

## Remove the Hocus-Pocus from zIIPs and Costing from System z

**Bernie O'Connor**  
*Anixter Inc.*

Db2 for z/OS

Tuesday, April 30th, 10:15 – 11:15



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Bernie O'Connor:

- 25-year career with Anixter
- Currently Director of Information Technology
- Other roles included:
  - DBA, DBA Manager
  - Technical Architecture
  - M&A and Divestitures
  - BI/DW/Analytics, Pricing Analytics, Computer OPS, System Programmers and Admins, Web Services
  - Other Industries: Insurance, Banking, Publishing, Manufacturing

IDUG Participation: IDUG Hall of Fame Speaker, NA Conference Chair (2005 – Denver), IDUG President (2007-2008)

User Groups: MWDUG, IDUG, WindySphere (and IBM Champion)

Contact – berniedbaoconnor@gmail.com

## Agenda

- “Can Someone Please Explain to Me How Costs Work on z/OS?”
- Anixter’s experience with zIIPs: How does this work?
  - MIPS, MSUs, VWLC, a little history on zIIPs for Java, Distributed, BI/DW
- Tips for smoothing MSU consumption
- Db2 Native SQL Stored Procedures: A Tale of Two Applications
- Other Opportunities Anixter Addressed:
  - Tomcat on the mainframe
  - CICS and Threadsafe – an opportunity we should have taken in 2001
    - For more on CICS and Db2, see Dave Raiman’s presentations
- Road not taken: zNALC and why this could be a good deal

## Anixter Inc.

- Anixter is a leading global distributor of Network & Security Solutions, Electrical & Electronic Solutions and Utility Power Solutions. We help build, connect, protect and power valuable assets and critical infrastructures.
- Anixter's 8,500 employees speak 35 languages in over 50 countries
- Anixter reported \$7.9 billion in revenue for the year ending December 31, 2017
- For more information, please see [www.anixter.com](http://www.anixter.com)

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Anixter is a global distributor with three major lines of business. As a distributor, Anixter gives about 1% of top line revenue to IT. The 1% funding level is fairly common inside this distribution vertical. That means we're very cost-conscious, and we try to make decisions that maximize benefits while minimizing costs.

## Bernie O'Connor

- With Anixter for over 25 years as Director of Information Technology, DBA, DBA Manager, Technical Architecture, M&A and Divestitures, BI/DW/Analytics, Pricing Analytics, Computer OPS, System Programmers and Admins, Web Services.
- Other industries: Banking, Insurance, Publishing, Manufacturing.
- Bernie's a member IDUG's Speakers Hall of Fame, was NA Conference Chair (2005 – Denver), IDUG Board Member (2004-2009) and IDUG President (2007-2008).
- Bernie is also active in the Midwest Db2 Users Group, WindySphere, and the Evanta Chicago CDO conference.

Anixter is a global distributor with three major lines of business. As a distributor, Anixter gives about 1% of top line revenue to IT. The 1% funding level is fairly common inside this distribution vertical. That means we're very cost-conscious, and we try to make decisions that maximize benefits while minimizing costs.

## Lowering Cost is Top Priority

- Top Priority: Lower IT costs / Business costs
  - Source: UBM survey of 400 technology decision makers March 2017

### Innovating Through Technology

What are the primary ways your organization plans to innovate in 2017?



Note: Maximum of three responses allowed  
 Data: UBM survey of 400 technology decision makers, March 2017

In case you thought it was just you, it's not: almost everyone ranks lowering IT costs and business costs as a top priority. Although the Digital Transformation and Customer Experience investments are very real, the relentless focus on cost reduction continues.

Can someone please explain  
to me how we're saving  
money on zIIPs?



This question about saving money on zIIPs is an actual question from our VP of Finance assigned to IT. Prompted by the continuing interest of Finance to control costs, the question led to a deeper dive into the guts of our AWLC

## It was a reasonable question... Finding the answer was a bit tricky

**What Finance wanted:**

**Full Price**  
**- Discounts**

-----

**Discounted Price**

**What we had:**

~~**Full Price**~~  
~~**- Discounts**~~

-----

**Discounted Price**

*To find our Discounts, we needed to work backwards using our CP and zIIP workloads and our Discounted Price to determine our Discounts and Full Price.*

Fortunately for us, the Discounted Price relates directly to the CP workload, that is the work done on the General Purpose Engines. Once we determine the value of the CP workload, we can correlate the zIIP workload and determine its value. Of course, we have to find a way to correlate the zIIP workload to the CP workload! It's all there somewhere in the SMF data....

To create a common understanding between Finance and IT, we have a lot of ground to cover first.

## The Burning Question: How Can I Prove that our zIIPs really do save us money?

- We see workload being routed to the zIIP engines
- We have evidence of savings from IBM and the ecosystem of ISVs
- We know what we paid for our zIIPs
- But in our shop, with our workloads:
  - How do we establish a financial benefit?
  - How much money are we saving?
  - Are DB2 Native Stored Procedures saving us money?

Given the drive to cut costs, IT needs to demonstrate savings not in terms of CPU or Memory or Storage or Network capacity, but rather in terms of currency, in terms of money. This is why we're here today.

This presentation will "set the table" for a discussion between IT specialists, who usually talk in terms of CPU/Memory/Storage/Network, and Finance professionals, who speak in terms of currency.

## Good News/Bad News Dilemma: Both IT and Finance speak Performance and KPIs... using different UOMs

- The Good News: Both IT and Finance focus on performance and KPIs
- The Bad News: They use different Units of Measure
  - Technicians focus on MIPS, CPU seconds, throughput, capacity, availability.
    - Timerons for relative improvements in SQL tuning
    - 5 Nines for Availability
    - PB, TB, GB for Storage and Gb for Network
  - Finance professionals focus on:
    - **Dollars (or other currency)** – whether Capex or Opex
- IS Technicians need to **translate** metrics into **Dollars** for Finance

So, we IT professionals need to translate our metrics in to the one metric that counts for Finance professionals: Dollars (or other currency)

The following is a familiar example that illustrates just how far DBAs can normally be from dollars while discussing “cost”:

<http://www.dbatodba.com/db2/how-to-do/how-is-timeron-calculated-and-what-is-it/>

How is TIMERON calculated and what is it ?

A timeron is a cost estimate calculated by DB2 based on an evaluation of the resources that will be used. IBM uses a proprietary algorithm for calculating timeron values that estimates the total cost as a weighted sum of the I/O cost and processor cost.

A weighting factor is applied to both the I/O cost estimate and CPU cost estimate to apply more (or less) emphasis to I/O versus CPU. So, if I/O were given a weighting factor of 1 and CPU given a weighting factor of 0.5, CPU cost would be weighted at half of the I/O cost. Actually, this weighting factor is the default used by DB2.

To determine the appropriate emphasis, DB2 examines the CPU model being used. Based upon this value, specific weighting factors are applied. Of course, the DB2 optimizer will utilize the statistics, indexes, filter factors, and other information at its disposal to estimate I/O and CPU cost (before applying the weighting factors).

<http://www-1.ibm.com/support/docview.wss?uid=swg21207055>

## The Goal of this Presentation: To Prepare you and the VP of Finance for a Conversation

- Create a Common Understanding of Compute and Costs
- Translate IT Metrics into Money
- Demonstrate how the zIIPs, and other efforts, really save money
- Provide References for Further Research and Discussion
- Get you the Credit You Deserve for Making these Good Choices
- ...Maybe even get you a bonus...
  - *Hey, it could happen!*

## The Background We Need to Translate zIIP workloads into \$ MIPS, MSUs, VWLC, Sysplex Licensing, SCRT, and zIIPs

- MIPS
- MSUs
- VWLC
- Sysplex Licensing
- SCRT
- zIIPs

***“The beginning of wisdom is the definition of terms.”***  
***- Socrates (probably apocryphal)***

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Definition of these terms gets IT and Finance professionals “on the same page” so that a clear discussion can ensue.

FYI – Anixter has a flavor of VWLC called AWLC – short for Advanced Workload License Charges

“When you elect AWLC for a particular operating system on a CPC, all of that operating system family’s sub-capacity eligible MLC products are licensed under AWLC on that CPC. Non-sub-capacity eligible MLC products are considered FWLC products and their pricing is a fixed, monthly charge unrelated to the capacity of the CPC on which they run.

“ [https://www.ibm.com/support/knowledgecenter/en/SSLTBW\\_2.3.0/com.ibm.zos.v2r3.e0zi100/awlcmetric.htm](https://www.ibm.com/support/knowledgecenter/en/SSLTBW_2.3.0/com.ibm.zos.v2r3.e0zi100/awlcmetric.htm)

<https://www.ibm.com/it-infrastructure/z/software/pricing-licensing>

## MIPS – Million Instructions Per Second

- Million instructions per second, a measure of a computer's central processing unit performance
  - Source: <https://en.wikipedia.org/wiki/MIPS>
  - *Some other numerical values include:*
    - *thousand/kilo instructions per second (TIPS/kIPS)*
    - *billion instructions per second (GIPS)*

Pretty straightforward definition, with a reference to give our Finance professionals. These MIPS are the typical basis for licensing full capacity for a CEC or for “MIPS on the floor.”

## MSU – Million Service Units

- **Definition of: MSU.** (Million Service Units) An **IBM** measurement of hardware performance. One **MSU** is roughly equivalent to six million mainframe instructions per second (6 MIPS). **IBM software** is priced according to the power of the hardware in MSUs that it runs in.
  - *Source: MSU Definition from PC Magazine Encyclopedia*
    - <https://www.pcmag.com/encyclopedia/term/61390/msu>
  - *Note: The equivalency between one MSU and 6 MIPS is a point-in-time example from PC Magazine. Later slides will demonstrate Anixter's actual experience.*

MSUs are the basis for sub-capacity licensing. MSUs can be correlated to MIPS, and IBM has control over this metric. The following slide shows my tied to

Some MSU Calculations of interest:

[https://www.ibm.com/support/knowledgecenter/en/SSUFR9\\_1.2.0/com.ibm.swg.ba.cognos.zcap\\_sol.1.2.0.doc/c\\_zcap\\_sol\\_msu\\_calculations\\_sca.html](https://www.ibm.com/support/knowledgecenter/en/SSUFR9_1.2.0/com.ibm.swg.ba.cognos.zcap_sol.1.2.0.doc/c_zcap_sol_msu_calculations_sca.html)

## Why Both Measures: MIPS and MSU? A Customer's View

- **Keep IBM Mainframes competitive with a tuning knob for TCO**
- **Detach the direct relationship between MIPS and Software Charges**
- **Create new variable pricing models that are proportional to MIPS**
  - **without disrupting existing MIPS-based contracts for IBM and ISVs**
  - **IBM, BMC, CA, Compuware, etc.**

MSU Calculations of interest:

[https://www.ibm.com/support/knowledgecenter/en/SSUFR9\\_1.2.0/com.ibm.swg.ba.cognos.zcap\\_sol.1.2.0.doc/c\\_zcap\\_sol\\_msu\\_calculations\\_sca.html](https://www.ibm.com/support/knowledgecenter/en/SSUFR9_1.2.0/com.ibm.swg.ba.cognos.zcap_sol.1.2.0.doc/c_zcap_sol_msu_calculations_sca.html)

## Determining the relationship between MIPS and MSU

### Reviewing Anixter's Mainframes since 2006: z9, z10, BC12

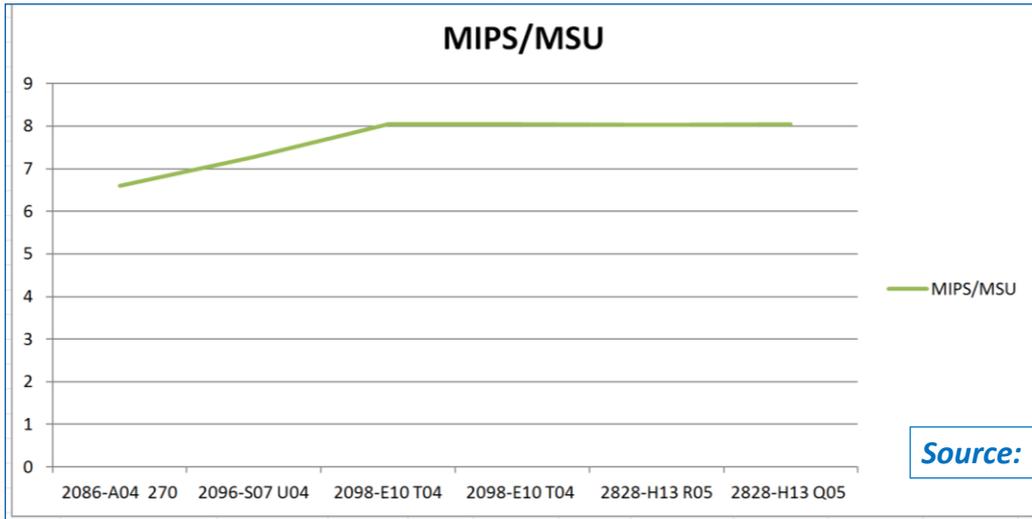
	<u>CEC</u>	<u>Model</u>	<u>Installed</u>	<u>Procs</u>	<u>zIIPs</u>	<u>MIPS</u>	<u>MSU</u>	<u>MIPS/MSU</u>
z9	1	2096-S07 U04	Dec-07	4	0	1004	138	7.2753623
z9	2	2086-A04 270	Apr-06	2	0	707	107	6.6074766
z10	1	2098-E10 T04	Jun-10	4	3	1151	143	8.048951
z10	2	2098-E10 T04	Apr-10	4	3	1151	143	8.048951
BC12	1	2828-H13 R05	Feb-15	5	7	1710	213	8.028169
BC12	2	2828-H13 Q05	Feb-15	5	7	1530	190	8.0526316

- Two-way Data Sharing in a Parallel Sysplex Environment
- Two CECs, each with Two LPARs
- ASYS and BSYS are PROD
- CEC1 has LPARS ASYS and CSYS
- CEC2 has LPARS BSYS and DSYS

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MIPs/MSUs

## MIPS per MSU over the years from z9 to z10 to BC12



Source: Anixter

Year Installed: **2006 \* 2007 \* 2010 \* 2010 \* 2015 \* 2015**

MIPs/MSUs: Charting the gradual increase from about 6 to 8 MIPS per MSU in our actual experience.

## VWLC – Variable Workload License Charge

(1 | 2)

### What is it?

- ***VWLC products will include z/OS and a select set of IBM's middleware products.*** All VWLC products will be IBM License Manager enabled for active license management and give customers the opportunity to define a product workload that is less than the total capacity of the zSeries 900 machine. ***This product defined capacity (in MSUs) will be the basis for the product's software charge.*** Each LPAR in which VWLC products run has its own defined capacity specified as part of an LPAR configuration. The z/OS Workload Manager manages ***average*** resource requirements of the ***workload across a rolling four-hour period.***

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#### Variable Workload License Charge (vwlc) Products

VWLC products will include z/OS and a select set of IBM's middleware products. All VWLC products will be IBM License Manager enabled for active license management and give customers the opportunity to define a product workload that is less than the total capacity of the zSeries 900 machine. This product defined capacity (in MSUs) will be the basis for the product's software charge. Each LPAR in which VWLC products run has its own defined capacity specified as part of an LPAR configuration. The z/OS Workload Manager manages average resource requirements of the workload across a rolling four-hour period. The IBM License Manager compares the sum of the defined capacity values of all LPARs in which a VWLC product is running with the customer's certificate capacity for that product.

The benefits that customers will derive from VWLC products include the following:

**Pay only for what you need** - For example, if a customer runs a workload that uses one or more VWLC products in an LPAR with a defined capacity of 100 MSUs on a zSeries 900 or equivalent machine that has a capacity of 150 MSUs, then the customer's charge for those VWLC products will be based on 100 MSUs, not the full capacity of the machine. If the customer later chooses to deploy a new workload on the same machine that uses some of the same VWLC products, the customer will see an increase in software charges for only the VWLC products used in the new workload.

**Buy additional hardware without increasing your software bill** - If a customer wants to buy additional hardware capacity for future workload requirements or spikes, but has no immediate plans to allocate the additional capacity for use by current workloads, the customer's existing VWLC product charges will not increase. Only when the customer allocates some of the additional hardware capacity to be used by a new or existing workload, will the customer see a change in his software charges for VWLC products.

**Flexibility to manage e-business spikes** - As described above, if a customer runs a workload which uses one or more VWLC products in an LPAR with a defined capacity of 100 MSUs, this MSU value represents the average capacity used by the workload during a rolling four-hour period and is the basis for the software charges. The workload will be allowed to spike above the 100 MSUs as long as the workload does not on average exceed the defined capacity during any four-hour period. Any available capacity will be used to respond to these workload spikes without effecting the software charges for the VWLC products.

