VS05 z/VSE Performance Updates

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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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- No other workload processing is authorized for execution on an SE.
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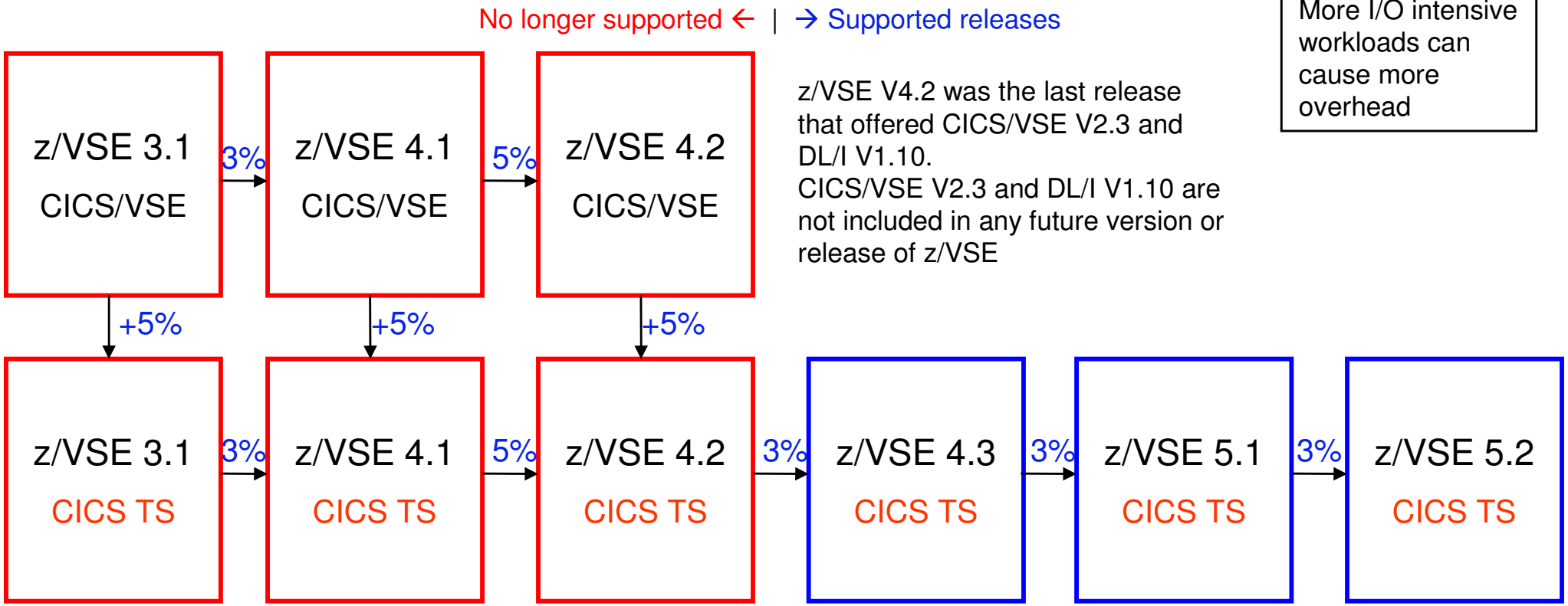
Overhead Deltas for VSE Releases

Remember that you get a lot of new functions that in most cases helps you to increase VSE system performance and throughput:

Partition Balancing, PRTY SHARE (Turbo Dispatcher), FlashCopy, Buffer Hashing, Shared data Tables (CICS TS), NOPDS with larger VSIZE

These numbers are for **a specific average I/O intensive** workload (PACEX16)

More I/O intensive workloads can cause more overhead



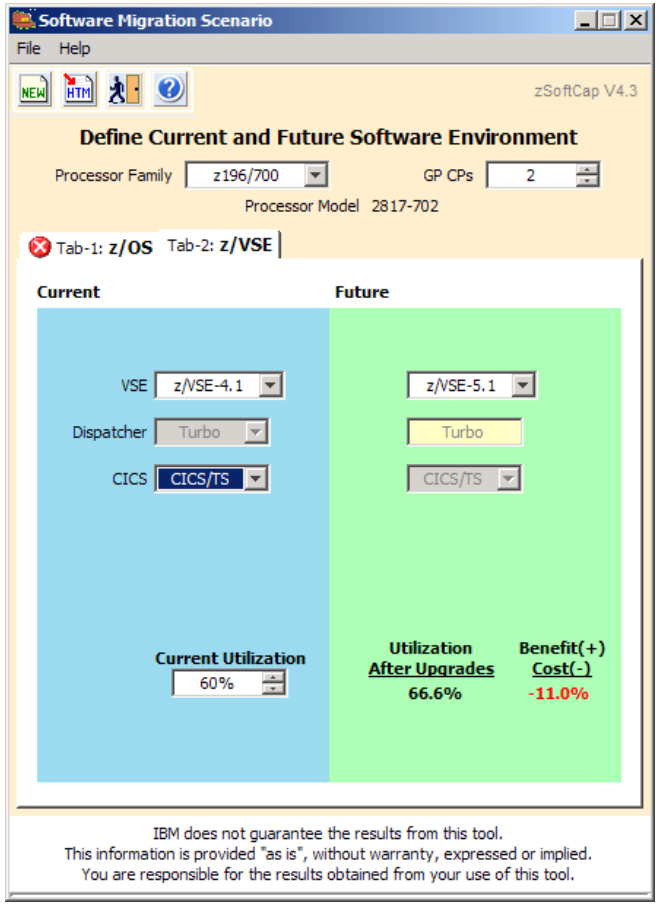
z/VSE V4.2 was the last release that offered CICS/VSE V2.3 and DL/I V1.10.
CICS/VSE V2.3 and DL/I V1.10 are not included in any future version or release of z/VSE

