How do you spell “SMT” on z Systems?

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… and any contributor I might have omitted
Agenda

- SMT Basics
- Getting the right stuff
- Setting the stuff up right
- New and changed commands
- Changes in Time
- CPU Scalability
- Summary
“Just the facts, ma’am.”
Why Simultaneous Multithreading?

- All the other kids are doing it (Power, x86).
- We’re reaching the physical limits of the machine, we can’t just keep making chips smaller and faster.
- We need now to look at ways to use the chip resources more efficiently.

![Work per Virtual CPU-second graph]

- z9
- z10
- z196
- zEC12
- z13 non-SMT
What is Simultaneous Multithreading (SMT)?

It is the ability of a single physical processor, or core, to run more than one stream of instructions at a time.

Each stream of instructions is called a thread.

The threads share the hardware assets on the core. Sometimes they collide or have to take turns… … but sometimes they don’t.

When the core cannot make progress on one thread, perhaps it can keep making progress on the other one. Cache miss is a really good example of this.

This can increase overall core capacity to complete instructions even though the individual threads might run.

Which approach is designed for the higher volume of traffic? Which road is faster?

*Illustrative numbers only
What’s mine is mine…

Single threaded cores

Core: L1, L2, address translator, …

Thread: PSW, registers, address translations, timers, … execution context

zEC12 had one thread per core.

What’s mine is mine, no sharing!

Multithreaded cores

Core: L1, L2, address translator, …

Thread: PSW, registers, address translations, timers, … execution context

z13 has two threads per core for IFLs and zIIPs. The rest have one.

The threads must share some core facilities!
How would this look, in a perfect world?

Thread 0

L    R3, FIELDA
L    R6, FIELDC

Thread 1

LLGC  R5, FIELDB
LGR   R3, R5
LGHI  R0, 1
SLLG  R3, R0, 0(R3)

Let's say FIELDA is in the L3 cache
FIELDB is in the L1 cache
FIELDC is in L4 cache

*Note that this is a contrived sample, not necessarily representative of the real amount of time these instructions take.
A happy marriage

<table>
<thead>
<tr>
<th>Thread 0</th>
<th>Thread 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resolving FIELDA</td>
<td>Resolving FIELDB</td>
</tr>
<tr>
<td>LLGC R5,FIELDB</td>
<td></td>
</tr>
<tr>
<td>L R3,FIELDA</td>
<td></td>
</tr>
<tr>
<td>Resolving FIELDC</td>
<td>LGR R3,R5</td>
</tr>
<tr>
<td>LGHI R0,1</td>
<td></td>
</tr>
<tr>
<td>SLLG R3,R0,0(R3)</td>
<td></td>
</tr>
<tr>
<td>L R6,FIELDC</td>
<td></td>
</tr>
</tbody>
</table>

While thread 0 is waiting for its memory references to be resolved, thread 1 can keep running, and so the core keeps making progress.

Because each thread has its own registers, the threads can run absolutely concurrently.
A fight for shared resources

<table>
<thead>
<tr>
<th>Thread 0</th>
<th>Thread 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>AR R3,R4</td>
<td>AR R0,R1</td>
</tr>
<tr>
<td>AR R3,R4</td>
<td>AR R3,R5</td>
</tr>
<tr>
<td></td>
<td>AR R3,R5</td>
</tr>
<tr>
<td></td>
<td>AR R0,R1</td>
</tr>
<tr>
<td>AR R3,R1</td>
<td></td>
</tr>
<tr>
<td>AR R9,R4</td>
<td>AR R2,R1</td>
</tr>
</tbody>
</table>

Of course this doesn't work well all the time—what if both threads just have instructions with no memory references?

In this case, each thread will run more slowly than it would if it had its own core.
Operators are standing by to take your order!
Expanding the Horizon of Virtualization

Release for announcement – the IBM z13™
January 14, 2015
Announcement link

z/VM compatibility support
PTFs available February 13, 2015
Also includes crypto enhanced domain support
z/VM 6.2 and z/VM 6.3
No z/VM 5.4 support
Refer to bucket for full list

Enhancements and exploitation support on only z/VM 6.3
IBM z13 Simultaneous Multithreading
Increased processor scalability
z/VM Support for IBM z13

Updates for z/VM 6.2 and 6.3
   Many components affected

No z/VM 5.4 support

No z/VM 6.1 support even if you have extended support contract.

