

# Linux, z/VM and Virtualisation on System z



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## Notes:

Performance is in Internal Throughput Rate (ITR) ratio based on measurements and projections using standard IBM benchmarks in a controlled environment. The actual throughput that any user will experience will vary depending upon considerations such as the amount of multiprogramming in the user's job stream, the I/O configuration, the storage configuration, and the workload processed. Therefore, no assurance can be given that an individual user will achieve throughput improvements equivalent to the performance ratios stated here.

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All customer examples cited or described in this presentation are presented as illustrations of the manner in which some customers have used IBM products and the results they may have achieved. Actual environmental costs and performance characteristics will vary depending on individual customer configurations and conditions.

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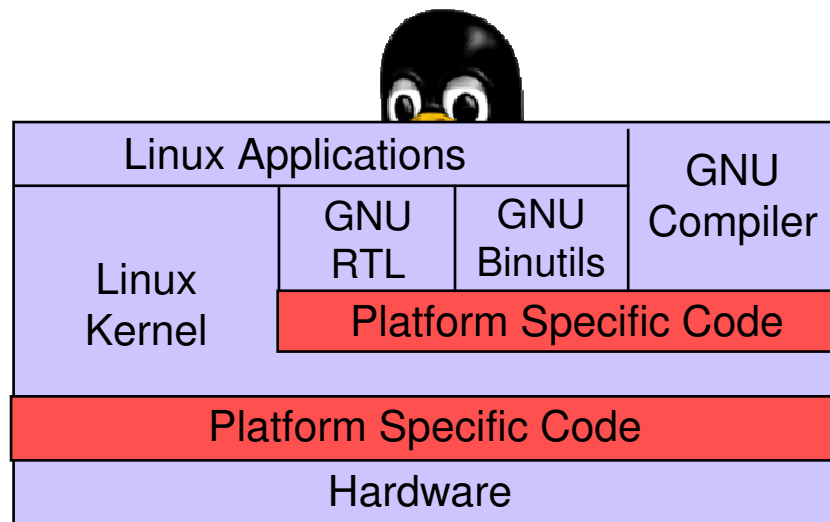
## Important Dates in IT History

- 1972 IBM announces VM/370
- 1974 UKI VM User Group established
- 1991 Linus Torvalds first post of Linux code on Internet
- 1994 Linux 1.0
- 1999 Linux 2.2
- 1999 UKI VMUG 100<sup>th</sup> meeting
- 1998 Bigfoot (aka i370) mainframe port of Linux undertaken
- 1999 IBM announces mainframe port of Linux
- 2000 SUSE distribution for mainframe
- 2001 Red Hat distribution for mainframe



- 2009 SLES10/11 RHEL5 available
- **2009 Linux on System z User Group (UK and Ireland) inaugural meeting**

## Why Linux on System z?



### Linux

- Reliable, stable, secure
- Large selection of applications middleware and tooling from IBM, ISV's and Open Source
- Available from multiple distributors
- Evolves rapidly to meet business challenges
- Plentiful availability of skilled administrators and developers



### System z10

- Legendary dependability
- Designed for multiple diverse workloads executing concurrently
- Highly scalable – up or out
- Rich security features
- Proven high volume data acquisition and management
- Advanced virtualisation capabilities

## VM/370

IBM



IBM

## Data Processing Division Program Announcement

### VM/370 PROVIDES VIRTUAL MACHINE, VIRTUAL STORAGE, AND TIME SHARING SUPPORT FOR SIX SYSTEM/370 MODELS

SCP 5749-010

Virtual Machine Facility/370 (VM/370) is System Control Programming for System/370 Models 135, 145, 155 II, 158, 165 II and 168.

#### Its major functions are:

- Multiple concurrent virtual machines with virtual storage support.
- Time sharing support provided by a conversational subsystem.

#### Role in Advanced Function Announcement

VM/370 is complementary to OS/VS2, OS/VS1 and DOS/VS, offering our customers extended capabilities and additional virtual storage-based functions.

Oriented to the on-line environment, VM/370 can be a significant assist in the development and installation of new applications, and can help justify additional equipment through satellite systems, additional storage and I/O, and CPU upgrades. Use it to help move your customers to virtual storage systems, and to help them grow when they get there.

