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Performance and Capacity Management Best Practices

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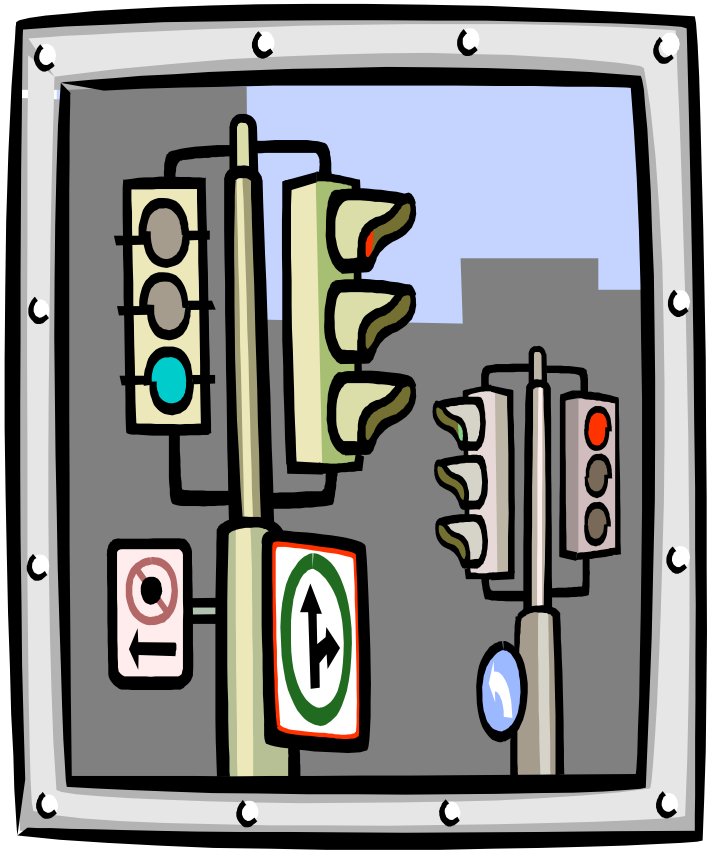
Agenda

- Best Practices
- Critical Success Factors
- Selected “Hot Topics”
- Q & A Anytime
  Ask your questions at any time for best results today.



What Did I Bring For You?

