

# Aktuelles zum IBM z Systems

## *IBM System z13(s) und LinuxONE*



# Agenda

- ➔ • **IBM z13s – Hardware - Betriebssysteme**
- **Hypervisor / Virtualisierung für z Systeme**
- **IBM Dynamic Partition Manager**
- **z Appliance Container Infrastructure (zACI)**
- **IBM z Systems und Speicher Synergie**



# IBM z Systems Integrated announcements



KVM and  
IBM LinuxONE



LinuxONE Refresh and  
Canonical Ubuntu

2015

2016

Jan

Feb

Mar

Apr

May

Jun

Jul

Aug

Sep

Oct

Nov

Dec

Jan

Feb

z13

GDPS  
Appliance

DS8800

z/OS  
2.2

KVM



z/VSE  
6.1

DS8880

z13s  
& z13  
GA2



## Our Servers

### IBM z Systems

IBM z13



IBM z13s



IBM LinuxONE Emperor

IBM LinuxONE Rockhopper

### IBM LinuxONE Systems

# IBM z Systems Generations

## N-4



- z9 Enterprise Class**
- Announced 7/2005
  - 1.7 GHz
  - Up to 54 cfg cores
  - CP, IFL, ICF, zAAP, zIIP
  - Up to 512 GB Memory



- z9 Business Class**
- Announced 4/2006
  - 1.4 GHz
  - Up to 7 cfg cores
  - CP, IFL, ICF, zAAP, zIIP
  - Up to 64 GB Memory

## N-3



- z10 Enterprise Class**
- Announced 2/2008
  - 4.4 GHz
  - Up to 64 cfg cores
  - CP, IFL, ICF, zAAP, zIIP
  - Up to 1.5 TB Memory



- z10 Business Class**
- Announced 10/2008
  - 3.5 GHz
  - Up to 10 cfg cores (5 CP)
  - CP, IFL, ICF, zAAP, zIIP
  - Up to 248 GB Memory

## N-2



- zEnterprise 196**
- Announced 7/22/2010
  - 5.2 GHz
  - Up to 80 cfg cores
  - CP, IFL, ICF, zAAP, zIIP
  - Up to 3 TB Memory



- zEnterprise 114**
- Announced 7/12/2011
  - 3.8 GHz
  - Up to 10 cfg cores (5 CP)
  - CP, IFL, ICF, zAAP, zIIP
  - Up to 248 GB Memory

## N-1



- zEnterprise EC12**
- Announced 8/28/2012
  - 5.5 GHz
  - Up to 101 cfg cores
  - CP, IFL, ICF, zAAP, zIIP
  - Up to 3 TB Memory



- zEnterprise BC12**
- Announced 7/23/2013
  - 4.2 GHz
  - Up to 13 cfg cores (6 CP)
  - CP, IFL, ICF, zAAP, zIIP
  - Up to 496 GB Memory

