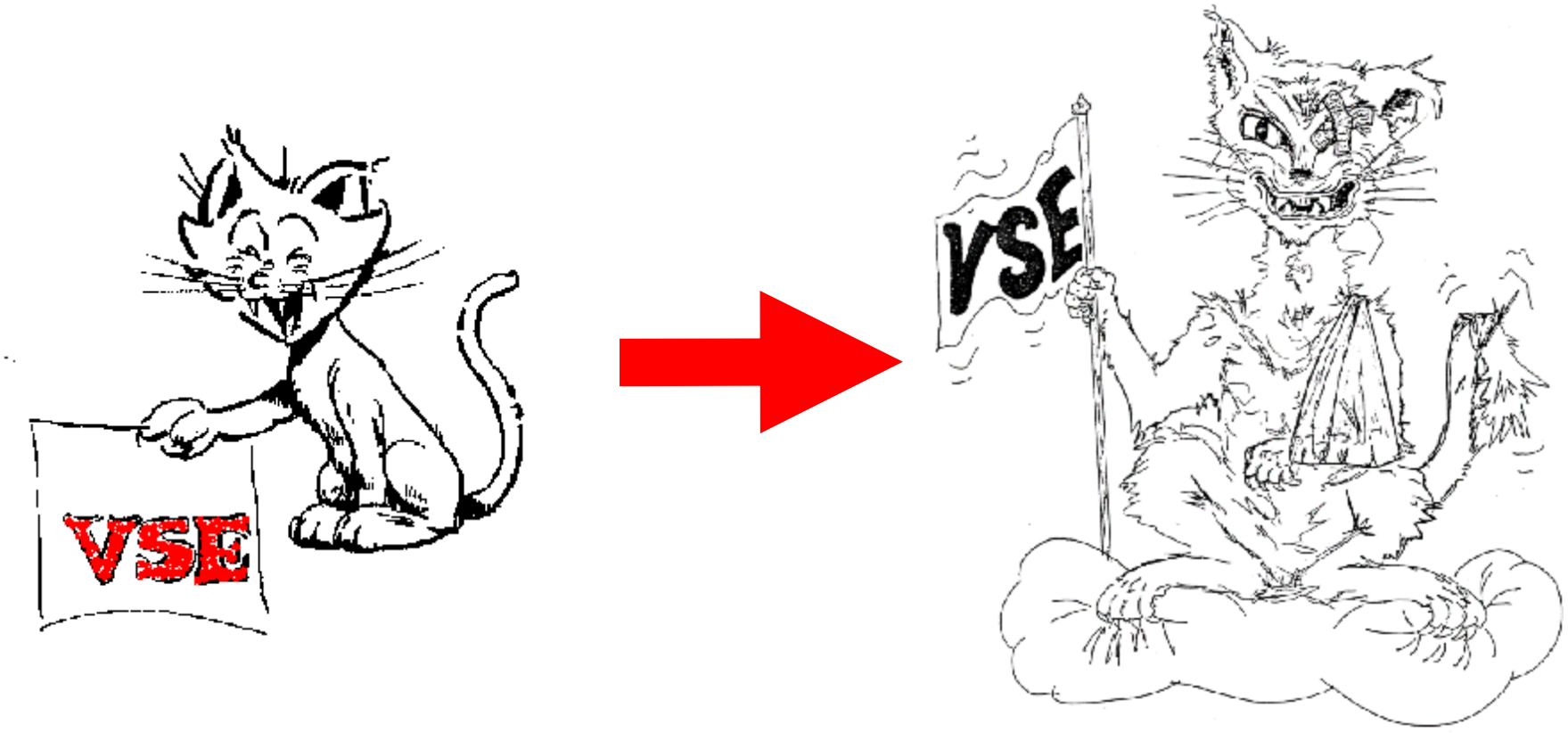


Ed Altman

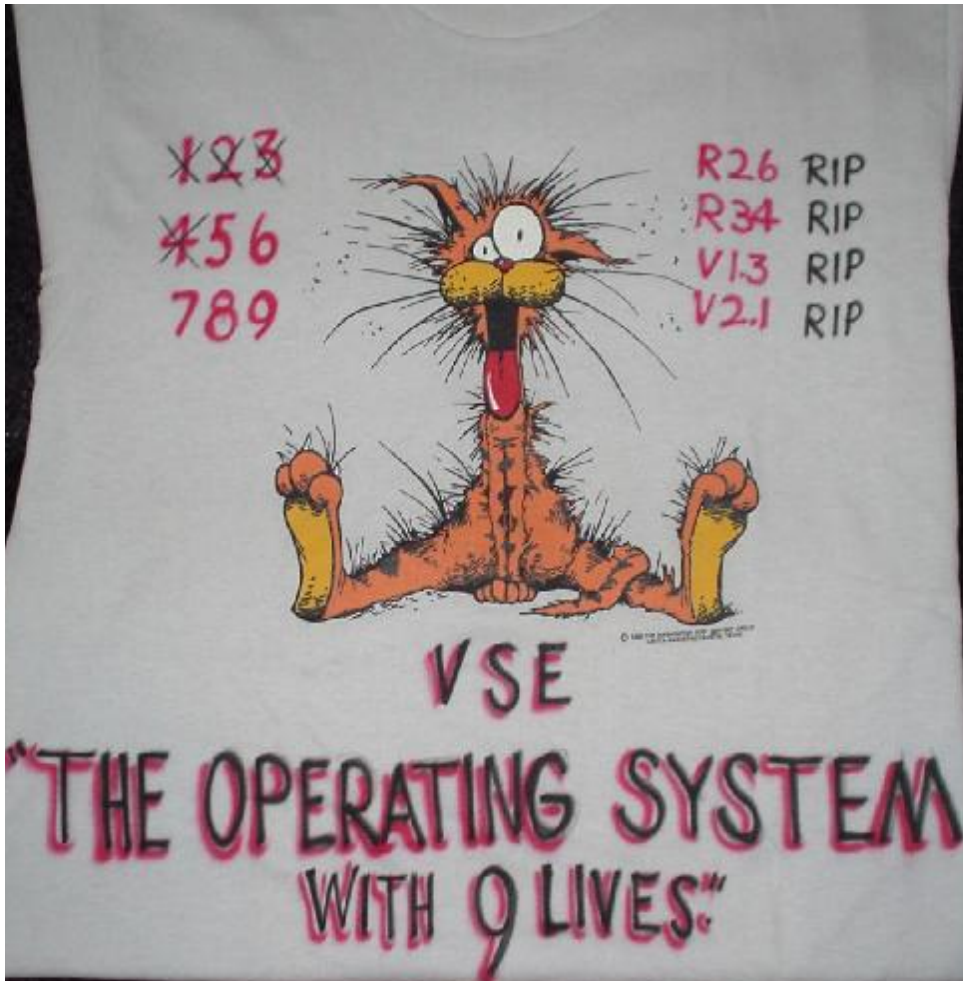
IBM Data Products Division President

“VSE is DEAD!!”

