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z/VM Performance Update for z/VM V6.2 VM02

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- **Brian Wade**

Agenda

- **z/VM V6.2 thoughts**
  - LGR and SSI
    - Performance notes
    - Management and monitoring thoughts
  - Various other line items
  - Monitor record changes
  - Performance-related service
- **Other thoughts**
  - z114 at a glance
  - Continued evolution of z/VM LSPR

z/VM V6.2 Highlights – A Performance View

- **Regression performance**
- **SSI and LGR considerations**
- **Memory management improvements**
- **MONDCSS and SAMPLE CONFIG increases**
- **STORBUF changes**
- **z/CMS and implications**
- **CPU Measurement Facility exploitation**
- **Monitor records**
- **z/VM Performance Toolkit changes**

z/VM V6.2 Regression Performance

- **Ran our usual library of workloads**
  - CMS interactive, various Apache configurations
- **Results are within usual 5% regression criteria**
- **Some workloads will see improvements:**
  - Overprovisioned for logical PUs compared to utilization
  - Storage-constrained with heavy contention for <2 GB real storage
  - High virtual CPU to logical CPU overcommit with virtual CPUs often in a ready-to-run state

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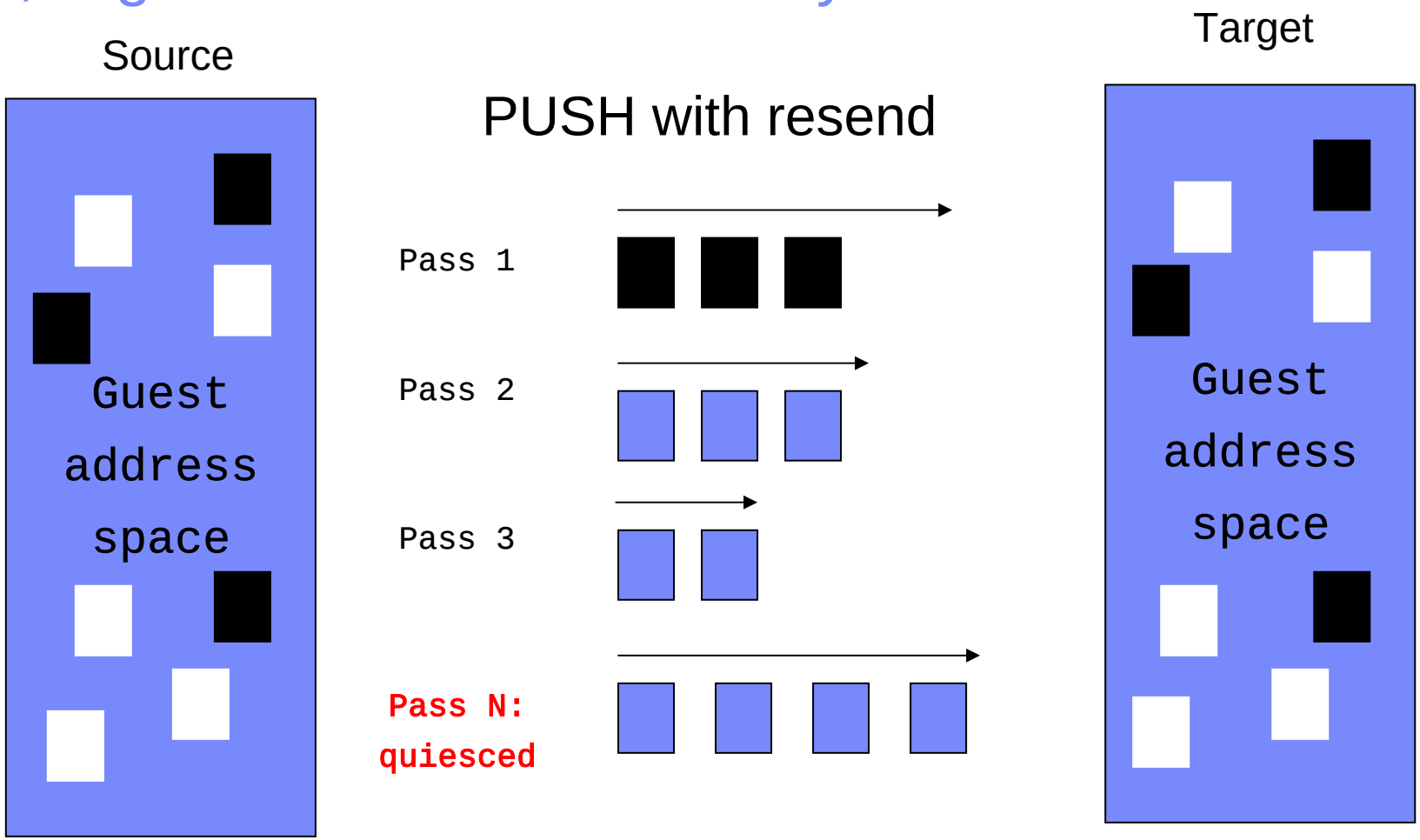
SSI and LGR Thoughts

LGR, High-Level View of Memory Move



Technique: iterative push with change detection

Live Guest Relocation – Key Performance Metrics

- **Quiesce Time (QT)**
  - **Elapsed time that the guest is stopped (stunned) so z/VM can move the guest's last set of storage pages – probably the frequently-changed ones**
  - **To tolerate relocation, the guest and its applications must tolerate the quiesce time**
  - **VMRELOCATE can be invoked with a specified maximum quiesce time**
    - **If the quiesce would run past the maximum, z/VM cancels the relocation**
- **Relocation Time (RT)**
  - **Elapsed time from when the VMRELOCATE command is issued to when the guest is successfully restarted on the destination system.**
  - **Elapsed time must fit within the customer's window of time for planned outages for system maintenance, etc.**
- **Bottom line: there are some scenarios where LGR is not feasible as a result of the requirements for relocation time and quiesce time**

LGR: Factors Affecting QT and RT

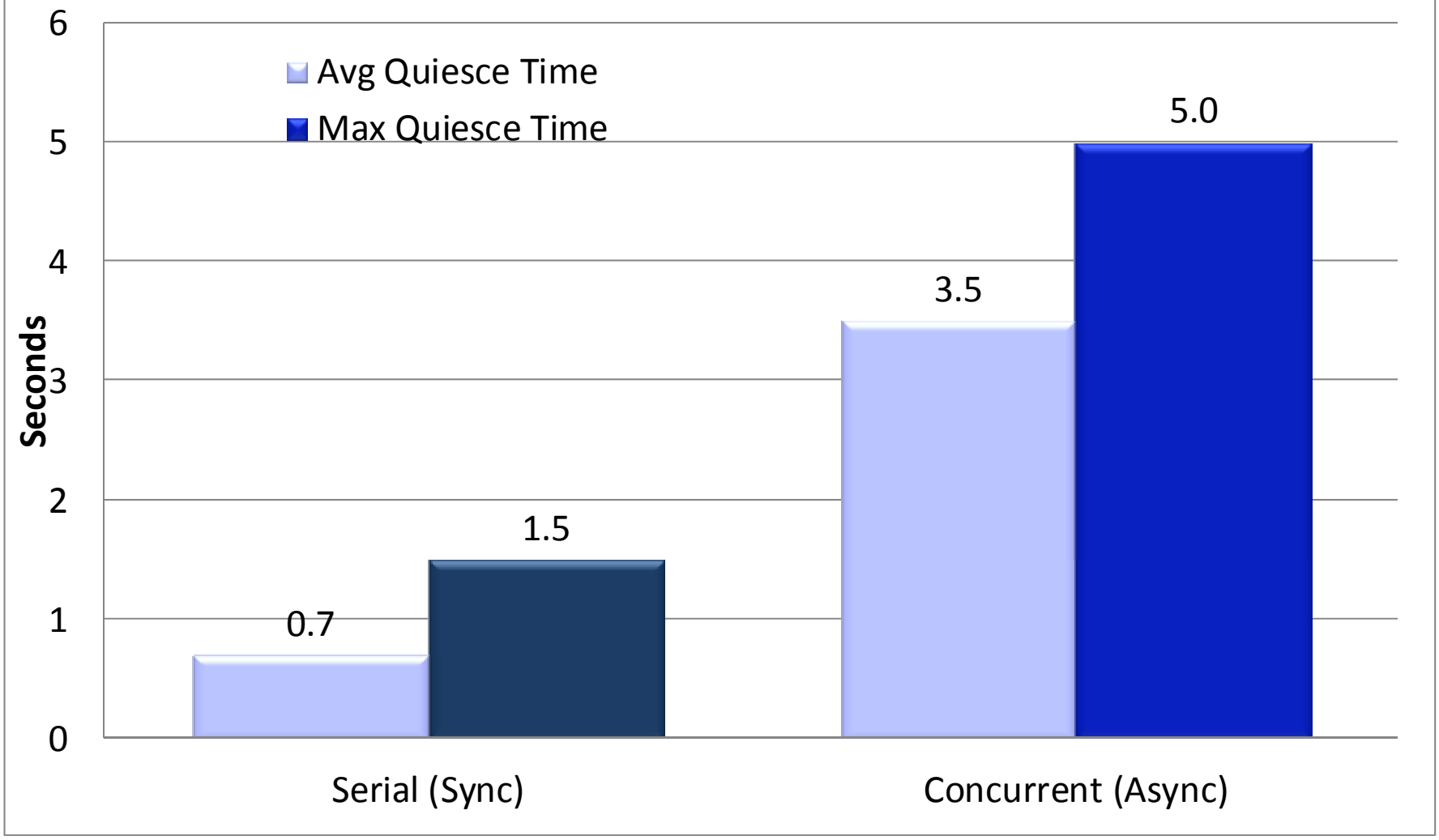
- **Size of the guest**
  - Amount of memory to move, time required to walk its DAT tables
- **How broadly or frequently the guest changes its pages**
  - It's an iterative memory push from source to destination
- **Time needed to relocate the guest's I/O configuration**
  - I/O device count, I/Os to quiesce, OSA recovery on target side
- **Capacity of the ISFC logical link**
  - Number of chpids, their speeds, number of RDEVs
- **Storage constraints on source and target systems**
- **Performance of paging subsystem**
- **Other work the systems are doing**
- **Other relocations happening concurrently with the one of interest**
  - There shouldn't be any!
- **LGR throttling of relocation to protect the z/VM system**