[https://www-01.ibm.com/common/ssi/cgi-bin/ssialias?infotype=an&subtype=ca&appname=gpatteam&supplier=877&letternum=ENUSZA00-0318#Header\\_23](https://www-01.ibm.com/common/ssi/cgi-bin/ssialias?infotype=an&subtype=ca&appname=gpatteam&supplier=877&letternum=ENUSZA00-0318#Header_23)

## VWLC – Variable Workload License Charge (2 | 2)

### Why use it?

- **Pay only for what you need** - For example, if a customer runs a workload that uses one or more VWLC products in an LPAR with a defined capacity of 100 MSUs on a zSeries ... machine that has a capacity of 150 MSUs, then the customer's charge for those VWLC products will be based on 100 MSUs, not the full capacity....
- **Buy additional hardware without increasing your software bill**
- **Flexibility to manage e-business spikes**
  - *Source:*
    - *IBM Announcement Letter No. ZA00-0318 dated October 03, 2000*
    - *(emphasis added)*

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#### Variable Workload License Charge (vwlc) Products

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The benefits that customers will derive from VWLC products include the following:

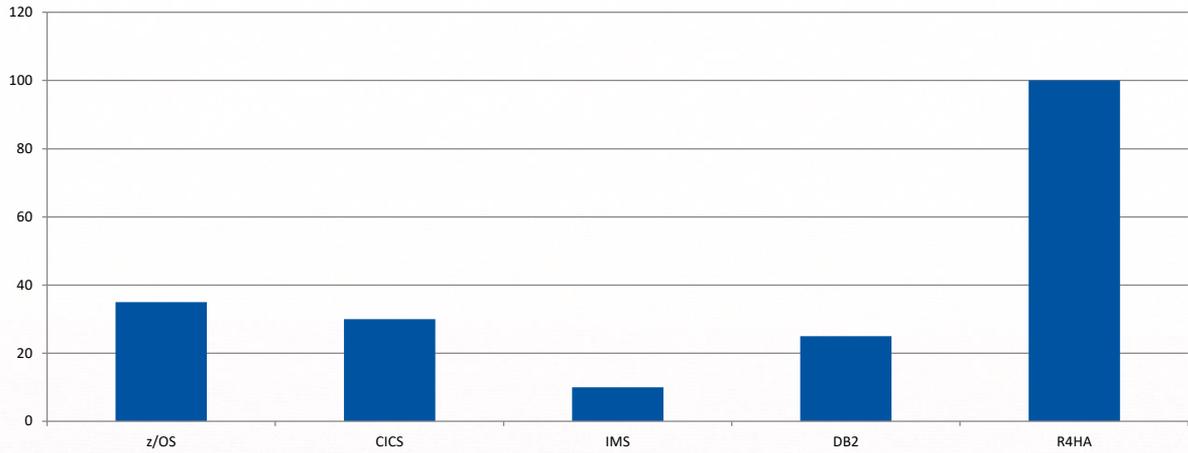
**Pay only for what you need** - For example, if a customer runs a workload that uses one or more VWLC products in an LPAR with a defined capacity of 100 MSUs on a zSeries 900 or equivalent machine that has a capacity of 150 MSUs, then the customer's charge for those VWLC products will be based on 100 MSUs, not the full capacity of the machine. If the customer later chooses to deploy a new workload on the same machine that uses some of the same VWLC products, the customer will see an increase in software charges for only the VWLC products used in the new workload.

**Buy additional hardware without increasing your software bill** - If a customer wants to buy additional hardware capacity for future workload requirements or spikes, but has no immediate plans to allocate the additional capacity for use by current workloads, the customer's existing VWLC product charges will not increase. Only when the customer allocates some of the additional hardware capacity to be used by a new or existing workload, will the customer see a change in his software charges for VWLC products.

**Flexibility to manage e-business spikes** - As described above, if a customer runs a workload which uses one or more VWLC products in an LPAR with a defined capacity of 100 MSUs, this MSU value represents the average capacity used by the workload during a rolling four-hour period and is the basis for the software charges. The workload will be allowed to spike above the 100 MSUs as long as the workload does not on average exceed the defined capacity during any four-hour period. Any available capacity will be used to respond to these workload spikes without effecting the software charges for the VWLC products.

[https://www-01.ibm.com/common/ssi/cgi-bin/ssialias?infotype=an&subtype=ca&appname=gateam&supplier=877&letternum=ENUSZA00-0318#Header\\_23](https://www-01.ibm.com/common/ssi/cgi-bin/ssialias?infotype=an&subtype=ca&appname=gateam&supplier=877&letternum=ENUSZA00-0318#Header_23)

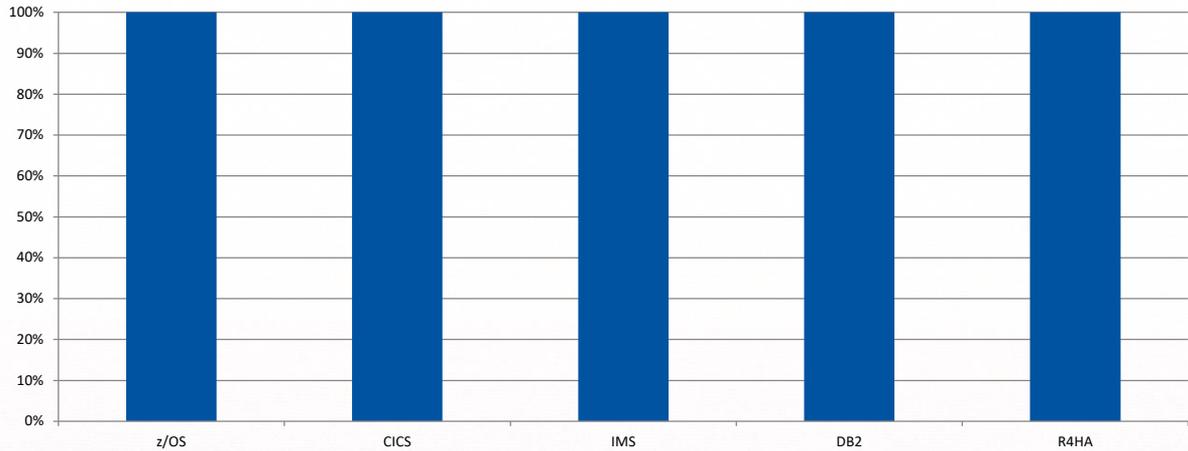
## VWLC – How Customers Often Think It Works Example is Rolling 4-Hour Average of 100 MSUs



**On first blush, customers often think that the individual software products are charged at their percentage contribution to the R4HA (aka 4HRA).**

## VWLC – How it Actually Works

### Each VWLC Product is Charged at the R4HA/4HRA Capacity



In actuality, each of the VWLC products is charged at 100% of the R4HA.

There is a savings, 100 MSUs instead of 120, for example. However, aside from a few edge cases (like COBOL being in only the LPAR that has compiles), all MLC is at the same peak R4HA.

## Sysplex Pricing Treats Anixter's 2 CECs as if they were 1 CEC Otherwise...

**\$50,295** for  
286 MSUs total  
Using  
Sysplex Pricing

**\$66,005** for  
143 MSUs each CEC  
still 286 MSUs total  
Without Using  
Sysplex Pricing

Product	Description	MSU's to be priced	3 MSU Base	4- 45 MSU Lev0	46- 175 MSU Lev1	176- 315 MSU Lev2	316- 575 MSU Lev3	Total Monthly Charge
<b>Price as of Jan 1, 2015</b>								
5605DB2	DB2 V10	286	5,469.36	303.68	150.80	112.32	85.28	\$50,295
5605DB2	DB2 V10	0	5,469.36	303.68	150.80	112.32	85.28	\$0
<b>Total</b>								<b>\$50,295</b>
<b>Price as of Jan 1, 2015</b>								
5605DB2	DB2 V10	143	5,469.36	303.68	150.80	112.32	85.28	\$33,002
5605DB2	DB2 V10	143	5,469.36	303.68	150.80	112.32	85.28	\$33,002
<b>Total</b>								<b>\$66,005</b>

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<https://www.ibm.com/it-infrastructure/z/software/pricing-licensing>

The first 3 MSUs are much more expensive than subsequent MSUs, and MIPS 4-45 step down from the first 3, and so on.

Sysplex Pricing favorably prices MSUs from additional CECs in the Sysplex as if they were all part of 1 CEC, and thus avoiding the pricier 3 MSU Base, etc., on the additional CECs.

## SCRT – Sub-Capacity Reporting Tool

- **SCRT**
- Generate sub-capacity reports or multiplex reports.
- You must submit SCRT report(s) to IBM each month in order to qualify for sub-capacity or multiplex charges.
- Input: Uses SMF records as input
- Output:
  - Weekly and monthly files
  - A Sub-Capacity Report filed monthly with IBM
- IBM Responds with a Confirmation

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For information on SCRT and other Pricing Tools, please see:

<https://www.ibm.com/it-infrastructure/z/software/pricing-tools>

### **Also of interest is the Sysplex Calculator**

No-charge, downloadable tool to help you assess whether your Parallel Sysplex qualifies for aggregation. Will analyze Systems Measurement Facility (SMF) data from two or more machines and produce a report describing which Parallel Sysplex each machine belongs to. For more information, please see:

<https://public.dhe.ibm.com/common/ssi/ecm/zs/en/zsl03523usen/zsl03523usen.pdf>

## SCRT – Sub-Capacity Reporting Tool

- **SCRT Include Card**

INCLUDE(70:79,89)

- SMF Type 70, subtype 1 Records have CPU Activity
- SMF Type 89 Records have Product Utilization

- **To Exclude Program Bugs, Loops in an Appeal to IBM:**

EXCLUDE CPC=2828-60F4B,IMAGE\_ID=C2P1,  
START=2017/09/14/22,RESUME=2017/09/15/05

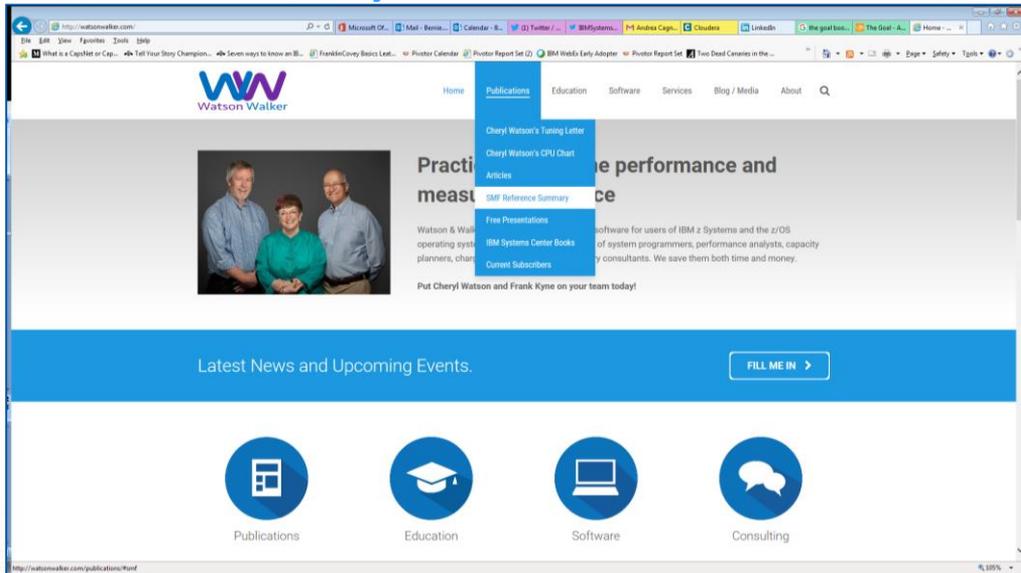
For information on SCRT and other Pricing Tools, please see:

<https://www.ibm.com/it-infrastructure/z/software/pricing-tools>

For additional information on SMF records, Cheryl Watson has a great SMF Record Summary at <http://watsonwalker.com/>

[https://www.ibm.com/support/knowledgecenter/en/SSLTBW\\_2.1.0/com.ibm.zos.v2r1.e0zi100/e0zi129.htm](https://www.ibm.com/support/knowledgecenter/en/SSLTBW_2.1.0/com.ibm.zos.v2r1.e0zi100/e0zi129.htm)

## SMF Reference Summary – watsonwalker.com



Cheryl Watson has been known for her regular newsletters. The watsonwalker.com site is a good resource for a number of free presentations, white papers and reference information.

Subcapacity\_Pricing

1	===== SCRT SUB-CAPACITY REPORT - IBM Corp =====	
2		
3	Run Date/Time	02 Oct 2017 - 04:04
4	Name of Person Submitting Report:	Sherrill Whelan
5	E-Mail Address of Report Submitter:	Sherrill.Whelan@anixter.com
6	Phone Number of Report Submitter:	224-521-8936
7		
8	Customer Name	Anixter Inc.
9	Customer Number	8970480702
10	Machine Serial Number	02-60F48
11	Machine Type and Model	2828-Q05
12	Machine Rated Capacity (MSUs)	190
13	Purchase Order Number	(optional)
14	Customer Comments (255 chars max)(optional)	
15		
16	For recurring charge (MLC) products, the data supplied in this report will be used to adjust the billable MSUs in inventory for all MLC Products listed under the MLC Product Name column on this report. In accordance with our agreement, IBM will treat a change in product licensed capacity as an order. If the MSUs have changed since the last report, software billing based on inventory MSUs will increase or decrease accordingly.	
17		
18	For One Time Charge (IPLA) products, the data supplied in this report will be used to bill those IPLA products listed under the IPLA Product Name column in this report which exceed your entitled capacity. In accordance with our agreement, IBM will treat the use of a product in excess of its entitled capacity as an order and you will be billed for the amount in excess of your entitlement.	
19		
20	Note: This report is expected to provide a "% data collected" > 95% and data reporting period beginning on the 2nd of the previous month and ending on the 1st of the current month.	
21		
22	=====	
23	TOOL INFORMATION	
24	Tool Release	24.10.4
25	Reporting Period	2 Sep, 2017 - 1 Oct, 2017 inclusive (30 days)
26		
27	Justification for low data collection (255 chars max)	
28		
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Hi Sherrill,  
I attached additional September IBM **SCRT report** with altered MSU total for machine serial nr 60F48 LPAR C2P1. Back on September 14-15, a production CICS user was unknowingly constantly submitting CICS transactions through either a script process or having a heavy object on the enter key. Causing high CPU usage for LPAR C2P1.  
  
Machine serial nr 60F48 original MSU total was 109 and is now 104 after excluding the excessive CICS transaction time period. I've included the IBM required reason at cell H44. Please submit the **SCRT** using the information from Subcapacity\_Pricing\_v2 report.  
Any concerns or questions, please let us know.

**Person Filing the Report**  
**Customer Information**  
**Machine Information**  
**Serial #, Type and Model, MSUs**  
**Data Collected > 95%**  
**Reporting Period:**  
**September 2<sup>nd</sup> -October 1<sup>st</sup>**  
**Note: Be Careful about Month-end and Year-End Processing**  
**SCRT Tool Version information**

Don't worry – this screen shot is not meant to be read. It is provided to communicate the idea that it's a cluttered spreadsheet that's hard to read. Annotated notes give you the key things to consider.

The screenshot shows an Outlook email interface with an Excel spreadsheet embedded. The spreadsheet is titled "Subcapacity\_Pricing" and contains two main sections of data. The first section, "PRODUCT SUMMARY INFORMATION", lists various products with their MLC Product, Tool MSUs, Customer MSUs, and Customer Comments. The second section, "DETAIL DATA COLLECTION", provides input data statistics for these products, including SYSID, Input Data Start, Input Data End, and Report Period % Data.

A callout box on the right side of the spreadsheet highlights the following information:

- Products – names, part numbers
- MSUs
- Input Data statistics

The email content includes a reminder for "InstantLogic 3:00p - 3:30p" and a message from Hi Sherrill regarding a machine serial number 60F4B LPAR C. The message states: "I attached additional September machine serial nr 60F4B LPAR C. Back on September 14-15, a production user was unexpectedly consistently submitting CICS transactions through either a script process or having a heavy object on the enter key. Causing high CPU usage for LPAR C2P1. Machine serial nr 60F4B original MSU total was 109 and is now 104 after excluding the excessive CICS transaction time period. I've included the IBM required reason at cell H44. Please submit the **SCRT** using the information from Subcapacity\_Pricing\_v2 report. Any concerns or questions, please let us know."

