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Leveraging Technologies for MLC Software Expense Management

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Agenda

- USAA Context
- Sub-capacity Pricing Overview
- Tools for Reducing MLC Expense
  - Workload Management
  - Peak Reduction
  - Hardware Configuration Management
- Issues / Challenges / Lessons Learned
- Building Support Across IT Community
- Financial Results
- Next Steps

USAA Business

Financial services company serving the military and their families

- Facilitate the financial security of our members
- Provide full range of highly competitive financial products and services

Resulting IT objectives

- “Always On” – 100% availability
- Financial efficiency

Sysplex / LPAR Configuration

Hardware – 4 zEC12s, 50K MIPS / 6500 MSUs

Software – z/OS 1.13, IMS V12, CICS V4, DB2 V10

Workload – 3 primary sysplexes on common HW

CPC A	CPC B	CPC F	CPC G
Prod Onln 1	Prod Onln 2	Prod Onln 3	Prod Onln 4
Prod Onln 5	Prod Onln 6	Prod Onln 7	Prod Onln 8
Prod Spcl 1	Prod Spcl 2	Prod Spcl 3	
Bank Onln 1	Bank Onln 2	Bank Onln 3	Bank Onln 4
		Bank Spcl 1	Bank Spcl 2
App Genl 1	App Genl 2	App Genl 3	App Genl 4
	App Spcl 1		

Sub-capacity Pricing - Terminology

Monthly License Charge (MLC) pricing applies to many core System Z software products

- z/OS, IMS, CICS, DB2, MQ Series, Netview

Various pricing metrics for MLC software

- Full capacity – based on capacity of hardware
- Sub-capacity – based on utilization of LPARs where products execute

Sub-capacity eligible MLC products covered under variety of Workload License Charge (WLC) models

- Modifications frequently offered by IBM to incent various behaviors (e.g., installing new hardware technology)

Sub-capacity Pricing - Concepts

Software expense for a product is determined by utilization of LPARs where that product executes

- Total utilization of LPAR, not utilization of individual product

Utilization is calculated as 4 hour rolling average (4HRA)

- Measured in MSUs (Millions of Service Units)

Monthly expense based on highest sum of concurrent 4HRAs for LPARs in CPC where product was executing

- Billing month is 2nd calendar day of one month through 1st day of following month

Sub-capacity Pricing – Scenario 1

	7/2-1 pm (1000-1359)			7/15-3 am (0000-0359)			8/1-11 pm (2000-2359)			Month	$
LPAR	A01	A02	A03	A01	A02	A03	A01	A02	A03	Peak	
4HRA	350	400	180	400	320	100	250	300	400		
z/OS	x	x	x	x	x	x	x	x	x		
		930			820			**950**		950	$60K
IMS	x	x		x	x		x	x			
		750			720			550		750	$92K
DB2	x	x		x	x		x	x			
		750			720			550		750	$41K
Total											$192K

Sub-capacity Pricing - Implications

"Guilt by Association"

- Any product execution on LPAR -> all LPAR MSUs included

"Whac-A-Mole"

- Billing based on highest 4HRA for month

"Warehouse Pricing"

- Volume discounts at top tier (1976 MSUs) exceed 80% for most core products
  - Even higher tier levels (up to 5477) and discounts with "Technology Upgrade Pricing" for zEC12 hardware
- Aggregate workloads into single pricing calculation wherever possible

Tools for Reducing SW Expense

Workload Management

- LPAR product configuration
- LPAR workload management

Peak Reduction

- Capping technologies
- Batch management

Hardware Configuration Management

- Machine consolidation
- Sysplex aggregation

LPAR Product Configuration

Charged for LPAR MSUs if any product execution on that LPAR

Removing product execution from LPAR reduces expense without reducing total workload

- Redeploy that product workload to another LPAR where product is already executing

Understand “marginal cost” of products to identify top opportunities

- “Marginal cost” = expense for 1 additional MSU

Marginal Cost of Products - Example

$ / MSU / Month	
IMS V12	$122
CICS V4	$61
DB2 V10	$54
z/OS V1	$49
MQ V7	$26
Netview	$14
Total	$326

MSU Discount Rates - Example

Full Suite	0%
Without IMS	37%
Only DB2	64%
No Onlines	81%

LPAR Product Configuration – Scenario 2

Assume IMS represented 10% of workload on A02; IMS removed from A02 & workload moved to A01

	7/2-1 pm			7/15-3 am			8/1-11 pm			Month	Scenario	
LPAR	A01	A02	A03	A01	A02	A03	A01	A02	A03	Peak	1	2
4HRA	390	360	180	432	288	100	280	270	400			
z/OS	x	x	x	x	x	x	x	x	x			
		930			820			**950**		950	$60K	$60K
IMS	x			x			x					
		390			**432**			280		432	$92K	$53K
DB2	x	x		x	x		x	x				
		750			720			550		750	$41K	$41K
Total											$192K	$153K

20% reduction in expense, same total workload

LPAR Product Configuration - Applied

Removed IMS from 2 of 4 Application sysplex LPARs

Reconfigured Production LPAR

- Moved Lab online systems off to existing online LPARs
- Repurposed as Batch/DB2 system

MLC Expense Levels by System - Example

Software	Discount	HPlex	MPlex	ADM	Other
Full suite incl. IMS	0%	H003, H006, H007, H009, H015, H017, H018, H019		A010, A020	B011
All except IMS	37%		All exc. M021	A004, A014	B012
Only DB2	64%	H008, H016			
No onlines	81%	H002	M021	A005	Z001

LPAR Workload Management

Migrate or direct portable work to LPARs where "MSUs are on sale"

Example workloads migrated to low cost systems

- Started tasks executing on a single system
- Started task workloads (e.g., DFHSM space mgmt)
- TSO users
- OMVS workloads
- Batch – leveraging Job Action Language capabilities of ThruPut Manager

