Optimizing MLC expenses of your Mainframe Data Center with System Automation for z/OS

Abstract

Monthly License Charge (MLC) costs constitute a significant part of the IT costs in a Mainframe Data Center. IBM System Automation for z/OS provides with a flexible and simple solution to optimize IT operations reducing the MLC expenses without to impact overall IT performance.

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Executive Summary

Many clients face software cost challenges that they try to resolve with sub-capacity pricing for Variable Workload License Charges (VWLC) software that is based upon monthly peak rolling 4 hour average (R4HA) usage measured in MSUs (Millions of Service Units) and LPAR size definitions (LPAR Defined Capacity).

When the R4HA becomes higher or equal to the Defined Capacity then the LPAR is capped by the z/OS Workload Manager (WLM) which slows down the system and priority workload.

This white paper describes how clients can use IBM Tivoli System Automation for z/OS capabilities to avoid extra VWLC charges during peak hours by:

1. Automatically moving low priority workloads to systems with free capacity
2. Providing just-in-time cushioning of the R4HA
3. Adjusting LPAR Weights on behalf of IBM Capacity Provisioning Manager for z/OS
4. Adjusting capacity across LPARs and WLM capacity groups automatically
5. Moving workload to under-utilized system based on the predicted free capacity and WLM data or based on OMEGAMON metrics
6. A policy-based solution for active suppression of looping address spaces

Introduction

Explosive growth in online transactions, a high amount of processed data and an ever increasing number of IT consumers on one side and globalization pressure requiring expense reduction on the other side, shift the focus of IT Organizations to optimize and automate IT operations to remain competitive in the market. While Software License charge is one of the high expensive positions in a mainframe-operating Data Center, License costs optimization gets business critical for mainframe customers.

IBM License Models

IBM offers a variety of Monthly License Charge (MLC) pricing metrics to meet diverse needs of z/OS customers. MLC pricing applies to many z/OS products like IMS, CICS, DB2, MQ, etc.
With different Workload License Charge (WLC) models IBM offers pricing metrics based on utilization of LPARs where eligible products are being executed. WLC allows managing software costs by managing workload utilization. Customers may choose to implement WLC in one of two ways:

- **Full-Capacity WLC** - charges are based on the full System z server capacity where each VWLC (Variable Workload License Charge) product executes.
- **Sub-Capacity WLC** - charges are based on the utilization of the LPAR or LPARs where a VWLC product executes.

This article discusses optimization of the Sub-capacity WLC model.

**Key properties of the Sub-capacity WLC:**

- License expenses are determined by total utilization of LPARs where a product executes, not by utilization of the particular product. All LPAR MSUs are counted for any MLC product executed on the LPAR.
- Monthly expense based on a highest sum of concurrent 4 Hours rolling averages (4HRA) for all LPARs where the product is executing. Highest 4HRA is used to determine monthly price.

**Right balancing between Performance Goals and Software expenses**

**Ways to limit WLC costs**
There are different ways allowing optimization of IT configuration to reduce MLC costs

**Utilize IBM System z Defined Capacity and Group Capacity**
IBM System z allows limiting capacity available to an LPAR or LPAR group. If the 4HRA average consumption exceeds the limit, the LPAR(s) will be capped to remain within the defined capacity.

**Defined capacity**
An installation can specify a Defined Capacity expressed in millions of service units (MSU) per hour for an LPAR. The Defined Capacity sets the capacity limit of an individual LPAR when soft capping is in effect.

z/OS Workload Manager (WLM) keeps a 4-hour rolling average of the CPU usage of the LPAR. When the 4-hour average CPU consumption exceeds the defined capacity limit, WLM dynamically activates soft capping. When the rolling 4-hour average returns below the Defined Capacity, soft capping is removed.

**Group Capacity Limit**
The Group Capacity Limit allows the definition of a group of LPARs on the same CPC and a limit for the combined capacity available to those LPARs. This allows the system to manage the group in such a way that the limit for Group Capacity in MSUs per hour
will not be exceeded. PR/SM and WLM work together to enforce the capacity defined for the group and also enforce the capacity optionally defined for each individual LPAR. An LPAR can be restricted by Defined Capacity and in addition it can belong to a capacity group.

**Optimizing software configuration**

*Move workloads*
Moving workloads off from high cost LPARs with high 4HRA to other LPARs with lower average where the same products already available may reduce MLC costs for the product.

*Reduce peaks*
Reduce peak 4HRA on LPARs with most expensive products by moving uncritical workloads to other LPARs, for example moving batch execution to another LPAR during peak online IMS processing.

*Batch management*
Reduce peaks and decrease overall consumption with intelligent batch jobs management holding or redistributing batch jobs to low-cost LPARs.

*Monitor and block looping tasks*
Products errors, incorrect configuration or operator decisions may cause unnecessary high CPU consumption, for example looping address spaces. Detection of such high consumers and automation to stop the address spaces may save a lot of money reducing peaks in the CPU consumption, which will affect bill for ALL MLC products running on the same LPAR. On systems utilizing Group Capacity this will ensure higher productivity due to less capping caused by looping systems.

