Aktuelle Informationen zu z/VM

Dr. Manfred Gnirss
gnirss@de.ibm.com

Frank Heimes
frank.heimes@de.ibm.com

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Topics

Teil 1 – Manfred Gnirss:

- Scalability
  - Large Memory Support
- HiperDispatch
- Miscellaneous Enhancements

Teil 2: Frank Heimes:

- IBM Wave

z/VM 6.3 Themes

- Reduce the number of z/VM systems you need to manage
  - Expand z/VM systems constrained by memory up to four times
    - Increase the number of Linux virtual servers in a single z/VM system
  - Exploit HiperDispatch to improve processor efficiency
    - Allow more work to be done per IFL
    - Support more virtual servers per IFL
  - Expand real memory available in a Single System Image Cluster up to 4 TB

- Improved memory management flexibility and efficiency
  - Benefits for z/VM systems of all memory sizes
  - More effective prioritization of virtual server use of real memory
  - Improved management of memory on systems with diverse virtual server processor and memory use patterns

Scalability –
Large Memory Support

Large Memory Support

- Support for up to **1TB** of real memory (increased from 256GB)
  - Proportionately increases total virtual memory
  - Individual virtual machine limit of **1TB** is unchanged

- Improved efficiency of memory over-commitment
  - Better performance for large virtual machines
  - More virtual machines can be run on a single z/VM image (depending on workload)

- Paging DASD utilization and requirements have changed
  - No longer need to double the paging space on DASD
  - Paging algorithm changes increase the need for a properly configured paging subsystem

- Eliminate use of expanded storage for z/VM paging, allowing greater flexibility
  - Recommend converting all Expanded Storage to Central Storage
  - Expanded Storage will be used if configured (up to 128 GB)
  - SOD: z/VM 6.3 will be the last to support expanded storage

