Back to Basics – Processor Consumption Analysis

(Part 1 (and maybe some Part 2)): What Is Consuming All The CPU?

Peter Enrico

Email: Peter.Enrico@EPStrategies.com

z/OS Performance
Education, Software, and
Managed Service Providers

Creators of Pivotor®

Enterprise Performance Strategies, Inc.
3457-53rd Avenue North, #145
Bradenton, FL 34210
http://www.epstrategies.com
http://www.pivotor.com

Voice: 813-435-2297
Mobile: 941-685-6789

Contact, Copyright, and Trademarks

Questions?

Send email to performance.questions@EPStrategies.com, or visit our website at https://www.epstrategies.com or http://www.pivotor.com.

Copyright Notice:

Trademarks:

Enterprise Performance Strategies, Inc. presentation materials contain trademarks and registered trademarks of several companies.

The following are trademarks of Enterprise Performance Strategies, Inc.: **Health Check®, Reductions®, Pivotor®**

The following are trademarks of the International Business Machines Corporation in the United States and/or other countries: IBM®, z/OS®, zSeries®, WebSphere®, CICS®, DB2®, S390®, WebSphere Application Server®, and many others.

Other trademarks and registered trademarks may exist in this presentation

Abstract

Back to Basics – Processor Consumption Analysis

- The first step to any processor analysis is to understand your processor configuration and settings. The second step is to understand what workloads, address spaces, and transactions are consuming the fixed processor resource. It is only after understanding what and how the processor is being consumed can you conduct any sort of processor tuning or optimization exercise.

- During this presentation, Peter Enrico will show you how to conduct a processor resource consumption analysis. You will be provided with a top-down approach to better understand processor measurements available to help you gain a drilldown insight into how the CPU resource is being consumed, and by what LPARs, Workloads, and transactions. Shown is what is known as a drill down approach for a processor performance analysis.

EPS: We do z/OS performance…

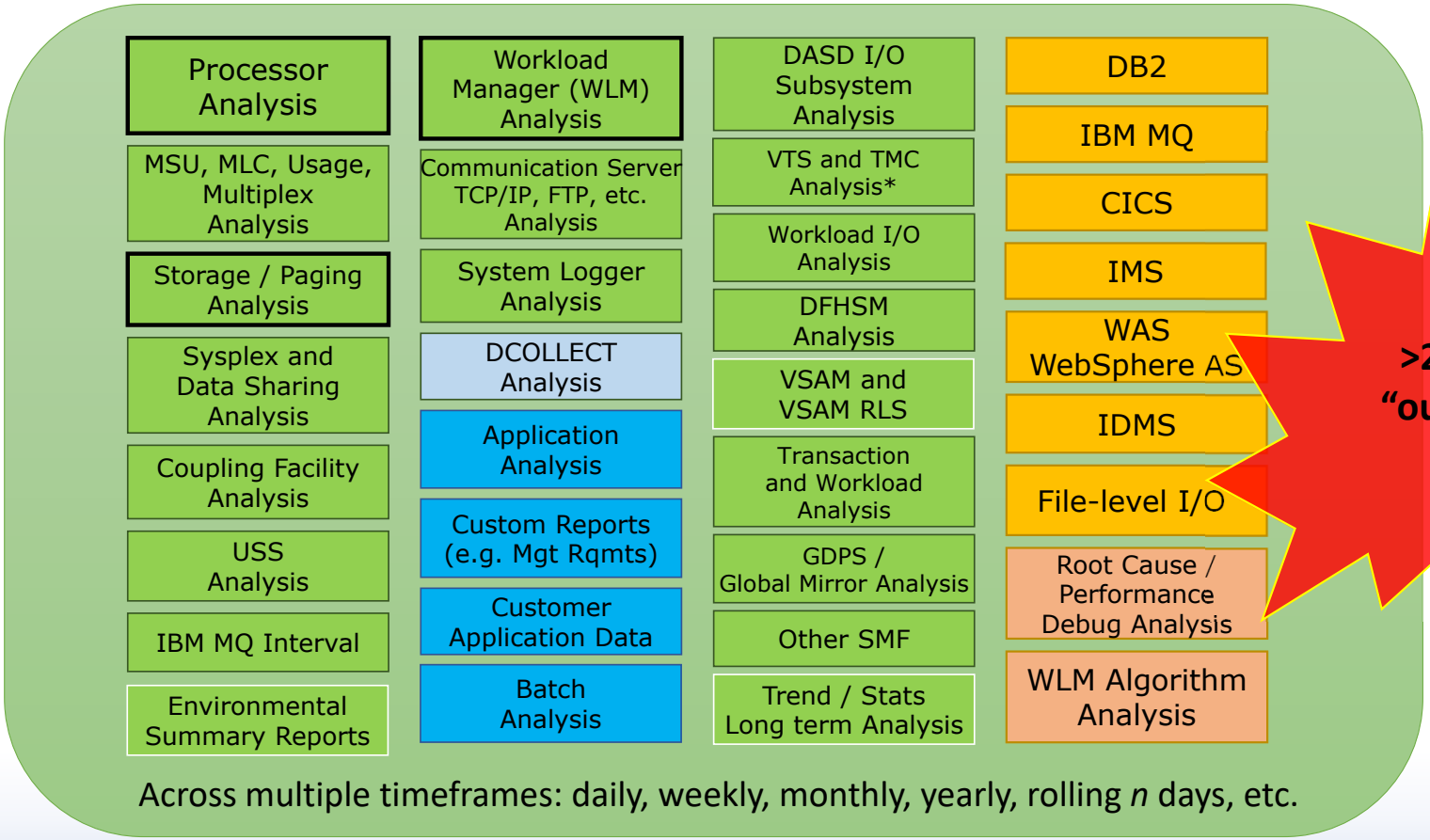
- **Pivotor** – z/OS performance reporting and analysis software and services
  - Not just SMF reporting, but analysis-based reporting based on expertise
  - www.pivotor.com
- **Education and instruction**
  - We teach our z/OS performance workshops all over the world
  - Want a workshop in your area? Just contact me.
- **z/OS Performance War Rooms**
  - Intense, concentrated, and highly productive on-site performance group discussions, analysis and education
  - Amazing feedback from dozens of past clients
- **MSU Reduction Exercises**
  - The goal is to reduce the MSU consumption of your applications and environment
- **Information**
  - We present around the world and participate in online forums
  - https://www.pivotor.com/content.html
    https://www.pivotor.com/webinar.html

z/OS Performance workshops available

During these workshops you will be analyzing your own data!

- WLM Performance and Re-evaluating Goals
  - April 28 – May 2, 2025 (4 days)
- Parallel Sysplex and z/OS Performance Tuning
  - July 15-16, 2025 (2 days)
- Essential z/OS Performance Tuning
  - September 22-26, 2025 (4 days)
- Also… please make sure you are signed up for our free monthly z/OS educational webinars! (email contact@epstrategies.com)

Pivotor's Comprehensive Report Sets for Immediate Performance Analysis



Like what you see?

- Free z/OS Performance Educational webinars!
  - The titles for our Spring / Summer 2025 webinars are as follows:
    - *Back to basics - Processor Consumption Analysis*
    - *Pivotor Pointers*
    - *WLM and CPU Critical Control*
    - *Back to Basics - Evaluating Latent Demand*
    - *Understanding SMF 98 Locking Measurements*
    - *Overseeing z/OS Performance Management With Your Outsourcer*
    - *Standard Measurements when Monitoring Transactions*
    - *Processor Comparison Discussion*
    - *z/OS Performance Management in an AI World*
    - *Understanding z/Architecture Processor Topologies*
    - *SMF 99 WLM Decision Making Traces*
    - *Understanding SMF 98 Address Space Consumption Measurements*

- If you want a free cursory review of your environment, let us know!
  - We're always happy to process a day's worth of data and show you the results
  - See also: http://pivotor.com/cursoryReview.html