**Ensure workload performance and availability targets**

Limiting WLC costs should not affect the execution of time critical workloads, sacrificing business availability and performance goals. The right balance between capacity settings and performance and availability targets can be achieved using intelligent automation of the workloads and smart capacity management. IBM Tivoli System Automation for z/OS offers a comprehensive framework for goal-driven automation and hardware management functions that can help to reduce WLC expenses and to achieve high availability and high performance of the System z platform.

**IBM Tivoli System Automation for z/OS capabilities**
Tivoli System Automation for z/OS is a policy-based, self-healing, high-availability solution to maximize efficiency and availability of critical systems and applications.

- Delivers high availability for IBM z/OS® systems and IBM Parallel Sysplex® clusters through flexible, cluster-wide, policy-based self-healing, helping to minimize the implementation, coding and support time.

- Optimizes system health and performance by using goal-driven automation to simplify operations, minimize costs, and support business goals.

- Reduces automation implementation time and cost by proactively managing availability through performance-driven automation, improving the speed of problem notification and resolution, automated alert notification and escalation.

- Provides with Hardware automation feature allowing monitoring and automation of almost all System z Hardware components and Hardware Management Console tasks.

**Key SA for z/OS features helping to implement high available and balanced solution reducing MLC expenses**

**Application management**
System Automation for z/OS provides integrated solution helping to implement cost-effective application and hardware automation helping to optimize operations in a mainframe operating data center.

**Move Group**
Is a SA managed group of applications which ensures availability if one instance of a resource in the Sysplex. With just one simple command (INGMOVE) you can move the applications to another system reducing load of current LPAR.

**Server group**
Is a SA managed group of applications which ensures availability if predefined number of instances of resources in the Sysplex. With just one command (INGGROUP) you can exclude one system from running defined applications reducing CPU consumption and move the workload to other LPARs to satisfy availability target for the group.

**Runmodes**
Runmodes is a flexible way to control the availability of resources without the need to place explicit START or STOP requests against them or manipulating their automation flag. Runmodes provide with simple way to implement switch between two or more scenarios with the same configuration. For instance, you can switch between "Weekday" and "Weekend" or "Day" and "Night" shifts adjusting load of your LPARs with just one command (INGRUN).
Active Looping address space suppression
System Automation for z/OS provides integration with OMEGAMON monitoring products and provides an out of the box policy-based solution for active suppression of looping address spaces. It allows quick detection of started tasks / jobs showing abnormal utilization and depends on predefined policy throttle or cancel users showing abnormal usage patterns. Using this integration technology you are able to prevent peaking 4HRA caused by software or human errors.

Integration with IBM Tivoli Workload Scheduler
The TWS Automation part of IBM Tivoli System Automation for z/OS brings together batch and online console automation to a common focal point. TWS Automation automates, simplifies, and standardizes console operations and the management of component, application, and production related tasks. TWS Automation is an extension of SA z/OS that capitalizes on the strengths of NetView, SA z/OS, and TWS by providing the ability to greatly expand job execution, scheduling, monitoring, and alert notification capabilities. Tivoli Workload Scheduler for z/OS Automation consists of two basic functions:
- Requests from TWS to SA z/OS and associated status updates
- Requests from SA z/OS to TWS and associated status updates

Hardware Automation – Processor Operations
System Automation for z/OS provides an easy of use set of enterprise-wide hardware management functions (ProcOps – Processor Operations) from a Focal Point allowing automation of almost all operations performed on a Hardware Management console. The ProcOps is available through TCPIP connection to the HMC or SE of the System z processor. For GDPS customers or customers not allowing TCPIP connection between z/OS LAN and Hardware LAN, a subset of functions is available through Base Control Program internal interface (BCPii).

Capacity and LPAR weight management using ProcOps
ProcOps implements a simple command ISQCCMD ICNTL allowing enterprise-wide query and change LPAR-specific values and settings. The PR/SM™ hardware component or WLM use this information to manage partition performance and to distribute shared processor resources among the images of a CPC. Changing the image control values and settings with ICNTL allows you to influence LPAR performance and LPAR resource capacities at run time:
- Defined capacity
- Group capacity
- Capacity Group Profiles
- LPAR processing weight
- Enable/Disable WLM Management
- And much more…
Collecting utilization information
IBM offers several solutions helping to collect LPAR capacity information.

**IBM Capacity Management for zEnterprise**
IBM Capacity Management Analytics is single, integrated solution that can help clients manage their zEnterprise investment efficiently and cost-effectively for optimal results. IBM CMA provides everything necessary for the cost effective analysis of zEnterprise usage, service objectives, resource utilization, system tuning, accounting, cost recovery to provide better service to the business.

**IBM z/OS Resource Measurement Facility (RMF)**
IBM RMF is de-facto standard solution for z/OS performance measurement and management. RMF collects SMF Data offering CPC capacity reports for detailed long-term performance analysis and capacity planning.

