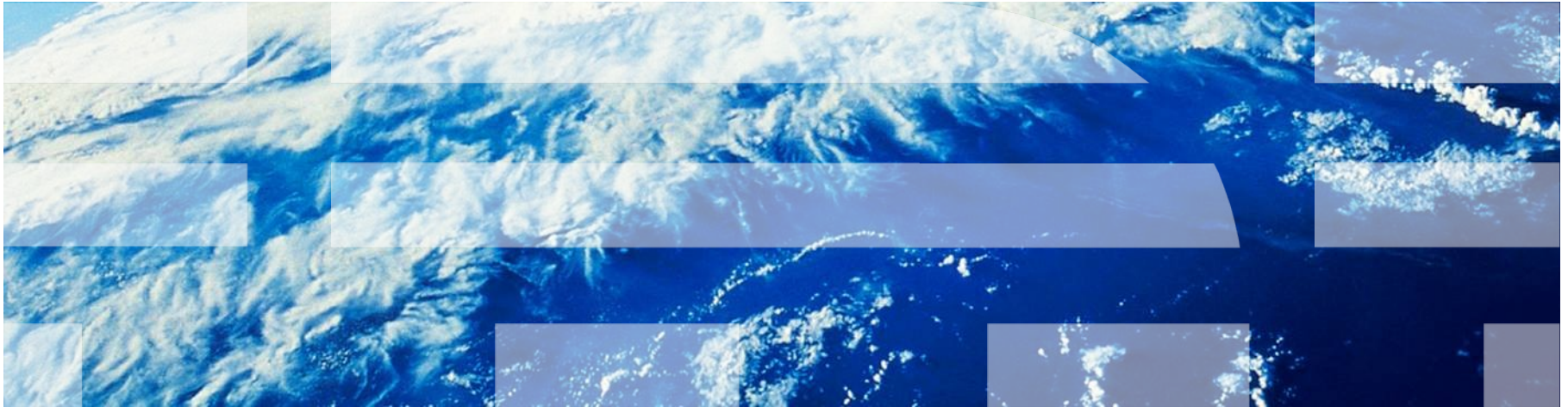


z/VM Capacity Planning Overview

SHARE 117 – Orlando – Session 09561