PSP Bucket
   Upgrade  2964DEVICE
   Subset  2964/ZVM

If running Linux, please also check for required updates prior to migration.
# z/VM Service Required for the IBM z13


---

<table>
<thead>
<tr>
<th>APAR Number</th>
<th>z/VM Service Released</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>VM55577</td>
<td>z/VM V6.3</td>
<td>Provides z/VM support that will enable guests to exploit IBM zEnterprise FC12 function on the IBM z13</td>
</tr>
<tr>
<td>VM55577</td>
<td>z/VM V6.3</td>
<td>Provides support for the new Crypto Express55 adapter and enhanced domain support for Crypto Express55 and Crypto Express55</td>
</tr>
<tr>
<td>VM55595</td>
<td>z/VM V6.3</td>
<td>Provides host exploitation support for SMT or IBM z13, which will enable z/VM to dispatch work on up to two threads (logical CPUs) of an IFL processor core</td>
</tr>
<tr>
<td>VM55676</td>
<td>z/VM V6.3</td>
<td>Provides SMT stand-alone dump support</td>
</tr>
<tr>
<td>VM55583</td>
<td>z/VM V6.3</td>
<td>Provides support for up to 64 logical processors on IBM z13</td>
</tr>
<tr>
<td>VM55670</td>
<td>z/VM V6.3</td>
<td>Provides Multi-VMSwitch Link Aggregation Support, allowing a port group of DSX ExpressN™ Switches to span multiple virtual switching within a single z/VM system or between multiple z/VM systems</td>
</tr>
<tr>
<td>VM55588</td>
<td>z/VM V6.3</td>
<td>Performance Toolkit compatibility support for z13</td>
</tr>
<tr>
<td>VM55588</td>
<td>z/VM V6.3</td>
<td>Performance Toolkit support for simultaneous multithreading on z13</td>
</tr>
<tr>
<td>VM55590</td>
<td>z/VM V6.3</td>
<td>Performance Toolkit support for Multi-VMSwitch Aggregation on z13</td>
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<td>VM55648</td>
<td>z/VM V6.3</td>
<td>DMV/MP support for enhanced crypto domain support on z13</td>
</tr>
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<td>VM55409</td>
<td>z/VM V6.3</td>
<td>VMHCD support for z13</td>
</tr>
<tr>
<td>VM55458</td>
<td>z/VM V6.4</td>
<td>VMHCD isolation support for z13 IODF</td>
</tr>
<tr>
<td>VM54437</td>
<td>z/VM V6.3</td>
<td>VMHCM support for z13</td>
</tr>
<tr>
<td>VM54609</td>
<td>z/VM V5.4</td>
<td>VMHCM isolation support for z13 IODF</td>
</tr>
<tr>
<td>VM54555</td>
<td>z/VM V6.3</td>
<td>VM EREP support for z13</td>
</tr>
<tr>
<td>VM59801</td>
<td>z/VM V6.3</td>
<td>HLASM support for z13</td>
</tr>
</tbody>
</table>
## Tested Linux Platforms

http://www.ibm.com/systems/z/os/linux/resources/testedplatforms.html

<table>
<thead>
<tr>
<th>Distribution</th>
<th>z13</th>
<th>zEnterprise - zBC12 and zEC12</th>
<th>zEnterprise - z114 and z196</th>
<th>System z10 and System z9</th>
</tr>
</thead>
<tbody>
<tr>
<td>RHEL 7</td>
<td>✔️  (1,3)</td>
<td>✔️  (4)</td>
<td>✔️  (4)</td>
<td>✗</td>
</tr>
<tr>
<td>RHEL 6</td>
<td>✔️  (1,3)</td>
<td>✔️  (5)</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td>RHEL 5</td>
<td>✔️  (1,3)</td>
<td>✔️  (6)</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td>RHEL 4 (*)</td>
<td>✗</td>
<td>✗</td>
<td>✔️  (9)</td>
<td>✔️</td>
</tr>
<tr>
<td>SLES 12</td>
<td>✔️  (2,3)</td>
<td>✔️</td>
<td>✔️</td>
<td>✗</td>
</tr>
<tr>
<td>SLES 11</td>
<td>✔️  (2,3)</td>
<td>✔️  (7)</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td>SLES 10 (*)</td>
<td>✗</td>
<td>✔️  (8)</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td>SLES 9 (*)</td>
<td>✗</td>
<td>✗</td>
<td>✔️  (10)</td>
<td>✔️</td>
</tr>
</tbody>
</table>