You can also use the zSoftCap tool to determine release migration overhead:
http://www-03.ibm.com/support/techdocs/atsmastr.nsf/WebIndex/PRS268

New: zSoftCap Tool

You can use the zSoftCap tool to determine release migration overhead:
http://www-03.ibm.com/support/techdocs/atsmastr.nsf/WebIndex/PRS268

zSoftCap is a PC-based productivity tool designed to assess the effect on capacity for IBM System z processors, when migrating to more current releases of the operating system or major subsystems. zSoftCap assumes that hardware remains constant while software releases change.



What is Performance ?

→ Performance is about:

–How fast does it run

- Job Duration
- CPU seconds
- Throughput
- Response times

–How much resources does it use

- Memory
- I/Os

–Why doesn‘t it run faster?

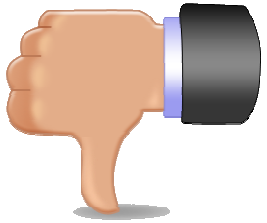
- Where is the bottleneck ?

Performance is all about comparing

- **Absolute values do not tell you much**

  Examples:
  - Job A runs 4 minutes and 10 seconds
  - Program B requires 5 MB of memory

  → Is that good? Is that bad ?



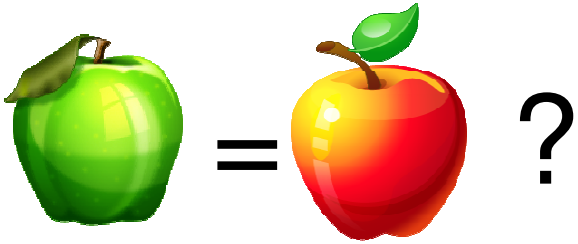
- **Comparison tells you if its good or bad**

  Examples:

  - After migrating to z/VSE X.Y to z/VSE X.Z, job A now runs 4:10 versus 3:40
    → 13% increase
  - On version X Program B now needs 5 MB, on version Y it did only need 4 MB
    → 25 % increase

Performance is all about comparing (continued)

- **When comparing, make sure you compare apples to apples**
- **Comparing A to B is only valid if**
  - Environment is the same
    - Storage layout, Sizes, Priorities, ...
  - Workload is the same
    - Same amount of data processed, same number of requests, …



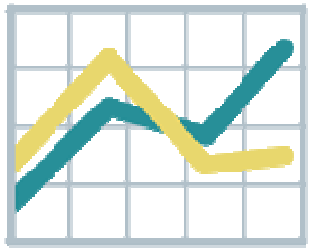
- **Little changes can cause big differences !**

- **True performance comparisons can only be done in a strictly isolated (clinic) environment**
  - Measurements in a production environment may not produce usable results
  - Results may be influenced by many different things
    - Concurrent users
    - Other work running in parallel (batch jobs)
    - Other work running on shared processors in other LPAR or z/VM guest

Performance Monitoring

- **Performance Monitor Tools**
  - Periodically gather values of certain counters (sampling)
  - Gather values of certain counters at special events (e.g. Job Accounting - At end of Job Step)

- **Data to be monitored:**
  - CPU usage (percent, CPU seconds)
  - I/O times and rate
  - Memory usage
  - Transaction rate
  - …



- **Real time monitoring**
  - Displays how the counters are NOW
  - Does not help you much to solve a problem if you are not looking at the screen at the time the problem occurs

- **History data**
  - Allows you to look at the samples over time
  - You can find out what happened when the problem occurred by looking back in history
  - You can draw charts to analyze the data

Performance Monitor tools

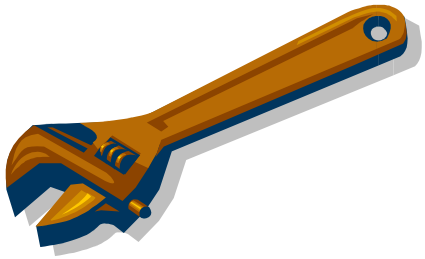
Commercial products provided by ISVs:

- TMON (ASG)
- Explore (CA)

- **Built into z/VSE**
  - Display System Activity Dialog (361/362)
  - QUERY TD
  - SIR SMF, SIR MON
  - Job Accounting
  - SNMP Monitoring Agent
  - CICS Statistics