## N

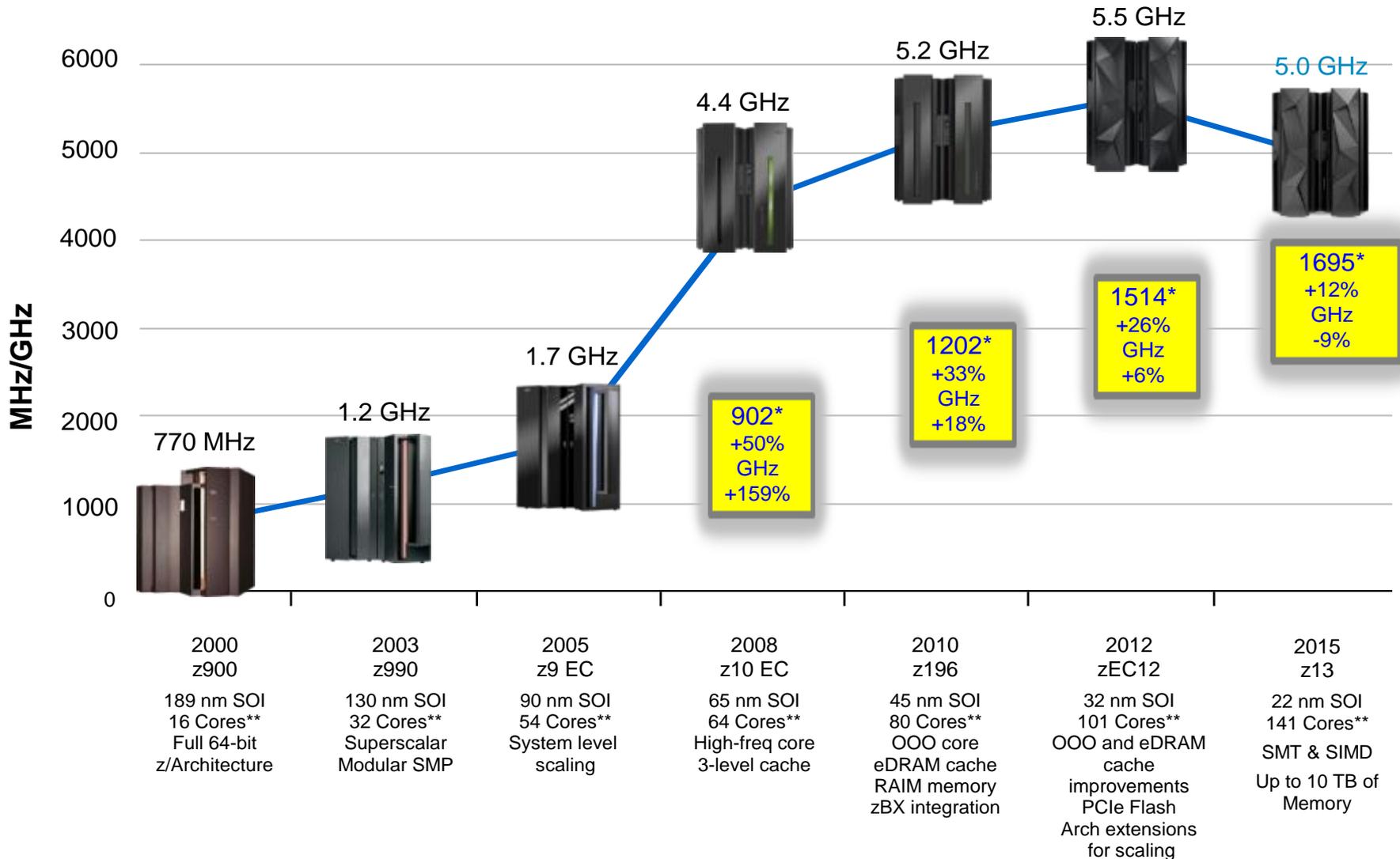


- IBM z13**
- Announced 1/14/2015
  - 5.0 GHz
  - Up to 141 cfg cores
  - CP, IFL, ICF, zIIP
  - Up to 10 TB Memory



- IBM z13s**
- Announced 2/16/2016
  - 4.3 GHz
  - Up to 20 cfg cores (6 CP)
  - CP, IFL, ICF, zIIP
  - Up to 4 TB Memory