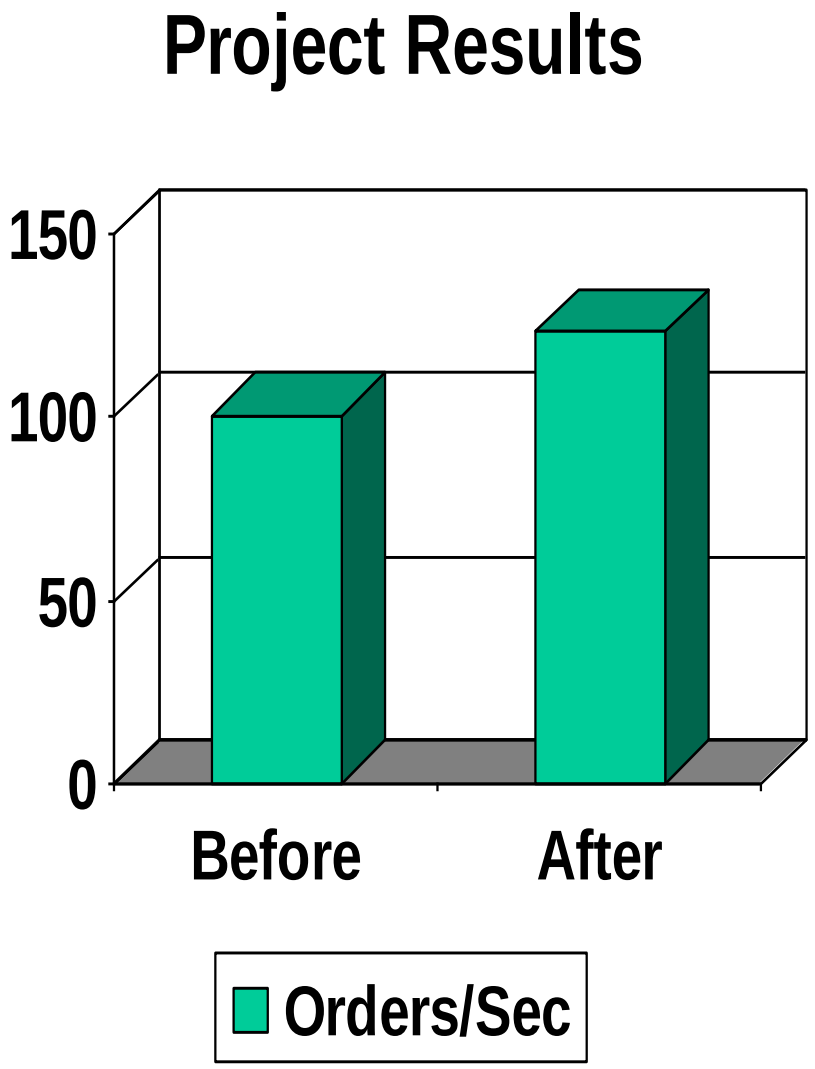
Best Practices / Recommendations - 1

- ➲ Always communicate with management in common business terms: orders, deliveries, customers served, and effect on total cost.

- ➲ Always avoid technical jargon and acronyms when communicating with business people.

“Good For ALL” Report Example

- Best: “Capacity of our configuration increased from 100 to 123 orders/second without any increase in spending.”
- Very Good: “The order entry application can handle 23% more volume without any increase in spending.”



Best Practices / Recommendations - 2

- ➲ Service Level Agreements (SLA) are the foundation for effective Capacity Planning (CP) and Performance Management (PM).
  - "Say no more. Say no more. Wink, wink."
    *One of the Monthy Python Characters
- The SLA's three key statements:
  - Service level,
  - Stated business activity level, and
  - Consequences if SLA not met

Best Practices / Recommendations - 3

- ➲ Effective Capacity Planning (CP) and Performance Management (PM) will yield required service level quantity and quality for least total cost.

- ➲ Design WLM service policy to mirror business activity – this enables the most effective CP & PM activities. You will know when you need to do something, and what you may need to pay closer attention to.

Best Practices / Recommendations - 4

- ➲ Given less time and more data to analyze, choose your tools and techniques so YOUR effectiveness is improved

- ➲ Practice routinely scheduled z/OS Workload Manager (WLM) service policy health checks. Ask: **“Is it still working as intended?”**

Best Practices / Recommendations - 5

- ➲ Choose tools and techniques that enable analysis of each workload independently and in combination with present and future workloads

- ➲ For capacity planning studies, insure that you isolate workloads not just along business importance but also based on key attributes that affect scalability: physical disk I/O intensity, virtual storage needs, use of z/OS services, total CPU time in applications code, network services, etc...etc…

My Favorite Tools

- Free (i.e. zPCR)
- Recycled from…
- Borrowed for free
- Tested, “tried and true”

Critical Success Factors (CSF)

- The enablers
- Business services mapped to all IT components
- Business data
- Technical data
- Service Level Agreements (SLA)
- Known IT Total Cost of Ownership (TCO)
- Established value of IT services
- ITIL? Six Sigma? Or something like them…

The Enablers

- Leadership (and the politics of it all)
- People with skills
- Governance
- Tactical plans
- Strategic plans
- Resources
- Tools and techniques

Technical Enablers

- Complete synergy between all IT Service Management (ITSM) components
- Symbiotic relationships among:
  - Quality assurance / Change management
  - Load /Stress testing
  - Performance management
  - Capacity planning
  - Finance
- "Boundaries" are powerful disablers!

Business and Technical Data

- Current and planned business activity
- IT services metrics / business unit of work collected during critical periods of activity:
  - Processor
  - Disk I/O
  - All other I/O
  - Required SLA
  - Required Service Level Objectives (SLO) to meet the SLA

Example of Costs Presentation

Three Year Cost Of	Deployed on Intel	Best fit on zEnterprise
Servers	$314M	$138M
Network	$3.8M	$0.2M
Power	$5.6M	$1.1M
Labor	$94.8M	$36.4M
Storage	$211M	$108M
Total	**$629M**	**$284M**
Total cost per workload	$62K	$28K

55% less

Results may vary based on customer workload profiles/characteristics. Prices based on publicly available US list prices. Prices may vary by country

Source: July 22, 2010, zEnterprise Launch, John Shedletsky, IBM Corp.