#### VM/370 Highlights

- Virtual machine, virtual storage, and time sharing support.
- The execution of multiple concurrent operating systems, including DOS, DOS/VS, OS/MFT, MVT, VS1 and VS2, and VM/370 itself.
- Virtual storage facilities for operating systems which do not support Dynamic Address Translation, such as OS/MFT.
- A general-purpose time sharing system suitable for both problem solving and program development, available to customers beginning with a 240K byte Model 135.
- Capability of running many types of batch problem-solving applications from a remote terminal with no change in the batch program.
- Up to 16 million bytes of virtual storage available to each user.
- Capability of performing system generation, maintenance, and system testing concurrent with other work.

- A high degree of security, isolation, and integrity of user systems.
- The ability for many users to test privileged code in their own virtual machines.
- An aid in migrating from one operating system to another.
- Device address independence for all supported operating systems.
- Multiple forms of disk protection, e.g., preventing users from writing and/or accessing specific disks.
- Ability to use virtual machines to provide backup for other systems.
- Options to improve the performance of selected virtual machines.
- Ability to run many System/370 emulators in virtual machines.

#### Customers who should consider VM/370

- Large, multi-system users: satellite systems for virtual machine applications and on-line program development.
- Customers not yet large enough to utilize TSO and who are interested in on-line program development and/or interactive application programs.
- Universities, colleges, and schools: time sharing applications for students, faculty, research and administration.
- Users of non-IBM systems: VM/370 is a strong new IBM entry with many advanced functional capabilities.
- Customers considering conversion from DOS to OS or OS/VS: VM/370 can assist through its virtual machine function, and can supplement the DOS emulator available with OS systems.
- Mixed systems or mixed release installations, including those using PS/44 or modified back releases of DOS or OS.
- Customers with high security requirements: operating applications in separate virtual machines may provide an extra measure of security.
- Current CP/67 users: the features of the virtual storage-based Control Program 67/Cambridge Monitor System (CP/67/CMS), originally designed and implemented in 1968 for use on the System/360 Model 67, have been refined and improved to form the foundation for VM/370.

#### Description

VM/370 is a multi-access time shared system with two major elements:

- The Control Program (CP) which provides an environment where multiple concurrent virtual

machines can run different operating systems, such as OS, OS/VS, DOS and DOS/VS, in time-shared mode.

- The Conversational Monitor System (CMS) which provides a general-purpose, time-sharing capability.

#### Multiple Concurrent Virtual Machines

The control program of VM/370 manages the resources of a System/370 to provide virtual storage support through implementation of virtual machines. Each terminal user appears to have the functional capabilities of a dedicated System/370 computer at his disposal. Multiple virtual machines may be running conversational, batch, or teleprocessing jobs at the same time on the same real computer. A user can define the number and type of I/O devices and storage size required for his virtual machine application provided sufficient resources are available with the real machine's configuration.

A customer can concurrently run many versions, levels, or copies of IBM operating systems under VM/370, including DOS, DOS/VS, OS, OS/VS, and VM/370 itself. (See sales manual pages for the major restrictions pertaining to the operation of systems in virtual machines.)

The capability of running multiple virtual machines should assist the customer in scheduling multiple operating systems and various mixes of production jobs, tests, program maintenance, and FE diagnostics. It can aid new systems development, reduce the problems of converting from one operating system to another, and provide more economical backup facilities.

#### Time Sharing

The Conversational Monitor System (CMS) component of the VM/370 system provides a general-purpose, conversational time sharing facility that is suitable for general problem solving and program development, and can serve as a base for interactive applications.

CMS, specifically designed to run under VM/370, provides broad functional capability while maintaining a relatively simple design.

CMS can help programmers become more productive and efficient by reducing unproductive wait time. CMS also allows non-programmers such as scientists, engineers, managers, and secretaries to become more productive via its problem-solving and work-saving capabilities. CMS gives the user a wide range of functional capabilities, such as: creating and maintaining source programs for such operating systems as DOS and OS on CMS disks; compiling and executing many types of OS programs directly under CMS; setting up complete DOS or OS compile, linkedit and execute job streams for running in DOS

or OS virtual machines; and transferring the resultant output from those virtual machines back to CMS for selective analysis and correction from the user's remote terminal.

#### Service Classification

VM/370 is System Control Programming (SCP).

Note: VM/370 does not alter or effect in any way the current service classification of any IBM operating system, language, program product, or any other type of IBM program while under the control of VM/370.