Here's a continuation

Excel Online Subcapacity\_Pricing

#IDUGdb2

	A	B	C	D	E	F	G	H	I
56	=====								
57	DETAIL DATA COLLECTION								
58									
59		SYSID	Input Data Start		Input Data End		Report Period % Data		
60									
61	C2P1	BSYS	02 Sep 2017 - 00:00		02 Oct 2017 - 00:00		96.50%		
62	C2P2	DSYS	02 Sep 2017 - 00:00		02 Oct 2017 - 00:00		66.30%		
63									
64	CPC		02 Sep 2017 - 00:00		02 Oct 2017 - 00:00		99.10%		
65									
66	=====								
67	DETAIL DATA SECTIONS - FOR CUSTOMER ANALYSIS PURPOSES ONLY								
68	=====								
69	SMF / SCRT89 INPUT DATA STATISTICS								
70									
71		SYSID	Input Data Start		Input Data End				
72									
73	C2P1	BSYS	26 Aug 2017 - 23:00		02 Oct 2017 - 00:00				
74	C2P2	DSYS	26 Aug 2017 - 23:00		02 Oct 2017 - 00:00				
75									
76	CPC		26 Aug 2017 - 23:00		02 Oct 2017 - 00:00				
77									
78	=====								
79	DETAIL LPAR DATA SECTION								
80									
81		Highest	Hour Count	Date/Time	2nd Highest	Hour Count	Date/Time		
82									
83	C2P1	107	1	15 Sep 2017 - 04:00	102	1	27 Sep 2017 - 15:00		
84	C2P2	4	11	14 Sep 2017 - 12:00	3	72	07 Sep 2017 - 13:00		
85									
86	CPC	109	1	15 Sep 2017 - 04:00	104	1	27 Sep 2017 - 15:00		

**Input Data statistics  
LPAR Data by CEC  
R4HA MSU Utilization by LPAR  
First Highest  
Second Highest  
R4HA MSU by CEC**

**Note: On next slide, we'll see  
how BSYS and CEC align**

We're zooming in a little more...Next slide will get to the detailed MSU information.

## September – CEC2 – BSYS and DSYS CPC R4HA Corresponds to BSYS (C2P1) + DSYS at same time

DETAIL LPAR DATA SECTION						
	Highest	Hour Count	Date/Time	2nd Highest	Hour Count	Date/Time
C2P1	107	1	15 Sep 2017 - 04:00	102	1	27 Sep 2017 - 15:00
C2P2	4	11	14 Sep 2017 - 12:00	3	72	07 Sep 2017 - 13:00
CPC	109	1	15 Sep 2017 - 04:00	104	1	27 Sep 2017 - 15:00

28

We can see here the two highest R4HA periods for each LPAR. It so happens that IBM billed Anixter for the highest period on BSYS, and whatever was running on DSYS at the same time. That's because our MSU calculation is at a CEC level for billing purposes, not at an LPAR level.

	A	B	C	D	E	F	G	H	I
199									
200	==N5=====								
201	DETAIL LPAR DATA SECTION								
202									
203		Highest	Hour Count	Date/Time		2nd Highest	Hour Count	Date/Time	
204									
205	C1P1	104	1	19 Sep 2017 - 15:00		103	2	14 Sep 2017 - 15:00	
206	C1P2	38	2	27 Sep 2017 - 22:00		37	2	27 Sep 2017 - 21:00	
207									
208	CPC	127	1	12 Sep 2017 - 15:00		126	1	28 Sep 2017 - 15:00	
209									
210	==P5=====								
211	PRODUCT MAX CONTRIBUTORS								
212									
213									
214	Product Name	Product ID	Highest	Date/Time		LPAR C1P1	LPAR C1P2		
215									
216	z/OS V2	5650-ZOS	127	12 Sep 2017 - 15:00		99	28		
217	DB2 12 for z/OS	5650-DB2	38	27 Sep 2017 - 22:00		0	38		
218	DB2 11 for z/OS	5615-DB2	127	12 Sep 2017 - 15:00		99	28		
219	CICS TS for z/OS V5	5655-Y04	127	12 Sep 2017 - 15:00		99	28		
220	WebSphere MQ for z/OS V7	5655-R36	127	12 Sep 2017 - 15:00		99	28		
221	IBM Enterprise Cobol for z/OS V4	5655-S71	38	27 Sep 2017 - 22:00		0	38		
222	zSecure Alert V2	5655-N21	127	12 Sep 2017 - 15:00		99	28		
223									
224	==Q5=====								
225	PRODUCT GRID SNAPSHOT								
226									
227	Product Name	Product ID				C1P1	C1P2		
228									
229	z/OS V2	5650-ZOS				100.00%	100.00%		
230	DB2 12 for z/OS	5650-DB2					23.00%		
231	DB2 11 for z/OS	5615-DB2				100.00%	100.00%		
232	CICS TS for z/OS V5	5655-Y04				100.00%	100.00%		
233	WebSphere MQ for z/OS V7	5655-R36				100.00%	100.00%		
234	zSecure Alert V2	5655-N21				100.00%	100.00%		
235									

**Input Data statistics**  
**LPAR Data by CEC**  
**R4HA MSU Utilization by LPAR**  
**First Highest**  
**Second Highest**  
**R4HA MSU by CEC**  
  
**Note: Next slide zooms in to see ASYS, CSYS and CEC –**  
**None of these align**

Here is the more interesting CEC, because it has Production and Development. We'll zoom in on the next slide.

## September – CEC1 – ASYS and CSYS CPC R4HA Corresponds to Neither P1 Nor P2. This is normal.

DETAIL LPAR DATA SECTION						
	Highest	Hour Count	Date/Time	2nd Highest	Hour Count	Date/Time
C1P1	104	1	19 Sep 2017 - 15:00	103	2	14 Sep 2017 - 15:00
C1P2	38	2	27 Sep 2017 - 22:00	37	2	27 Sep 2017 - 21:00
CPC	127	1	12 Sep 2017 - 15:00	126	1	28 Sep 2017 - 15:00

30

Here we can see that the billing for the CEC (see CPC) is for a time period that corresponds to neither the first nor second period for P1 or P2. The IBM billing algorithm picked a CEC-level average that combined LPAR1 (ASYS) and LPAR2 (CSYS) at a peak R4HA for a different date and time than the peaks in the individual LPARs. This can be confusing, especially if you are trying to add 104 and 38 to get 127.

This is normal.

## September 2, 2017 – October 1, 2017: an Anixter Problem CICS Transaction Volume due to Uncontrollable Script

Special conditions						
SMF/SCRT89	Exclusion	Image ID	Product ID	Start	Resume	Customer Comments (255 chars max)
Control Statements						
Exclude	Control Statement	<b>C2P1</b>	<b>*ALL</b>	14 Sep - 2017 22:00	15 Sep - 2017 05:00	<b>(Due to an uncontrollable user initiated script submitting continuous CICS transactions to CICS region on C2P1 causing high CPU usage. CICS region cancelled to stop the process of unnecessary CICS transactions and then restarted.)</b>

31

Here's what the IBM confirmation looks like, and what a Special Condition looks like for a customer application problem in September 2017, from 10 PM on September 14 to 5 AM on September 15.

**Note:** If there are no special conditions, the confirmation has no LPAR information. Because this month shown has a Special Condition, with records excluded, the affected Partition is referenced: **C2P1**.



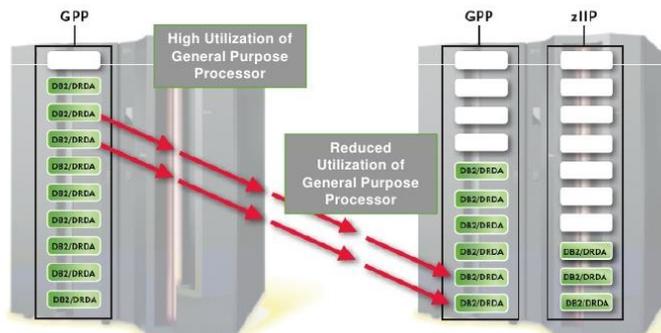
## zIIP – z Integrated Information Processor Optimize Resources, Reduce Costs, Balance Workloads

- IBM® z Integrated Information Processor (zIIP) is a purpose-built processor designed to operate asynchronously with the general processors in the mainframe to help improve utilization of computing capacity and control costs. It is designed for **select data and transaction processing workloads** and for **select network encryption workloads**. **zIIPs allow customers to purchase additional processing power without affecting the total million service units (MSU) rating or machine model designation.** IBM does not impose IBM software charges on zIIP capacity, but charges apply when additional general purpose CP capacity is used.

Source: IBM (emphasis added)

## IBM zIIP Specialty Engines – How They Work

- **IBM's original focus for the zIIP was related to DB2 and support for ERP/CRM/BI data intensive workloads**
- **Better performance and TCO associated with DB2**



*Source: Improving the Economics of Mainframe SOA Enablement, Mike Nelson, 2009*

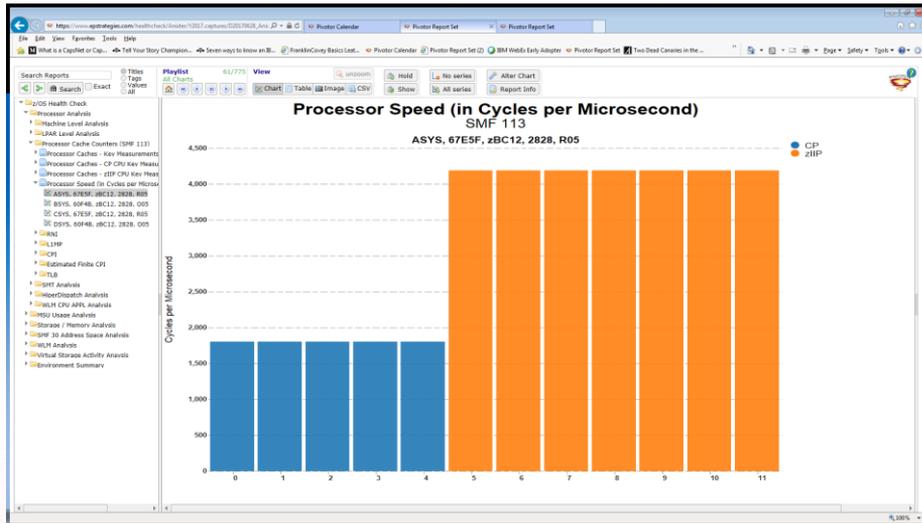
This reference is provided to show a variety of sources are available to discuss the intended role of zIIPs. All of these sources can combine to provide a very effective communication to our VP of Finance, and other Business Executives.

## **Kneecap Strategy: Your CPs are dialed back and your zIIPs are on steroids**

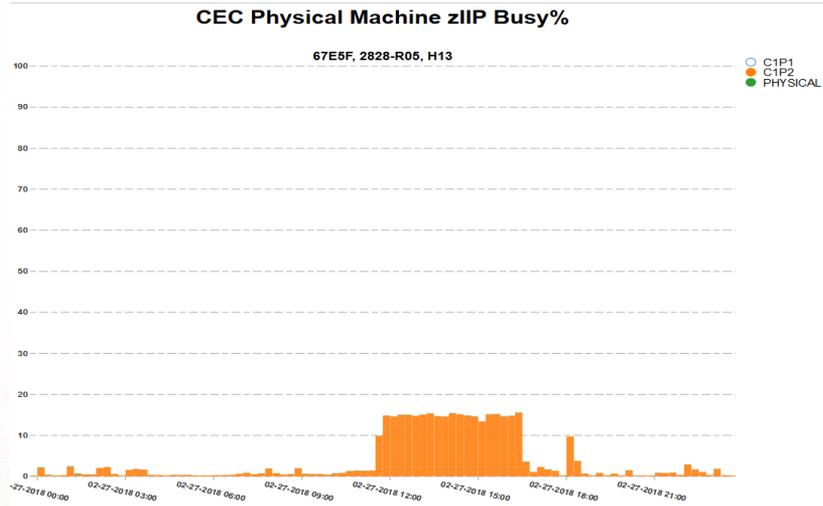
- **R05 CEC**
- **5 CPs, 7 zIIPs**
  - By one measure, zIIPs have 2.3x power of CPs
- **Q05 CEC**
- **5 CPs, 7 zIIPs**
  - By one measure, zIIPs have 2.6x power of CPs

“Kneecap” is a very common term in use to communicate that the CPs are dialed back, and the zIIPs are not dialed back. This provides a real advantage in processing power. It can also be a little confusing, as we discuss in the next three slides.

# What a Kneecap Strategy Looks Like on a Graph

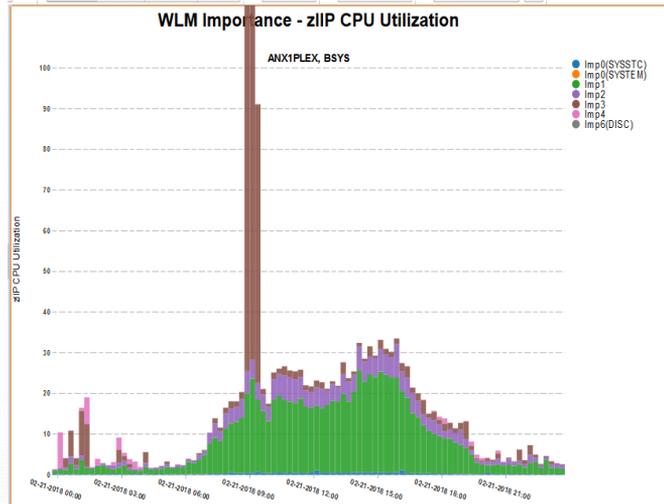


## zIIPs Can Be Taken for Granted, even Dismissed, Unless Busy % Is Normalized to CPs



The visual communication has the effect of minimizing the important role that zIIPs are playing to reduce cost and to offload work from the CPs.

## This Chart Got Our Attention zIIP Utilization Was Literally Off the Chart



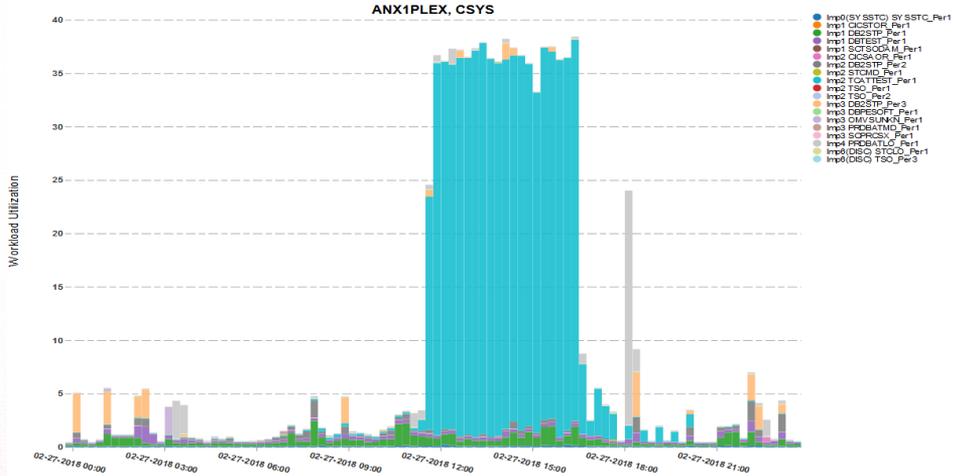
38

This recent chart really communicated to the System Programmers that there was a lot more work going in the zIIPs, and that the effect in the R4HA was significant.

# CPU for zIIPs % normalized to CP

## A More Intuitive Understanding “At a Glance”

**WLM CPU - zIIP Workload Utilization for Service Classes**  
 (Normalized to Speed of CP CPUs)



The chart now normalizes the zIIPs to CPs, more correctly communicating the salutary impact of the zIIPs “at a glance.”

That's a little odd, isn't it?  
Who else directs workload  
to another processor?



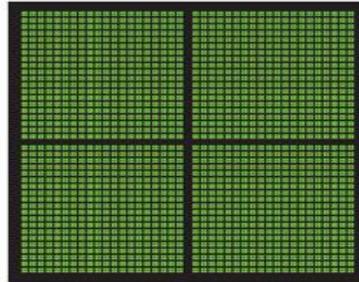
There's an answer to this question....

## If Your Finance VP asks, “Who Else Uses Specialty Engines?” Nvidia is an example of another “Specialty Processor”

- General-purpose computing on graphics processing units...is the use of a graphics processing unit (GPU)...to perform computation in applications traditionally handled by the central processing unit (CPU). – Wikipedia



CPU  
MULTIPLE CORES



GPU  
THOUSANDS OF CORES

**Graphic Source: Nvidia**

General-purpose **computing** on graphics **processing** units (GPGPU, rarely GPGP) is the use of a graphics **processing** unit (**GPU**), which typically handles **computation** only for computer graphics, to perform **computation** in applications traditionally handled by the central **processing** unit (CPU).