The VSE mascot – Turning from lucky to ugly



How many lives with a cat ?



VSE/ESA = Extended Systems Architecture

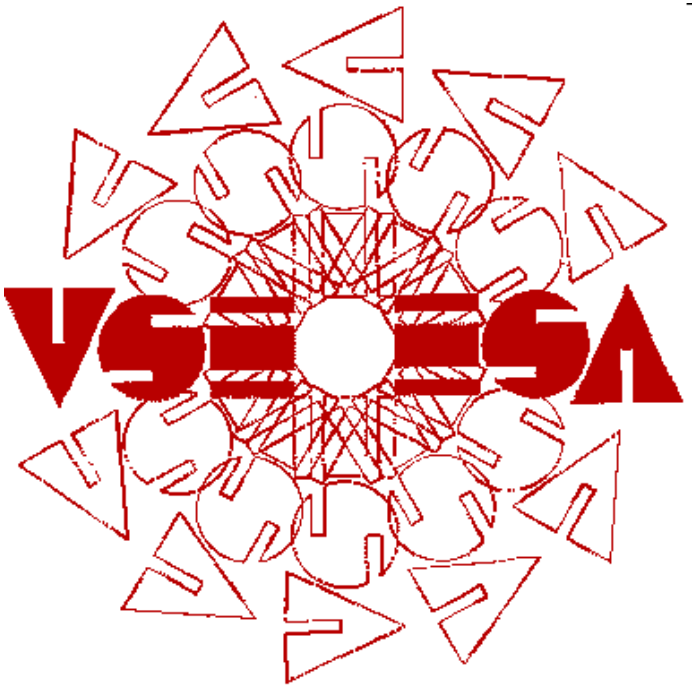
VSE/ESA V1 (1990)