LGR: Serial vs. Concurrent Relocations

- **By default, the VMRELOCATE command operates synchronously.**
  - There is a command option to run it asynchronously (a la SPXTAPE)
- **You could achieve concurrent relocations, though:**
  - Use the asynchronous version of VMRELOCATE
  - Run VMRELOCATE commands in multiple users concurrently
- **The best practice, though, is to run only one relocation at a time.**
- **QT and individual RT improves substantially when relocations are done serially**
  - … and total RT elongates only slightly

Individual Virtual Machine Quiesce Time

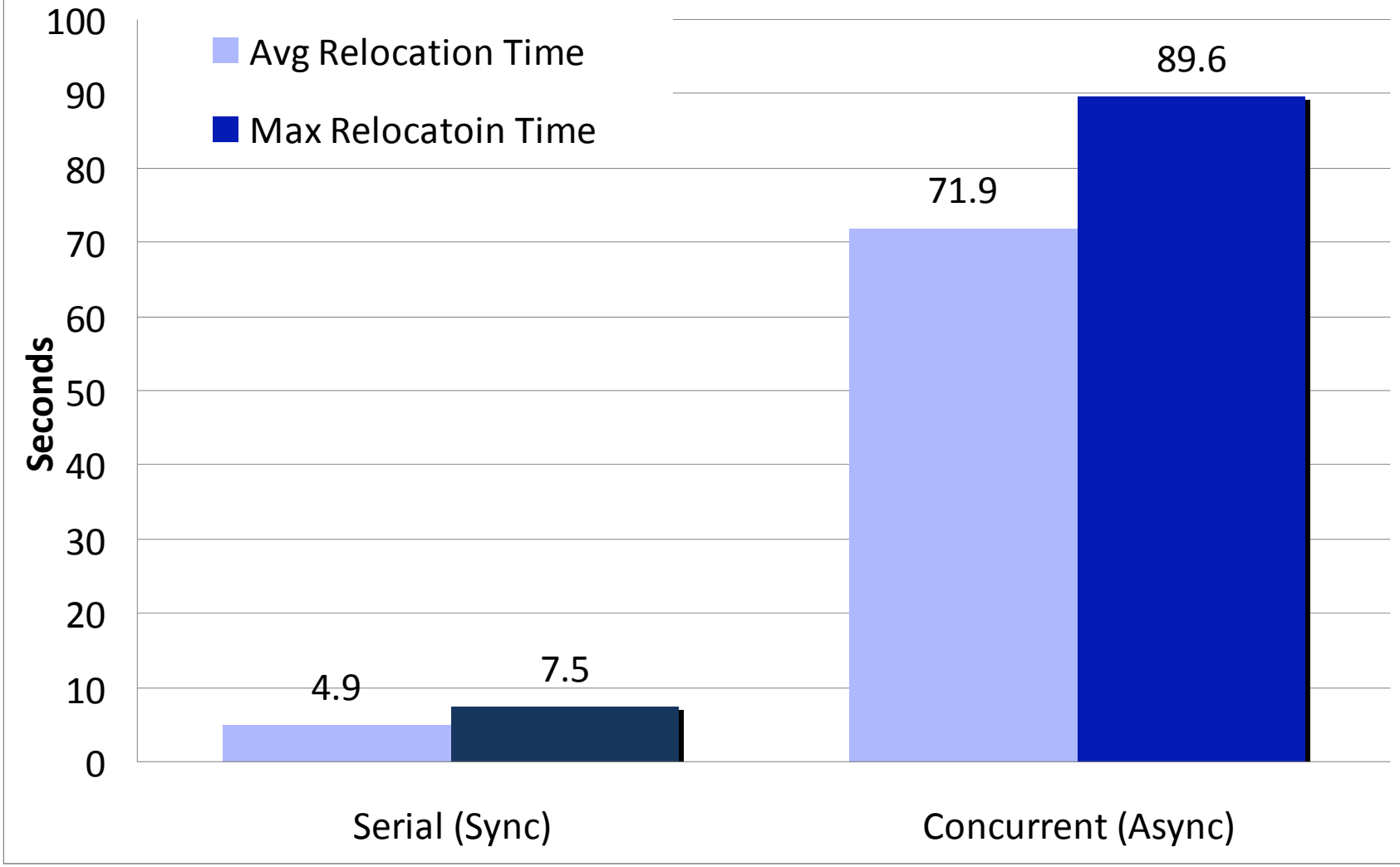
LGRSPEC Workload - 25 Virtual Machines



Preliminary results. z/VM 6.2 Performance Report is due later this year.

Individual Virtual Machine Relocation Time

LGRSPEC Workload - 25 Virtual Machines



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ISFC Channel Impact on Quiesce Time

- For an 8 GB guest changing 6 GB of its pages
  - **20 seconds (4 Gb chpid)**
  - **14 seconds (2 Gb, 4 Gb chpids)**
  - **9 seconds (2 Gb, 4 Gb, 4 Gb chpids)**
  - **6 seconds (2 Gb, 4 Gb, 4 Gb, 8 Gb chpids)**
- For a 40 GB idle guest
  - **< 5 seconds (2 Gb, 4 Gb, 4 Gb, 8 Gb chpids)**

Notes:

1. CHPIDs (CTCs) are all FICON
2. Maximum efficiency is achieved with 4 to 5 RDEVs per CHPID
3. Best practice is to use CHPIDs of all the same speed… more on this later