### GPU vs CPU Performance

A simple way to understand the difference between a GPU and a CPU is to compare how they process tasks. A CPU consists of a few cores optimized for sequential serial processing while a GPU has a massively parallel architecture consisting of thousands of smaller, more efficient cores designed for handling multiple tasks simultaneously.

## Video Cards Became the New ALU - Math Co-processor

When Intel came out with Ivy Bridge and great video graphics on the chip, Nvidia looked like it was in real trouble. So, what happened since?

*Math, AI, Visualization, Deep Learning, Bitcoin...*

The screenshot shows a Google search for 'nvidia stock price'. The search results include a 5-year stock price chart for NVIDIA Corporation (NASDAQ: NVDA) as of Nov 13, 2:15 PM EST. The current price is 213.28 USD, up 2.86 (1.32%). The chart shows a steady upward trend from 2013 to 2017. Key statistics include: Open: 216.14, High: 217.17, Low: 212.43, Mkt cap: 127.96B, P/E ratio: 53.36, Div yield: 0.28%. The right sidebar provides company details: Nvidia Corporation, Santa Clara, CA, founded April 1993, CEO: Jensen Huang, and video game: GRID Beta. Social media profiles for YouTube, LinkedIn, Facebook, and Twitter are also listed.

Period	Price
1 day	213.28
5 day	213.28
1 month	213.28
3 month	213.28
1 year	213.28
5 year	213.28
max	213.28

Not only are other companies using similar approaches to software and hardware solutions, but Nvidia really took off in the stock market because of their solutions. These solutions are analogous to the IBM solution of routing qualified workloads to other processors.

## But What if Batch Processing Drives R4HA/4HRA? Bob Hill of Anixter came through with the fix...

- 33 year career with Anixter
  - Computer Operations
  - z/OS System Programmer
  - Storage Architect
  - DR/BC Coordinator
  - Manager – ITSM Change Management & Workload Automation
  
- Contact – [Bob.Hill@Anixter.com](mailto:Bob.Hill@Anixter.com)



Giving Bob Hill Credit for his great work in finding and fixing the Batch Bottlenecks on Saturday morning that were driving the R4HA. Without his work, we would never have achieved the cost savings with the zIIPs.

- 2014 Initiative - Analyze & Control the 4HRA
- zIIP utilization - Effect on the 4HRA
- Converting zIIP utilization into \$\$\$\$

- Bob helped share the story about the zIIP effect on the MSU 4HRA and calculating cost savings.

Bob's favorite joke:

- How many DBA's are in the audience?
- How do you keep a DB2 DBA in suspense? – Pause - I'll tell you tomorrow

- 2014 Initiative - Analyze & Control the 4HRA



- Converting zIIP utilization into \$\$\$

- The first of three topics is the zIIP effect on the MSU 4HRA and calculating cost savings.

## Analyze and Control the 4HRA

- **Goal**
  - Understand and gain better control of the MSU 4HRA
  - Reduce our IBM MLC variable license charges
- **Resource Gaps**
  - Resource - z/OS Performance Analyst
  - Performance analysis reporting and metrics

2014 - Management initiated a project to analyze our 4HRA and look for opportunities to reduce and control costs.

### Missing Resources

- on staff Computer Performance Analyst
- comprehensive performance reporting

## Analyzing SMF Data using Pivotor from EPS

- Performance Services - SAAS Engagement
- Enterprise Performance Strategies Inc.
  - <https://www.epstrategies.com>
- Product - Pivotor Performance Reporting Services
  - Process SMF Data - Daily feed
  - Comprehensive performance charts and reports
  - Daily, Weekly, & Monthly, Yearly report intervals

47

### SAAS engagement with Enterprise performance strategies

- Contracted the use of Pivotor Reporting Service
- Daily FTP and processing of SMF Data
- Comprehensive charts and reports

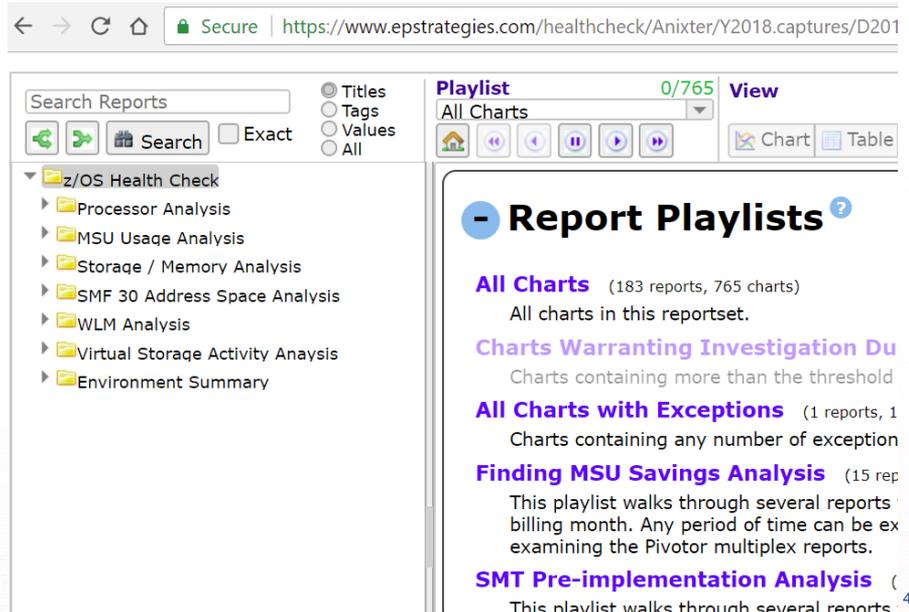


Pivotor Support  
Calendar Help

<a href="#">ANX1PLEX</a>					<a href="#">ANX1PLEX</a>	<a href="#">ANX1PLEX</a>	<a href="#">ANX1PLEX</a>	<a href="#">ANX1PLEX</a>
Rolling 8 Week Reports								
2018								
2017								
<b>Rolling Year</b>								
<a href="#">ANX1PLEX</a>								
<b>Navigation</b>								
<a href="#">January</a>								
<a href="#">February</a>								
<a href="#">March</a>								
<a href="#">April</a>								
<a href="#">May</a>								
<a href="#">June</a>								
<a href="#">July</a>								
<a href="#">August</a>								
<a href="#">September</a>								
<a href="#">October</a>								
<a href="#">November</a>								
<a href="#">December</a>								
2016								
2015								
	04	05	06	07	08	09	10	
	<a href="#">ANX1PLEX</a>	<a href="#">ANX1PLEX</a>	<a href="#">ANX1PLEX</a>	<a href="#">ANX1PLEX</a>	<a href="#">ANX1PLEX</a>	<a href="#">ANX1PLEX</a>	<a href="#">ANX1PLEX</a>	<a href="#">ANX1PLEX</a>
	11	12	13	14	15	16	17	
	<a href="#">ANX1PLEX</a>	<a href="#">ANX1PLEX</a>	<a href="#">ANX1PLEX</a>	<a href="#">ANX1PLEX</a>	<a href="#">ANX1PLEX</a>	<a href="#">ANX1PLEX</a>	<a href="#">ANX1PLEX</a>	<a href="#">ANX1PLEX</a>
	18	19	20	21	22	23	24	
	<a href="#">ANX1PLEX</a>	<a href="#">ANX1PLEX</a>	<a href="#">ANX1PLEX</a>	<a href="#">ANX1PLEX</a>	<a href="#">ANX1PLEX</a>	<a href="#">ANX1PLEX</a>	<a href="#">ANX1PLEX</a>	<a href="#">ANX1PLEX</a>
	25	26	27	28	29	30		
	<a href="#">ANX1PLEX</a>	<a href="#">ANX1PLEX</a>	<a href="#">ANX1PLEX</a>	<a href="#">ANX1PLEX</a>	<a href="#">ANX1PLEX</a>	<a href="#">ANX1PLEX</a>		
	<b>June Monthly Reports</b>							
	<a href="#">ANX1PLEX</a>							
	<a href="#">MULTIPLY</a>							

Primary selection menu provides drill down capability into various report views, by day, week, month....

# Pivotor Report Selection Menus



The screenshot shows a web browser window with the URL <https://www.epstrategies.com/healthcheck/Anixter/Y2018.captures/D201>. The interface includes a search bar for reports, a navigation menu with categories like 'z/OS Health Check', 'Processor Analysis', 'MSU Usage Analysis', 'Storage / Memory Analysis', 'SMF 30 Address Space Analysis', 'WLM Analysis', 'Virtual Storage Activity Analysis', and 'Environment Summary'. A 'Playlist' section is visible, showing 'All Charts' (0/765) and a 'View' button. The playlist content includes:

- All Charts** (183 reports, 765 charts)  
All charts in this reportset.
- Charts Warranting Investigation Du**  
Charts containing more than the threshold
- All Charts with Exceptions** (1 reports, 1  
Charts containing any number of exception
- Finding MSU Savings Analysis** (15 rep  
This playlist walks through several reports  
billing month. Any period of time can be ex  
examining the Pivotor multiplex reports.
- SMT Pre-implementation Analysis** (49  
This playlist walks through several reports

Drill down capabilities into various report views and categories

## Pivotor Report Selection Menus

The screenshot displays the Pivotor web application interface. At the top, there is a browser address bar showing the URL `https://www.epstrategies.com/healthcheck/Anixter`. Below the address bar, there is a search bar labeled "Search Reports" with a search icon and an "Exact" checkbox. To the right of the search bar are radio buttons for "Titles", "Tags", "Values", and "All".

The main content area is divided into two columns. The left column contains a tree view of report categories under the heading "z/OS Health Check". The categories include:

- Processor Analysis
  - Machine Level Analysis
  - LPAR Level Analysis
    - General Purpose Engines
      - LPAR CP Busy%, MVS CP Busy%,
      - CPU Work Unit Distribution
      - CP Work Units - Min, Avg, Max
      - LPAR - I/O Interrupt Rate by Proc
    - Specialty Engines
    - Processor Cache Counters (SMF 113)
    - SMT Analysis
    - HiperDispatch Analysis
    - WLM CPU APPL Analysis
  - MSU Usage Analysis
    - LPAR - R4HA, Actual MSUs, Image Ca
      - 60F4B, C2P1
      - 60F4B, C2P2
      - 67E5F, C1P1
      - 67E5F, C1P2
    - MSU Usage by CEC
    - MSU Usage by LPAR
  - Storage / Memory Analysis
  - SMF 30 Address Space Analysis
  - WLM Analysis

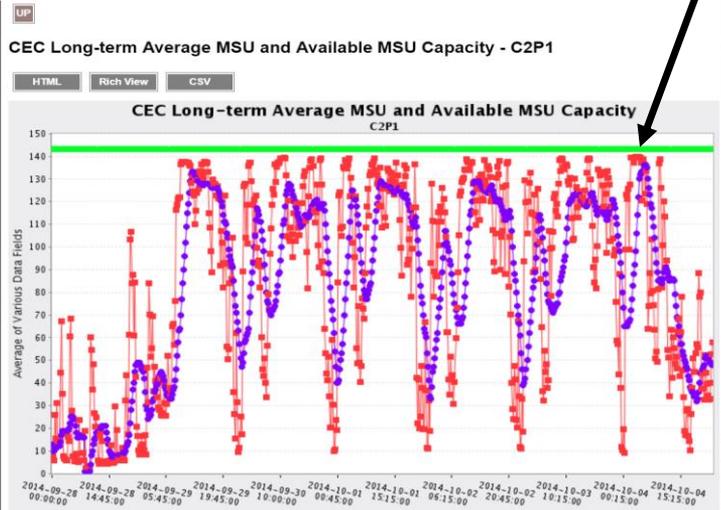
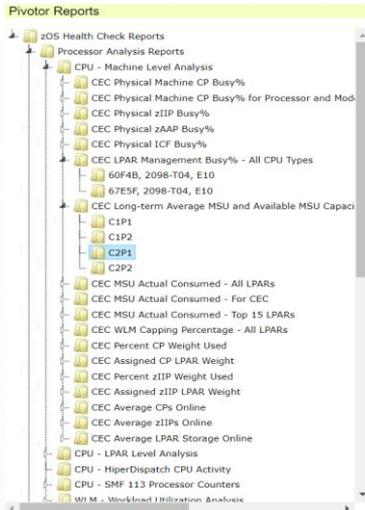
The right column contains a "Playlist" section with a dropdown menu set to "All Charts" and a progress indicator "0/765". Below this, there are several sections with a minus sign icon:

- Report Pla**: This section lists several report categories with brief descriptions:
  - All Charts** (183 reports, All charts in this repor
  - Charts Warranting I**: Charts containing mor
  - All Charts with Exce**: Charts containing any
  - Finding MSU Saving**: This playlist walks thro billing month. Any per examining the Pivotor
  - SMT Pre-implem:**: This playlist walks thro
- Search Terms**: This section is currently empty.
- Tags**: This section displays several tags: `1MB`, `Available`, `Batch`, `CP`, `CPU Intensity`, and `CPU LPAR Leve`.

Drill down capabilities into report view and categories

## Pivotor Reporting Reveals Tuning Opportunities

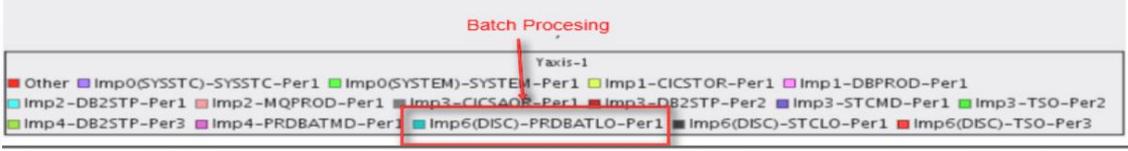
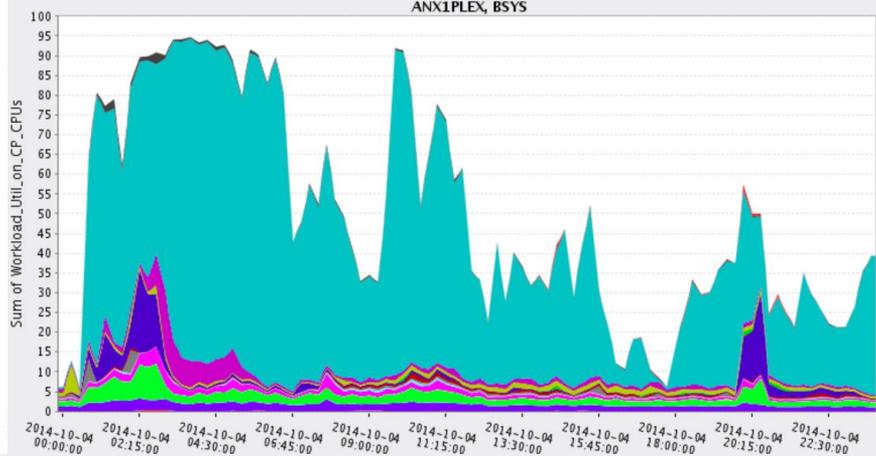
**PEAK  
4HRA**



- One of the first reports that helped us identify tuning opportunities - Long-Term Average MSU
- Weekly view of the long term MSU usage on 1 single LPAR
- 4HRA patterns show peaks occurring outside of online processing windows
- Monthly peak was Saturday morning during monthly batch processing

**WLM  
 Service  
 Class  
 PRDBATLO  
 Driving Peak  
 4HRA**

**WLM CPU Analysis - Top Service Classes - Captured Workload Utilization CP CPU  
 (CP + zAAP on CP + zIIP on CP)  
 ANX1PLEX, BSY5**



Looking at utilization peaks were occurring on weekends during weekly and monthly batch processing.

WLM Service class PRODBATLO was the top contributor in CPU utilization.