LPAR Workload Management – Scenario 3

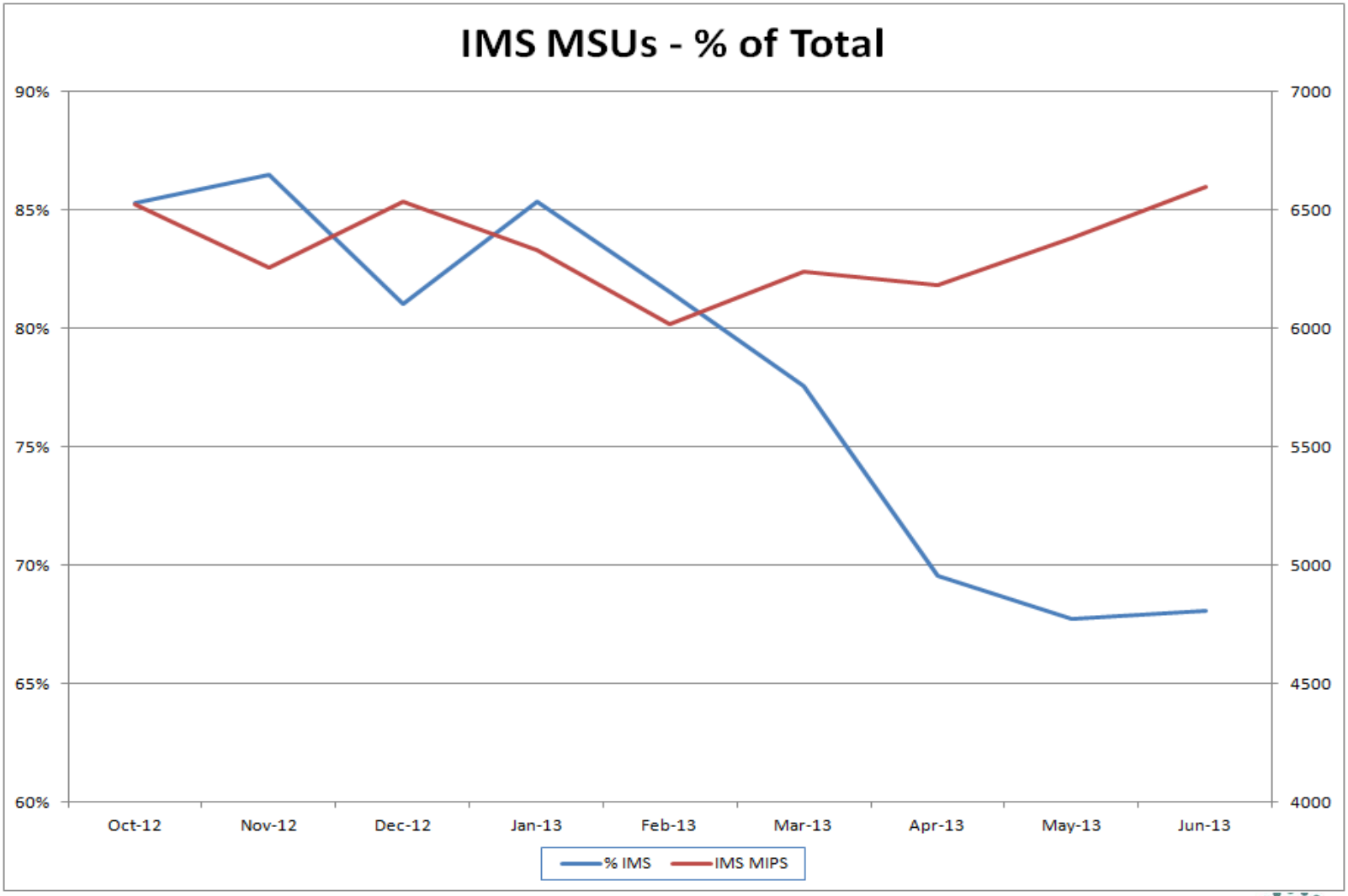
Assume some work can be moved off high cost A01

- 25% of A01 workload non-online & moves to A03
- 25% of A01 workload uses DB2 & moves to A02

	7/2-1 pm			7/15-3 am			8/1-11 pm			Month	Scenario		
LPAR	A01	A02	A03	A01	A02	A03	A01	A02	A03	Peak	1	2	3
4HRA	195	458	278	216	396	208	140	340	470				
z/OS	x	x	x	x	x	x	x	x	x				
		930			820			**950**		950	$60K	$60K	$60K
IMS	x			x			x						
		195			**216**			140		216	$92K	$53K	$26K
DB2	x	x		x	x		x	x					
		653			612			480		653	$41K	$41K	$35K
Total											$192K	$153K	$121K

Savings now up to 37%, same total workload

LPAR Workload Management - Example



Tools for Reducing SW Expense

Workload Management

- LPAR product configuration
- LPAR workload management

Peak Reduction

- Capping technologies
- Batch management

Hardware Configuration Management

- Machine consolidation
- Sysplex aggregation

Capping Technologies

Initial Capping ("hard cap")

- Sets capacity limit always enforced by WLM

Defined Capacity/DC ("soft cap")

- Current utilization can exceed DC as long as 4HRA < DC
- When 4HRA reaches DC, WLM caps LPAR at DC until 4HRA drops below DC
- 4HRA can exceed DC but SW is never billed above DC

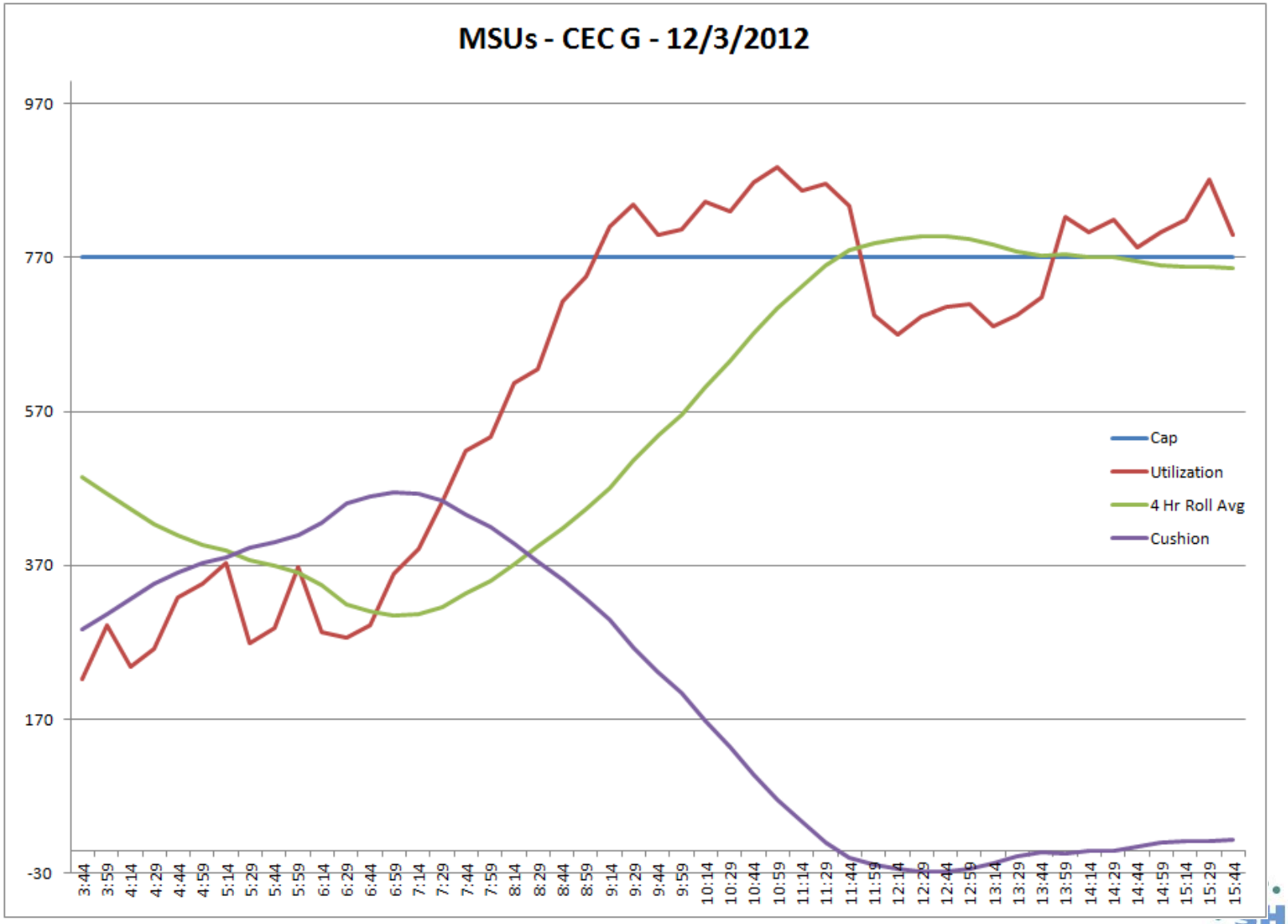
Group Capacity ("group cap")