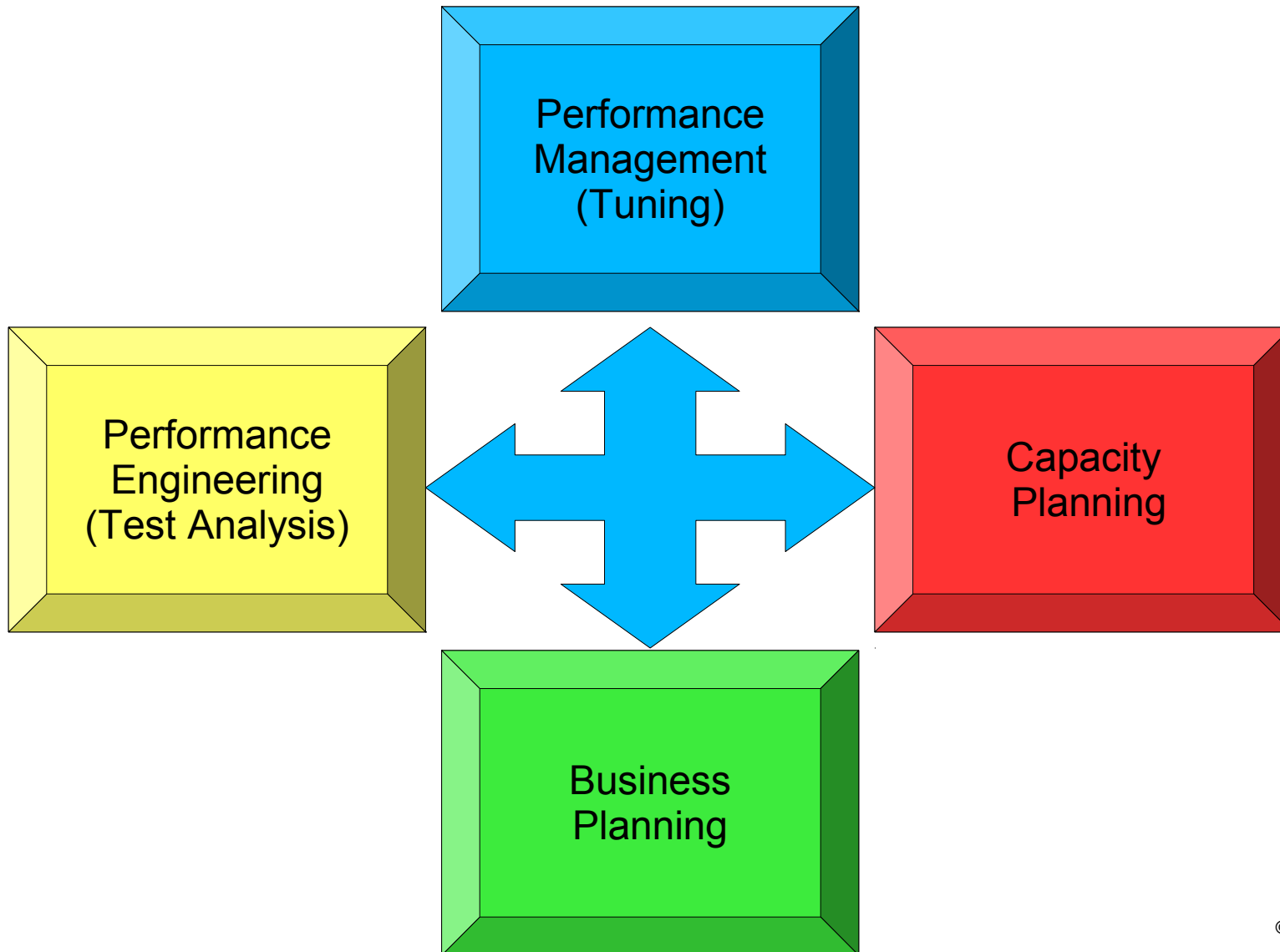
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Introduction