## What if your 4HRA Peak is in your batch stream? Before realizing the zIIP ROI, batch cycle must be tamed

### Actions:

- Reduce batch concurrency
- Distribute batch workload into low utilization periods
- Identify and tune high CPU programs

### Benefits:

- High 4HRA during online processing – Paying for sales orders
- Realization of zIIP ROI

Attacked batch processing schedules – reduced batch concurrency, moved workload into low utilization windows, and addressed inefficient code

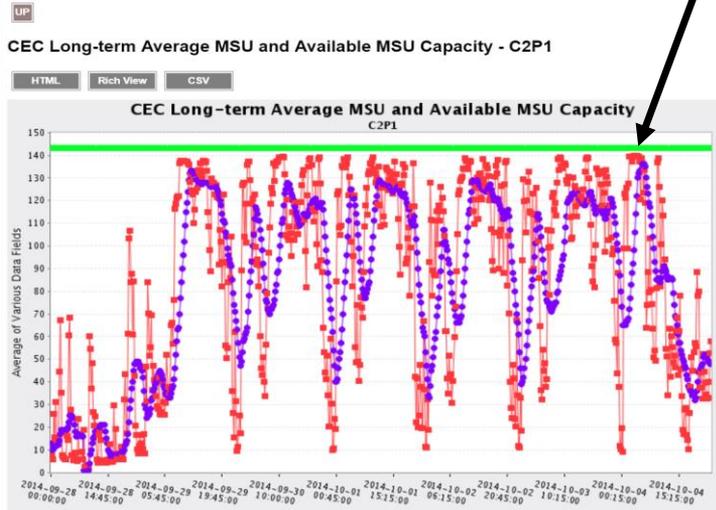
Benefits – Moved peak 4RHA to online processing periods, Realized zIIP ROI and Savings

# Pivitor Reporting Reveals Tuning Opportunities

**PEAK  
4HRA**

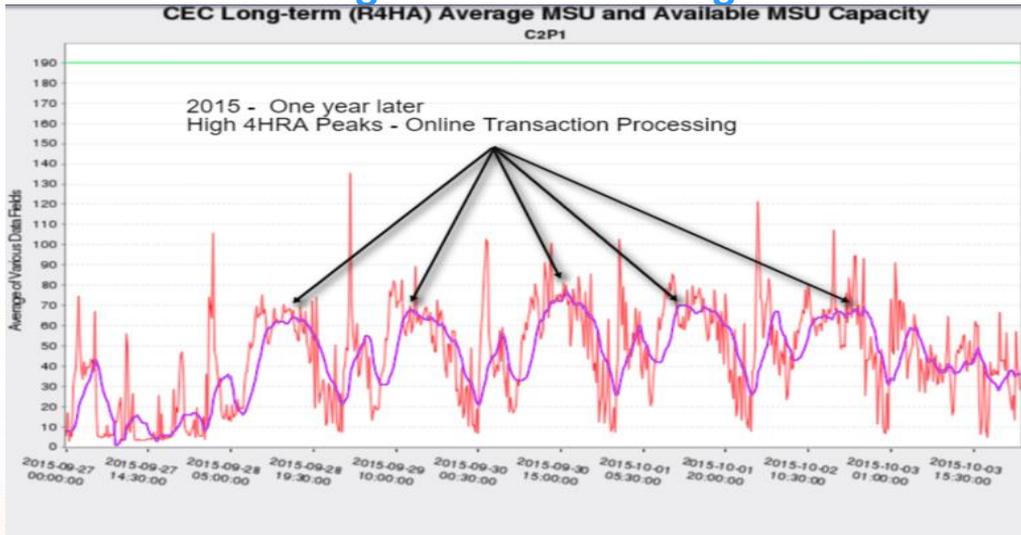
**Pivitor Reports**

- zOS Health Check Reports
  - Processor Analysis Reports
    - CPU - Machine Level Analysis
      - CEC Physical Machine CP Busy%
      - CEC Physical Machine CP Busy% for Processor and Mod
      - CEC Physical zIIP Busy%
      - CEC Physical zAAP Busy%
      - CEC Physical ICF Busy%
      - CEC LPAR Management Busy% - All CPU Types
        - 60F4B, 2098-T04, E10
        - 67E5F, 2098-T04, E10
      - CEC Long-term Average MSU and Available MSU Capacity
        - C1P1
        - C1P2
        - C2P1**
        - C2P2
    - CEC MSU Actual Consumed - All LPARs
    - CEC MSU Actual Consumed - For CEC
    - CEC MSU Actual Consumed - Top 15 LPARs
    - CEC WLM Capping Percentage - All LPARs
    - CEC Percent CP Weight Used
    - CEC Assigned CP LPAR Weight
    - CEC Percent zIIP Weight Used
    - CEC Assigned zIIP LPAR Weight
    - CEC Average CPs Online
    - CEC Average zIIPs Online
    - CEC Average LPAR Storage Online
  - CPU - LPAR Level Analysis
  - CPU - HyperDispatch CPU Activity
  - CPU - SMF 113 Processor Counters
- WLM - Workload Distribution Analysis



- Weekly view of the long term MSU usage on 1 single LPAR
- 4HRA patterns show peaks occurring outside of online processing windows
- Monthly peak was Saturday morning during monthly batch processing

## Tuning Results – 1 Year Later 4HRA Peaks During Online Processing



Same week, one year later – utilization peaks occur during online processing .



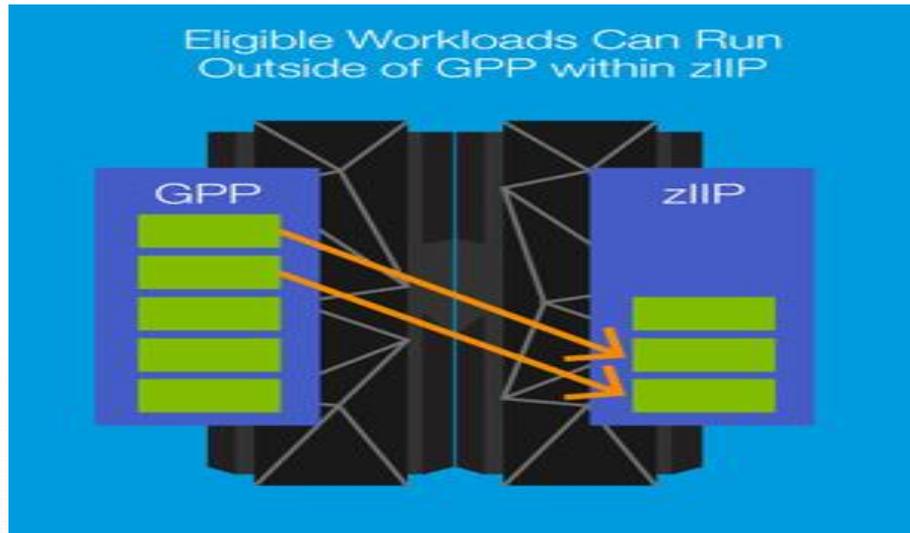
## • zIIP utilization - Effect on the 4HRA



Converting zIIP utilization into SSS

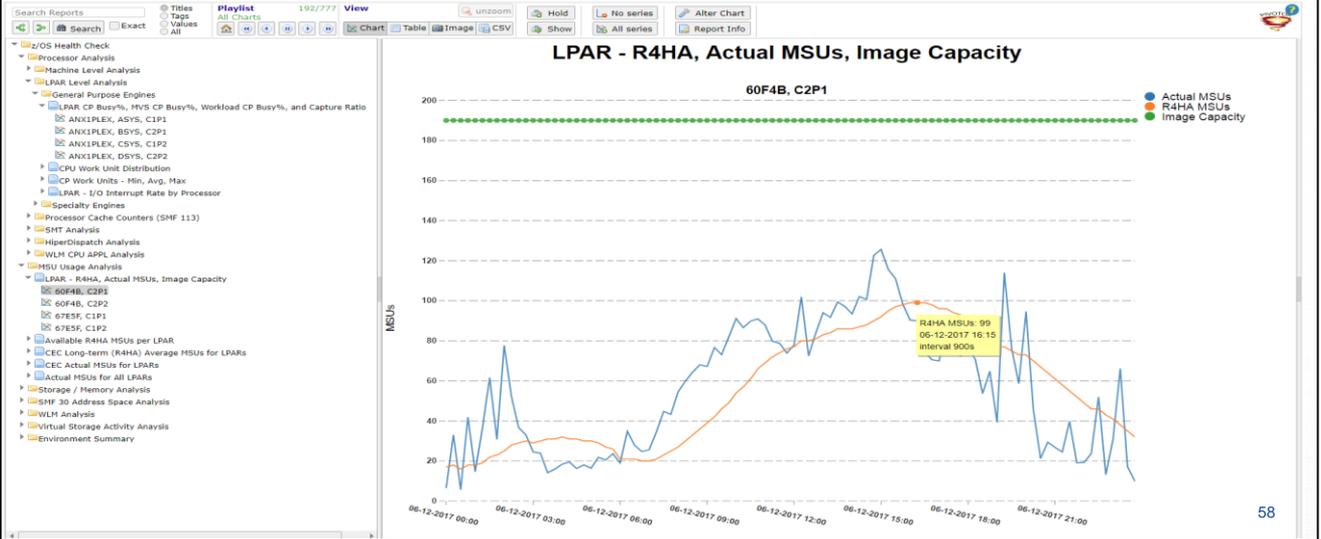
- The next few slides demonstrate the positive effect that zIIP utilization has on the GP use and the 4HRA .

## zIIP – Specialty Offload Engine – No Monthly MSU Charge



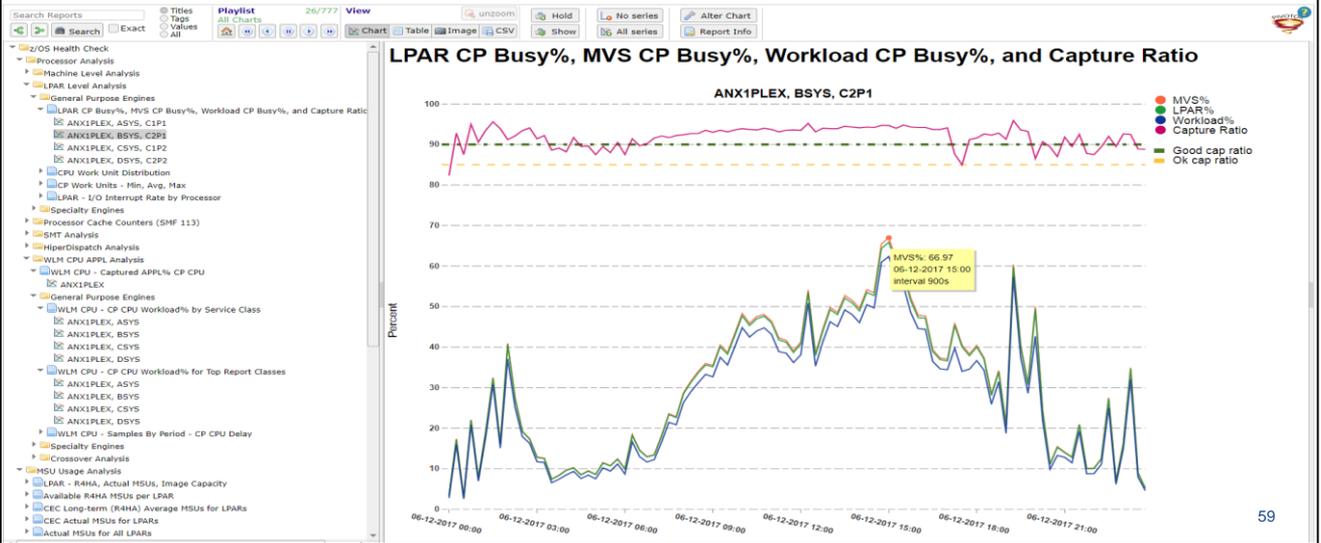
# zIIP utilization - Effect on the 4HRA

## June 12<sup>th</sup> 2017 – 4HRA at 16:15 MSU's 99



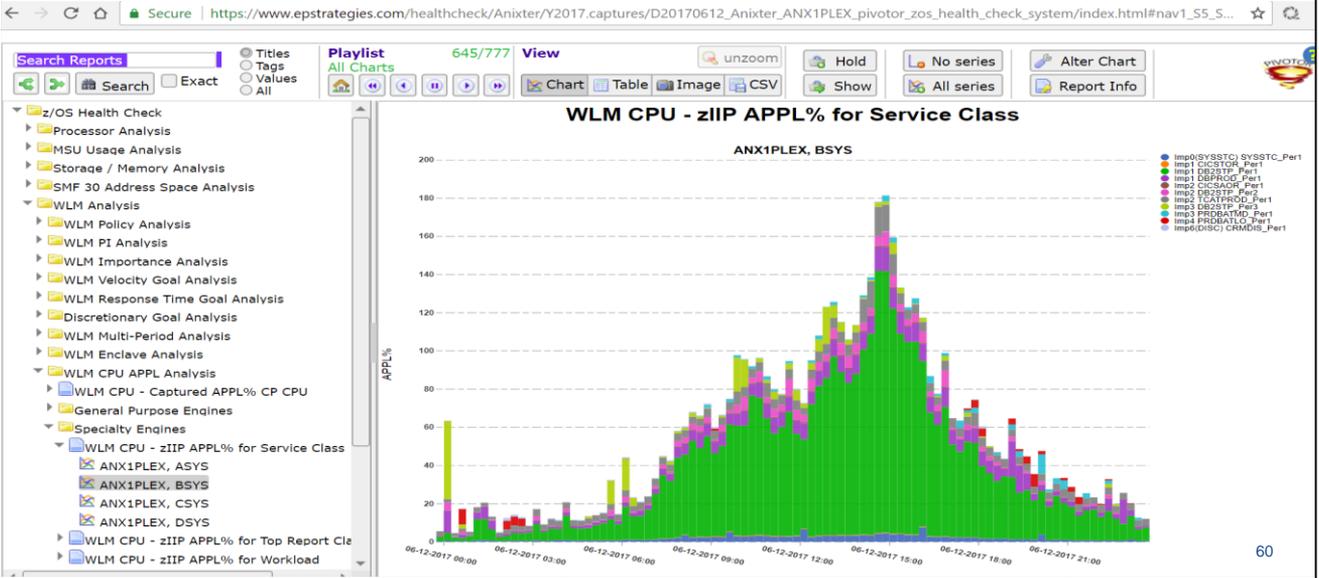
Monthly peak 4hra 6/12/2017 99 MSU's

# June 12<sup>th</sup> 2017 – Peak General Purpose Engine Busy 67%



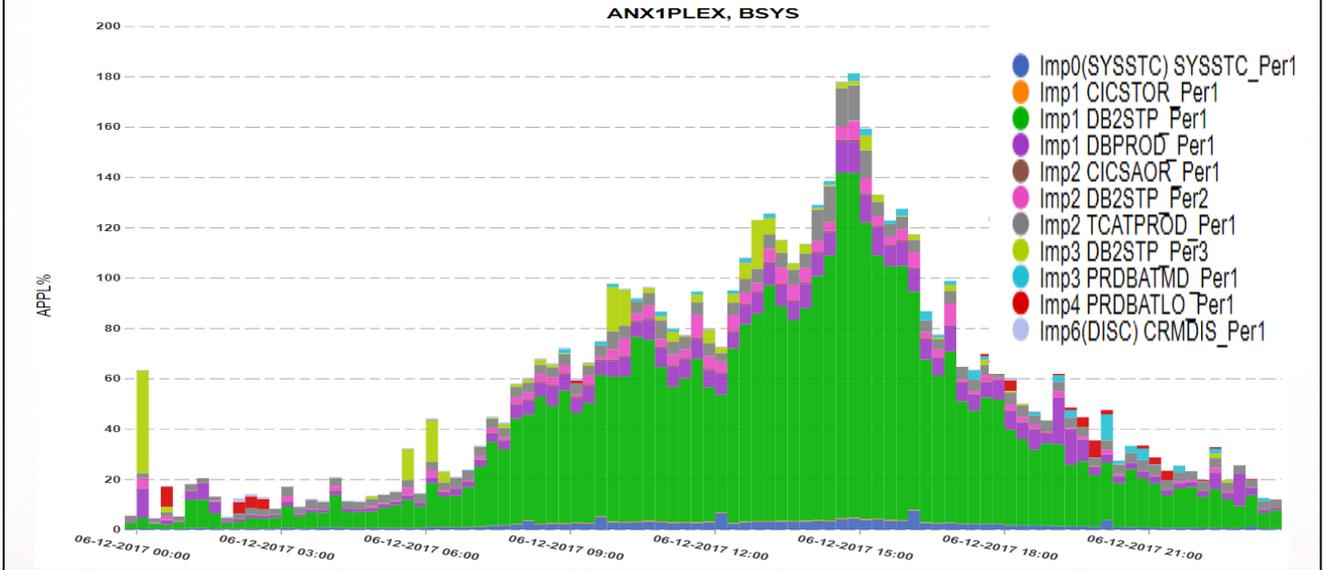
GP engines were running at about 67 % busy.

# June 12<sup>th</sup> 2017 – zIIP APPL % - Peak Offload 180% of GPE



Application zIIP % Peak Utilization -180% of a general purpose engine.

### WLM CPU - zIIP APPL% for Service Class



Peak zIIP utilization 180% of a general purpose engine

Top reporting class - DB2 Stored procedure. zIIP service peaked at 140% of a GP engine.

Net result - Reduced demand on the GP engines and lowering the total cost of the MSU 4HRA.