- **Free tools**
  - CPUMON Tool

- **z/VM & LPAR**
  - z/VM Performance Toolkit
  - HMC provides very basic monitoring capabilities



QUERY TD command

- Usage:
  - SYSDEF TD,RES… eset the counters
  - // run the workloa…
  - QUERY TD,INTE… displa…

SPIN_TIME
spin CPU time waiting for a resource occupied by another CPU, not contained in TOTAL_TIME

NP_TIME
non-parallel CPU time, contained in TOTAL_TIME

TOTAL_TIME
total CPU time

```
AR 0015  CPU    STATUS     SPIN_TIME     NP_TIME  TOTAL_TIME  NP/TOT   DISP_ENTR
AR 0015   00    ACTIVE             0       76670      121778   0.629    13163221
AR 0015                   ----------------------------------------------------
AR 0015 TOTAL                      0       76670      121778   0.629    13163221
AR 0015
AR 0015                 NP/TOT:  0.629       SPIN/(SPIN+TOT):  0.000
AR 0015  OVERALL UTILIZATION:     %          NP UTILIZATION:    0%
AR 0015
AR 0015  ELAPSED TIME SINCE I        SET:     166387830
AR 0015  NUMBER OF SVC
AR 0015 1I40I  READY
```

Non-Parallel-Share (NPS) = NP / TOT

Maximum number or exploitable CPUs can be calculated as follows:

Max expl. CPUs = 0.8 / NPS

QUEUED:
Average time that an I/O request was queued in z/VSE (I/O supervisor).

If the PENDING time is not given explicitly then the QUEUED time does also include the time the request was PENDING in the Channel Subsystem.

An I/O request is queued in z/VSE from the time the I/O request is enqueued up to the point where the Start I/O operation (SSCH) has successfully been initiated. Starting with the successful initiation of the SSCH instruction, the time will be counted as PENDING in Channel Subsystem. A request would be held pending in the Channel Subsystem if e.g. a channel or a Control Unit (CU) is currently busy.

TOTAL
Average time of a complete I/O operation and is actually the sum of QUEUED (+PENDING), CONNECT and DISCONN (+DEV.BUSY).

An excessive value in this field could be the indication of a device problem.

- S

– SIR SMF=OFF

```
AR 0015 DEVICE   I/O-CNT      QUEUED      CONNECT      DISCONN      TOTAL
AR 0015                      msec/SSCH   msec/SSCH    msec/SSCH    msec/SSCH
AR 0015
AR 0015   150          107        0.2          0.406          705        1.349
AR 0015   151          136          3          0.327           01        0.792
AR 0015   152                       3          0.3
AR 0015 1I40
```

CONNECT:
Average time that a device is logically connected to a channel for purposes of transferring information between it and the Channel Subsystem.

DISCONN
Average time that a device is logically disconnected from the Channel Subsystem while the device is still busy and has not yet presented primary interrupt (Channel End) status.

In case a DEV.BUSY time is not outlined explicitly, then the DISCONN time does also include the DEV.BUSY time
which is the time between the primary status (CE) and the secondary
device-end status (DE).

– SIR SMF=,Queue

```
AR 0015 TIMING VALUES FOR 200 BASED ON       20
AR 0015 MAXIMUM I/O QUEUE   2
AR 0015
AR 0015    QUEUED       PENDING      CONNECT
AR 0015   msec/SSCH    msec/SSCH    msec/SSCH    m                    CH
AR 0015       0.001        0.000        0.604        0.000        0.000        0.606
```

SIR MON command

- Usage:
  - SIR MON=ON ← enable MON
  - SYSDEF TD,RESETCNT ← reset the counters
  - // run the workload
  - SIR MON ← display the counters
  - SIR MON=OFF ← disable MON

