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Central Canada Db2 Users Group
April 29-30, 2019

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# 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

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## 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

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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.

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## 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.

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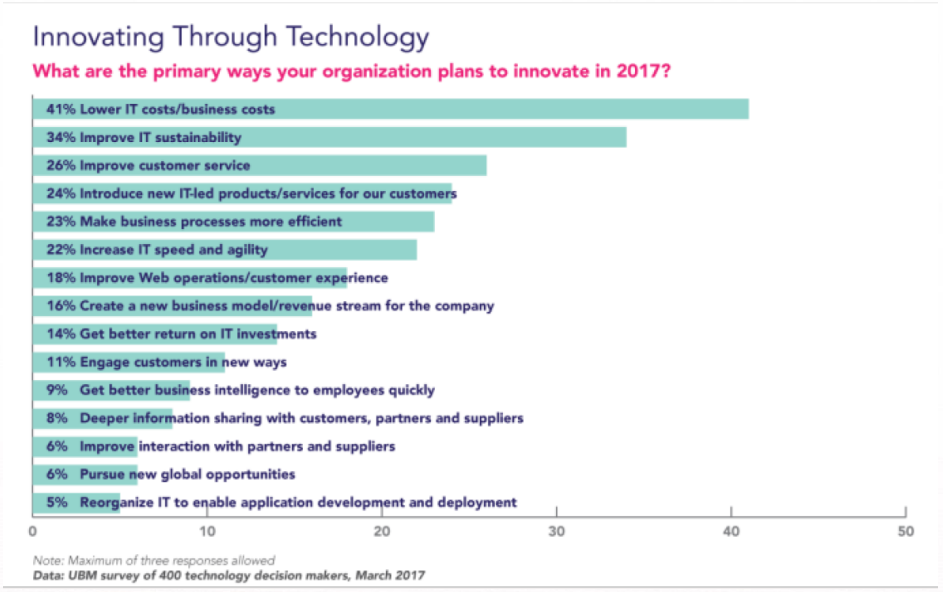
# Lowering Cost is Top Priority

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

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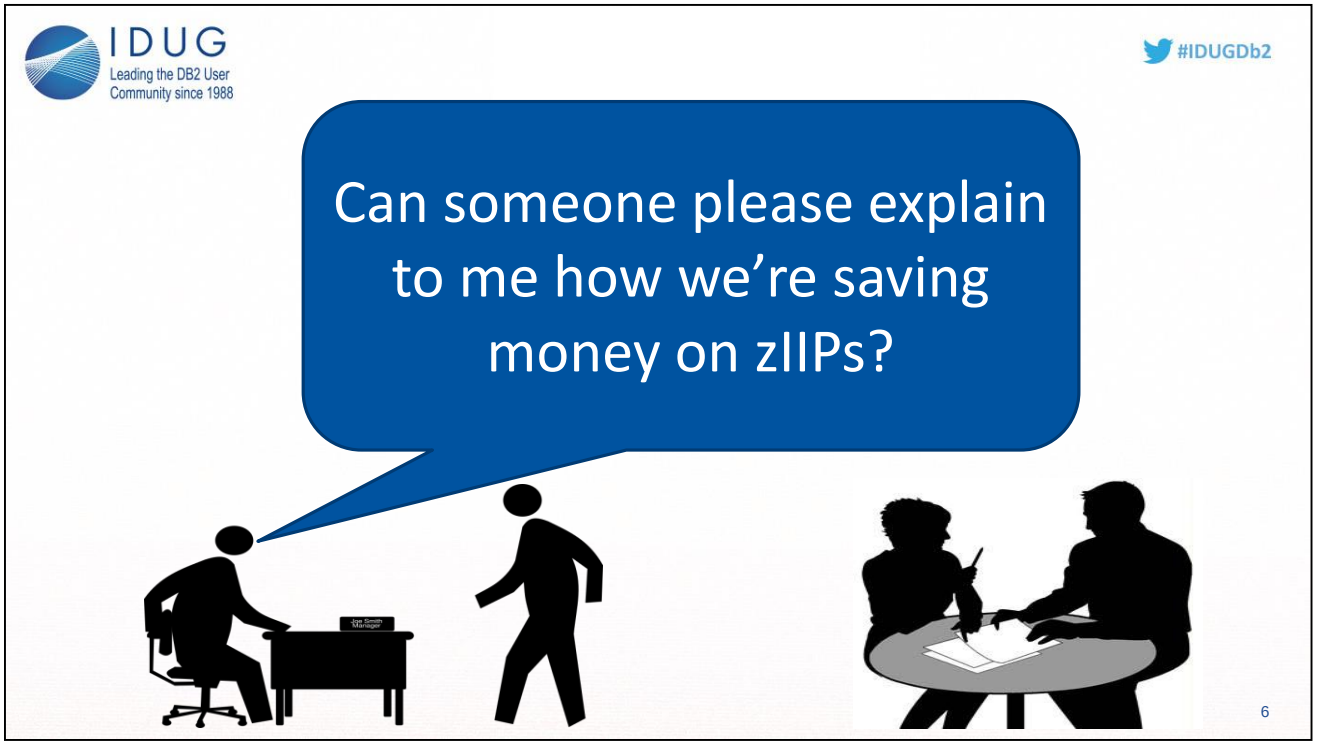
In case you thought it was just you, it's not: almost everyone ranks lowering IT costs and business costs as a top priority. Although the Digital Transformation and Customer Experience investments are very real, the relentless focus on cost reduction continues.




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


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.

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## 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*** ?

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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.

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## 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

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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!*

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## 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/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."

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## 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.*

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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

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## 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.

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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

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## Determining the relationship between MIPS and MSU Reviewing Anixter's Mainframes since 2006: z9, z10, BC12

| | CEC | Model | Installed | Procs | zIIPs | MIPS | MSU | MIPS/MSU |
|---|---|---|---|---|---|---|---|---|
| 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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MIPSs/MSUs

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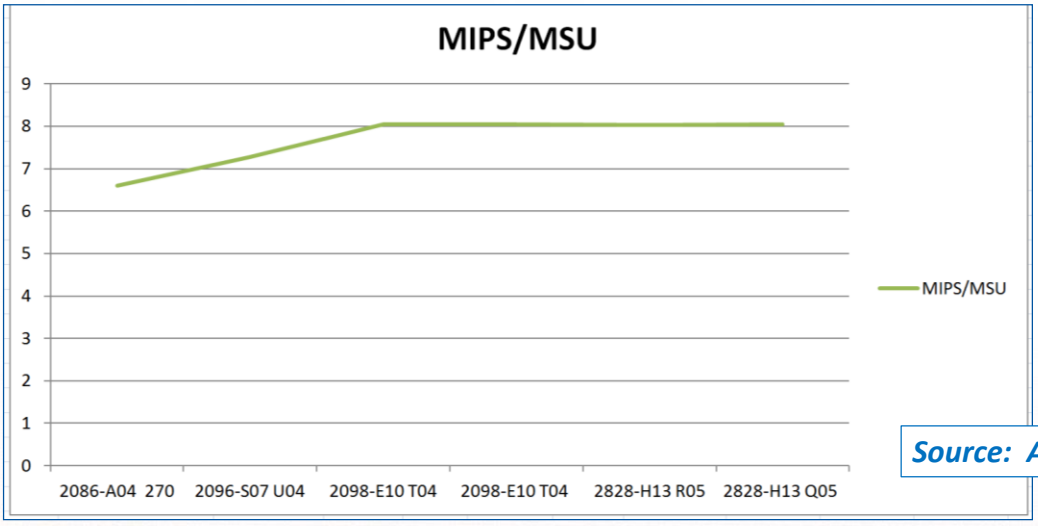
# MIPS per MSU over the years from z9 to z10 to BC12




*Source: Anixter*

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

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

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# 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**

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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.

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## 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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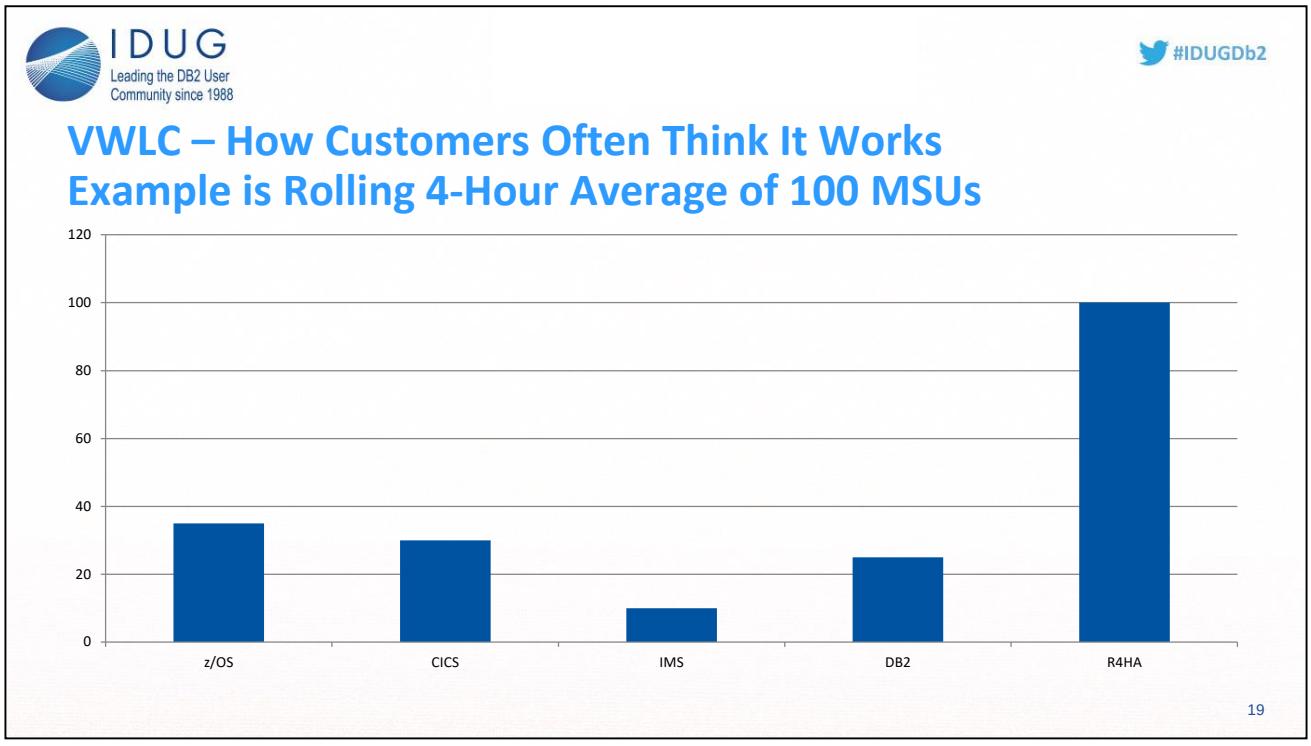


**On first blush, customers often think that the individual software products are charged at their percentage contribution to the R4HA (aka 4HRA).**

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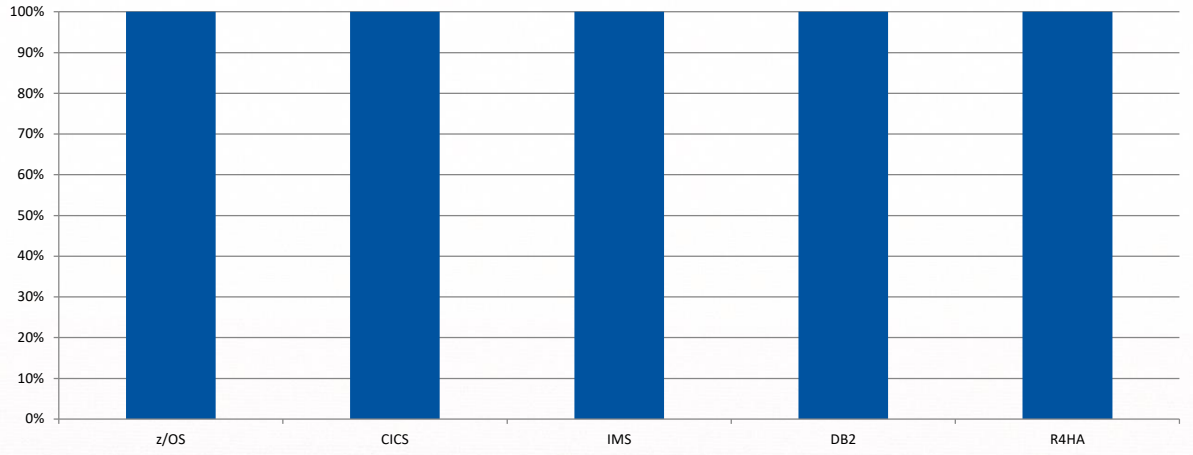
## VWLC – How it Actually Works
## Each VWLC Product is Charged at the R4HA/4HRA Capacity

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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.

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# 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 |
|---|---|---|---|---|---|---|---|---|
| Price as of Jan 1, 2015 | | | | | | | | |
| 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 |
| Total | | | | | | | | $50,295 |

| Price as of Jan 1, 2015 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 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 |
| Total | | | | | | | | $66,005 |

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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.

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## 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

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## 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

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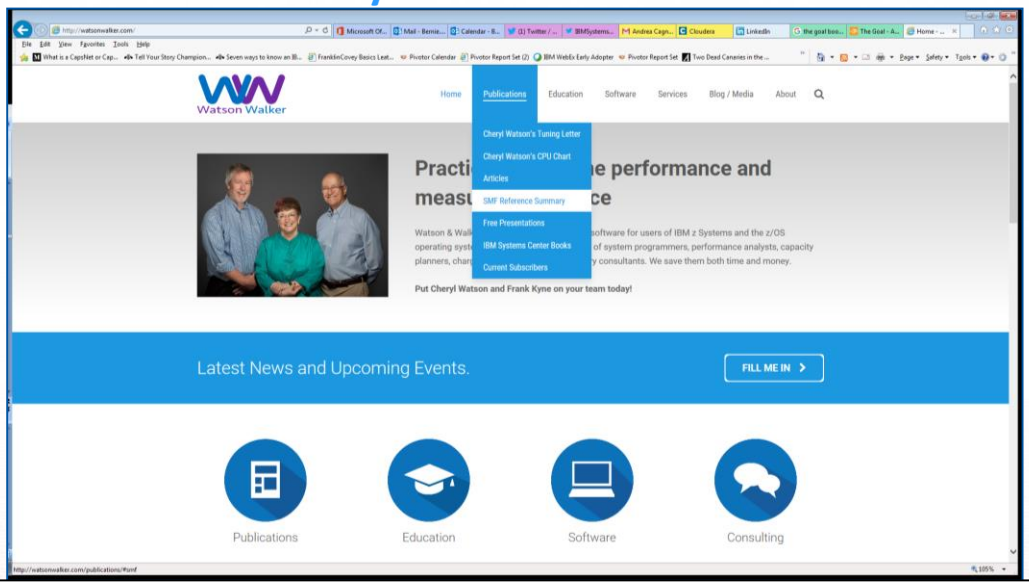
For information on SCRT and other Pricing Tools, please see:
https://www.ibm.com/it-infrastructure/z/software/pricing-tools