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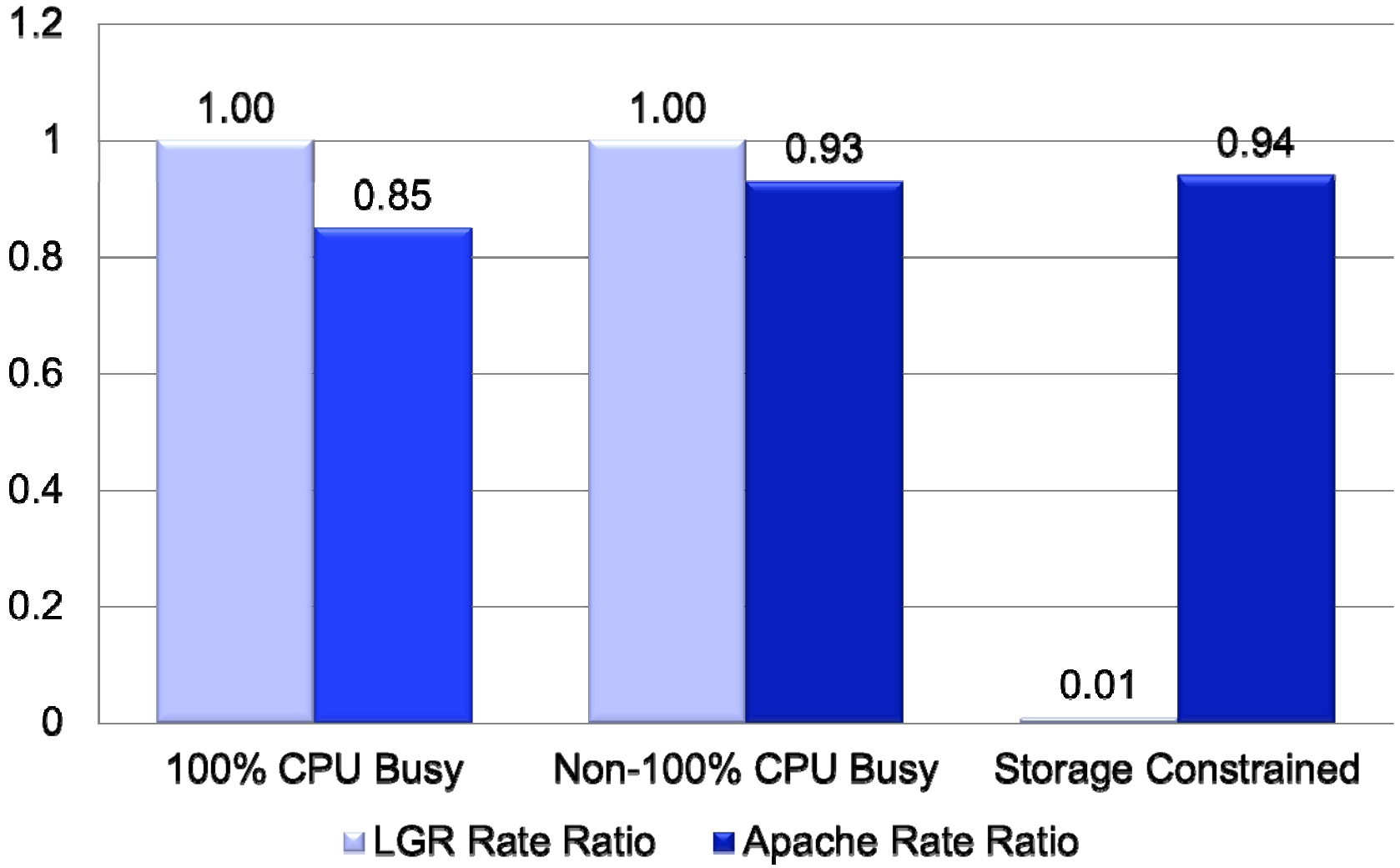
LGR: CPU and Memory Use Habits

- **CPU: generally LGR gets what it needs**
  - Taken “off the top” compared to your workload
- **Memory: CP tries really hard not to interfere**
  - End-to-end throttling, ISFC buffer limits, …
  - Socket memory-move throttling – triggered by memory consumption
  - ISFC logical link throttling – triggered by ISFC running out of queued traffic buffers
  - Considers effect on paging, memory use for specific relocations, …

Effect of LGR on Existing Workload

LGR Bounce and Apache Web Serving Workloads



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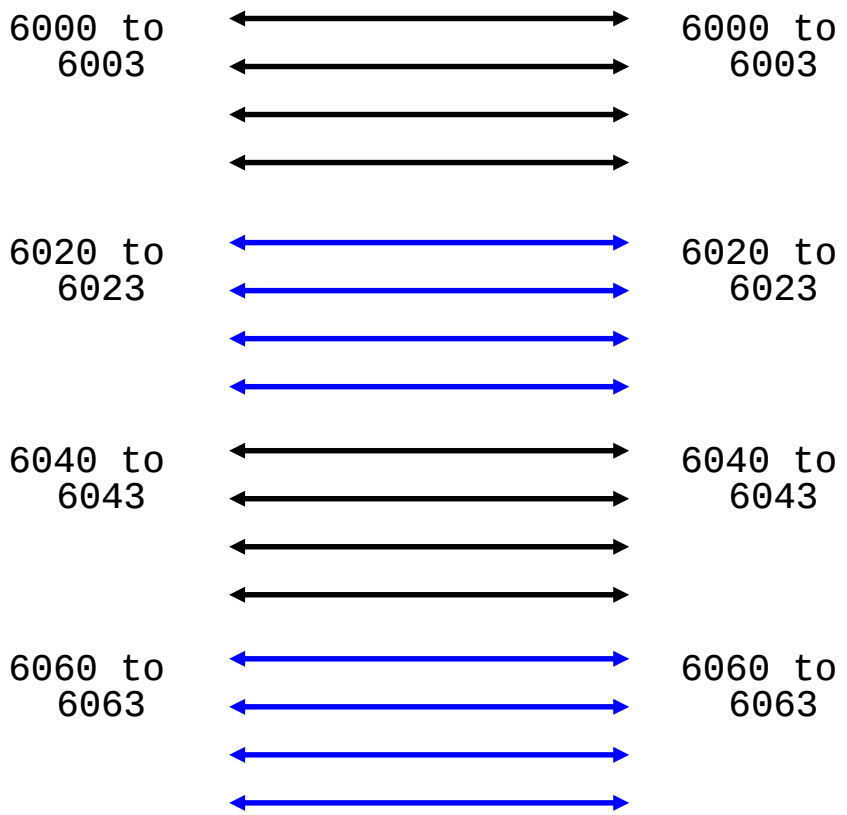
LGR: Keep These in Mind…

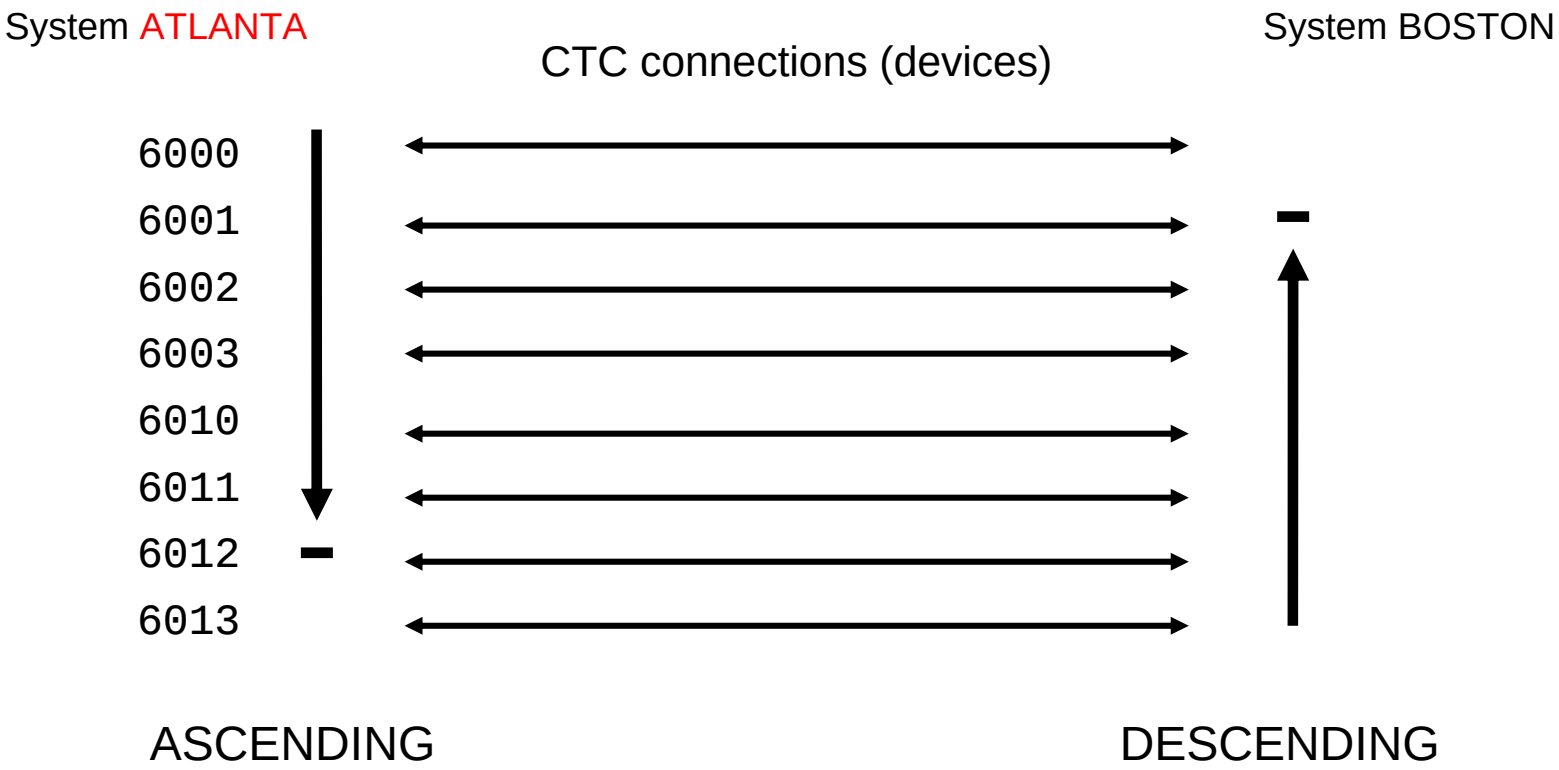
- **Charge back: can your procedures handle guests that suddenly disappear and then reappear somewhere else?**
- **VMRM: if VMRM-A tweaks the guest and then the guest moves to system B, what happens? And then what happens when the guest comes back?**
  - Best practice is to exclude relocating guests from VMRM-managed groups.
- **Second-level schedulers: do you have them? Can they handle guest motion?**

SSI: ISFC Logical Link Configuration Best Practices

- **Use four FICON chpids of all same speed**
- **Use four CTC devices per chpid**
- **Use same RDEV numbers on both ends**
- **More esoteric configurations are certainly possible**



SSI: ISFC Logical Link Write Scheduling, under the covers



Moral: put the fast chpids in the **middle** of ATLANTA's RDEV range.