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SMT on z/VM

Objective is to improve system capacity, not the speed of a single instruction stream.

z/VM can now dispatch work on up to two threads of a z13 IFL core
Up to 32 cores supported

VM65586 for z/VM 6.3 only
PTF UM34552 became available March 13, 2015

Transparent to virtual machine
Guest does not need to be SMT-aware
SMT is not virtualized to the guest

z13 bundle 11

z/VM exploitation is for IFL cores only

SMT is disabled by default
Requires a system configuration setting and re-IPL
Once enabled, applies to the entire z/VM system

Potential to increase the overall capacity of the system
Workload-dependent
Okay, I bought it, how do I turn it on?
7 Easy Steps to SMT Greatness!

1. Install your IBM z13 mainframe
2. Install service for APAR VM65586
3. Set up an LPAR with at least some IFL engines
   • Could be a Linux-only LPAR with all IFLs
   • Could be a VM-mode LPAR with some IFLs
LPAR setup

- Logical processor
  - A dispatching context for a stream of instructions

- Logical core
  - A pair of logical processors,
  - …owned by the same partition, and…
  - always dispatched together on the same physical core

- Your partition’s activation profile defines how many logical cores it has

- PR/SM adjusts the number of logical processors according to whether the partition enables, or opts in for, SMT
LPAR setup – bottom line

Put number of cores on this screen.
7 Easy Steps to SMT Greatness!

1. Install your IBM z13 mainframe

2. Install service for APAR VM65586

3. Set up an LPAR with at least some IFL engines
   • Could be a Linux-only LPAR with all IFLs
   • Could be a VM-mode LPAR with some IFLs

4. The system must be in *vertical polarization mode* (this is the default)
   Make sure you *don't* have an SRM POLARIZATION HORIZONTAL statement in your SYSTEM CONFIG.

5. The system must be using the *reshuffle dispatcher method* (this is the default)
   Make sure you *don't* have an SRM DSPWDMETHOD REBALANCE statement in your SYSTEM CONFIG.

6. Add the **MULTITHreading ENAble** statement to your SYSTEM CONFIG

7. Re-IPL your system!
Tell me more!

The **MULTITHreading** configuration statement allows you to specify either:

- a maximum number of threads for all core types
- a different number of threads for each type.
  
  - z/VM only supports IFL cores for multithreading.

**CPSYNTAX** has been updated to verify:

- Are there multiple **MULTITHreading** statements?

- Is the maximum activated thread value less than the number of threads specified for any type?

- Is **MULTITHreading ENABLE** specified with any incompatible **SRM** statements?
I enabled SMT; what does that mean for guests?

z/VM provides virtual CPUs for guests.

z/VM dispatches virtual CPUs on logical CPUs.

When the partition does not opt in to SMT, PR/SM provides logical CPUs for the partition.

PR/SM dispatches one logical CPU on a physical core at a time.

Each physical IFL core can run two streams of instructions at a time.

We say each one has two threads.

In this case for IFL cores, one thread goes unused.
I enabled SMT; what does that mean for guests?

z/VM still provides virtual CPUs for guests.

z/VM still dispatches virtual CPUs on logical CPUs.

When the partition opts in to SMT, PR/SM provides logical CPUs for the partition and groups them into logical cores.

PR/SM dispatches one logical core on a physical core at a time.

Each physical IFL core can run two streams of instructions at a time. We say each one has two threads. In this case for IFL cores, both threads are used.
Is there anything important to know about mixed engines environments and SMT?