**IBM Tivoli OMEGAMON XE on z/OS**
The data and resources provided by OMEGAMON XE on z/OS enable you to monitor and manage workload performance and resource usage in a variety of ways.

The System CPU Utilization workspace shows the number of physical processors reported on, number of processors online, the average percentage of time that all processors collectively available in this z/OS system were busy dispatching work, and other information specific to CPU workload and partition workload. If you use defined capacity as a basis for pricing, this workspace also shows the long-term average processor service used by this system or LPAR in millions of service units (MSUs) per hour. Being integrated with System Automation for z/OS it allows to implement health-checking and automation of monitored situations based on real-time monitoring data.

Implementation scenarios
This chapter discusses concrete scenarios and implementation outline using System Automation for z/OS helping to reduce MLC expenses on System z systems.

The simplest way reducing MLC costs in this scenario is using IBM Capacity Provisioning Manager for z/OS - is a non-priced component of your z/OS operating system. Using CPM you can manage additional temporary capacity and concurrently adjust defined capacity or group capacity. Capacity Provisioning does not adjust LPAR weights after activation of additional temporary capacity or changed defined capacity. Nevertheless, you may automate such changes based on the messages issued by Capacity Provisioning.

**Automating CPM Messages**
With System Automation for z/OS you can extend the Capacity Provisioning management (CPM) automating CPM messages.
**Scenarios:**
1. Move non-critical applications off the current LPAR when CPM increases the defined capacity of an LPAR.

CPM produces messages (for example CPO3962I) in the case that a capacity change is initiated by the CPM or manually from the console. In this case SA can be used to move non-critical applications off the LPAR to reduce LPAR load limiting CPU average consumption and allowing critical workloads to complete their jobs.

Solution: If CPM reports initiation of capacity change, the automation may react to the CPM messages and move or stop non-critical applications using system automation commands.

2. Adjust LPAR Weights on behalf of CPM scheduled activation of additional capacity or changed defined capacity for an LPAR or LPAR group.

Solution: If CPM reports initiation of capacity change, the automation may react to the CPM messages, collect current LPAR weights, re-count them and rebalance LPAR weights according to your requirements using Processor Operations commands.

Combining both scenarios provides you with intelligent and powerful solution ensuring maximal performance by controlled MLC expenses.

**Scheduled capacity management**
System Automation for z/OS provides a full set of functions required to implement your own schedule-based automation for LPAR management.

In order to establish schedule-based automation for LPAR management, gather CPU utilization report, for example using IBM Capacity Management Analytics as shown bellow:

![CPU MIPS Used - zServer/LPAR Level](image_url)
Optimization of that environment requires:
- A scheduled adjustment of defined capping and weights for all affected LPARs to ensure performance requirements for business workload running on the LPARs and limit overall MSU consumption to avoid high MLC costs.
- Moving applications off the high cost LPARs to reduce peak consumption.

Solution:

1. Define scheduling information including scheduled time (hourly), affected systems with required capacity limits, weight and list of non-critical application groups which can be moved off the LPAR. System Automation Relational Data Services may be used as data store, allowing definition of the data in form of relational data tables manageable either from the automation environment, using ISPF Editor or even as import from a text file.
2. Implement an automation script triggered hourly:
   a. Query scheduling information for LPAR values for current hour
   b. Move away or stop non-critical applications using system automation commands.
   c. Instruct TWS to stop or redirect scheduled batch processing.
   d. Adjust capping values for affected LPARs according to the schedule.
   e. Adjust LPAR weights according to the schedule
   f. If necessary, you may use OOCOD command to increase your CPU capacity temporarily to achieve your performance goals.

The scenario can be extended implementing day/night shifts switching between online and batch modes using the INGRUN commands and even adjusting power setting using ISQCCMD POWERMOD command to reduce the overall power consumption. Optionally events can be created for the capacity changes, so that the operation team is notified and can correct the automation actions in case of unexpected situations as all the commands are available as operator commands.

Conclusion

Efficiency of the IT operations on IBM Mainframe is dependant on right automation and intelligent capacity management. System Automation for z/OS provides with a perfect tooling for all aspects of application automation and hardware management. Out of the box integration with other IBM Monitoring and Management products offers variety of methods optimizing System z environments at lower costs.
For more information

For more information on all IBM MLC metrics, please visit http://www-03.ibm.com/systems/z/resources/swprice/mlc/index.html.

IBM Tivoli System Automation for z/OS:

IBM Service Management Community:

User forum on IBM developerworks:

User forum on YAHOO (The purpose of this group is to discuss technical issues related to IBM Tivoli System Automation for z/OS with your peers):
http://tech.groups.yahoo.com/group/SAUSERS/

Service Management Suite for z/OS:

IBM Capacity Management for zEnterprise
http://w3-103.ibm.com/software/spcn/content/D791695H57940T63.html