



IBM System z

# The Mainframe and Linux

## Technischer Hintergrund von z/VM

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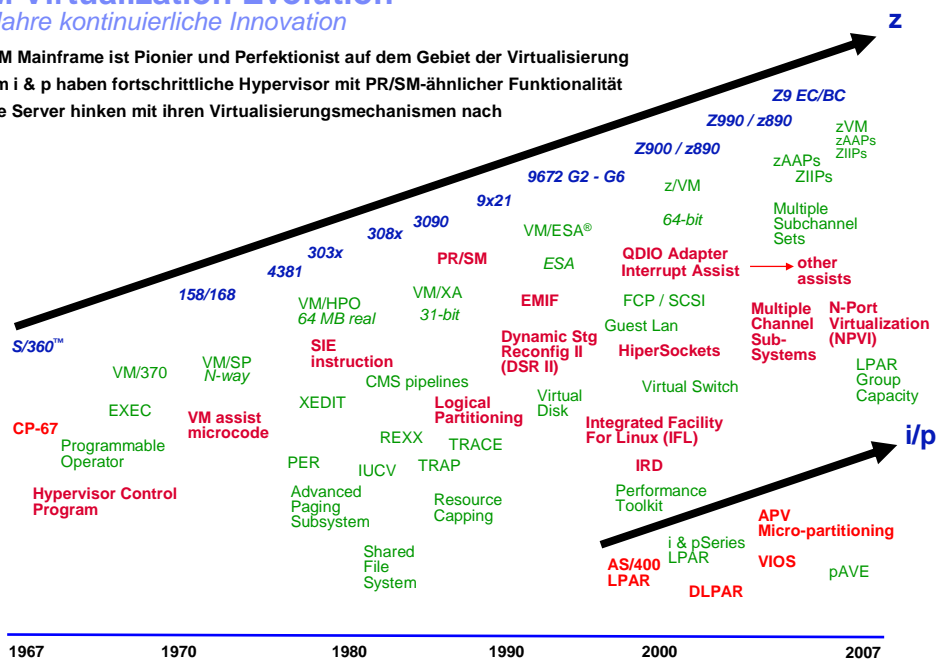
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## IBM Virtualization Evolution

40 Jahre kontinuierliche Innovation

Der IBM Mainframe ist Pionier und Perfektionist auf dem Gebiet der Virtualisierung  
System i & p haben fortschrittliche Hypervisor mit PR/SM-ähnlicher Funktionalität  
Andere Server hinken mit ihren Virtualisierungsmechanismen nach

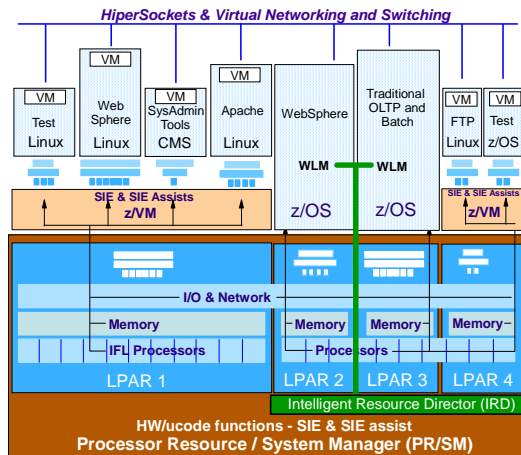


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IBM System z

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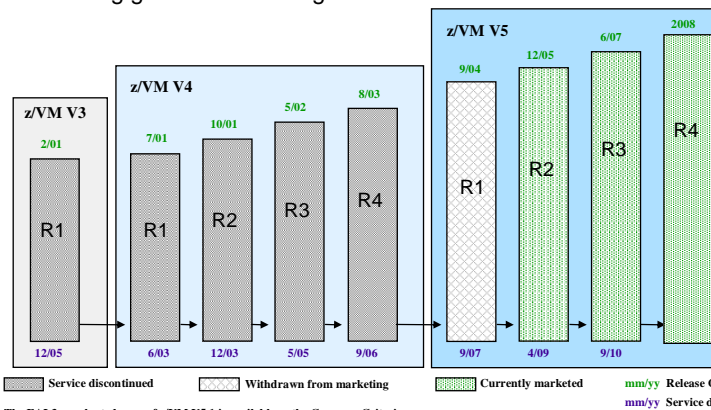
## System z Virtualization Architecture



