# z13: End-to-end Mobile, Analytics and Cloud Platform

## Session B01 / A10

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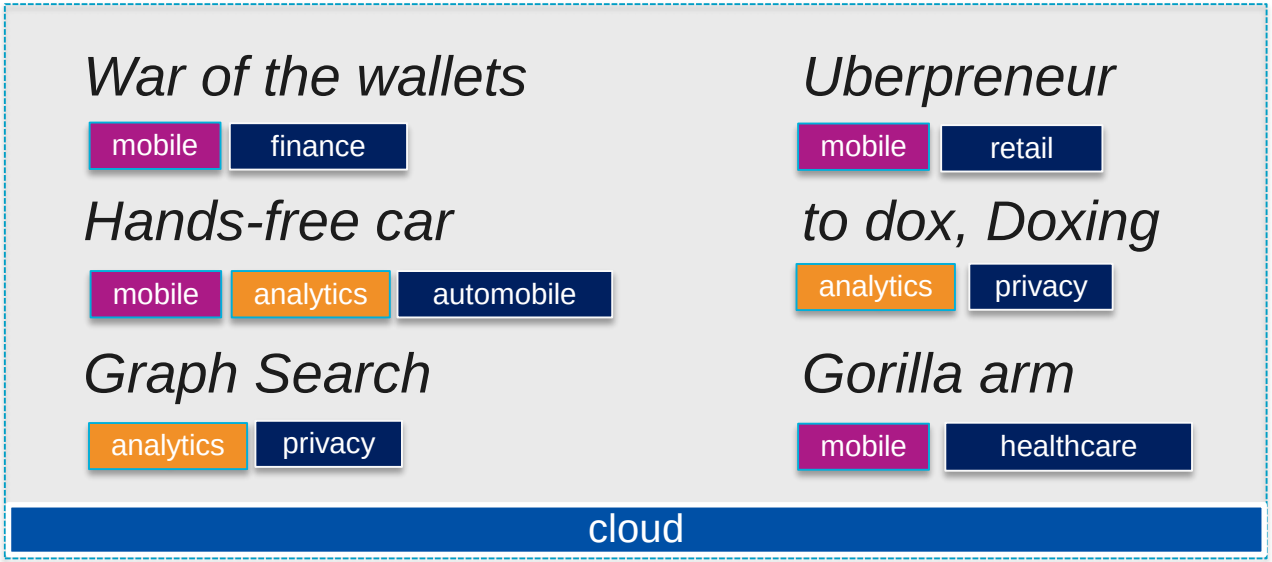
# Innovation never stops.
# …2015…



Digital Revolution
World becoming smarter

Transform interactions
Personalized everything
In the moment right now

# What is happening?

16 billion connected devices
75 billion devices by 2020
7 billion smart phones

Infrastructure of the company
Infrastructure of the city
Infrastructure of the world

Respect and protect security and privacy

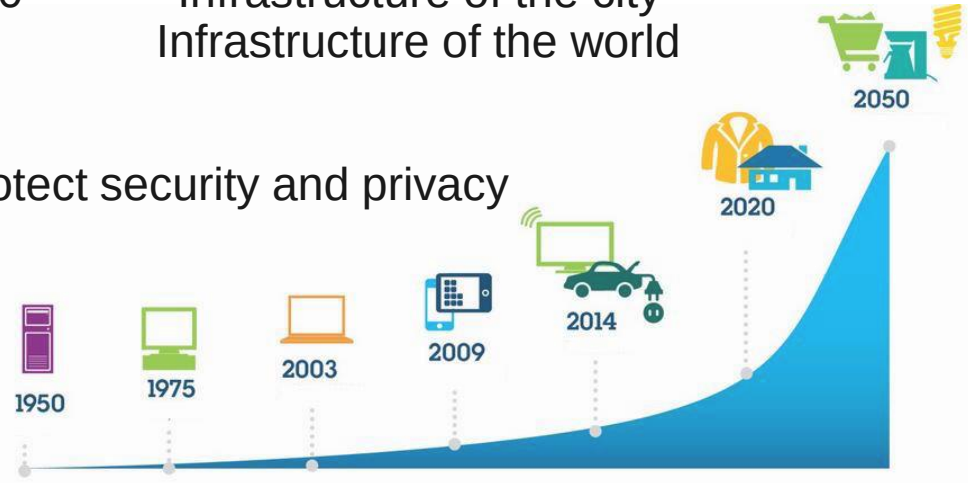



*Figure 1:* Each inflection point in the history of computing has triggered an explosion in the number of computing devices

**Explosion in transaction growth**

*driven by mobility and the Internet of Things*

**Analytics is moving to real time**

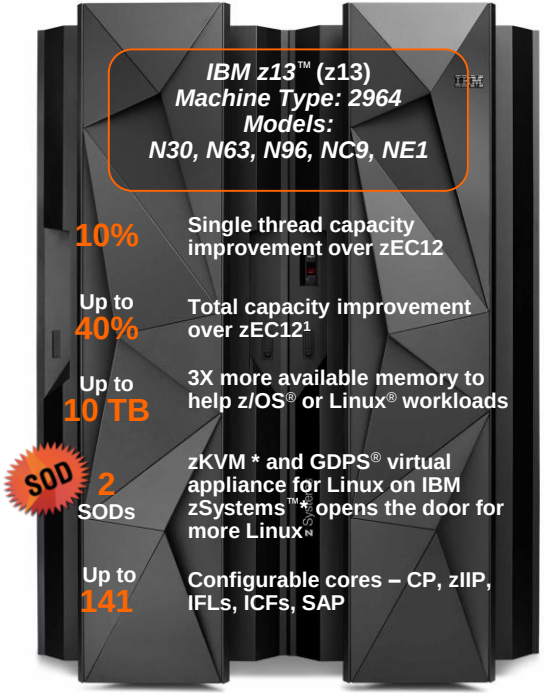
*to capture new opportunities at the point of impact*

**Hybrid cloud is the new standard**

*for delivering service, agility, trust and efficiency*

# Introducing the IBM z13

*The mainframe optimized for the digital era*




- Performance, scale, intelligent I/O and security enhancements to support transaction growth in the mobile world
- More memory, new cache design, improved I/O bandwidth and compression help to serve up more data for analytics
- Enterprise grade Linux solution, open standards, enhanced sharing and focus on business continuity to support cloud

***Upgradeable from IBM zEnterprise® 196 (z196) and IBM zEnterprise EC12 (zEC12)***

[1] Based on preliminary internal measurements and projections. Official performance data will be available upon announce and can be obtained online at LSPR (Large Systems Performance Reference) website at: https://www-304.ibm.com/servers/resourcelink/lib03060.nsf/pages/lsprindex?OpenDocument . Actual performance results may vary by customer based on individual workload, configuration and software levels

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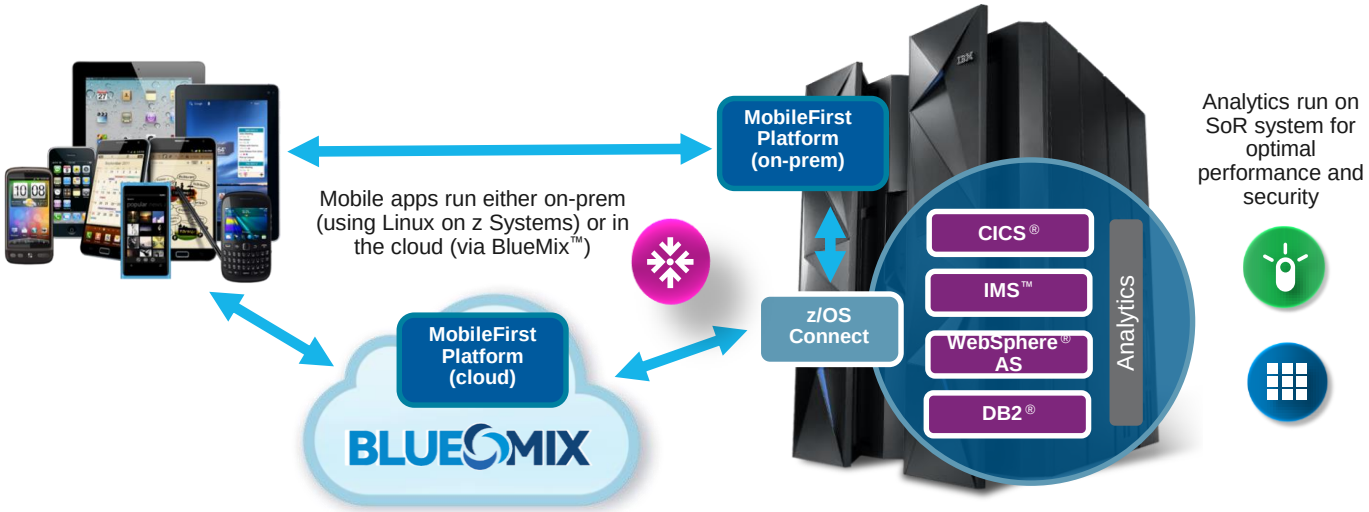
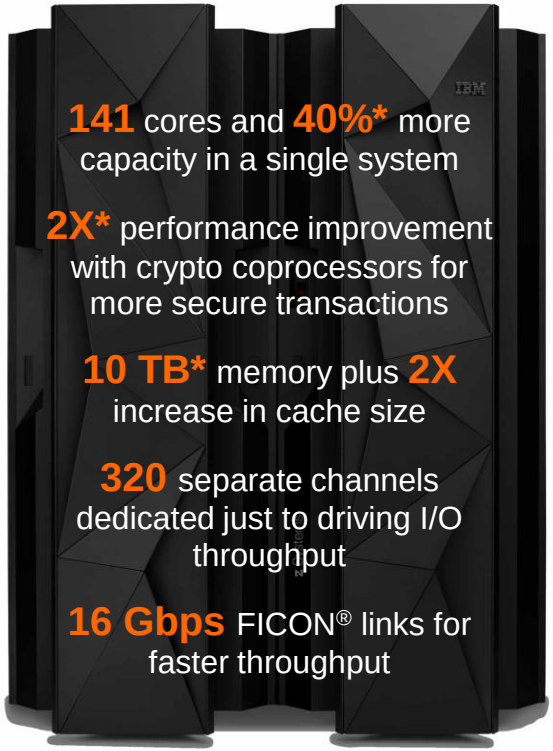
# z13 – Designed for data and transaction serving for the mobile generation

# Bridge systems of record to systems of engagement for rapid service delivery



# z13 – Redesigned for the scale and speed of a mobile generation




Performance, scale, intelligent I/O and security enhancements to support transaction growth in the mobile world

z/OS Connect provides consolidated REST APIs for all z/OS transactions

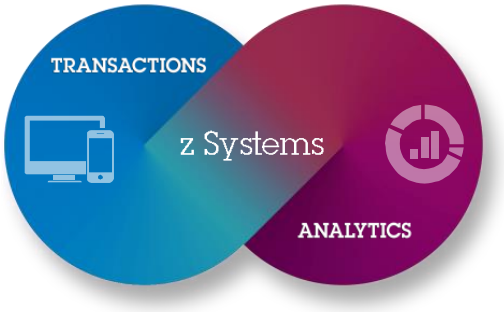
Seamlessly channel z/OS transactions to mobile devices with MobileFirst Platform