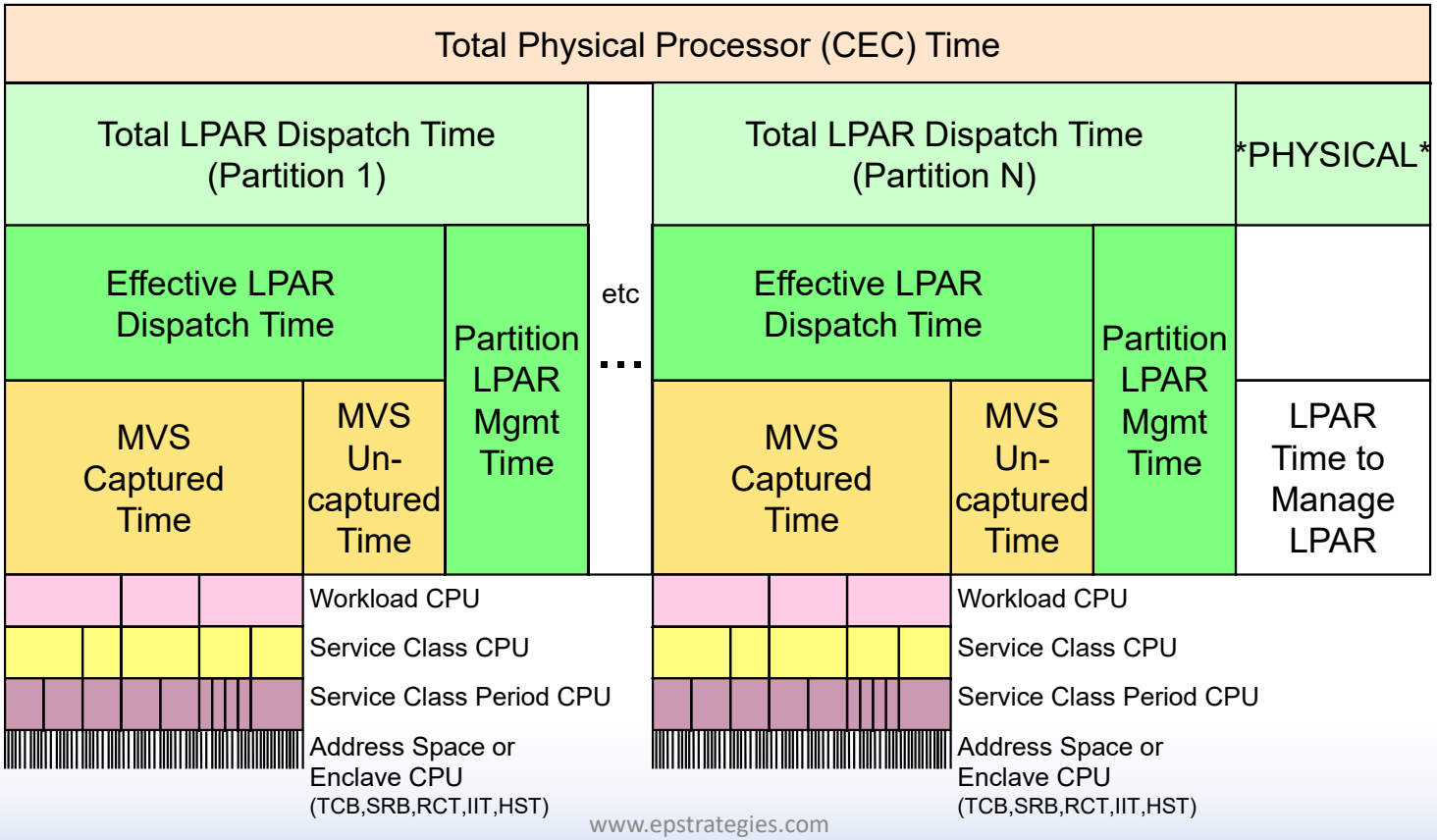
Like what you see?

- If you want a free cursory review of your environment, let us know!
  - We're always happy to process a day's worth of data and show you the results
  - See also: http://pivotor.com/cursoryReview.html
- We also have a ***free*** Pivotor offering available as well
  - 1 System, SMF 70-72 only, 7 Day rolling retention
  - That still encompasses over 100 reports!
- We offer free bi-monthly z/OS performance educational Webinars
  - Sign our guestbook to get invited
  - Or send an email to
    - Peter.Enrico@EPStrategies.com

Part 1 – CEC and LPAR Consumption Analysis

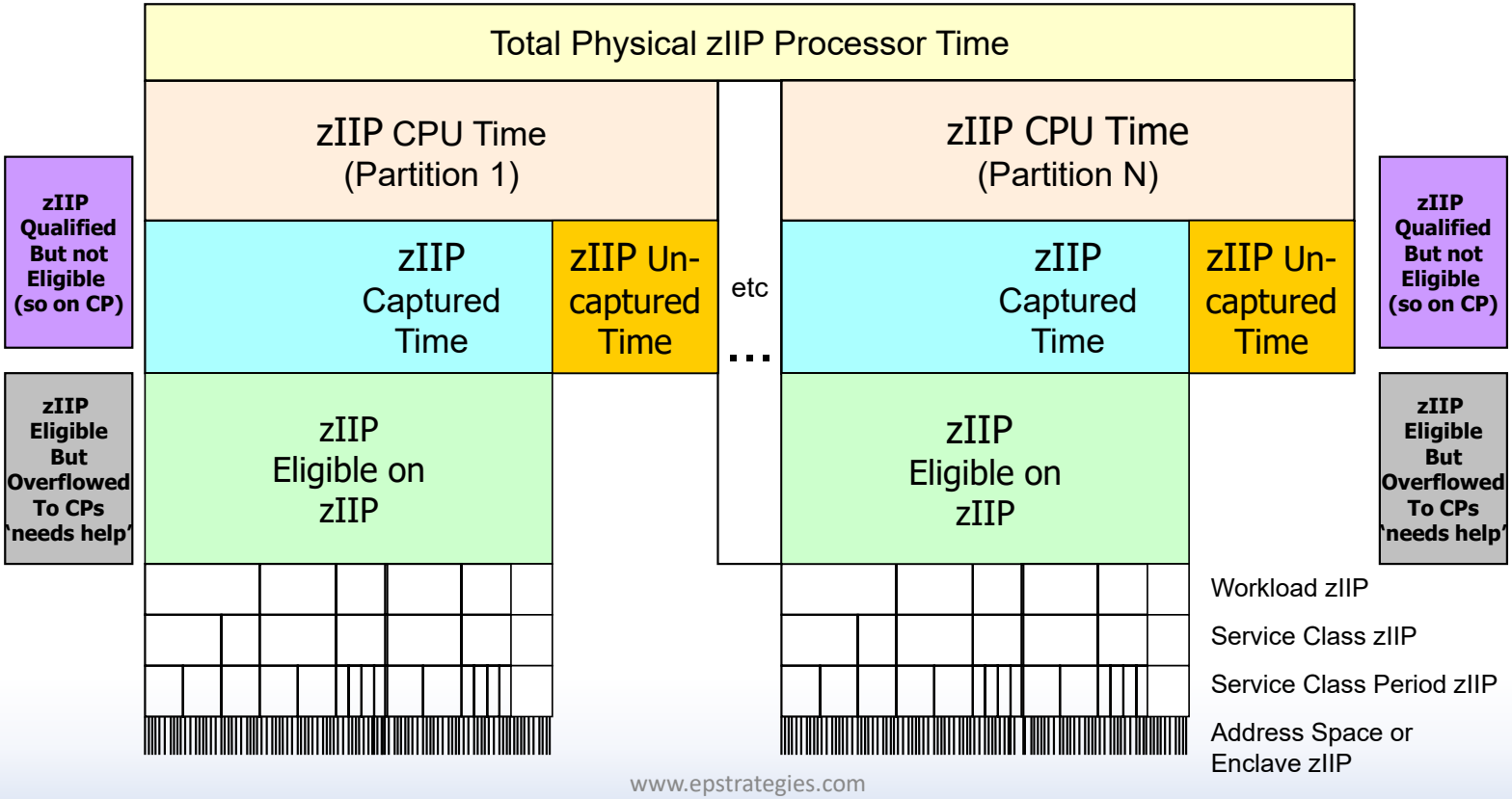
Breakdown of General-Purpose Processor

- We always needed to understand the break down of CP CPU consumption



Breakdown of zIIP Engine Time

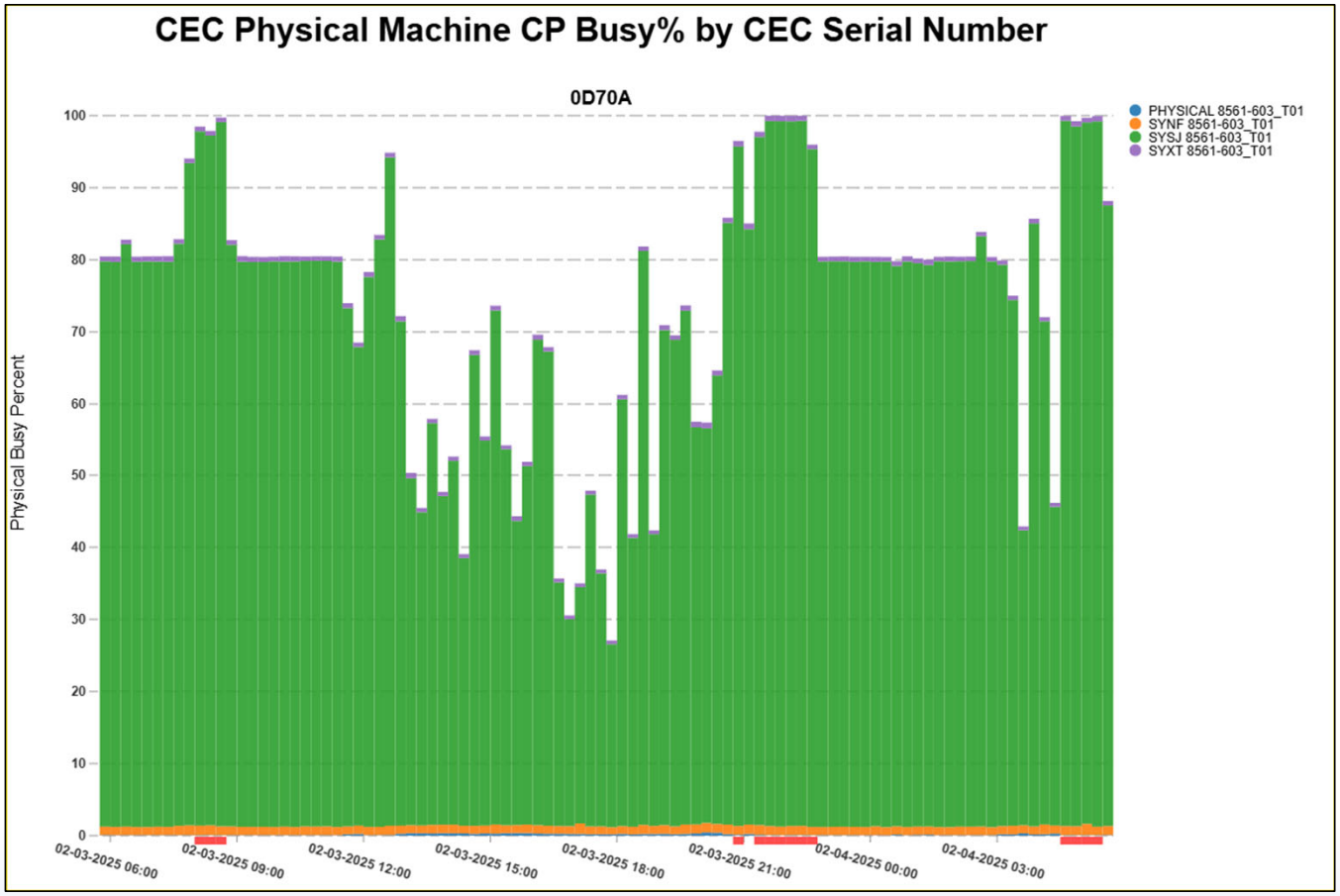
- We need to understand how PR/SM allocates the zIIP processor resource
  - In all measurements zIIPs



Decomposing CPU Consumption
-
Machine Level Analysis

- Which LPARs are using the physical CPUs?
  - Utilization
  - MSUs
- Look at LPAR Management Busy% to ensure it is within guidelines
- Was there LPAR weight enforcement?