- Multi-Dimensionale Virtualisierung**
- HW: PR/SM (LPAR's) & SW: z/VM (VM's)
  - Isolierte Umgebungen: EAL5 für PR/SM und EAL3+ für z/VM
  - Hochentwickelter Hypervisor
  - SIE Instruktion:** Virtualisierung ist eingebaut, kein Add-On
  - 10% der Integrierten Schaltkreise werden für Virtualisierung benutzt (SIE)
  - Zeit- und Ereignisgesteuertes Dispatching
  - SHARED ALL Architektur
  - Jegliche virtuelle CPU kann auf jeder beliebigen physischen CPU betrieben werden. Sharing ist bis auf "1"-Ebene möglich
  - Shared oder Dedizierter Pool an \*CPUs\*
  - Garantierte LPAR Kapazität
  - Physische & Virtuelle Ressourcen (CPU, I/O und Hauptspeicher) können dynamisch innerhalb und entlang der LPARs angepasst werden
  - LPAR Zoning: Jede LPAR hat eine 0-Origin. Das erlaubt I/O-Zugriffe auf den Hauptspeicher einer LPAR ohne Hypervisor Eingriff
  - z/VM kann virtuelle Devices erschaffen, die physisch nicht vorhanden sind
  - z/VM hat raffinierte Scheduling-Algorithmen um das Gesamtsystem für Reaktion und Throughput zu optimieren

## System z: Evolution of z/VM

- z/VM Version 5: High-Value Virtualization Technology
  - Generating new business with Linux on System z
  - Enabling growth for existing VM customers



- Future enhancements:**
- Hardware and I/O
  - Systems management
  - Linux/VM synergies
  - High availability
  - Virtualization
  - Networking
  - Security

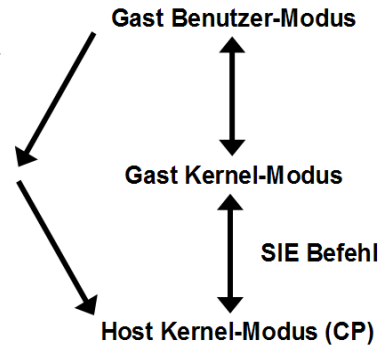
The EAL3+ evaluated copy of z/VM V5.1 is available as the Common Criteria Certification feature of z/VM V5.2

z/VM V5.2 will be withdrawn from marketing on June 15, 2007

Note: All statements regarding IBM's plans, directions, and intent are subject to change or withdrawal without notice, and represent goals and objectives only.

## System z Interpretive Execution –

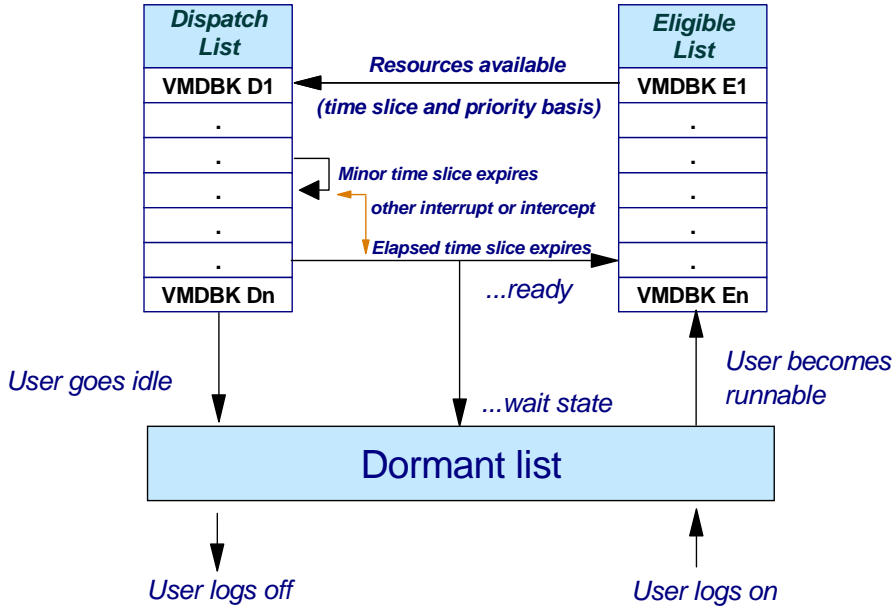
- **Start Interpretive Execution (SIE) instruction**
  - Establish the full architectural capabilities of an architecture for the guest
  - Supports **MULTIPLE** architectures **CONCURRENTLY** for multiple guests
  - Allows guests to run in **NORMAL mode** (no OS modifications needed/no TRAP'ing)
  - Reduces context switch time
  - Multiple control register sets
  - **PR/SM AND z/VM exploit SIE**  
No performance penalty for running z/VM in an LPAR