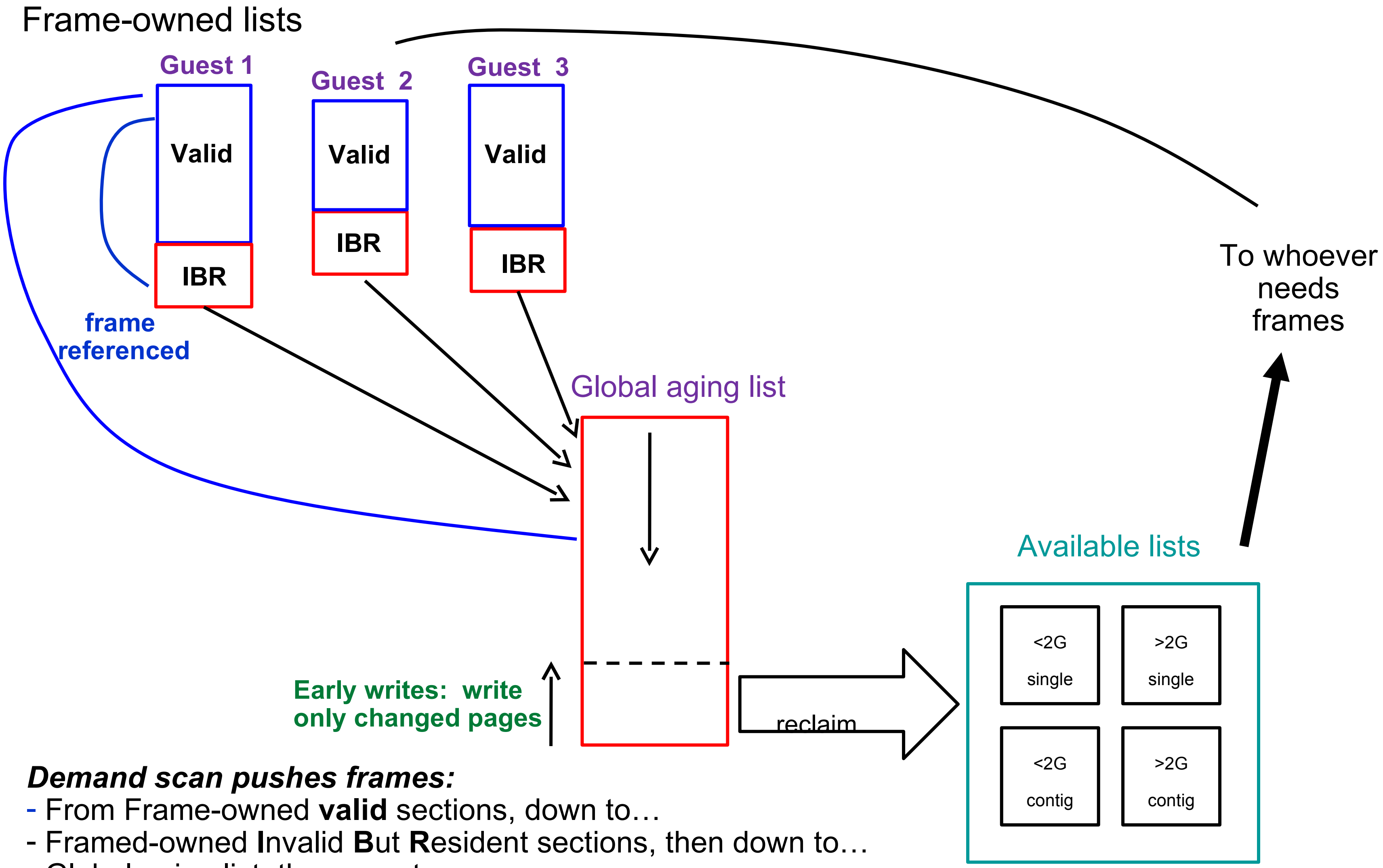
Large Memory Support: Reserved Storage

- Reserved processing is improved
  - More effective at keeping specified amount of reserved storage in memory

- Pages can be now be reserved for NSS and DCSS as well as virtual machines
  - Set ***after*** **CP SAVESYS** or **SAVESEG** of NSS or DCSS
    - Segment does not need to be loaded in order to reserve it
    - Recommend reserving monitor segment (**MONDCSS**)

- Reserved settings *do not* survive IPL
  - Recommend automating during system startup

Large Memory Support: The Big State Diagram



Demand scan pushes frames:

- From Frame-owned **valid** sections, down to…
- Framed-owned **I**nvalid **B**ut **R**esident sections, then down to…
- Global aging list, then over to…
- Available lists, from which they...
- Are used to satisfy requests for frames

Large Memory Support: Reorder

- Reorder processing has been removed
  - Could cause "stalling" of large virtual machines
  - No longer required with new paging algorithms
- Reorder commands remain for compatibility but have no impact
  - **CP SET REORDER** command gives RC=6005, “not supported”.
  - **CP QUERY REORDER** command says it’s OFF.
- Monitor data is no longer recorded for Reorder

Large Memory Support: New and Changed Commands

- New commands to **SET** and **QUERY AGELIST** attributes
  - Size
  - Early Writes

- Enhanced **SET RESERVED** command
  - Reserve pages for NSS and DCSS
  - Define ***number of frames*** or ***storage size*** to be reserved
  - Define maximum amount of storage that can be reserved for system
  - **QUERY RESERVED** command enhanced to show information about above

- **STORAGE** config statement enhanced to set AGELIST and maximum reserved storage

- **INDICATE** commands
  - New "instantiated" pages count where appropriate

Large Memory Support: Planning DASD Paging Space

- Calculate the sum of:
  - Logged-on virtual machines’ primary address spaces, plus…
  - Any data spaces they create, plus…
  - Any VDISKs they use, plus…
  - Total number of shared NSS or DCSS pages, … and then …
  - Multiply this sum by 1.01 to allow for PGMBKs and friends

- Add to that sum:
  - Total number of CP directory pages (reported by DIRECTXA), plus…
  - Min (10% of central, 4 GB) to allow for system-owned virtual pages

- Then multiply by some safety factor (1.25?) to allow for growth or uncertainty

- Remember that your system will take a PGT004 if you run out of paging space
  - Consider using something that alerts on page space, such as Operations Manager for z/VM

HiperDispatch

HiperDispatch

- Objective: Improve performance of guest workloads
  - z/VM 6.3 communicates with PR/SM to maintain awareness of its partition's topology to improve processor efficiency
    - Partition Entitlement and excess CPU availability
    - Better use of processor cache
    - Exploit cache-rich system design of System z10 and later machines