- Soft cap concepts applied to a group of LPARs on same CPC

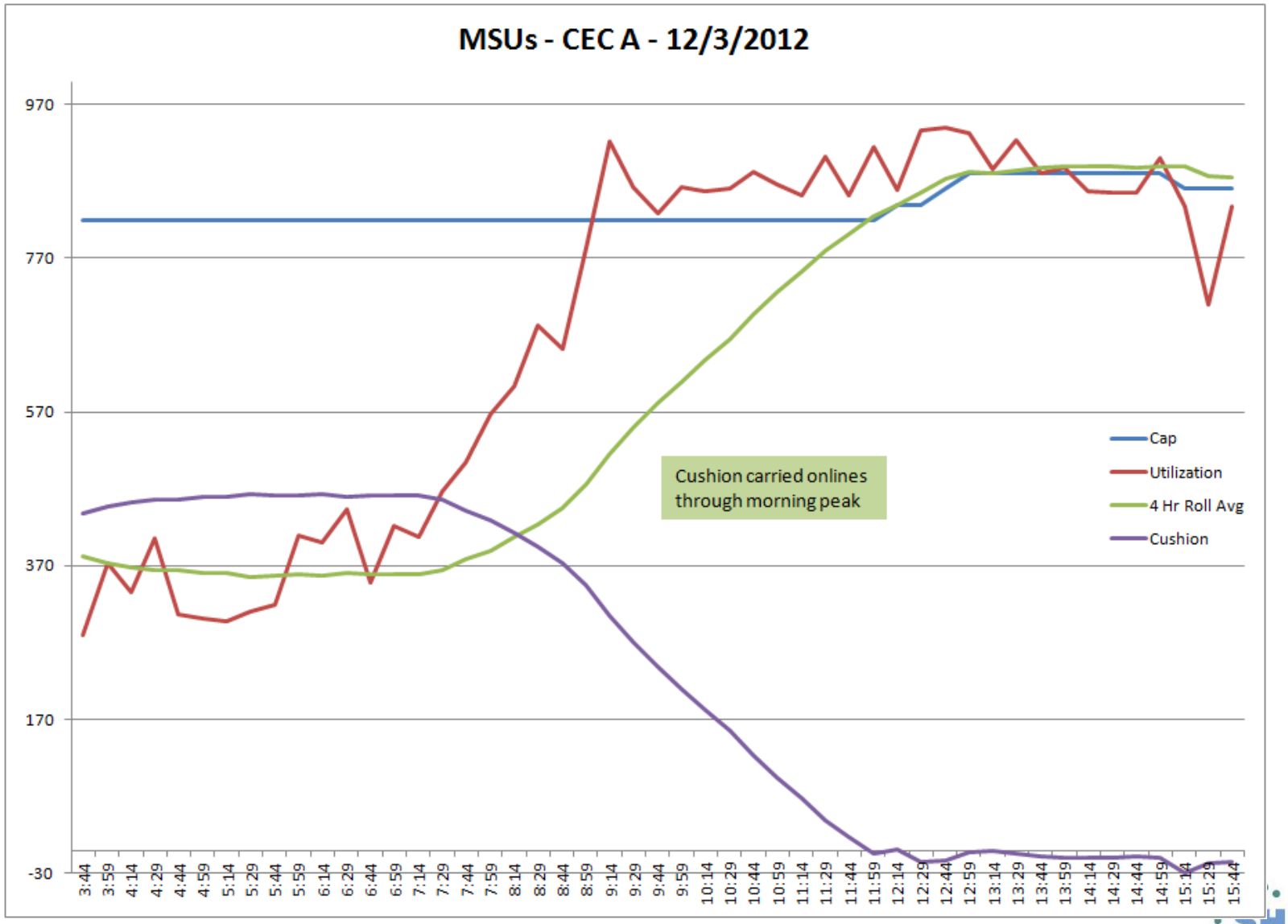
Absolute Capping Limit (zEC12 GA2)

- Expressed in terms of 1/100ths of a processor

Caps & 4HRA – Examples



Caps & 4HRA – Examples



Cap Type Considerations

Initial Capping ("hard cap")

- Far less flexible for varying workloads, we use only for ISVs not willing to adopt 4HRA methodology
- Mutually exclusive with other Soft and Group caps

Group Capacity

- Allows LPARs to donate capacity to other LPARs in Group
- Helpful when multiple LPARs on CPC have similar workloads and software cost profiles (we use for IMS LPARs)
- When WLM capping is in effect it may apply to all LPARs in group or only selected LPARs (more on this later)
- LPAR may be in a group and also have soft cap

Defined Capacity ("soft cap")

- Our default approach for remaining LPARs

Approach to Setting Caps

Fully committed to delivering highly responsive service to Production onlines and critical batch

Aggressive in setting caps to maximize savings

- Utilize RMF data and business knowledge to set caps going in to each billing month
- Expect need to raise caps at some point(s) during month, particularly on Mondays (our high volume business days)

Willing to expend effort to closely monitor Production online systems when required

- Magnitude of savings makes this worthwhile for us

Setting Cap Values – Example

---------- Date=07/29/13 Shift=Prime ----------

CEC A	Sysid/Weight									
2827_711										
	Totl Busy	Totl Ovhd	Phys Ovhd	H003	H018	H008	M022	A020	B012	Avl MSU 4 Hr
	.	.	.	258	258	188	130	150	16	MSU Cap
Hour										
7:00	34.5	1.4	0.9	7.8	7.0	2.9	6.0	8.0	1.4	666 / 492
8:00	41.4	1.5	1.0	12.8	11.5	4.2	7.3	3.3	0.8	666 / 431
9:00	52.2	1.6	1.1	17.2	15.6	5.0	8.6	2.8	1.3	666 / 334
10:00	57.3	1.7	1.2	19.9	17.9	5.0	8.6	3.2	0.9	666 / 227
11:00	59.0	1.8	1.2	20.1	19.5	4.8	9.2	2.9	0.8	666 / 128
12:00	59.5	1.8	1.3	20.0	18.8	7.1	8.4	2.6	0.8	666 / 72
13:00	58.1	1.8	1.3	19.3	18.2	6.7	8.0	3.1	1.0	666 / 53
14:00	66.5	2.0	1.4	18.9	17.1	15.6	8.2	3.8	0.9	666 / 52
15:00	63.3	2.0	1.3	19.4	17.6	11.0	8.5	3.7	1.0	666 / 65
16:00	58.0	1.9	1.3	18.1	16.5	8.1	9.2	3.4	0.9	666 / 74