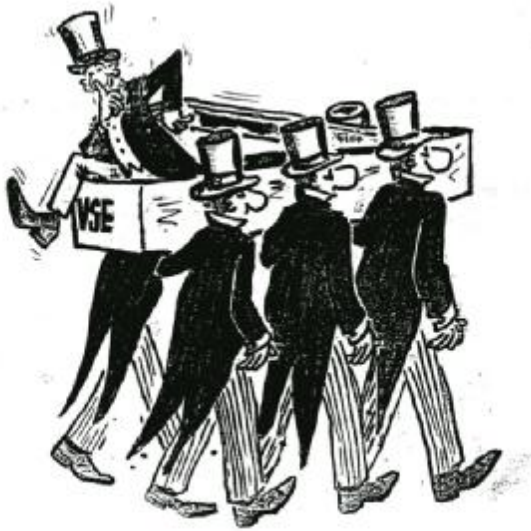
- **31-bit real memory support, then added 31-bit virtual addressing**
- **Dynamic partitions**
- **Virtual storage constraint relief (VSCR)**
  - Move ACF/VTAM and POWER out of shared partitions
  - Dynamic channels (XA channel subsystem)
  - Up to 1024 devices for added I/O bandwidth
- **ESA exploitation (later releases)**
  - ESA data spaces
  - Virtual disk in storage
  - ESA access registers
- **New versions of CICS/VSE, ACF/VTAM, VS COBOL II**
  - For greater MVS affinity

WAVV User Group (1995)

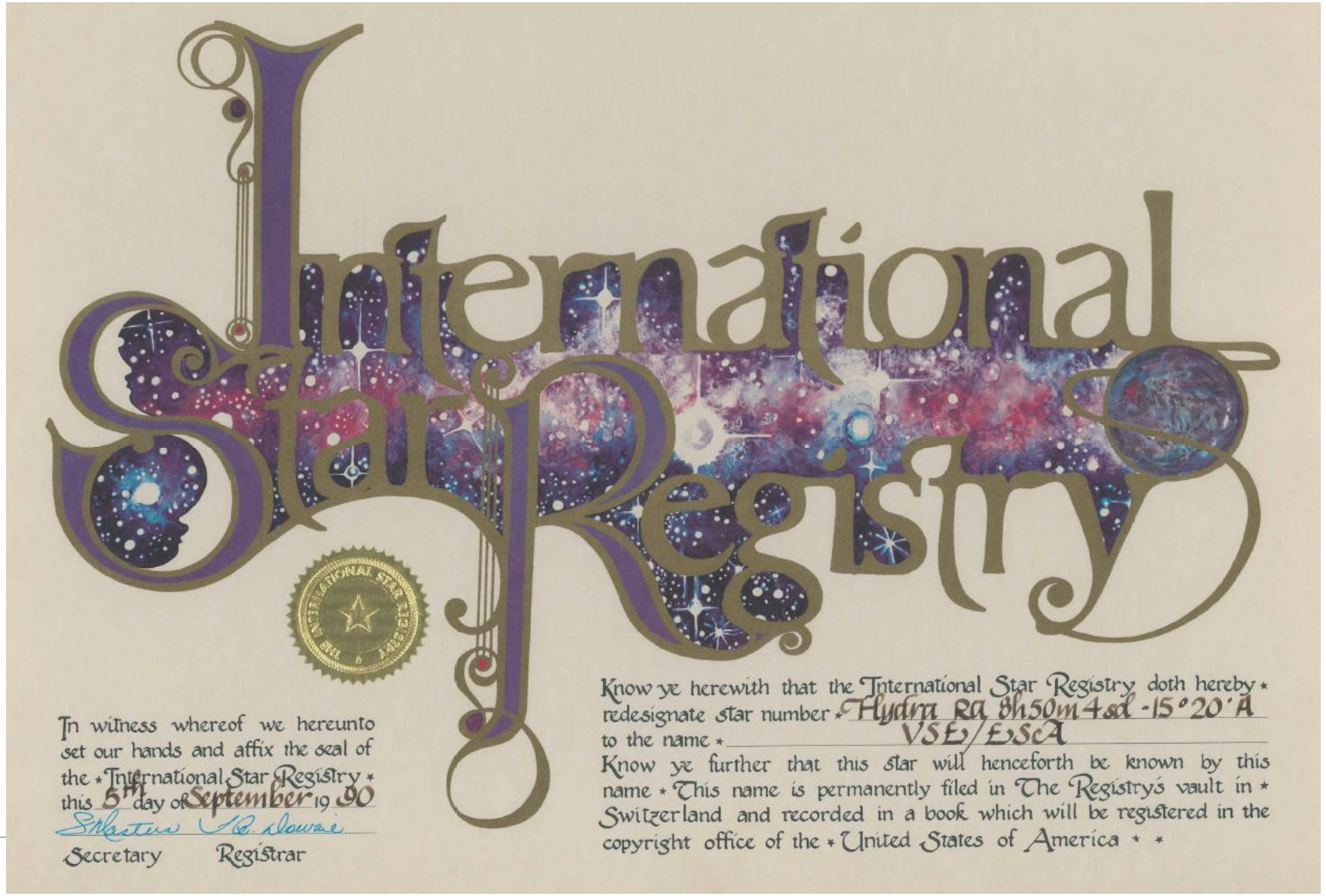
- Spin-off of GUIDE user group in the U.S.A.
- First conference held in October 1995 in Winston Salem, NC