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

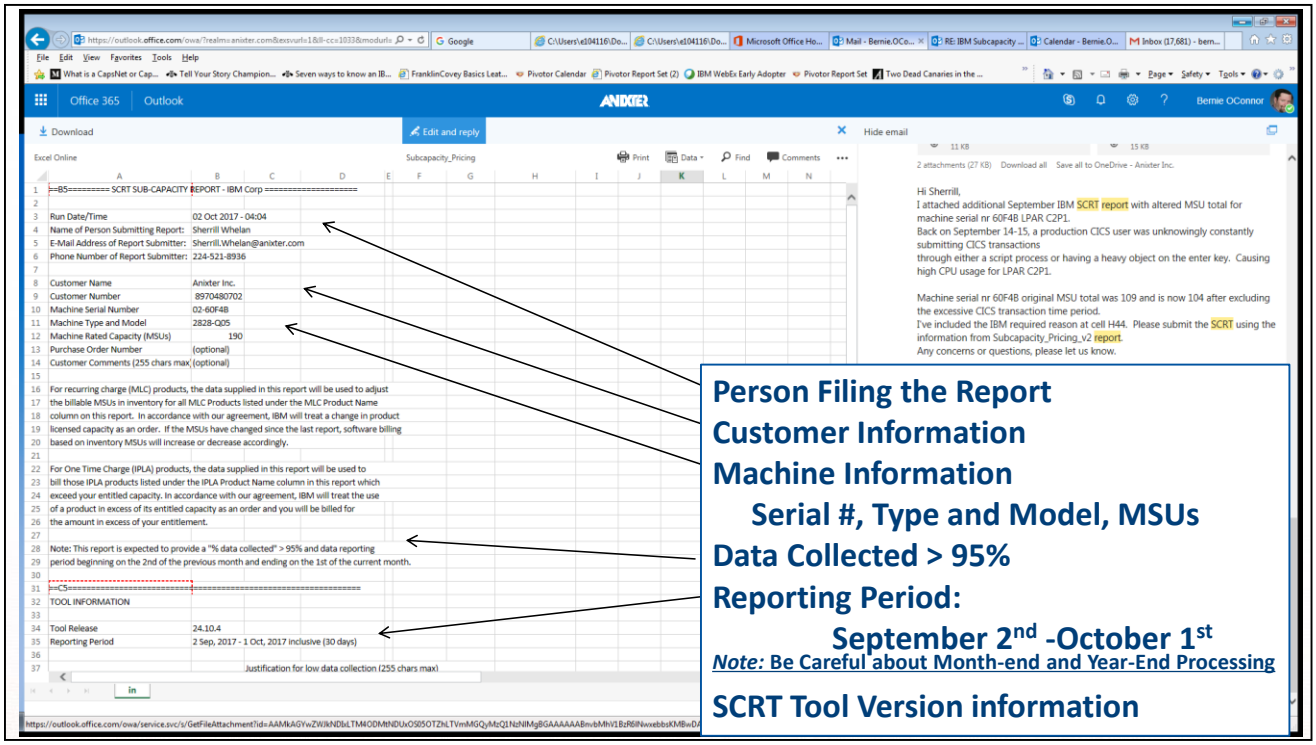
**https://www.ibm.com/support/knowledgecenter/en/SSLTBW_2.1.0/com.ibm.zos.v2r1.e0zi100/e0zi129.htm**

# SMF Reference Summary – watsonwalker.com

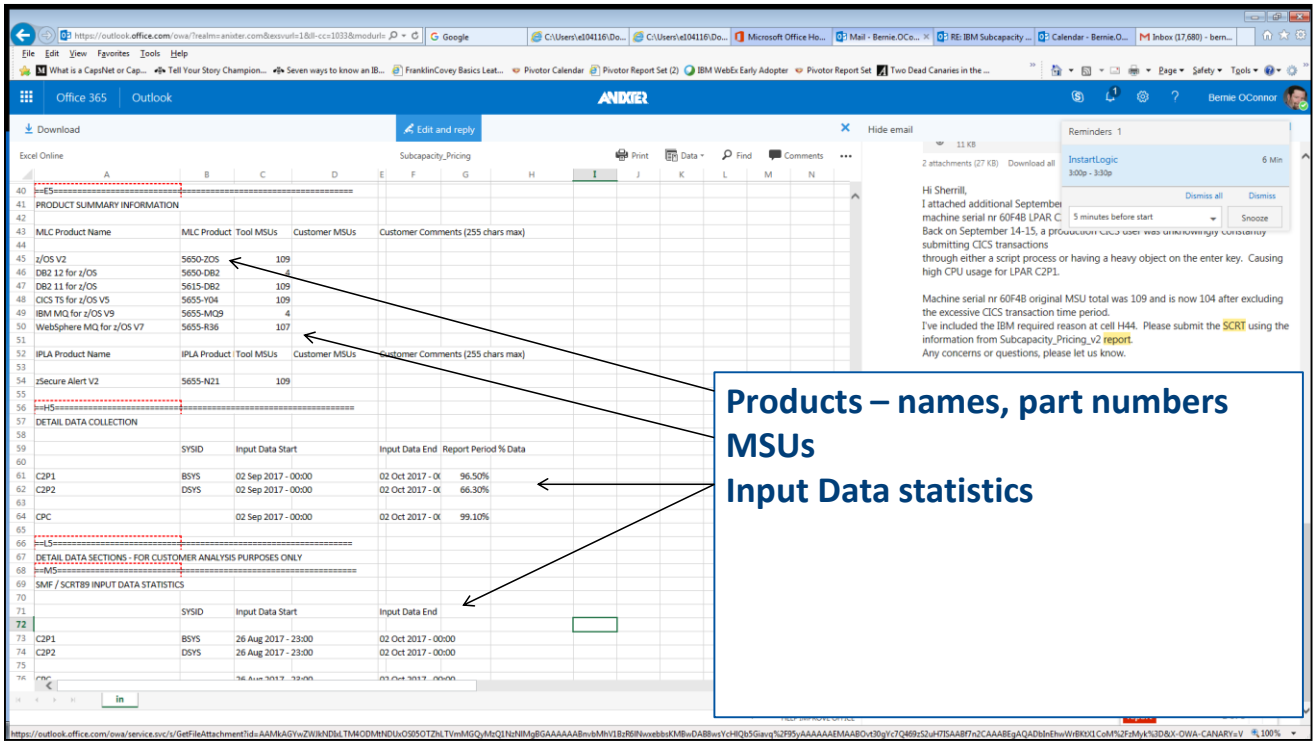




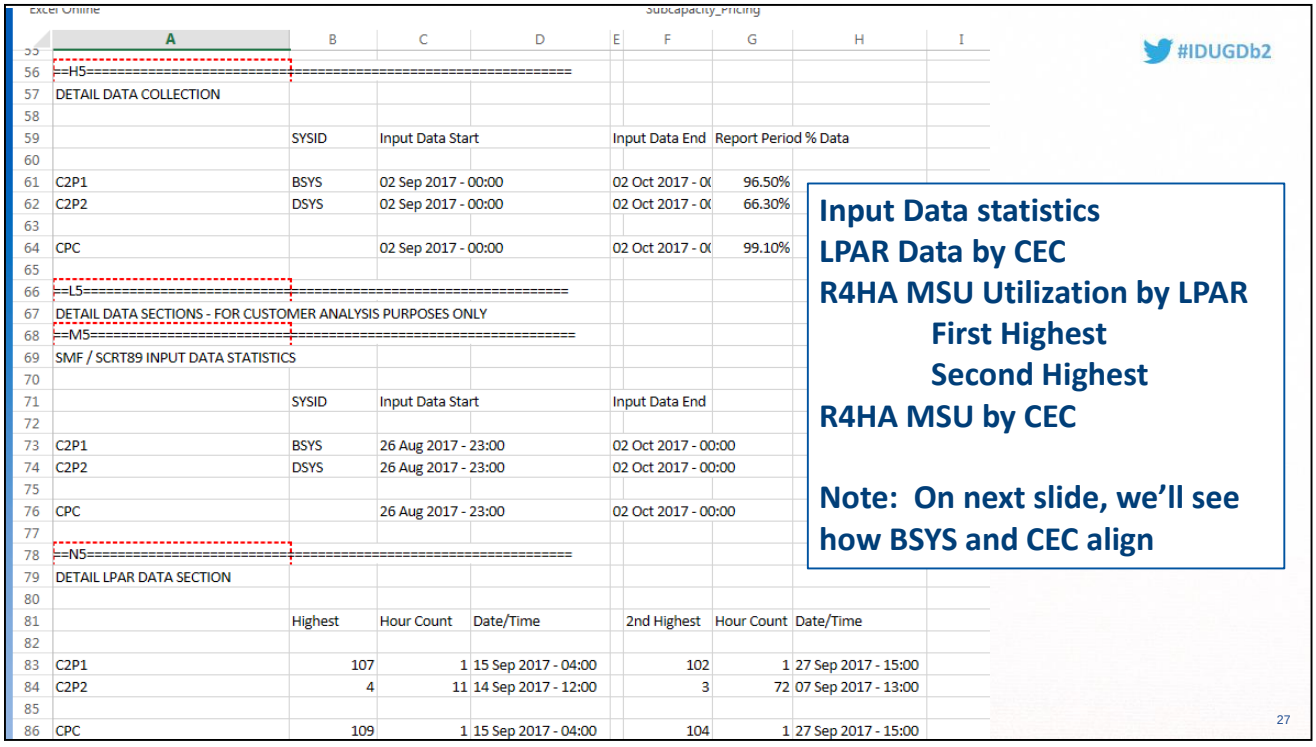

Cheryl Watson has been known for her regular newsletters. The watsonwalker.com site is a good resource for a number of free presentations, white papers and reference information.




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.




Here's a continuation



| | A | B | C | D | E | F | G | H | I |
|---|---|---|---|---|---|---|---|---|---|
| 56 | ==H5========== | | | | | | | | |
| 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 - 0( | 96.50% | | |
| 62 | C2P2 | DSYS | 02 Sep 2017 - 00:00 | | | 02 Oct 2017 - 0( | 66.30% | | |
| 63 | | | | | | | | | |
| 64 | CPC | | 02 Sep 2017 - 00:00 | | | 02 Oct 2017 - 0( | 99.10% | | |
| 65 | | | | | | | | | |
| 66 | ==L5========== | | | | | | | | |
| 67 | DETAIL DATA SECTIONS - FOR CUSTOMER ANALYSIS PURPOSES ONLY | | | | | | | | |
| 68 | ==M5========== | | | | | | | | |
| 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 | ==N5========== | | | | | | | | |
| 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 | |



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

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# 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 |

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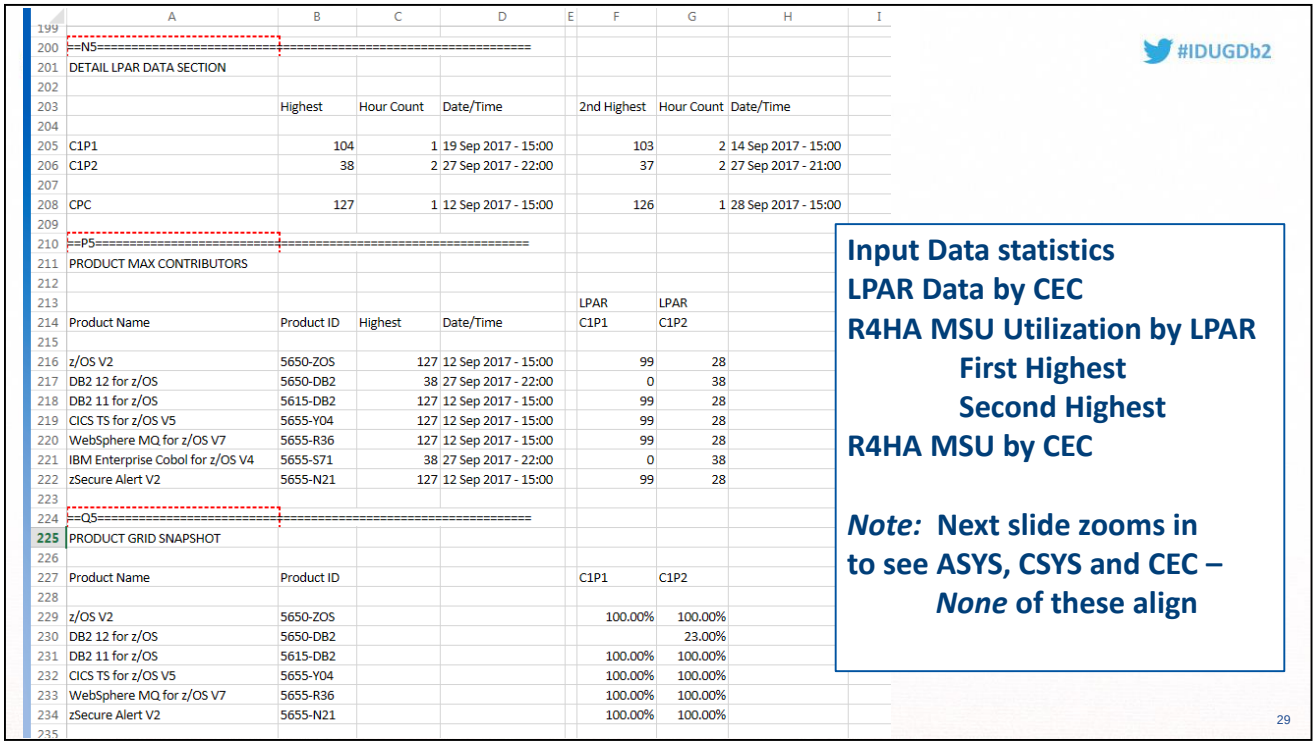
We can see here the two highest R4HA periods for each LPAR. It so happens that IBM billed Anixter for the highest period on BSYS, and whatever was running on DSYS at the same time. That's because our MSU calculation is at a CEC level for billing purposes, not at an LPAR level.



| | 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 | | | | | | LPAR | LPAR | | |
| 214 | Product Name | Product ID | Highest | Date/Time | | C1P1 | 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 | | | | | | | | | |



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

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# 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 |

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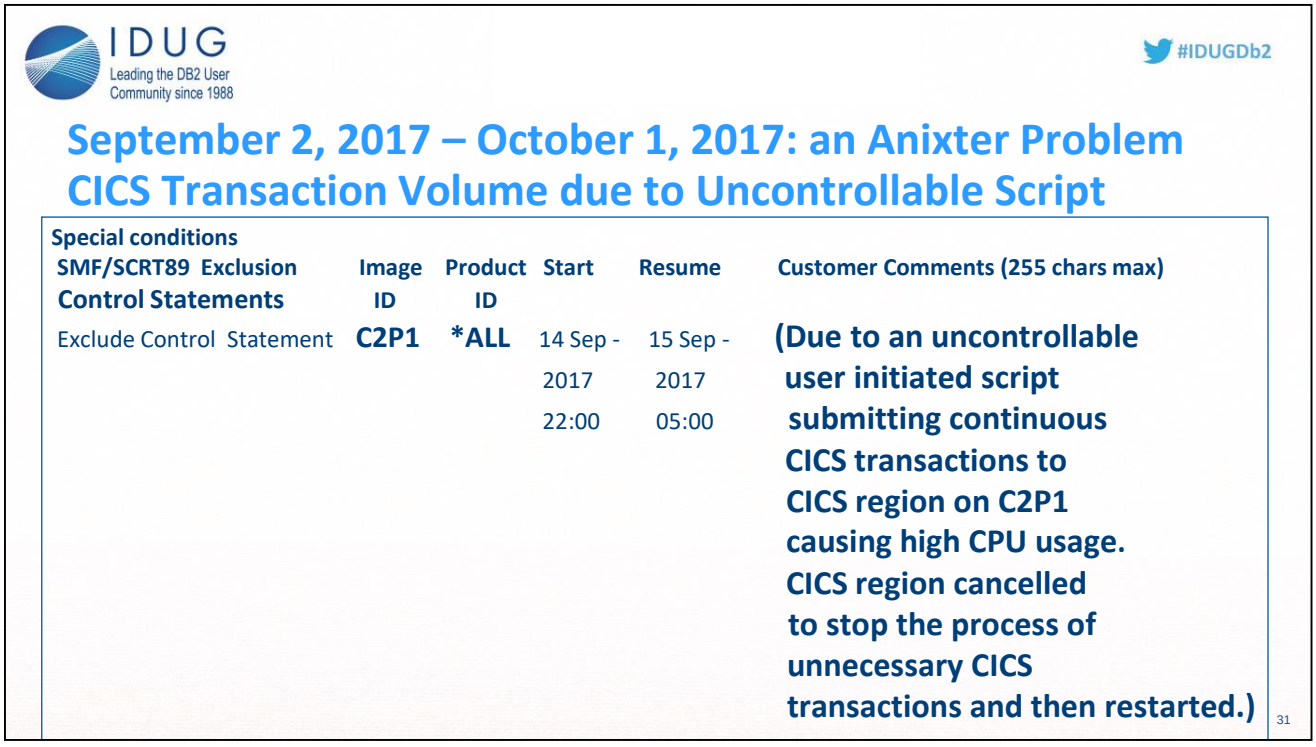
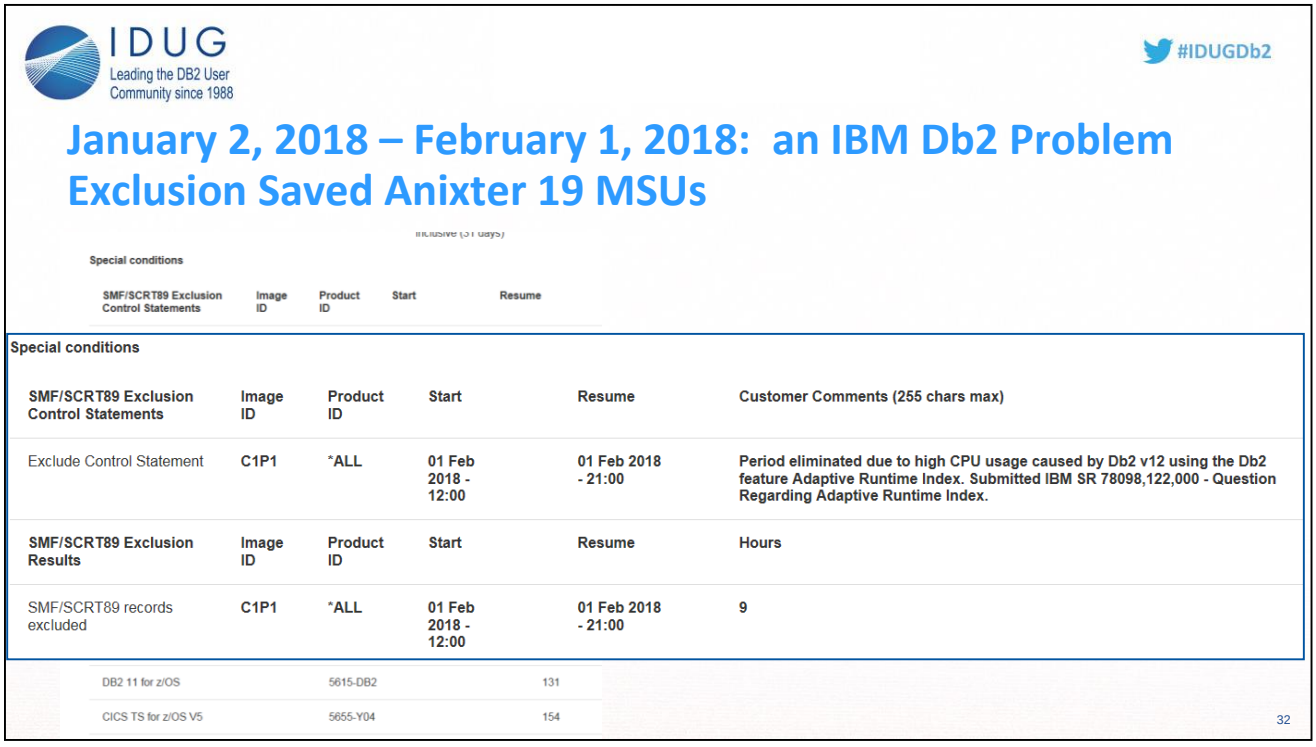
Here we can see that the billing for the CEC (see CPC) is for a time period that corresponds to neither the first nor second period for P1 or P2. The IBM billing algorithm picked a CEC-level average that combined LPAR1 (ASYS) and LPAR2 (CSYS) at a peak R4HA for a different date and time than the peaks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