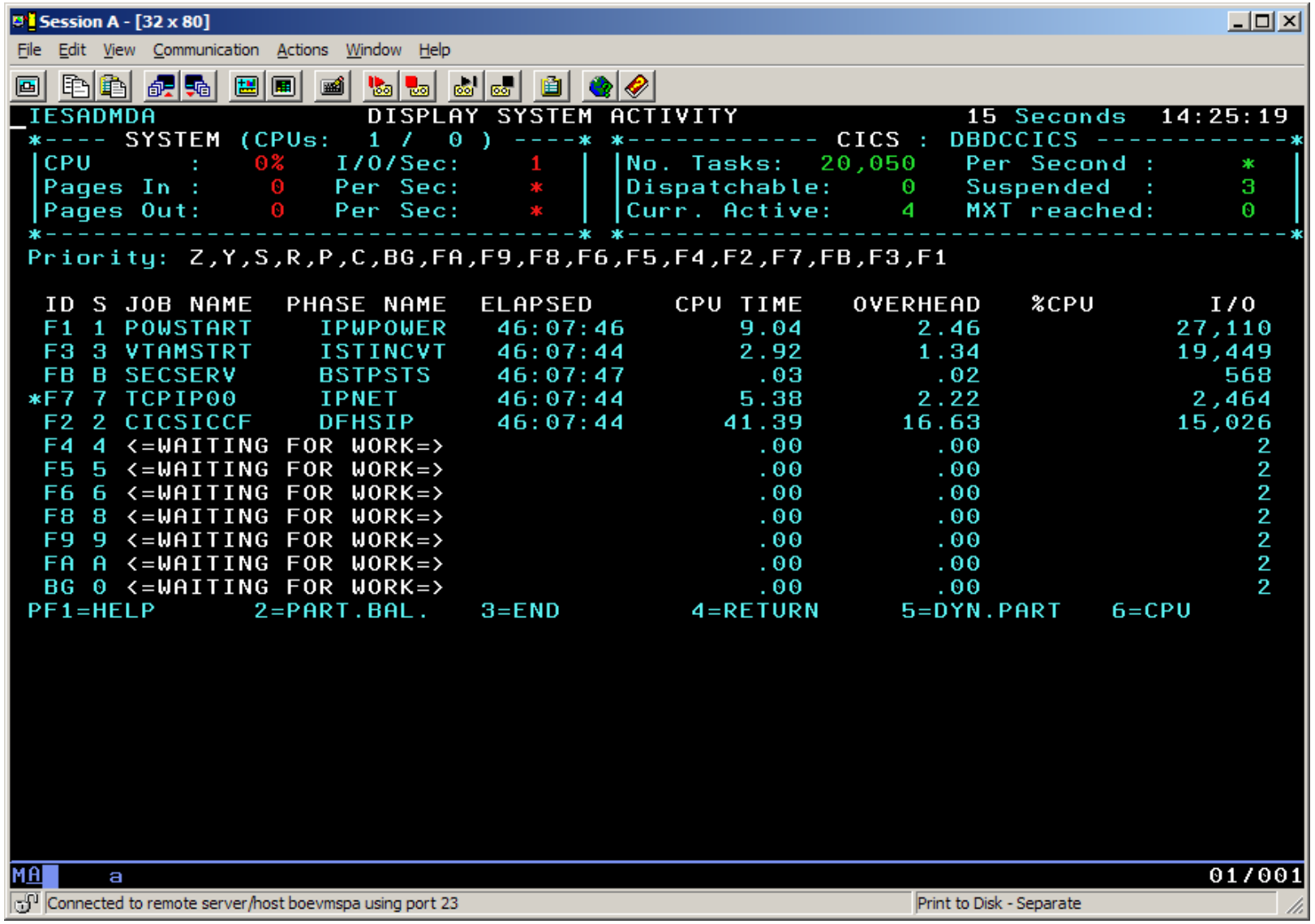
```
AR 0015                        MONITORING REPORT
AR 0015                  (BASED ON A 0000:00:13.338 INTERVAL)
AR 0015                          SVC SUMMARY REPORT
AR 0015 EXCP      =         195  FCH-$$B   =          14  SVC-03    =           1
AR 0015 LOAD      =         138  WAIT      =         405  SETIME    =          22
AR 0015 SVC-0B    =           5  SVC-0C    =         231  SVC-0D    =         236
AR 0015 EOJ       =           2  SYSIO     =         118  EXIT IT   =          28
AR 0015 SETIME    =          15  SVC-1A    =           4  WAITM     =          25
AR 0015 COMREG    =        1125  GETIME    =          25  FREE      =           1
AR 0015 POST      =         122  DYNCLASS  =           2  SVC-31    =          53
AR 0015 HIPROG    =           1  TTIMER    =           3  SVC-35    =         487
AR 0015 INVPART   =           2  GETVIS    =         708  FREEVIS   =         626
AR 0015 CDLOAD    =          11  RUNMODE   =           1  REALAD    =           1
AR 0015 SECTVAL   =         137  SETLIMIT  =           5  SVC-5B    =           1
AR 0015 XECBTAB   =           1  EXTRACT   =           7  GETVCE    =          30
AR 0015 EXTENT    =           2  SUBSID    =           1  FASTSVC   =        2992
...
```