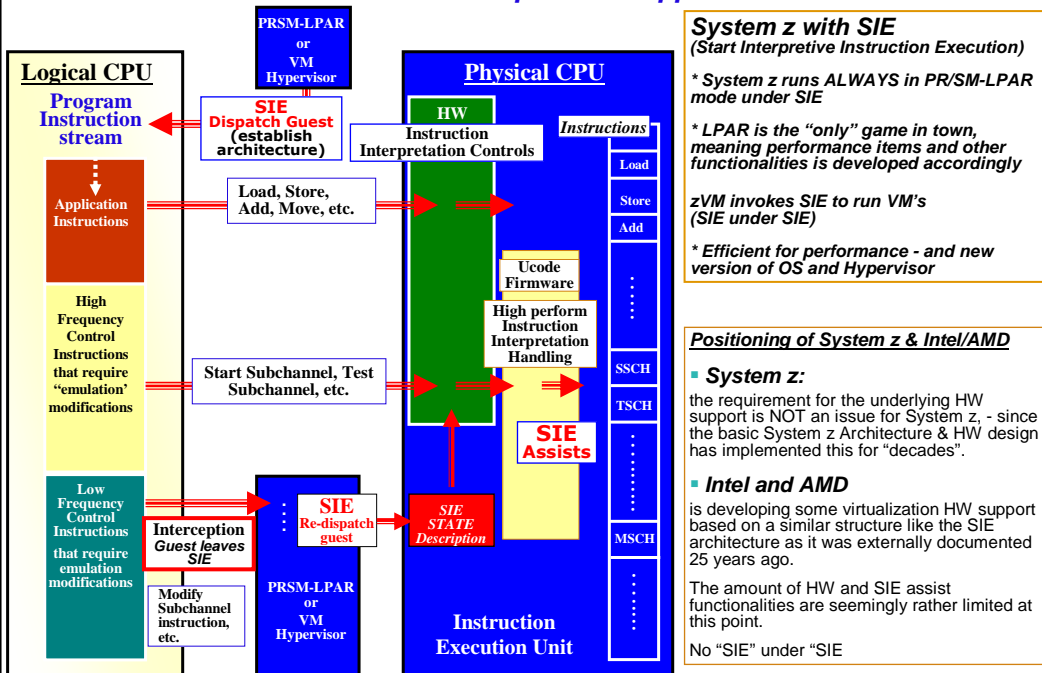
## How: Start Interpretive Execution (SIE)

- SIE = “Start Interpretive Execution”, an instruction
- z/VM (like the LPAR hypervisor) uses the SIE instruction to “run” virtual processors for a given virtual machine.
- SIE has access to:
  - A control block that describes the virtual processor state (registers, etc.)
  - The Dynamic Address Translation (DAT) tables for the virtual machine
- z/VM gets control back from SIE for various reasons:
  - Page faults
  - I/O channel program translation
  - Privileged instructions (including CP system service calls)
  - CPU timer expiration (dispatch slice)
  - Other, including CP asking to get control for special cases
- CP can also shoulder tap SIE from another processor to remove virtual processor from SIE (perhaps to reflect an interrupt)