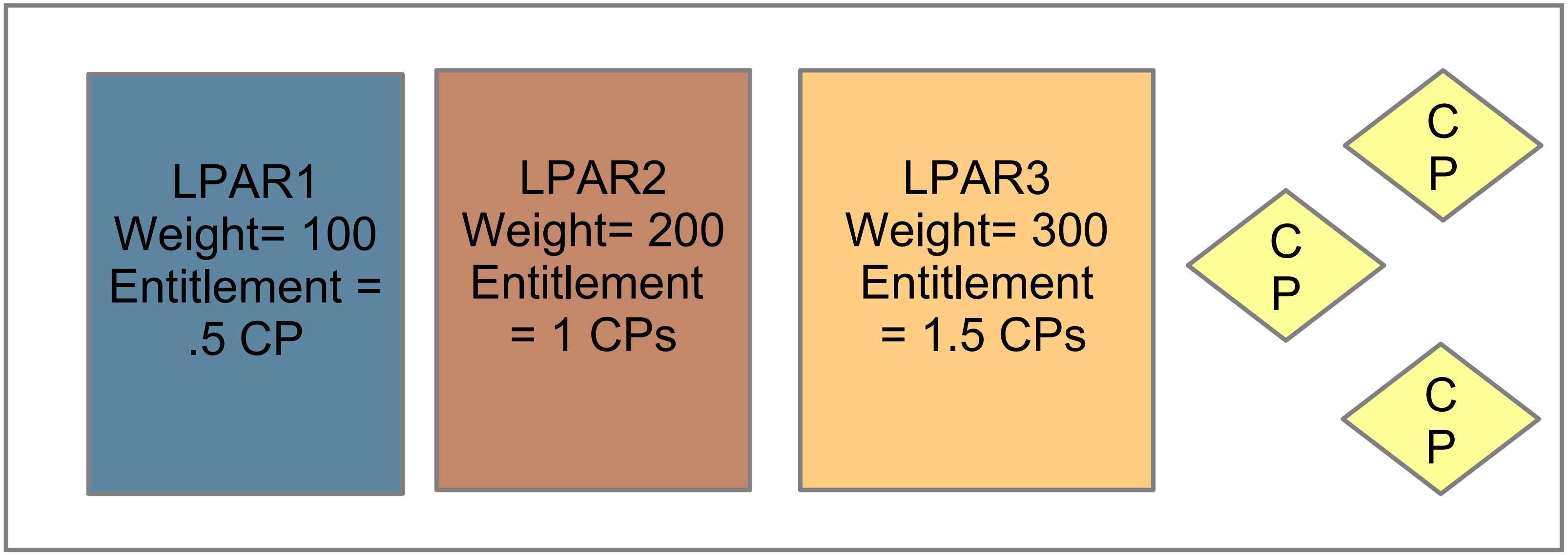
    z/VM polls for topology information/changes every 2 seconds

- Two components
  - Dispatching Affinity
  - Vertical CPU Management

- For most benefit, Global Performance Data (GPD) should be on for the partition
  - Default is ON

HiperDispatch: System z Partition Entitlement

- The allotment of CPU time for a partition
- Function of
  - Partition's weight
  - Weights for all other shared partitions
  - Total number of shared CPUs
- Dedicated partitions
  - Entitlement for each logical CPU = 100% of one real CPU



HiperDispatch: Horizontal Partitions

- *Horizontal Polarization Mode*
  - Distributes a partition's entitlement evenly across all of its logical CPUs of the z/VM LPAR
  - Minimal effort to dispatch logical CPUs on the same (or nearby) real CPUs ("soft" affinity)
    - Affects caches
    - Increases time required to execute a set of related instructions
  - z/VM releases prior to 6.3 always run in this mode
    - “soft” affinity to dispatch virtual CPUs
    - No awareness of chip or book

HiperDispatch: Vertical Partitions

- *Vertical Polarization Mode*
  - Consolidates a partition's entitlement onto a subset of logical CPUs (attempts to minimize the number of logical processors, allowing LPAR to similarly manage logical CPUs)
  - Places logical CPUs topologically near one another
  - Three types of logical CPUs
    - Vertical High (Vh)
    - Vertical Medium (Vm)
    - Vertical Low (Vl)
  - z/VM 6.3 runs in vertical mode by default
    - First level only
    - Mode can be switched between vertical and horizontal
    - Dedicated CPUs are not allowed in vertical mode

HiperDispatch: Partition Entitlement vs. Logical CPU Count

Suppose we have 10 IFLs shared by partitions FRED and BARNEY:

Partition	Weight	Weight Sum	Weight Fraction	Physical Capacity	Entitlement Calculation	Entitlement	Maximum Achievable Utilization
FRED, a logical **10-way**	**63**	100	63/100	1000%	1000% x (63/100)	**630%**	1000%
BARNEY, a logical **8-way**	**37**	100	37/100	1000%	1000% x (37/100)	**370%**	800%

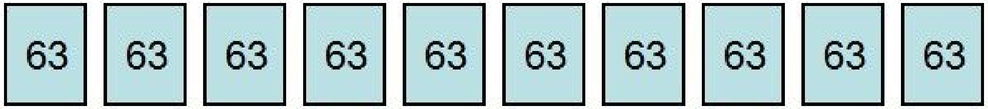
For FRED to run *beyond* **630%** busy, BARNEY has to leave some of its entitlement *unconsumed.*

(CEC’s excess power XP) = (total power TP) - (consumed entitled power EP).

HiperDispatch: Horizontal and Vertical Partitions

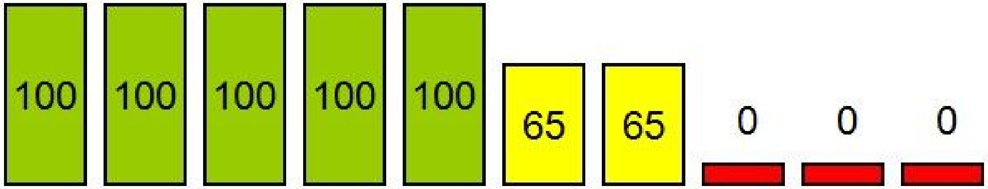
Two Ways To Get 630% Entitlement

Horizontally: 10 each @ 63%



- The logical processors are all created/treated equally.
- z/VM dispatches work evenly across the logical processors

Vertically: 5 Vh @ 100%, 2 Vm @ 65%, 3 Vl @ 0%



- The logical processors are skewed to where some get greater share of the weight.
- z/VM dispatches work accordingly to the heavier weighted workload.

In vertical partitions:

- Entitlement is distributed unequally among LPUs.

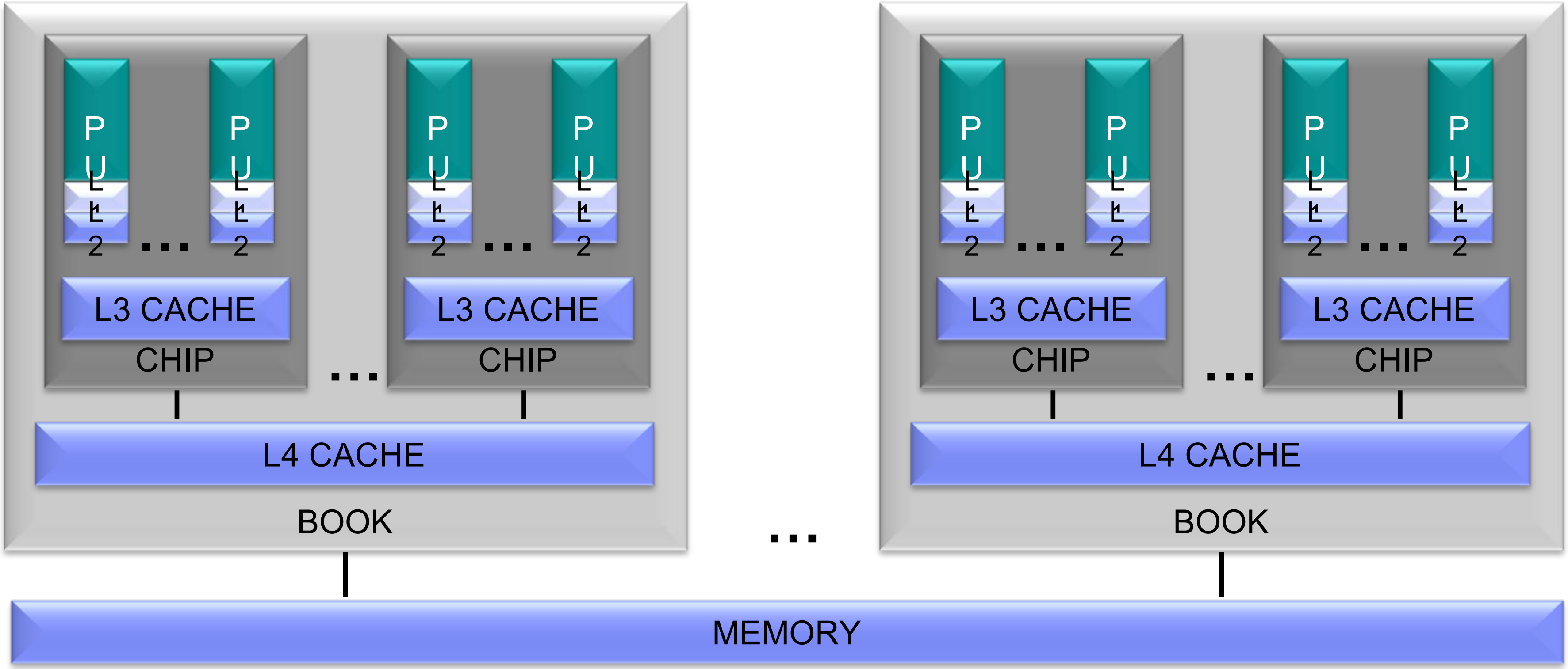
- Unentitled LPUs are useful only when other partitions are not using their entitlements.