Selection of where to start in selecting write path is alphabetical.

SSI: Contrived Workload Illustrates ISFC Traffic Scheduling

From H001569C PERFKIT B M-HL P-50 R-12

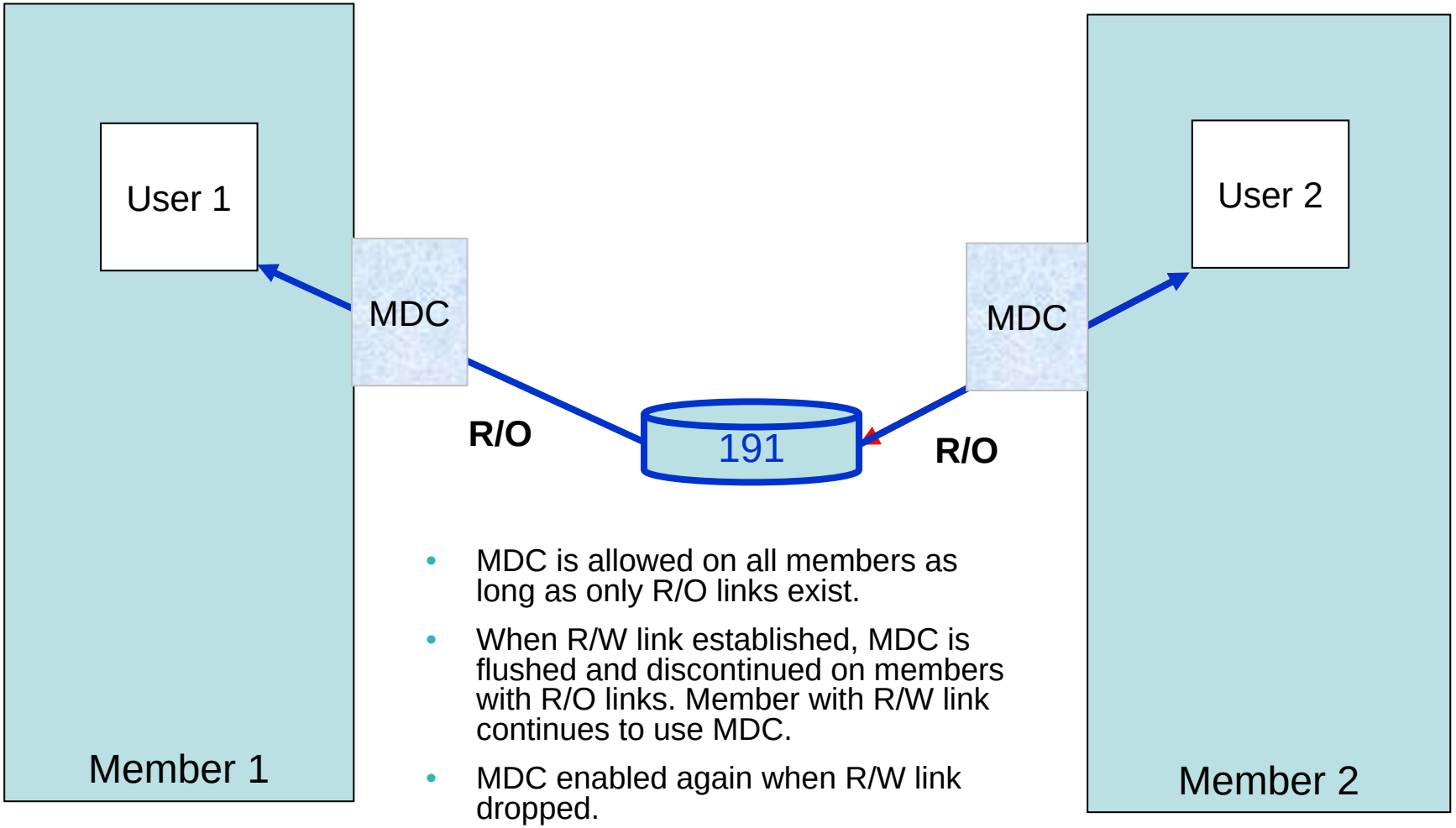
<-- Device Descr. -->			Mdisk	Pa-	<-Rate/s->		<------- Time (msec) ------->				Req.	<Percent>	
Addr	Type	Label/ID	Links	ths	I/O	Avoid	Pend	Disc	Conn	Serv	Resp	CUWt	Qued	Busy	READ
6000	CTCA		...	1	61.8	...	.5	1.7	13.7	15.9	15.9	.0	.0	98	..
6001	CTCA		...	1	61.7	...	.5	1.7	13.7	15.9	15.9	.0	.0	98	..
6002	CTCA		...	1	61.6	...	.5	1.7	13.7	15.9	15.9	.0	.0	98	..
6003	CTCA		...	1	61.6	...	.5	1.7	13.7	15.9	15.9	.0	.0	98	..
6020	CTCA		...	1	61.3	...	.5	1.8	13.7	16.0	16.0	.0	.0	98	..
6021	CTCA		...	1	61.5	...	.5	1.7	13.7	15.9	15.9	.0	.0	98	..
6022	CTCA		...	1	61.3	...	.5	1.7	13.8	16.0	16.0	.0	.0	98	..
6023	CTCA		...	1	61.4	...	.5	1.8	13.7	16.0	16.0	.0	.0	98	..
6040	CTCA		...	1	173	...	.4	1.9	3.2	5.5	5.5	.0	.0	95	..
6041	CTCA		...	1	173	...	.4	1.8	3.2	5.4	5.4	.0	.0	94	..
6042	CTCA		...	1	.9	...	.3	.3	1.0	1.6	1.6	.0	.0	0	..
6043	CTCA		...	1	525	...	.2	.1	.8	1.1	1.1	.0	.0	58	..

Run H001569C talking over link GDLBOFVM, config HL, P=50, R=12

____ISO-UTC_____	_TXPENDCT_	_WCol/sec_	_WMB/sec__	_WMsg/sec_	_WPkg/sec_	_WByt/pkg_	_WMsg/pkg_
2011-09-27 02:59:50.402251	32.0	0.0	663.2	5876.9	838.2	829648.3	7.0
2011-09-27 03:00:50.399438	26.0	0.0	662.0	5867.9	836.9	829443.2	7.0
2011-09-27 03:01:50.411664	20.0	0.0	662.1	5869.2	837.0	829460.3	7.0
2011-09-27 03:02:50.397239	18.0	0.0	661.2	5860.3	835.9	829386.5	7.0