Selected “Hot Topics”

- Variable Workload License (VWLC) Charging
- z/OS Workload Manager (WLM)
- PR/SM Considerations
- The 80/20 of Disk I/O Analysis

Variable Workload License (VWLC) Charging Method for Software

Audience Poll:

1. **Sub-capacity licensed now with IBM?**
2. **Sub-capacity licensed now with other z-Software Vendors?**

VWLC Overview - 1

- Variable workload license (VWLC) charging method available in USA since March 2001 for selected IBM software products. Examples: z/OS, COBOL, CICS, DB2, CICS, IMS, MQSeries plus over 25 more
- Started sub-capacity software licensing trend
  - Software license capacity can be dramatically lower than installed hardware capacity.
- Concept moving ahead very slowly, or not at all, in the independent software vendors' (ISV) world.

VWLC Overview - 2

- Basis for sub-capacity of VWLC products is LPAR utilization
- Monthly charge based on highest rolling 4 hour average by product summed for LPARs w. software present in them
- Product isolation into LPARs for software capacity planning is a potentially cost saving activity
- 5 – 15% monthly software cost savings are possible
- LPAR's total capacity may be capped via PR/SM to comply with software license agreement

VWLS and zAAP Example

BEFORE zAAP:

- Machine Type: 2084-B16
- Rated @ 647 MSUs
- Sub-Capacity Pricing based on;
  - LPAR A rolling 4hr avg @ 233 MSUs
  - LPAR B rolling 4hr avg @200 MSUs
  - LPAR C rolling 4hr avg @ 267 MSUs
- Rolling 4hr avg of Machine = 547 MSUs
- Average Prime Shift Machine Utilization = 80%

AFTER zAAP:

- Machine Type: 2084-B16
- Rated @ 647 MSUs
- Java cycles executed on zAAPs
- New Sub-Capacity Pricing on *reduced* rolling 4hr avg
  - LPAR A rolling 4hr avg @ 213 MSUs
  - LPAR B rolling 4hr avg @ 100 MSUs
  - LPAR C rolling 4hr avg @ 167 MSUs
- New Rolling 4hr avg of Machine = 480 MSUs
- Average Prime Shift Machine Utilization = 50%

Illustration Source: "z890 and z990 zAAP – What it Can Do for You," By Kathy Walsh, IBM Corp.

Workload Manager

(WLM)

Audience Poll:

1. **Does WLM Goal mode deliver the service levels you hoped for, and protect the most important work?**
2. **Do you schedule WLM service policy "checkups" at regular interval, or you wait until…..you must!**

WLM Advice - 1

- ➲ **Recommendation**: Create service classes aligned with the business importance of the work within them.

Example: A service class can be, and we recommend that it should be, a single critical CICS or IMS transaction. Etc…

WLM Advice - 2

- ➲ **Recommendation**: Create resource groups for any workload you wish to control regardless of processor utilization level.

Example: Service class can be limited to maximum of 1 service unit / second rate (this is the “sleeper hold” of WLM)

WLM Role in CP and PM

- WLM is single most critical success factor (CSF) for CP and PM
- Insure that critical business workloads are captured in service policy so they are easy to observe and analyze.
- WLM exercises control on following:

WHAT?	HOW?
CPU access priority	Task dispatch priority guided by importance and service level goal
CPU time limits	Defined via resource groups
I/O performance	Workload Priority propagation to the I/O controller & PAV-s (parallel access vol.)
Enclaves for DDF, stored procedures, etc…	Coded min/max service level definitions
Dynamic batch initiators	Goal and resource driven controls
Storage paging	Isolation to protect working set size

WLM Definitions Do-s and Don't-s

- Service Definition Coefficients
- Percentile Response Time
- Average Response Time
- Velocity Goals

Service Definition Coefficients

- ➲ **Recommended** service definition coefficients:
  - **MSO = 0.0**
  - CPU = 1.0
  - SRB = 1.0
  - IOC = 1.0 or less by orders of 10 (0.1 or 0.01; IBM recommends 0.5)
    - ➲ Note 1: Potential impact on chargeback algorithms if they use MSO service units in their calculations
    - ➲ Note 2: Non-zero MSO value will cause unstable performance under most conditions and regardless of key factors such as CPU or I/O activity

Percentile Response Time

- **The recommended** way to manage the business critical CICS, DB2, and IMS production work
- Stated as:
  - 90% of transactions with < 1 sec. Resp.
- If properly defined, prevents service problems caused by long running or never ending transactions
- Region level goals may be lower WLM CPU overhead than CICS Transaction level goals, but…? ? ?
  - Just what has to be managed?
  - What are the SLA terms?