Job Accounting

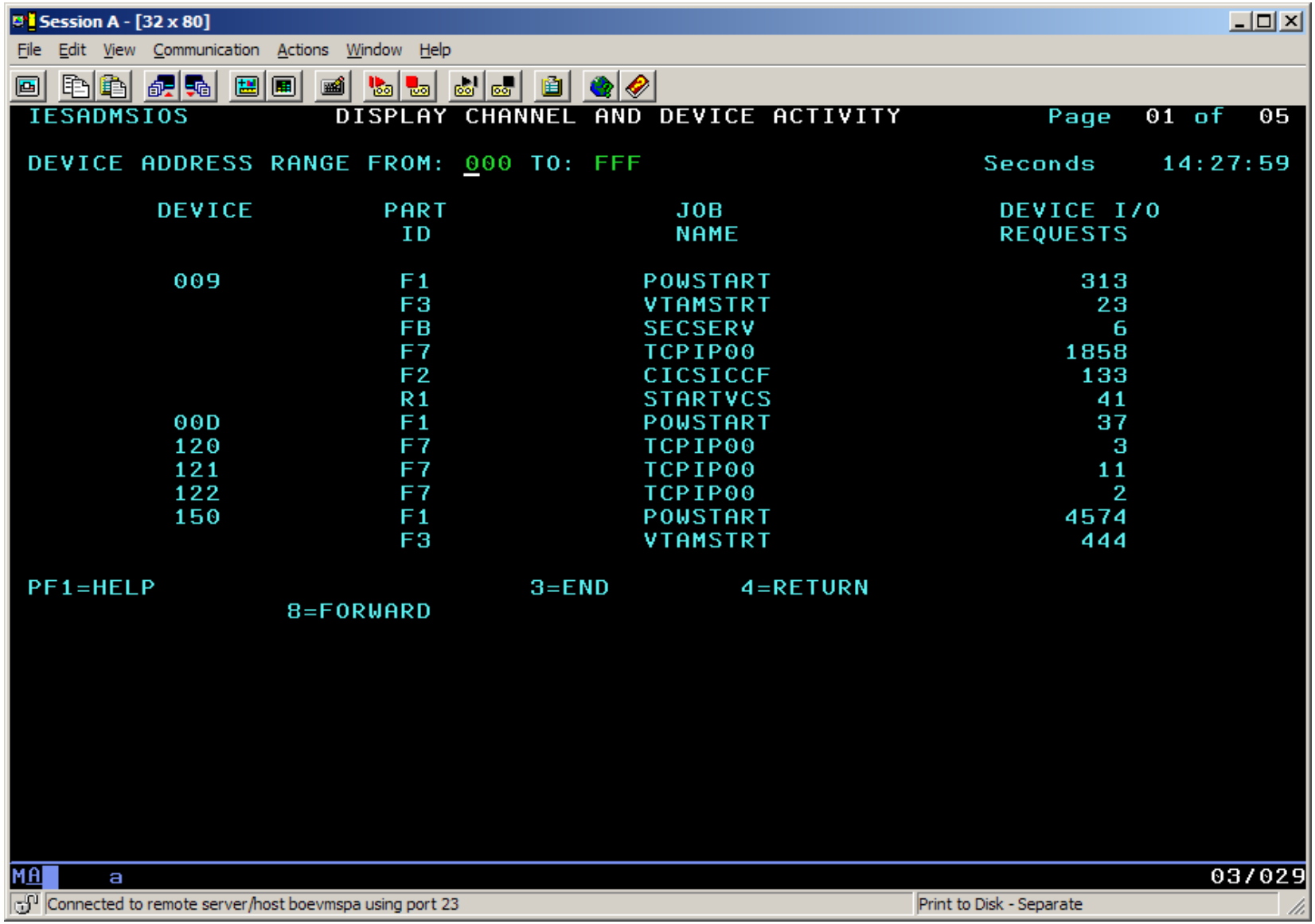
- Use skeleton SKJOBACC in ICCF Library 59
  to assemble Job Accounting routine $JOBACCT
- Prints info about CPU usage and I/Os after every job step

```
JOBNAME    = PRINTLOG  USER INFO = PR       EXEC NAME = PRINTLOG
DATE       = 11/05/99  PART ID   = BG
START      = 10:56:23  STOP      = 10:56:28 DURATION  = 5.560 SEC
CPU        =     0.060 SEC      PAGEIN SINCE IPL   = 0
OVERHEAD   =     0.017 SEC      PAGEOUT SINCE IPL  = 0
TOTAL CPU =      0.077 SEC
UNIT = E15       UNIT = FEC       UNIT = 01F      UNIT = E16
SIO  = 26        SIO  = 5         SIO  = 5        SIO  = 105
UNIT = FEE
SIO  = 4083
```

Display System Activity Dialog (361)



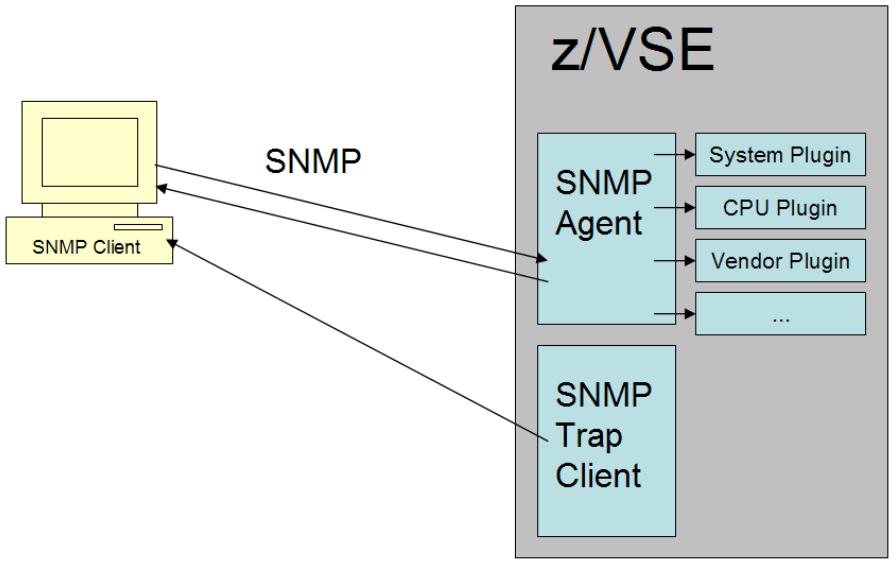
Display Channel and Device Activity (362)



z/VSE SNMP Monitoring Agent support

- **z/VSE Monitoring Agent enables customers to monitor z/VSE systems using standard monitoring interfaces (SNMP V1)**
  - Available since z/VSE V4.3
  - It also includes an open interface, which enables customers or vendors to use own programs (plugins) to collect additional data