- Objectives:
 - Provoke thought and ultimately action about Capacity Planning
 - Concepts and approaches will be covered, not so much the mechanics
- Companion Piece:
 - z/VM Performance Metrics – also available on SHARE website or from author
- Time permitting – dialogue on what can IBM do to help in this space?

More to Performance

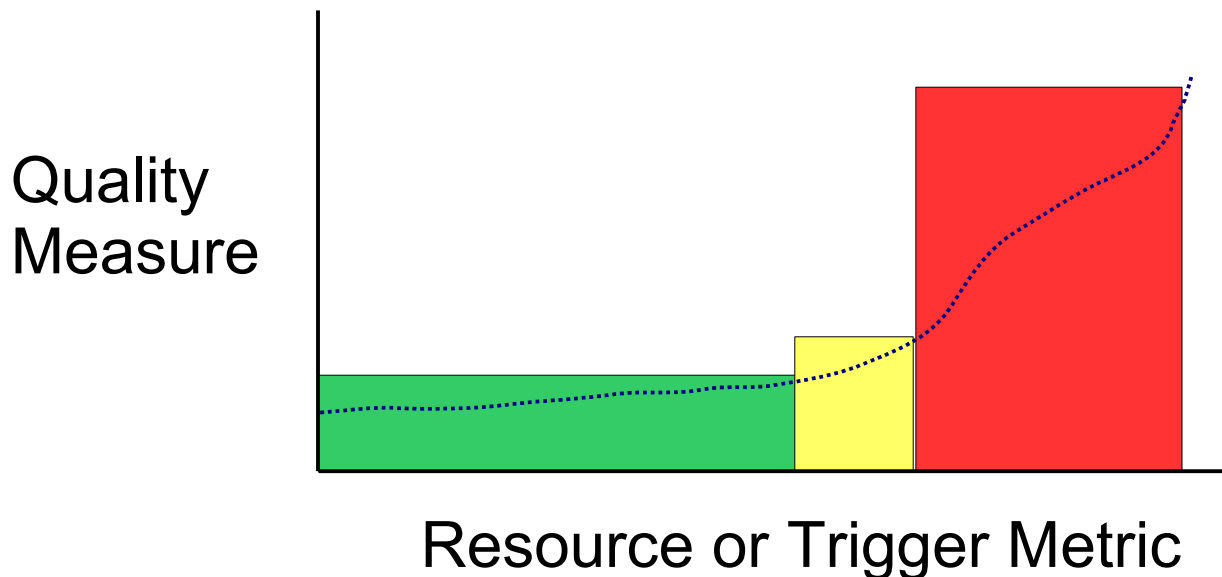


Real vs. Virtual Planning

- Capacity planning for 'real' resources is one thing, but how do we incorporate 'virtual' resources?
- Need to address “Overhead” or management costs
 - Define 'overhead'
 - z/VM Control Program processor time?
 - System Management virtual machines?
- Virtual ≠ Free
- Need to address peaks
 - Averages alone are not sufficient
- Define what is acceptable – “capacity lag” or impact to SLA
 - Acceptable overcommitment of resources is very dependent on:
 - Workload
 - Environment
 - SLA

Looking at Resources

- Utilization Metrics: metrics of interest to determine utilization & distribution of resources
- Indicator Metrics: metrics that relate to thresholds or the degree of constraint and pain the system is expressing
- Quality Measures: something that indicates workload and response time and whatever is important to the business
 - Well defined and defined throughout all the disciplines
 - Something that can be mapped to other metrics to indicate a sweet spot



Real Processor Resources

- Real Processor Resources are perhaps easiest to measure and manage
- Utilization Metrics:
 - LPAR Overhead Time
 - System CPU Time
 - CP CPU time associated with virtual machines
 - Virtual CPU time associated with virtual machines
- Indicator Metrics:
 - System Spin Time (Wall clock, not processor measure)
 - LPAR Suspend Time
 - CPU Wait
- Need to handle Specialty Engines
 - Measure each type
 - Mixed speeds?
- Keep in mind processor resource limits can pop up elsewhere
 - e.g. Both HiperSockets require processors
- Compare or prorate based on workload (transaction rates).

Virtual Processor Resources

- Utilization Metrics:
 - CP CPU Time
 - Virtual CPU Time
 - Total CPU Time

- Potentially also include:
 - Processes within Linux
 - Linux Steal time
 - At very least have the above available from Performance Engineering for comparison if z/VM totals look abnormal.

- Again, make accommodations for Specialty Engines
 - Real and Virtual

- Indicator Metrics:
 - CPU Wait
 - Diagnose x'44'
 - Diagnose x'9C'

Other Processor Planning Thoughts

- Need to have some measure of work or throughput
- Best to determine cost per <something meaningful to everyone>
 - Performance Engineering
 - Business Planning
 - Performance Management
 - Capacity Planning
- Establish in Performance Engineering testing what the target cost / transaction
- Bring in Business Planning to determine target or range of transaction load
- Capacity Planning projects requirements based on above two
- Performance Management folks can help identify problems when things do not track.
- Rinse and repeat
- I prefer computing CPU seconds, but if you want to convert to some “MIPS” number or “IFLS” or “European Swallow Computing Units” feel free. Just make sure everyone uses the same decoder ring.