This is normal.




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.***




Here's what the IBM confirmation looks like, and what a Special Condition looks like for an IBM problem that caused additional CPU consumption.

***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: ***C1P1.***

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## 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)***

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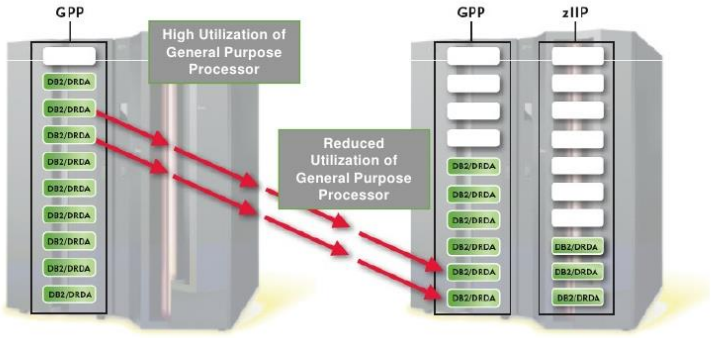
https://www.ibm.com/us-en/marketplace/z-integrated-information-processor-ziip

# 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.

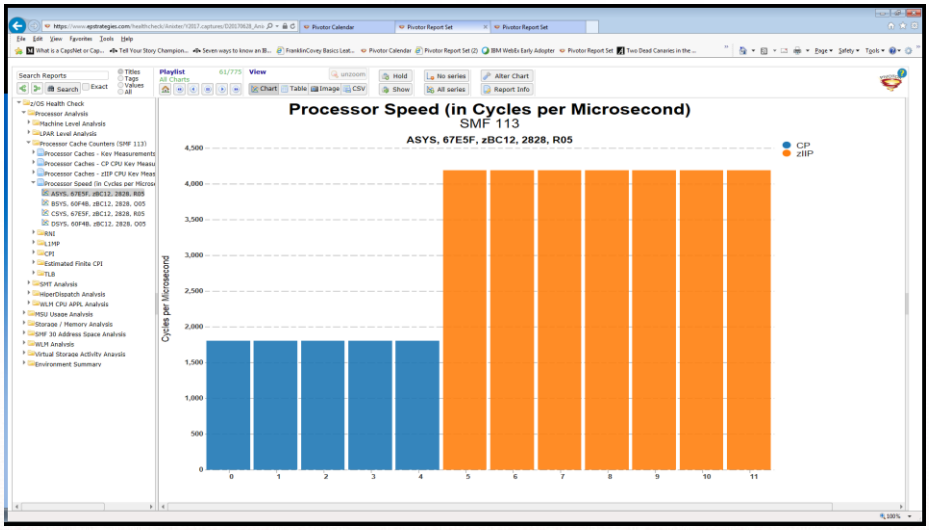
## Kneecap Strategy:
## Your CPs are dialed back and your zIIPs are on steroids

- 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



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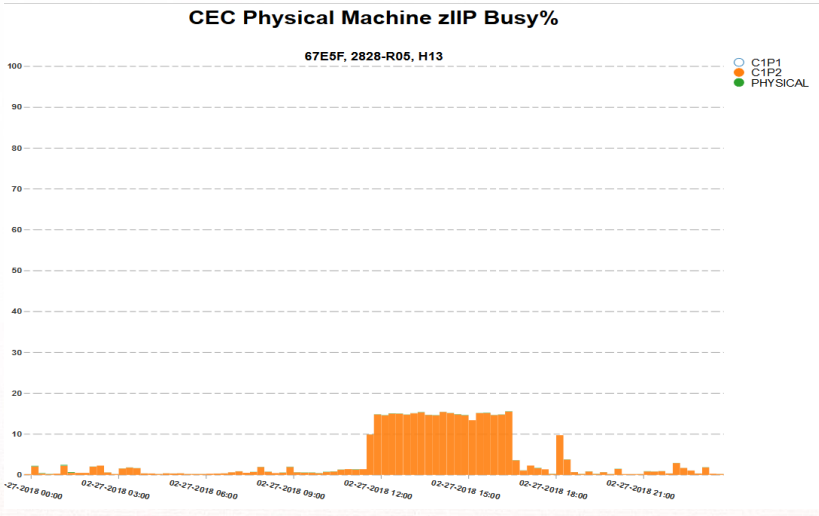
# zIIPs Can Be Taken for Granted, even Dismissed, Unless Busy % Is Normalized to CPs

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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.

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Source: Anixter

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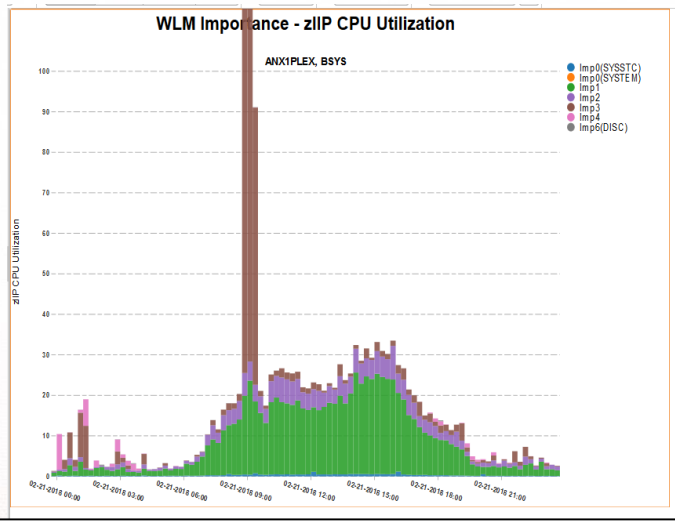
# This Chart Got Our Attention
# zIIP Utilization Was Literally Off the Chart






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.

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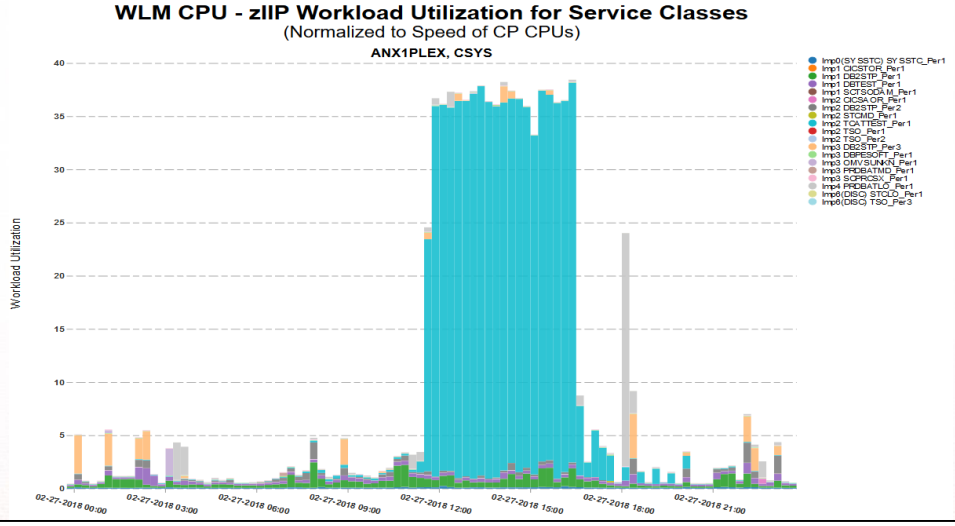
# CPU for zIIPs % normalized to CP
# A More Intuitive Understanding "At a Glance"






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

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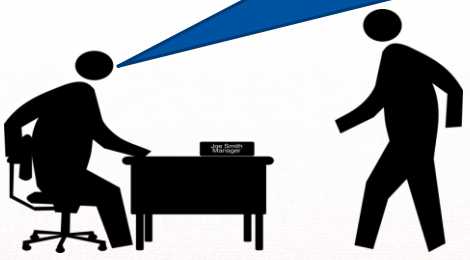
That's a little odd, isn't it? Who else directs workload to another processor?

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There's an answer to this question….

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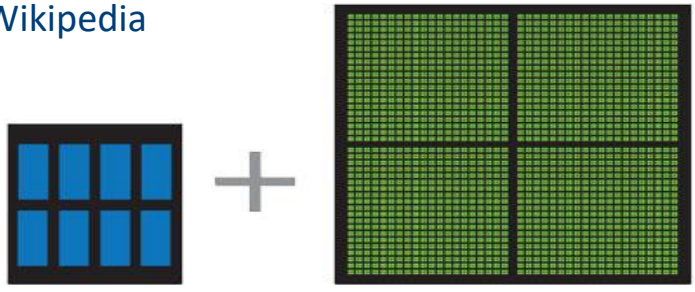
## If Your Finance VP asks, "Who Else Uses Specialty Engines?" Nvidia is an example of another "Specialty Processor"

- 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




***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.

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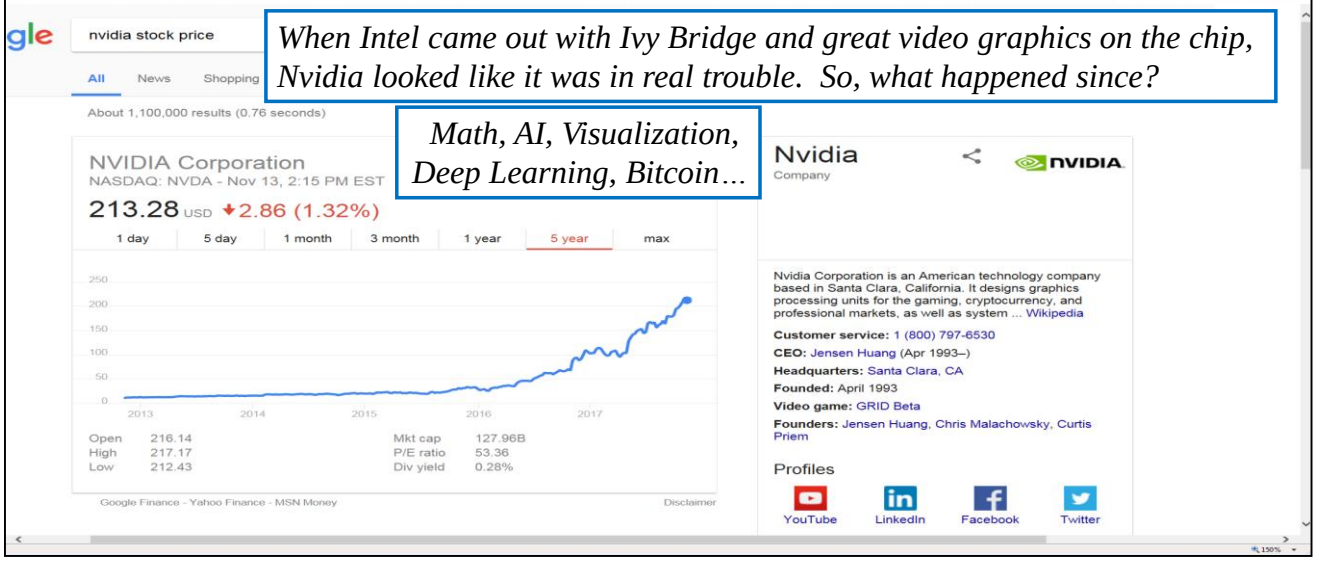
# Video Cards Became the New ALU - Math Co-processor




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.

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## 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

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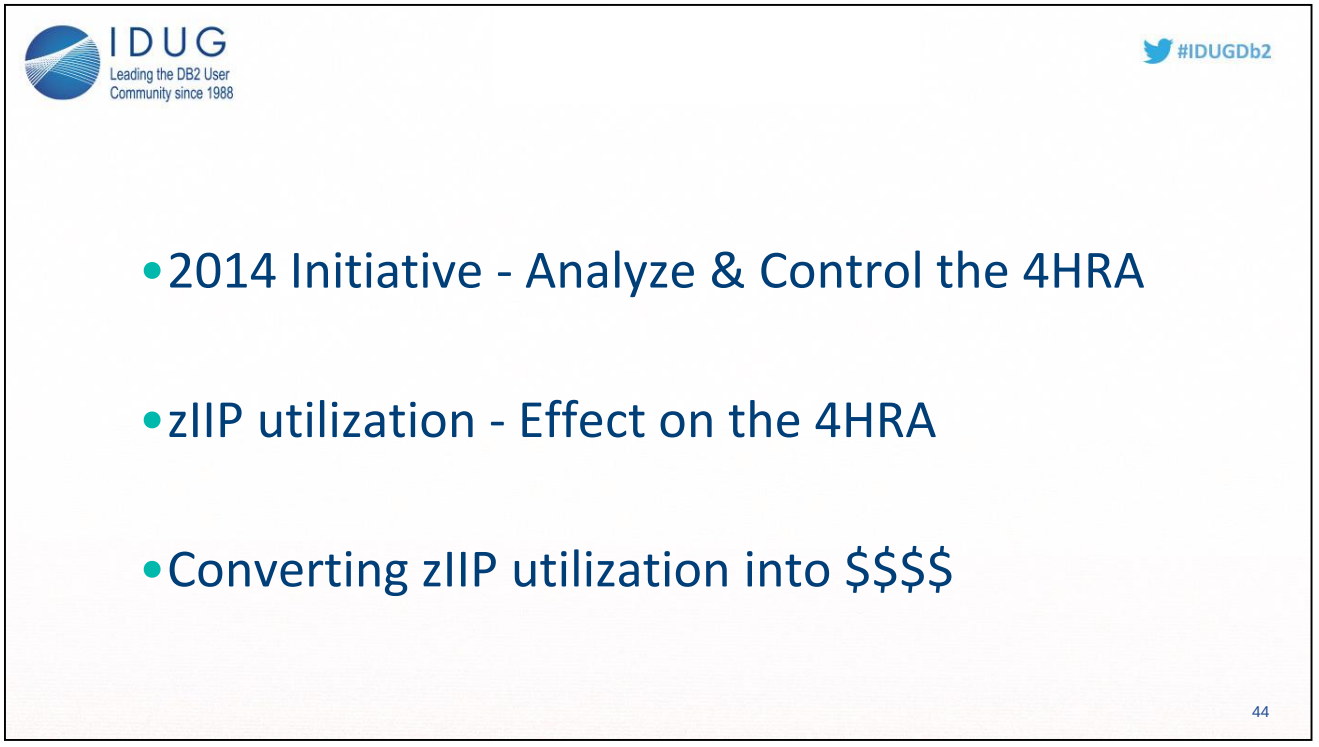
Giving Bob Hill Credit for his great work in finding and fixing the Batch Bottlenecks on Saturday morning that were driving the R4HA. Without his work, we would never have achieved the cost savings with the zIIPs.