- PR/SM tries very hard not to move Vh LPUs.

- PR/SM tries very hard to put the Vh LPUs close to one another.

- Partition consumes its XPF on its Vm and Vl LPUs.

HiperDispatch: Dispatching Affinity



- Processor cache structures have become increasingly complex and critical to performance
- Goal is to re-dispatch work close (in terms of topology) to where it last ran
- Dispatcher is aware of the cache and memory topology. Dispatch virtual CPU near where its data may be in cache based on where the virtual CPU was last dispatched
- z/VM 6.3 groups together the virtual CPUs of n-way guests
  - Dispatches guests on logical CPUs and in turn real CPUs that share cache
  - Goal is to re-dispatch guest CPUs on same logical CPUs to maximize cache benefits
  - Better use of cache can reduce the execution time of a set of related instructions

HiperDispatch – Vertical CPU Management

- Better use of cache can reduce the execution time of a set of related instructions

Especially:

- When CEC is constrained, the LPAR's entitlement is reduced to fewer IFLs
- z/VM and LPAR will cooperate
  - z/VM will concentrate the workload on a smaller number of logical processors
  - LPAR will redistribute the partition weight to give a greater portion to this smaller number of logical processors

HiperDispatch: Parked Logical CPUs

- z/VM automatically *parks* and *unparks* logical CPUs
  - Based on usage and topology information
  - Only in vertical mode
- Parked CPUs remain in wait state
  - Still varied on
- Parking/Unparking is faster than VARY OFF/ON

HiperDispatch: Checking Parked CPUs and Topology

- **QUERY PROCESSORS** shows PARKED CPUs

```
PROCESSOR nn MASTER type
PROCESSOR nn ALTERNATE type
PROCESSOR nn PARKED type
PROCESSOR nn STANDBY type
```

- **QUERY PROCESSORS TOPOLOGY** shows the partition topology

```
q proc topology
13:14:59 TOPOLOGY
13:14:59   NESTING LEVEL: 02  ID: 01
13:14:59     NESTING LEVEL: 01  ID: 01
13:14:59       PROCESSOR 00  PARKED     CP    VH  0000
13:14:59       PROCESSOR 01  PARKED     CP    VH  0001
13:14:59       PROCESSOR 12  PARKED     CP    VH  0018
13:14:59     NESTING LEVEL: 01  ID: 02
13:14:59       PROCESSOR 0E  MASTER     CP    VH  0014
13:14:59       PROCESSOR 0F  ALTERNATE  CP    VH  0015
13:14:59       PROCESSOR 10  PARKED     CP    VH  0016
13:14:59       PROCESSOR 11  PARKED     CP    VH  0017

13:14:59   NESTING LEVEL: 02  ID: 02
13:14:59     NESTING LEVEL: 01  ID: 02
13:14:59       PROCESSOR 14  PARKED     CP    VM  0020
13:14:59     NESTING LEVEL: 01  ID: 04
13:14:59       PROCESSOR 15  PARKED     CP    VM  0021
13:14:59       PROCESSOR 16  PARKED     CP    VL  0022
13:14:59       PROCESSOR 17  PARKED     CP    VL  0023
```