## Classic Scheduler / Dispatcher Picture



## Basic Direct HW virtualization – transparent to applications/OS



**System z with SIE**  
(Start Interpretive Execution)

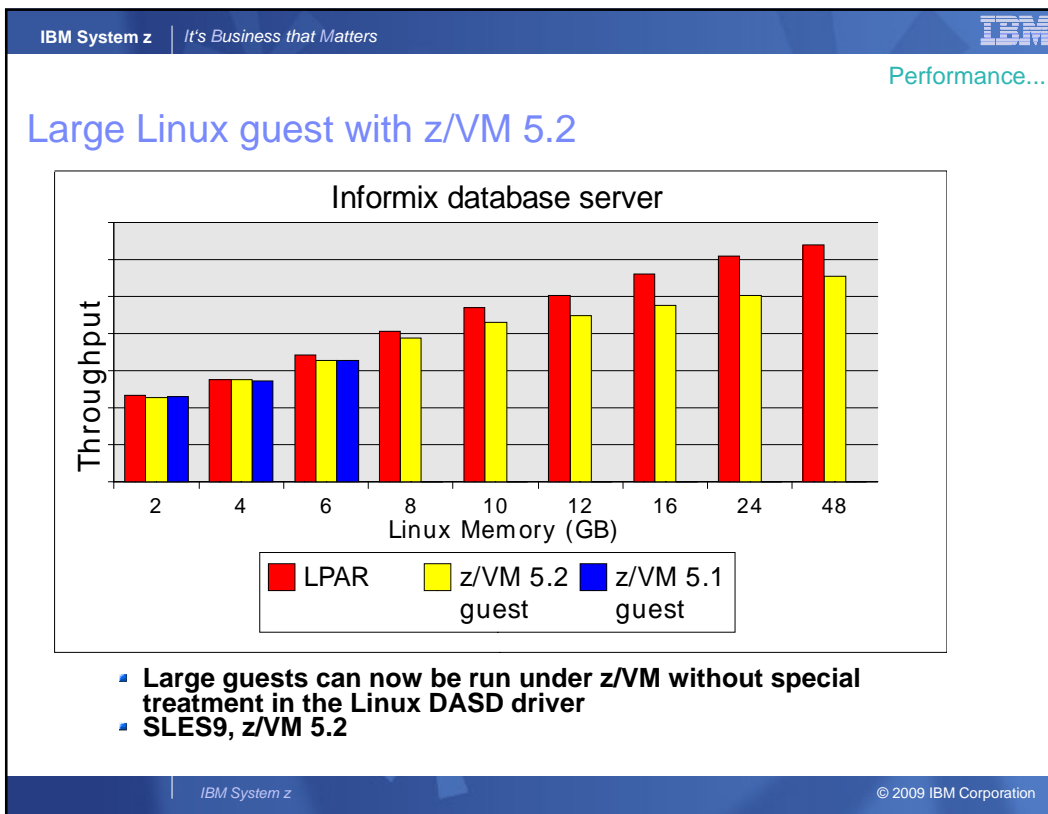
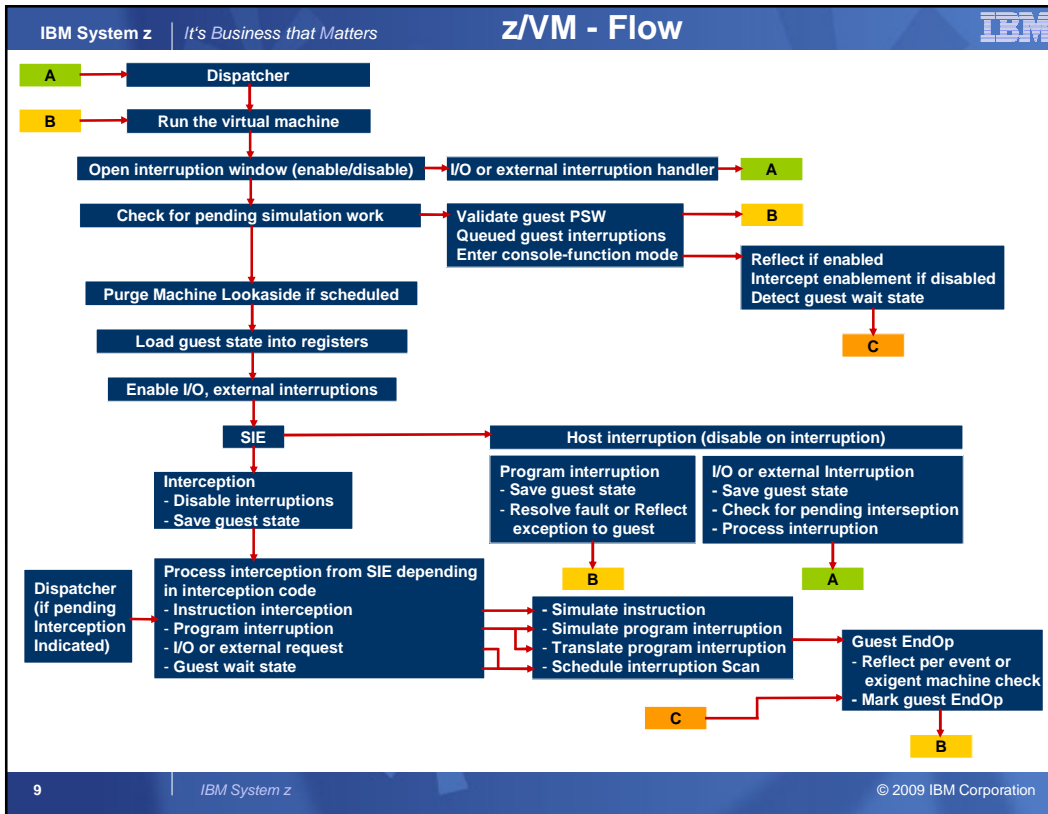
- \* System z runs ALWAYS in PR/SM-LPAR mode under SIE
- \* LPAR is the "only" game in town, meaning performance items and other functionalities is developed accordingly
- zVM invokes SIE to run VM's (SIE under SIE)
- \* Efficient for performance - and new version of OS and Hypervisor