#### Language Support for CMS

A VM/370 System Assembler is distributed as a part of the system and is required for installation and maintenance. All necessary macros are provided in CMS libraries.

The following is distributed with VM/370 as a convenience to the customer but is not part of the SCP.

A BASIC language facility consisting of the CALL-OS BASIC (Version 1.1) Compiler and Execution Package adapted for use with CMS. This facility will receive Class A maintenance by the VM/370 Central Programming Service.

The following program products may also be ordered for use with CMS:

OS Full American National Standard COBOL V4 Compiler and Library	5734-CB2
OS Full American National Standard COBOL V4 Library	5734-LM2
OS FORTRAN IV (G1)	5734-F02
OS FORTRAN IV Library Mod I	5734-LM1
OS Code and Go FORTRAN	5734-F01
OS FORTRAN IV H Extended	5734-F03
OS FORTRAN IV Library Mod II	5734-LM3
FORTRAN Interactive Debug	5734-F05
OS PL/I Optimizing Compiler	5734-PL1
OS PL/I Resident Library	5734-LM4
OS PL/I Transient Library	5734-LM5
OS PL/I Optimizing Compiler and Libraries	5734-PL3

Further details on language support and execution-time limitations appear in the manual *IBM Virtual Machine Facility/370: Introduction*, and in the *Program Product* section of the sales manual.

#### Availability

VM/370 has a planned availability of November 30, 1972, supporting the Dynamic Address Translation facility on the System/370 Models 135 and 145. Planned support for certain advanced VM/370 facilities, other System/370 machines, and additional I/O devices will be via Independent Component Releases on the dates shown below.

ICR1, planned for April 1973, will support the System/370 Models 155 II, the 158, the Integrated

File Adapter Feature (4655) for 3330 Model 1 and 3333 Model 1 on the Model 135, and the following additional VM/370 facilities:

- The Virtual-Real and Dedicated Channel performance options.
- The virtual and real Channel-to-Channel Adapter.
- Support of OS/ASP in a VM/370 environment, effective with the availability of ASP Version 3.
- The 3811 Control Unit and the 3211 Printer.

ICR2, planned for August 1973, will support the CMS Batch Facility, the Model 168, and the Integrated Storage Controls (ISCs) for the 158 and 168.

ICR3, planned for December 1973, will support the 165 II.

See the respective program product announcement letters for planned availability of the program products for CMS.

Note: VM/370 requires the system timing facilities (i.e., the Clock Comparator and the CPU Timer).

#### Maintenance

Maintenance for VM/370 Release 1 will be provided by the VM/370 Central Programming Service until nine months after the next release of VM/370.

#### Education

See Education Announcement Letter E72-14 for details of VM/370 Introduction (no charge) and additional educational plans.

#### Publications

*IBM Virtual Machine Facility/370: Introduction* (GC20-1800), is available from Mechanicsburg. Other manuals to be available at a later date include logic manuals, as well as planning, system generation, command language, system operator, terminal user, and programmer guides. Titles and form numbers will be announced in a future Publications Release Letter (PRL).

#### Reliability, Availability and Serviceability (RAS)

VM/370 provides facilities which supplement the reliability, availability, and serviceability (RAS) characteristics of the System/370 architecture. See the sales manual or the introduction manual for details.

#### MINIPERT

VM/370 planning information is available in the MINIPERT Master Library as an aid to selling and installing System/370.