Monitoring Utilization vs. Caps

Green – WLM capping not impending

- Cushion between current 4HRA and Cap

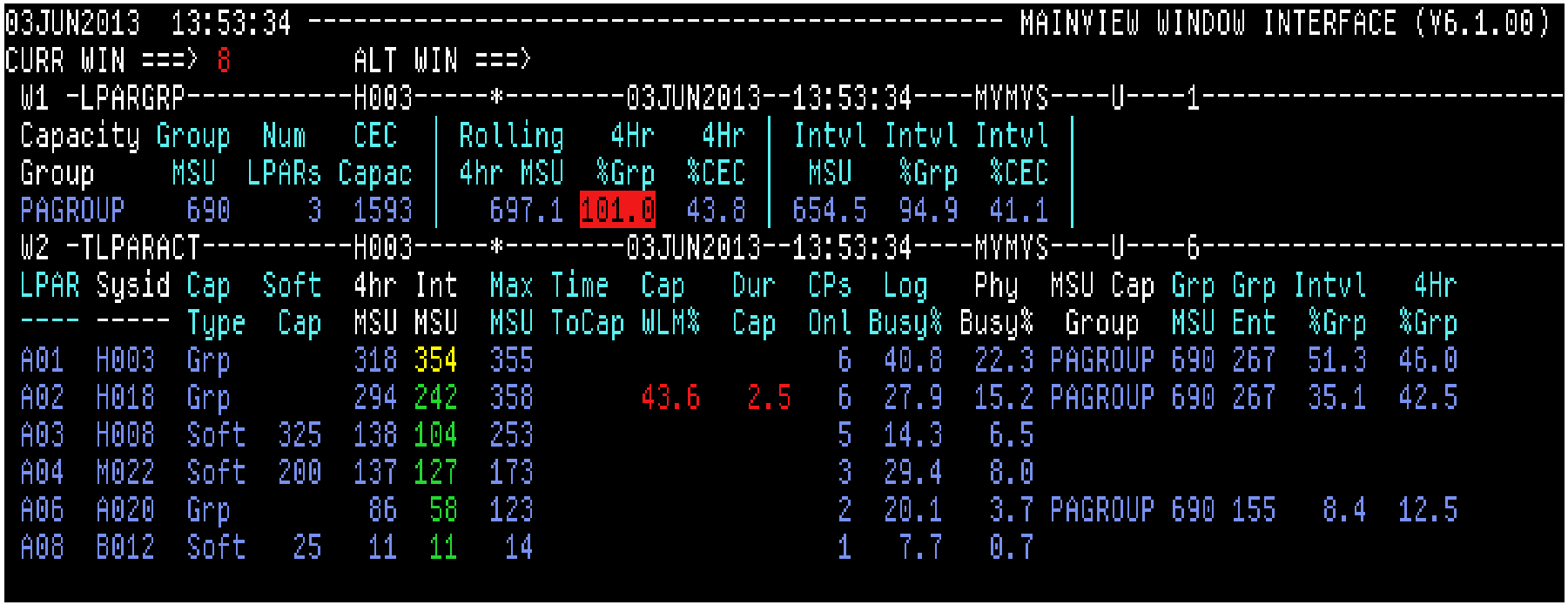
Yellow – 4HRA very near or at Cap

- On alert for WLM capping to become active

Red – WLM capping in effect for LPAR(s)

- Watch transaction monitors for queuing and RMF Monitor III for CPU delay percentages
- Raise Caps incrementally as required to maintain online service
- Can sustain excellent online performance for extended time with WLM capping active if current workload demand < Cap

Monitoring Example



Batch Management

Manage to capacity required by online workloads

- Expect monthly peaks to occur during day shift, especially for high cost products
- Leverage capping to prevent night batch from setting peaks

Minimize batch executing during prime shift peaks

- Avoid Cap increases driven by batch
- Preserve cushion in 4HRA for online workload peaks

Coordinated with IT community on batch cycle scheduling to minimize prime shift batch

Batch Management - Automation

Leverage ThruPut Manager Automated Capacity Management to manage batch during prime shift

Supports 5 user-defined capacity levels measured as percentage of 4HRA that progressively

- Restrict job initiation
- Assign executing jobs to WLM service classes associated with WLM resource groups to limit resource consumption

Provides automated batch management responsive to available capacity relative to the Cap

Batch Capacity Levels - Example

Capacity Level	4HRA % of Cap	WLM Resource Group Max Capacity
5	81%	5%
4	85%	4%
3	89%	3%
2	92%	2%
1	WLM Capping	1%

Batch Management - Results

Month	Batch MIPS @ Peak	Batch MSUs	% Chg vs Jan 2012
Jan 2012	7,656	928	
May 2012	6,745	818	-12%
Jul 2012	4,254	516	-44%
Sep 2012	2,697	327	-65%
Mar 2013	1,804	219	-76%
Apr 2013	607	74	-92%
May 2013	875	106	-89%
Jun 2013	469	57	-94%

Tools for Reducing SW Expense

Workload Management

- LPAR product configuration
- LPAR workload management

Peak Reduction

- Capping technologies
- Batch management

Hardware Configuration Management

- Machine consolidation
- Sysplex aggregation

Machine Consolidation – Scenario 4

Consolidate from separate CPCs into LPARs on a single CPC to benefit from rules for timing of peaks

- Single hour for LPARs running given product on one CPC
- Can be different hours for given product on different CPCs

	7/2-1 pm			7/15-3 am			8/1-11 pm			Month	Scenario	
CPC	A	B	C	A	B	C	A	B	C	Peaks	1	4
4HRA	350	400	180	400	320	100	250	300	400			
z/OS	x	x	x	x	x	x	x	x	x			
		400		**400**					**400**	1200	$60K	$76K
IMS	x	x		x	x		x	x				
		400		**400**						800	$92K	$98K
DB2	x	x		x	x		x	x				
		400		**400**						800	$41K	$43K
Total											$192K	$216K

Separate CPCs raises expense 12%

Sysplex Aggregation

Allows multiple CPCs to be considered as a single entity for pricing purposes ("PricingPlex")

- Critical to reaping benefit of volume discounts!

Numerous criteria to qualify

- All z/OS systems must participate in parallel sysplex
- If applied to multiple sysplexes, one sysplex must consume at least 50% of the total prime shift z/OS utilization on every CPC

Sysplex Aggregation – Phase I

Aggregated Production General and Banking sysplexes several years ago with great benefit

Application sysplex located at remote location also serving as Disaster Recovery site

	CPC A	CPC B	CPC F	CPC G
Local Site	Prod Onln 1 Prod Onln 5 Prod Spcl 1 Bank Onln 1	Prod Onln 2 Prod Onln 6 Prod Spcl 2 Bank Onln 2	Prod Onln 3 Prod Onln 7 Prod Spcl 3 Bank Onln 3 Bank Spcl 1	Prod Onln 4 Prod Onln 8 Bank Onln 4 Bank Spcl 2

	DR CPC R	DR CPC S
Remote Site	App Genl 1 App Genl 3 App Spcl 1	App Genl 2 App Genl 4

Sysplex Aggregation – Phase II

Business case to relocate Application sysplex onto Production CPCs became compelling

- Change from capacity-based to usage-based pricing model
- Leverage Production's 80%+ volume discounts
- Application peak utilization periods are offset from Production

CPC A	CPC B	CPC F	CPC G
Prod Onln 1	Prod Onln 2	Prod Onln 3	Prod Onln 4
Prod Onln 5	Prod Onln 6	Prod Onln 7	Prod Onln 8
Prod Spcl 1	Prod Spcl 2	Prod Spcl 3	
Bank Onln 1	Bank Onln 2	Bank Onln 3	Bank Onln 4
		Bank Spcl 1	Bank Spcl 2
App Genl 1	App Genl 2	App Genl 3	App Genl 4
	App Spcl 1		

Expense savings far exceeded expectations!

Issues / Challenges / Lessons Learned

RMF I not reporting WLM Capping on zEC12s

- Hindered monitoring for whether capping was active
- Corrected in MCL Bundle 24 released April 2013

Running with WLM capping active exposed CICS response time goals in WLM policy that did not meet business requirements

- Our CICS response time goals were too lenient (e.g., 90% < 0.5 sec)
- WLM allowed CICS regions to experience significant CPU delay (70% for 1 minute interval) impacting response times

“Available” MSUs in RMF I Report

```
P A R T I T I O N   D A T A   R E P O R T

SYSTEM ID H003                DATE 01/23/2013
RPT VERSION V1R13 RMF         TIME 08.29.00

        GROUP NAME    PAGROUP
        LIMIT              919
        AVAILABLE         -13

--------- PARTITION DATA -------
                      ----MSU----
NAME         S    WGT   DEF     ACT
A01          A    392     0     247
A02          A    392     0     221
A03          A     63     0      34
A04          A    153     0     130
```

- Actual MSU utilization: 632 (sum of 4 LPARs)
- Available but not used in current interval: 919-632=287
- Recognize “Available” is reported relative to 4HRA only; it has no relationship to current RMF interval

Be Careful What You Wish For

Approached July 1 expecting routine day but instead experienced online workload “tsunami”