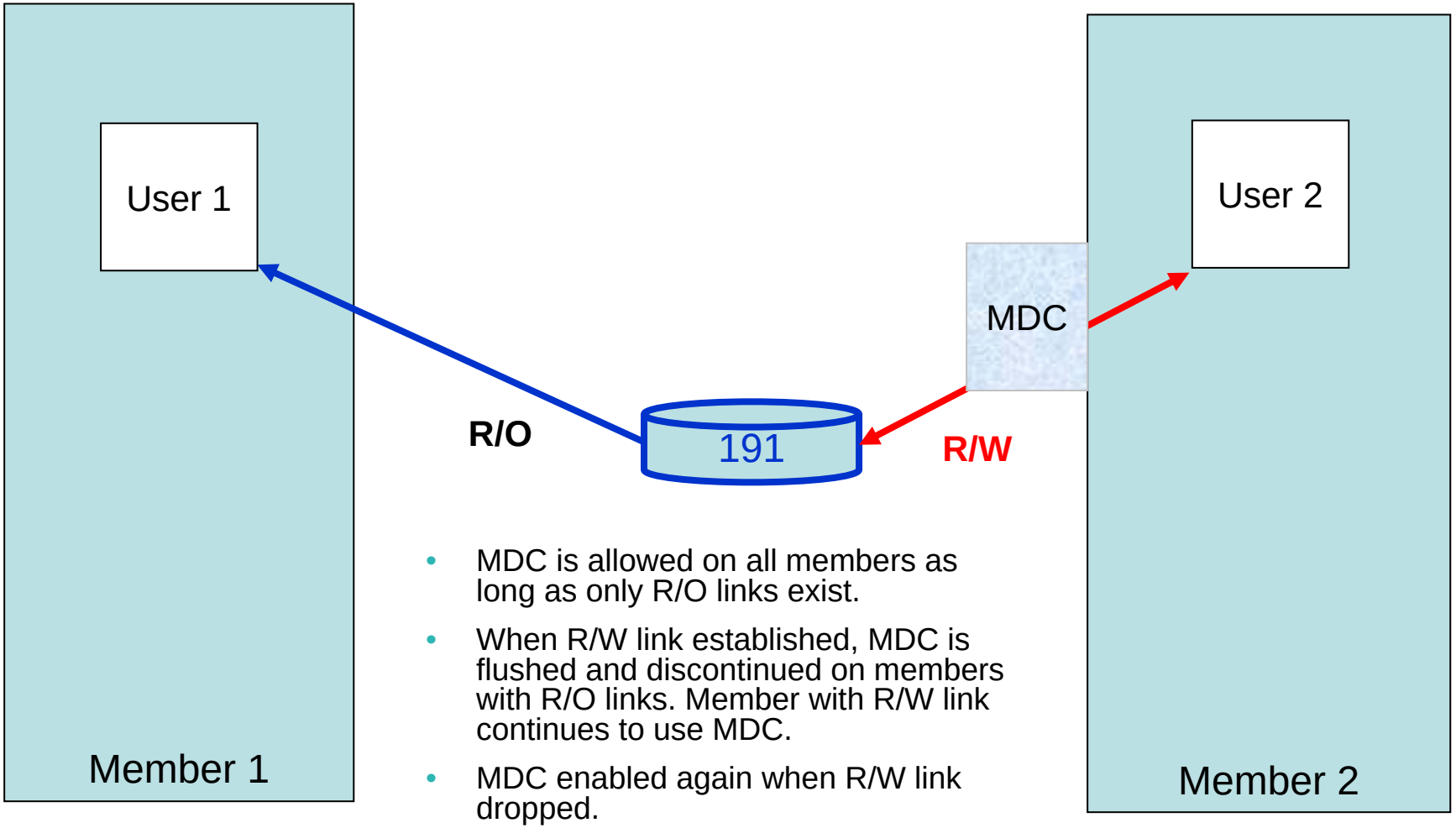
6000-6003 2 Gb/sec; 6020-6023 2 Gb/sec; 6040-6043 4 Gb/sec

SSI: Automatic MDC Management



- MDC is allowed on all members as long as only R/O links exist.
- When R/W link established, MDC is flushed and discontinued on members with R/O links. Member with R/W link continues to use MDC.
- MDC enabled again when R/W link dropped.

SSI: Automatic MDC Management



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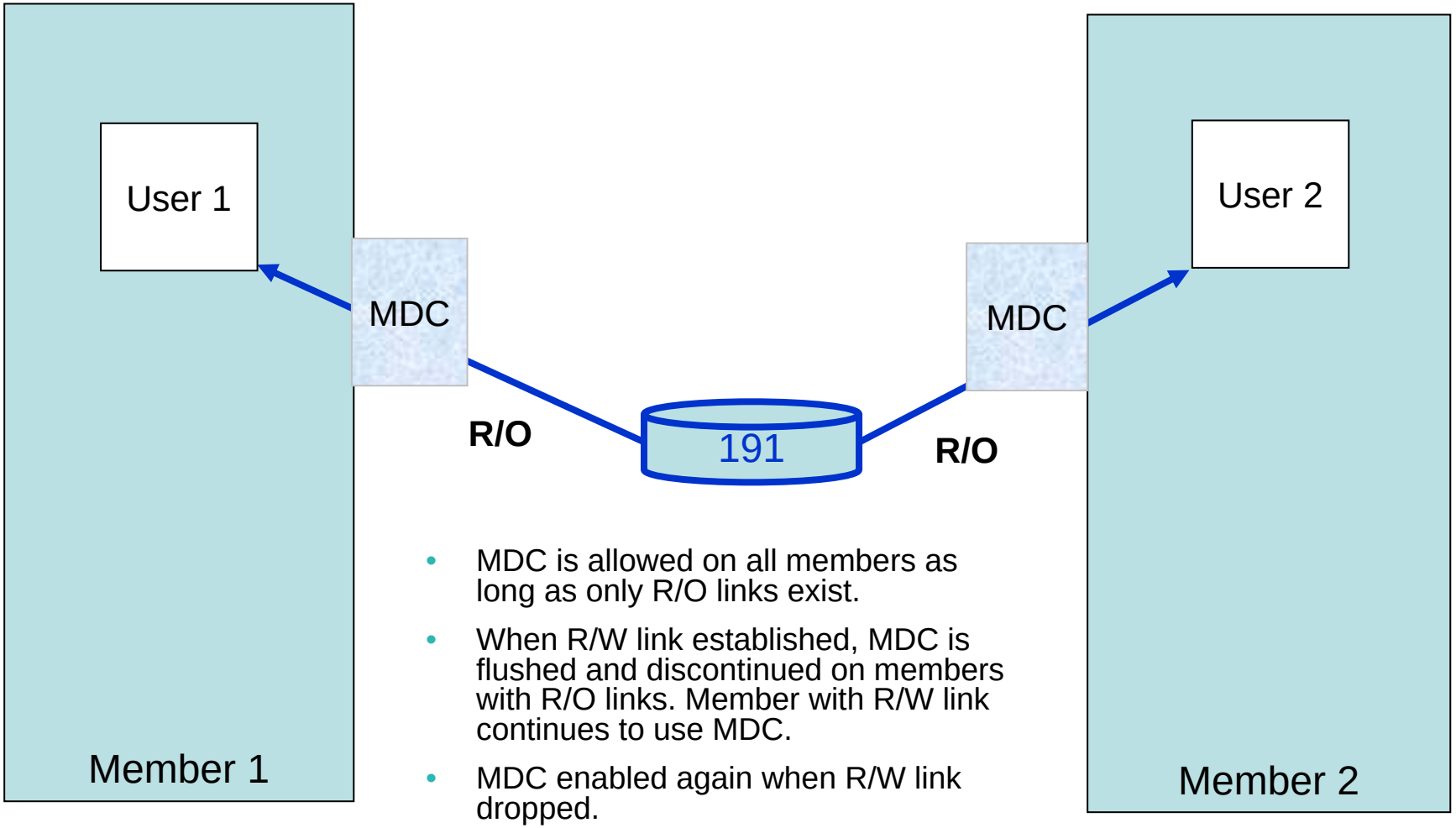

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SSI: Performance Toolkit, Considerations

- **Performance Toolkit continues to run separately on each member of the cluster**
  - There continues to be a unique z/VM monitor data stream for each member.
  - There will be a PERFSVM virtual machine on each member
- **Configuration and usage**
  - Configure so that you will log onto or connect to a different PERFSVM on each system.
  - Configure Performance Toolkit to use the Remote Performance Monitoring Facility, which allows local and remote performance monitoring from a single screen.
- **In general, Performance Toolkit does not produce "cluster view" reports**
  - DASD device-busy view, for example

SSI: Performance Toolkit, New Reports

- **New Reports for SSI**
  - SSICONF: SSI configuration
  - SSISCHLG: SSI state change synchronization activity log
  - SSISMILG: SSI state/mode information log
- **New ISFC reports related to SSI**
  - ISFECONF: ISFC end point configuration
  - ISFEACT: ISFC end point activity
  - ISFLCONF: ISFC logical link configuration
  - ISFLACT: ISFC logical link activity
  - ISFLALOG: ISFC logical link activity log

SSI: MONWRITE Considerations

- **IBM often asks you to run MONWRITE**
  - PMR diagnosis, for example
- **You should be running MONWRITE anyway**
- **You should now be running MONWRITE on every member of the cluster**
- **Make sure it's easy to go find the MONWRITE data for all members for a specified time interval**

SSI: Dump and PMR Considerations

- **To solve your PMR,**
- **… IBM might need concurrently-taken dumps.**

- **Just be prepared:**
  - Know how to take a SNAPDUMP. Practice.
  - Know the effect of SNAPDUMP on your workload.
  - Know how to take a restart dump.