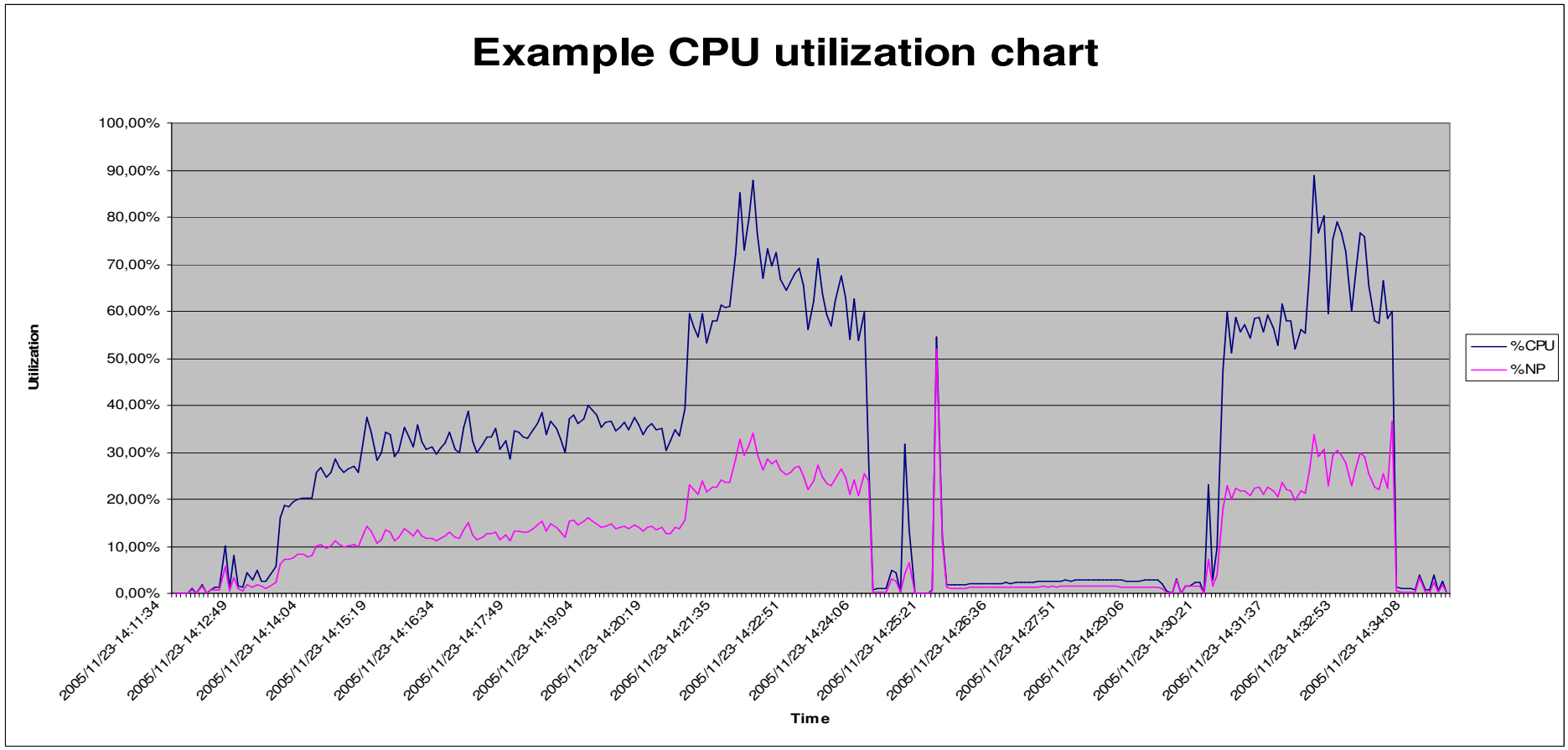
- **Data collected by the IBM provided plugins contains**
  - Information about the environment (e.g. Processor, LPAR and z/VM information)
  - Number of partitions (static, dynamic, total, maximum)
  - Partition priorities
  - Number of CPUs (active, stopped, quiced)
  - Paging (page ins, page outs)
  - Performance counters overall and per CPU
  - CPU address and status
  - CPU time, NP time, spin time, allbound time
  - Number of SVCs and dispatcher cycles



z/VSE CPU Monitor Tool (CPUMON)