Average Response Time

- Can work if workload is homogeneous (this is rare indeed!) – different units of work require very similar amounts of computer resources and similar service goals

- Stated as:
  - ALL transactions < 1 sec. AVG. Resp.

- Problem:
  - "Fooled" by long running transactions ending in the interval

Velocity Goals

- "Execution velocity is an abstract mathematical description with no objectively measurable metric."
  --John Arwe, WLM Developer at IBM

- Velocity goals do not determine the actual CPU dispatching priority

- Application systems velocities fluctuate severely due to factors like work mix, total utilization, service policy, virtual storage management activities, non-zero WLM MSO service definition coefficient, etc…

Velocity Goals – 2

- ➲ **Recommendation**: Use for non-transactional, or seldom- never-ending work
- ➲ **Recommendation**: Use for work that needs a limiter
- ➲ **Recommendation**: Consider use of resource group with velocity goals to impose an absolute limit if needed for vWLC
- Velocity goals may require lower WLM CPU to manage, but response time goals provide better overall CP and PM tools

Case Study: The Butler Did It

- Capacity plan blamed for very unstable performance
- If CPU utilization increased to over 95% during any 30 minute period, DB2 response time would begin to wildly fluctuate.
- CICS, DB2 involved
- Significant DB2 activity generated directly from Internet as well as CICS regions

Case Study: The Butler Did It – 2

- Some of the evidence:
  - CPU activity reports from various sources Showed that utilization was at 100% a lot of the time
  - Degradation analysis reports from various incidents of degradation showed virtually every task within the system as THE suspect cause of the problem
  - IO activity reports did not show any unusual activity between the good v. the bad response time periods

Case Study: The Butler Did It – 3

So who done it? The Butler of course! In plain view!

- WLM Service policy did it!
  - All service classes regardless of importance, had velocity goals, and
  - The sum of velocity goals of the active service class periods exceeded processor capacity
- The fix:
  - Introduced response time goals for some service classes
  - Used CPU Critical attribute for importance 1 work service classes
  - Reduced velocity goals of lower importance work

PR/SM Considerations

- If PR/SM overhead greater than 1.5% or so, try to figure out what is causing it and is it worth it.

- **Recommendation**: Minimize number of LPARS

  The ISSUE! Some important LPAR's performance suffers or some lower importance LPAR customers complain whenever PR/SM enforces the specified LPAR weights (a. k. a. CPU share)
  - When does it happen?
  - What to do?

The 80/20 of Disk I/O Analysis

- Our experience shows IO activity tuning is 95/05 rather than an 80/20 proposition
- Most benefits achieved within 5% of the selection list candidates from the many files
- Examples:
  - Data & Index tables with highest total time in use
  - Volumes at or near practical capacity limits
  - Transaction with highest total disk I/O time/Unit-Of-Work (UOW)

Case Study: "Analyze This" I/O

Plan Name	Total Elapsed	Total CPU	CPU / Elapsed	Total Run	Total I/O Time	@25% I/O Time Saved
P09GI0032	120	18	15%	100	12,000	-2,550
P09GI0003	240	44	18%	100	24,000	-4,900
P09GI0009	80	48	60%	1000	80,000	-8,000
P09GI0018	310	53	17%	100	31,000	-6,425

- What order would you focus your I/O tuning efforts? Why?
- How many votes for the sequence of 18, 3, 32, 9?
- How many votes for the sequence of 9, 18, 3, 32?

Need / Want to Know More

- **Start at: www.ibm.com/servers/eserver/zseries/**
- **Large Systems Performance Reference: http://www-1.ibm.com/servers/eserver/zseries/lspr/**
- **“HOT TOPICS” a z/OS newsletter: www.ibm.com/servers/s390/os390/bkserv/hot_topics.html**
- **Computer Measurement Group (CMG): www.cmg.org**
- **SHARE: www.share.org**

Any More Time for…? Lunch!