- Converting zIIP utilization into \$\$\$\$

The next several slides will demonstrate how to convert zIIP savings into real \$\$\$



## Converting zIIP Utilization Into \$\$\$\$

### Simple Formula:

**MSU Per GP \* zIIP % GP (avg offload % during monthly peak 4HRA) \* Cost Per MSU =  
\$ Savings**

Formula source - Scott Chapman (Enterprise Performance Strategies Inc.)

\*Disclaimer - zIIP % GP, Cost per MSU, & Savings are approximations (not exact).

A person smarter than me, Scott Chapman of Enterprise Performance Strategies, provided the formula

The next series of slides will walk you through how to find the required numbers.



## Converting zIIP Utilization Into \$\$\$\$

### Calculating IBM Processor MSU Ratings

IBM Published zEnterprise Processor MSU ratings:

<https://www-304.ibm.com/servers/resourceink/lib03060.nsf/pages/lsprlTRzOSv2r1?OpenDocument>

#### Anixter Processor Configuration - zEnterprise BC12 2828-Q05

**2828-Q05 MSU Rating Per GP = 190/5**

zEnterprise BC12  
 (System z9 2094-701 = 1.00)

Processor	#CP	PCI**	MSU***	Low*	Average*	High*
2828-Q05	5	1,530	190	2.96	2.73	2.40

64

How to find and calculate MSU rating for your GP engines  
 my examples - running on a BC12 2828-Q05

Total MSU rating 190 divided by 5 GP engines.

## Converting zIIP Utilization Into \$\$\$\$



Simple Formula:

**MSU Per GP \* Avg zIIP % GP (avg offload % during monthly peak 4HRA) \*  
Cost Per MSU = \$ Savings**

**(38) x Avg zIIP % GP (avg offload % during monthly peak 4HRA) \*  
Cost Per MSU = \$ Savings**

*Disclaimer – zIIP % GP, Cost per MSU, & Savings are close approximations.*

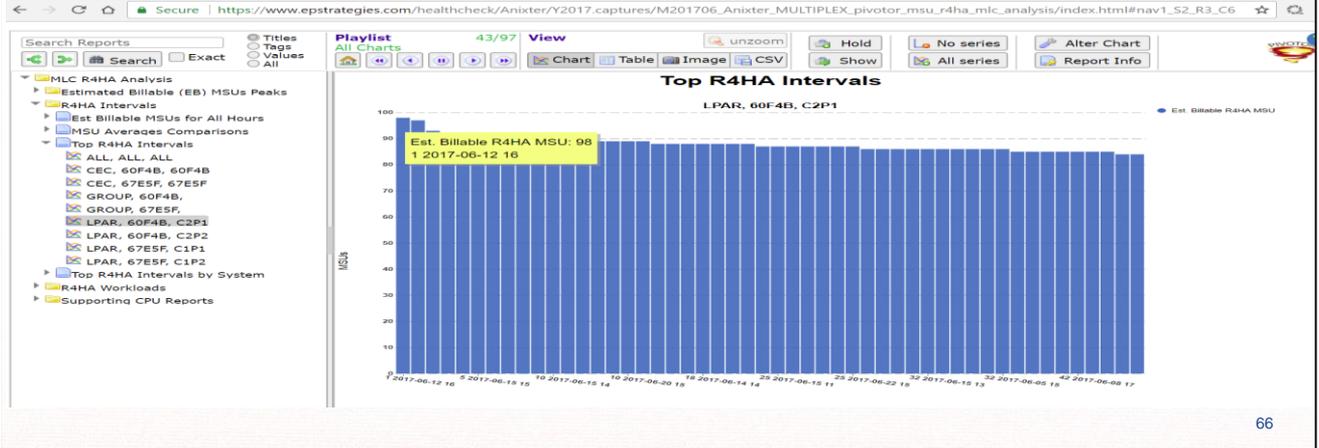


## Converting zIIP Utilization Into \$\$\$\$

### Calculating Avg zIIP % GP (During Peak 4HRA)

Peak 4HRA - 6/12/17 @ 16:00 MSU's 98

Hours 12, 13, 14, 15 will be used to calculate "AVG zIIP % GP"



First we find the peak 4HRA for the LPAR C2P1 - 6/12/2017 16:00 MSU's 98

We use this to interval to determine the 4 hours needed to calculate our avg zIIP utilization.



## Using Pivotor CSV Function – Supporting Data Graphs can be converted to CSV Format

Hours 12, 13, 14, 15 will be used to calculate “AVG zIIP % GP”



All supporting data for Pivotor graphs is easily converted to CSV format



## zIIP Appl % by Service Class – Hours 12, 13, 14, 15 used to calculate “AVG zIIP % GP”

1	sysplex	system	smfdate	smftime	duration	Imp0(SYSSSTC) SYSSSTC Per1	Imp1_CICSTOR Per1	Imp1_DB2STP Per1	Imp1_DBPROD Per1	Imp2_CICSAOR Per1	Imp2_DB2ST P_Per2	Imp2_TCATPROD Per1	Imp3_DB2STP Per3	Imp3_PRDBATM D_Per1	Imp4_PRDBATLO Per1	Imp6(DISC )_CRMDIS Per1
2	ANX1PLEXBSYS		6/12/2017	12:15:00	900	6.646	0.297	46.817	8.437	0.52	4.027	3.494	2.276	0.148		0.121
3	ANX1PLEXBSYS		6/12/2017	12:30:00	900	2.502	0.271	69.349	6.398	0.497	6.256	4.918	3.507	1.383		0.146
4	ANX1PLEXBSYS		6/12/2017	12:45:00	900	2.999	0.315	78.353	7.811	0.544	4.209	5.511	6.326	1.787		0.423
5	ANX1PLEXBSYS		6/12/2017	13:00:00	900	3.216	0.322	82.411	8.227	0.56	3.357	5.624	19.272	0.133		
6	ANX1PLEXBSYS		6/12/2017	13:15:00	900	3.169	0.352	93.623	8.595	0.592	5.436	5.622	6.519	1.679	0.001	0.311
7	ANX1PLEXBSYS		6/12/2017	13:30:00	900	3.313	0.348	85.313	8.052	0.594	6.686	5.783	4.955	0.122		0.047
8	ANX1PLEXBSYS		6/12/2017	13:45:00	900	3.204	0.365	79.848	7.137	0.584	6.207	6.055	2.47	0.138		0.122
9	ANX1PLEXBSYS		6/12/2017	14:00:00	900	3.347	0.349	84.418	9.725	0.578	5.653	5.758	3.603	0.134		0.122
10	ANX1PLEXBSYS		6/12/2017	14:15:00	900	3.565	0.363	96.902	9.128	0.602	4.172	12.456	0.661	1.29		0.03
11	ANX1PLEXBSYS		6/12/2017	14:30:00	900	3.435	0.358	105.176	9.235	0.588	3.41	14.284	0.671	1.401		0.118
12	ANX1PLEXBSYS		6/12/2017	14:45:00	900	4.331	0.391	137.201	12.391	0.66	5.231	15.243	2.261	0.133		0.367
13	ANX1PLEXBSYS		6/12/2017	15:00:00	900	4.524	0.382	136.926	12.387	0.738	7.537	14.212	1.61	3.078	0.002	0.074
14	ANX1PLEXBSYS		6/12/2017	15:15:00	900	3.944	0.369	117.881	10.695	0.591	6.426	10.866	5.913	2.594		0.3
15	ANX1PLEXBSYS		6/12/2017	15:30:00	900	4.115	0.353	104.549	11.145	0.58	3.792	5.783	2.78	0.134		0.034
16	ANX1PLEXBSYS		6/12/2017	15:45:00	900	3.653	0.343	100.807	7.948	0.584	3.213	4.968		1.335		0.034
17	ANX1PLEXBSYS		6/12/2017	16:00:00	900	3.557	0.324	100.974	9.546	0.565	4.473	5.005	0.377	2.718		0.163
18																

Filter the records to only include the 4 hour peak. In my example hours 12, 13, 14, 15 will be used to calculate “AVG zIIP % GP”



# Calculating Avg zIIP % GP (During Peak 4HRA)

## zIIP Appl % by Service Class – Sum values For Each Interval (Column Q)

ANX1PLEX\_BSYS (14).csv - Excel

File Home Insert Draw Page Layout Formulas Data Review View Nitro Pro 10 Tell me what you want to do

Clipboard Font Alignment Number Styles

Q2 =SUM(F2:P2)

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
	sysplex	system	smfdate	smftime	duration	Imp0(SYSSTC) _SYSSTC_Per1	Imp1_CICSTOR _Per1	Imp1_DB2STP _Per1	Imp1_DBPROD _Per1	Imp2_CICSAOR _Per1	Imp2_DB2ST P_Per2	Imp2_TCATPROD _Per1	Imp3_DB2STP _Per3	Imp3_PRDBATM D_Per1	Imp4_PRDBATLO _Per1	Imp6(DISC) )_CRMDIS _Per1	Sum Of Intervals
1	ANX1PLEX	BSYS	6/12/2017	12:15:00	900	6.646	0.297	46.817	8.437	0.52	4.027	3.494	2.276	0.148		0.21	72.783
2	ANX1PLEX	BSYS	6/12/2017	12:30:00	900	2.502	0.271	69.349	6.398	0.497	6.256	4.918	3.507	1.383		0.146	95.227
3	ANX1PLEX	BSYS	6/12/2017	12:45:00	900	2.999	0.315	78.353	7.811	0.544	4.209	5.511	6.326	1.787		0.423	108.278
4	ANX1PLEX	BSYS	6/12/2017	13:00:00	900	3.216	0.322	82.411	8.227	0.56	3.357	5.624	19.272	0.133			123.122
5	ANX1PLEX	BSYS	6/12/2017	13:15:00	900	3.169	0.352	93.623	8.595	0.592	5.436	5.622	6.519	1.679	0.001	0.311	125.899
6	ANX1PLEX	BSYS	6/12/2017	13:30:00	900	3.313	0.348	85.313	8.052	0.594	6.686	5.783	4.955	0.122		0.047	115.213
7	ANX1PLEX	BSYS	6/12/2017	13:45:00	900	3.204	0.365	79.848	7.137	0.584	6.207	6.055	2.47	0.138		0.122	106.13
8	ANX1PLEX	BSYS	6/12/2017	14:00:00	900	3.347	0.349	84.418	9.725	0.578	5.653	5.758	3.603	0.134		0.122	113.687
9	ANX1PLEX	BSYS	6/12/2017	14:15:00	900	3.565	0.363	96.902	9.128	0.602	4.172	12.456	0.661	1.29		0.03	129.169
10	ANX1PLEX	BSYS	6/12/2017	14:30:00	900	3.435	0.358	105.176	9.235	0.588	3.41	14.284	0.671	1.401		0.118	138.676
11	ANX1PLEX	BSYS	6/12/2017	14:45:00	900	4.331	0.391	137.201	12.391	0.66	5.231	15.243	2.261	0.133		0.367	178.209
12	ANX1PLEX	BSYS	6/12/2017	15:00:00	900	4.524	0.382	136.926	12.387	0.738	7.537	14.212	1.61	3.078	0.002	0.074	181.47
13	ANX1PLEX	BSYS	6/12/2017	15:15:00	900	3.944	0.369	117.881	10.695	0.591	6.426	10.866	5.913	2.594		0.3	159.579
14	ANX1PLEX	BSYS	6/12/2017	15:30:00	900	4.115	0.353	104.549	11.145	0.58	3.792	5.783	2.78	0.134		0.034	133.265
15	ANX1PLEX	BSYS	6/12/2017	15:45:00	900	3.653	0.343	100.807	7.948	0.584	3.213	4.968	1.335	1.335		0.034	122.885
16	ANX1PLEX	BSYS	6/12/2017	16:00:00	900	3.557	0.324	100.974	9.546	0.565	4.473	5.005	0.377	2.718		0.163	127.702

Summarize the zIIP percentage values of each service class. Column Q



# Converting zIIP Utilization Into \$\$\$\$

## Calculating Avg zIIP % GP (During Peak 4HRA)

### Cell Q18 - Average Function (AVG interval totals column Q)

### Avg zIIP % GP = 127%

ANXIPILEX\_BSYS (14).csv - Excel

File Home Insert Draw Page Layout Formulas Data Review View Nitro Pro 10 Tell me what you want to do

Calibri 11 A A Wrap Text General Normal Bad Good Neutral Calculation

Q18 =AVERAGE(Q2:Q17)

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
	sysplex	system	smfdate	smftime	duration	Imp0(SYSSTC)_SYSSTC_Per1	Imp1_CICSTOR_Per1	Imp1_DB2STP_Per1	Imp1_OBPROD_Per1	Imp2_CICSAOR_P_Per2	Imp2_DB2STP_Per1	Imp2_TCATPROD_Per1	Imp3_DB2STP_Per3	Imp3_PRDBATM_D_Per1	Imp4_PRDBATLO_Per1	Imp6(DISC)_CRMDIS_Per1	Sum Of Intervals
1	ANXIPILEX_BSYS		6/12/2017	12:15:00	900	6.646	0.297	46.817	8.437	0.52	4.027	3.494	2.276	0.148		0.121	72.783
2	ANXIPILEX_BSYS		6/12/2017	12:30:00	900	2.502	0.271	69.349	6.398	0.497	6.256	4.918	3.507	1.383		0.146	95.227
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5	ANXIPILEX_BSYS		6/12/2017	13:15:00	900	3.169	0.352	93.623	8.595	0.592	5.436	5.622	6.519	1.679	0.001	0.311	125.899
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7	ANXIPILEX_BSYS		6/12/2017	13:45:00	900	3.204	0.365	79.848	7.137	0.584	6.207	6.055	2.47	0.138		0.122	106.13
8	ANXIPILEX_BSYS		6/12/2017	14:00:00	900	3.347	0.349	84.418	9.725	0.578	5.653	5.758	3.603	0.134		0.122	113.687
9	ANXIPILEX_BSYS		6/12/2017	14:15:00	900	3.565	0.363	96.902	9.128	0.602	4.172	12.456	0.661	1.29		0.03	129.169
10	ANXIPILEX_BSYS		6/12/2017	14:30:00	900	3.435	0.358	105.176	9.235	0.588	3.41	14.284	0.671	1.401		0.118	138.676
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17																	126.9559
18																	
19																	

Calculate % GP using the average function for all intervals during the 4 hours. (Cell Q18)

Over the peak 4 hours, work serviced by ZIIP equals %127 of a GP engine (rounded up) .



## Converting zIIP Utilization Into \$\$\$\$

### Simple Formula:

**MSU Per GP \* Avg zIIP % GP (during 4 hours of peak 4HRA) \* Cost Per MSU =  
\$ Savings**

**(38) x ( 1.27) = 48.26 MSU's x Cost Per MSU = \$ Savings**

Disclaimer – zIIP % GP, Cost per MSU, & Savings are close approximations.

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MSU Per GP \* Avg zIIP % GP (during 4 hours of peak 4HRA) \* Cost Per MSU = \$ Savings

**(38) x ( 1.27) = 48.26  
MSU's x Cost Per MSU = \$ Savings**



## Converting zIIP Utilization Into \$\$\$\$

Calculating Avg zIIP % GP (During Peak 4HRA)

### Cost Per MSU

- Variable based on machine type, software type, and MSU utilization
- Cost per MSU's scales down, as GP utilization scales up
- Standard Deviation AVG provides approximation based on differences

Anixter uses monthly MSU utilization and billing history data to calculate the estimated cost per MSU. Using 24 months worth of history data, we used the standard deviation function to average the differences in monthly MSU usage and IBM billing charges. Finally, divide the billing sum by the MSU sum, to get an estimated cost per MSU @ \$743.00

72

- Variable based on machine type, software type, and MSU utilization
- Cost per MSU's scales down, as GP utilization scales up
- Standard Deviation AVG provides approximation based on differences

Using 24 months worth of history data, we used the standard deviation function to average the differences in monthly MSU usage and IBM billing charges. Finally, divide the billing sum by the MSU sum, to get an estimated cost per MSU @ \$743.00

## Converting zIIP Utilization Into \$\$\$\$



### Simple Formula:

**MSU Per GP \* Avg zIIP % GP (during 4 hours of peak 4HRA) \* Cost Per MSU = \$ Savings**

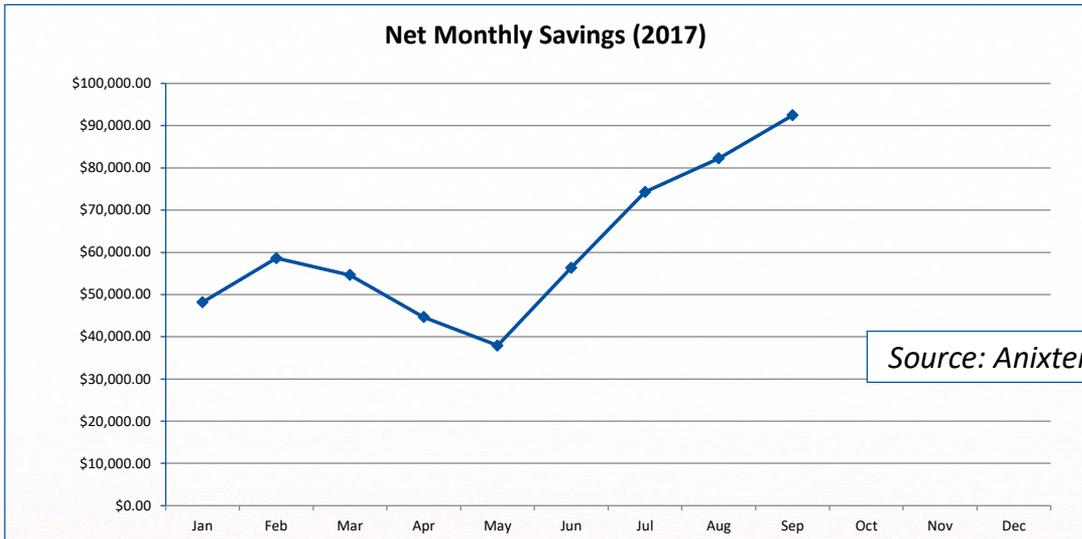
$$(38) \times (1.27) = 48.26 \text{ MSU's} \quad \times \quad \$743 = \$35,857$$

\*Disclaimer – zIIP % GP, Cost per MSU, & Savings are close approximations.