Apple iOS apps packaged with GBS implementation services for z Systems

New reference architectures enable integration with back-end resources and end-to-end security from mobile device to mainframe

* Compared to zEC12

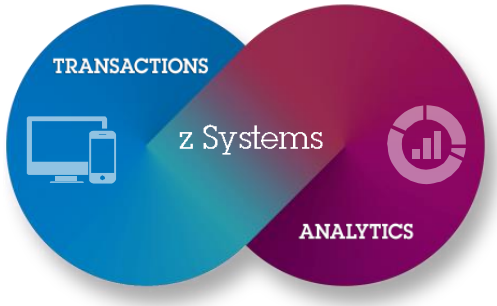
# z13 – Designed for integrating transactions and analytics for insight at the point of impact




# Integrated analytics and transaction processing

*The greatest value is achieved when analytics are run where the transactions and data originate*

***Insights on every transaction***



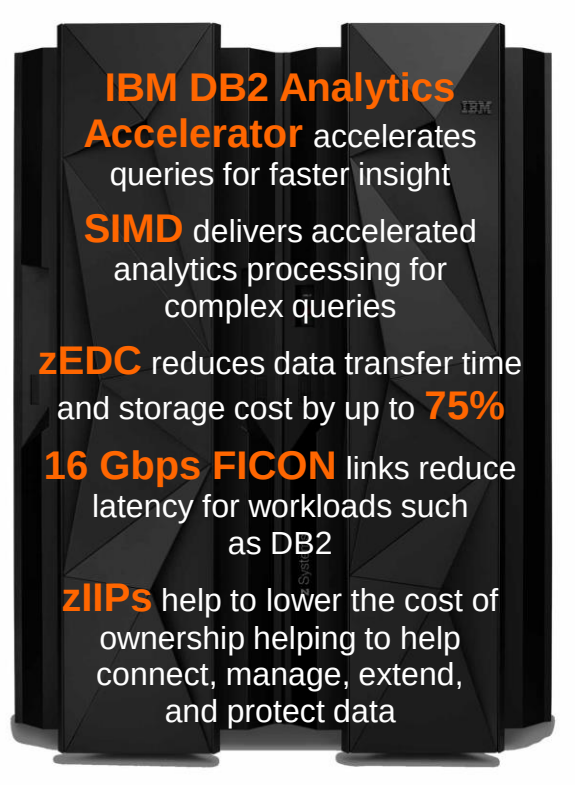

***Analytics as part of the flow of business***

More transaction throughput | Faster data access | Increased analytics performance

**Avoid (ETL)**
- Eliminate complexity
- Eliminate cost
- Eliminate redundancy

**Deliver real-time insights at the point of impact**
- Improve customer experience
- Increase revenue opportunities
- Improve response time

# z13 – Delivering insights at the point of impact




Mega-memory and new opportunities for in-memory computing

New machine architecture boosts complex mathematical model performance

Use Hadoop with IBM InfoSphere® BigInsights™ to explore z Systems within the secure zone of the mainframe

IBM DB2 Analytics Accelerator and DB2 BLU creating new and innovative use cases, such as in-database transformation and advanced predictive analytics

z13 – Designed for efficient and trusted cloud services to transform the economics of IT

# z13 supports all dimensions of cloud service delivery

## Private Cloud

z/OS and Linux on z Systems as the foundation of the most secure, scalable private cloud infrastructure

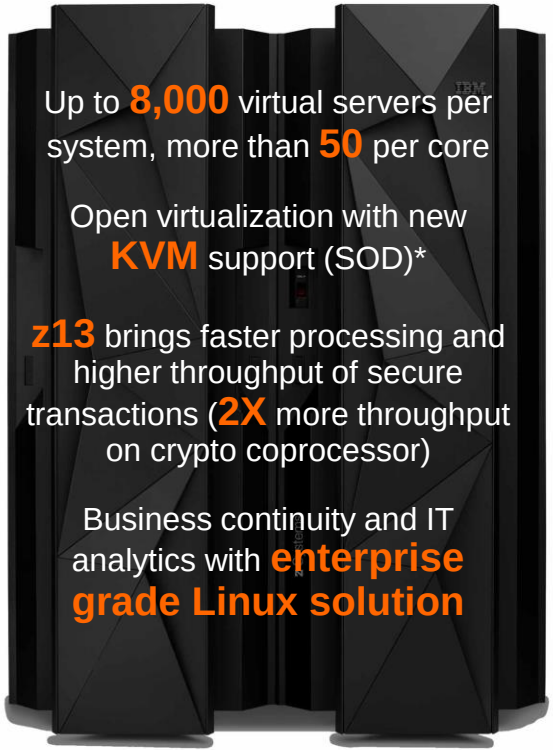
## Hybrid Cloud

Leveraging BlueMix and interoperability with SoftLayer and other public cloud offerings

## Public Cloud

Enabling MSPs/CSPs to deliver differentiated mainframe-based service offerings

# z13 – Redesigned for efficient and trusted cloud services




- Open support extended with OpenStack®, PostgreSQL, Node.JS, and KVM (SOD)
- Enterprise-grade Linux provides the foundation for public, private, and hybrid cloud
- Patterns for Linux on z Systems to quickly build out complex cloud workload instances
- Improved overall system performance leads to a lower TCO compared to public cloud deployments and deployments on x86 architectures
- Enabling next generation cloud applications with IBM Bluemix on z Systems

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# Operating Systems focused on exploiting hardware innovation

**z/OS Version 2.1**

HARDWARE EXPLOITATION

- Improved price performance for zIIP workloads with SMT
- Support new analytics workloads with SIMD and large memory
- Digitally sign audit records to reduce risk
- Improved operations agility with entitled z/OSMF

**z/VM® Version 6.3**

HARDWARE EXPLOITATION

- Improved price performance with simultaneous multithreading technology – support for twice as many processors
- Improved systems management and economics
- Embracing Open Standards and Open Source Interoperability
- Supports more virtual servers than any other platform in a single footprint

**z/VSE® Version 5.1**

HARDWARE EXPLOITATION

- Reduced risk of access from unauthorized users
- Reduced memory constraints
- Wide portfolio using Linux on z
- Continued system usability enhancements with CICS Explorer
- More efficient communications

**Linux on z Systems**

HARDWARE EXPLOITATION NEW

- Multithreading allows for per core software savings
- Ability to host and manage more workloads efficiently and cost-effectively
- Automatic identification of unusual messages
- Integrated continuous availability & disaster recovery solution

# Reinventing enterprise IT for digital business

Designed for data and transaction serving for the mobile generation

Designed for integrating transactions and analytics for insight at the point of impact

Designed for efficient and trusted cloud services to transform the economics of IT

***The trusted enterprise platform for integrating Data, Transactions and Insight!***

ZSP04335-USEN-00

# z13 Technical details

# z13 Functions and Features *(GA Driver Level 22)*

| System, Processor, Memory |
|---|
| **Five hardware models** |
| **Eight core 22nm PU SCM** |
| **Up to 141 processors configurable as CPs, zIIPs, IFLs, ICFs, or optional SAPs** |
| **Increased Uni processor capacity** |
| Up to 30 sub capacity CPs at capacity settings 4, 5, or 6 |
| **CPC Drawers and backplane Oscillator** |
| SMT (for IFLs and zIIPs only) and SIMD |
| **Enhanced processor/cache design with bigger cache sizes** |
| Up to 10 TB of Redundant Array of Independent Memory (RAIM) |
| CPC Drawer/Memory Affinity |
| LPARs increased from 60 to 85 |


| I/O Subsystem, Parallel Sysplex, STP, Securty |
|---|
| New PCIe Gen3 I/O fanouts with 16 GBps Buses |
| LCSS increased from 4 to 6 |
| 4th Subchannel Set per LCSS |
| Increased (24k to 32k) I/O Devices (subchannels) per channel for all z13 FICON features |
| FICON Enhancements |
| SR-IOV support for RoCE |
| New Integrated Coupling Adapter (PCIe-O SR ) for coupling links |
| Support for up to 256 coupling CHPIDs per CPC |
| CFCC Level 20 |
| Crypto Express5S and Cryptographic enhancements with support for 85 Domains |
| STP Enhancements |

| RAS, Other Infrastructure Enhancements | |
|---|---|
| **IBM zAware for Linux on z Systems (June 23, 2015)** | System Control Hub (SCH). Replaces BPH |
| New N+2 'radiator' design for Air Cooled System | Rack Mounted Support Elements in the CPC |
| Key Locks for doors | Rack mounted HMCs for customer supplied rack |
| Support for ASHRAE Class A2 datacenter | TKE 8.0 LICC |

# IBM z Systems naming for IBM z13 (z13)

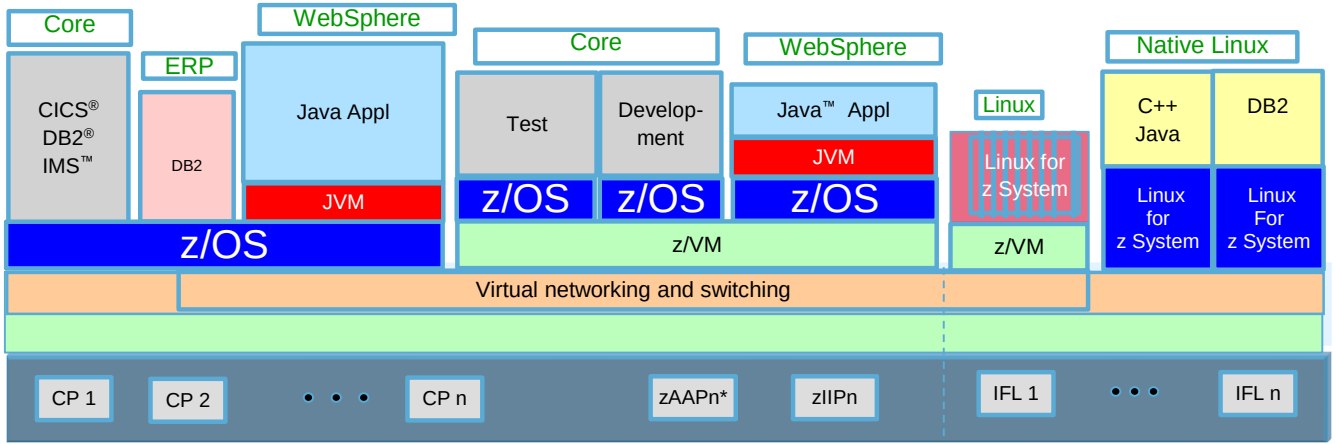
| | |
|---|---|
| Brand Name: | **IBM** |
| Product Class: | **IBM mainframe** |
| Family Name: | **IBM z S** |
| Family Short Name: | |
| Product | **M z Systems™** |
| Prod | **z Systems** |
| Product Name: | **IBM z13™** |
| Short Name: | **z13** |
| Models: | **N30, N63, N** |
| Machine Type: | **2** |
| Workload Optimizing Attachments: | **BladeCenter® Extension (zBX) Model 004**<br>**IBM DB2® Analytics Accelerator for z/OS® Version 4** |
| Management Firmware: | **IBM z Unified Resource Manager** |
| Management Firmware Short Name: | **Unified Resource Manager or zManager** |