VSE reborn in early 90‘s





VSE/ESA – Our star in the universe



VSE/ESA Version 2

VSE/ESA V2.1 (1994)

- N-way support for S/390 Parallel Enterprise Server
- Year 2000 ready

VSE/ESA V2.3 (1997)

- Turbo dispatcher
- VSAM KSDS > 4GB
- TCP/IP for VSE/ESA, offered under agreement with CSI
- ACF/VTAM V4.2
- LE and LE-based languages: COBOL, PL/I, C for VSE/ESA

VSE/ESA V2.4 (1999)

- CICS Transaction Server (TS) V1.1
  - Affinity with OS/390 CICS
  - CICS/VSE V2.3 still shipped until z/VSE V4.2

VSE/ESA V2.5 (2000)

- Connectors (VSE and Java-based components)

PIE strategy

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z/VSE PIE strategy –
Invented in Year 2000, still valid today and into the future

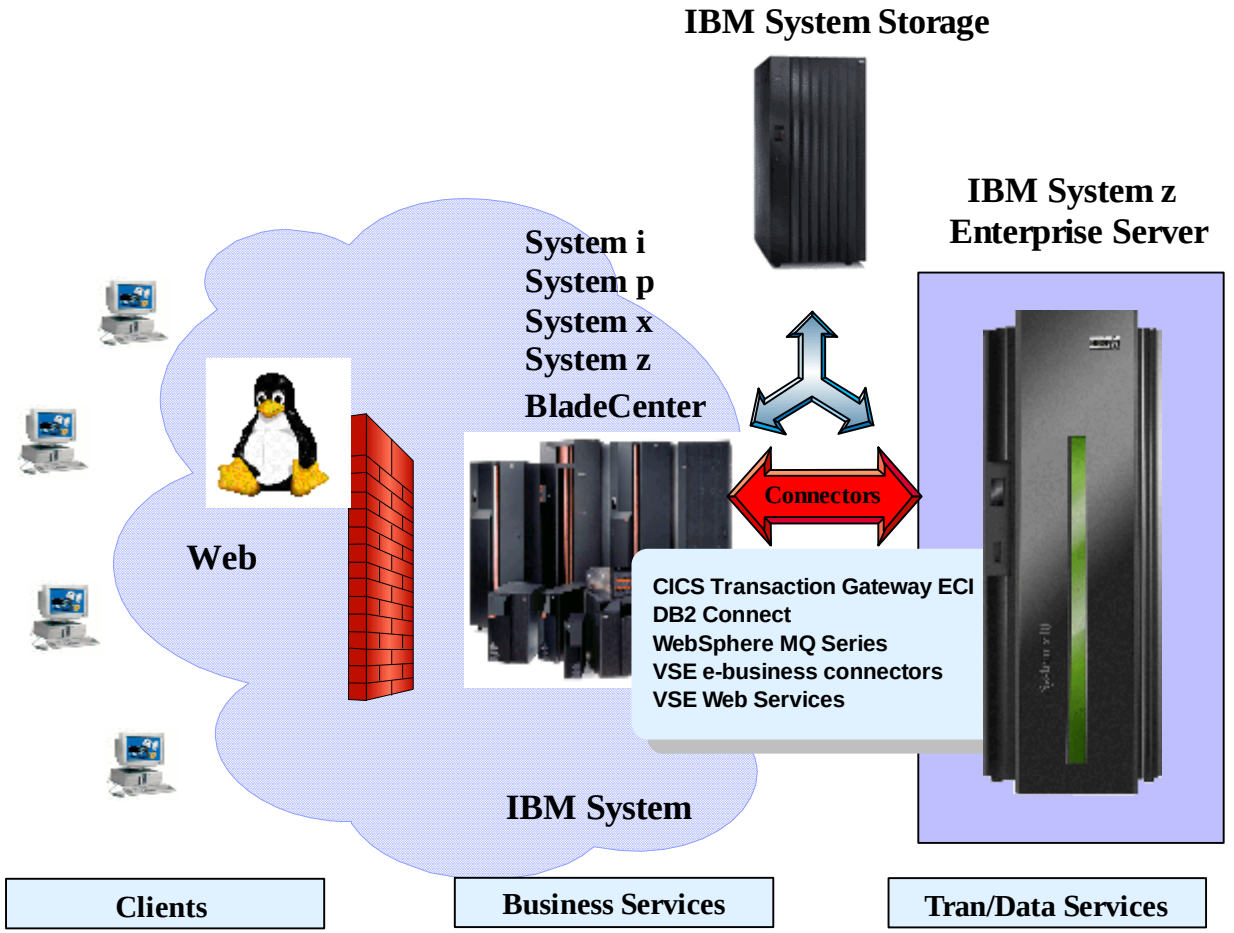
alias

- § 3-tier Strategy
- § Hybrid Strategy
- § Connector Strategy
- § Migration Strategy
- § Coexistence Strategy
- § Linux Surround Strategy
- § **PIE Strategy**