Good news: You can check against your own bills to validate your estimates!



## At Long Last: zIIP Software Savings

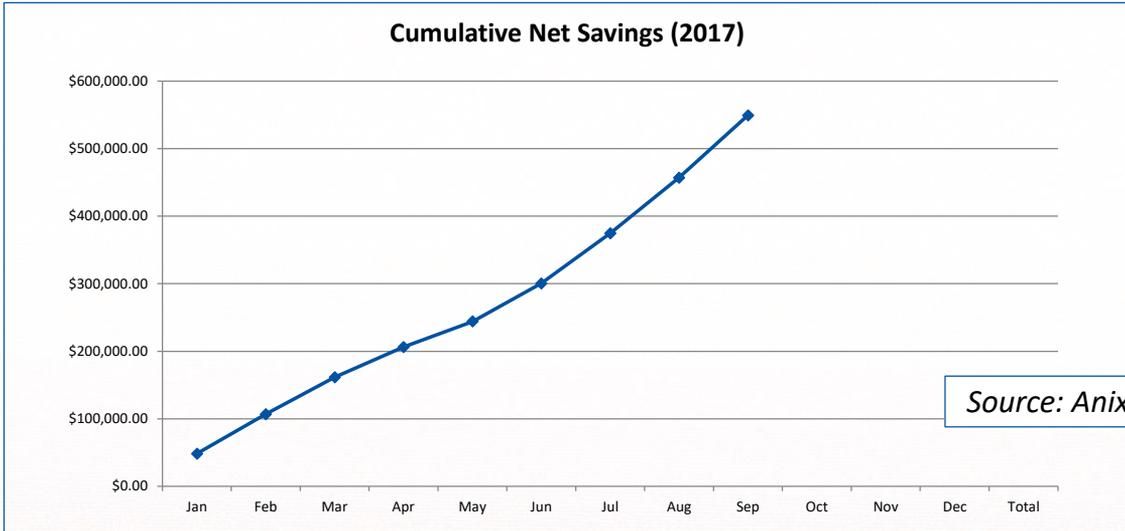


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At Long Last: We have a way to calculate the savings!

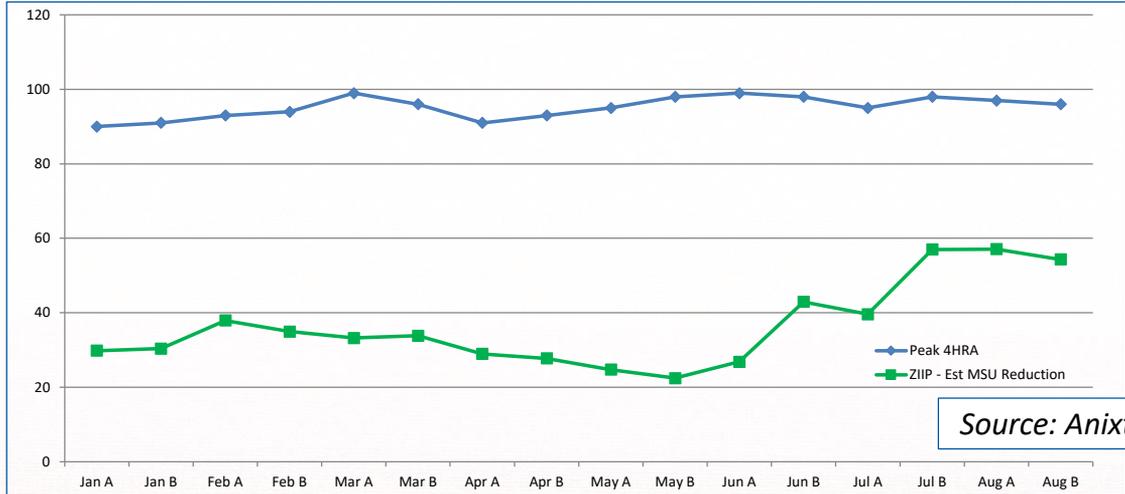


## zIIP Software Savings

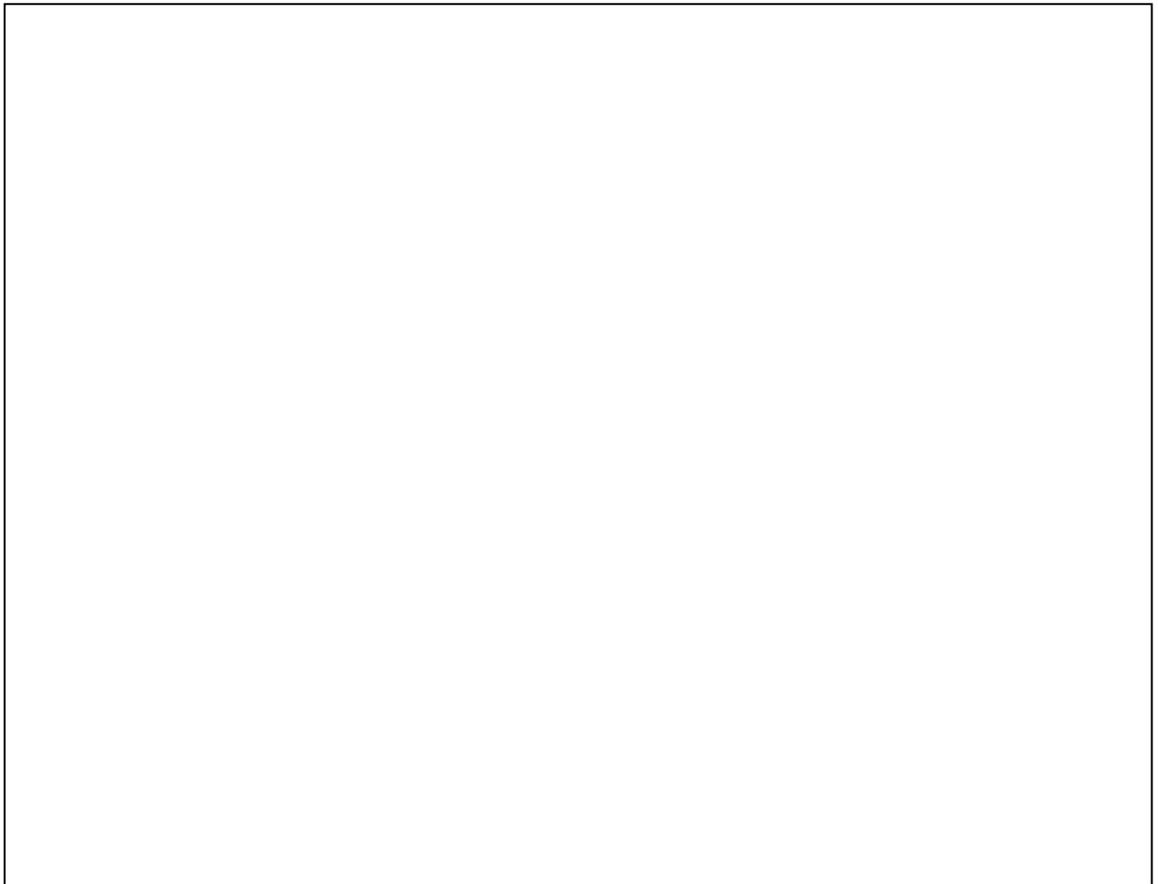




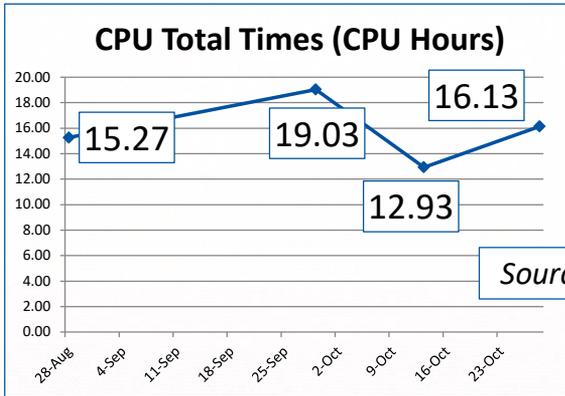
## Using Db2 Native Stored Procedures to Utilize zIIP Engines In July and August: zIIPs increases compared to CPs



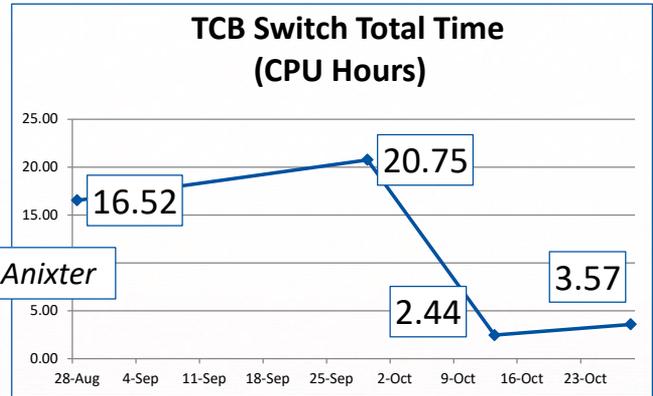
Source: Anixter



## Another Tip Worth Sharing: CICS Threadsafe TCB Switch CPU Reduced Significantly



**CICS CPU Fairly Constant**



**TCB CPU affects z/OS CPU**

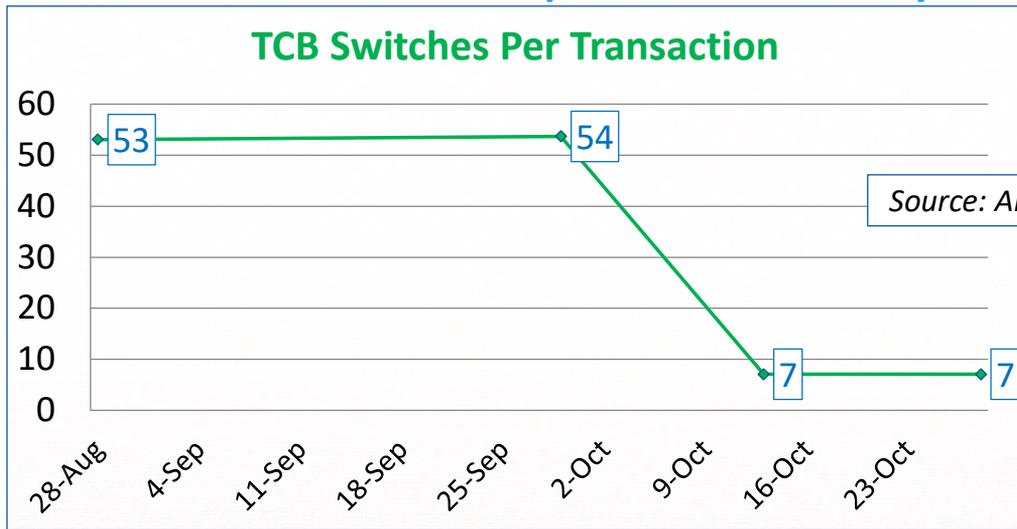
## TCB Switches Improve Dramatically with Threadsafe



Source: Anixter

	28-Aug	29-Sep	13-Oct	28-Oct
<b>Transactions</b>	3,238,335	3,473,683	2,640,639	3,329,286
<b>TCB Switches</b>	171,897,284	186,565,249	18,622,461	23,460,919

## TCB Switches Per Transaction Improves Dramatically

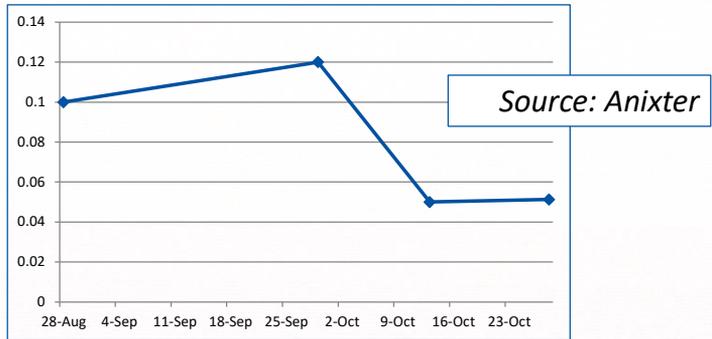


## With Threadsafe, CICS Average Response Times Drop 50%

### Anixter Application CICS Avg Reponse Times

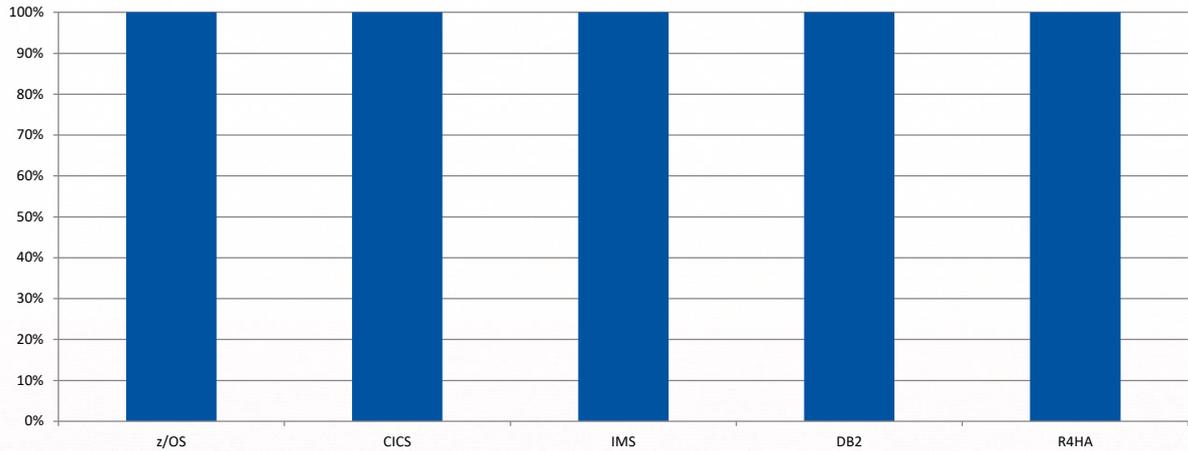
#### All CICSP\*

<b>28-Aug</b>	<b>0.10</b>
<b>29-Sep</b>	<b>0.12</b>
<b>13-Oct</b>	<b>0.05</b>
<b>28-Oct</b>	<b>0.0513</b>



An additional with Threadsafe: Response times improved, dropping 50%.

## zNALC – If you can eliminate software products by isolating New Workload, zNALC Can Save Expense, and become Capex



In actuality, each of the VWLC products is charged at 100% of the R4HA.

zNALC can make sense if you can eliminate some software products by isolating the new workload on a separate LPAR or CEC.

You mean to tell me that we don't know until the end of the month that we're over our MSU forecast?



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Good question, right? If we wait until the end of the month, we can't dramatically affect the outcome. If we can monitor intraday, then we can turn the knows to throttle batch or fix a loop or other remediation.