Announced January 14th

General Available March 9

# IBM z Systems / Landscape

An integrated, highly scalable computer system that allows many different pieces of work to be handled at the same time, sharing the same information as needed with protection, handling very large amounts of information for many users with security, without users experiencing any failures in service

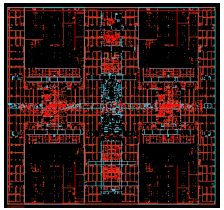



- Large scale, robust consolidation platform
- Built-in Virtualization
- 100’s to 1000’s of virtual servers on z/VM
- Intelligent and autonomic management of diverse workloads and system resources

*zAAPs not available on z13

# z Systems - Processor Roadmap

**z10**
**2/2008**



Workload Consolidation and Integration Engine for CPU Intensive Workloads

Decimal FP

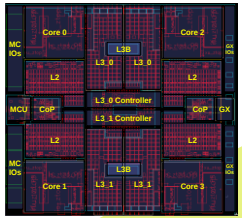
Infiniband

64-CP Image

Large Pages

Shared Memory

**z196**
**9/2010**




Top Tier Single Thread Performance,System Capacity

Accelerator Integration

Out of Order Execution

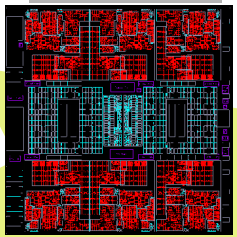
Water Cooling

PCIe I/O Fabric

RAIM

Enhanced Energy Management

**zEC12**
**8/2012**



Leadership Single Thread, Enhanced Throughput

Improved out-of-order

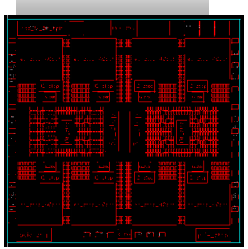
Transactional Memory

Dynamic Optimization

2 GB page support

Step Function in System Capacity

**z13**
**1/2015**



Leadership System Capacity and Performance

Modularity & Scalability

Dynamic SMT

Supports two instruction threads

SIMD

PCIe attached accelerators

Business Analytics Optimized

# z13 Technical details

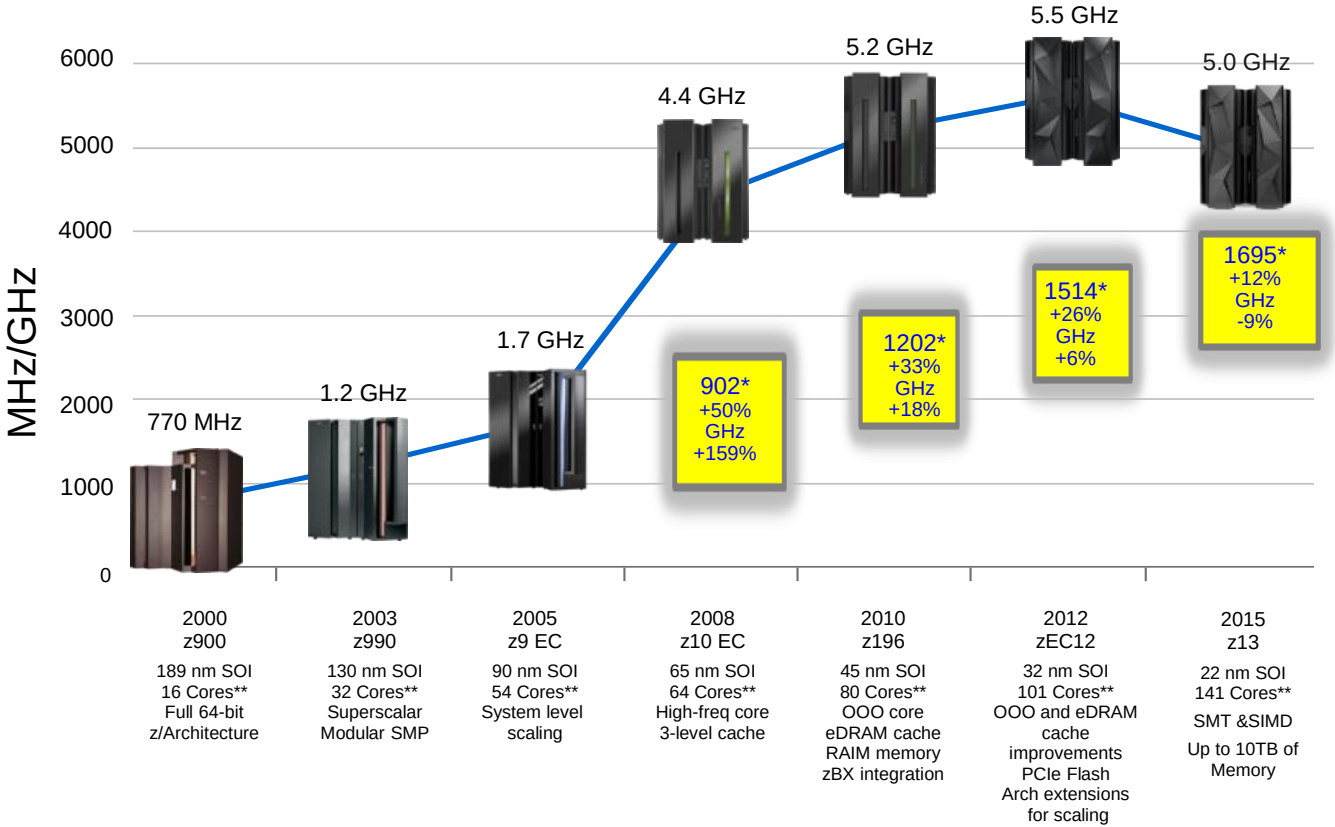
## Processor design

# Performance increase forever?

- Moore’s Law is a computing term which originated around 1970; the simplified ver… of this law states that processor speeds, or overall processing power for computers wi… very two years. A quick check among technicians in different computer com… …s that the term is not very popular but the rule is still accepted.
- Future challenges:
  - Density
  - Heat
- Gordon Moore stated i… that the law cannot be sustained indefinitely: "It can't continue forever. The n… …ponentials is that you push them out and eventually disaster happens." He also… …transistors would eventually reach the limits of miniaturization at atomic levels.

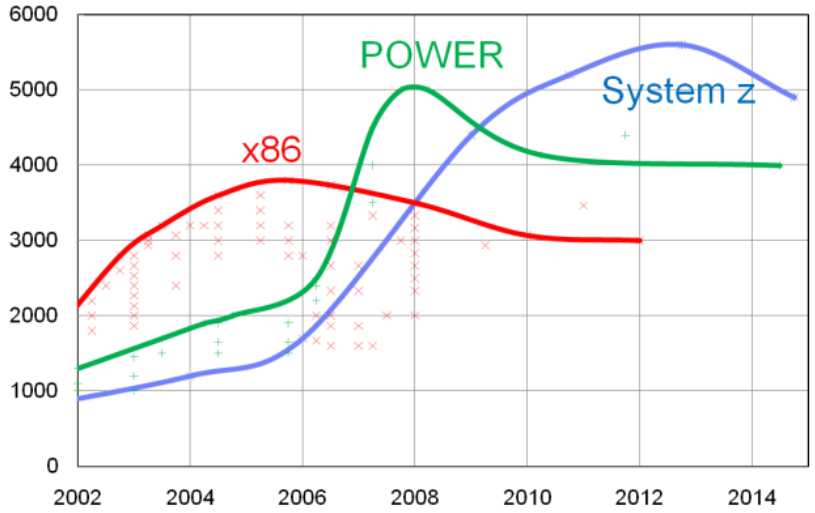
Moore’s Law is no longer valid in terms of processor speed

# z13 Continues the CMOS Mainframe Heritage begun in 1994




* MIPS Tables are NOT adequate for making comparisons of z Systems processors. Additional capacity planning required
** Number of PU cores for customer use

# “The end of the GHz Race”

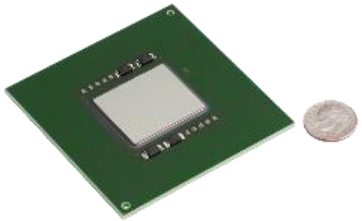



- x86 and POWER already transitioned to a throughput-centric model
  - Frequency peaked for x86 in 2005, POWER in 2008
- In System z we have held this off with unique cooling, packaging, technology, and design solutions

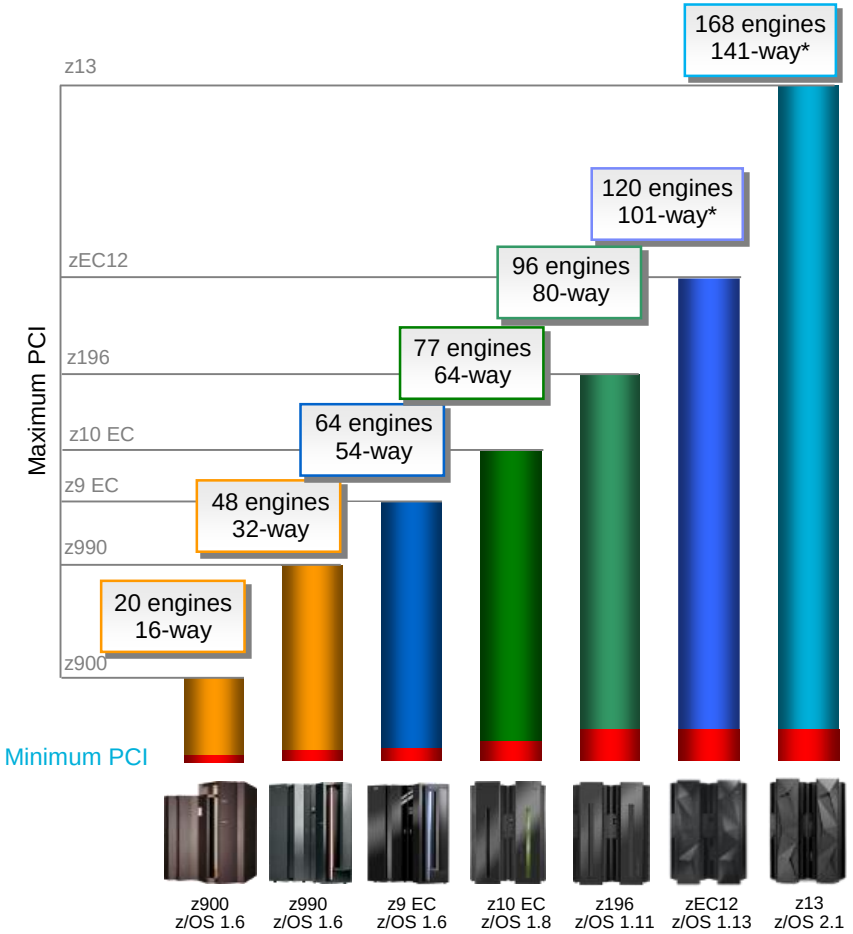
# z System Servers Continue to Scale with z13

Each new range continues to deliver:

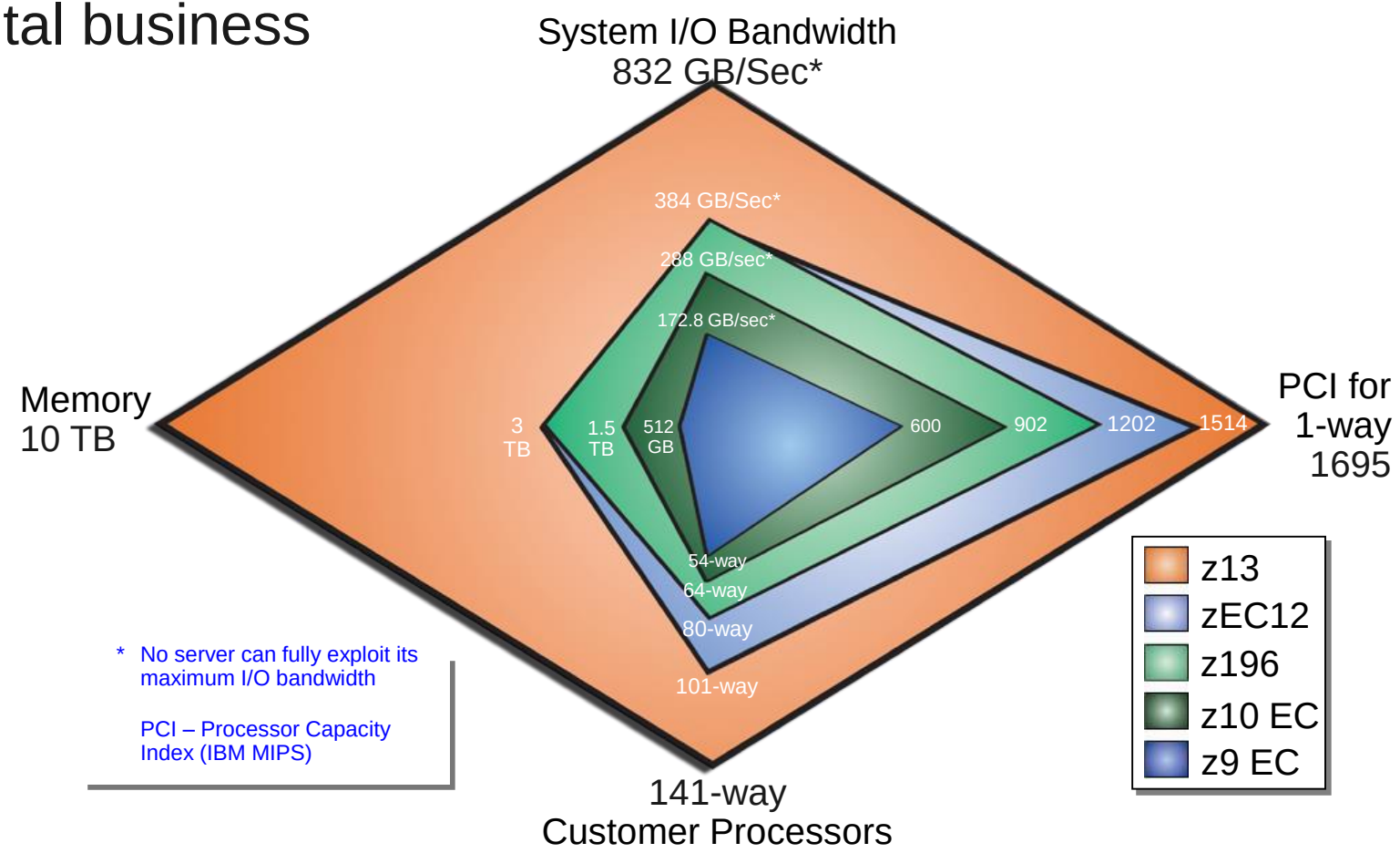
- New function
- Unprecedented capacity to meet consolidation needs
- Improved efficiency to further reduce energy consumption
- Continues to delivering flexible and simplified on demand capacity
- A mainframe that goes beyond the traditional paradigm



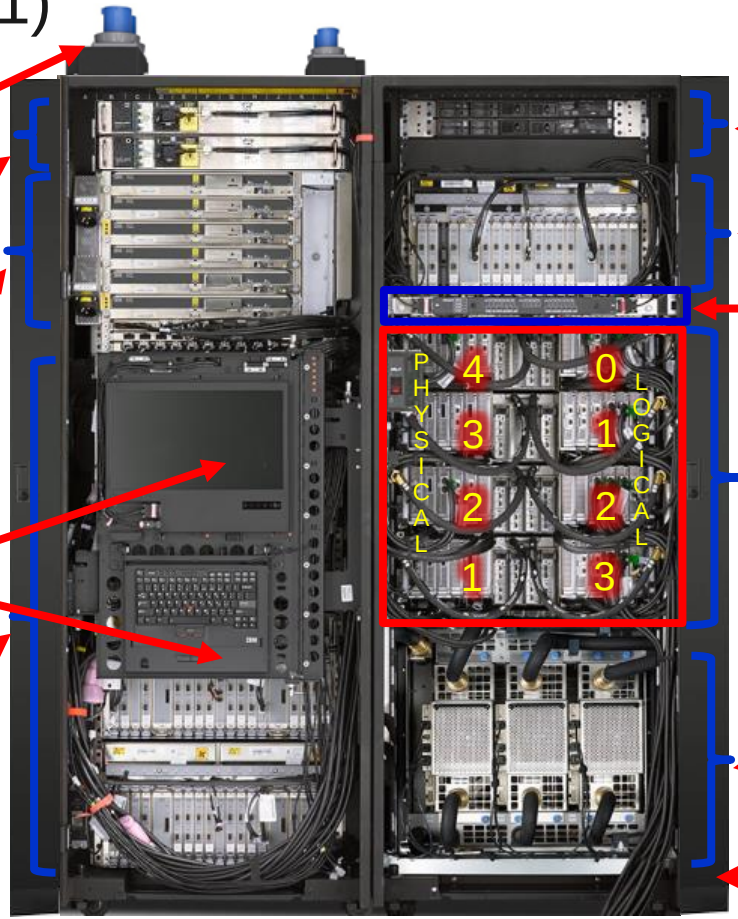
PCI - Processor Capacity Index
*z/OS supports up to a 100-way only



# IBM z13: Advanced system design optimized for digital business



# z13 Radiator-based Air cooled – Front View (Model NC9 or NE1)




Overhead Power Cables (option)

Internal Batteries (optional)

Power Supplies

Displays and keyboards for Support Elements

PCIe I/O drawers numbers 1 to 4 (Note: for an upgraded System, drawer slots 1 and 2 are used for the I/O Drawer

2 x 1U Support Elements

PCIe I/O drawer number 5

System Control Hubs (used to be BPHs)

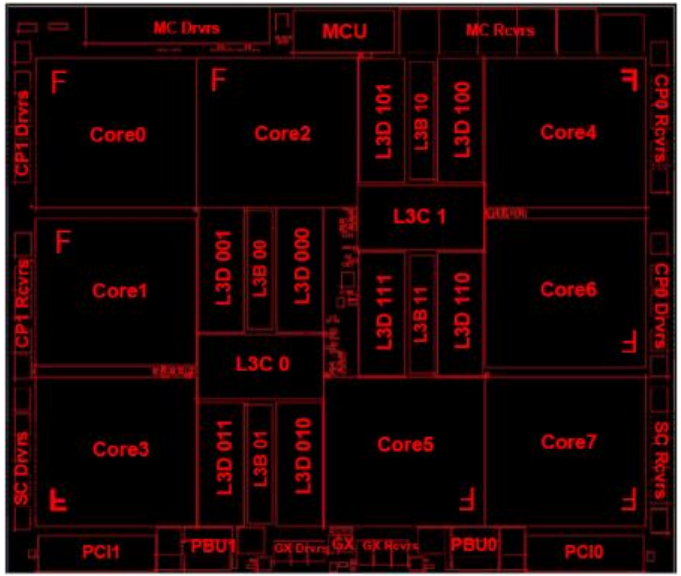
CPC Drawers, PCIe Fanouts, Cooling water manifold and pipes, PCIe I/O interconnect cables, FSPs and ethernet cables

Note: CPC Drawer plugging numbers are on the left and logical numbers on the right

N+2 Radiator Pumps

Overhead I/O feature is a co-req for overhead power option

# z13 8-Core Processor Unit (PU) Chip Detail



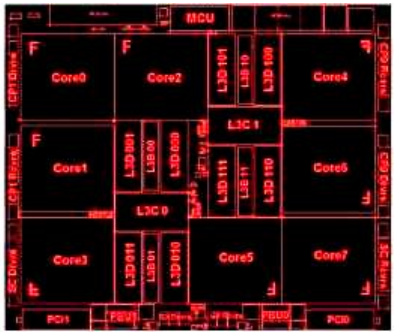

- 22nm SOI Technology
  - 17 layers of metal
  - 3.99 Billion Transistors
  - 13.7 miles of copper wire
- Chip Area:
  - 678.8 mm$^2$
  - 28.4 x 23.9 mm
  - 17,773 power pins
  - 1,603 signal I/Os

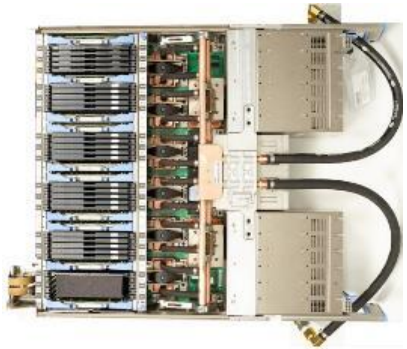
- Up to eight active cores (PUs) per chip
  - 5.0 GHz (v5.5 GHz zEC12)
  - L1 cache/ core
    - 96 KB I-cache
    - 128 KB D-cache
  - L2 cache/ core
    - 2M+2M Byte eDRAM split private L2 cache
- Single Instruction/Multiple Data (SIMD)
- Single thread or 2-way simultaneous multithreading (SMT) operation
- Improved instruction execution bandwidth:
  - Greatly improved branch prediction and instruction fetch to support SMT
  - Instruction decode, dispatch, complete increased to 6 instructions per cycle
  - Issue up to 10 instructions per cycle
  - Integer and floating point execution units
- On chip 64 MB eDRAM L3 Cache
  - Shared by all cores
- I/O buses
  - One InfiniBand I/O bus
  - Two PCIe I/O buses
- Memory Controller (MCU)
  - Interface to controller on memory DIMMs
  - Supports RAIM design

# z13 System Design Changes

- 22nm Processor with SIMD, SMT
- Integrated I/O with PCIe Direct Attach
- Single Chip Modules
- Drawer-Based CPC Design
- Cable-Based SMP Fabric
- Oscillator Backplane
- Flexible Service Processor (FSP2)
- Integrated Sparing
- On-chip power/thermal monitor / control

- New Memory Controller
- Crypto Express5S
- FICON Express16S
- 1U Support Element
- 2.7M lines of firmware changed
- Radiator Design improvements
- Expanded operating environment (Rear Doors)