Physical Process CPU Utilization



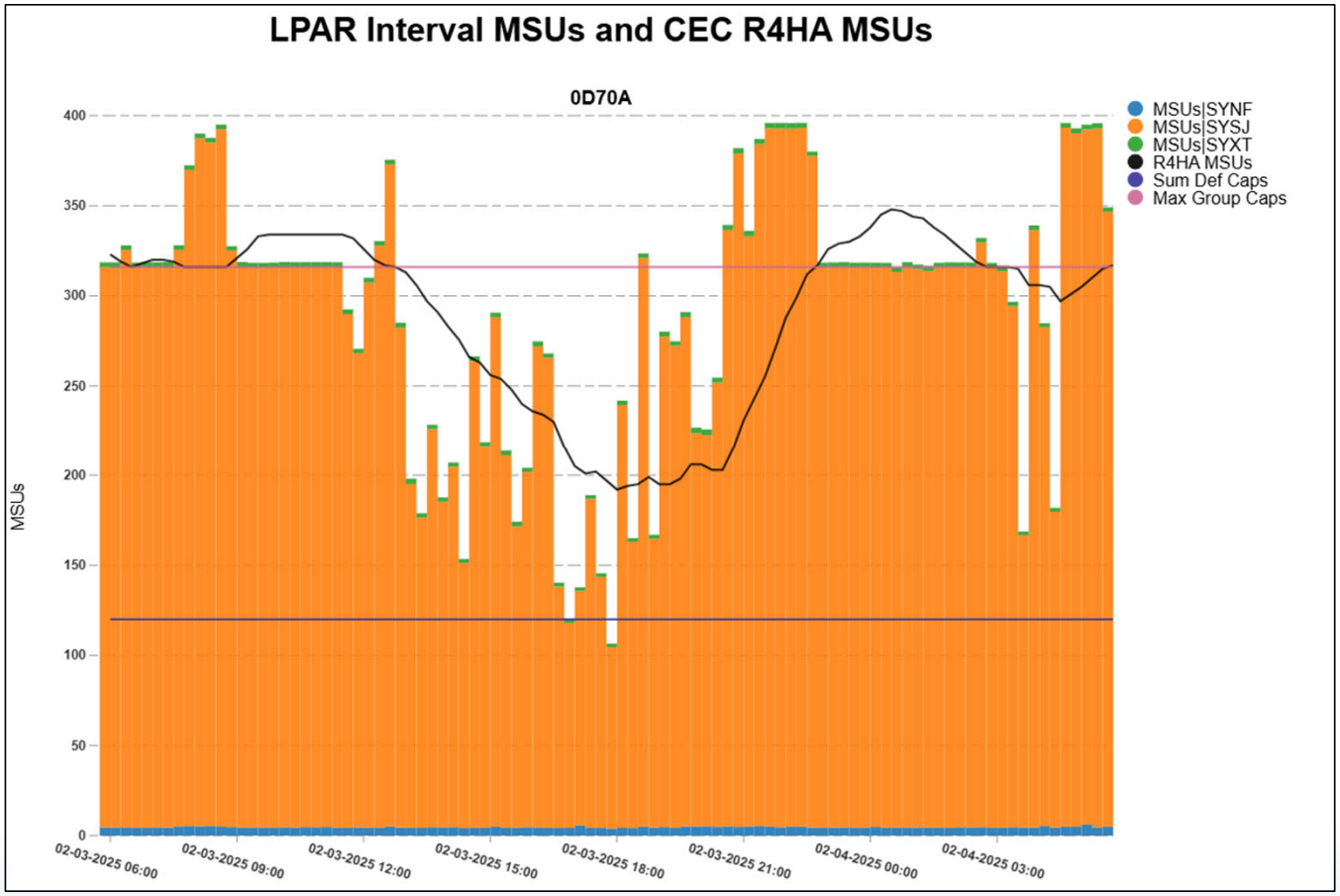
This chart just shows the utilization of a CEC for a single day. Although not many LPARs, it is still an interesting example.

Always take note of the CEC utilization pattern.

In this example, notice the flat lining of the CEC utilization. This usually indicates some sort of capping was in effect.

Also notice that this CEC regularly hits 100% CEC utilization.

Could measure CPU Consumption in MSUs



Another way of looking at CEC utilization is in terms of MSUs.

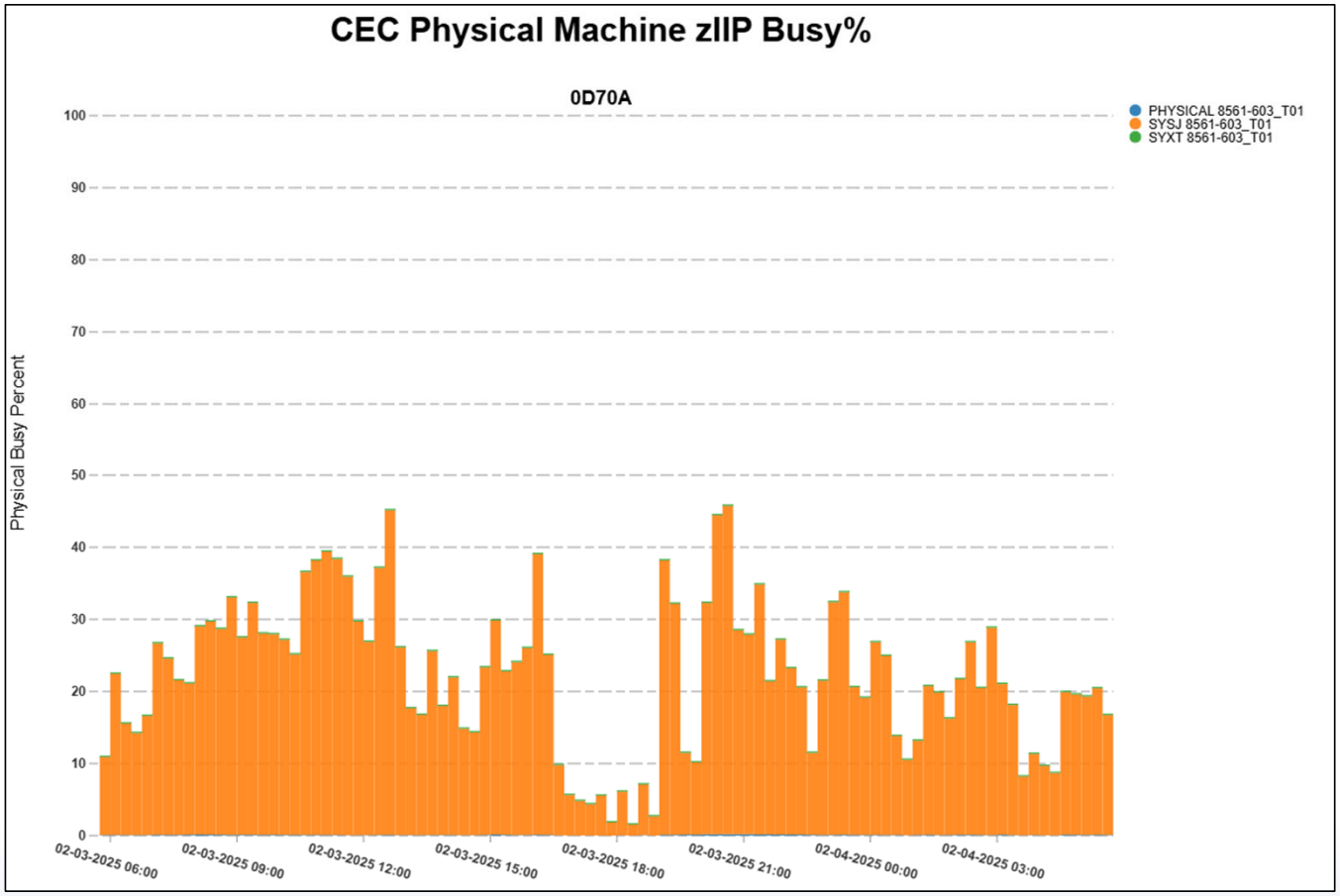
Best to look at MSUs consumed by each LPAR, but then also relate these values to MSU limits that may exist that would affect the MSU consumption.

In this example we see we have a group cap.

Also note the rolling 4-hour average pattern relative to the group cap value.

As a side note, we are not a fans of reporting things in terms of 'MIPS', but if you have a MIPS to MSU value, it can be applied here.