HiperDispatch: New and Changed Commands

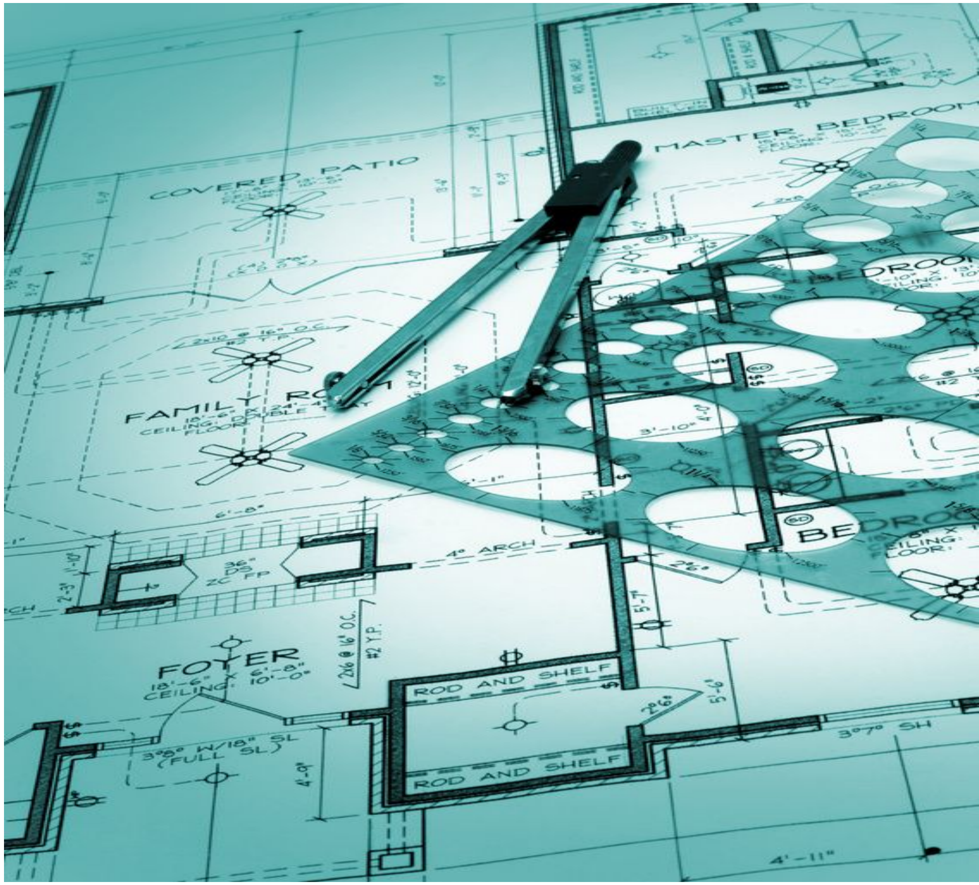
- **INDICATE LOAD**
  - AVGPROC now represents average value of the portion of a real CPU that each logical CPU has consumed

- **SET SRM** command can be used to change default settings for attributes related to HiperDispatch
  - Review monitor data and/or performance reports before changing

z/VM 6.3 Enhancements: Available June 27, 2014

Enhancing the Foundation for Virtualization

- Release for Announcement – zBX and zEnterprise System Enhancements
  - February 24, 2014
- Software Enhancements
  - CPU Pooling
  - Environment Information Interface
- Hardware Support
  - 10GbE RoCE Express Feature
  - zEDC Express Feature
- Available June 27, 2014



z/VM 6.3 Enhancements: CPU Pooling

- Fine grain CPU limiting for a group of virtual machines

- Define one or more named pools in which a limit of CPU resources is set
  - No restrictions on number of pools or aggregate capacity (can overcommit)

- CPU pools coexist with individual share limits
  - More restrictive limit applies

- CPU pools in SSI clusters
  - Pool capacities are independent and enforced separately on each member
  - Live Guest Relocation
    - Destination member must have an identically named pool with same **TYPE** attribute
    - If limit is not required on destination, remove guest from pool before relocating
  - Recommend defining identical pools on all members of cluster

- Support Details
  - z/VM 6.3 with APAR VM65418 - June 27, 2014

z/VM 6.3 Enhancements: CPU Pooling

- Use the **DEFINE CPUPOOL** command to define named pools
  - **LIMITHARD** - % of system CPU resources
  - **CAPACITY** – number of CPUs
  - Define for a particular **TYPE** of CPU (**CP** or **IFL**)