# z13 continues the CMOS mainframe heritage

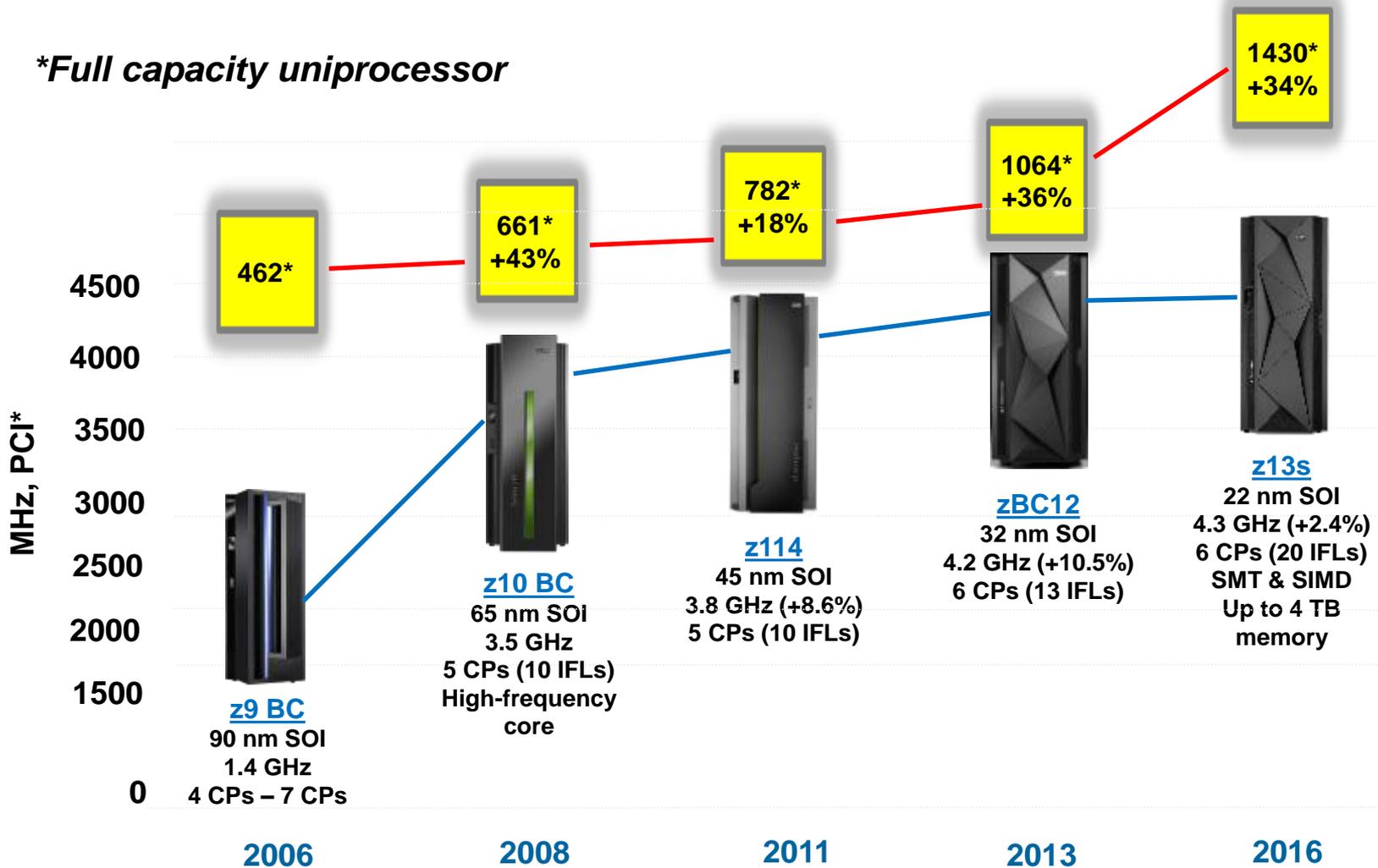


\* MIPS Tables are NOT adequate for making comparisons of z Systems processors. Additional