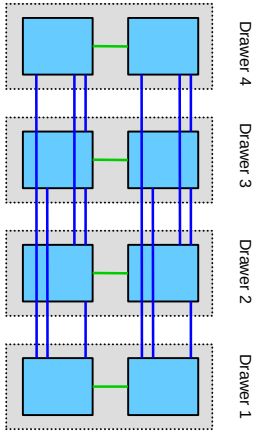



# z13 PU and SC SCM assembly

Capped PU

6x PU SCMs

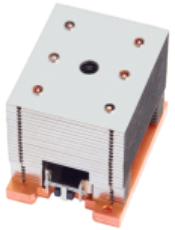
PU Chip




4 CPC Drawer System connectivity

2x SC SCMs (Air Cooled)

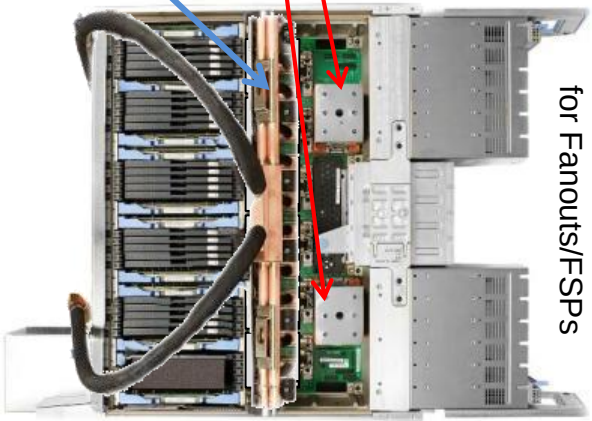
SC SCM with Thermal Module



6x PU SCMs under the cold-plates

Capped SC

SC Chip

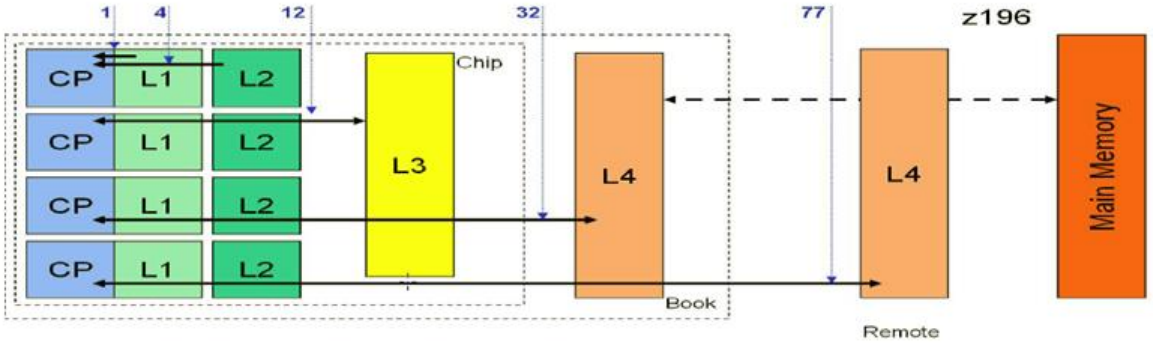



Fully assembled CPC Drawer with the chilled water supply manifold lifted to the left

# Cache Latency

- Why needs the CPU access Memory? Instruction / Data

- Cache latency for z196 (1, 4, 12, 32 & 77 are relative access times)
  Ratios are still accurate



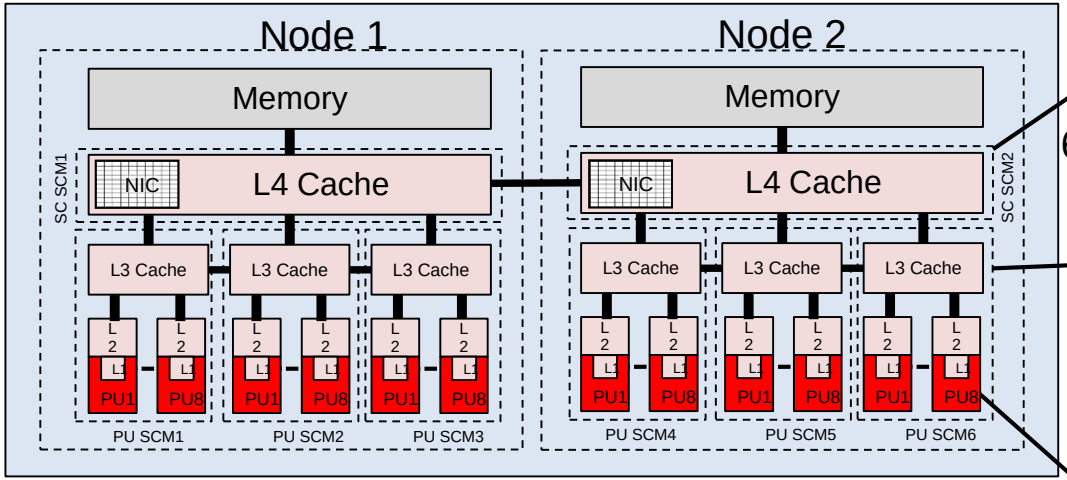
# Hiperdispatch

- Motivation to Hiperdispatch
  - In the past, System z hardware, firmware, and software have remained relatively independent of each other
  - CPU gets faster and faster, memory is still slow, connections “remains on light speed”
    >>> CPUs have different distance-to-memory attributes
  - Memory accesses can take less than 10 to several hundred cycles depending upon cache level / local or remote repository accessed
  - Reduce the multi-processor overhead

- Hardware cache can be optimized when a given unit of work is consistently dispatched on the same physical CPU (or related set of CPUs)
- With z/OS 1.8 and z10 IBM introduced Vertical processing instead of horizontal processing
- Interaction between z/OS and PR/SM to optimize work unit and logical processor placement to physical processors consists of 2 parts
  - In z/OS (sometimes referred as Dispatcher Affinity)
    Because it attempts to create a temporary affinity between work and processors
  - In PR/SM (sometimes referred as Vertical CPU Management)
    Because it attempts to assign physical processors exclusively to logical processors (as much as possible)

# z13 CPC Drawer Cache Hierarchy Detail

Single CPC Drawer View (N30 Model) – 2 Nodes



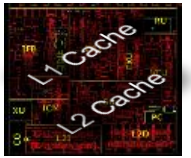

Node 1 - Caches
- L1 private 96k i, 128k d
- L2 private 2 MB i + 2 MB d
- L3 shared 64 MB / chip
- L4 shared 480 MB / node
  - plus 224 MB NIC

Node 2 - Caches
- L1 private 96k i, 128k d
- L2 private 2 MB i + 2 MB d
- L3 shared 64 MB / chip
- L4 shared 480 MB / node
  - plus 224 MB NIC

2 SC SCM Chips
(1 per node)


6 PU SCM Chips
(3 per node)


* Up to 8 PU cores per chip




Single PU core

* Not all PU's active

# z13 Processor Unit Allocation/Usage – zIIP to CP 2:1 ratio

| Model | Drawers /PUs | CPs | IFLs uIFLs | zIIPs | ICFs | Std SAPs | Optional SAPs | Std. Spares | IFP |
|---|---|---|---|---|---|---|---|---|---|
| N30 | 1/39 | 0-30 | 0-30<br>0-29 | 0-20 | 0-30 | 6 | 0-4 | 2 | 1 |
| N63 | 2/78 | 0-63 | 0-63<br>0-62 | 0-42 | 0-63 | 12 | 0-8 | 2 | 1 |
| N96 | 3/117 | 0-96 | 0-96<br>0-95 | 0-64 | 0-96 | 18 | 0-12 | 2 | 1 |
| NC9 | 4/156 | 0-129 | 0-129<br>0-128 | 0-86 | 0-129 | 24 | 0-16 | 2 | 1 |
| NE1 | 4/168 | 0-141 | 0-141<br>0-140 | 0-94 | 0-141 | 24 | 0-16 | 2 | 1 |

1. At least one CP, IFL, or ICF must be purchased in every machine
2. Two zIIPs may be purchased for each CP purchased if PUs are available. This remains true for sub-capacity CPs and for “banked” CPs.
3. On an upgrade from z196 or zEC12, installed zAAPs are converted to zIIPs by default. (Option: Convert to another engine type)
4. “uIFL” stands for Unassigned IFL
5. The IFP is conceptually an additional, special purpose SAP

- z13 Models N30 to NC9 use drawers with 39 cores. The Model NE1 has 4 drawers with 42 cores.
- The maximum number of logical ICFs or logical CPs supported in a CF logical partition is 16
- The integrated firmware processor (IFP) is used for PCIe I/O support functions
- Concurrent Drawer Add is available to upgrade in steps from model N30 to model NC9

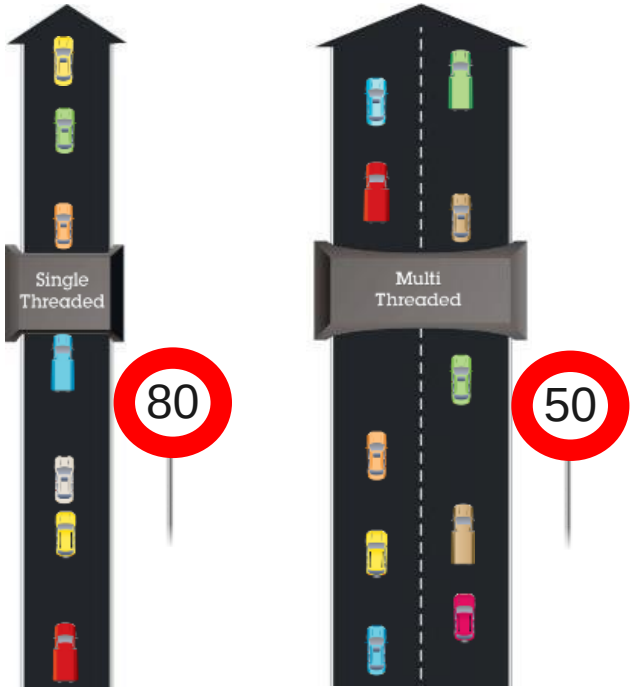


# z13 Technical details

## Processor: new functions

# Simultaneous Multi-Threading (SMT)

- Simultaneous multithreading allows instructions from one or two threads to execute on a zIIP or IFL processor core.
- SMT helps to address memory latency, resulting in an overall capacity* (throughput) improvement per core
- Capacity improvement is variable depending on workload. For AVERAGE workloads the estimated capacity* of a z13:
  - zIIP is 38% greater than a zEC12 zIIP
  - IFL is 32% greater than a zEC12 IFL
  - zIIP is 72% greater than a z196 zIIP
  - IFL is 65% greater than a z196 IFL
- SMT exploitation: z/VM V6.3 + PTFs for IFLs and z/OS V2.1 + PTFs in an LPAR for zIIPs
- SMT can be turned on or off on an LPAR by LPAR basis by operating system parameters. z/OS can also do this dynamically with operator commands.
- Notes:
  1. SMT is designed to deliver better overall capacity (throughput) for many workloads. Thread performance (instruction execution rate for an individual thread) may be faster running in single thread mode.
  2. Because SMT is not available for CPs, LSPR ratings do not include it