- Limits can be changed with **SET CPUPOOL** command
- Assign and remove guests to/from a CPU pool with the **SCHEDULE** command

z/VM 6.3 Enhancements: Environment Information Interface

- New interface allow guest to capture execution environment
  - Configuration and Capacity information
  - Various Levels:
    - Machine, logical partition, hypervisor, virtual machine, CPU pools

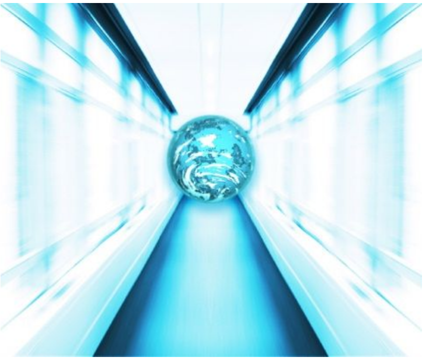
- New problem statement instruction STore HYpervisor Information (STHYI)
  - Supported by z/VM 6.3
  - Tolerated by z/VM 6.2 ("function not supported")

- Includes support for CPU Pooling enhancement

- Foundation for future software licensing tools

- Support details:
  - z/VM 6.3 with APAR VM65419 – June 27, 2014

10GbE RoCE Express Feature



- Support for RDMA over Converged Ethernet for guests
- Based on new hypervisor PCIe support
- Designed to support z/OS's Shared Memory Communications-Remote Direct Memory Access (SMC-R) in z/OS V2.1
- Helps reduce CPU resource consumption
- Support details:
  - IBM zEC12 or zBC12 with appropriate millicode (driver 15)
  - z/VM 6.3 with APAR VM65417 – June 27, 2014
  - z/OS 1.12, z/OS 1.13, z/OS 2.1 with APAR OA43256
  - Fulfills 2013 Statement of Direction

zEDC Express Feature

- Guest support for zEDC Express Feature
- High performance, low latency, low CPU consumption compression
- Possible disk utilization reduction
- Support details:
  - IBM zEC12 or zBC12 with appropriate millicode (driver 15)
  - z/VM 6.3 with APAR VM65417 – June 27, 2014
  - z/OS 1.12, z/OS 1.13, z/OS 2.1 with APAR OA43256
  - z/OS 1.12, z/OS 1.13, z/OS 2.1 with APAR OA44482
  - Fulfills 2013 Statement of Direction

z/VM 6.3 Enhancements: PCIe Support

- Allows guests with PCIe drivers to access PCI "functions" (devices)
  - PCI functions can be dedicated to a guest
    - Guest must have PCI driver supporting specific function

- **DEFINE PCIFUNCTION** defines real PCI function to I/O configuration
  - PCI Function ID (PFID) used to reference a function

- Basis for support for guest exploitation of 10GbE RoCE Express feature
  - Supports z/OS's Shared Memory Communications-Remote Direct Memory Access (SMC-R) in z/OS V2.1

- Support details:
  - IBM zEC12 or zBC12 with appropriate millicode (driver 15)
  - z/VM 6.3 with APAR VM65417 – June 27, 2014
  - z/OS 1.12, z/OS 1.13, z/OS 2.1 with APAR OA43256
  - Fulfills 2013 Statement of Direction

Fragen?