■ Yes!

■ SMT on z/VM is only allowed for IFL cores, so if you're running in a VM mode partition, it means you will have some singlethreaded cores (e.g., CPs, zIIPs) with your multithreaded IFL cores.

■ If you are running in an VM mode partition and you want to use your IFL cores, remember that your guests will need to have virtual IFLs defined.
  
  – Virtual IFLs are only valid when you SET VCONFIG LINUX or VM.
  
  – If you SET VCONFIG LINUX you have to choose either all virtual IFLs or all virtual CPs.
  
  – Resetting your VCONFIG settings or redefining the type of CPUs will cause a SYSTEM RESET that will kill your guest's operating system.
New and Changed Commands
I believe I enabled SMT, but how do I know it's on?

- A new command – **Query MultiThread** will tell you!

- Compares what you requested in the SYSTEM CONFIG statement to what was actually able to be activated, given the hardware and software levels.

```
query multithread
Multithreading is enabled.

<table>
<thead>
<tr>
<th></th>
<th>Requested</th>
<th>Activated</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAX_THREADS</td>
<td>MAX</td>
<td>2</td>
</tr>
<tr>
<td>CP core</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>IFL core</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>ICF core</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>zIIP core</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

Ready; T=0.01/0.01 11:51:29
```
So with SMT on, nothing really changes, threads are CPUs and everyone is happy?

- Yes! Isn't that nice?
- **Query PROCessors** will now show which core the CPU is on:

```plaintext
query processors
PROCESSOR 00 MASTER CP CORE 0000
PROCESSOR 02 ALTERNATE CP CORE 0001
PROCESSOR 04 ALTERNATE IFL CORE 0002
PROCESSOR 05 ALTERNATE IFL CORE 0002
PROCESSOR 06 PARKED IFL CORE 0003
PROCESSOR 07 PARKED IFL CORE 0003
PROCESSOR 08 ALTERNATE IFL CORE 0004
PROCESSOR 09 ALTERNATE IFL CORE 0004
PROCESSOR 0A ALTERNATE IFL CORE 0005
PROCESSOR 0B ALTERNATE IFL CORE 0005
PROCESSOR 0C ALTERNATE IFL CORE 0006
PROCESSOR 0D ALTERNATE IFL CORE 0006
PROCESSOR 0E PARKED IFL CORE 0007
PROCESSOR 0F PARKED IFL CORE 0007
PROCESSOR 10 ALTERNATE IFL CORE 0008
PROCESSOR 11 ALTERNATE IFL CORE 0008
PROCESSOR 12 ALTERNATE IFL CORE 0009
PROCESSOR 13 ALTERNATE IFL CORE 0009
PROCESSOR 14 ALTERNATE ZIIP CORE 000A
PROCESSOR 16 ALTERNATE ZIIP CORE 000B
```

*Ready; T=0.01/0.01 11:55:52*
What if I want to vary off or vary on, can I do that by thread/CPU still?

- No, it wouldn't make sense to vary off one thread of a core.
- **VARY PROCESSOR** isn't allowed with SMT enabled.
- Instead use **VARY CORE** to vary off or on an entire core. Note that you do this even for single-threaded cores.
- When SMT is not installed or not enabled, **VARY CORE** is the same as **VARY PROCESSOR**.

```plaintext
vary off processor a
HCPCPS1321E VARY PROCESSOR is not valid because multithreading is enabled.
Ready(01321);
vary off core 5
Command accepted
Ready;
Core 0005 offline Proc 000A-000B
vary on core 5
Command accepted
Core 0005 online Proc 000A-000B
Ready;
```
SMT is enabled, how do I see what's going on with my cores?

- **Indicate Load** will still show information by processor/CPU, which means by individual thread on multithreaded cores.
  - Can be confusing because each thread won't always be able to use 100% of the core (we're good, but we're not that good!)