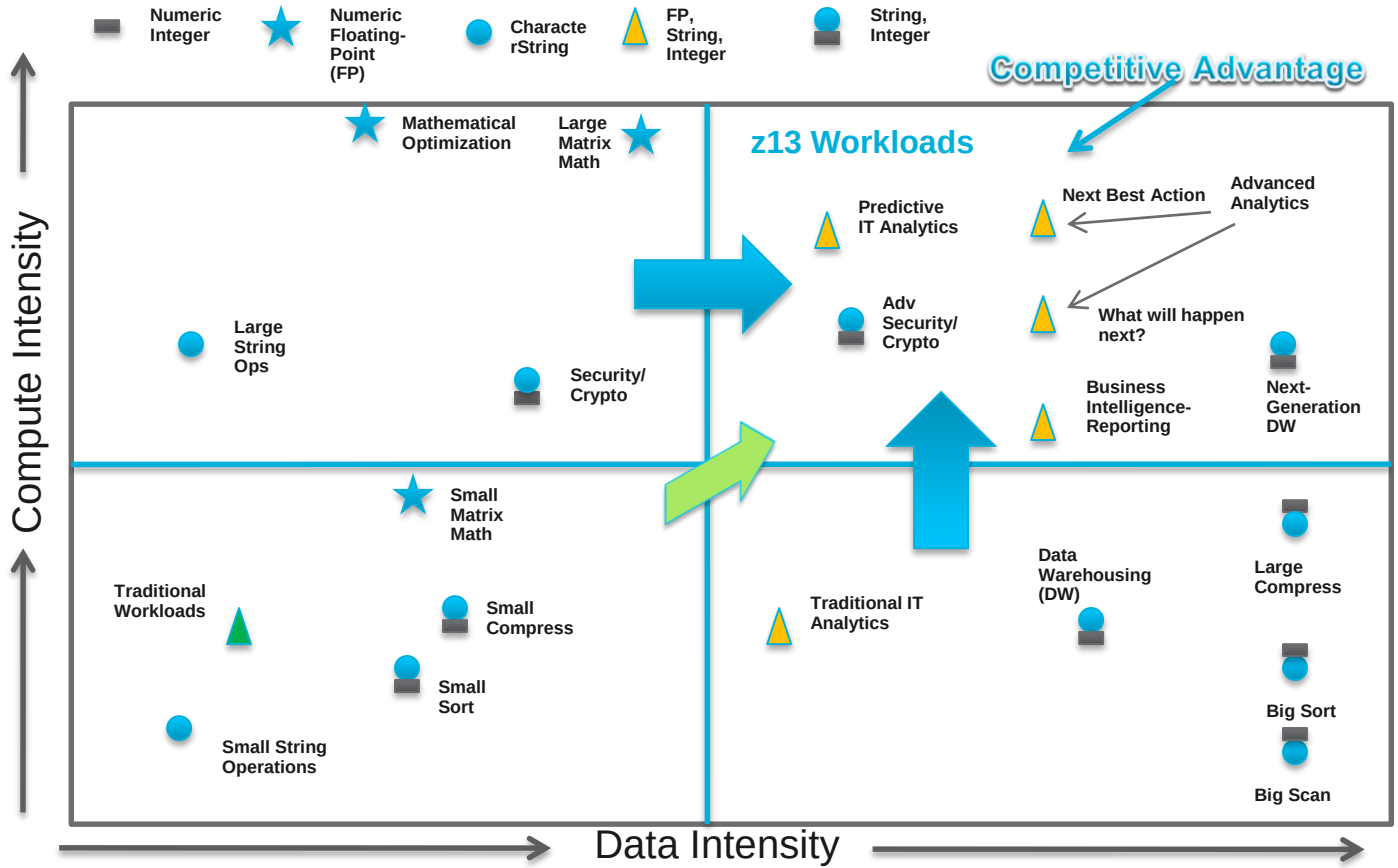

*Which approach is designed for the highest volume** of traffic? Which road is faster?*

***Two lanes at 50 carry 25% more volume if traffic density per lane is equal*

*Capacity and performance ratios are based on measurements and projections using standard IBM benchmarks in a controlled environment. 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 .

# Increasing Data and Compute Requirements

SIMD, Large Memory and SMT Enable Upper Right Quadrant Workloads

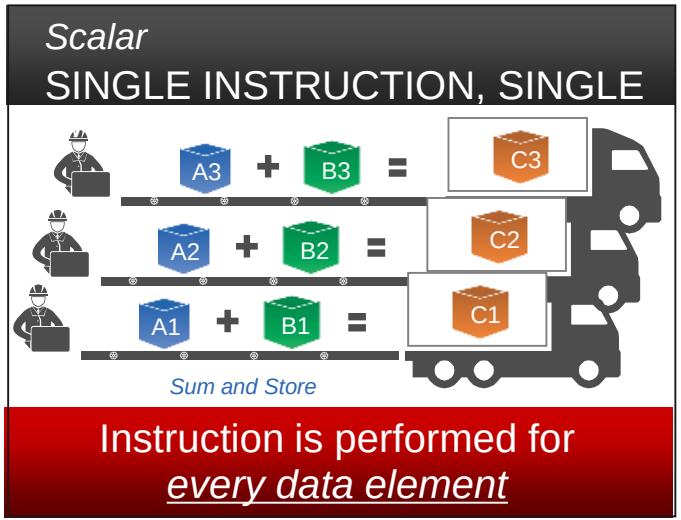


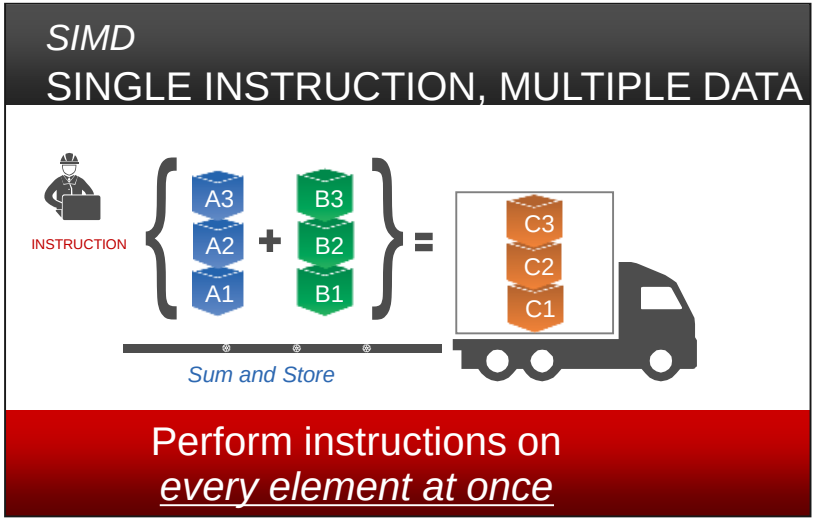
# SIMD (Single Instruction Multiple Data) processing

Increased parallelism to enable analytics processing

- Smaller amount of code helps improve execution efficiency
- Process elements in parallel enabling more iterations
- Supports analytics, compression, cryptography, video/imaging processing

**Value**
- ✓ Enable new applications
- ✓ Offload CPU
- ✓ Simplify coding



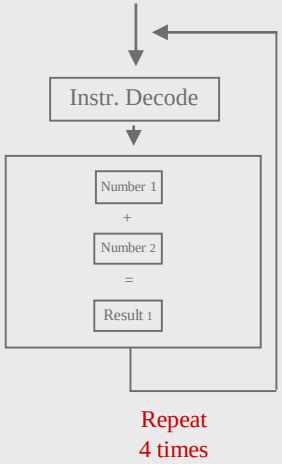



# SIMD (Single Instruction Multiple Data) Accelerator

Data-level parallelism / operate on multiple data elements simultaneously

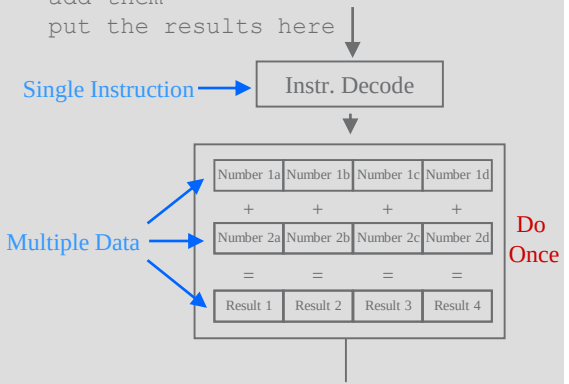
## Scalar code

```
read the next instruction and decode it
get this number
get that number
add them
put the result here
read the next instruction and decode it
get this number
get that number
add them
put the result here
read the next instruction and decode it
get this number
get that number
add them
put the result here.
read the next instruction and decode it
get this number
get that number
add them
put the result there
```




## SIMD code

```
read instruction and decode
     it
get these 4 numbers
get those 4 numbers
add them
put the results here
```




- (Significantly) smaller amount of code => improved execution efficiency
- Number of elements processed in parallel = (size of SIMD / size of element)

# SIMD Roadmap and Client Value

z/VM | Linux | z/OS

**Last Updated: 08/03/2014**

Roadmap is subject to Change

- ***ILOG-CPLEX***
  - *Faster mathematical modeling solutions*
- ***XMLSS***
  - *Improved performance for parsing*
  - *Exploiters: COBOL, PL/I, DB2 Pure XML*
- ***MASS/ATLAS w/SIMD***
  - *Construct rich complex analytics models*
  - *Port from POWER and x86 to accelerate business insight*
  - *Increased programmer productivity*
- ***XL C/C++***
  - *Improved price/perf, single-thread performance*
- ***Java.Next***
  - *Improved String and Floating Point performance*
  - *Auto-SIMD*
- ***COBOL V5.2***
  - *Improved price/perf, single-thread performance*
  - *Reduced execution time*
  - *Improved efficiency*

- ***XL C/C++***
  - *Auto-SIMD: recognize code fragments that can be SIMD-enabled*

- ***MASS/ATLAS w/SIMD***
  - *Improved price & single-thread performance*
  - *Reduced execution time*
- ***XL C/C++***
  - *Auto-SIMD*

**Under Investigation**
- z/VM
- Security
- R
- Java Enabled Workloads: WAS/Liberty, DB2, IMS, CICS, ODM, Traditional WAS, SPSS, Cognos, InfoSphere Streams, Unica SPSS Analyzer
  - Timeline varies as new JVM gets adopted

SIMD HW and SW Stack will grow in ease of use and capability

***02/2015*** — ***3Q2015*** — ***09/2015*** — ***2016*** — ***2017***

***zNext GA1 (SIMD-enabled Instruction Set and Register files), z/OS V2.1 SPE***
- *ILOG-CPLEX V12.6.1 or V12.6.0.2, XMLSS*
- *MASS/ATLAS (z/OS: zEC12, zNext GA1)*
- *MASS/ATLAS (zLinux: zEC12, NO SIMD)*
- *Java.Next, XL C/C++ for z/OS, COBOL V5.2, PL/I*

***Linux RHEL7.2 / SLES12.1***
- *MASS/ATLAS w/SIMD*
- *XL C/C++ , GCC & LLVM Compilers; binutils, gdb, and register file save/restore*

***z/OS V2.2***
- *XL C/C++*

HLASM

ISV: z/XDC (Colesoft)

***SIMD Ecosystem***
***SIMD Optimized Workloads***
***Enabling Libraries***
***Enabling Compilers / Built-in Functions***

# Compilers in the Spotlight on IBM z13

## Enterprise COBOL 5.2 on z13 vs. Enterprise COBOL 5.1 on zEC12

- **Up to 14% reduction in CPU time** for compute intensive batch COBOL programs
- Enterprise COBOL 5.2 takes advantage of expanded Decimal Floating point facility on z13 by performing more packed decimal arithmetic in decimal floating point. (Carefully used based on conditions.)
- Enterprise COBOL 5.2 takes advantage of the SIMD unit available on z13 to improve the processing of certain COBOL statements including many instances of INSPECT… TALLYING and INSPECT ... REPLACING (Up to 30x improvement for these specific functions)
- This workload got about a 3% performance benefit moving from zEC12 to z13. 11% was compiler improvement.