Real Memory

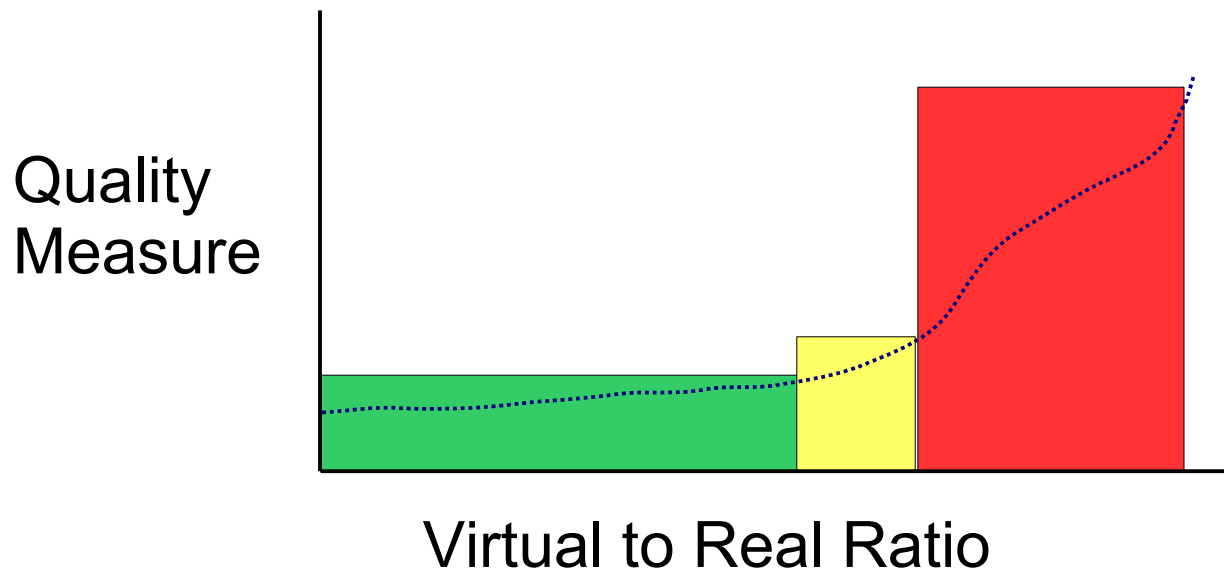
- Utilization Metrics:
 - NonPageable
 - Pageable
 - Minidisk Cache
 - Misc
- Don't forget Xstore
- Indicator Metrics:
 - Emergency Scan on Demand Scan
 - Emergency Scan failures
 - Available List(s) going empty

Virtual Memory

- Types of Virtual Memory:
 - Virtual Machines
 - NSS/DCSS
 - Virtual Disks in Storage
 - System Utility Spaces
 - PTRM spaces
- Virtual Machine Utilization Metrics:
 - Defined virtual memory
 - Backed virtual memory
 - Resident virtual memory
 - Estimated WSS
- Indicator Metrics:
 - Paging Rates (Reads and Writes)
 - Loading User
 - Page Wait (Asynchronous and Synchronous)
- A guest pages may exist on both DASD and Real Memory
- Private DCSSs are considered part of the virtual machine for most metrics, while Shared DCSSs have their own metrics.

Memory Overcommitment

- Gather data to determine a curve such as below
 - Performance Engineering
 - Tracking Production
 - Artificially limiting amount of real memory
- Result is a V:R ratio for your workload that is edge of green/yellow.
 - For example, lets say it is 1.8
 - If you are going to increase workload by adding 30GB of virtual, then you need to add real memory to keep the ratio at 1.8 or lower.



Network

- Session of its own
- Real Level
- Virtual Level
- Link Aggregation
- Limits/Thresholds/Quality Measures

Real I/O

- Utilization Metrics:
 - Channel Utilization
 - Device I/O Rates
 - System I/Os
 - User Driven I/Os
 - Device Utilization
 - Access Density (I/Os per GB space)

- Indicator Metrics:
 - Device Queuing
 - Error Rates
 - IOP Statistics

Virtual I/O

- Utilization Metrics
 - Virtual I/O per Guest
 - I/Os avoided due to MDC or VDisk
- Indicator Metrics
 - Various levels in software stack where I/O queuing can occur
 - Virtual I/O to Virtual CPU Ratio

Data Collection Considerations

- Keep all groups in mind and in agreement
 - The value of your data increases when it can be combined with other data.
- Volume of data
- Retention time
- Granularity or interval of data
- Correlation with other data
- Time zone considerations
- Terminology