- A new command, **INDicate MULTITHread** (MT) will show you the per type information, giving you an idea of how much capacity you have left for each type. The utilization shown is an average of the utilization of the cores of that type.

```
indicate multith
Multithreading is enabled.
Statistics from the interval 12:00:53 - 12:01:23
Core Type CP Busy 8%     TD 1.00 of 1 Prod 100% Util 8%
  CF 100% MaxCF 100%
Core Type IFL Busy  1%     TD 1.50 of 2 Prod 90% Util 1%
  CF 113% MaxCF 125%
Core Type ZIIP Busy  0%     TD 1.00 of 1 Prod 100% Util 0%
  CF 100% MaxCF 100%
Ready;
```
What are all those other numbers on Indicate MT?

- Busy time – percent of time at least one thread of the core was busy (i.e., executing instructions).

- Thread density - how often the core was able to run both threads at once, while the core was in use at all.

- Productivity – work completed while core non-idle, compared to work that could have been completed if all non-idle time were two-threads-busy time

- Utilization - how much of the maximum core capacity was used.

- Capacity factor - total work rate for the core while busy, compared to its work rate when it was running with one-thread-busy (the “SMT benefit”)

- Maximum Capacity factor - work rate for two-threads-busy, compared to the work rate for one-thread-busy
Does multithreading affect the space-time continuum in any way?
Additional Work Capacity

IFL (SMT disabled) – Instruction Execution Rate: 10

IFL (SMT enabled) – Instruction Execution Rate: 7

Thread 0

1  2  3  4  5  6  7

Thread 1

1  2  3  4  5  6  7

• Numbers are just for illustrative purposes
• Without SMT, 10 / second
• With SMT, 7 / second but two threads yields capacity of 14 / second
Interleaving Virtual CPUs of Guests

- In single core, we time slice access with each guest getting 5 ops completed.
- With SMT, each guest gets 7 ops completed for total of 14

**IFL (SMT disabled) – Instruction Execution Rate: 10**

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
</table>

**IFL (SMT enabled) – Instruction Execution Rate: 7**

**Thread 0**

<table>
<thead>
<tr>
<th></th>
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<th>3</th>
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</table>

**Thread 1**

<table>
<thead>
<tr>
<th></th>
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<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
</table>
Potential Need to Increase Virtual CPUs

- Lets look at a single guest that hits maximum of its virtual resources
- In single core, it can execute 10 ops, but only 7 with SMT as there is only one virtual CPU to dispatch.

**IFL (SMT disabled) – Instruction Execution Rate: 10**

**IFL (SMT enabled) – Instruction Execution Rate: 7**

<table>
<thead>
<tr>
<th>Thread 0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
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<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thread 1</td>
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<td></td>
<td>6</td>
<td>7</td>
</tr>
</tbody>
</table>
Potential Need to Increase Virtual CPUs

- Taking that guest and giving it a second virtual CPU allows additional work to be completed (if guest can exploit multiple virtual CPUs)

**IFL (SMT disabled) – Instruction Execution Rate: 10**

<table>
<thead>
<tr>
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<th>1</th>
<th>2</th>
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</tbody>
</table>

**IFL (SMT enabled) – Instruction Execution Rate: 7**
Processor Time Reporting

• **Raw time** (the old way, but with new implications)
  – Amount of time each virtual CPU is run on a thread
  – This is the only kind of time measurement available when SMT is disabled
  – Used to compute dispatcher time slice and scheduler priority

• **MT-1 equivalent time** (new)
  – Used when SMT is enabled
  – Approximates what the raw time would have been if the virtual CPU had run on the core all by itself
    • Adjusted downward (decreased) from raw time
  – Intended to be used for chargeback
# Processor Time Reporting

<table>
<thead>
<tr>
<th>Raw Time</th>
<th>MT-1 Equivalent time</th>
</tr>
</thead>
<tbody>
<tr>
<td>INDICATE USER</td>
<td>x</td>
</tr>
<tr>
<td>QUERY TIME</td>
<td>x</td>
</tr>
<tr>
<td>LOGOFF</td>
<td>x</td>
</tr>
<tr>
<td>TYPE 1 Accounting record</td>
<td>x</td>
</tr>
<tr>
<td>TYPE F Accounting record</td>
<td>x</td>
</tr>
<tr>
<td>Diag x'0c'</td>
<td>x</td>
</tr>
<tr>
<td>Diag x'70'</td>
<td>x</td>
</tr>
<tr>
<td>Diag x'270'</td>
<td>x</td>
</tr>
<tr>
<td>Diag x'2FC'</td>
<td>x</td>
</tr>
<tr>
<td>Monitor Records</td>
<td>x</td>
</tr>
</tbody>
</table>