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

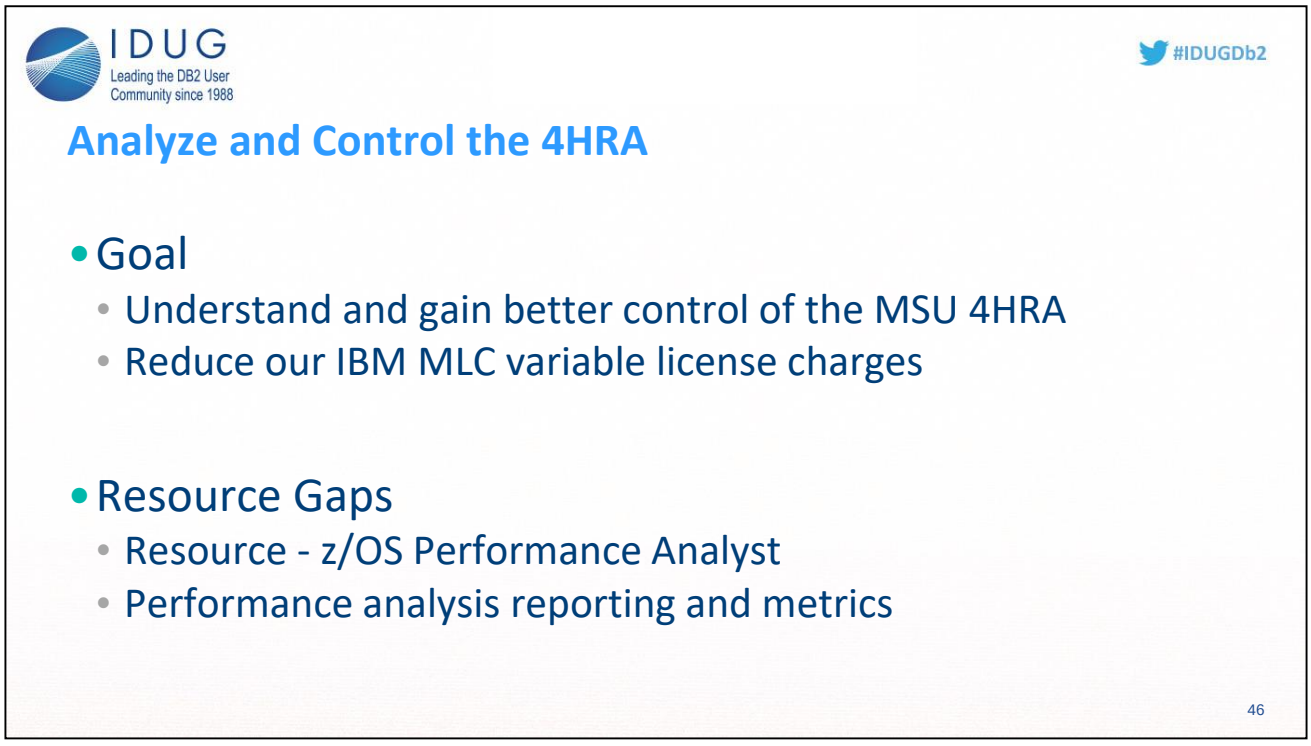
Bob's favorite joke:

- 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
- [illegible]
- [illegible]

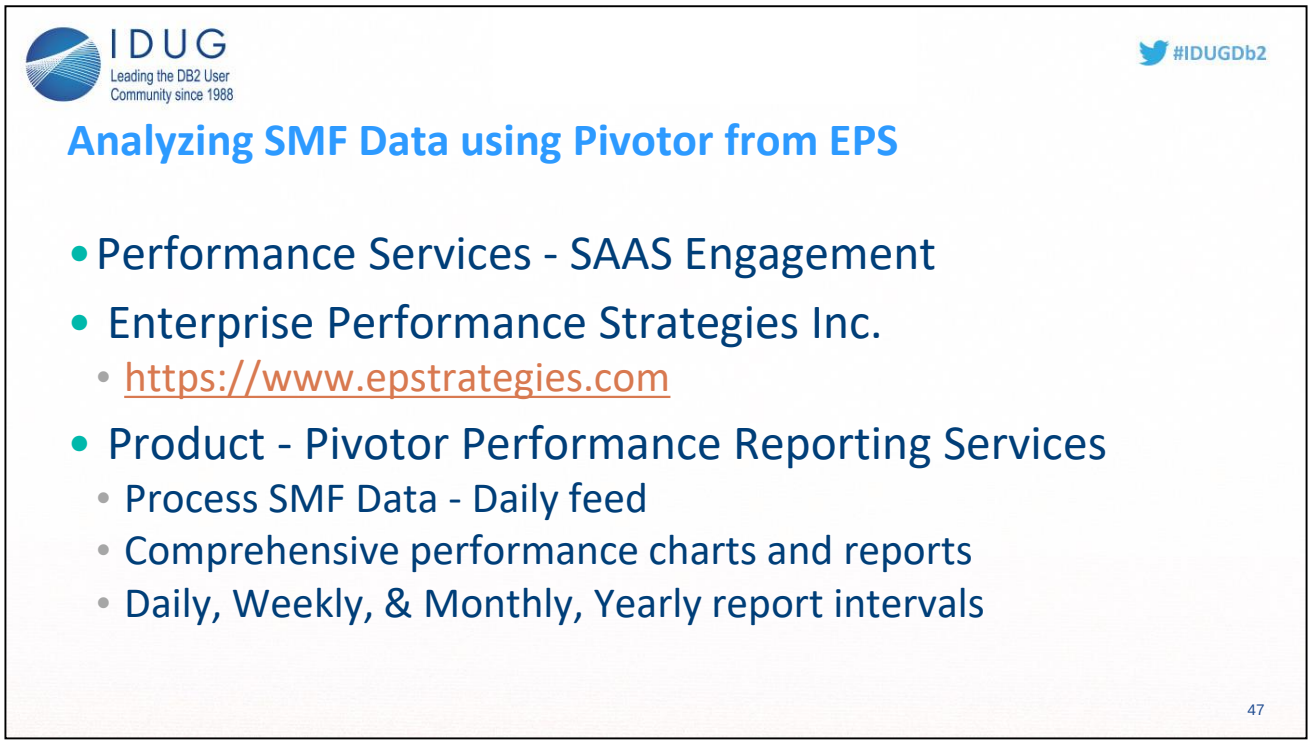


- The first of three topics is the zIIP effect on the MSU 4HRA and calculating cost savings.



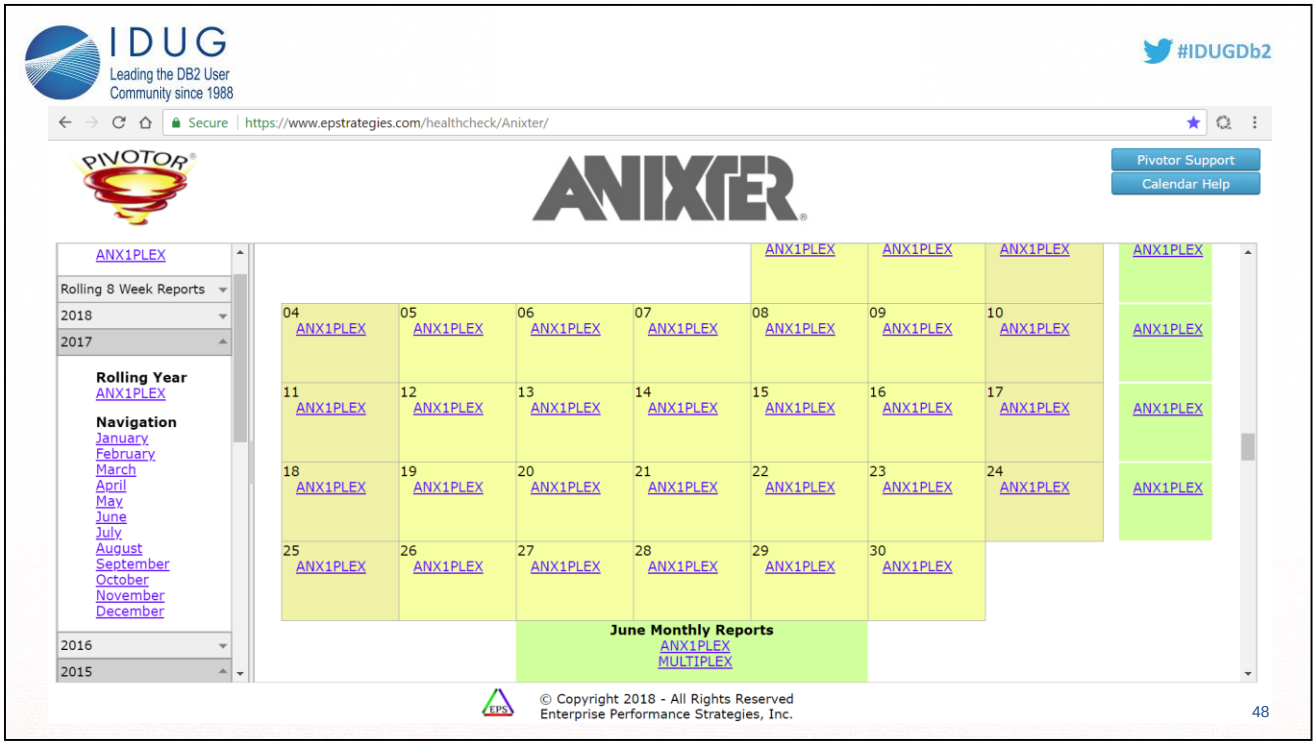

2014 - Management initiated a project to analyze our 4HRA and look for opportunities to reduce and control costs.

Missing Resources
- on staff Computer Performance Analyst
- comprehensive performance reporting

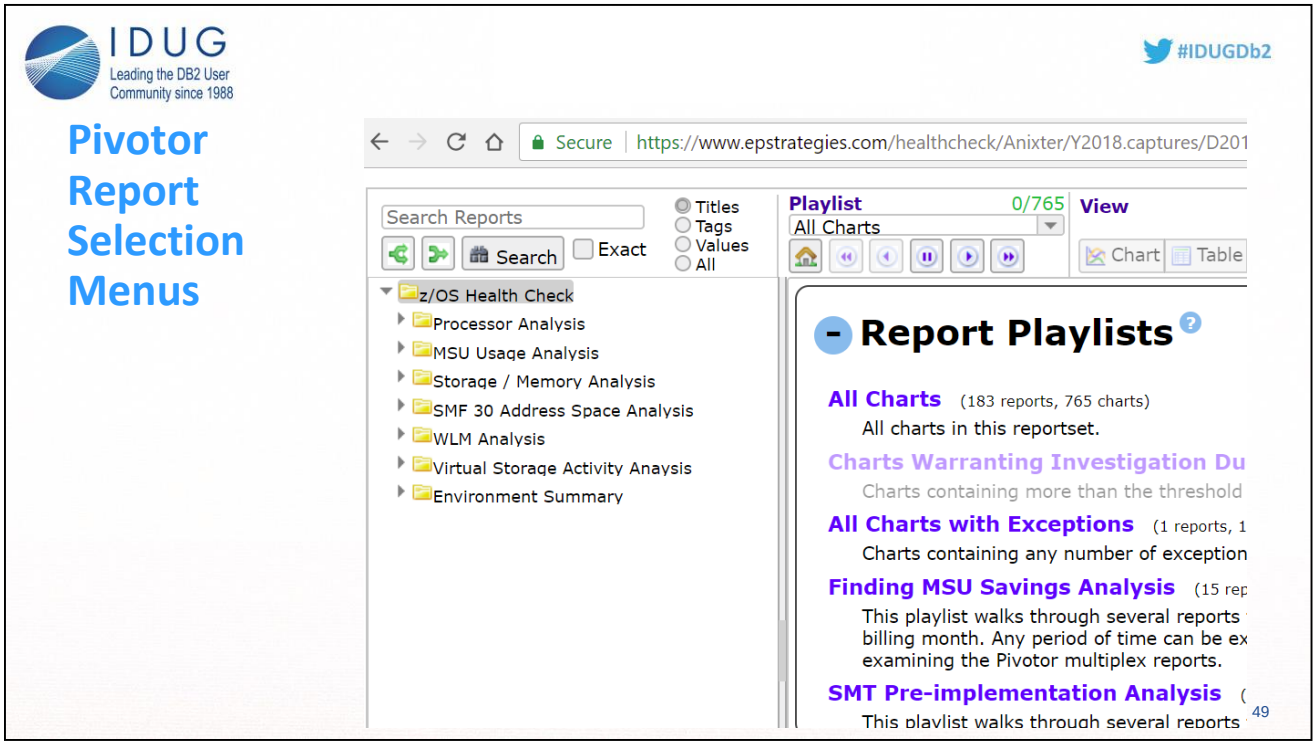



SAAS engagement with Enterprise performance strategies

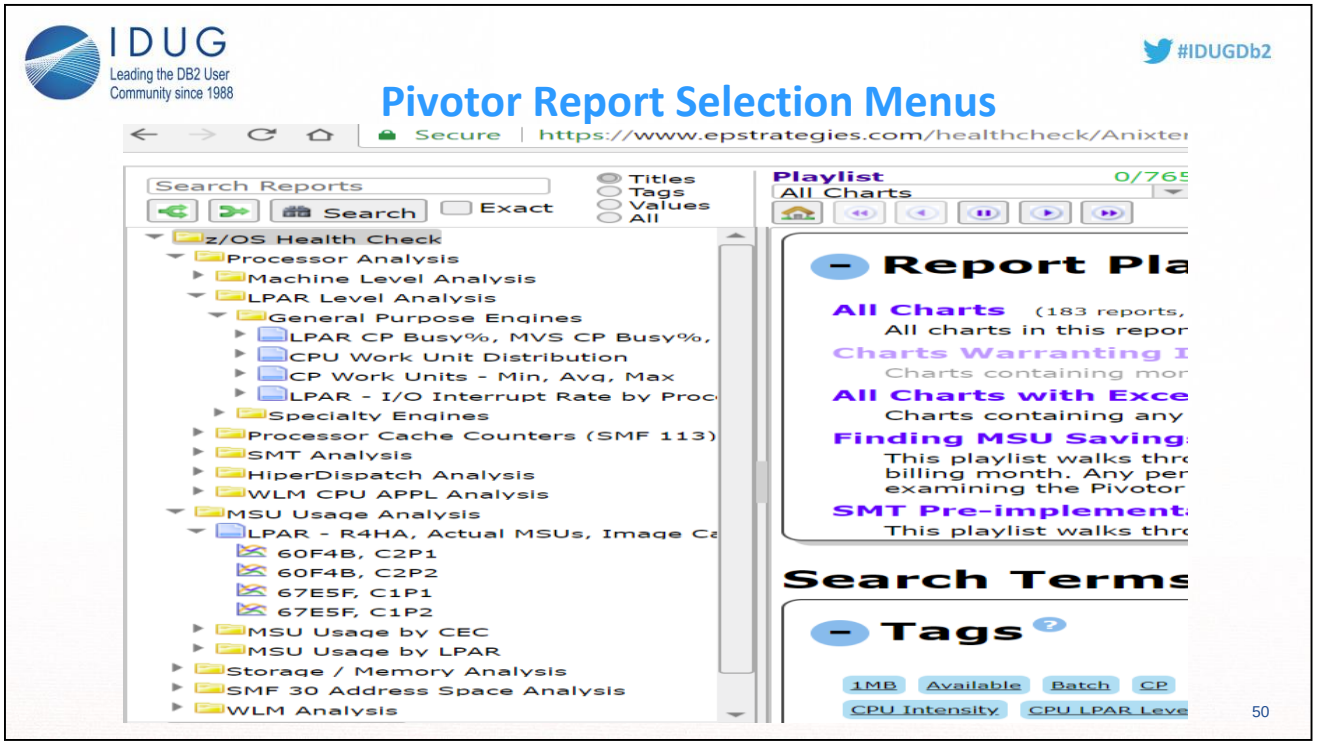
- Contracted the use of Pivotor Reporting Service
- Daily FTP and processing of SMF Data
- Comprehensive charts and reports