***Remember, the VWLC "month" runs from the 2<sup>nd</sup> of the first month into the 1<sup>st</sup> of the next month.***

## Need Alerts Before the R4HA is History? IDUG 2017 NA E04 by Damon Anderson & Michael Cotignola

- See Session E04 from IDUG 2017 NA with the presentation by Damon Anderson & Michael Cotignola: ***There's Gold in them there "peaks"***

### MSU 4 Hour Warning



DB2 Admin Scheduler <DSG@Anixter.COM>

Today, 4:35 PM

IS Technical Services Group; Steven Loesch; Damon Anderson; Darryl Grimes; IS Computer Operators; IS Operations Analysts ✕

03/01/2018      MSU 4 Hour Average Warning      TIME 16.35.11  
Please contact the Operations Analyst on-call to have them investigate.  
Limits are ASYS/CSYS(146) and BSYS/DSYS(125)  
==> ASYS/CSYS = 155 \*\*\*, BSYS/DSYS = 123

Our VP of Finance asked if he really had to wait until the end of the month to find out about exceeding the expected R4HA. Damon Anderson, Steve Loesch and Bob Hill put together a process to notify us and give us a chance to smooth out the average before it got worse.

You can see the how presentation in IDUG's site in the presentations from IDUG NA 2017 - E04 There's Gold in them there "peaks" by Damon Anderson of Anixter and Michael Cotignola of BMC.

## A simple ( and free ! ) process that might be able to prevent your organization from pushing the MSU usage over where you want to be.

- You have isolated ( moved ) your workload and tuned the SQL and have it running efficiently.
- You run the Sub Capacity Reporting Tool ( SCRT ) report and you are still above where you want to be.
- This free process requires 3 things:
  - Knowing what the MSU number you want to be below.
  - Implementing a few stored procedures and a table.
  - Being willing to take action when notified of high MSU usage.

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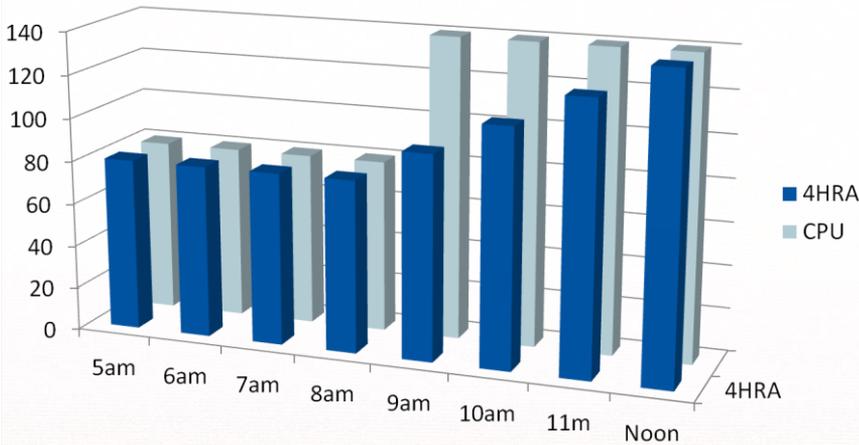
The last portion of this presentation is going back to address finding out when your peak 4HRA is.

The simple little method of doing this requires 3 things:

- Knowing what the MSU number you want to be below.
- Implementing a few stored procedures and a table.
- Being willing to take action when notified of high MSU usage.

The last one is likely the most difficult of the three. It is difficult because you may think there is nothing you can do. That may not be the case.

## The 4 hour rolling average (4HRA) and momentum.



Want below 110, notify at 100.

Value of knowing.

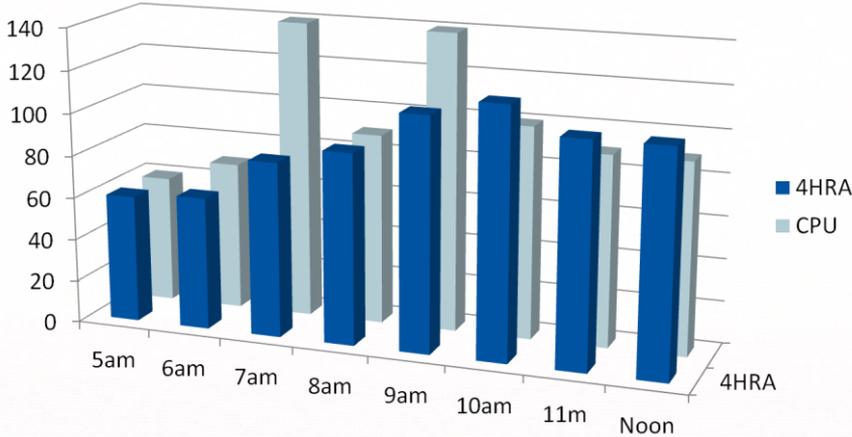
Time	CPU	4HRA
5am	80	80
6am	80	80
7am	80	80
8am	80	80
9am	140	95
10am	140	110
11am	140	125
Noon	140	140

This slide shows a system running flat at a small number. Then at 9am, an intensive process starts that drives the CPU up. It takes 4 hours for the average to get as high as it will go.

The question was, "Is there something I can do?" If the workload that is driving the system can be ran at a time where even less is going on with the system, then the answer is "Yes". You can cancel the job and run it later. What if this was a set of 2 jobs that run 2 hours each, back to back on a Saturday morning? Changing the schedule to wait 2 hours between the jobs could prevent a high 4HRA.

**Momentum isn't always the situation.  
 This example shows that.**

Want below 110, notify at 100.  
 Can we still do something?  
 Get ready to write a check.



Time	CPU	4HRA
5am	60	60
6am	70	62.5
7am	140	82.5
8am	90	90
9am	140	110
10am	100	117.5
11am	90	105
Noon	90	105

This case shows the example of a large spike in workload 3 hours ago followed by a more recent spike one hour ago. In this case the 4 hour average will go higher despite most efforts.

## Definition of a Rexx Stored procedure to get the 4HRA from CVT

```

EDIT      E200301.BMCCAT.WORK
Command ==>
***** ***** Top of Data ****
000001 CREATE PROCEDURE E200301.GET4HMSU
000002 ( OUT  DECIMAL(4) )
000003 EXTERNAL NAME 'GET4HMSU'
000004 PARAMETER STYLE GENERAL
000005 DYNAMIC RESULT SETS 0
000006 PARAMETER CCSID EBCDIC
000007 LANGUAGE REXX
000008 COLLID DSNREXCS
000009 WLM ENVIRONMENT DB2BSB ;
***** ***** Bottom of Data **

```

Member name of the Rexx Exec in SYSEXEC concatenation of the WLM Address Space

Rexx WLM Application Environment

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The Rexx routine needs to be defined on a Subsystem running on every LPAR for this to work. The definition of the Rexx procedure is as follows:

```

CREATE PROCEDURE E200301.GET4HMSU
( OUT  DECIMAL(4) )
EXTERNAL NAME 'GET4HMSU'
PARAMETER STYLE GENERAL
DYNAMIC RESULT SETS 0
PARAMETER CCSID EBCDIC
LANGUAGE REXX
COLLID DSNREXCS
WLM ENVIRONMENT DB2BSB

```

Obviously, schema, name, external name and WLM environment can all be customized to your environment.

## The Rexx code that is the Stored procedure ( gets the 4HRA from CVT )

The Rexx procedure to the left needs to be placed in a library that is in the SYSEXEC concatenation of your Rexx WLM Stored Procedure address spaces.

Control block chasing courtesy of Google.

```
File Edit Edit_Settings Menu Utilities Compilers Test Help
EDIT T80.EXEC(T804HMSU) - 01.02 Columns 00001 00080
Command ==> - Scroll ==> CSR
***** Top of Data *****
000001 /***** REXX *****/
000002 /** */
000003 /** EXEC : T804HMSU */
000004 /*I PURPOSE : REXX PROCEDURE TO LOOK IN THE CVT FOR THE 4 HR MSU AVG */
000005 /** */
000006 /***** */
000007
000008 MSU = 0
000009 CVT = C2D(STORAGE(10,4)) /* POINT TO CVT */
000010 RMCT = C2D(STORAGE(D2X(CVT+604),4)) /* POINT TO RMCT */
000011 RCT = C2D(STORAGE(D2X(RMCT+228),4)) /* RESOURCE CTRL TBL*/
000012 MSU = C2D(STORAGE(D2X(RCT+196),4)) /* 4 HR MSU AVERAGE */
000013
000014 RETURN MSU
***** Bottom of Data *****
```

The Rexx routine code that needs to be placed in the PDS member in the SYSEXEC concatenation of the Rexx WLM address space.

```

/***** REXX *****/
/** */
/** EXEC : T804HMSU */
/*I PURPOSE : REXX PROCEDURE TO LOOK IN THE CVT FOR THE 4 HR MSU AVG */
/** */
/***** */

MSU = 0
CVT = C2D(STORAGE(10,4)) /* POINT TO CVT */
RMCT = C2D(STORAGE(D2X(CVT+604),4)) /* POINT TO RMCT */
RCT = C2D(STORAGE(D2X(RMCT+228),4)) /* RESOURCE CTRL TBL*/
MSU = C2D(STORAGE(D2X(RCT+196),4)) /* 4 HR MSU AVERAGE */

RETURN MSU

```

## Testing the Rexx code to get the 4HRA from CVT.

Invoke the Stored Procedure in Data Studio to confirm a number comes back.

The screenshot shows the 'Run GET4HMSU' dialog box in IBM Data Studio. The 'Parameters' tab is active, displaying a table with the following data:

Name	Type	Data type	Value	Value (OUT)
DB2_14860048672251	OUTPUT	DECIMAL		19

A large blue arrow points to the value '19' in the 'Value (OUT)' column.

Invoke the Rexx Stored Procedure and confirm the number matches the number presented by your monitor.

This shows how to invoke the Rexx stored procedure from Data Studio.

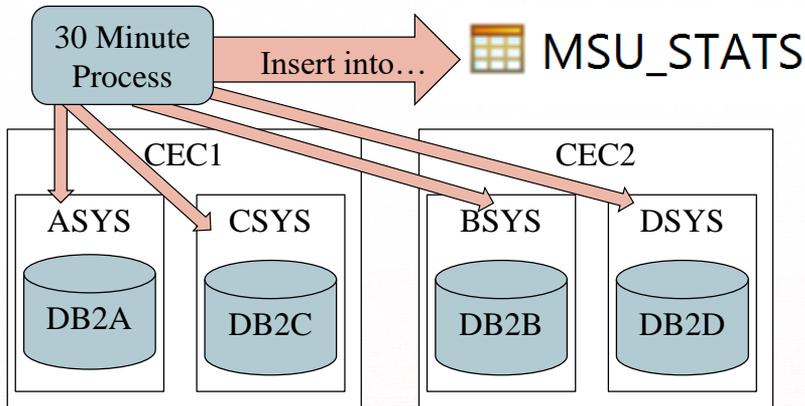
## The Rexx code and proc works... now what?

- Create a table on your favorite Db2 Subsystem to hold the numbers for every LPAR.
- CEC usage can be calculated from LPARs. You need to know LPAR to CEC assignments.

```
EDIT          E200301.BMCCAT.WORK
Command ==>
***** ***** Top of Data *****
000001      CREATE TABLE
000002          T800BA.MSU_STATS
000003      ( CRT_DT  TIMESTAMP NOT NULL
000004          ,ASYS  INTEGER NOT NULL WITH DEFAULT
000005          ,CSYS  INTEGER NOT NULL WITH DEFAULT
000006          ,BSYS  INTEGER NOT NULL WITH DEFAULT
000007          ,DSYS  INTEGER NOT NULL WITH DEFAULT
000008          , CONSTRAINT MSU_STAT_PK
000009          PRIMARY KEY
000010          ( CRT_DT  ) )
000011
```

We have a table to store the MSU numbers from every LPAR. We can then calculate the CEC usage by adding the appropriate LPARS together.

## Automated process with calls to as many subsystems as you have LPARs. (Assumption is a Db2 is running on every LPAR.)



Our process runs every thirty minutes, calling the proc on 4 subsystems. Values are plugged into variables and the row is inserted into the table.

If over the limit, text the interested parties.

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Our process that runs every 30 minutes has affinities defined to specific members of data sharing groups to that it can get the 4HRA info from each LPAR.

The process then stores them in the table so when we are over 90% or so of where we want to max out at, we can see what has been happening in the last 4 hours.

If we are over the limit, the process send text messages to support personnel.

## Select statement to generate a formatted report of the last 7 days worth of information.

```

*Script43.sql
Connection: DB2B1 [e200301]
SELECT CASE
  WHEN DAYOFWEEK(CRT_DT) = 1 THEN 'Sunday'
  WHEN DAYOFWEEK(CRT_DT) = 2 THEN 'Monday'
  WHEN DAYOFWEEK(CRT_DT) = 3 THEN 'Tuesday'
  WHEN DAYOFWEEK(CRT_DT) = 4 THEN 'Wednesday'
  WHEN DAYOFWEEK(CRT_DT) = 5 THEN 'Thursday'
  WHEN DAYOFWEEK(CRT_DT) = 6 THEN 'Friday'
  ELSE 'Saturday' END AS WEEKDAY
, CHAR(LEFT(CHAR(CRT_DT),10) CONCAT SPACE(2) CONCAT
LEFT(CHAR(TIME(CRT_DT)),5),18) AS CRT_DT
, CAST(ASYS + CSYS AS CHAR(6)) AS CEC1
, CAST(BSYS + DSYS AS CHAR(6)) AS CEC2
, CAST(ASYS AS CHAR(6)) AS ASYS
, CAST(CSYS AS CHAR(6)) AS CSYS
, CAST(BSYS AS CHAR(6)) AS BSYS
, CAST(DSYS AS CHAR(6)) AS DSYS
FROM T80DBA.MSU_STATS
WHERE CRT_DT > CURRENT TIMESTAMP - 7 DAYS
ORDER BY 2 DESC
WITH UR ;
  
```

ASYS & CSYS are CEC1  
 BSYS & DSYS are CEC2

This query creates a formatted report of the MSU numbers for the last seven days.

## Output of the prior select statement showing our history.

Status	Parameters	Result1						
WEEKDAY	CRT_DT	CEC1	CEC2	ASYS	CSYS	BSYS	DSYS	
Wednesday	2017-02-01	21.39	67	57	48	19	56	1
Wednesday	2017-02-01	21.09	73	63	55	18	62	1
Wednesday	2017-02-01	20.38	79	70	60	19	68	2
Wednesday	2017-02-01	20.08	87	75	66	21	73	2
Wednesday	2017-02-01	19.37	97	76	73	24	74	2
Wednesday	2017-02-01	19.07	103	79	78	25	77	2
Wednesday	2017-02-01	18.36	112	83	85	27	81	2
Wednesday	2017-02-01	18.06	116	86	87	29	84	2
Wednesday	2017-02-01	17.35	117	88	88	29	86	2
Wednesday	2017-02-01	17.05	120	89	89	30	88	2
Wednesday	2017-02-01	16.37	120	90	90	30	90	2
Wednesday	2017-02-01	16.07	121	90	90	31	91	2
Wednesday	2017-02-01	15.36	121	90	90	31	91	2
Wednesday	2017-02-01	15.09	119	88	88	31	90	2
Wednesday	2017-02-01	14.38	117	91	86	31	89	2
Wednesday	2017-02-01	14.05	118	92	87	31	90	2
Wednesday	2017-02-01	13.35	119	94	88	31	92	2
Wednesday	2017-02-01	13.05	119	93	88	31	91	2
Wednesday	2017-02-01	12.38	119	92	88	31	90	2
Wednesday	2017-02-01	12.08	119	91	88	31	89	2
Wednesday	2017-02-01	11.38	116	87	85	31	85	2
Wednesday	2017-02-01	11.08	113	82	83	30	80	2
Wednesday	2017-02-01	10.38	104	74	77	27	72	2
Wednesday	2017-02-01	10.08	95	64	70	25	62	2
Wednesday	2017-02-01	09.35	82	53	61	21	51	2

High Point of 121, around 4pm on a Wednesday

The process that runs every 30 minutes checks for our thresholds and if it is exceeded, it sends a message to several parties.

Here the output of the previous query shows the high occurring around 3:30 / 4:00 PM on a date on or near the end of the month. ( 4-4-5 Accounting Calendar )

## Summary

- We answered the question:
  - “Can Someone Please Explain to Me How we’re saving money on zIIPs?”
- Defined terms
  - MIPS, MSUs, VWLC, SCRT, Sysplex Pricing, zIIPs for Java, Distributed, BI/DW
- Found the Peak 4HRA/R4HA (Batch first, then Online & Distributed)
- Converted GPEs and zIIPs into MSUs, and MSUs into Dollars
  - Validated against our own bills – you can do the same!
- Demonstrated the impact of tuning Batch, and use of zIIPs
- Db2 Native Stored Procedures: A Tale of Two Applications
- Bonus tips on CICS and Threadsafe, zNALC, and intra-day monitoring

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