- **Intended to help customers to measure the CPU utilization of their VSE system over a period of time.**
- **The VSE CPU Monitor Tool is not intended to replace any existing monitoring product provided by partners.**
  - It provides only very basic monitoring capabilities on an overall VSE system level (same data as QUERY TD)
  - No details about CPU usage of certain applications are provided
- **Download**
  - http://www.ibm.com/systems/z/os/zvse/downloads/tools.html
  - 'As is', no official support, e-mail to zvse@de.ibm.com
- **CPUMON supports 2 different output data formats**
  - CSV Format (Comma Separated Values)
    - Good for importing into spreadsheet
    - This is the default
  - XML Format
    - Used for zCP3000 Capacity Planning tool
    - Specify XML in PARM on EXEC card
  - Conversion from one format to the other one is possible (manually)

z/VSE CPU Monitor Tool

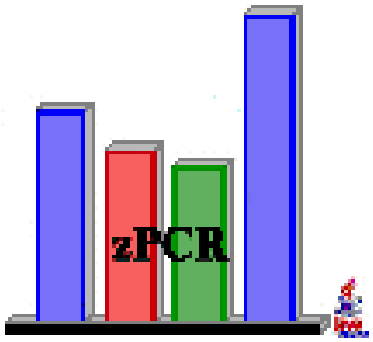


Sizing a system for z/VSE

- Sizing a system for z/VSE is different from sizing a system for z/OS
  - Although z/VSE supports multiprocessing, z/VSE does not scale as good as z/OS does
    - Do not use more than 3 active processors per z/VSE LPAR or z/VM Guest
- In general, a faster single CPU is better than multiple smaller CPUs
  - One partition can only exploit the power of one CPU
    - The largest partition (e.g. CICS) must fit into one single CPU
  - Dependent on nonparallel share (NPS) value
- Additional CPUs can be useful when multiple LPARs or z/VM Guests are used
  - Define only up to 3 CPUs per LPAR or z/VM Guest, even if more than 3 CPUs are available on the CEC
- Do **not** use MIPS tables for capacity planning purposes
  - Use zPCR Tool instead with the z/VSE workloads Batch, Online or Mixed
  - Use free of charge Capacity Planning Services from IBM

IBM Processor Capacity Reference for zSeries (zPCR)

- The zPCR tool was released for customer use on October 25, 2005
  - http://www.ibm.com/support/techdocs/atsmastr.nsf/WebIndex/PRS1381
  - 'As is', no official support, e-mail to zpcr@us.ibm.com
- PC-based productivity tool under Windows
- It is designed to provide capacity planning insight for IBM System z processors running various workload environments



- Capacity results are based on IBM's LSPR data supporting all IBM System z processors
  - Large System Performance Reference: https://www-304.ibm.com/servers/resourcelink/lib03060.nsf/pages/lsprindex
- For z/VSE use z/VSE workloads Batch, Online or Mixed

z/VSE Capacity Planning Offering

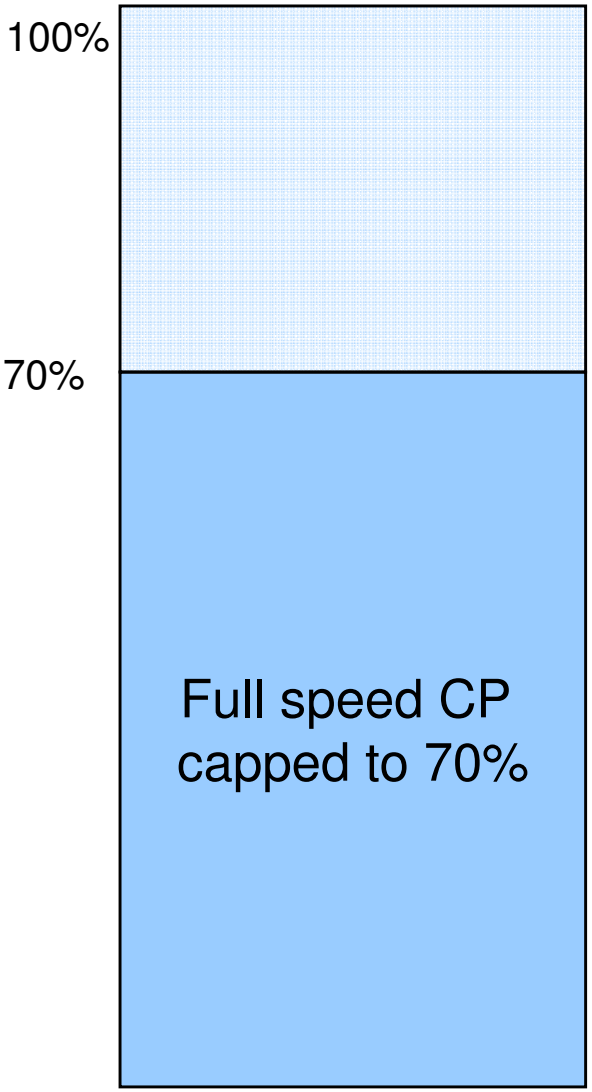
- A z/VSE Capacity Planning Offering is available
  - for Business Partners
  - and Customers
- Performance data collection is based on the XML data produced by the CPUMON Tool
- Analysis is done using zCP3000