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




Drill down capabilities into various report views and categories




Drill down capabilities into report view and categories

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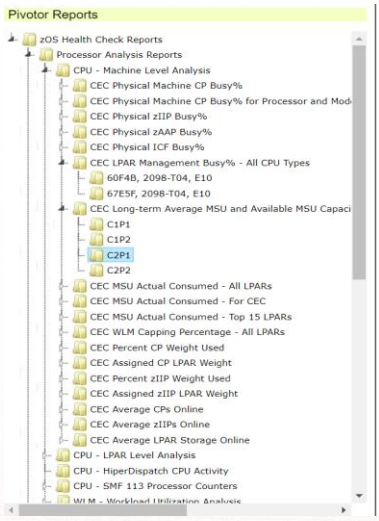
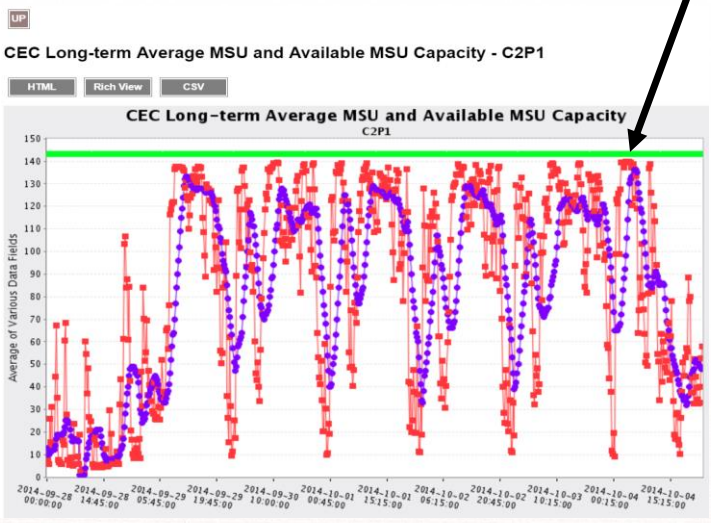
# Pivotor Reporting Reveals Tuning Opportunities




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

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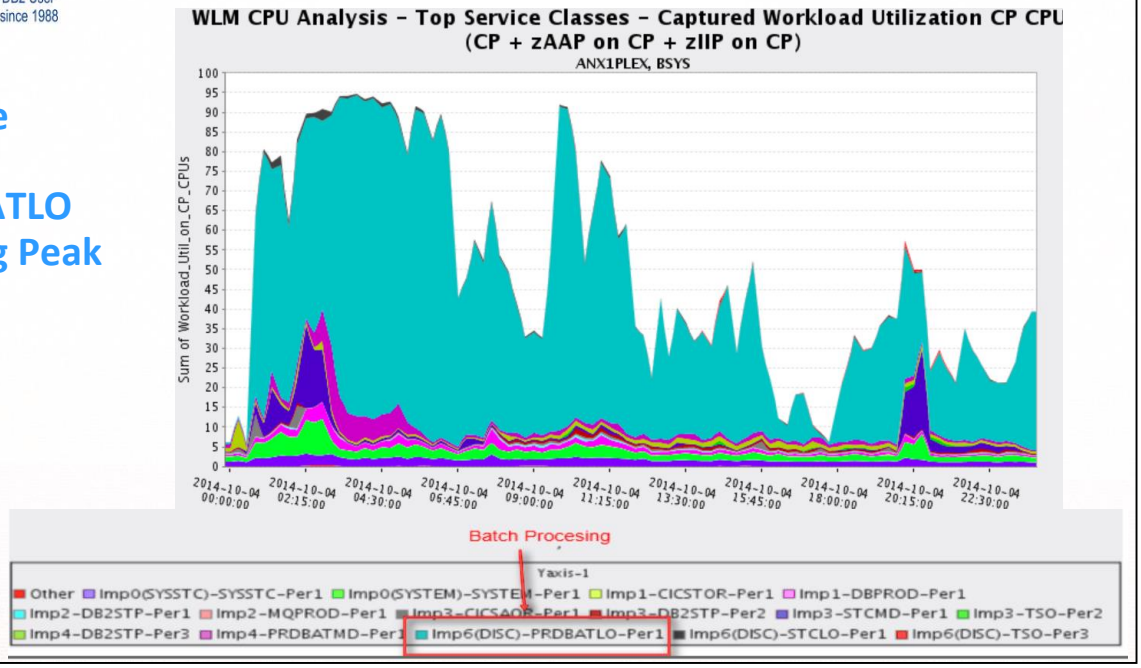
## WLM Service Class PRDBATLO Driving Peak 4HRA




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.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## 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

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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

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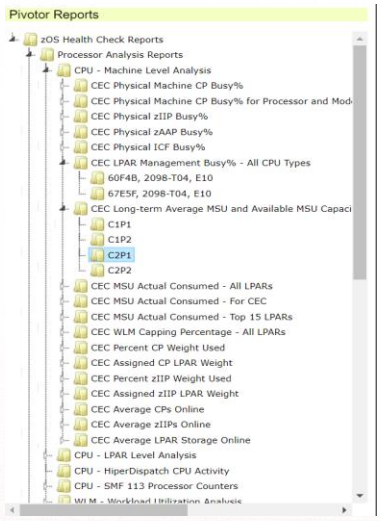
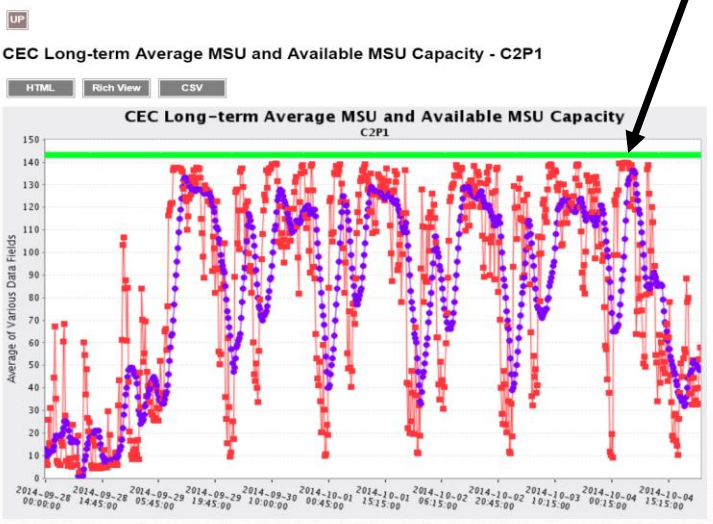
# Pivitor Reporting Reveals Tuning Opportunities

PEAK 4HRA

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- 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

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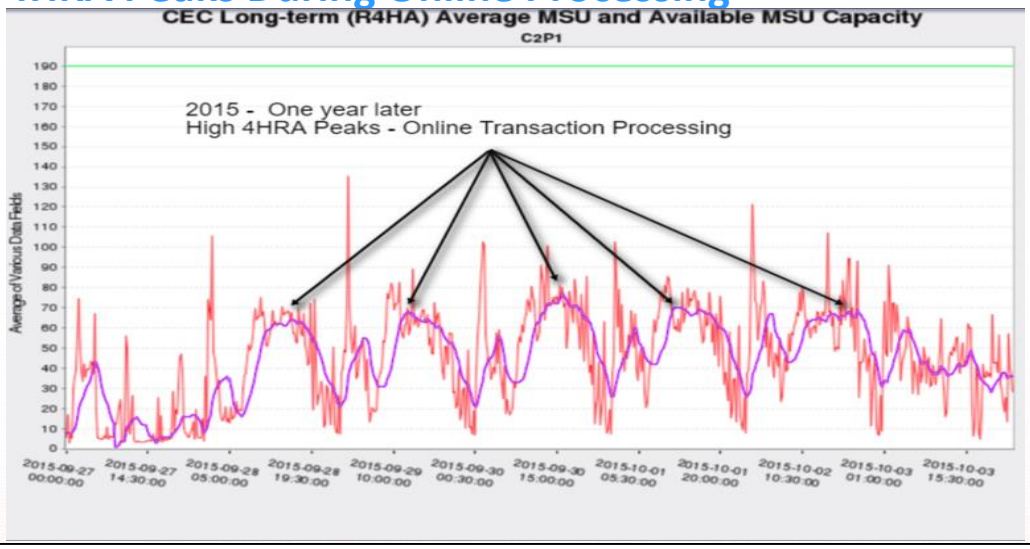
# Tuning Results – 1 Year Later
# 4HRA Peaks During Online Processing




55

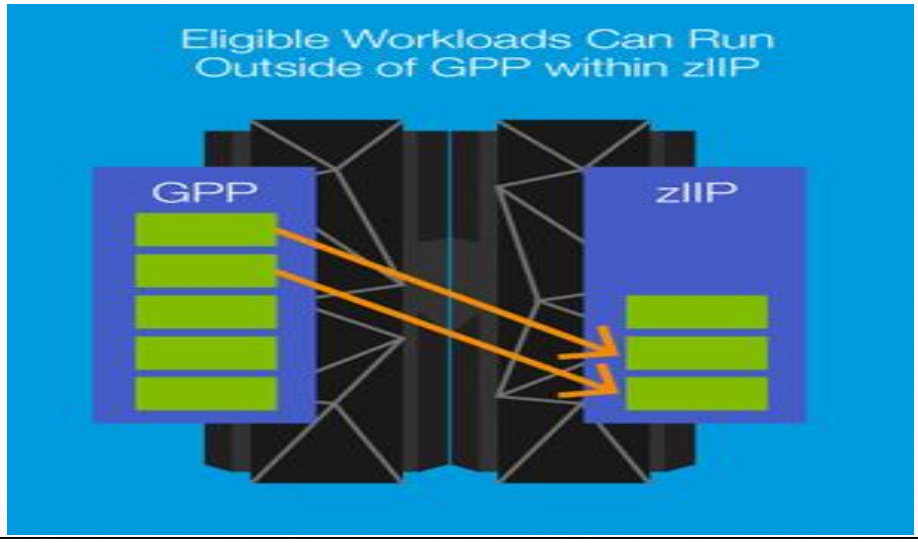
Same week, one year later – utilization peaks occur during online processing .

- zIIP utilization - Effect on the 4HRA



- 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



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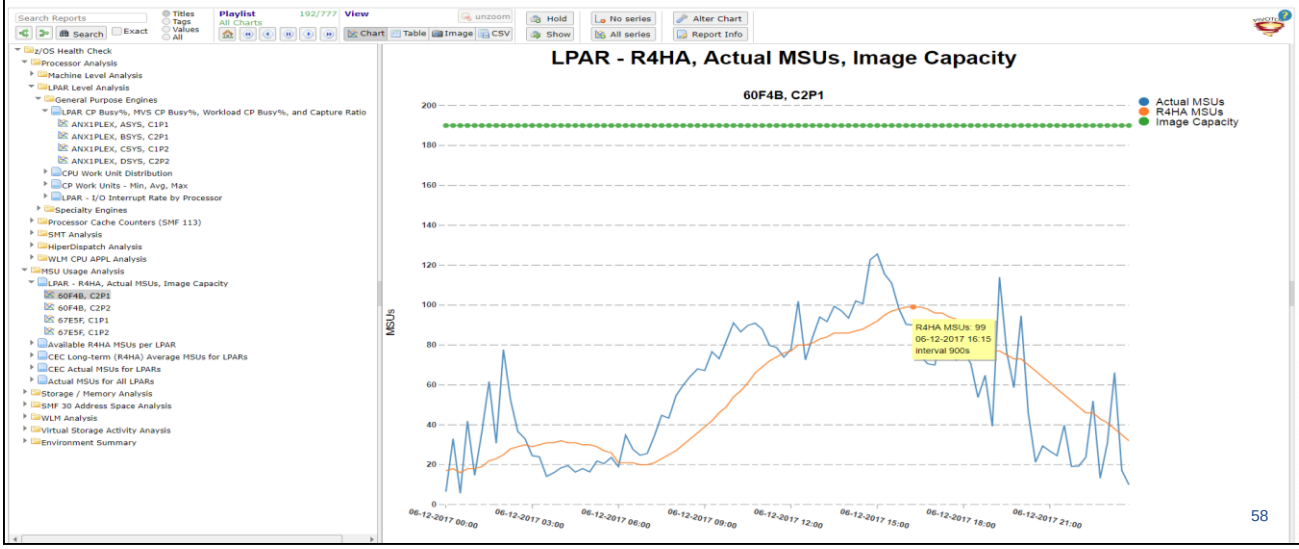
# zIIP utilization - Effect on the 4HRA
# June 12th 2017 – 4HRA at 16:15 MSU's 99