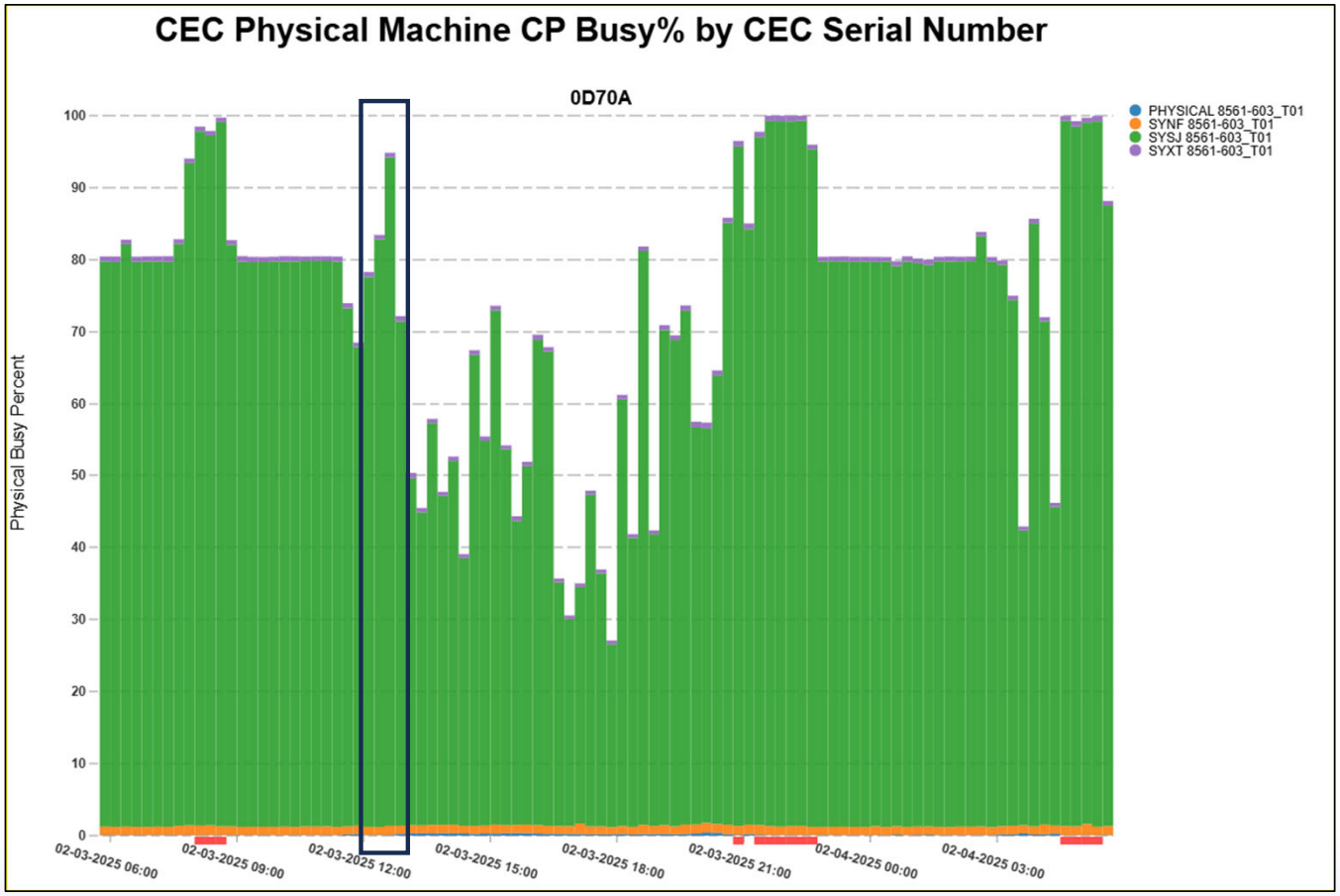
Machine Busy – zIIP Percent Busy



Naturally, when examining CPU usage, make sure you do a similar analysis of the zIIP engines.

In this example, we see the zIIPs have relatively minor usage, so for the rest of this presentation we will not discuss zIIPs much.

Physical Process CPU Utilization

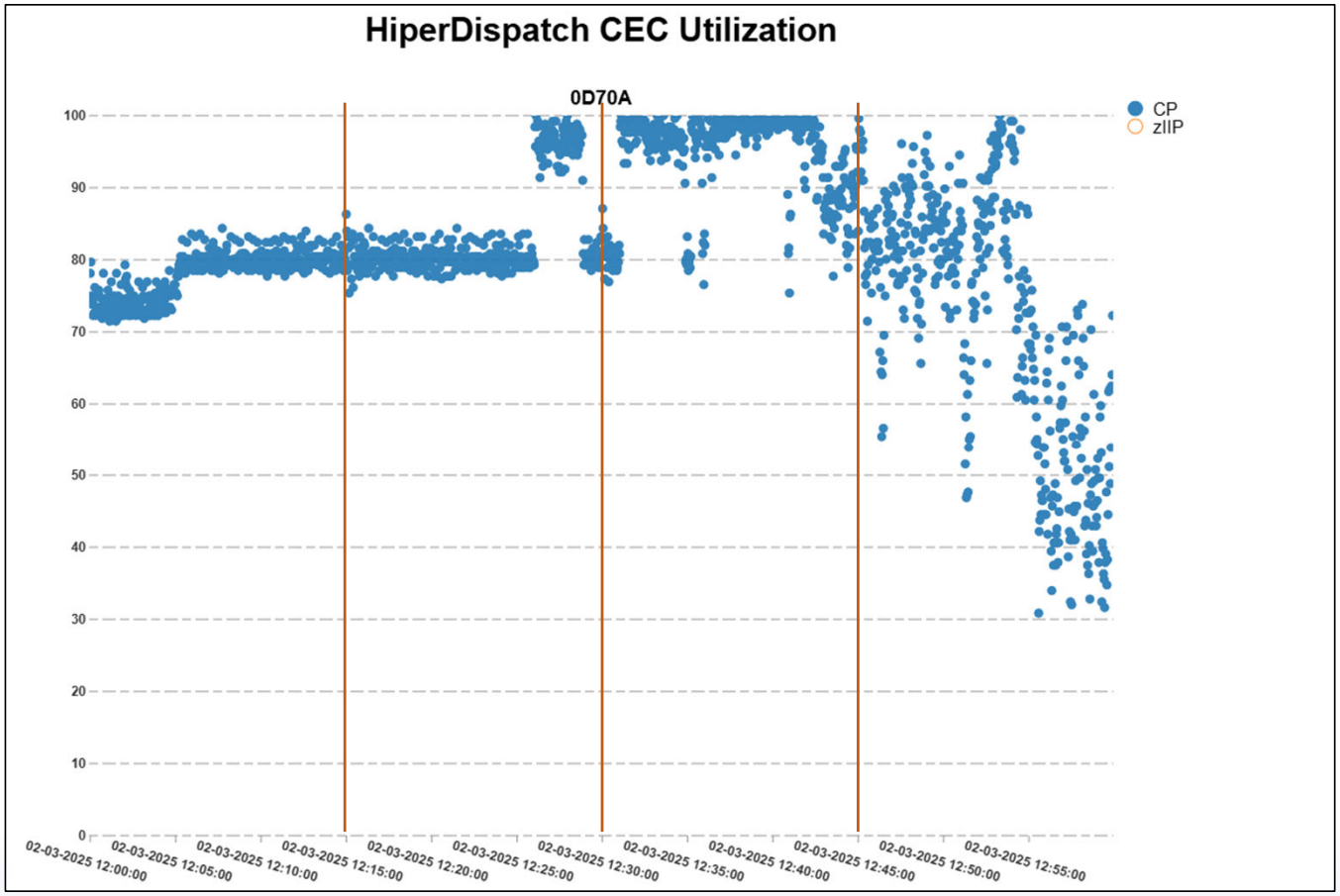


Also remember that utilization can be misleading.

In this example, each interval is 900 seconds long (i.e. 15 minutes). Remember, the average is for 15 minutes. There will be periods of time the utilization is lower than the interval average, and periods of time when it is higher.

Note the noon hour highlighted on this chart.