- Contact techline@us.ibm.com and ask for z/VSE Capacity Planning Support

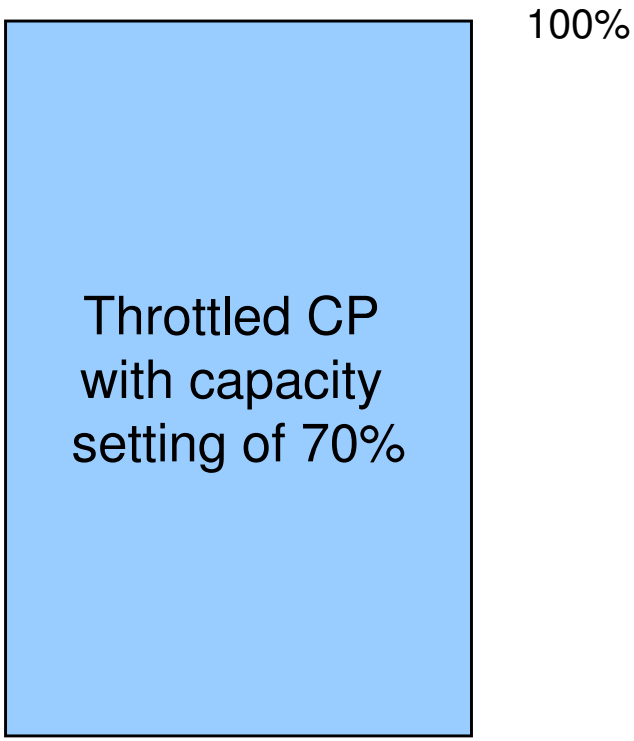
Capping versus Capacity Settings

Attention: Do not use Capping to simulate Capacity Settings !

- With **Capping**, the processor runs on its full speed, until the capping stops the guest from getting dispatched by the LPAR hypervisor or z/VM (time slicing)
- With a **Capacity Setting**, the processor runs on a slower speed (and all related tasks as well, like HiperSockets memory copy, Hypervisor processing, etc)



Capping is NOT equivalent to Capacity Settings !



Shared OSA Adapter versus HiperSockets

To connect a z/VSE system with a Linux on System z you have 2 options:

1. Using a shared OSA Adapter

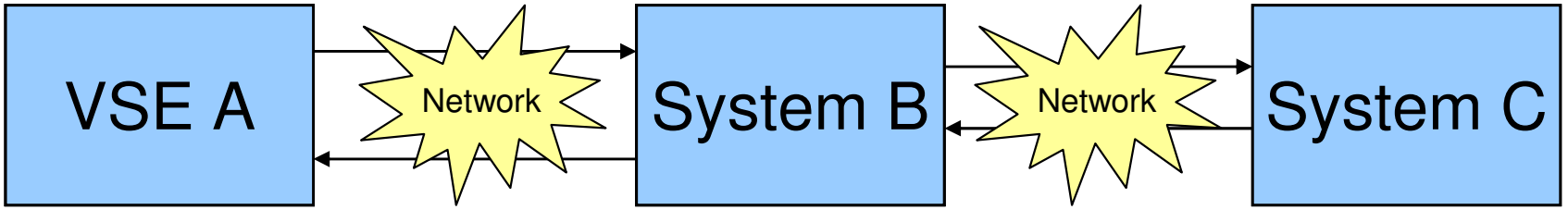
- All traffic is passed through the OSA Adapter
- The OSA Adapter has its own processor
  - Processing occurs asynchronous
  - Processing in OSA Adapter does not affect host processors

2. Using HiperSockets

- Direct memory copy from one LPAR/Guest to the other
- Memory copy is handled by the host processors
  - Processing occur synchronous
  - Consider mixed speed processors (full speed IFLs and throttled CPs)

    → Memory copy performed by throttled CP is slower than memory copy performed by full speed IFL

Performance tuning in a distributed environment



- **Performance of a function in VSE may be dependent on other systems**
  - Where is the bottleneck ?
    - Is it on VSE A, or on System B or System C
    - Is it in the network ?
  - Tuning the VSE system will not help if the bottleneck is outside of VSE
  - Simple tasks on VSE may produce very time consuming tasks on other systems
- **You need to understand the whole environment**
  - With all affected systems and their dependencies

Performance problem solving

- **There is no 'standard' path to solve a performance problem**
  - Every customer environment is different
  - Every workload is different
- **Very seldom, a performance problem is caused by a bug in the code**
  - E.g. loops, unnecessary waits, etc
- **Mostly it is about monitoring and then suggesting tuning options**
  - Tune configuration settings
  - Find and remove bottlenecks
- **Sometimes a performance problem is because of unrealistic expectations**
  - Customer 'thinks' or 'wishes' that it should run faster
  - Customer underestimates resource/CPU requirements of a new function/workload
  - Someone 'promised' good performance to get a deal closed

Questions ?

THANK YOU

http://www.ibm.com/zVSE