capacity planning is required.

\*\* Number of PU cores for customer use.

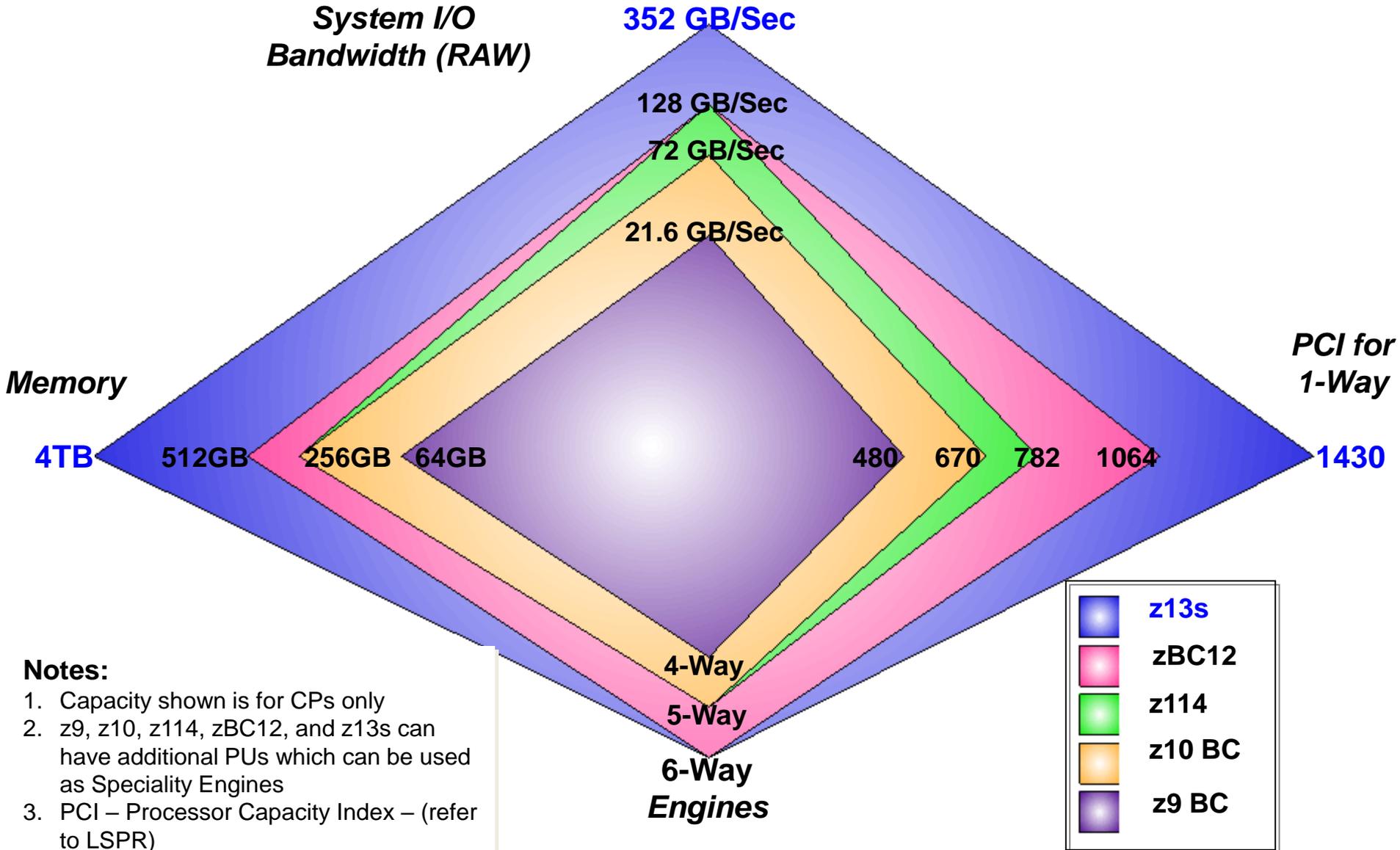
# z13s continues the CMOS Mainframe Heritage