Protect existing investments

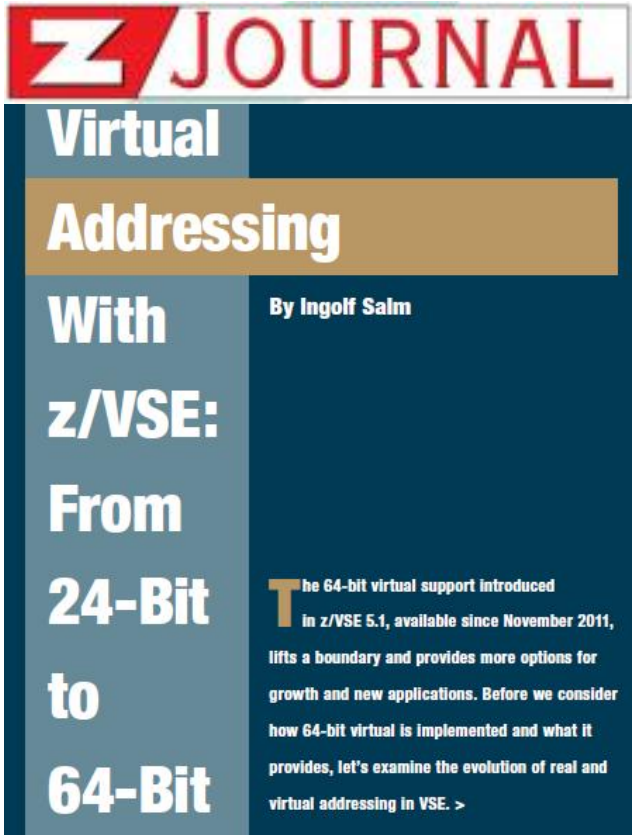
Integrate with other systems

Extend for new workloads



z/VSE in the 21st century

- **z/VSE V3 (2005)**
  - 31-bit addressing only
    - No z/Architecture, no 64-bit mode
  - FCP/SCSI support
- **z/VSE V4 (2007)**
  - 64-bit real memory addressing
    - No support of 64-bit virtual memory addressing
  - MWLC pricing
  - IPv6/VSE
  - Fast Path to Linux on System z
- **z/VSE V5 (2011)**
  - 64-bit virtual memory addressing
  - CICS Explorer
- **z/VSE V6 (2015)**
  - New CICS TS for z/VSE
  - Firewall



z/VSE PIE strategy – Implemented with Linux on z Systems
Hybrid environment leveraging z/VSE, z/VM and Linux on z Systems

Protect existing z/VSE investments
Integrate using middleware and z/VSE connectors
Extend with Linux on z Systems technology & solutions

Infrastructure Simplification

Linux on z Systems

Tivoli® Identity Mgmt, TSM, Print Serving, DNS, Firewall, etc.

IBM Middleware

Linux on z Systems

WebSphere Appl Server, Java, CTG, HOD/HATS, WS MQ, etc.

Info on Demand

Linux on z Systems

DB2 LUW, Information Server, Cognos® BI

DB2

z/VSE Connectors

Connection via HiperSockets

z/VSE Production Environment