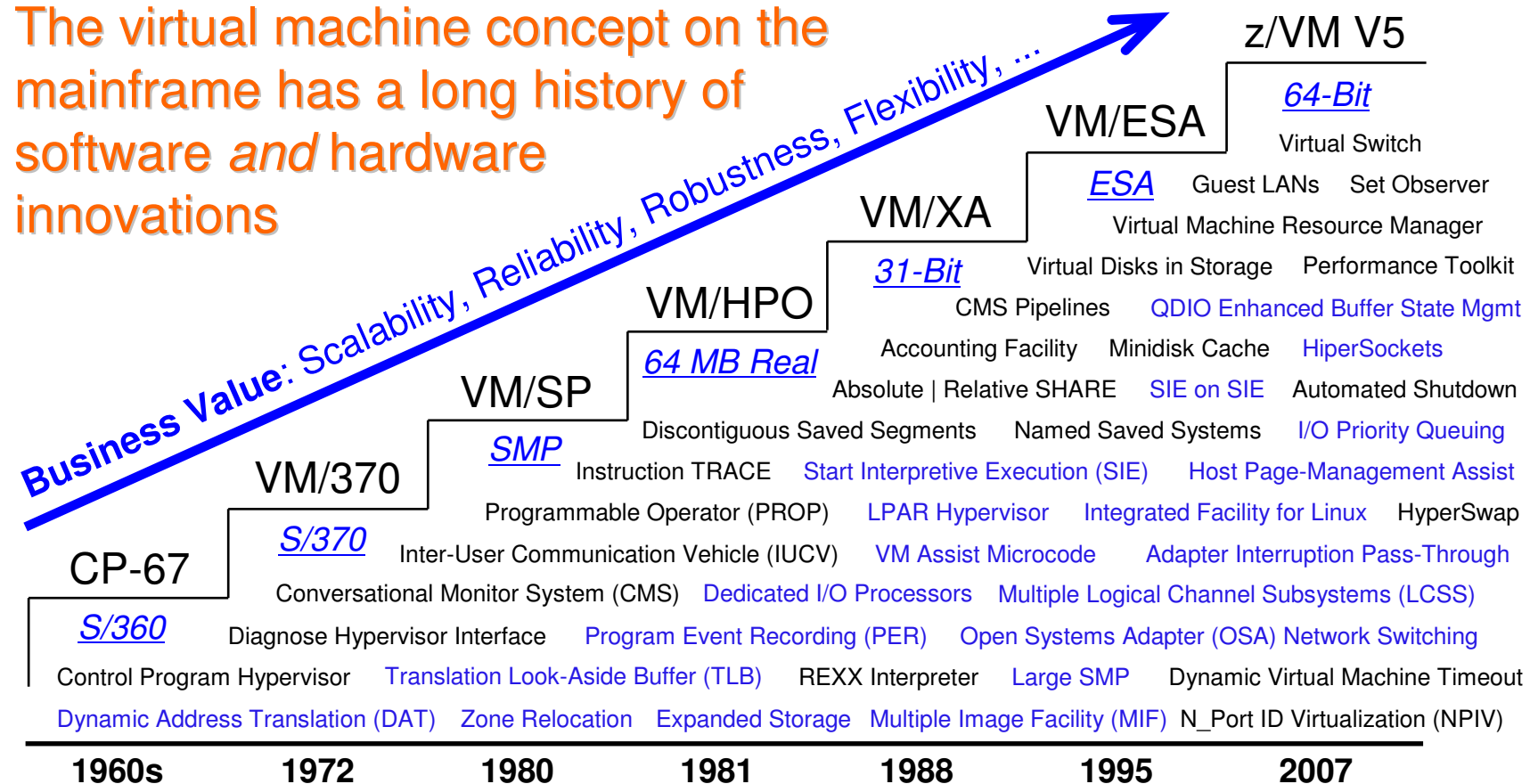
No RPOs will be accepted at this time.

Detailed information on the VM/370 system is in sales manual pages.

*W. W. Egerton*  
W. W. Egerton  
Vice President, Marketing

## IBM System z Virtualisation Genetics

The virtual machine concept on the mainframe has a long history of software *and* hardware innovations

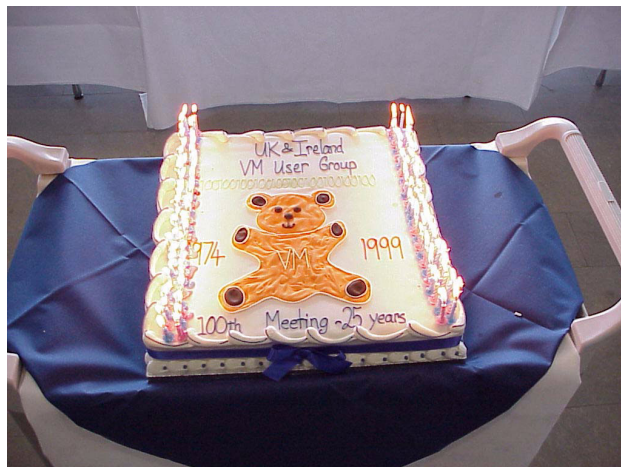


System z virtualisation starts on the chip; an integration of hardware, firmware, and software functionality

**UK & Ireland VM User Group 100<sup>th</sup> meeting (25 years)  
– IBM Bedfont Lakes, 17, Feb 1999**



Ying Chu cutting cake



Cake with 100 candles!