*\*Full capacity uniprocessor*

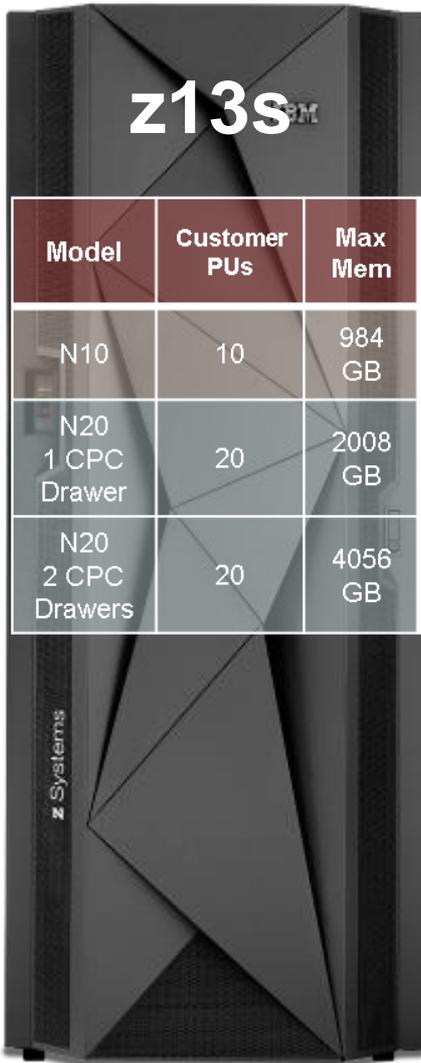


\*NOTE: MIPS Tables are NOT adequate for making comparisons of z Systems processors in proposals

# Advanced System Design Optimized for Digital Business



# z13s at a Glance



Model	Customer PUs	Max Mem
N10	10	984 GB
N20 1 CPC Drawer	20	2008 GB
N20 2 CPC Drawers	20	4056 GB

## ▪Machine Type

–2965

## ▪2 Models

–N10 and N20

- N20 available as one- or two- processor drawer model
- The 2<sup>nd</sup> drawer in the N20 is driven by I/O and/or memory requirements

–Single frame, air cooled

–Non-raised floor option available

–Overhead Cabling and DC Power Options

## ▪Processor Units (PUs)

–13 PU active cores (model N10 – 10 client configurable) or 26 PU active cores (model N20 – 20 client configurable)

–Up to 3 standard SAPs per system (2 for model N10, 3 for model N20)

–2 spares designated for Model N20

–1 Integrated firmware processor (IFP)