+ TCP/IP
+ VTAM
+ CICS TS
+ VSAM
+ COBOL
+ DB2 client
+ LDAP client

z/VSE Test/Dev Environment

z/VM-mode LPAR with z/VM

IFL Engine(s) | **CP Engine(s)**

IBM System z10®, IBM zEnterprise: z196, z114, zEC12, zBC12, IBM z Systems: z13

z/VSE – Getting stronger year by year!

Crypto Express
Ficon Express
OSA Express

ECKD
FBA
FCP/SCSI
PAV
DS8k
Flash System
Flashcopy
XIV
Storwize

PL/I
Cobol
C
Fortran
LE
RPG

64-bit
DVD Install
Data Spaces
FSU

CICS TS
CICS Explorer
Channels & Container
Health Checker
Navigator

MWLC
SCRT
CMT
AEWLC
SVC
MPO

Encryption Facility
OpenSSL
CPACF
Tape Encryption
Keyman/VSE

DB2
VSAM
DL/I

LFP
LDAP Client
VIA
DBCLI
VSAM Redirector
MQ Trigger Monitor
DB2 Connect
Web Services
SNMP
CTG
VTAPE
CICS2WS
GDPS Client
SOAP
XML

TCP/IP
IPv6/VSE
Firewall
GPS
BSM

Happy Anniversary, z/VSE!

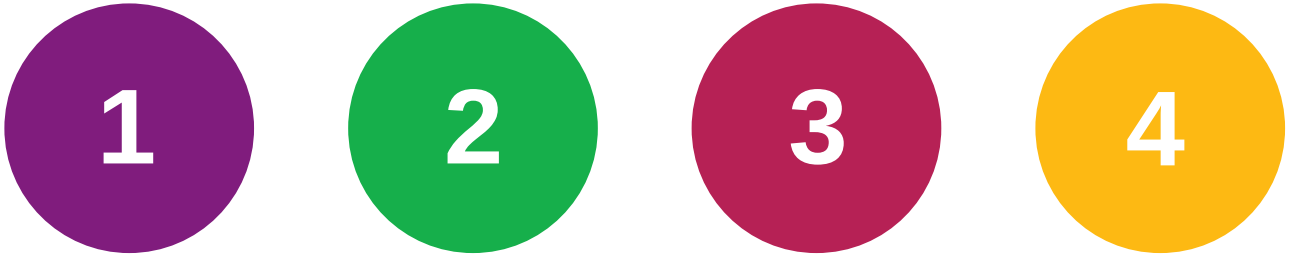
z/VSE

50 years of innovation

IBM

Session Evaluations

YOUR OPINION MATTERS!



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*Winners will be notified Thursday morning. Prizes must be picked up at registration desk, during operating hours, by the conclusion of the event.

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