- Raised caps numerous times for total of 304 MSUs
- $95K expense increase on last day of billing month
- Impact spilled over next day into second billing month

Isolated to 2000 MIPS increase in one CICS transaction

- Inadvertently invoked by new business functionality implemented over weekend

Usage-based pricing model

- Can achieve expense reductions immediately
- Can encounter expense increases immediately

Group LPAR Capping "Inequity"

When Group 4HRA exceeds Cap and WLM Capping is in effect, it may apply to all LPARs or selected ones

Unexpected occurrence – low-consuming LPAR capped far more than high-consuming LPAR

- 2 LPAR members of Group with identical weights
- For entire 50 minute interval, actual MSU consumption of H018 ("Low") was less than H003 ("High")
- "Low" LPAR was 100% WLM Capped (per RMF III & I)
- "High" LPAR was occasionally Capped (17 of 50 minutes)

IBM response – working as designed

Removing LPAR From Group Capping

Unexpected occurrence – after removing LPAR from LPAR group, WLM capped remaining LPARs when sum of 4HRA less than Group Cap

- LPAR Group has three members
- One member is removed at 10:42
- Later that day (12:24-13:15)
  - Sum of 4HRAs for remaining two LPARs is 787
  - Group Cap is 835
  - Yet remaining 2 LPARs are 100% WLM Capped

IBM response – working as designed

WLM Routing Recommendations and Cap-based Capacity

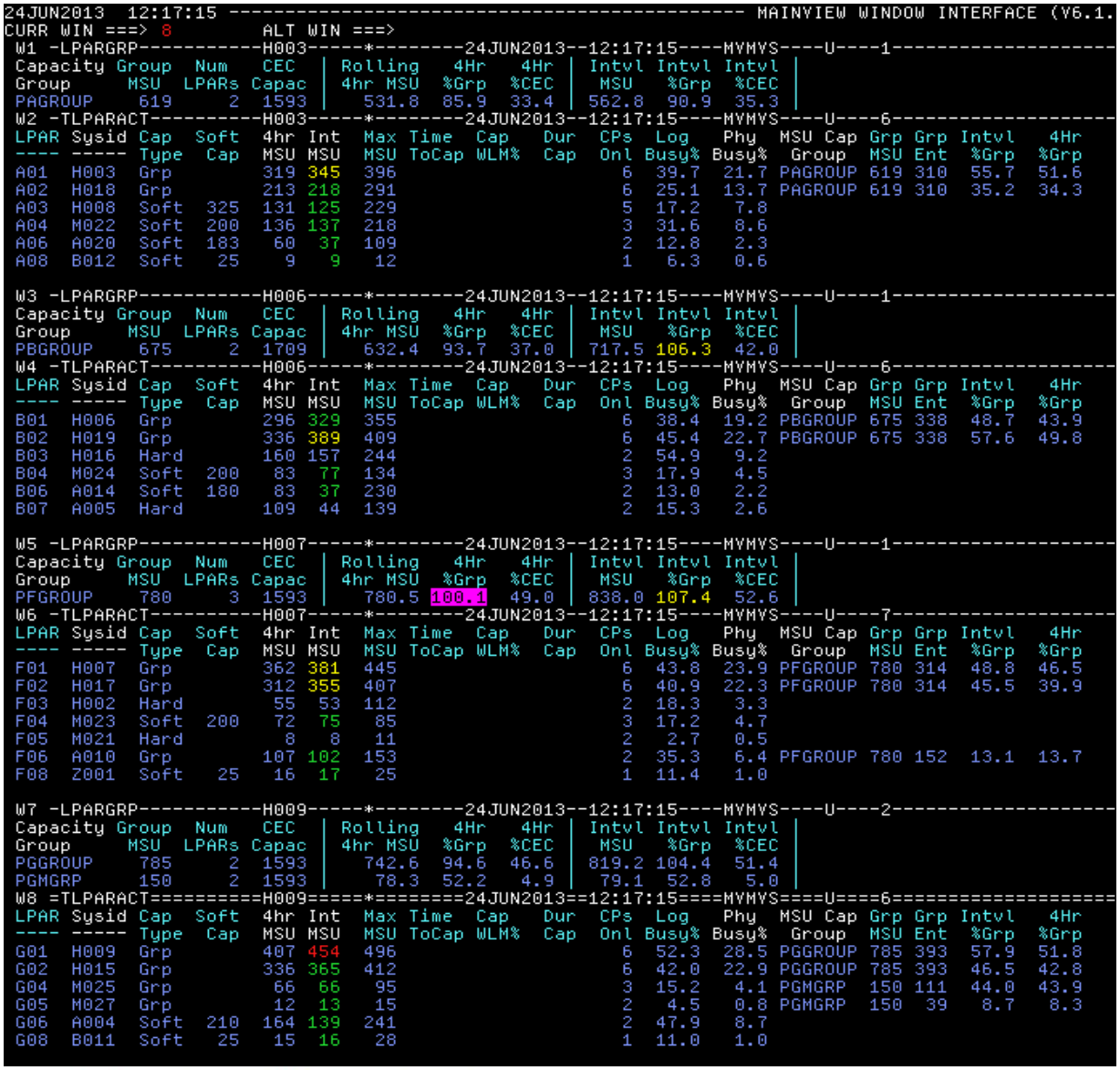
Background

- Sysplex Distributor configured with BASEWLM routing large IMS and CICS workloads
- 8 IMS/CICS systems on 4 CPCs (2 x CPC) delivering excellent response times
- All systems members of Group Caps
- Minimal batch executing

Experience

- 1 CPC approaches and exceeds Group Cap
- Other 3 CPCs have plenty of available capacity