–Dependent on the H/W model - up to 10 (N10) or 20 (N20) PU cores available for characterization:

- Central Processors (CPs), Integrated Facility for Linux (IFLs), Internal Coupling Facility (ICFs), IBM z Integrated Information Processor (zIIP), optional - additional System Assist Processors (SAPs), Integrated firmware processor (IFP)

•156 capacity settings

## ▪Memory

–Up to 4 TB including:

- System minimum = 64 GB
- 40 GB fixed HSA separately managed
- RAIM standard
- Maximum for customer use 4056 GB (Model N20-2 drawer)
- Increments of 128 to 1024 GB
- Flash Express Read/Write Cache in HSA (0.5 GB)

## ▪I/O

–PCIe Gen3 channel subsystem

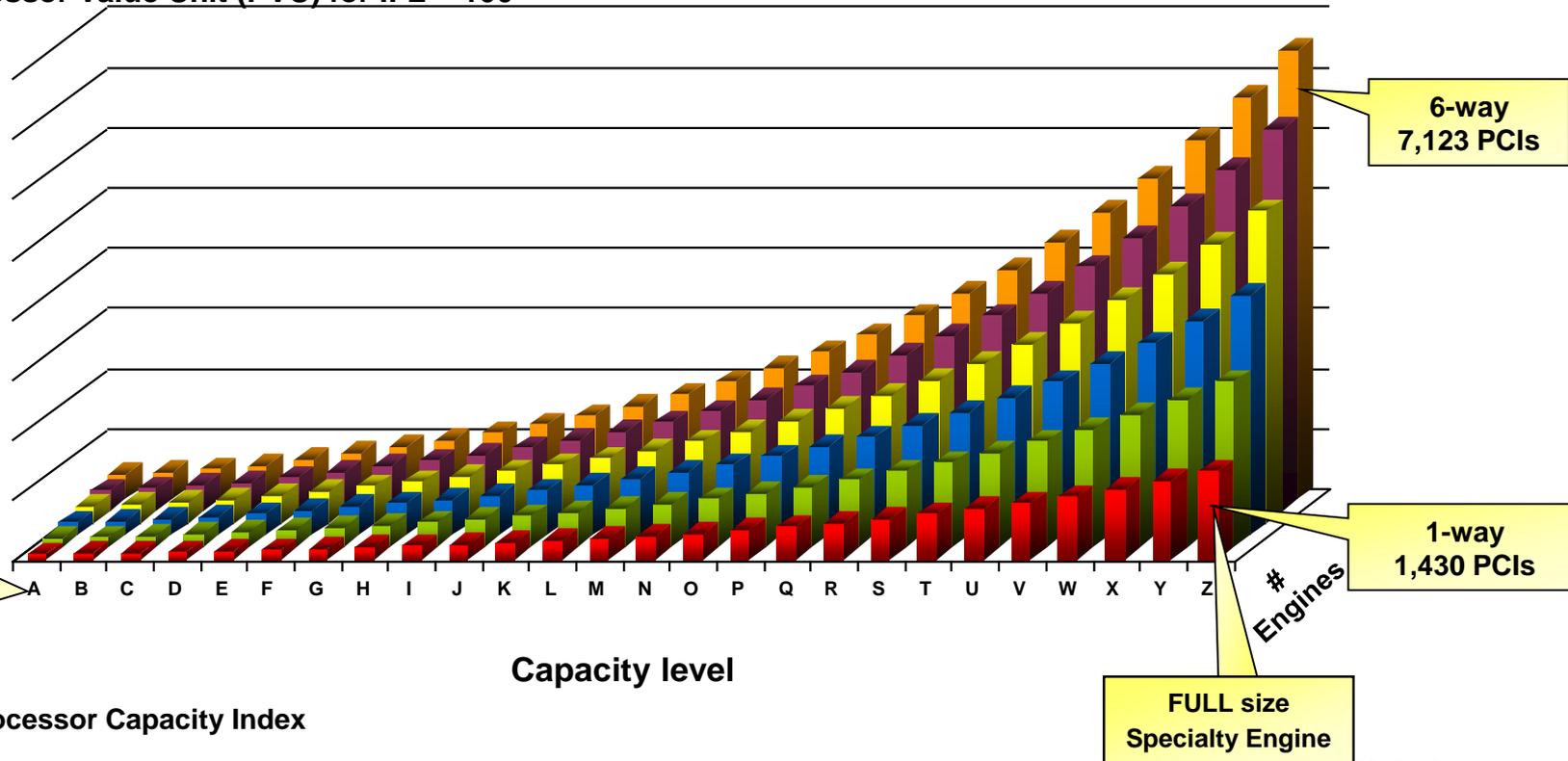
- Up to 64 PCIe Channel features
  - Support for non-PCIe Channel features (max one I/O drawer via carry forward)
- Up to 3 Logical Channel Subsystems (LCSSs)