## Enterprise PL/I 4.5 on z13 vs. Enterprise PL/I 4.4 on zEC12

- **Up to 17% reduction in CPU time** for compute intensive batch PL/I programs
- Improved compiler optimization, increased exploitation of the Decimal Floating Point facility and exploitation of SIMD
- Most of this improvement is hardware benefit zEC12 to z13.
- SIMD exploitation makes a huge difference to a few important string-handling functions, but those are not important to the benchmark suite

- **COBOL:** All **benchmarks were compiled with OPT(2), STGOPT, AFP(NOVOLATILE),H GPR (NOPRESERVE) and an appropriate ARCH level.In the case of tests compiled for z13 using Enterprise COBOL 5.2, that value is ARCH(11).**In all other cases, it is ARCH(10).
- PL/I: **.All benchmarks were executed on zEC12 and z13, and built using the OPT(3) compiler option. The benchmarks compiled with the 4.4 compiler were built using the ARCH(10) option;the benchmarks compiled with the 4.5 compiler used ARCH(11).**

The performance improvements are based on internal IBM lab measurements. Performance results for specific applications will vary, depending on the source code, the compiler options specified, and other factors

# IBM z Integrated Information Processor (zIIP) on the z13

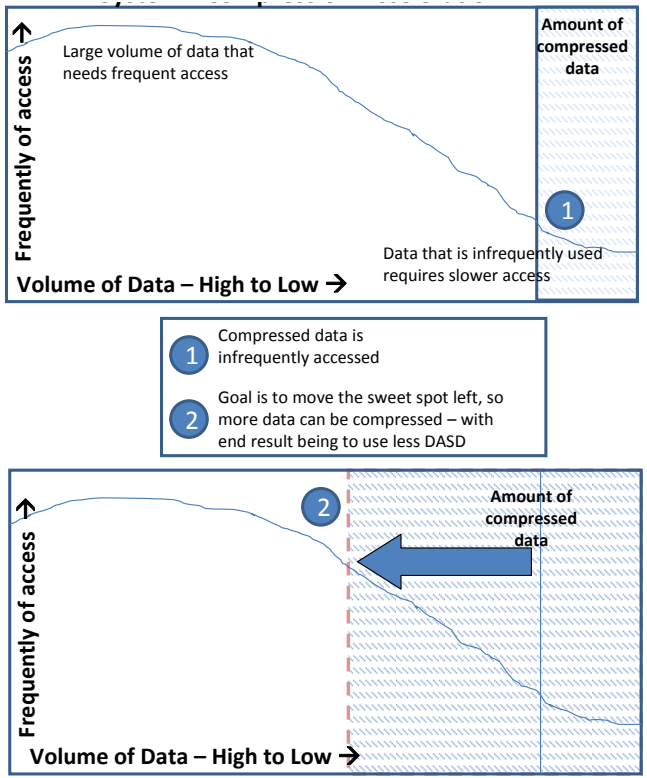
- The IBM z13 continues to support the z Integrated Information Processor (zIIP) which can take advantage of the optional simultaneous multithreading (SMT) technology capability. SMT allows up to two active instruction streams per core, each dynamically sharing the core's execution resources.
  - With the multithreading function enabled, the performance capacity of the zIIP processor is expected to be up to 1.4 times the performance capacity of these processors on the zEC12
- The rule for the CP to zIIP purchase ratio is that for every CP purchased, up to two zIIPs may be purchased
- zAAP eligible workloads such as Java and XML, can run on zIIPs using zAAP on zIIP processing.
- zAAPs are no longer supported on the z13

# z13 Technical details

## zEnterprise Data Compression

# IBM zEnterprise Data Compression (zEDC) capability

- The cost of storing and handling data in CP consumption and DASD space is growing.
- Data compression using software can address this today. There is substantial benefit, but it comes with a cost: CP time.
- Simplistically, data can be classified two ways:
  - Not compressed for <u>frequent access</u> – CPU time used to compress/decompress would be wasted to compress/decompress each time data is accessed. Examples: BSAM/QSAM writing data sequentially and reading it back; DB2 using sequential write to create a report; and SMF logger.
  - Compressed for <u>infrequent access</u> - Historical data that is written out to tape and archived for a few years. Very little need to access this data.
- Goal of IBM zEnterprise Data Compression (zEDC) is to save storage (create storage “white space”) and improve wall clock time for compression.



# zEDC Express feature

- Configuration:
  - One coprocessor per PCIe I/O feature
  - Supports concurrent requests from up to 15 LPARs
  - Up to 8 features supported by zEC12/zBC12
  - Minimum two feature configuration recommended
- Exploitation and Compatibility
  - Exclusive to zEC12 GA2 and z/OS support in V2R1
  - z/OS Support Planned:
    - z/OS V2.1 – Hardware exploitation for SMF, September 2013, and BSAM/QSAM, 1Q2014*
    - z/OS V1.13 and V1.12 with PTFs - Software decompression support only
    - Authorized APIs for ISV use are planned
    - Includes new PCIE activity report in RMF

- Great results for archived logs (DB2)
- IMS SLDS are also good candidates for zEDC

zEDC Express
FC 0420


Note: Full performance benefits are not achieved unless all systems sharing data are enabled

# QSAM/BSAM Data Set Compression with zEDC

Reduce the cost of keeping your sequential data online

- zEDC compresses data up to 4X, saving up to 75% of your sequential data disk space
- Capture new business opportunities due to lower cost of keeping data online

Better I/O elapsed time for sequential access

- Potentially run batch workloads faster than either uncompressed or QSAM/BSAM current compression

Sharply lower CPU cost over existing compression

- Enables more pervasive use of compression
- Up to 80% reduced CPU cost compared to tailored and generic compression options

Simple Enablement

- Use a policy to enable the zEDC

Disclaimer: Based on projections and/or measurements completed in a controlled environment. Results may vary by customer based on individual workload, configuration and software levels.

## Example Use Cases

*SMF Archived Data* can be stored compressed to increase the amount of data kept online up to 4X

*zSecure* output size of Access Monitor and UNLOAD files reduced up to 10X and CKFREEZE files reduced by up to 4X

Up to 5X more *XML* data can be stored in sequential files

*The IBM Employee Directory* was stored in up to 3X less space

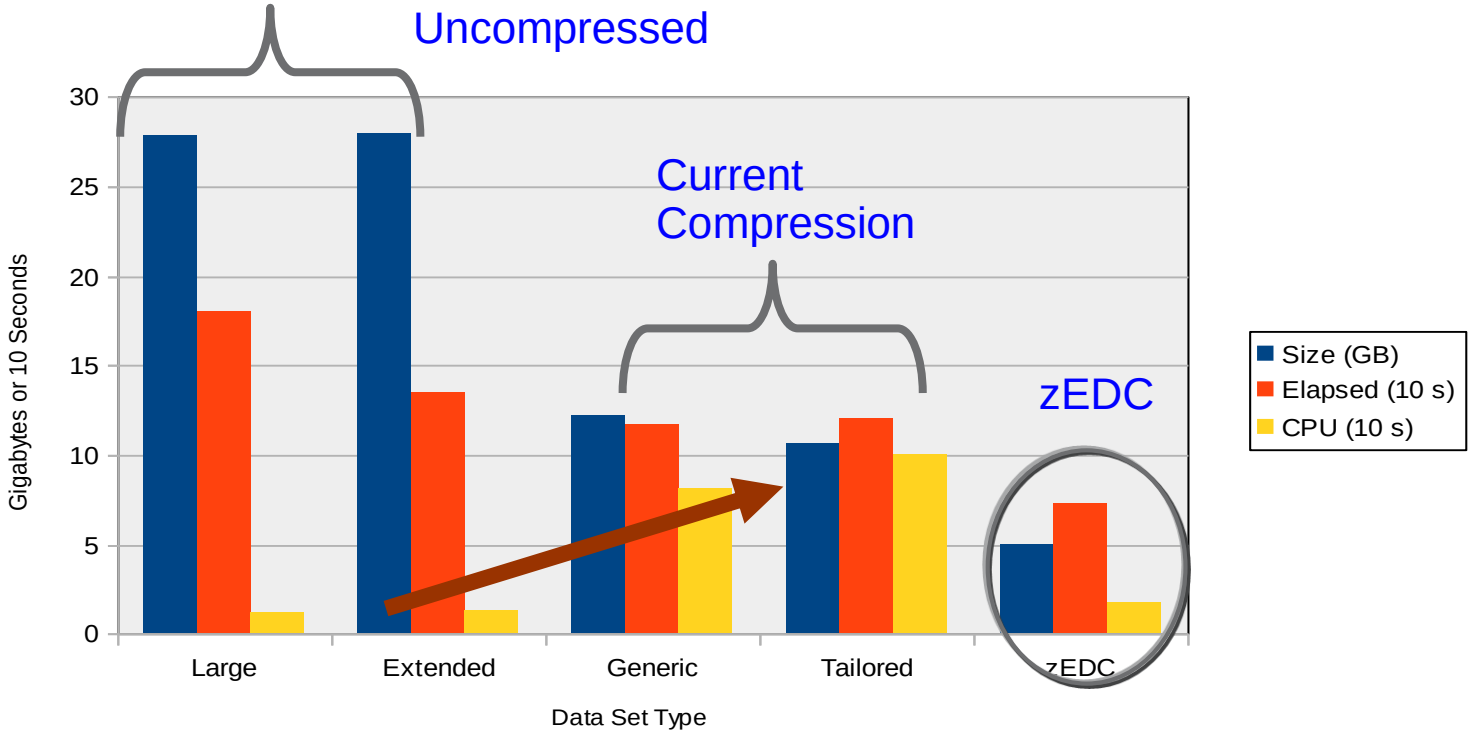
*z/OS SVC and Stand Alone DUMPs* can be stored in up to 5X less space

# QSAM/BSAM Data Set Compression with zEDC

- Setup is similar to setup for existing types of compression (generic and tailored)
  - It can be selected at either or both the data class level or system level.
    - Data class level
      In addition to existing tailored (T) and generic (G) values, new zEDC Required (ZR) and zEDC Preferred (ZP) values are available on the COMPACTION option in data class. When COMPACTION=Y in data class, the system level is used
    - System level
      In addition to existing TAILORED and GENERIC values, new zEDC Required (ZEDC_R) and zEDC Preferred (ZEDC_P) values are available on the COMPRESS parameter found in IGDSMSxx member of SYS1.PARMLIB.
    - Activated using SET SMS=xx or at IPL
      Data class continues to take precedence over system level. The default continues to be GENERIC.
- zEDC compression for new extended format data sets is Optional
  - All previous compression options are still supported
  - For the full zEDC benefit,  zEDC should be active on ALL systems that might access or share compressed format data sets. This eliminates instances where software inflation would be used when zEDC is not available.