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

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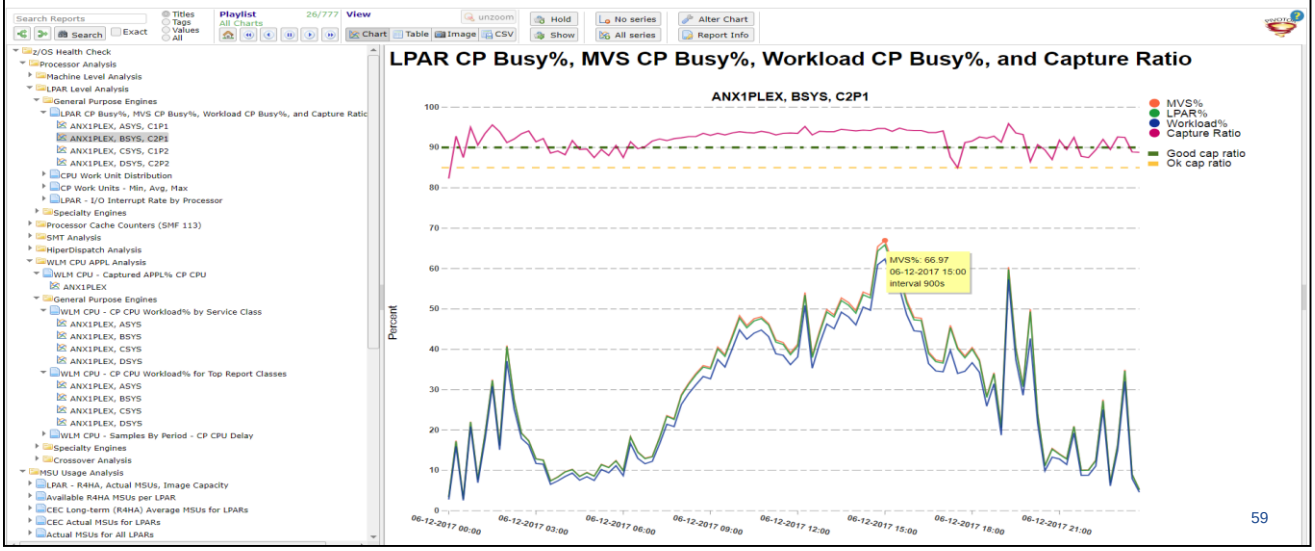
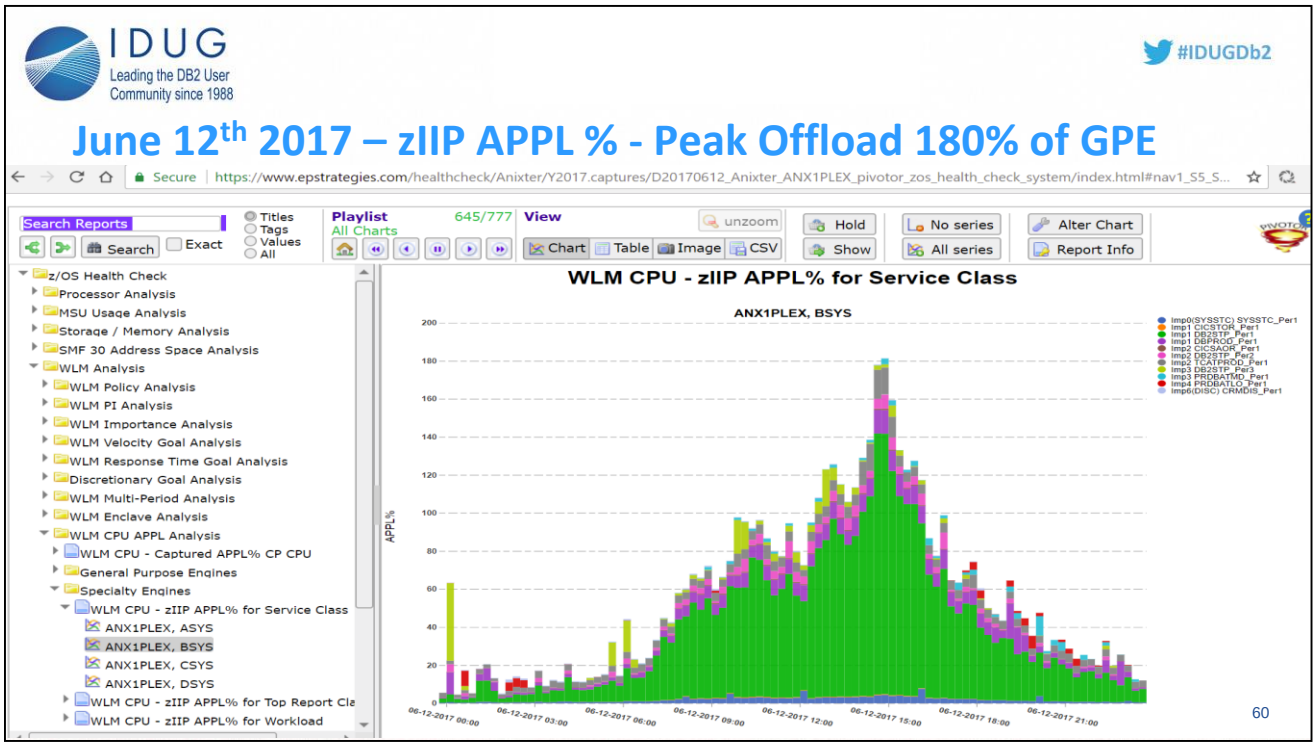
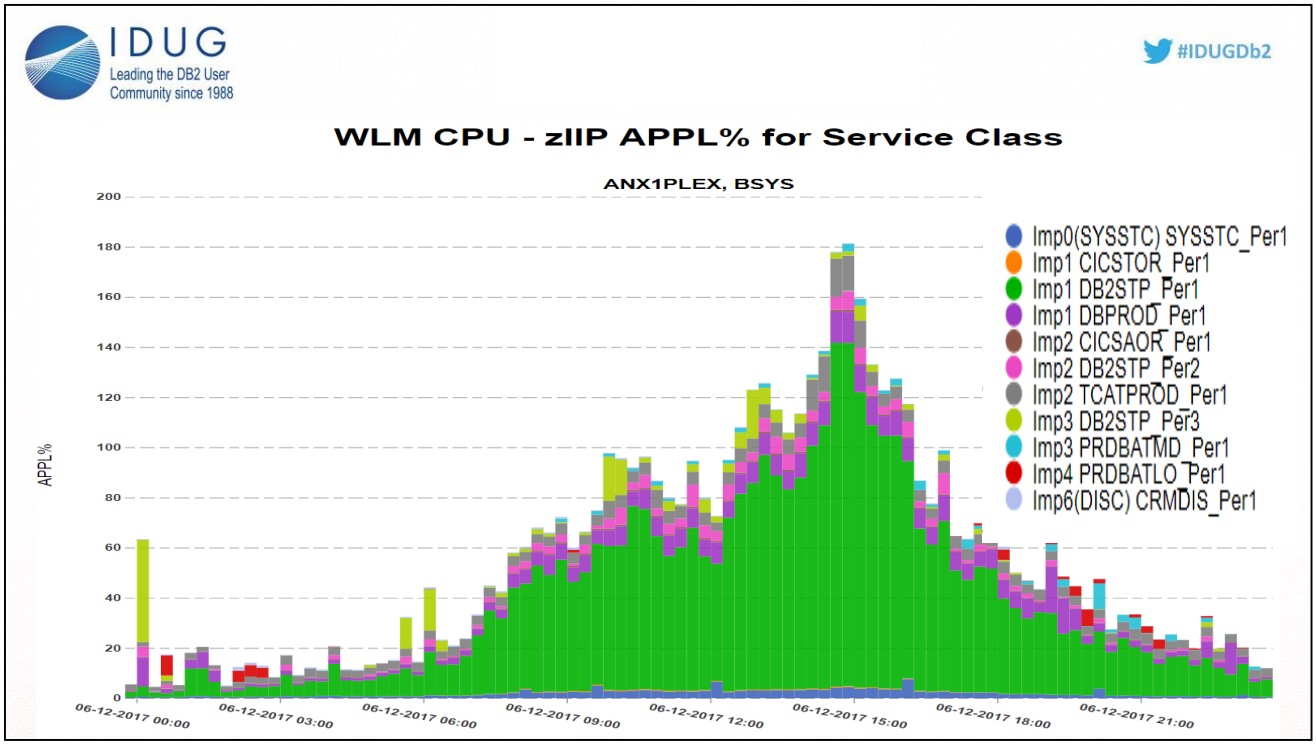
# June 12th 2017 – Peak General Purpose Engine Busy 67%




GP engines were running at about 67 % busy.




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




Peak zIIP utilization 180% of a general purpose engine

Top reporting class - DB2 Stored procedure. zIIP service peaked at140% 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 $$$

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# 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).

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

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

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## Converting zIIP Utilization Into $$$$

### Calculating IBM Processor MSU Ratings

IBM Published zEnterprise Processor MSU ratings:

https://www-304.ibm.com/servers/resourcelink/lib03060.nsf/pages/lsprITRzOSv2r1?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 |

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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.

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## 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.*

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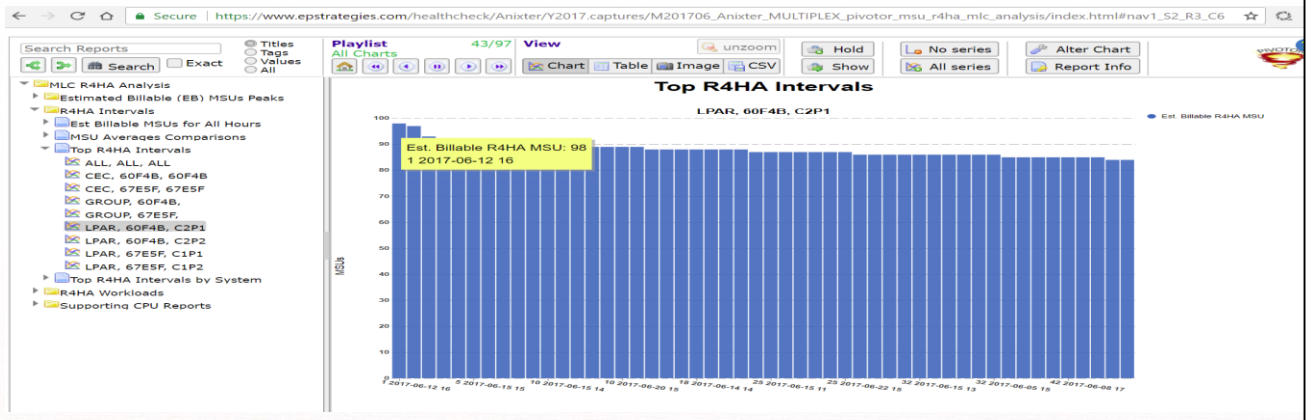
# Converting zIIP Utilization Into $$$$

## 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"




66

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.

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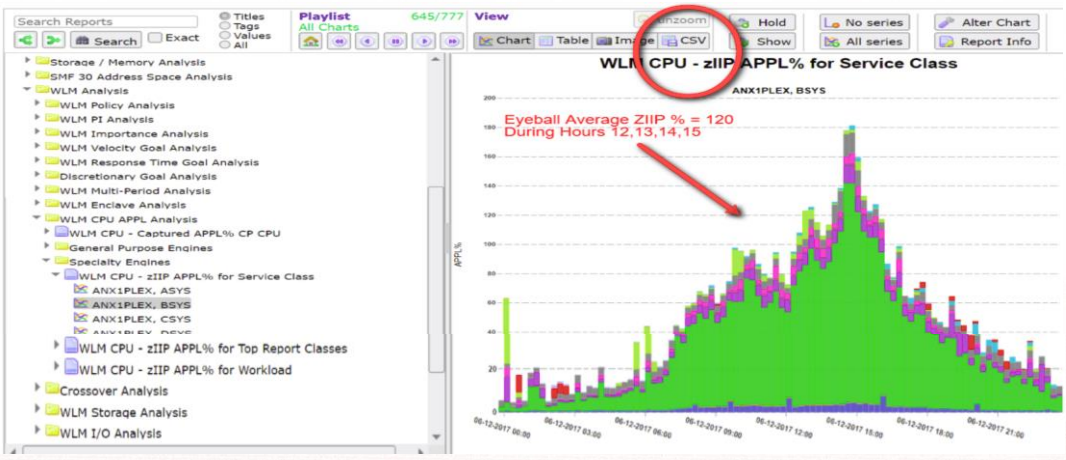
# Using Pivotor CSV Function – Supporting Data Graphs can be converted to CSV Format

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

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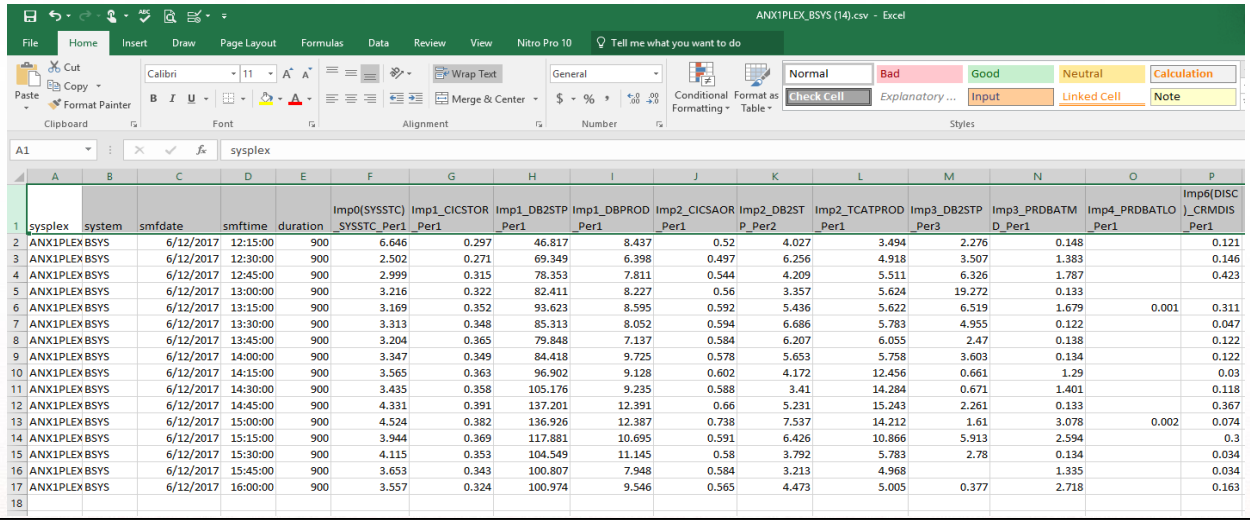
# zIIP Appl % by Service Class – Hours 12, 13, 14, 15 used to calculate "AVG zIIP % GP"




| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | sysplex | system | smfdate | smftime | duration | Imp0(SYSSTC)_SYSSTC_Per1 | Imp1_CICSTOR_Per1 | Imp1_DB2STP_Per1 | Imp1_DBPROD_Per1 | Imp2_CICSAOR_Per1 | Imp2_DB2STP_Per2 | Imp2_TCATPROD_Per1 | Imp3_DB2STP_Per3 | Imp3_PRDBATMD_Per1 | Imp4_PRDBATLO_Per1 | Imp6(DISC)_CRMDIS_Per1 |
| 2 | 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 | | 0.121 |
| 3 | 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 |
| 4 | 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 |
| 5 | 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 | | |
| 6 | 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 |
| 7 | 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 |
| 8 | 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 |
| 9 | 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 |
| 10 | 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 |
| 11 | 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 |
| 12 | 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 |
| 13 | 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 |
| 14 | 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 |
| 15 | 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 |
| 16 | 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 | | 0.034 |
| 17 | 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 |
| 18 | | | | | | | | | | | | | | | | |

Cull 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"

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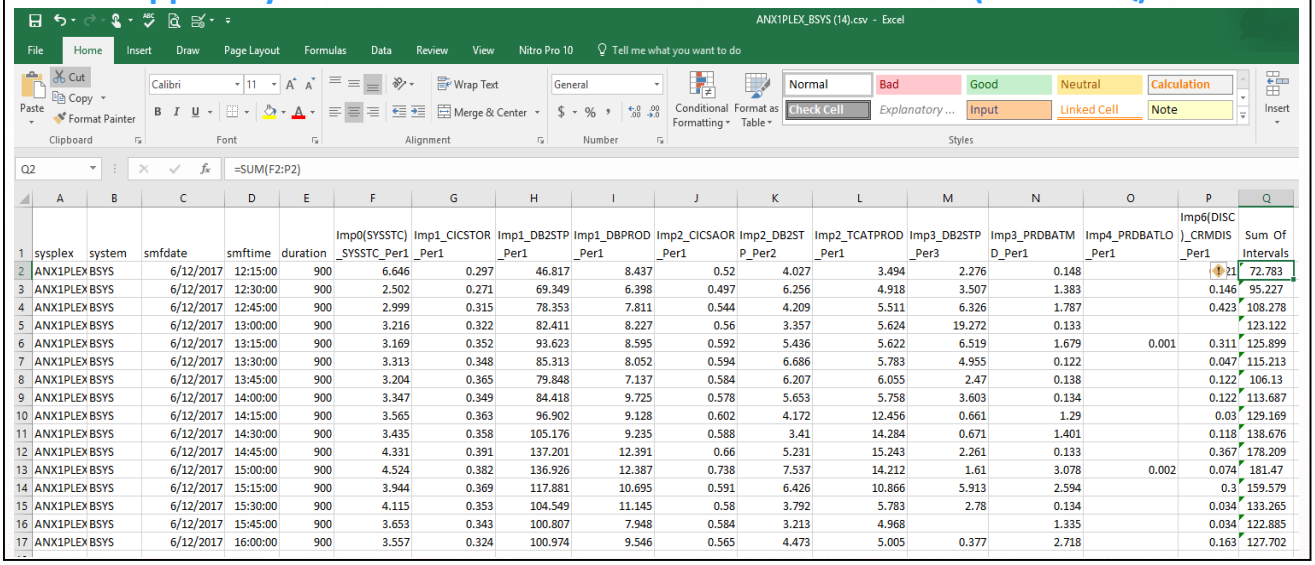
# Calculating Avg zIIP % GP (During Peak 4HRA)

## 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

Cut Copy Format Painter Paste — Clipboard
Calibri 11 — Font
Wrap Text Merge & Center — Alignment
General — Number
Conditional Formatting Format as Table
Normal Bad Good Neutral Calculation Check Cell Explanatory ... Input Linked Cell Note — Styles
Insert

Q2 =SUM(F2:P2)

| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 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 |
| 2 | 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 | | 21 | 72.783 |
| 3 | 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 |
| 4 | 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 |
| 5 | 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 |
| 6 | 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 |
| 7 | 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 |
| 8 | 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 |
| 9 | 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 |
| 10 | 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 |
| 11 | 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 |
| 12 | 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 |
| 13 | 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 |
| 14 | 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 |
| 15 | 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 |
| 16 | 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 | | 0.034 | 122.885 |
| 17 | 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

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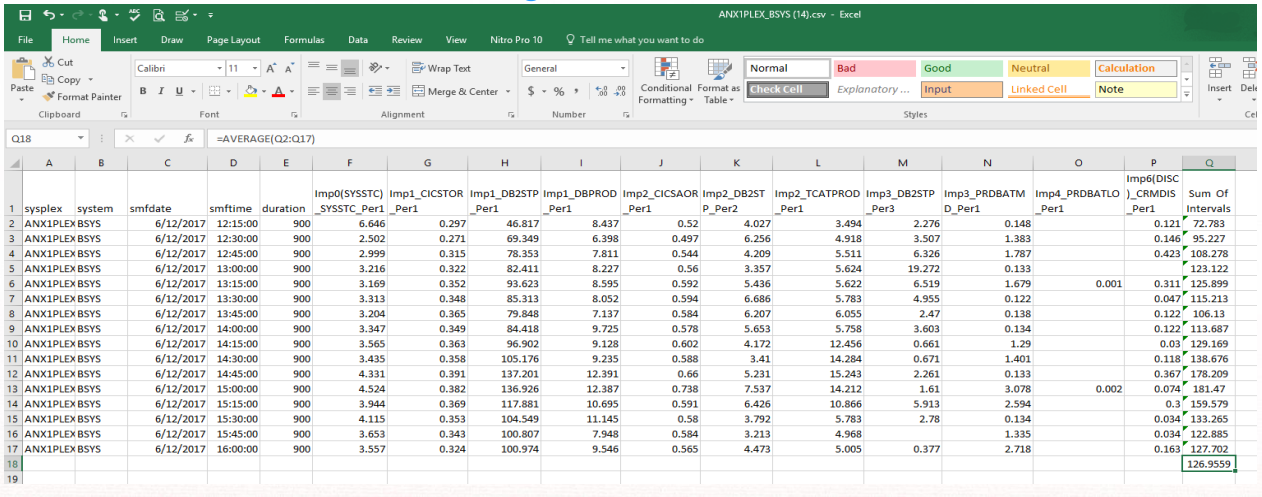
# Converting zIIP Utilization Into $$$$

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

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

## Avg zIIP % GP = 127%




| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 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 |
| 2 | 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 | | 0.121 | 72.783 |
| 3 | 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 |
| 4 | 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 |
| 5 | 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 |
| 6 | 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 |
| 7 | 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 |
| 8 | 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 |
| 9 | 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 |
| 10 | 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 |
| 11 | 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 |
| 12 | 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 |
| 13 | 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 |
| 14 | 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 |
| 15 | 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 |
| 16 | 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 | | 0.034 | 122.885 |
| 17 | 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 |
| 18 | | | | | | | | | | | | | | | | | 126.9559 |
| 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) .