CEC Physical Busy % distribution

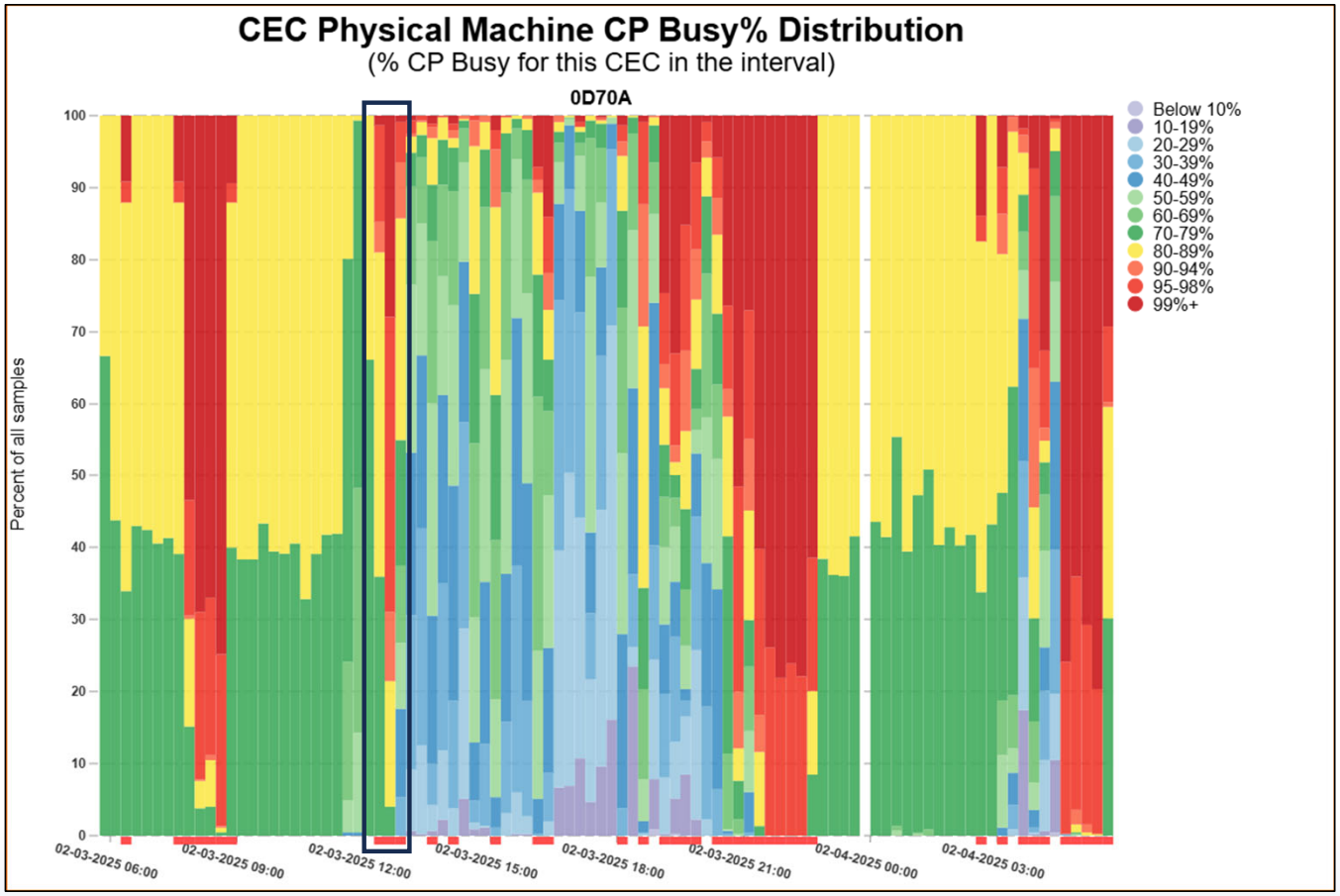


This chart shows the CEC physical busy every 2 seconds for the noon hour of the day for the previous CEC utilization chart.

Roughly note the CEC utilizations every 2 seconds.

Notice utilizations pegged near 100% busy, yet on the 15 minute CEC utilization chart we do not see any highlighted interval hit 100% CEC utilization.

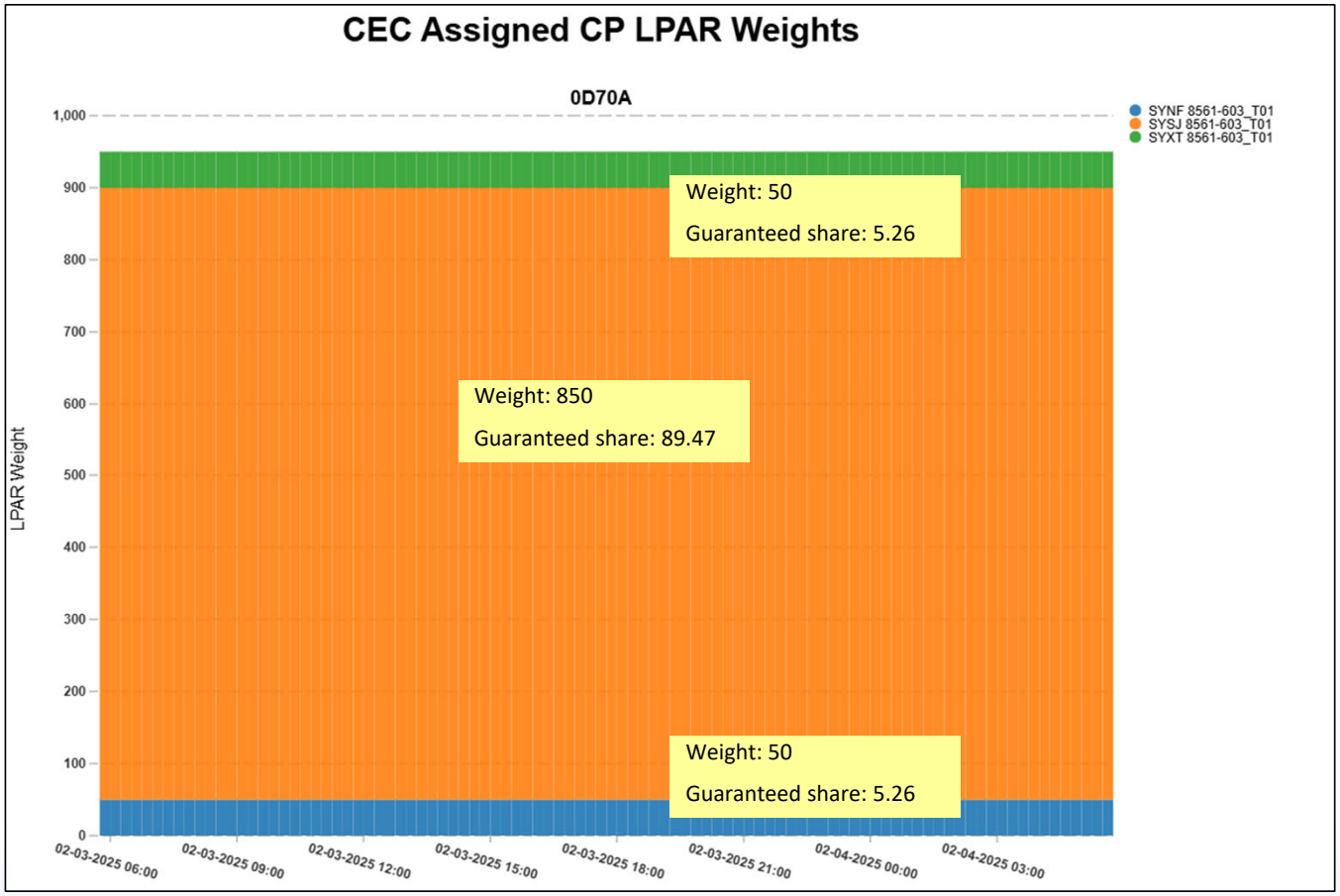
CEC Physical Busy % distribution



This chart shows a distribution of the CEC physical busy percentage over time.

This additional viewpoint of CEC utilization provides insights into how busy the CEC is for more granular periods of time.

Assigned LPAR Weights for CP Engines



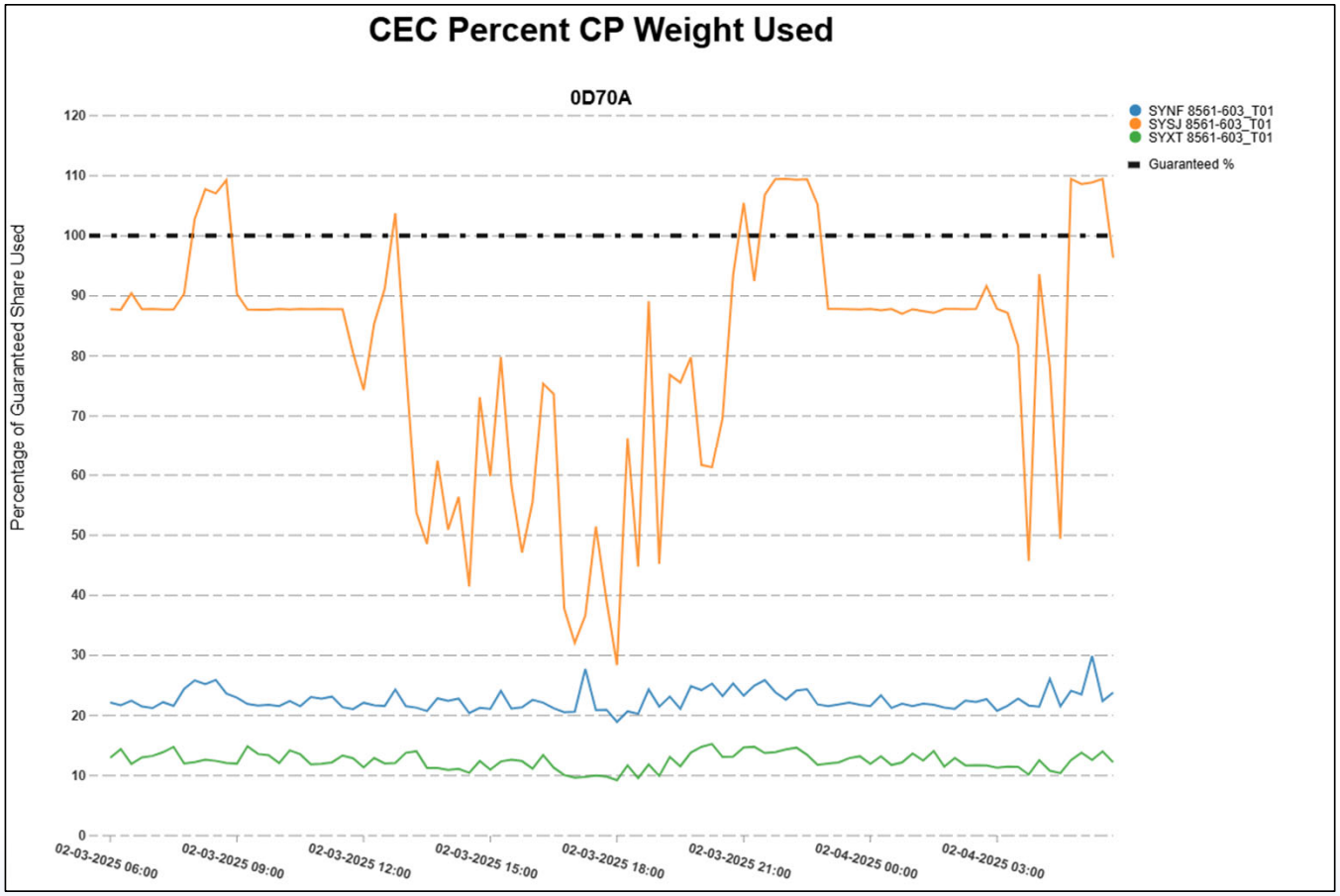
Always know your LPAR weights and guaranteed shares.