Approaching Cap Limit



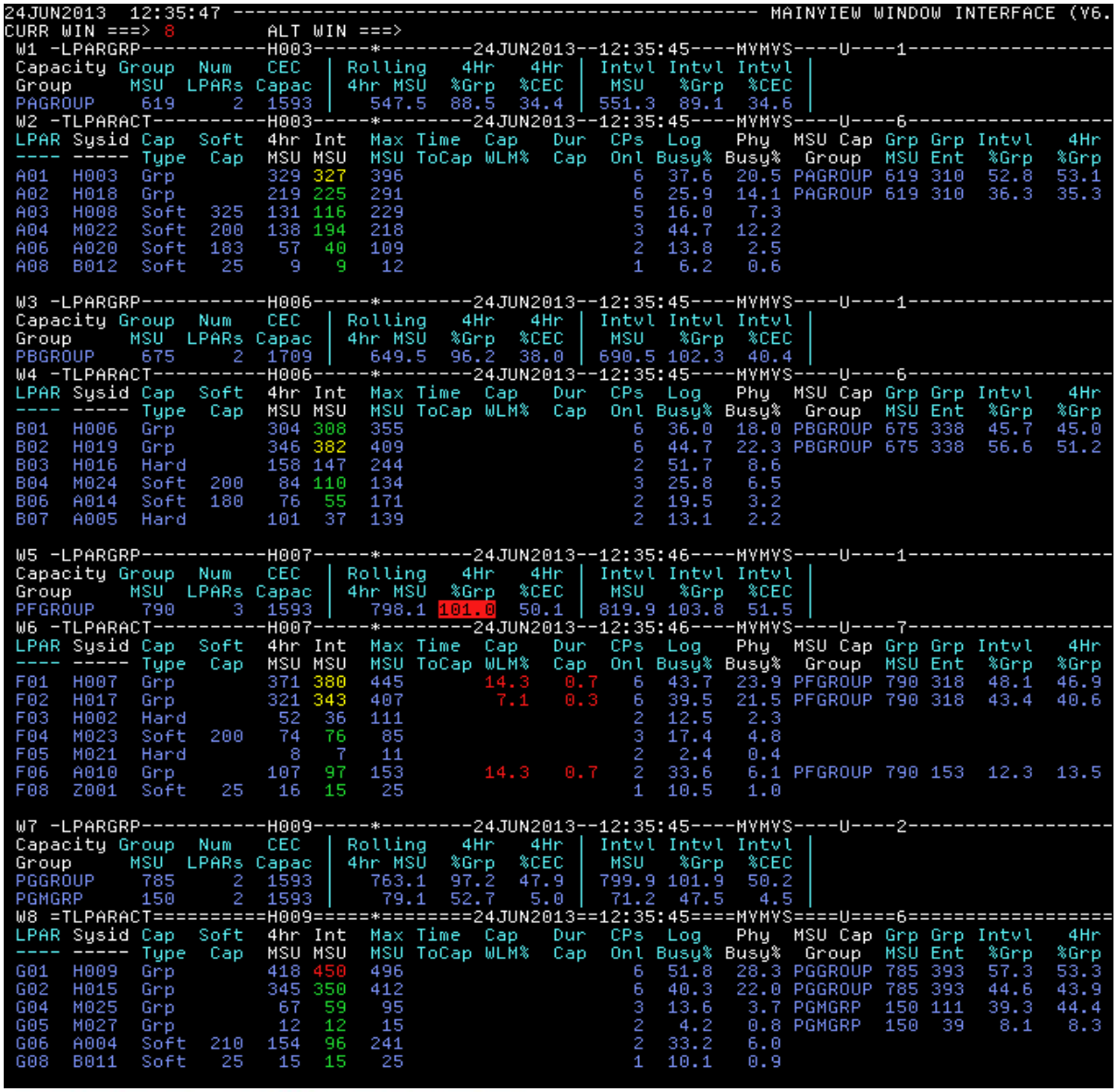
```
24JUN2013  12:17:15 ------------------------------------------- MAINVIEW WINDOW INTERFACE (V6.1.
CURR WIN ===> 8         ALT WIN ===>
 W1 -LPARGRP-----------H003-----*--------24JUN2013--12:17:15----MVMVS----U----1--------------------
 Capacity Group  Num    CEC    | Rolling    4Hr    4Hr  | Intvl Intvl Intvl |
 Group      MSU  LPARs Capac   | 4hr MSU   %Grp   %CEC   |  MSU   %Grp   %CEC |
 PAGROUP    619      2  1593   |   531.8  85.9  33.4  | 562.8  90.9  35.3 |
 W2 -TLPARACT----------H003-----*--------24JUN2013--12:17:15----MVMVS----U----6--------------------
 LPAR Sysid Cap   Soft  4hr Int   Max Time  Cap    Dur  CPs  Log   Phy   MSU Cap Grp Grp Intvl   4Hr
 ---- ----- Type  Cap   MSU MSU   MSU ToCap WLM%   Cap  Onl Busy% Busy%  Group  MSU Ent  %Grp  %Grp
 A01  H003  Grp         319 345   396                      6  39.7  21.7 PAGROUP 619 310  55.7  51.6
 A02  H018  Grp         213 218   291                      6  25.1  13.7 PAGROUP 619 310  35.2  34.3
 A03  H008  Soft  325   131 125   229                      5  17.2   7.8
 A04  M022  Soft  200   136 137   218                      3  31.6   8.6
 A06  A020  Soft  183    60  37   109                      2  12.8   2.3
 A08  B012  Soft   25     9   9    12                      1   6.3   0.6

 W3 -LPARGRP-----------H006-----*--------24JUN2013--12:17:15----MVMVS----U----1--------------------
 Capacity Group  Num    CEC    | Rolling    4Hr    4Hr  | Intvl Intvl Intvl |
 Group      MSU  LPARs Capac   | 4hr MSU   %Grp   %CEC   |  MSU   %Grp   %CEC |
 PBGROUP    675      2  1709   |   632.4  93.7  37.0  | 717.5 106.3  42.0 |
 W4 -TLPARACT----------H006-----*--------24JUN2013--12:17:15----MVMVS----U----6--------------------
 LPAR Sysid Cap   Soft  4hr Int   Max Time  Cap    Dur  CPs  Log   Phy   MSU Cap Grp Grp Intvl   4Hr
 ---- ----- Type  Cap   MSU MSU   MSU ToCap WLM%   Cap  Onl Busy% Busy%  Group  MSU Ent  %Grp  %Grp
 B01  H006  Grp         296 329   355                      6  38.4  19.2 PBGROUP 675 338  48.7  43.9
 B02  H019  Grp         336 389   409                      6  45.4  22.7 PBGROUP 675 338  57.6  49.8
 B03  H016  Hard        160 157   244                      2  54.9   9.2
 B04  M024  Soft  200    83  77   134                      3  17.9   4.5
 B06  A014  Soft  180    83  37   230                      2  13.0   2.2
 B07  A005  Hard        109  44   139                      2  15.3   2.6

 W5 -LPARGRP-----------H007-----*--------24JUN2013--12:17:15----MVMVS----U----1--------------------
 Capacity Group  Num    CEC    | Rolling    4Hr    4Hr  | Intvl Intvl Intvl |
 Group      MSU  LPARs Capac   | 4hr MSU   %Grp   %CEC   |  MSU   %Grp   %CEC |
 PFGROUP    780      3  1593   |   780.5 100.1  49.0  | 838.0 107.4  52.6 |
 W6 -TLPARACT----------H007-----*--------24JUN2013--12:17:15----MVMVS----U----7--------------------
 LPAR Sysid Cap   Soft  4hr Int   Max Time  Cap    Dur  CPs  Log   Phy   MSU Cap Grp Grp Intvl   4Hr
 ---- ----- Type  Cap   MSU MSU   MSU ToCap WLM%   Cap  Onl Busy% Busy%  Group  MSU Ent  %Grp  %Grp
 F01  H007  Grp         362 381   445                      6  43.8  23.9 PFGROUP 780 314  48.8  46.5
 F02  H017  Grp         312 355   407                      6  40.9  22.3 PFGROUP 780 314  45.5  39.9
 F03  H002  Hard         55  53   112                      2  18.3   3.3
 F04  M023  Soft  200    72  75    85                      3  17.2   4.7
 F05  M021  Hard          8   8    11                      2   2.7   0.5
 F06  A010  Grp         107 102   153                      2  35.3   6.4 PFGROUP 780 152  13.1  13.7
 F08  Z001  Soft   25    16  17    25                      1  11.4   1.0

 W7 -LPARGRP-----------H009-----*--------24JUN2013--12:17:15----MVMVS----U----2--------------------
 Capacity Group  Num    CEC    | Rolling    4Hr    4Hr  | Intvl Intvl Intvl |
 Group      MSU  LPARs Capac   | 4hr MSU   %Grp   %CEC   |  MSU   %Grp   %CEC |
 PGGROUP    785      2  1593   |   742.6  94.6  46.6  | 819.2 104.4  51.4 |
 PGMGRP     150      2  1593   |    78.3  52.2   4.9  |  79.1  52.8   5.0 |
 W8 =TLPARACT==========H009=====*========24JUN2013==12:17:15====MVMVS====U====6====================
 LPAR Sysid Cap   Soft  4hr Int   Max Time  Cap    Dur  CPs  Log   Phy   MSU Cap Grp Grp Intvl   4Hr
 ---- ----- Type  Cap   MSU MSU   MSU ToCap WLM%   Cap  Onl Busy% Busy%  Group  MSU Ent  %Grp  %Grp
 G01  H009  Grp         407 454   496                      6  52.3  28.5 PGGROUP 785 393  57.9  51.8
 G02  H015  Grp         336 365   412                      6  42.0  22.9 PGGROUP 785 393  46.5  42.8
 G04  M025  Grp          66  66    95                      3  15.2   4.1 PGMGRP  150 111  44.0  43.9
 G05  M027  Grp          12  13    15                      2   4.5   0.8 PGMGRP  150  39   8.7   8.3
 G06  A004  Soft  210   164 139   241                      2  47.9   8.7
 G08  B011  Soft   25    15  16    28                      1  11.0   1.0
```