## ▪STP - optional (No ETR)

# z13s Sub-capacity Processor Granularity

- The z13s has 26 CP capacity levels (26 x 6 = 156)
  - Up to 6 CPs at any capacity level
    - All CPs must be the same capacity level
- zAAPs are not available on z13s
- The ratio of zIIPs for each CP purchased is the same for CPs of any speed.
  - 2:1 zIIP to CP ratio – unchanged from zBC12
  - All specialty engines run at full speed
  - **Processor Value Unit (PVU) for IFL = 100**

Number of z13s CPs	Base Ratio	Ratio zBC12 to z13s
1 CP	zBC12 Z01	1.34
2 CPs	zBC12 Z02	1.38
3 CPs	zBC12 Z03	1.40
4 CPs	zBC12 Z04	1.42
5 CPs	zBC12 Z05	1.43
6 CPs	zBC12 Z06	1.44



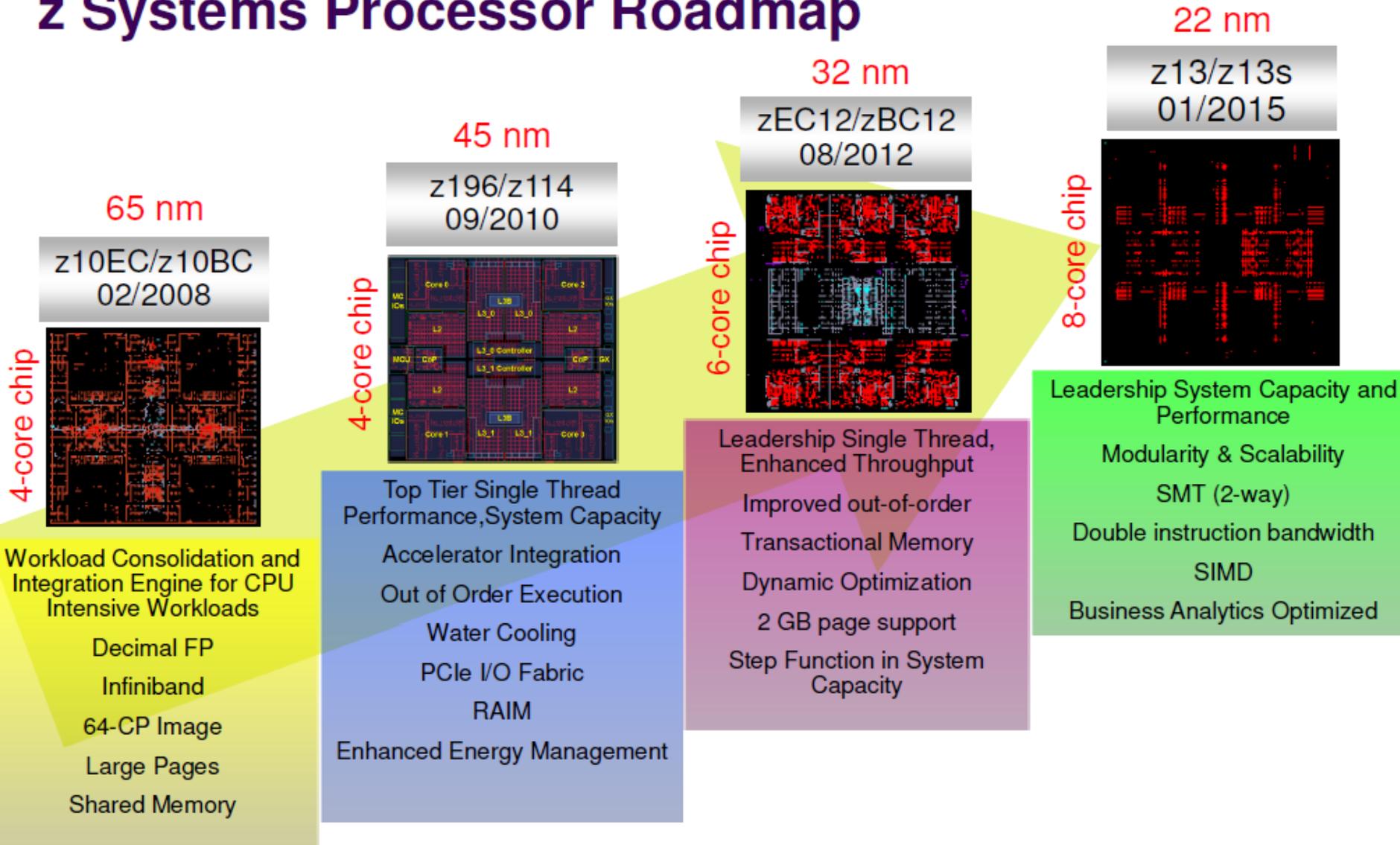
PCI – Processor Capacity Index

## Vergleich z13 / z13s Leistungsdaten

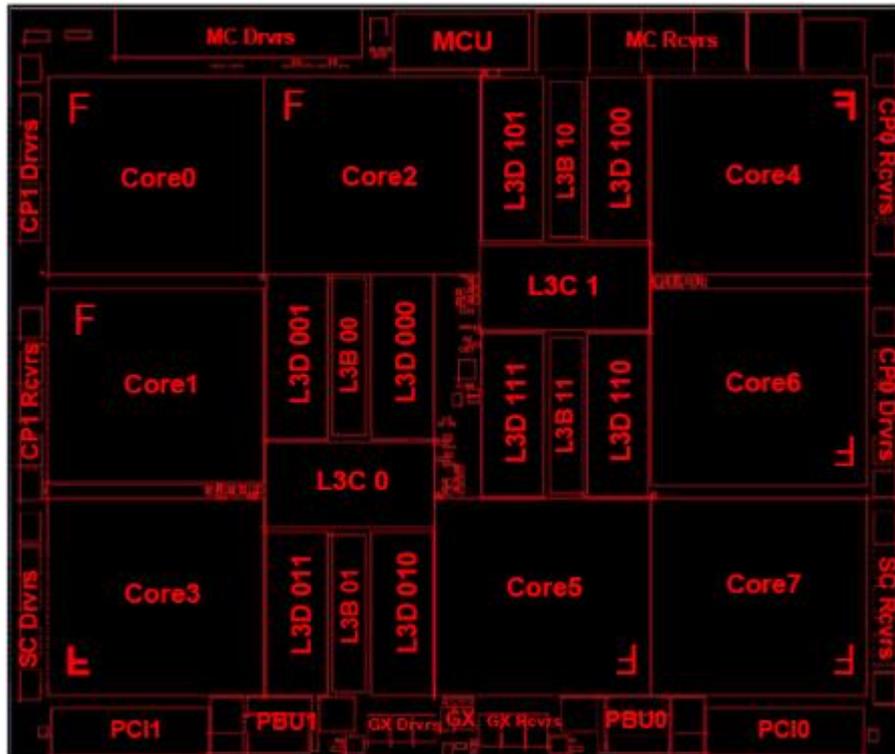
	CP (MIPS) Min	CP (MIPS) Max	MSUs Min	MSUs Max
<b>z13</b>	250	111.556	31	13.078
<b>z13s</b>	80	7.123	10	884
zBC12	50	4.958	6	614
z114	26	3.139	3	388
z10 BC	26	2.749	3	342
z9 BC	26	1.786	4	246



# z Systems Processor Roadmap



## z13s Processor Unit (PU) Chip Details



- **14S0 22nm SOI Technology**
  - 17 layers of metal
  - 3.99 Billion Transistors
  - 13.7 miles of copper wire
- **Chip Area**
  - 678.8 mm<sup>2</sup>
  - 28.4 x 23.9 mm
  - 17,773 power pins
  - 1,603 signal I/Os