Cumulative weight – 950

The guaranteed share is the percentage of the processor that each LPAR will be guaranteed when the cumulative CPU demand by all LPARs is greater than the capacity available.

The capacity is not reserved for the LPAR. Instead, it is guaranteed based on demand.

Percentage of LPAR Weights being used



Determine how LPAR weights are influencing the CEC utilizations.

This charge shows the percentage of the weight used for each LPAR.

100% means that the LPAR is using exactly its guaranteed share.

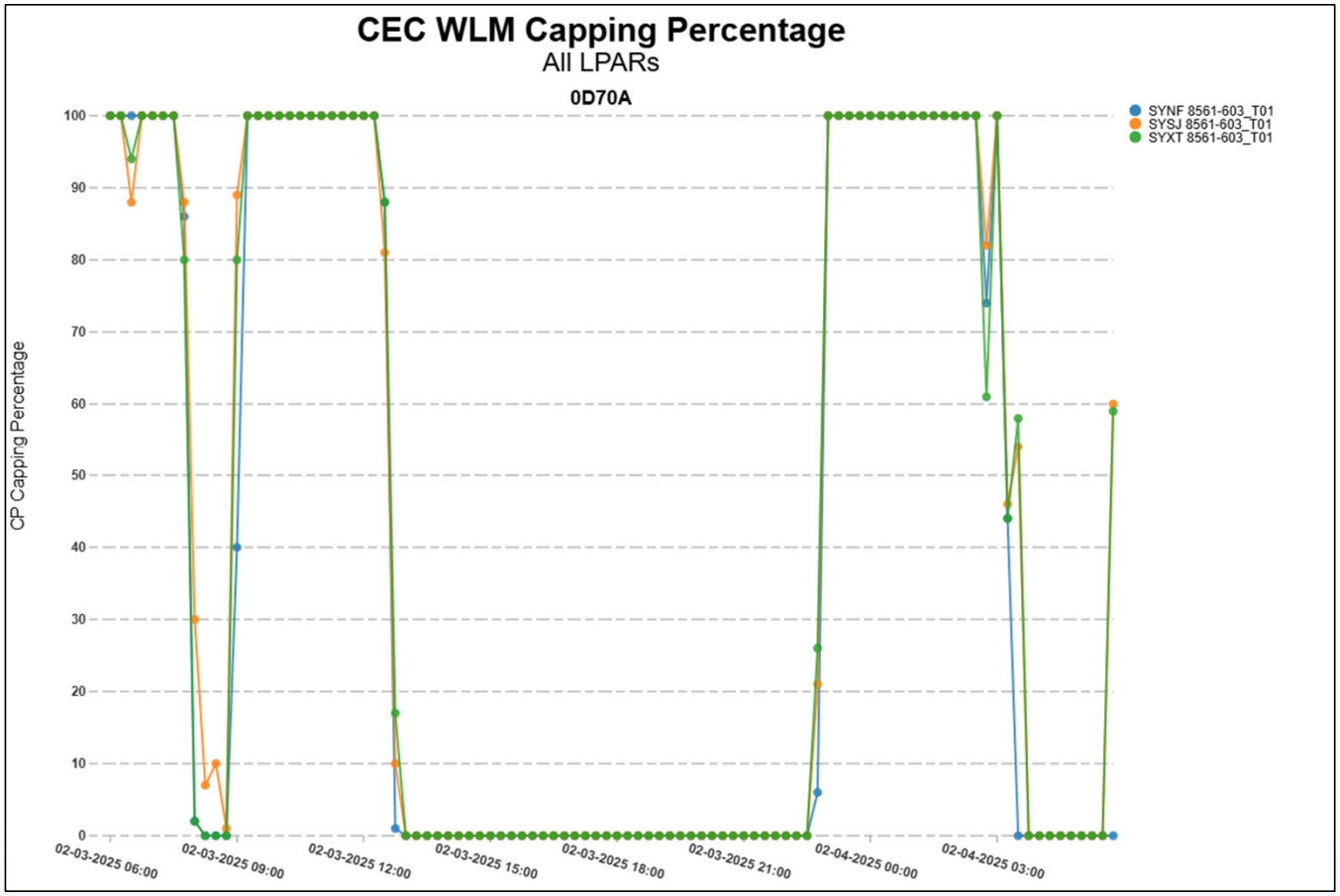
Below 100% means it is using less than its guaranteed share.

- Example: 20% means LPAR is using 20% of its guarantee share.

Above 100% means the LPAR is using more than its guaranteed share (because other LPARs have less demand than their guarantee share.

- Example: 110 means LPAR is using 10% more than its guarantee share.

Understand if LPARs are being capped

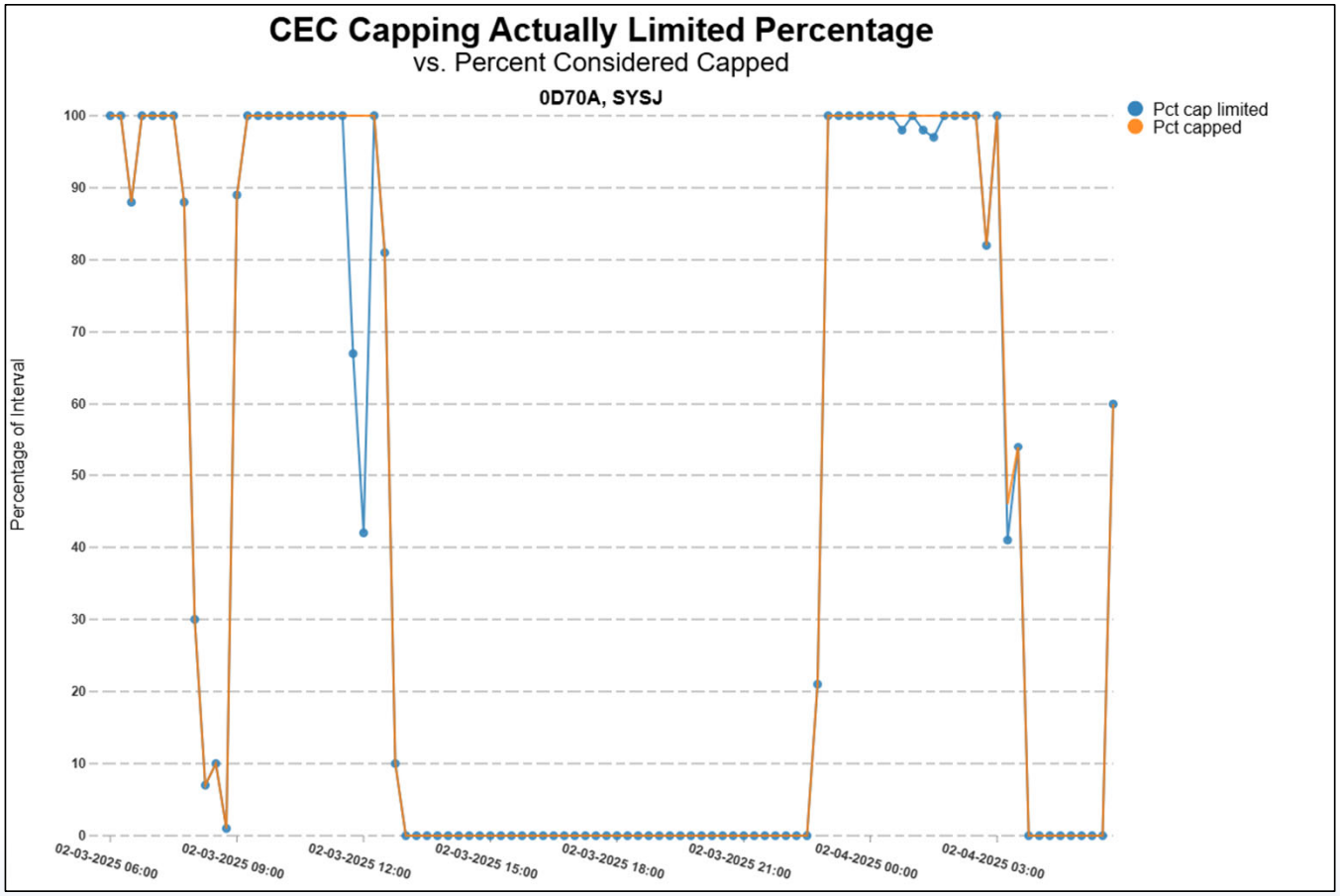


Part of processor consumption analysis is also understanding if processor is being limited to an LPAR due to capping.

Look at capping patterns.