Methods of data collection

- RYO
- Performance Toolkit Summary/Trend
- OMEGAMON XE
- Shipping to z/OS

IBM Technical Support Capacity Planning in a Nutshell

IBM System z

z10 Capacity Planning in a nutshell

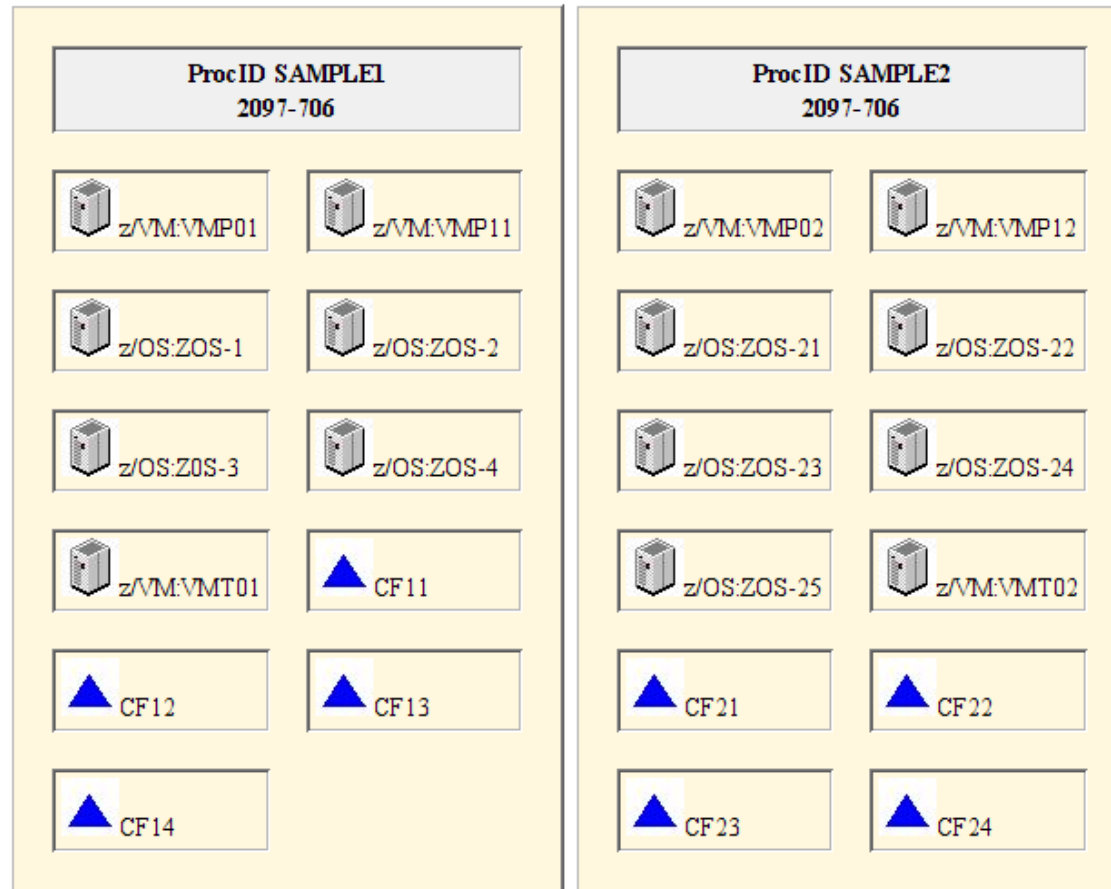


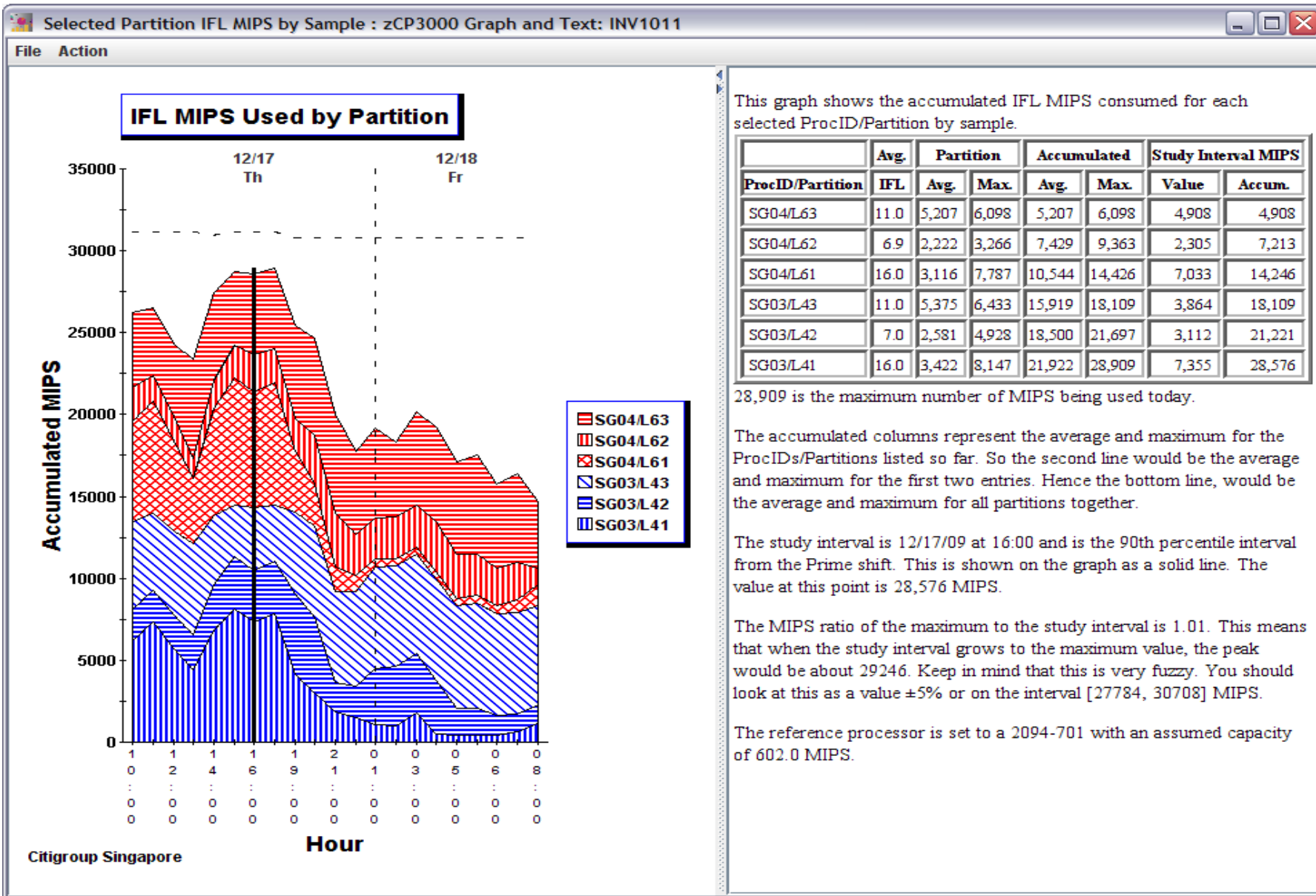
Don't use "single-number tables" for capacity comparisons!

Use zPCR and/or zCP3000 to model before and after configurations
Work with IBM technical support for capacity planning!
Customers can now use zPCR

IBM Techline: Complete topology from z/VM data

Processor View for Generic Customer





IBM Techline: Memory Summary Example



VP03: SYS zCP3000 -

File Analysis

System Workloads **Memory** Performance

Express Memory Sizes As: MB Pages

Description	Virtual Memory	CMMA Active	WSS Intv	WSS Min	WSS Max	Memory Used Intv	Memory Used Min	Memory Used Max
LXPS3061	1,707	0	1,491	409	1,707	1,259	346	1,504
LXPS3095	4,608	0	4,096	3,772	4,291	3,406	3,145	3,581
LXPS3093	11,750	1	11,428	11,423	11,750	9,533	9,522	9,877