Dr. Manfred Gnirss

Senior IT Specialist

IBM Client Center

IBM Germany Lab

Schönaicher Strasse 220
71032 Böblingen, Germany

Phone +49 (0)7031-16-4093
gnirss@de.ibm.com

More Information

z/VM 6.3 resources

http://www.vm.ibm.com/zvm630/

http://www.vm.ibm.com/events/

z/VM 6.3 Performance Report

http://www.vm.ibm.com/perf/reports/zvm/html/index.html

z/VM Library

http://www.vm.ibm.com/library/

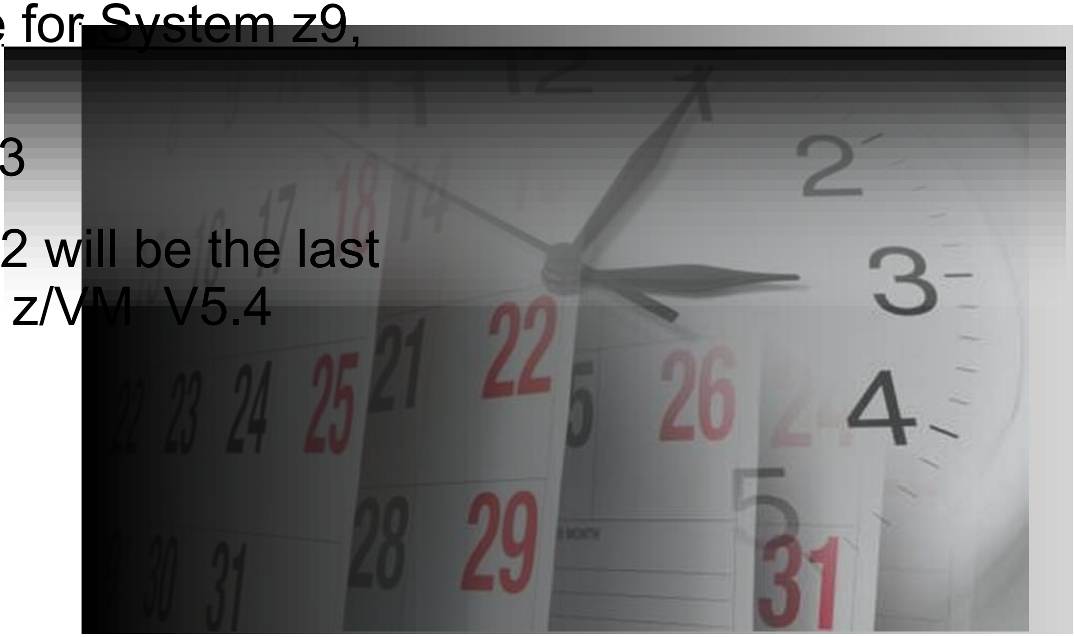
Live Virtual Classes for z/VM and Linux

http://www.vm.ibm.com/education/lvc/

z/VM Version 5 Release 4

- The last release of z/VM to support IBM System z9® and older processors
  - **No longer available as of March 12, 2012**
  - Also supports the IBM zEnterprise® EC12 (zEC12) and IBM zEnterprise BC12 (zBC12)

- End of Service was been extended to **December 31, 2014** or end of IBM service for System z9, whichever is ***later***
  - Statement of Direction 2013
    - The zEC12 and zBC12 will be the last processors to support z/VM V5.4



z/VM Version 6

Security Certification Plans

UPDATE

- Common Criteria (ISO/IEC 15408)
  - z/VM V6.1 has been certified: BSI-DSZ-CC-0752
  - Evaluated to EAL 4+ for the Operating System Protection Profile (OSPP) with:
    - Virtualization extension (-VIRT)
    - Labeled Security extension (-LS)
- Federal Information Protection Standard (FIPS) 140-2
  - z/VM V6.1 System SSL is FIPS 140-2 Validated(TM)
  - Enablement requirements for certificate database and servers
    - http://csrc.nist.gov/groups/STM/cmvp/documents/140-1/1401val2012.htm#1735
- z/VM V6.2 and z/VM 6.3 are designed to conform to both Common Criteria and FIPS 140-2 evaluation requirements

A Certification Mark of NIST, which does not imply product endorsement by NIST, the U.S. or Canadian Governments.

SOD 23.7.2013: Security Evaluation of z/VM 6.3

IBM intends to evaluate z/VM V6.3 with the RACF Security Server feature, including labeled security, for conformance to the Operating System Protection Profile (OSPP) of the Common Criteria standard for IT security, ISO/IEC 15408, at Evaluation Assurance Level 4 (EAL4+).

- We continue the practice of taking every other release through certification.
- Evaluation is with inclusion of RACF Security Server optional feature.
- See http://www.vm.ibm.com/security/ for current z/VM Security information.
- Update: z/VM 6.3 is formally listed as "In Certification" (with Certification ID BSI-DSZ-CC-0903) on the BSI website: https://www.bsi.bund.de/EN/Topics/Certification/incertification.html

SOD 23.7.2013: FIPS Certification of z/VM 6.3

IBM intends to pursue an evaluation of the Federal Information Processing Standard (FIPS) 140-2 using National Institute of Standards and Technology's (NIST) Cryptographic Module Validation Program (CMVP) for the System SSL implementation utilized by z/VM V6.3.

- Federal Information Protection Standard (FIPS) 140-2
  - Target z/VM 6.3 System SSL is FIPS 140-2 Validated*
  - Enablement requirements for certificate database and servers
    - http://csrc.nist.gov/groups/STM/cmvp/documents/140-1/1401val2012.htm#1735

- See http://www.vm.ibm.com/security/ for current z/VM Security information.

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