

Identifying SLS Inefficiency by using CPU MF Counters

May 2022

John Burg

jpburg@us.ibm.com



Identifying Store Into Instruction Stream (SIIS) Inefficiency by Using CPU MF Counters

What is SIIS ?

- What is “Store Into Instruction Stream” (SIIS) ?
 - Modern Processors require codependence between their design and the code it expects to execute including the following characteristics:
 - Separating data and instructions, localizing storage references, no self modifying code
 - Cache line today is 256 bytes
 - Most modern compilers have been written with the microprocessor architecture in mind
 - “Old” (usually Assembler) programs with poor program practices continue to run
 - Updating these “SIIS” programs can result in significant CPU reductions

- DFSort APAR PI58848 corrects a SIIS programming error

CPU MF SIIS Indicator can help Identify potential SIIS

- CPU MF can be used to help identify potential SIIS timeframes
 - Based on % of certain I Writes / D Writes sourced
 - LPAR view, identifies when it happens, not who is causing it
 - Identify the program(s) running in the time period, e.g. via zBNA Top Programs
 - Use a hot spot analyzer to find the issue
 - Remediate the source code to correct the issue

Processor	SIIS Indicator %	Description
zEC12 / zBC12	E130 / B4 * 100%	D Writes sourced with L2 intervention / D Writes
z13 / z13s	E163 / B2 * 100%	I Writes sourced with L3 intervention / I Writes
z14 / ZR1	E164 / B2 * 100%	I Writes sourced with L3 intervention / I Writes
z15	E164 / B2 * 100%	I Writes sourced with L3 intervention / I Writes
z16	E170 / B2 * 100%	I Writes sourced with L2 intervention / I Writes