Cap Exceeded – WLM Capping Active



24JUN2013 12:35:47 ---------- MAINVIEW WINDOW INTERFACE (V6.
CURR WIN ===> 8 ALT WIN ===>

W1 -LPARGRP----------H003-----*--------24JUN2013--12:35:45----MVMVS----U----1----------

Capacity Group	Num	CEC	Rolling 4Hr	4Hr	Intvl	Intvl	Intvl
Group	MSU	LPARs	Capac	4hr MSU	%Grp	%CEC	MSU	%Grp	%CEC
PAGROUP	619	2	1593	547.5	88.5	34.4	551.3	89.1	34.6

W2 -TLPARACT----------H003-----*--------24JUN2013--12:35:45----MVMVS----U----6----------

LPAR	Sysid	Cap Type	Soft Cap	4hr MSU	Int MSU	Max MSU	Time ToCap	Cap WLM%	Dur Cap	CPs Onl	Log Busy%	Phy Busy%	MSU Cap Group	Grp MSU	Grp Ent	Intvl %Grp	4Hr %Grp
A01	H003	Grp		329	327	396				6	37.6	20.5	PAGROUP	619	310	52.8	53.1
A02	H018	Grp		219	225	291				6	25.9	14.1	PAGROUP	619	310	36.3	35.3
A03	H008	Soft	325	131	116	229				5	16.0	7.3					
A04	M022	Soft	200	138	194	218				3	44.7	12.2					
A06	A020	Soft	183	57	40	109				2	13.8	2.5					
A08	B012	Soft	25	9	9	12				1	6.2	0.6					

W3 -LPARGRP----------H006-----*--------24JUN2013--12:35:45----MVMVS----U----1----------

Capacity Group	Num	CEC	Rolling 4Hr	4Hr	Intvl	Intvl	Intvl
Group	MSU	LPARs	Capac	4hr MSU	%Grp	%CEC	MSU	%Grp	%CEC
PBGROUP	675	2	1709	649.5	96.2	38.0	690.5	102.3	40.4

W4 -TLPARACT----------H006-----*--------24JUN2013--12:35:45----MVMVS----U----6----------

LPAR	Sysid	Cap Type	Soft Cap	4hr MSU	Int MSU	Max MSU	Time ToCap	Cap WLM%	Dur Cap	CPs Onl	Log Busy%	Phy Busy%	MSU Cap Group	Grp MSU	Grp Ent	Intvl %Grp	4Hr %Grp
B01	H006	Grp		304	308	355				6	36.0	18.0	PBGROUP	675	338	45.7	45.0
B02	H019	Grp		346	382	409				6	44.7	22.3	PBGROUP	675	338	56.6	51.2
B03	H016	Hard		158	147	244				2	51.7	8.6					
B04	M024	Soft	200	84	110	134				3	25.8	6.5					
B06	A014	Soft	180	76	55	171				2	19.5	3.2					
B07	A005	Hard		101	37	139				2	13.1	2.2					

W5 -LPARGRP----------H007-----*--------24JUN2013--12:35:46----MVMVS----U----1----------

Capacity Group	Num	CEC	Rolling 4Hr	4Hr	Intvl	Intvl	Intvl
Group	MSU	LPARs	Capac	4hr MSU	%Grp	%CEC	MSU	%Grp	%CEC
PFGROUP	790	3	1593	798.1	101.0	50.1	819.9	103.8	51.5

W6 -TLPARACT----------H007-----*--------24JUN2013--12:35:46----MVMVS----U----7----------

LPAR	Sysid	Cap Type	Soft Cap	4hr MSU	Int MSU	Max MSU	Time ToCap	Cap WLM%	Dur Cap	CPs Onl	Log Busy%	Phy Busy%	MSU Cap Group	Grp MSU	Grp Ent	Intvl %Grp	4Hr %Grp
F01	H007	Grp		371	380	445		14.3	0.7	6	43.7	23.9	PFGROUP	790	318	48.1	46.9
F02	H017	Grp		321	343	407		7.1	0.3	6	39.5	21.5	PFGROUP	790	318	43.4	40.6
F03	H002	Hard		52	36	111				2	12.5	2.3					
F04	M023	Soft	200	74	76	85				3	17.4	4.8					
F05	M021	Hard		8	7	11				2	2.4	0.4					
F06	A010	Grp		107	97	153		14.3	0.7	2	33.6	6.1	PFGROUP	790	153	12.3	13.5
F08	Z001	Soft	25	16	15	25				1	10.5	1.0					

W7 -LPARGRP----------H009-----*--------24JUN2013--12:35:45----MVMVS----U----2----------

Capacity Group	Num	CEC	Rolling 4Hr	4Hr	Intvl	Intvl	Intvl
Group	MSU	LPARs	Capac	4hr MSU	%Grp	%CEC	MSU	%Grp	%CEC
PGGROUP	785	2	1593	763.1	97.2	47.9	799.9	101.9	50.2
PGMGRP	150	2	1593	79.1	52.7	5.0	71.2	47.5	4.5

W8 =TLPARACT==========H009=====*========24JUN2013==12:35:45====MVMVS====U====6==========

LPAR	Sysid	Cap Type	Soft Cap	4hr MSU	Int MSU	Max MSU	Time ToCap	Cap WLM%	Dur Cap	CPs Onl	Log Busy%	Phy Busy%	MSU Cap Group	Grp MSU	Grp Ent	Intvl %Grp	4Hr %Grp
G01	H009	Grp		418	450	496				6	51.8	28.3	PGGROUP	785	393	57.3	53.3
G02	H015	Grp		345	350	412				6	40.3	22.0	PGGROUP	785	393	44.6	43.9
G04	M025	Grp		67	59	95				3	13.6	3.7	PGMGRP	150	111	39.3	44.4
G05	M027	Grp		12	12	15				2	4.2	0.8	PGMGRP	150	39	8.1	8.3
G06	A004	Soft	210	154	96	241				2	33.2	6.0					
G08	B011	Soft	25	15	15	25				1	10.1	0.9					

Working as Designed

WLM does not take into account available capacity due to capping limitations in its routing recommendations