In this example, we see all LPARs being capped (due to the group caps we saw earlier).

Understanding if capping is limiting an LPAR

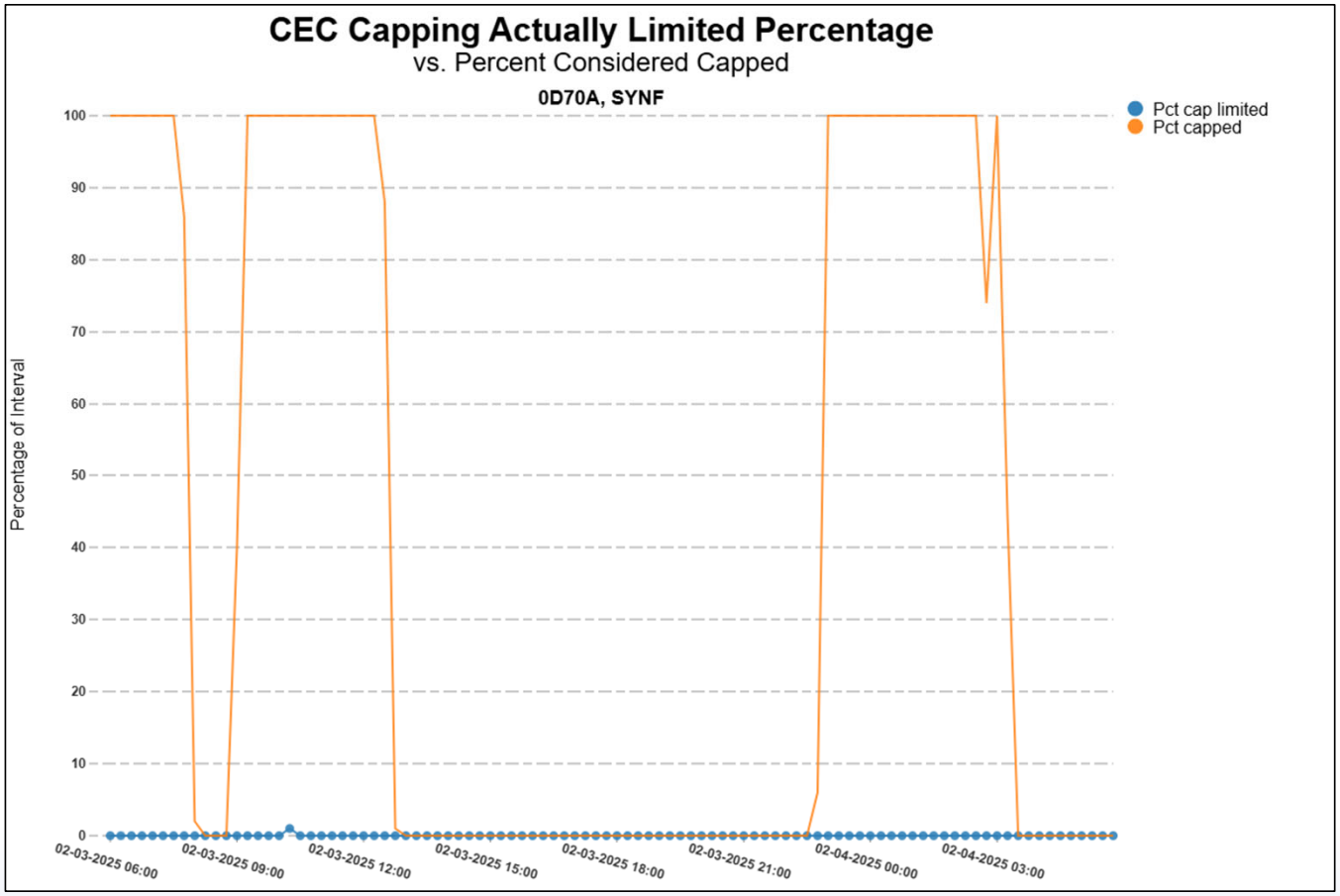


An LPAR could be capped, but if the LPAR does not have demand for CPU during the capping period, we probably care less about the capping.

So, when looking at capping, make sure you also determine if the LPAR is being limited by the Cap.

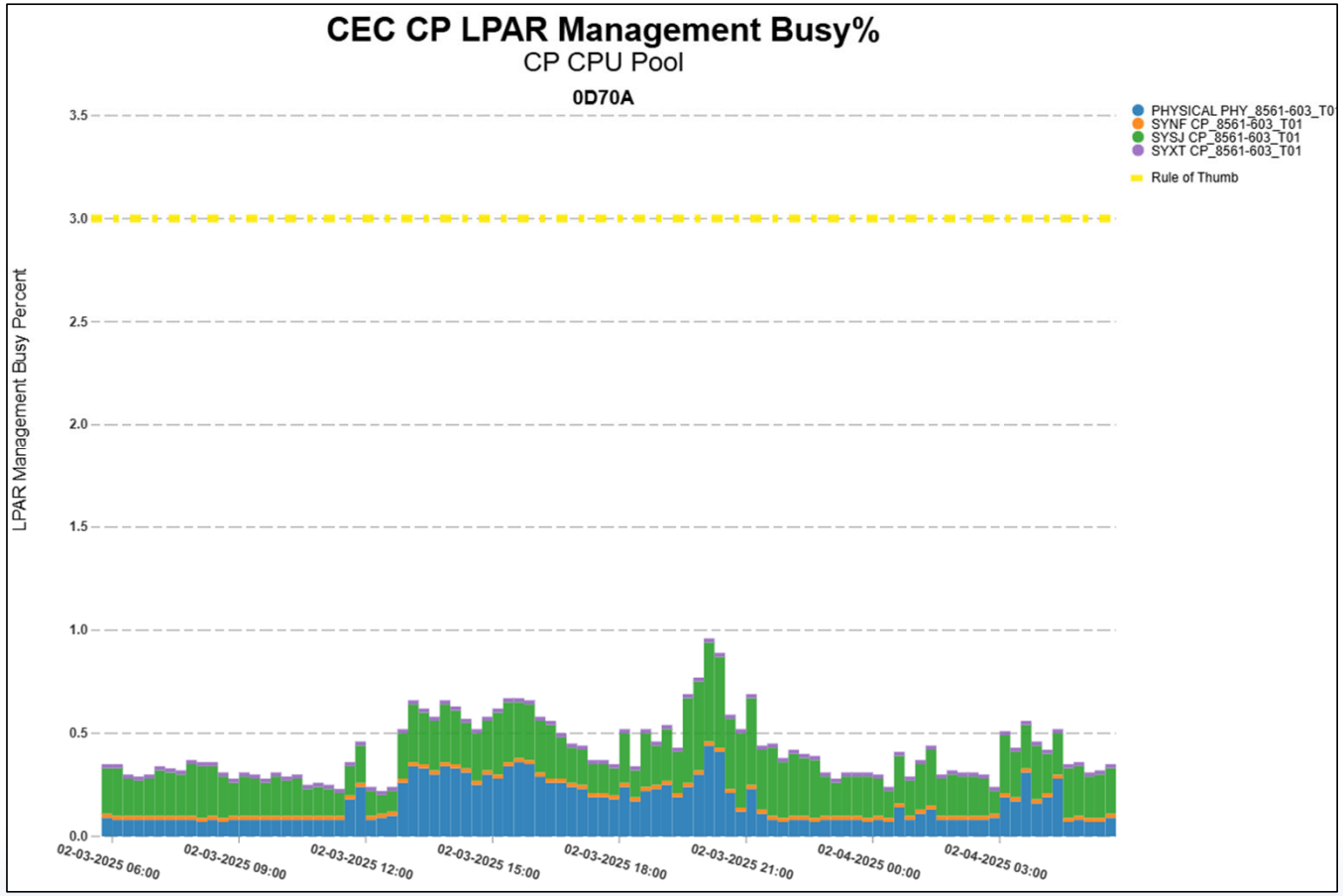
In this example, we see the LPAR is being limited by the capping most of the capping periods of time.

Understanding if capping is limiting an LPAR



In this example, we see that LPAR SYNF is being capped, but the workloads have so little demand for CPU that the percent capped limited is very low. In this case, we probably care less that the LPAR is capped.