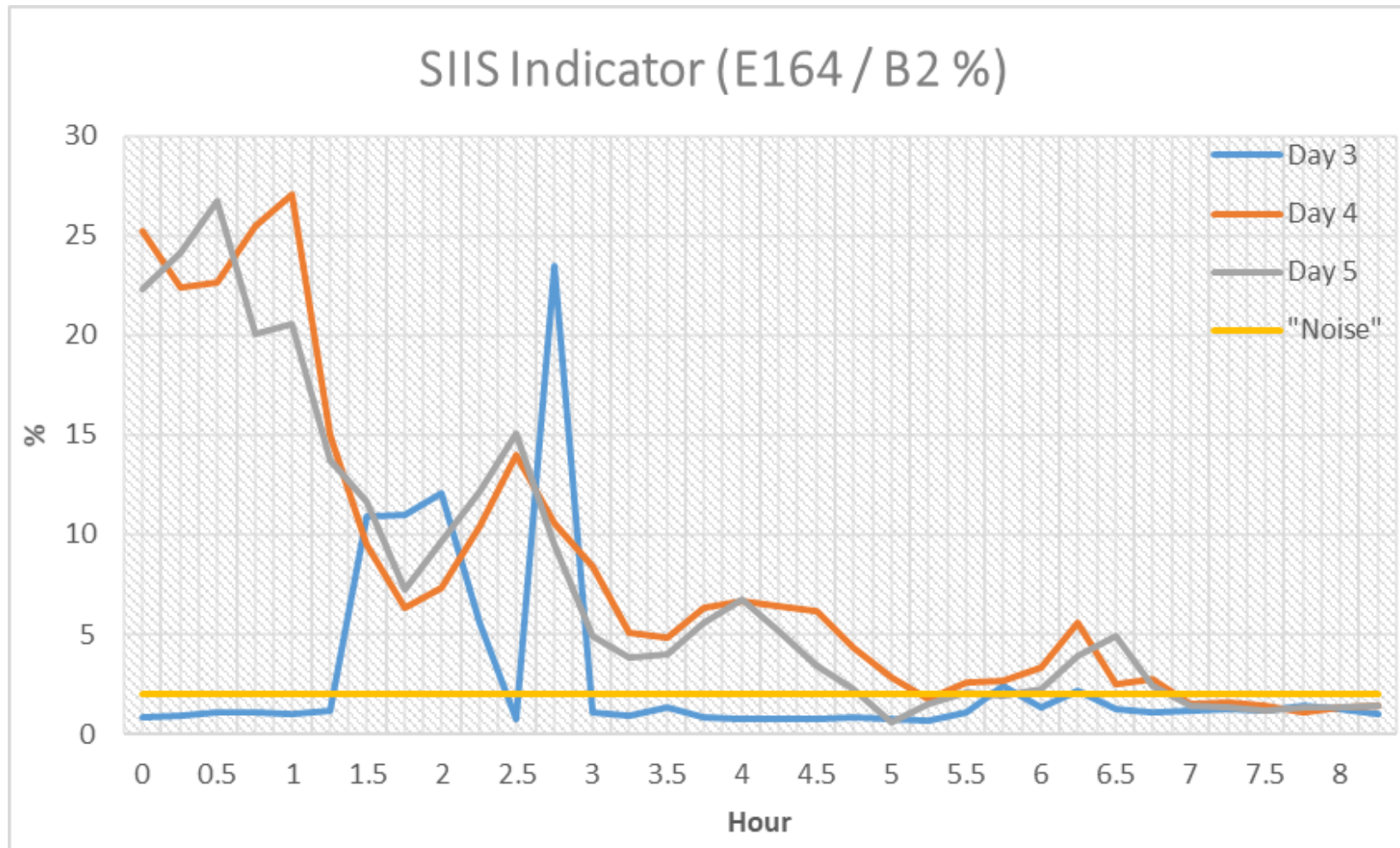
SIIS Indicator and Actions

- Based on the SIIS Indicator %, the following actions are recommended

SIIS Description	SIIS Indicator %	Action
Noise – it will never be 0%	< 2%	None
Minimal SIIS impact	2% < 5%	Low Priority but potential MSU savings
Noteworthy SIIS impact	5% < 10%	Medium Priority – Investigate and Remediate
Considerable SIIS impact	>= 10%	Top Priority – Investigate and Remediate

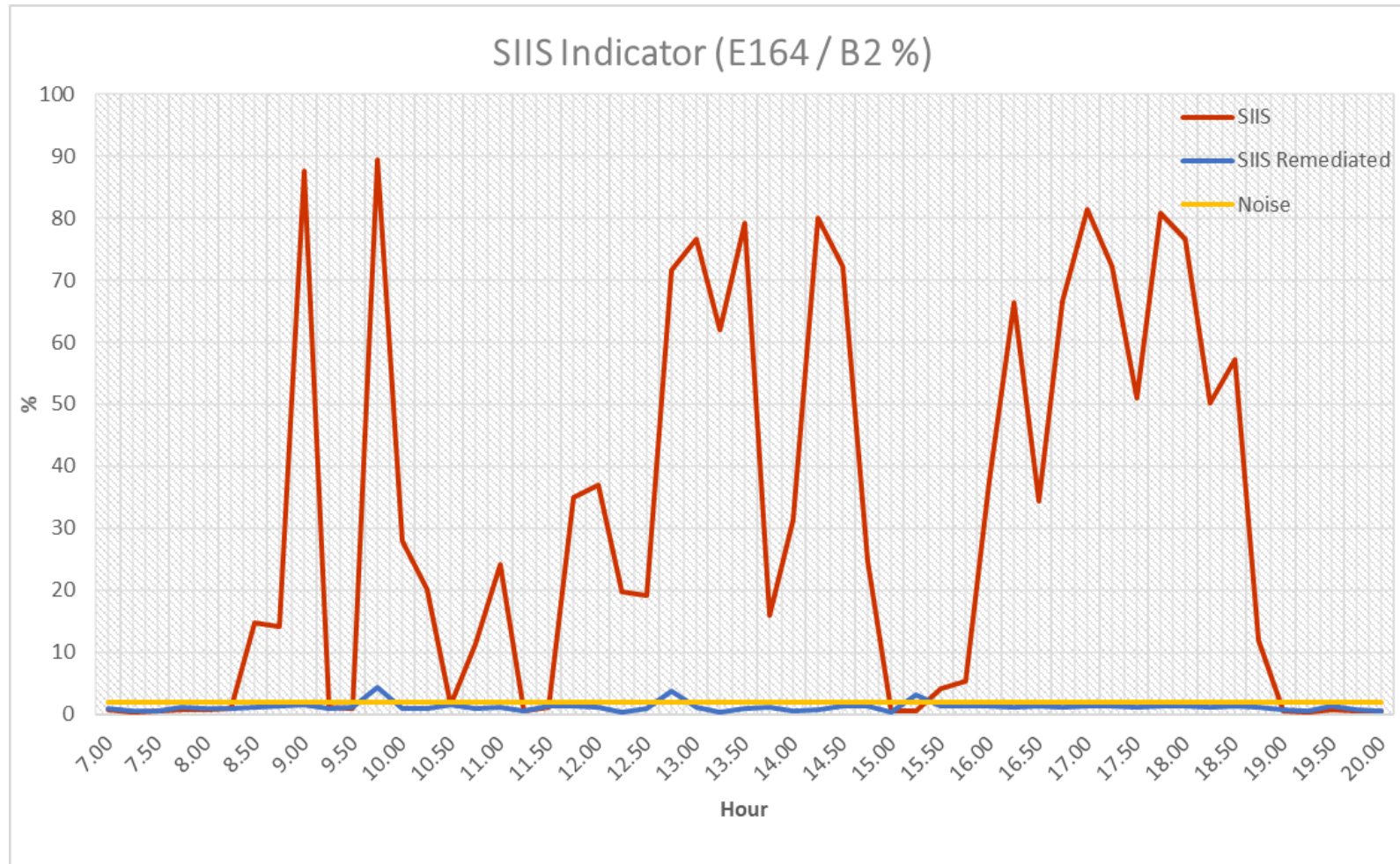
SIIS Customer Experience 1

- Customer z14 experience: SIIS activity detected consistently in Batch Window across 3 days