SSI: Capacity Planning

- **Great flexibility in managing multiple LPARs**
  - Previously, if you split work across LPARs and had an imbalance, it was more difficult to rebalance
  - With SSI, virtual machines can run anywhere in the cluster without a lot of additional work
- **Greater responsibility in planning, at two levels**
  - Individual members
    - Need to ensure sufficient capacity and resources for the workload on each member
    - Track growth in requirements to limits of the member
  - Cluster-wide
    - Track growth in requirements of overall cluster to the limits of that cluster
    - Need to ensure sufficient white space for planned outages where LGR will be used to move workload out of a given member.

The “Getting Started With Linux” book has been updated with SSI and LGR planning tips.

SSI & LGR: Planning White Space

- **Need white space for planned outages where you move work off of a given member .**
- **How will work move off the member?**
  - Use existing HA solutions to redirect work to existing servers on other members or elsewhere in enterprise.
  - Use LGR to move to another member.
  - Log off and then logon to another member.
  - Shutdown non-critical virtual machine for duration of unplanned outage.
- **To where do you move the virtual machines?**
  - To a single member or multiple members?
  - To a member on same CEC or another CEC?
  - To a member held in reserve (such as a DR LPAR)?
  - It's not just one z/VM image anymore

SSI & LGR: Planning White Space

- **CPU**
  - Shared logical processors?
  - Adjust LPAR weight settings?
  - Vary on additional engines?
- **I/O**
  - Ensure sufficient resources at all levels:
    - Channel, switch, control unit, device
  - Shared channels?
- **Memory white space is not as easy to manage**
  - Ensure sufficient paging space and concurrency or data rate capability
  - Increase real memory over commitment?
  - Temporarily decrease size of some virtual machines?
  - Use Dynamic Memory Upgrade?
    - No downgrade available

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z/VM 6.2 – More Than Just SSI and LGR

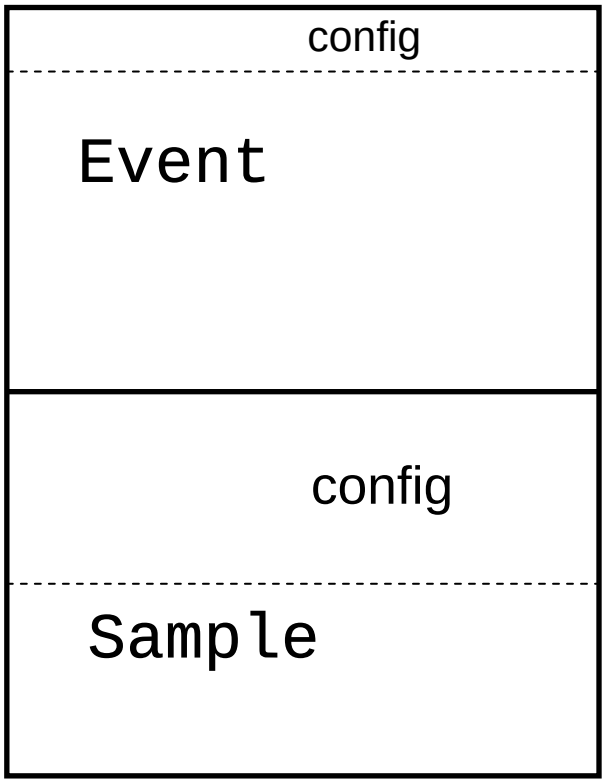
Memory Management: Needle-in-Haystack Searches

- **Searching for a below-2-GB frame in lists dominated by above-2-GB frames**
  - In months of study we identified about 10 of these searches
  - Development prototype that shut off all unnecessary use of <2GB storage gave us tremendous results
- **z/VM now does not allocate pageable buffers <2GB if:**
  - Dynamically, usable >2GB to usable <2GB is beyond a certain threshold
  - Statically, if the partition is beyond a certain size, for the life of the IPL
- **Result: no more needle searches**
- **Practically speaking, systems with 128 GB or more of real memory use below-2-GB memory only when it is architecturally required.**

MONDCSS and SAMPLE CONFIG Changes

- **The old defaults are too small for most systems nowadays**
- **So we have changed the default layout**
- **MONDCSS is 64 MB now (16384 pages)**
  - Half (32 MB) for EVENT
  - Half (32 MB) for SAMPLE
    - Half (16 MB) for SAMPLE CONFIG
- **As before, empty pages are not instantiated**
- **Remember, config pages evaporate after a short time**
- **MONWRITE 191 disk also increased to 300 cylinders.**
- **If you use your own MONDCSS, the new default SAMPLE CONFIG size may be too large, requiring you to set it manually or to change your MONDCSS.**

MONDCSS – 16384 pages



Default STORBUF Changes

- **Many parties were noticing that the old defaults of 125 105 95 were not appropriate for Linux workloads**
- **We considered several different proposals**
  - From IBM ATS
  - From vendors
  - From Redbooks
  - From customer data
- **After careful consideration by “top people” we came to 300 250 200 as new defaults**
- **If you already override defaults, the only impact would be if you also use SET SRM STORBUF INITIAL at some point.**
- **For CMS-intensive workloads, the old defaults might be more appropriate, and you should validate the settings for these workloads when you migrate to z/VM 6.2**

z/CMS

- **Prior to z/VM V6.2, z/CMS was supplied as a sample.**
- **z/VM V6.2 supports z/CMS as an optional alternative to the standard CMS that runs in ESA and XC mode virtual machines and 31-bit addressing.**
- **z/CMS can run in a z/Architecture guest**
  - Allows programs to use z/Architecture instructions, including 64-bit addressing
- **Standard CMS function does not exploit memory above 2GB**
- **Remember that z/Architecture is not XC**
  - No VM Data Spaces
  - No SFS DIRCONTROL directories in a data space
  - No DB2 for VM and VSE data space use
- **The standard, usual, XC-mode CMS is still there**

CPU Measurement Facility Counters

- **CPU MF counters are a System z hardware facility that characterizes the performance of the CPU and nest**
  - Instructions, cycles, cache misses, and other processor related information
- **Available on z10 EC/BC, z196, and z114**
- **The CPU MF counter values:**
  - Help IBM to understand how your workload stresses a CEC for future design
  - Help IBM to map your workload into the LSPR curves for better sizing results
  - Help IBM better understand your system when there is a processor performance related problem.
- **z/VM 6.2, 6.1, and 5.4 can all collect the CPU MF counters**
  - z/VM 5.4 and 6.1: VM64961, UM33440 (5.4), UM33442 (6.1)
- **We want volunteers to send us MONWRITE data!**
  - Your contributions will help us to understand customer workloads!

CPU MF Counters and CP Monitor, Details

- **Counter sample record is in the Processor domain**
- **MONITOR SAMPLE command manipulates counter collection**
- **QUERY MONITOR reveals whether counter collection is on**
- **z/VM writes the collected counters into the Monitor data stream**
  - Domain 5 Record 13: MRPRCMFC, Processor domain, sample record
- **The D5 R13 records land in your MONWRITE data**

IBM Wants Your CPU MF Counter Data

- **Your data will help IBM to build a library of customer workloads**
- **Collect an hour's worth of MONWRITE data…**
  - From a peak period,
  - With CPU MF counters enabled,
  - With one-minute sample intervals
- **Contact Richard Lewis at rflewis@us.ibm.com**
- **Richard will send you instructions on how to transmit the data to IBM**
- **No deliverable will be returned to you**
- **We will be ever grateful for your contribution**

Monitor Records – Highlights – New and Almost-New

- **In domain 1 (monitor), ISFC and SSI config records**
- **In domain 1, system topology record (PU-book-chip)**
- **In domain 4 (user), LGR start and LGR end**
- **In domain 5 (processor), CPU MF and system topology**
- **In domain 6 (I/O), minidisk MDC setting change event**
- **New domain 9 – ISFC performance records**
- **New domain 11 – SSI performance records**

- **Other changes to report on LGR, mostly in user domain**

z/VM 6.2: Service Integrated in Base of z/VM 6.2

- **VM64774 SET/QUERY REORDER command**
- **All of the SSL scaling fixes**
- **VM64721 LIMITHARD now works**
  - SET SRM LIMITHARD CONSUMPTION is default now
- **VM64767/64876 VARY PROCESSOR causes hangs**
- **VM64850 VSWITCH failover buffer mixup**
- **VM64795 Enhanced Contiguous Frame Handling**
- **VM64927 Spin Lock Manager Improvement**
- **VM64887 Erratic System Performance (PLDV overflow)**
- **VM64756 Long CPEBK Chains, Master-only work, and SYSTEMMP**

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z/VM Performance: Other Thoughts

z114 Performance

- **We ran workloads to help evaluate z114 compared to z196**
- **Equal N-way: about 0.65 of a z196**
- **Remember, it's a smaller machine than z196**
  - Only 10 engines, not 80
  - Only 248 GB, not 3072 GB
- **For more information:**

  http://www-03.ibm.com/systems/z/hardware/zenterprise/z114_specs.html

Evolution of z/VM LSPR Workload

- **From memory-rich to memory-constrained**
- **From 16-way to 32-way**
- **From equally-active to unequally-active**
- **From workload-indexed to RNI-indexed**
  - We do want your CPU MF counter data
- **Our goal is a lab setup that represents z/VM customers' environments**