[↑ Back to top](#)

If you want to contact the Linux on System z IBM team refer to the [Contact the Linux on System z IBM team](#) page.

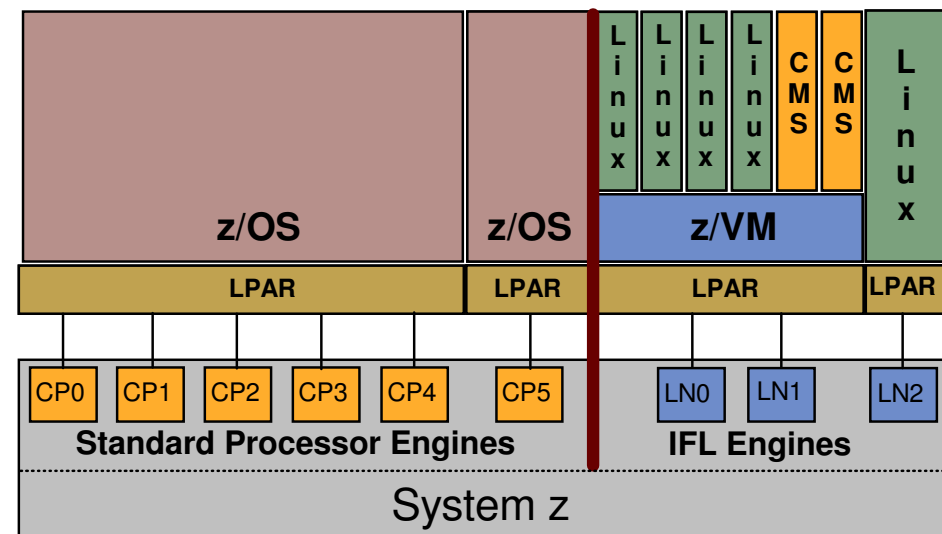
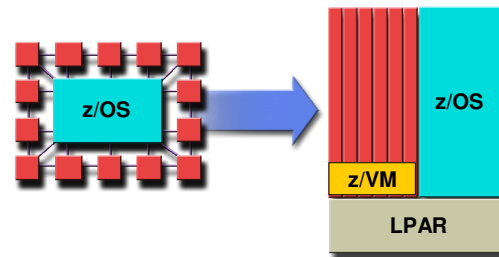
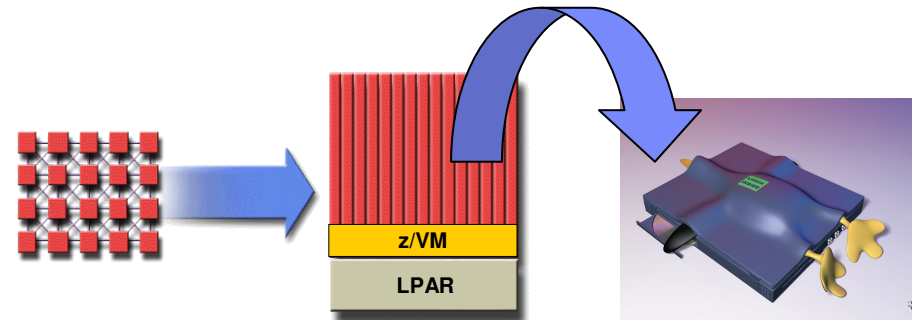
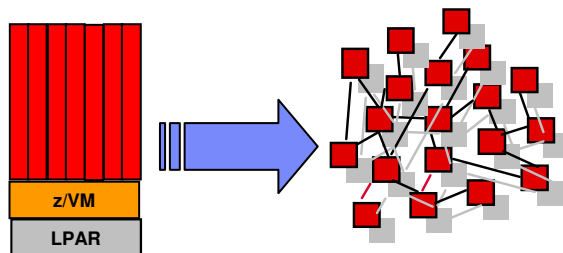
## Linux on System z in UK and Ireland

- Rapid growth during 2008/9
  - green agenda, virtualisation
- Production environments
- Many PoC/Pilot projects
- Skills improving (VM and Linux)
  - IT organisational realignment
  - hands-on workshops