SIIS Customer Experience 2

- Customer z14 experience: Each Line represents the SIIS indicator for a day with “SIIS” and a day after the code was remediated “SIIS Remediated”
- Overall the customer saved ~3000 CPU seconds (top 15 jobs)



Summary

- Use CPU Counters “SIIS Indicator” to identify potential timeframes when inefficient “SIIS” programs may be running
- Look for repeating and high impact timeframes
 - Drill down to identify potential Jobs / Programs
 - Use Hot Spot analyzer / Examine / Remediate Source Code
 - Reduce CPU time and elapsed time
- With Tailored Pricing, all MIPS count
- 2006 TechDoc: *IBM System z and eserver zSeries Processor Performance: Processor Design Considerations*
 - <http://www-03.ibm.com/support/techdocs/atsmastr.nsf/WebIndex/FLASH10208>

Trademarks

The following are trademarks of the International Business Machines Corporation in the United States, other countries, or both.

Not all common law marks used by IBM are listed on this page. Failure of a mark to appear does not mean that IBM does not use the mark nor does it mean that the product is not actively marketed or is not significant within its relevant market.

Those trademarks followed by ® are registered trademarks of IBM in the United States; all others are trademarks or common law marks of IBM in the United States.

For a more complete list of IBM Trademarks, see www.ibm.com/legal/copytrade.shtml:

*BladeCenter®, CICS®, DataPower®, Db2®, e business(logo)®, ESCON, eServer, FICON®, IBM®, IBM (logo)®, IMS, MVS, OS/390®, POWER6®, POWER6+, POWER7®, Power Architecture®, PowerVM®, PureFlex, PureSystems, S/390®, ServerProven®, Sysplex Timer®, System p®, System p5, System x®, z Systems®, System z9®, System z10®, WebSphere®, X-Architecture®, z13™, z13s™, z14™, **z15™**, z Systems™, z9®, z10, z/Architecture®, z/OS®, z/VM®, z/VSE®, zEnterprise®, zSeries®, IBM Z®, IBM LinuxONE III™, IBM LinuxONE Emperor™, IBM LinuxONE Rockhopper™

The following are trademarks or registered trademarks of other companies.

Adobe, the Adobe logo, PostScript, and the PostScript logo are either registered trademarks or trademarks of Adobe Systems Incorporated in the United States, and/or other countries.

Cell Broadband Engine is a trademark of Sony Computer Entertainment, Inc. in the United States, other countries, or both and is used under license therefrom.

Java and all Java-based trademarks are trademarks of Sun Microsystems, Inc. in the United States, other countries, or both.

Microsoft, Windows, Windows NT, and the Windows logo are trademarks of Microsoft Corporation in the United States, other countries, or both.

Intel, Intel logo, Intel Inside, Intel Inside logo, Intel Centrino, Intel Centrino logo, Celeron, Intel Xeon, Intel SpeedStep, Itanium, and Pentium are trademarks or registered trademarks of Intel Corporation or its subsidiaries in the United States and other countries.

UNIX is a registered trademark of The Open Group in the United States and other countries.

Linux is a registered trademark of Linus Torvalds in the United States, other countries, or both.

ITIL is a registered trademark, and a registered community trademark of the Office of Government Commerce, and is registered in the U.S. Patent and Trademark Office.

IT Infrastructure Library is a registered trademark of the Central Computer and Telecommunications Agency, which is now part of the Office of Government Commerce.

* All other products may be trademarks or registered trademarks of their respective companies.

Notes:

Performance is in Internal Throughput Rate (ITR) ratio based on measurements and projections using standard IBM benchmarks in a controlled environment. The actual throughput that any user will experience will vary depending upon considerations such as the amount of multiprogramming in the user's job stream, the I/O configuration, the storage configuration, and the workload processed. Therefore, no assurance can be given that an individual user will achieve throughput improvements equivalent to the performance ratios stated here.

IBM hardware products are manufactured with new parts, or new and serviceable used parts. Regardless, our warranty terms apply.

All customer examples cited or described in this presentation are presented as illustrations of the manner in which some customers have used IBM products and the results they may have achieved. Actual environmental costs and performance characteristics will vary depending on individual customer configurations and conditions.

This publication was produced in the United States. IBM may not offer the products, services or features discussed in this document in other countries, and the information may be subject to change without notice. Consult your local IBM business contact for information on the product or services available in your area.

All statements regarding IBM's future direction and intent are subject to change or withdrawal without notice, and represent goals and objectives only.

Information about non-IBM products is obtained from the manufacturers of those products or their published announcements. IBM has not tested those products and cannot confirm the performance, compatibility, or any other claims related to non-IBM products. Questions on the capabilities of non-IBM products should be addressed to the suppliers of those products.

Prices subject to change without notice. Contact your IBM representative or Business Partner for the most current pricing in your geography.