Note: "CONNECT" time displayed by commands represents wall-clock time and is not changed
CPU Pooling Implications

• With SMT enabled
  – **CAPACITY** limit for CPU pools is defined as processing power of a number of IFL cores ... but limit enforcement is based on thread utilization (raw time)
  – In some cases, guests in a CPU pool will not be able to complete the same amount of work as before SMT with the same capacity limit
    • Capacity limits for CPU pools might need to be increased
    • More problematic when trying to match experience from zEC12 processor than older, slower processors
Prorated Core Time (availability TBD)

- Prorated core time will divide the time a core is dispatched proportionally among the threads dispatched in that interval
  - Full time charged while a vCPU runs alongside an idle thread
  - Half time charged while a vCPU is dispatched beside another active thread

- Therefore:
  - CPU pool capacity consumed as if by cores
  - Suitable for core-based software licensing

- When SMT is enabled, prorated core time will be calculated for users who are
  - In a CPU pool limited by the CAPACITY or LIMITHARD option
  - Limited by the SET SHARE LIMITHARD command
    (currently raw time is used; raw time will continue to be used when SMT is disabled)

- Only CAPACITY-based CPU pools meet requirements for sub-capacity pricing

- QUERY CPUPOOL will report capacity in terms of cores’ worth of processing power instead of CPUs’

- Prorated core time will be reported in monitor records and the new Type F accounting record.

- Watch for APAR VM65680
How about other effects?

■ Live Guest Relocation

– Guests are allowed to relocate between SMT enabled and disabled z/VM systems because SMT is transparent to guests.

– However, because of the above-noted differences in time, they may see their CPU time advance at different rates.

– Their time will never go backward though!
Increased CPU Scalability
Increased CPU Scalability

- Various improvements to help z/VM to run more efficiently when large numbers of processors are present, thereby improving the N-way curve

- APAR VM65586 for z/VM 6.3 **only**
  - PTF UM34552 available March 12, 2015

- For z13
  - With SMT disabled, increases logical processors supported from 32 to 64
  - With SMT enabled, the limit is 32 logical cores (yields at most 64 logical processors)

- For machines prior to z13
  - Limit remains at 32 logical processors
  - Might still benefit from improved N-way curves
Areas Improved to Increase CPU Scalability

• Improvements were made to the following areas to improve efficiency and reduce contention:
  – Scheduler lock
  – VSWITCH data transfer buffers
  – Serialization and processing of VDISK I/Os
  – Memory management

• Some areas needing improvement were known – others required thorough investigation and experimentation

• All tested workloads showed acceptable scaling up to…
  – … 64 logical processors when SMT is enabled
  – … 32 logical processors when SMT is not enabled

• Benefits are workload-dependent
Creating a Scalability Enhancement

Scalability of Test Workload

- 6.3 base
- Ideal
- CAF
- Driver 10

Achievement vs. Number of processors
Did the CPU scalability work affect Hiperdispatch at all?

■ Yes!

■ We no longer park entitled engines (vertical highs or mediums).
  – More efficient use of resources means that the CPUPAD option on the SET SRM command and SRM configuration statement is used only when global performance data is off.
  – Global performance data is a setting in the LPAR activation profile on the HMC/SE. By default, this is on.
Leadership

z/VM continues to provide additional value to the platform as the strategic virtualization solution for z Systems. Virtual Switch technology in z/VM is industry-leading.

Innovation

z/VM 6.3 added HiperDispatch, allowing greater efficiencies to be realized. Now adding SMT with topology awareness raises the bar again.

Growth

z/VM 6.3 increases the vertical scalability and efficiency to complement the horizontal scaling introduced in z/VM 6.2, because we know our customers’ systems continue to grow. This year we continue to extend the limits with processor scalability improvements.
Thanks!

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