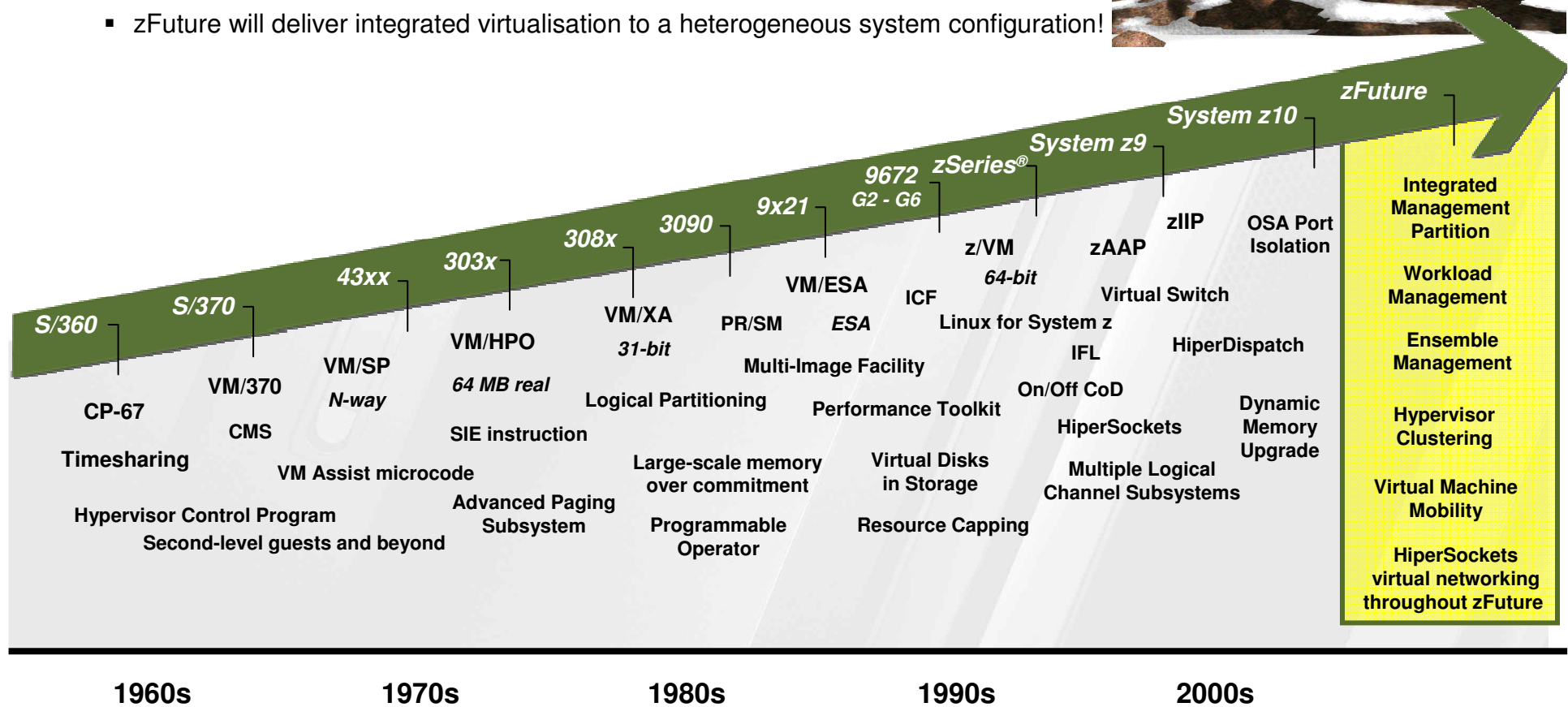
## Solutions/Middleware

- WebSphere Application Server
- Oracle DB
- CommerceSuite
- Process Server
- Tivoli Enterprise Portal Server
- Rational Clearcase
- Tivoli Composite Application Manager
- WebSphere Message Broker
- Communications Controller for Linux
- Domino
- DB2
- Cognos and InfoSphere
- Open Source e-mail, HTTP serving etc.



## zFuture: The next leap in virtualisation

- Virtualisation was pioneered and perfected on IBM mainframes
- System z continues to set the gold standard in virtualisation
- All other servers lag in virtualisation capabilities
- zFuture will deliver integrated virtualisation to a heterogeneous system configuration!





# Thank You!