# BSAM/QSAM zEDC Compression Results




*Measurements completed in a controlled environment. Results may vary by customer based on individual workload, configuration and software levels.

# z13 Technical details

## IBM z Systems Advanced Workload Analysis Reporter

IMS Technical Symposium 2015

# IBM zAware background cont

Systems are more complex and more integrated than ever

- Errors can occur anywhere in a complex system
- Difficult to detect, difficult to diagnose, symptoms / problems can manifest hours/ days later
- Problem can grow, cascade, snowball
- Volume of data is unmanageable – need information and insight.
- Systematic ‘soft failures’ (sick but not dead) much harder to detect – several allowable anomalies can build up over time

IBM zAware is a chargeable feature

# IBM zAware Background - cont…

- IBM zAware monitors z/OS OPERLOG messages including all z/OS console messages, ISV and application generated messages
  - Reports on 10 minute intervals
    - Updated every 2 minutes
  - Uses 90 days baseline (customizable)
  - Detects anomalies monitoring systems miss:
    - Messages may be suppressed or rare
    - Messages may indicate a trend
  - XML Output is consumable through published API
    - IBM Products
    - ISV products

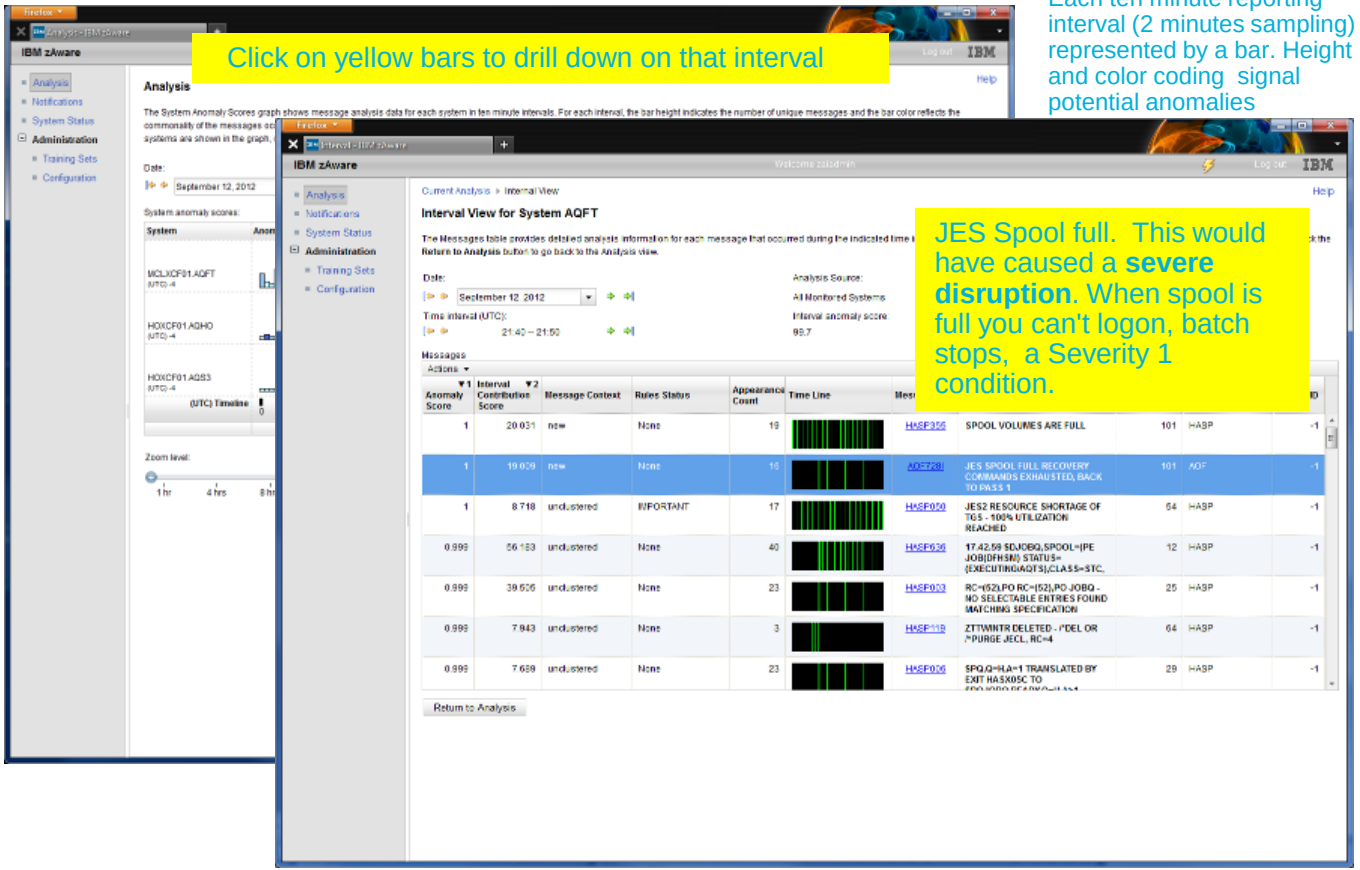
# IBM zAware Version 1


- Identify unusual system behavior of zOS images
- Proactively surface anomalies in z/OS operlog

# IBM zAware V2.0 - Analyze z/OS and Linux on z Systems


- Identify unusual system behavior of Linux on system z images
- Monitors *syslog** from guest or native image in real time
- Improved analytics for z/OS message logs
- Upgraded internal database for improved RAS
- Completely rewritten UI, including heat map views

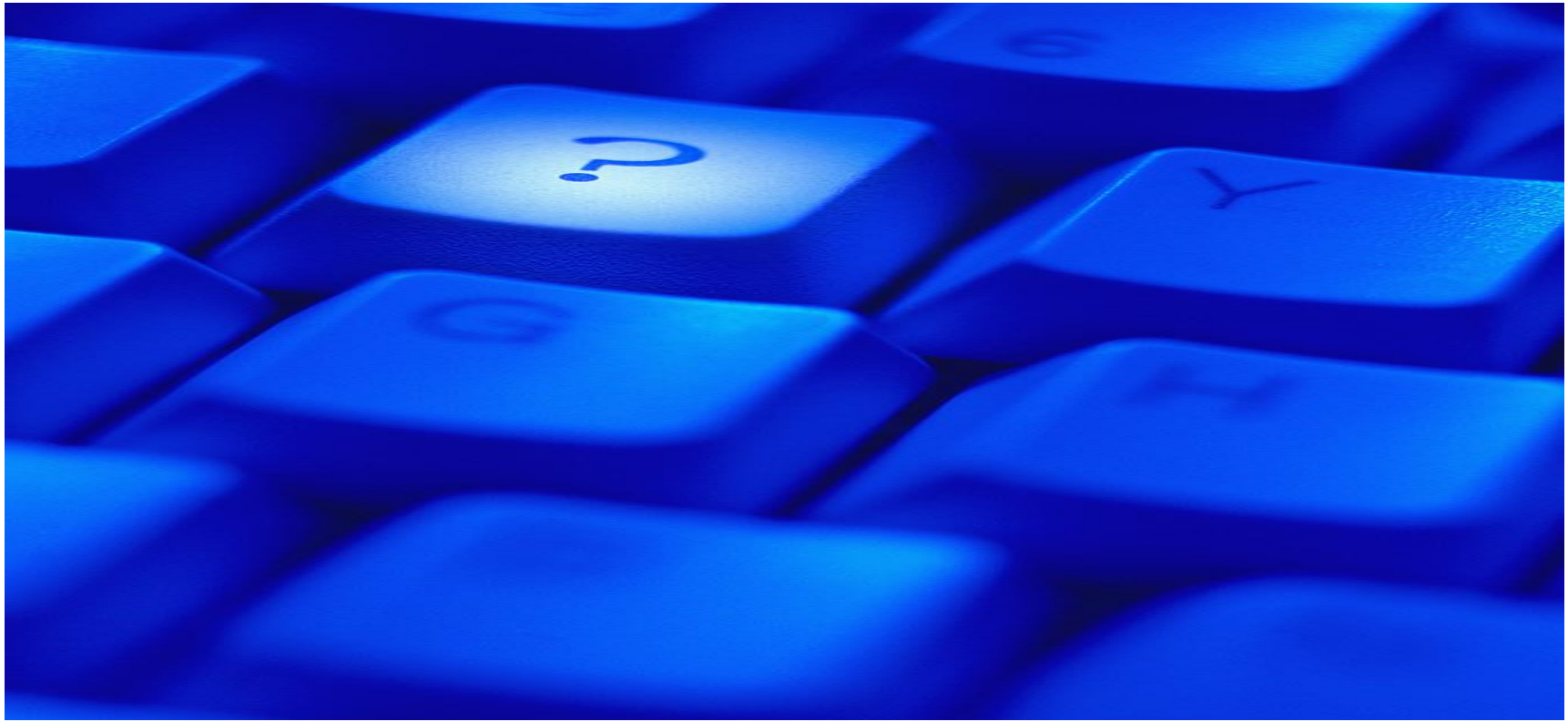
# Problem Determination in 2 clicks instead of Hours




Each ten minute reporting interval (2 minutes sampling) is represented by a bar. Height and color coding signal potential anomalies

JES Spool full. This would have caused a **severe disruption**. When spool is full you can't logon, batch stops, a Severity 1 condition.

# Questions



# IBM z13 Redbooks


- **IBM z13 Technical Introduction, SG24-8250:** This publication provides concepts, positioning, and a business value view of IBM z13 capabilities, hardware functions/features, and associated software support. It is intended for IT Managers, consultants, IT Architects and Specialists, and anyone who wants to understand the basic elements of the IBM z13.
- **IBM z13 Technical Guide, SG24-8051:** This publication provides specific information about the IBM z13 (z13) and its functions, features, and associated software support. Greater detail is offered in areas relevant to technical planning. It is intended for systems engineers, system programmers (IT Specialists), planners, and anyone wanting to understand the z13 functions and plan for their usage.
- **IBM z Systems Connectivity Handbook, SG24-5444:** This publication highlights the hardware and software components, typical uses, coexistence, and relative merits of the z System I/O features. It is intended for data center planners, IT Specialists, system engineers, technical sales staff, and network planners who are involved in planning connectivity solutions for z System servers.
- **IBM z13 Configuration Setup, SG24-8260:** This publication helps you install, configure, and maintain the IBM z13. This book is intended for systems engineers, hardware planners, and anyone who needs to understand IBM z Systems® configuration and implementation. Readers should be generally familiar with current IBM z Systems technology and terminology. For details about the z13, see IBM z13 Technical Introduction, SG24-8250, and IBM z13 Technical Guide, SG24-8251.

- **The z13 IBM Redbooks launch page will be:**

  http://www.redbooks.ibm.com/redbooks.nsf/pages/z13?Open

# THANK YOU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