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## 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

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# 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

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-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

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# 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 $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!

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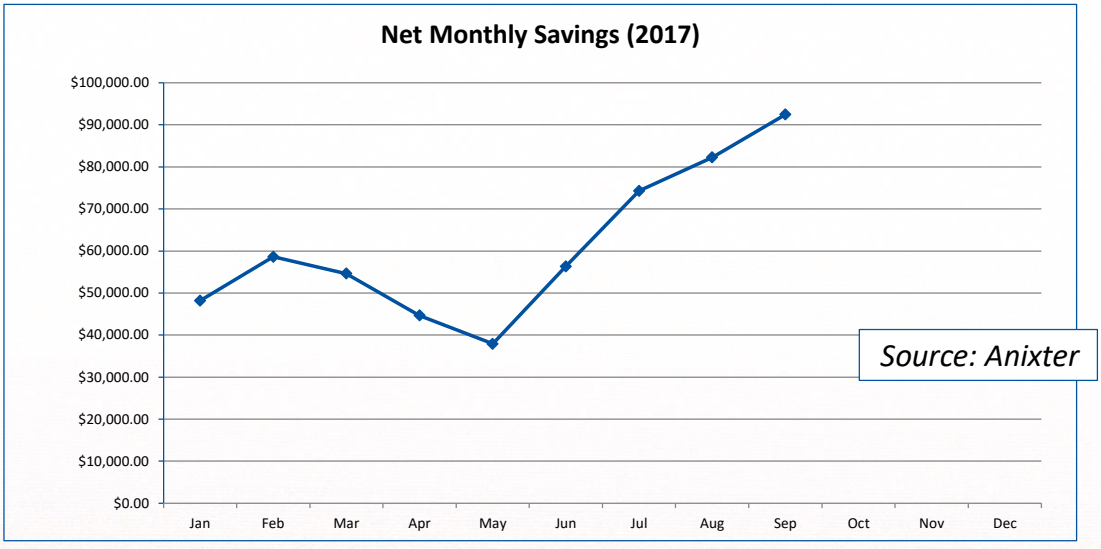
# At Long Last: zIIP Software Savings




74

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

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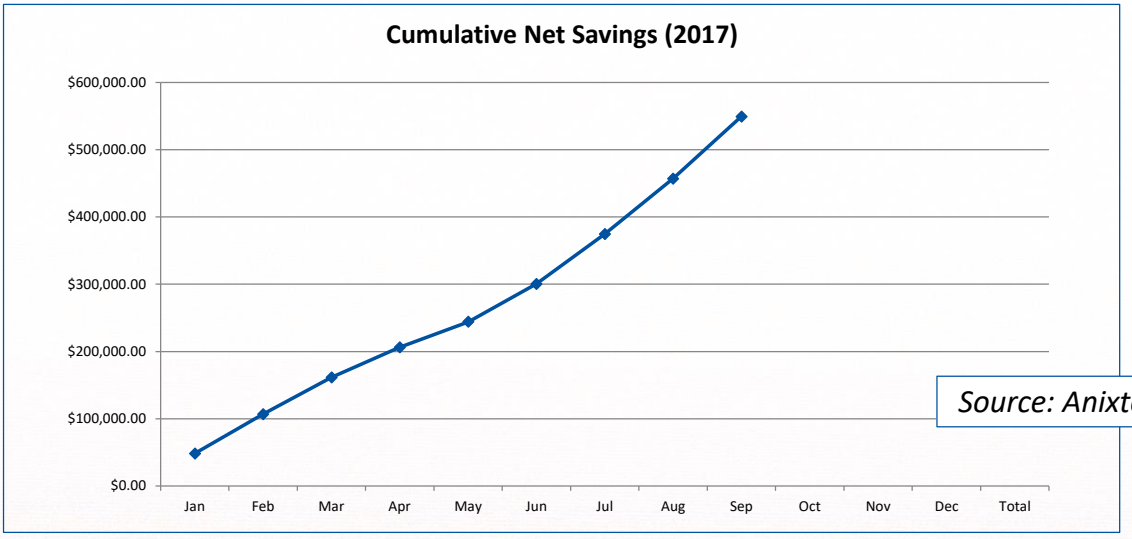
# zIIP Software Savings




*Source: Anixter*

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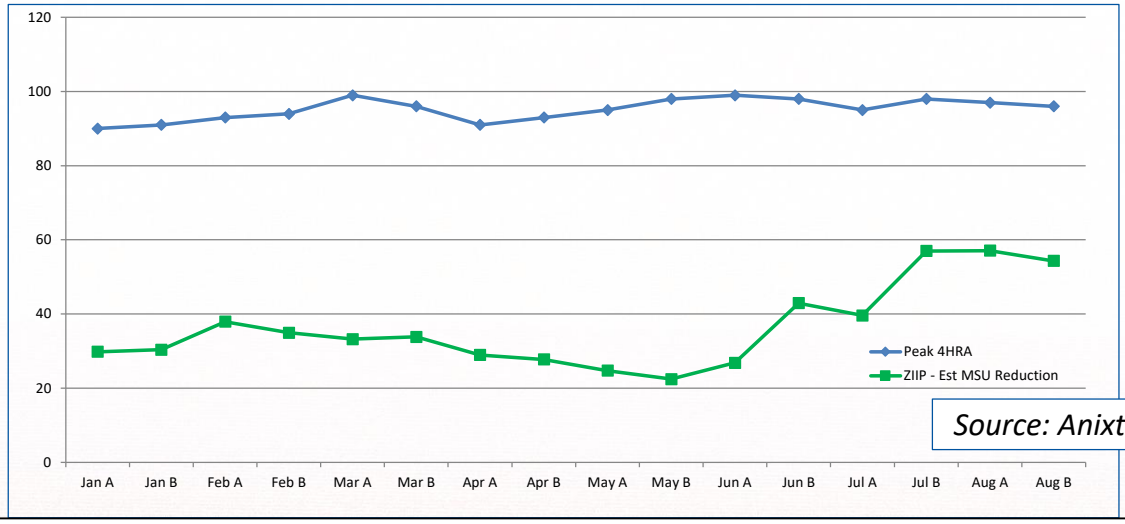
# Using Db2 Native Stored Procedures to Utilize zIIP Engines
## In July and August: zIIPs increases compared to CPs




*Source: Anixter*

76

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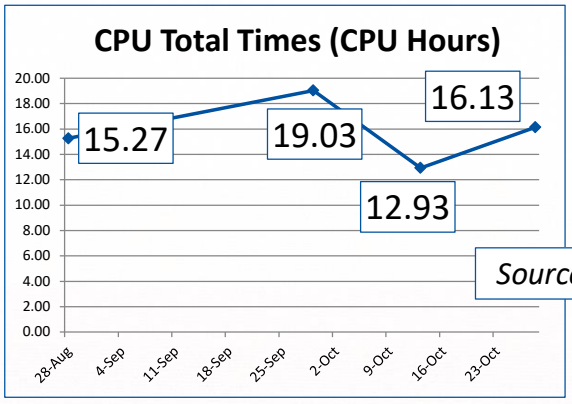
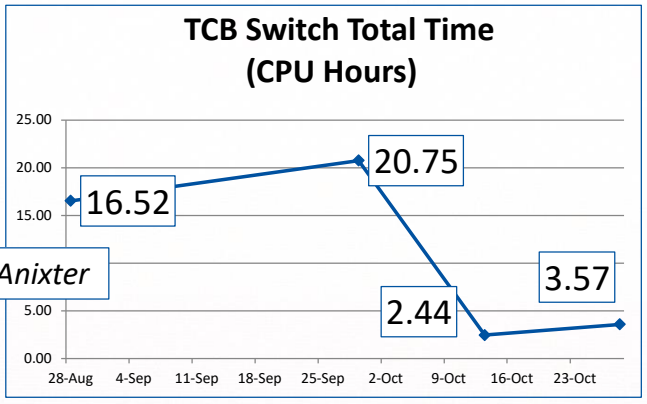
#IDUGDb2

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




CICS CPU Fairly Constant

*Source: Anixter*




TCB CPU affects z/OS CPU

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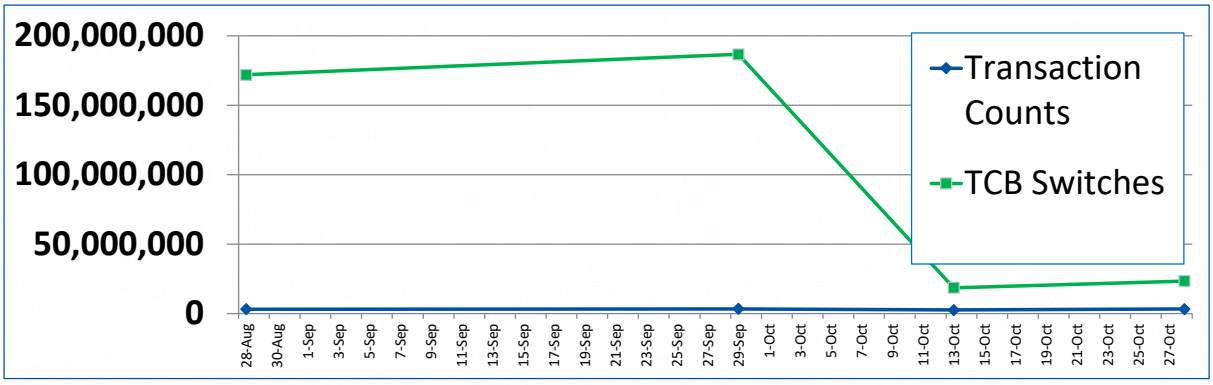
#IDUGDb2

## TCB Switches Improve Dramatically with Threadsafe




*Source: Anixter*

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

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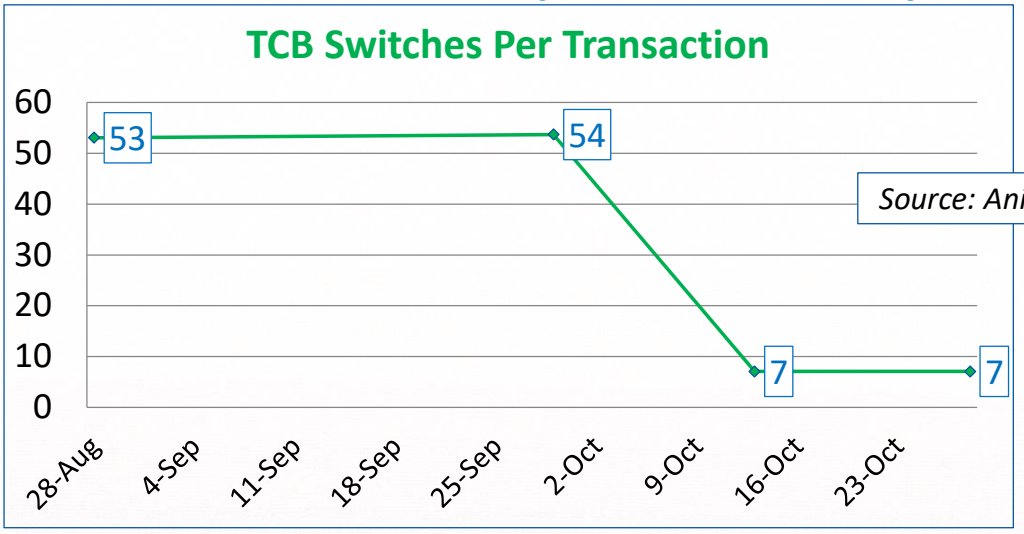
#IDUGDb2

# TCB Switches Per Transaction Improves Dramatically



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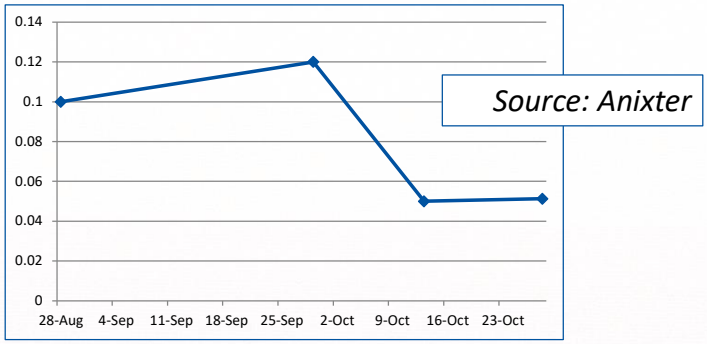
#IDUGDb2

# With Threadsafe, CICS Average Response Times Drop 50%

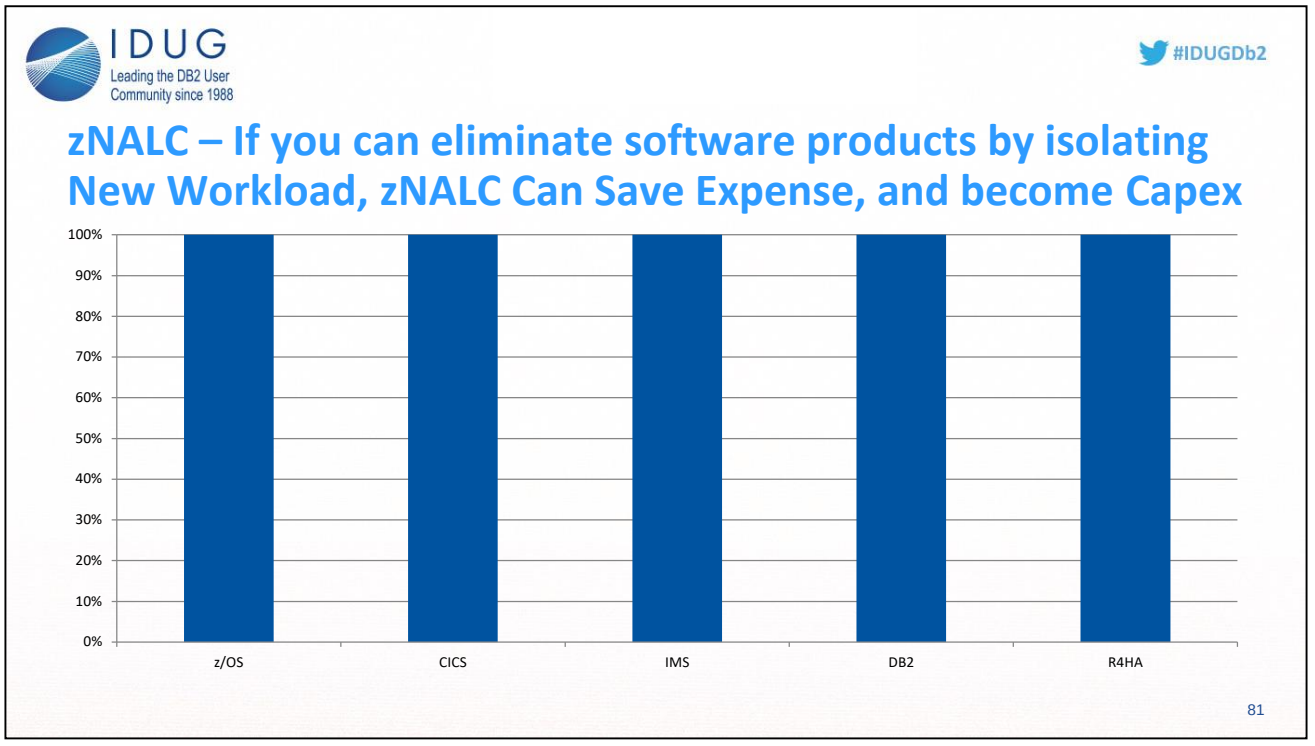
**Anixter Application CICS Avg Reponse Times**

| | All CICSP* |
|---|---|
| 28-Aug | 0.10 |
| 29-Sep | 0.12 |
| 13-Oct | 0.05 |
| 28-Oct | 0.0513 |




80

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




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.