Summary

z/VM Performance Update: Summary

- **z/VM v6.2: SSI and LGR, plus more**
  - Loose clustering for guest mobility
  - Recognition of systems becoming larger
    - Memory management improvements
    - Better defaults: MONDCSS, SAMPLE CONFIG, STORBUF
  - CPU MF counters: help us help you
  - Lots of good service rolled into the base
  - See http:/www.vm.ibm.com/perf/ for more details
- **LSPR: we keep trying to improve**
- **The adventure continues**

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Backup Charts – Just keep these in the deck in case somebody asks, “Remind me about that again, please?”

z/VM 6.2: Open Switches and Things Worth Watching

- **Reorder: /perf/tips/reorder.html**
- **VMDUMP: /perf/tips/vmdump.html**
- **Overconfiguring logical and virtual PUs**
- **VM64715 Page Release Serialization Impact**
- **Excess share distribution**
- **Low-utilization guests and memory management**
- **MDC and FlashCopy interaction**

Reorder Processing - Background

- ***Page reorder* is the process of managing user-frame-owned lists as input to demand scan processing.**
  - It includes resetting the HW reference bit.
  - Serializes the virtual machine (all virtual processors).
  - In all releases of z/VM
- **It is done periodically on a virtual machine basis.**
- **The cost of reorder is proportional to the number of resident frames for the virtual machine.**
  - Roughly 130 ms/GB resident on a z10
  - Delays of ~1 second for guest having 8 GB resident
  - This can vary for different reasons +/- 40%

Reorder Processing - Diagnosing

- **Performance Toolkit**
  - Check FCX113 UPAGE resident page fields R<2GB and R>2GB
  - Check FCX114 USTAT Console Function Mode wait %CFW
    - Reorders and CFW are somewhat correlated
- **REORDMON tool**
  - From Bill Bitner, on http://www.vm.ibm.com/download/packages/
  - Works against MONWRITE data or running system
  - Displays how often reorder happens

Reorder Processing - Mitigations

- **Keep guests as small as practical**
  - Perhaps split large guests with multiple applications each into several guests with one application each
- **Consider applying APAR VM64774**
  - Provides SET and QUERY commands with system-wide or per-user control
  - Corrects problem in earlier “patch” solution that inhibits paging of PGMBKs for virtual machines where reorder is set off.
  - z/VM 5.4 PTF UM33167 RSU 1003
  - z/VM 6.1 PTF UM33169 RSU 1003
- **See http://www.vm.ibm.com/perf/tips/reorder.html for more details.**

VMDUMP Processing Concern

- **VMDUMP is a very helpful command for problem determination.**
- **Some weaknesses:**
  - Does not scale well, can take up to 40 minutes per GB.
  - It is not interruptible
    - APAR VM64548 is open to address this.
- **Linux provides a disk dump utility which is much faster relative to VMDUMP.**
  - It is disruptive
  - Does not include segments outside the normal virtual machine.
- **See http://www.vm.ibm.com/perf/tips/vmdump.html**

VM64721 SET SHARE ABSOLUTE LIMITHARD

- **Customers reported both underlimiting and overlimiting**
- **Problematic configurations:**
  - Sum of absolute shares > 100%
  - Guest with low relative minimum and larger absolute maximum
  - LIMITHARD used and system not very busy
- **Status:**
  - VM64721 closed and available for z/VM 5.3, 5.4, and 6.1
    - R530 UM32851 October 2009 RSU 1001
    - R540 UM32852 October 2009 RSU 1001
    - R610 UM32853 October 2009 RSU 1001
  - Introduces new SET SRM LIMITHARD options:
    - DEADLINE = current behavior and default
    - CONSUMPTION = new approach. Will become the default in a future release.
    - Applies to only ABSOLUTE

Excess Share Distribution: Background

- **Shares are relative to other users that want to run.**
- **Example:**
  - Four compute-bound virtual machines on a real 1-way:
    - LINUX01 Relative 100 = 17%
    - LINUX02 Relative 100 = 17%
    - LINUX03 Relative 200 = 33%
    - LINUX04 Relative 200 = 33%
  - Total Shares = 600
  - What happens if LINUX04 wants to use only 3%?

Excess Share Distribution Problem

User ID	Share	Normalize	Should Get	Problem Scenario
LINUX01	100	17%	24.5%	17%
LINUX02	100	17%	24.5%	17%
LINUX03	200	33%	48%	63%
LINUX04	200	33%	3%	3%

Excess Share Distribution Problem: Status

- **IBM is aware, has recreated the problem, and is working on correcting.**
- **No APAR currently open.**
- **No customer has opened a problem report.**
- **There was a previous problem like this that was changed by major code changes in VM/ESA 1.2.2, June 1994.**
  - http://www.vm.ibm.com/perf/reports/vmesa/vm122prf.pdf describes the changes
- **Unclear when the problem was re-introduced.**

MDC and FlashCopy Interaction

- **Sometimes, z/OS guests have minidisks**
- **Sometimes, z/OS guests do FlashCopy functions**
  - z/OS DFSMS and other utilities can make extensive use of FlashCopy for functions such as defragmentation
- **These two things do NOT play together well**
  - FlashCopy channel programs induce large numbers of MDC track invalidations
  - This can send z/VM storage management into a tizzy
  - Symptom is very high unexplained system time
- **Mitigations**
  - Turn off MDC for minidisks that are FlashCopy targets

VM64715 Page Release Serialization

- **z/VM 5.4 and 6.1 – still open, target 3Q 2011**
- **The problem scenario:**
  - Page release serialization changes from z/VM 5.2 and service resulted in the Page Table Invalidation Lock (PTIL) exclusive in cases that result in poor performance.
  - Worse in environments with significant segment creation/deletion, such as large DB2 for VM & VSE data space exploitation scenarios
- **The fix:**
  - Change various PTIL-exclusive locks to PTIL-shared
  - Restructure code appropriately

VM64965 – PE Correction for VM64862

- **Red alert: www.vm.ibm.com/service/redalert/**
- **VM64862**
  - HCPHRMDP may get wrong PTIL lock to invalidate STE
  - Locked wrong VMDBK's address space by mistake!
- **Affects z/VM 5.4 and 6.1**
- **Can cause abends in HCPHRM**
- **Available April 2011:**
  - 5.4: UM33346
  - 6.1: UM33347

Excessive PR/SM Overhead

- **CPU consumption falls into three categories**
  - Consumed by guests (FCX144 PROCLOG)
  - Consumed by z/VM Control Program (FCX144 PROCLOG)
  - Consumed by PR/SM hypervisor (FCX126 LPAR)
- **Some installations have seen the third category >100%**
  - Multiple engines burned up running PR/SM functions
  - Correlated with high CPU time in the z/VM Control Program
- **Usually due to poor configuration practices:**
  - Too many logical PUs compared to partitions' needs
  - Too many virtual PUs compared to guests' needs
- **Best practices:**
  - For each partition,
    - Configure just enough logical PUs to cover demand
    - Set LPAR weights appropriately
  - For each guest,
    - Configure just enough virtual PUs to cover demand
    - Set share appropriately
    - For Linux guests, consider cpuplugd to shut off unneeded virtual PUs

VM64927 z/VM Spin Lock Manager Improvement

- **When a z/VM logical PU senses lock contention, the logical PU tells PR/SM it wants to give up its physical PU**
  - So some other logical PU can run and thereby finish up and release the lock
- **Old way: z/VM just issues Diag x'44' to PR/SM**
  - Not a functionally rich interface – basically a dumb yield
- **New way: z/VM acts very differently**
  - Logical PU now knows which other logical PU is holding the lock it wants
  - SIGP Sense-Running to see if the holding logical PU is already running
    - If not already running, use Diag x'9C' to tell PR/SM to run the holder
    - If so, just spin
- **Behavior change is…**
  - z/VM stays out of PR/SM much better
  - When z/VM does in fact call PR/SM, z/VM tells PR/SM something genuinely useful
- **Savings for you is decreased PR/SM overhead**
  - "%Ovhd" in FCX126, first table
  - "%LPOVHD" and "%NCOVHD" in FCX126, second table
- **z/VM 6.1 UM33297 February 2011 -- and future RSU candidate**

More on Excessive PR/SM Overhead, z10

- **PR/SM itself was found in some workloads to be the cause of excessive PR/SM overhead**
- **Problem related to how PR/SM manages mutual exclusion (locking) in some situations**
  - Cache line getting dragged around
- **Benefits mostly seen in:**
  - High physical N-way (>32)
  - Larger numbers of partitions (>6)
  - Larger logical-to-physical ratios
- **MCL N24404.008, driver 79F, bundle 37a**