LXPS3033	4,736	0	4,736	4,341	4,736	4,662	3,031	4,708
LXPS3139	5,120	1	5,120	5,120	5,120	4,605	4,443	4,891

	Interval	Min	Max
Virtual Memory Sum	53,521	53,521	53,521
WSS Total	52,472	44,576	52,862
DPA	142,090	142,082	142,090
Memory Utilization %	36.9%	31.4%	37.2%
Memory Overcommit	0.4	0.4	0.4
Available Queue	9	6	39,017
CS<->ES Page Rate	603	2	603

LPAR ES 20,480 MB
LPAR CS 143,360 MB

Cancel Apply

IBM Techline Support

- **IBM Techline Support – z/VM Capacity Planning**
 - <http://www.ibm.com/support/techdocs/atmastr.nsf/WebIndex/PRS2875>
- **Contact your IBMer for indepth analysis**
- **See free tools such as zPCR for processor sizing**
 - <http://www.ibm.com/support/techdocs/atmastr.nsf/WebIndex/PRS1381>
- **Thanks to following for info on Techline and ATS Offerings:**
 - **Gretchen Frye**
 - **Liz Holland**

Summary

- You have to Plan to do Capacity Planning if you want to do it successfully
- Otherwise, it becomes Capacity Scrambling
- Lots of resources available to help from IBM and Others