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 2nd of the first month into the 1st of the next month.***

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## 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"***

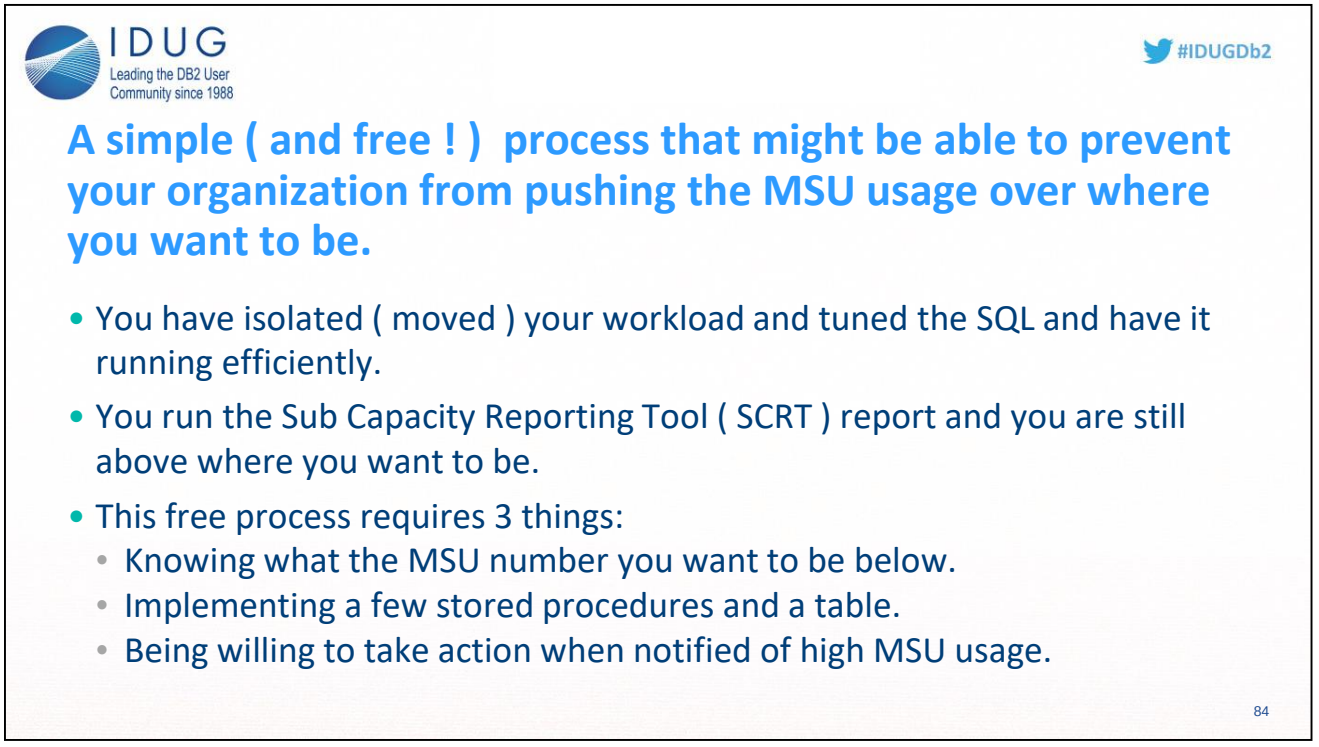
MSU 4 Hour Warning

DS 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.




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.

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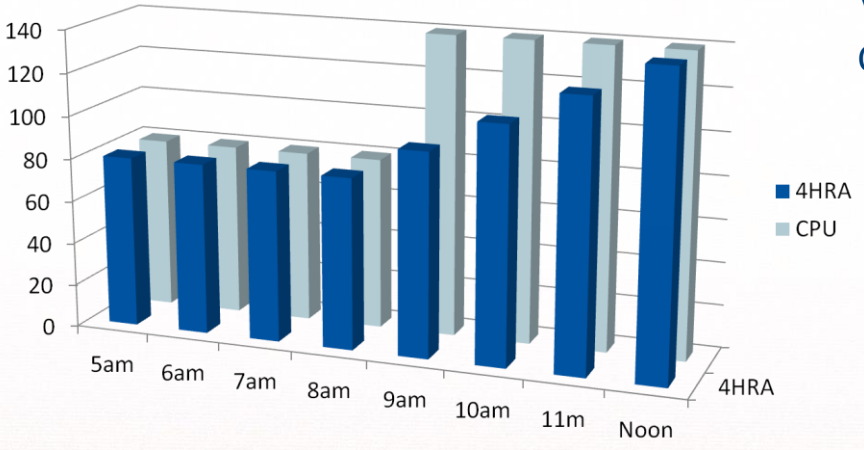
## The 4 hour rolling average (4HRA) and momentum.




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 |

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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.

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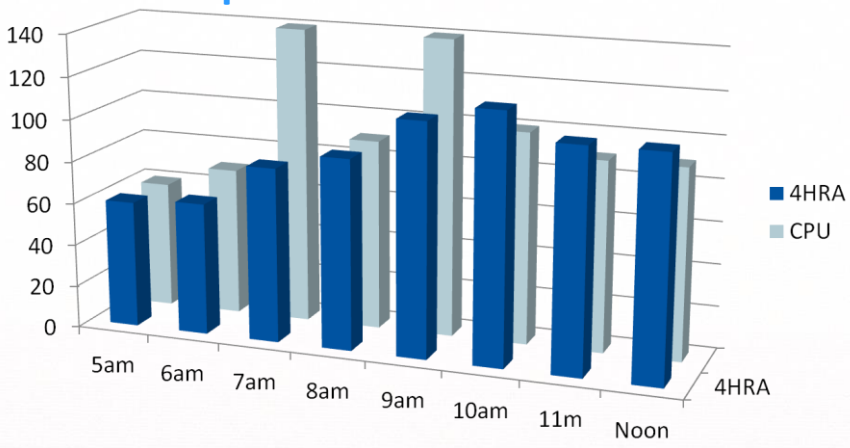
## Momentum isn't always the situation. This example shows that.

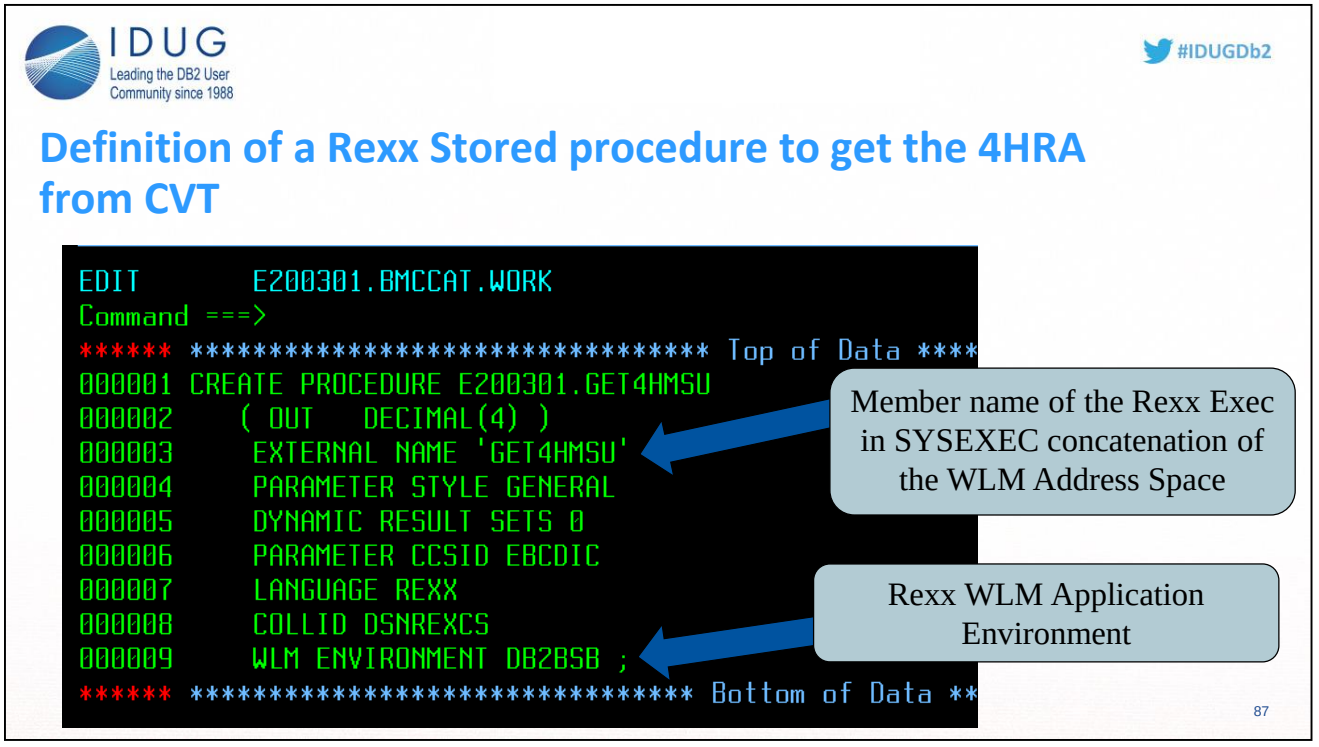



Want below 110, notify at 100.
Can we still do something?
Get ready to write a check.

| 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 |

86

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.




The Rexx routine needs to be defined on a Subsystem running on every LPAR for this to work. The definition of he Rexx procedre 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.

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

```
 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 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.

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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
```

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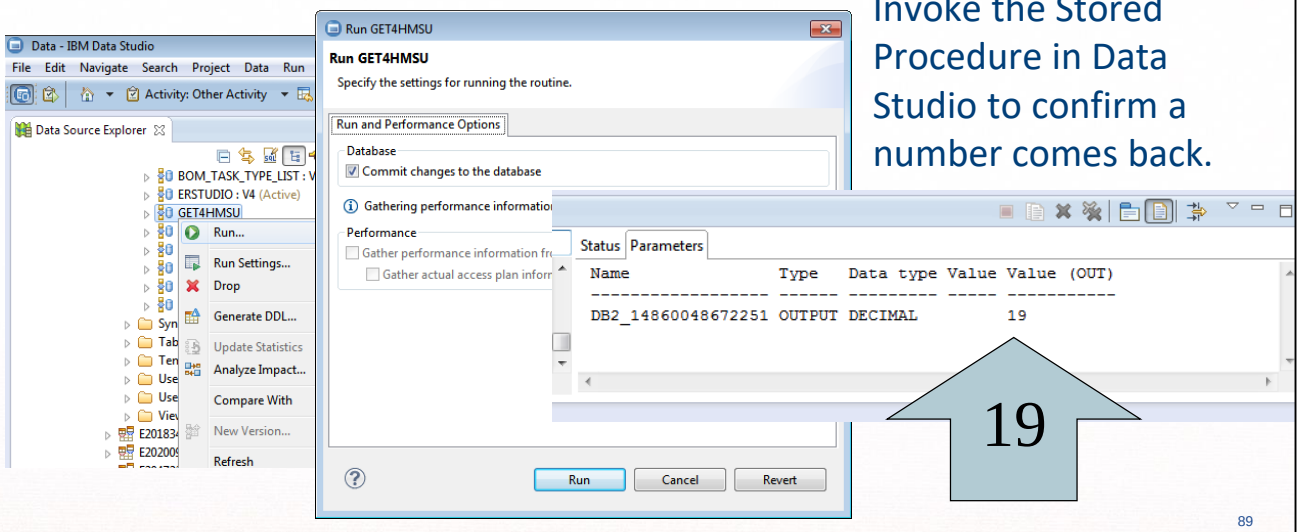
# Testing the Rexx code to get the 4HRA from CVT.




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

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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.

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## 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         T80DBA.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
```

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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.

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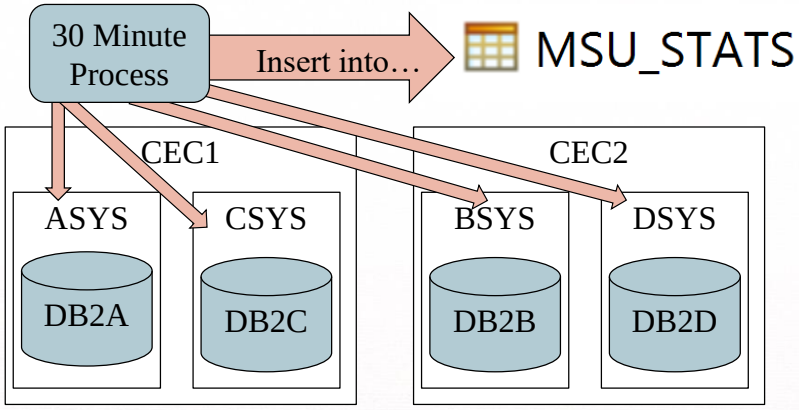
## Automated process with calls to as many subsystems as you have LPARs. (Assumption is a Db2 is running on every LPAR.)




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.

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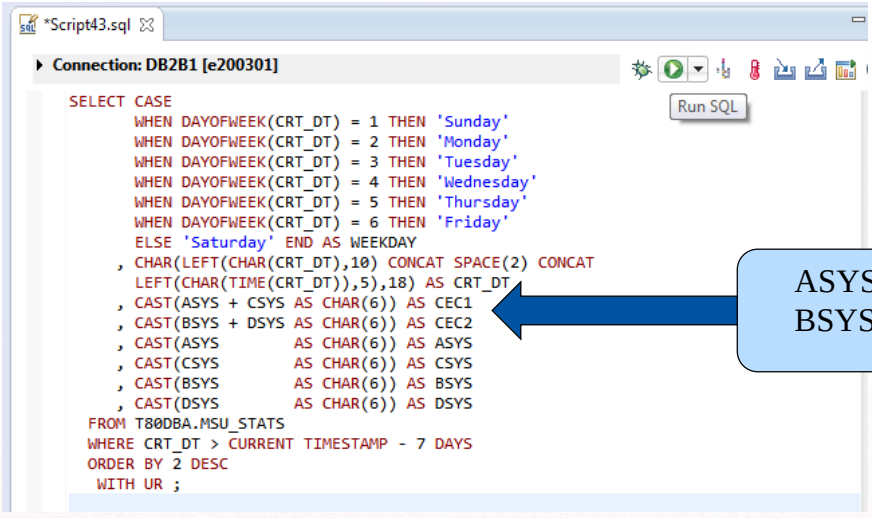
# Select statement to generate a formatted report of the last 7 days worth of information.




ASYS & CSYS are CEC1
BSYS & DSYS are CEC2

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

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## 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 | 78 | 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 | 117 | 88 | 89 | 30 | 88 | 2 |
| Wednesday | 2017-02-01 | 16.37 | 120 | 92 | 90 | 30 | 90 | 2 |
| Wednesday | 2017-02-01 | 16.07 | 121 | 91 | 90 | 31 | 91 | 2 |
| Wednesday | 2017-02-01 | 15.36 | 121 | 91 | 90 | 31 | 91 | 2 |
| Wednesday | 2017-02-01 | 15.09 | 119 | 92 | 88 | 31 | 90 | 2 |
| Wednesday | 2017-02-01 | 14.35 | 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.

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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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