LSPR Suite Changes for z/VM and Linux

- **More current levels of various components**
  - Updated from SLES 9 to SLES 10
  - Updated from DB2 8.1 to 9.5
  - Updated WebSphere from 6.02 to 7.01
  - Updated from z/VM 5.2 to z/VM 5.4
- **Application workload changed from Trade6 to Daytrader**
- **Measured up to a 32-way partition**
- **We are now tinkering with running storage-overcommitted workloads**
  - They stress the processor cache differently
  - They force the machine to run different instruction mixes

Other LSPR Changes

- **z196 LSPR introduces new view of how a workload stresses a CEC**
  - Old way: run specific application suites (IMS, etc.)
  - New way: try to measure the pressure the running workload exerts on the CEC, especially on the cache or "nest"
  - We are using CPU Measurement Facility counters for this (new in z10)
    - z/OS: SMF 113 records
    - z/VM: we are well aware of the exploitation requirement
- **"Nest intensity" (aka workload's cache habits) is key**
  - Low RNI: light use of memory hierarchy – high N-way scaling
  - Average RNI: centrist, similar to old LoIO
  - High RNI: very hard on the cache, similar to old DI-mix
- **We have a ways to go here**
  - Is RNI alone a sufficient predictor of how any given workload will scale?
  - Is there an additional metric that might be illuminating to collect?
  - How might we factor said additional metrics into what you read in LSPR?

VM64767: VARY PROCESSOR Hangs

- ***VARY PROCESSOR* command might sometimes never complete**
  - Mishandling of VARY lock in save area reclaim
- **Other work requiring the VARY lock can pile up behind this indefinite postponement**
- **Eventually the system can hang**
- **Order and apply the PTFs for these two APARs:**
  - VM64876, then
  - VM64767, which pre-reqs ‘876.
- **Fits z/VM 5.3, 5.4, and 6.1**

VM64527 MCW002 Abends from Memory Imbalance

- **z/VM 5.3, 5.4, and 6.1**
  - R530 UM32878 Nov 2009 RSU 1001
  - R540 UM32879 Nov 2009 RSU 1001
  - R610 UM32880 Nov 2009 RSU 1001
- **Imbalance in free storage pools when using dedicated FCP or OSA devices may lead to z/VM abend.**
- **Very large dumps because memory has been consumed by FOB blocks**

VM64850 Avoids Problem with VSWITCH Failover

- **z/VM 5.4 and 6.1**
  - R540 UM33119 July 2010 Future RSU
  - R610 UM33120 July 2010 Future RSU
- **The problem scenario:**
  - After a fail-over to a backup OSA adapter or
  - Adding an additional port to a LinkAG port group
  - When multiple LPARs, VSWITCHes, and OSA devices are involved.
- **The VSWITCH erroneously starts using only a single 64 KB buffer.**
  - Normally, it is 128 64 KB buffers (8 MB altogether).

VM64795 Enhanced Contiguous Frame Coalescing

- **Old way for coalescing free adjacent frames was exposed in certain scenarios**
- **Improved the coalesce function so as to help keep contiguous free frame lists populated**
- **Available now for z/VM 5.4 and 6.1**
  - 540 UM33244 November 2010 -- future RSU candidate
  - 610 UM33246 November 2010 -- future RSU candidate

VM64887 Erratic System Performance

- **In systems with runnable VMDBKs >> logical PUs,**
  - … during reshuffle,
  - … PLDV overflow was not getting recorded.
- **Thus, after a logical PU cleared its PLDV,**
  - … it didn't know overflow had happened,
  - … so it didn't know to go check the dispatch list for work.
- **Thus, runnable VMDBKs would sit in the dispatch list,**
  - … forlorn and forgotten,
  - … until next reshuffle.
- **VM64887, UM33213 (5.4), UM33214 (6.1)**
  - Not on an RSU, but under consideration for a future one

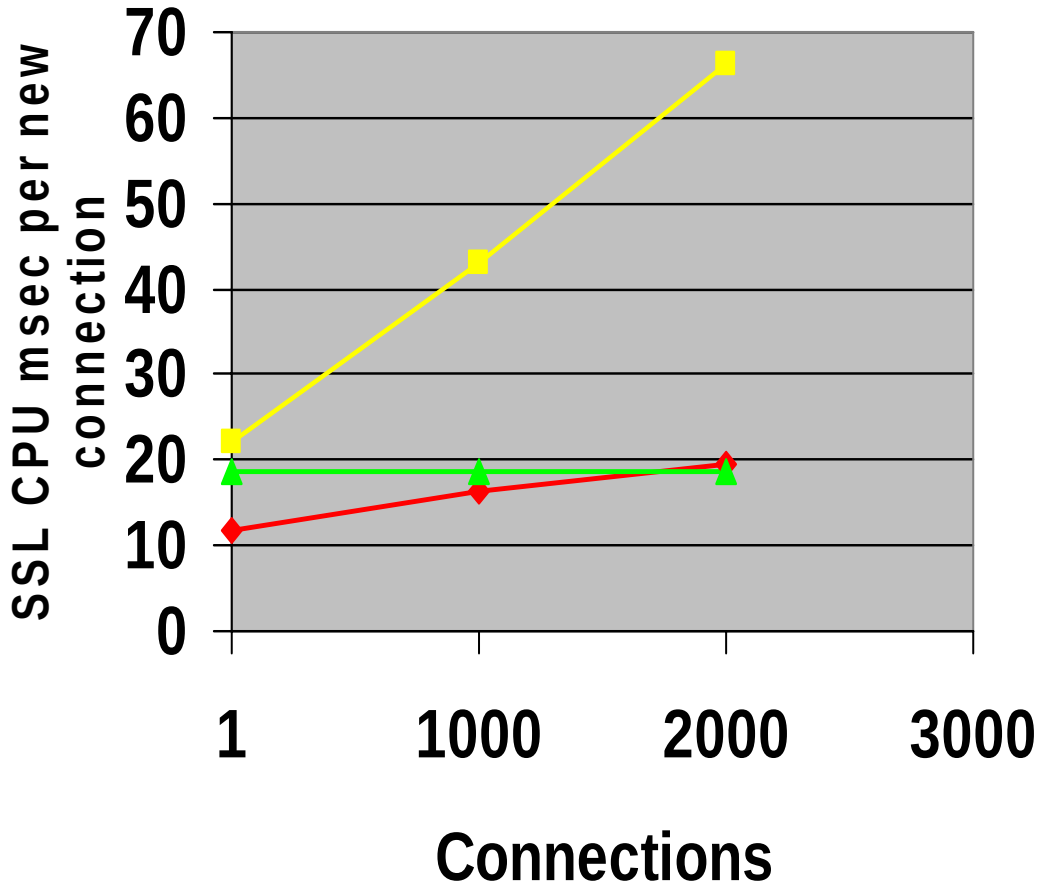
SSL Performance

- **In z/VM 5.4, the z/VM SSL server moved from being Linux-based to being CMS-based.**
  - APAR PK65850 shipped the support
- **Performance concerns compared to Linux-based server**
- **A group of related APARs to address performance**
  - All for z/VM 5.4 and 6.1
  - All now closed
  - PK75662 (stack)
  - PK97437 (packaging)
  - PK97438 (SSL)
  - VM64313 (CMS)
  - VM64740 (CMS)
  - PM06244 (SSL)
- **Because of significant changes in configuration for enhanced SSL, there is new documentation**
  - Overview: http://www.vm.ibm.com/related/tcpip/tcsslspe.html
  - Config: http://www.vm.ibm.com/related/tcpip/tcspepvs.html

SSL Enhancement Objectives

- **Increase scalability**
  - Support multiple SSL servers per TCP/IP stack
- **Increase the number of supported connections while maintaining the CPU cost of a connection stable**

2000 Connection Rampup



SSL Multi was 10 servers with 200 clients on each.

Default configuration is 5 servers, 600 each.

System programmer can change config as needed.

Altitude of green line is a function of the configured maximum in the server.

Results For Various TCP/IP Services

Service	Percentage Improvement (CPU/tx)	Comments
FTP	Degraded by 38%	The 'Select' code imported from z/OS is very inefficient. z/OS rewrote their 'Select' code for performance concerns. We did not have capacity available to rewrite the 'Select' code.
Telnet	Improved by 8%	A slight improvement but again, the z/OS 'Select' code held us back from obtaining better performance results
SMTP	Improved Infinitely	The SMTP environment in the SSL-Rehost environment was not functioning. This problem was fixed in the current level of SSL.

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The End