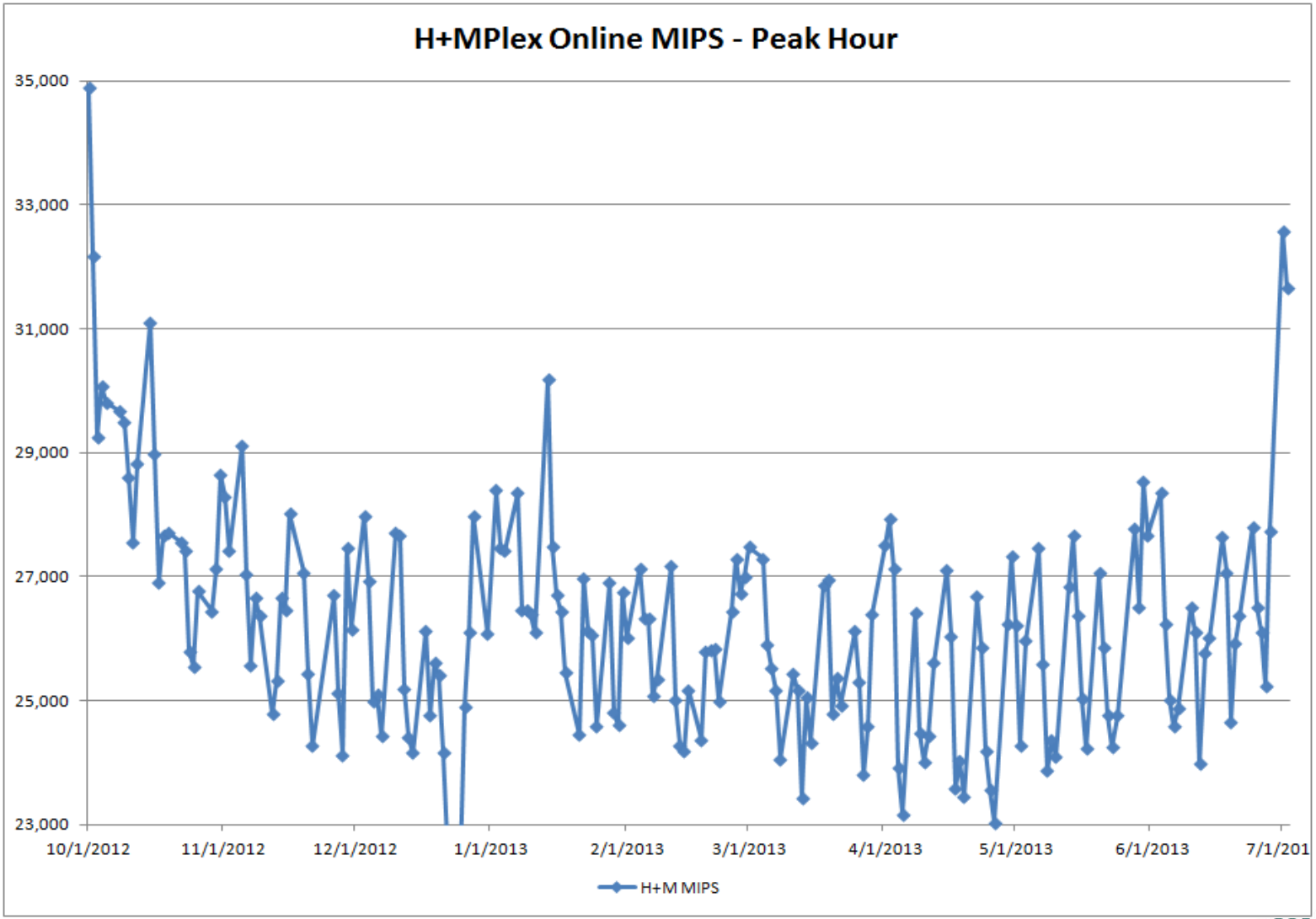
- WLM recognizes approaching hardware capacity constraints but not constraints due to capping
- This behavior can cause customers to raise Cap and thus increase software expense when plenty of capacity is available on other CPCs
- Seeking support for SHARE requirement **SSMVSE13028** that WLM recognize capacity limitations due to capping as it does with hardware capacity

Software Expense Reduction Initiative

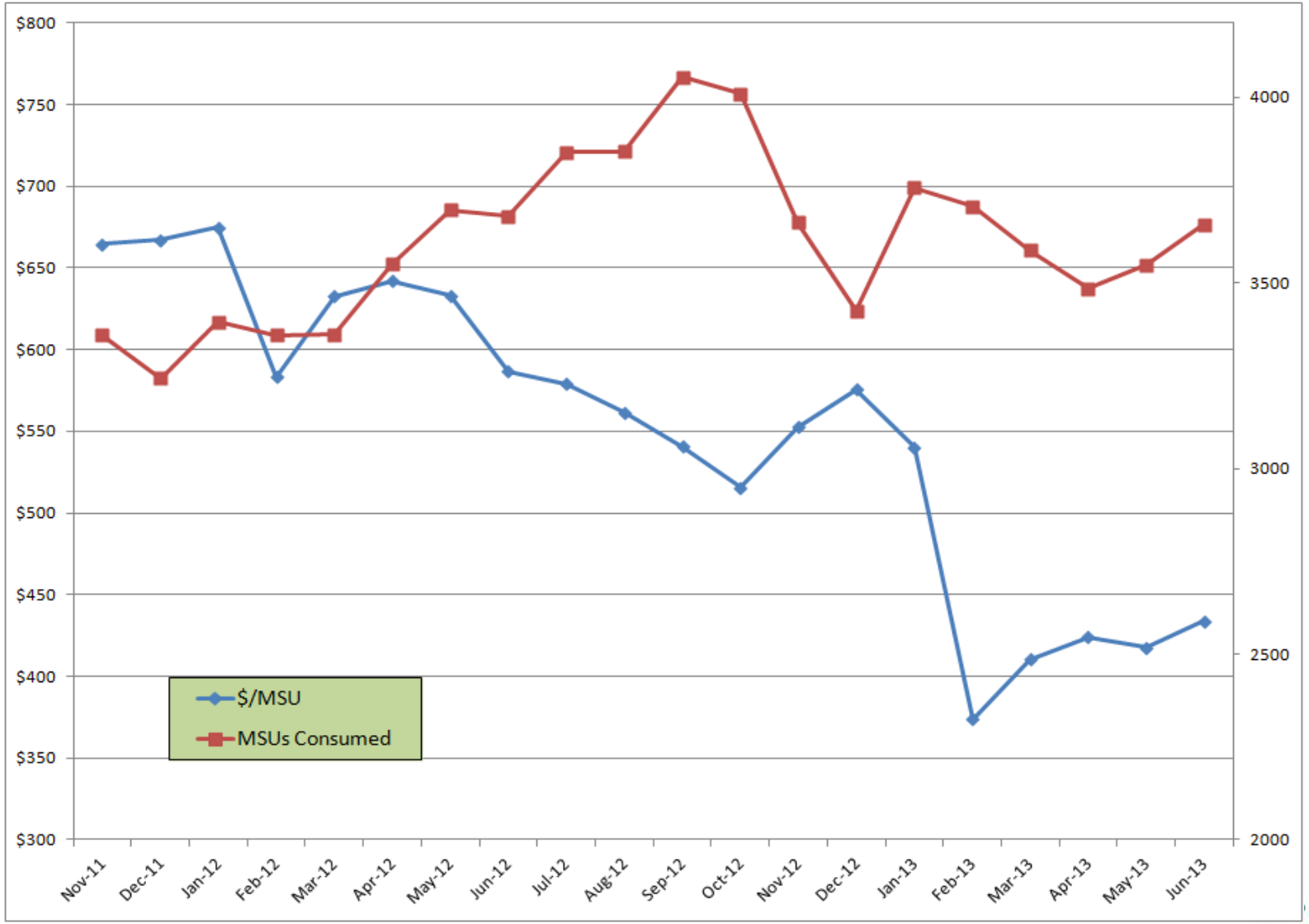
Broad effort across IT mainframe community

- Initiated and actively sponsored by executive management
- Involved both Operations and Applications from start
- Communicated basic MLC concepts
- Audiences were very receptive especially when they realized they could make a difference
- Challenge to “bend the curve” of typical Capacity chart by implementing efficiencies to outpace business growth

“Bend the Curve”



Financial Results



Next Steps

- Better understand and manage distribution of online workloads across systems reflecting capacity available relative to Caps
- Improve ability to proactively identify and address new high CPU workloads
- Further refine automation routing workloads to lower cost systems
- Pursue automation to reduce monitoring
- Continue pilot migrating selected batch to zIIP-eligible Java