**Positioning of System z & Intel/AMD**

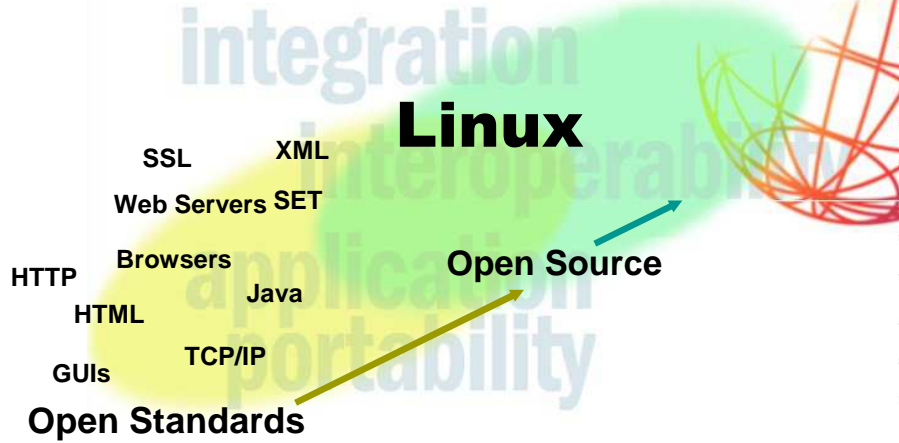
- **System z:** the requirement for the underlying HW support is NOT an issue for System z, - since the basic System z Architecture & HW design has implemented this for "decades".
- **Intel and AMD** is developing some virtualization HW support based on a similar structure like the SIE architecture as it was externally documented 25 years ago.

The amount of HW and SIE assist functionalities are seemingly rather limited at this point.

No "SIE" under "SIE"



### Questions?



# Thank You

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Thai

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Spanish

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