Assigned LPAR Weights for CP Engines

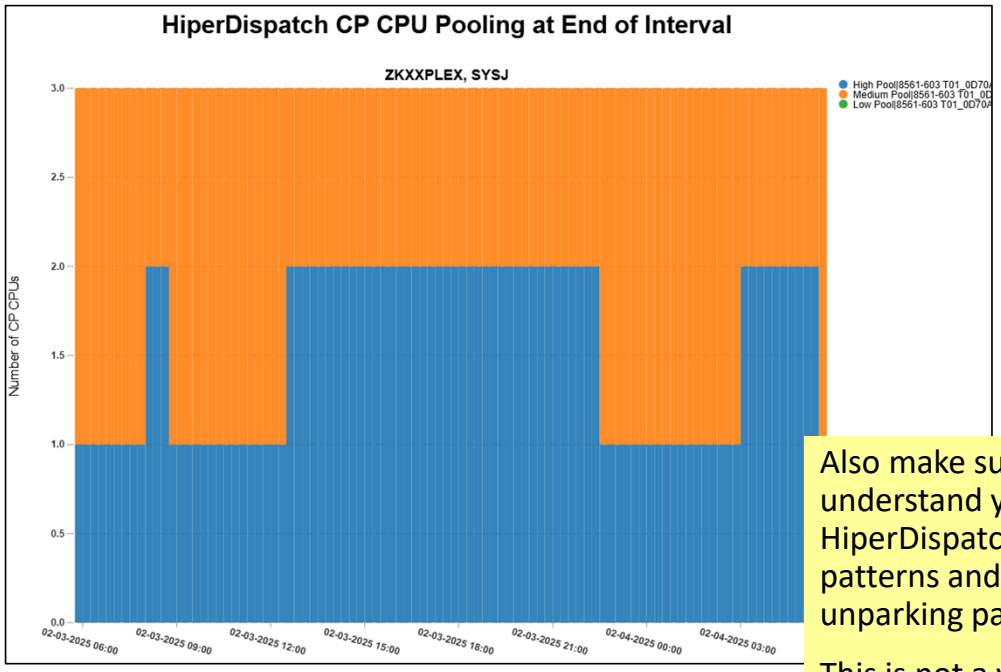


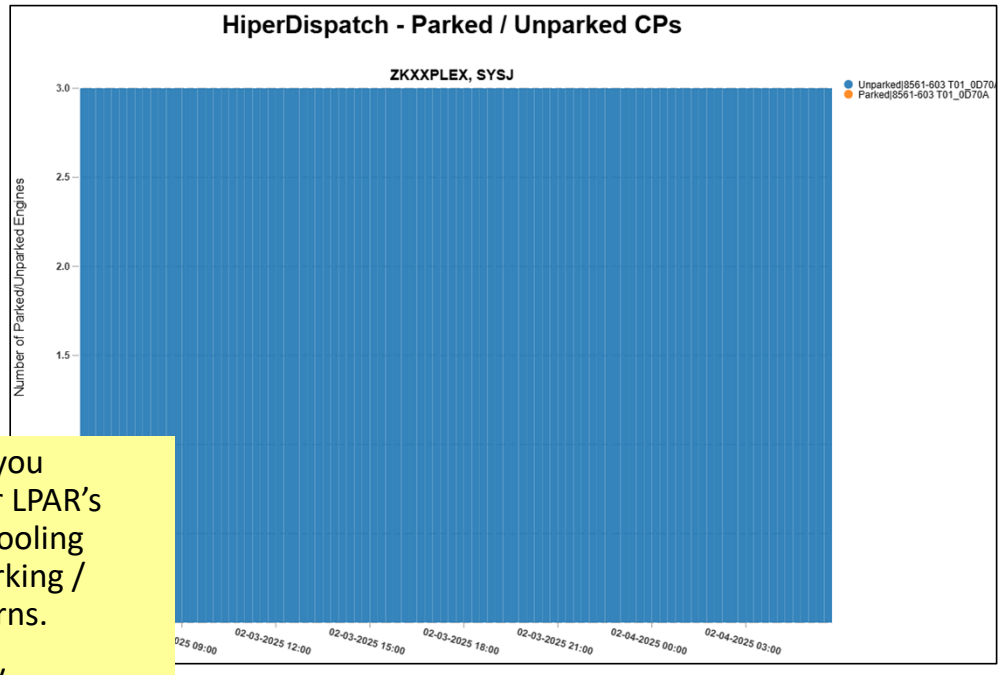
Processor consumption analysis means gaining insights into all the different areas where the CPU can be consumed.

This includes understanding LPAR Management busy percent. This is the percent of the CEC CPU consumed by PR/SM either to manage all LPARs or to do work on behalf of a particular LPAR.

Guideline: Combined LPAR Management% for CPs, zIIPs should be less than 3% of processor capacity.

HiperDispatch Parked and Unparked CPs

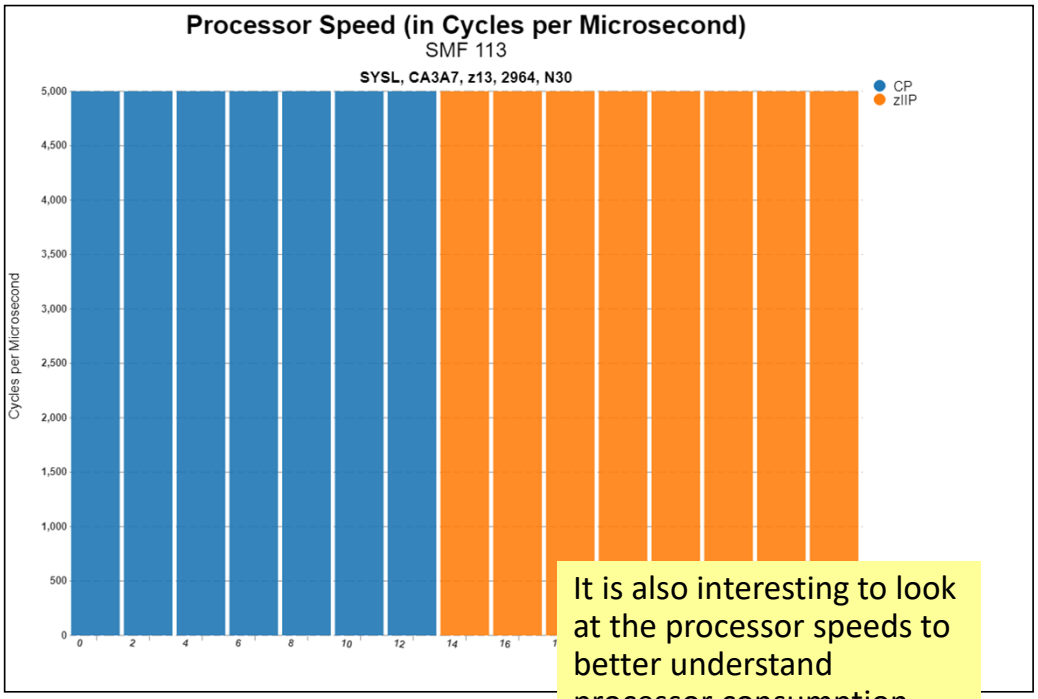




Also make sure you understand your LPAR's HiperDispatch pooling patterns and parking / unparking patterns.

This is not a very interesting example but note the change in pooling when caps are enforced.

Example of CPU Speed



It is also interesting to look at the processor speeds to better understand processor consumption.

Full speed CPs and zIIPs

Knee Capped CPs

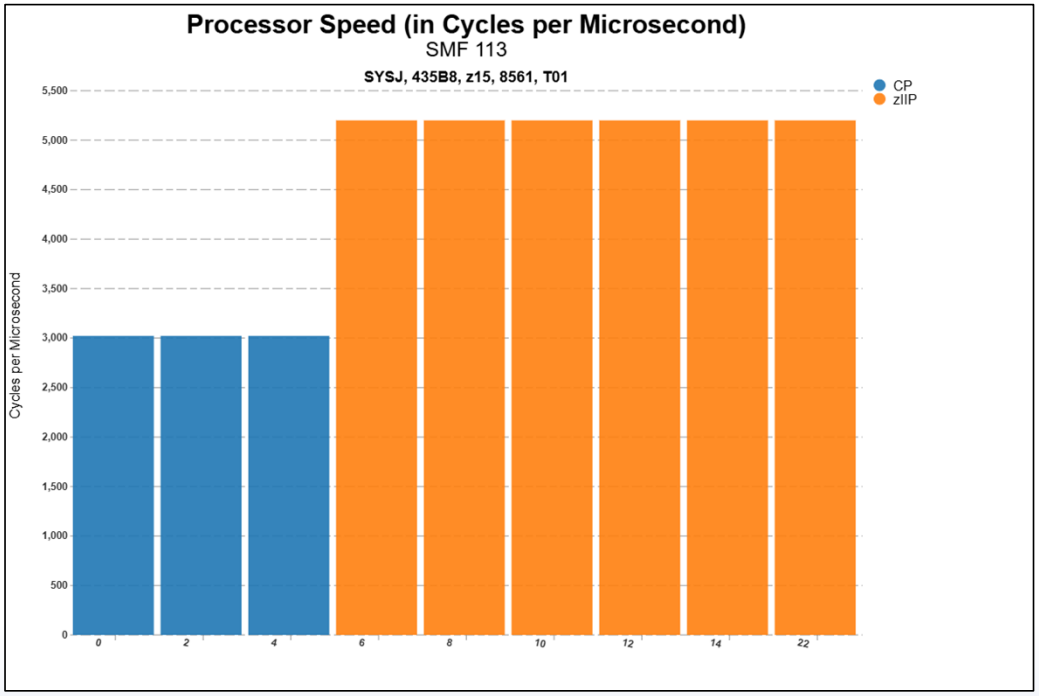


Chart created at www.pivotor.com

See Part 2 of this presentation for a continuation…

Session summary

- Many areas need to be examined when decomposing CPU consumption
  - This presentation just discussions some of the many areas

- Basic Processor Consumption Analysis
  - Part 1: Decomposing CPU Consumption
    - At Machine Level
  - Part 2: Decomposing CPU Consumption
    - At LPAR Level
    - At WLM workload Level
    - Looking at CPU Dispatching Priorities
    - Looking at Latent Demand

- Remember, there is much more to be looked at

CPU Measurement Reports Processing/Discussion Offer !!!

- Special Reports Offer!
  - See your Processor measurements in chart and table format
  - Please contact us for instructions for sending raw SMF data
    - Send an email to contact@epstrategies.com
  - Deliverable: Dozens of processor based reports (charts and tables)
    - CPU - Machine Level Analysis
    - CPU - LPAR Level Analysis
    - CPU - LPAR SMT Analysis
    - CPU - HiperDispatch CPU Activity
    - CPU - SMF 113 Processor Counters
    - WLM - Workload Utilization Analysis
    - MSU Analysis
    - And much more!

One-on-one phone call to explain your measurements

www.pivotor.com