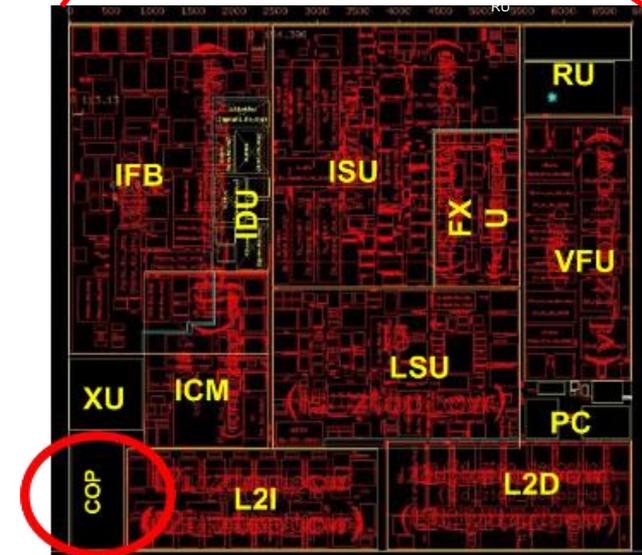
- **6 or 7 active cores (PUs) per chip on z13s (designed with 8 cores total)**
  - 4.3 GHz (vs. 4.2GHz for zBC12)
  - L1 cache/ core
    - 96 KB I-cache
    - 128 KB D-cache
  - L2 cache/ core
    - 2M i+2M d Byte eDRAM split private L2 cache
- **Single Instruction/Multiple Data (SIMD)**
- **Single thread 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

## z13s CPACF

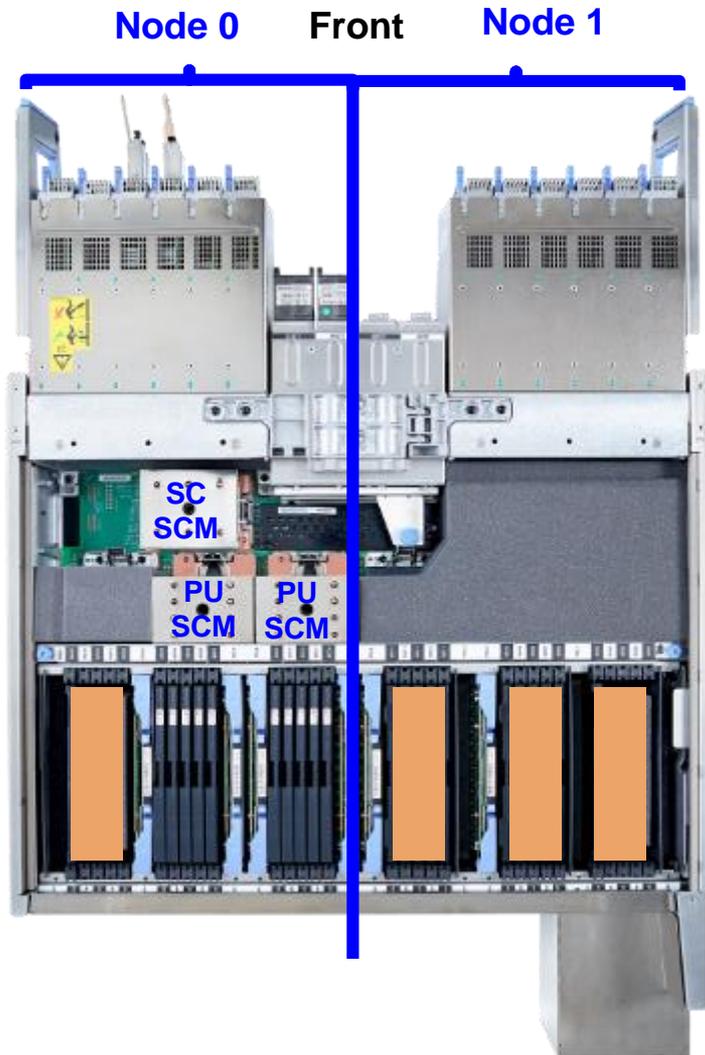
- CP Assist for Cryptographic Function Co-processor redesigned from "ground up" – same as used for z13
- 
- Enhanced performance over zBC12
  - Does not include overhead for COP start/end and cache effects
  - Enhanced performance for large blocks of data
    - AES: 2.5x throughput vs. zBC12
    - TDES: 2.5x throughput vs. zBC12
    - SHA: 3.5x throughput vs. zBC12
- Exploiters of the CPACF which benefit by the throughput improvements:
  - DB2/IMS encryption tool
  - DB2® built in encryption
  - z/OS Communication Server: IPsec/IKE/AT-TLS
  - z/OS System SSL
  - z/OS Network Authentication Service (Kerberos)
  - DFDSS Volume encryption
  - z/OS Java SDK
  - z/OS Encryption Facility
  - z/VM System SSL
  - Linux on z Systems; kernel, openssl, openCryptoki, GSKIT



PU Chip Floorplan

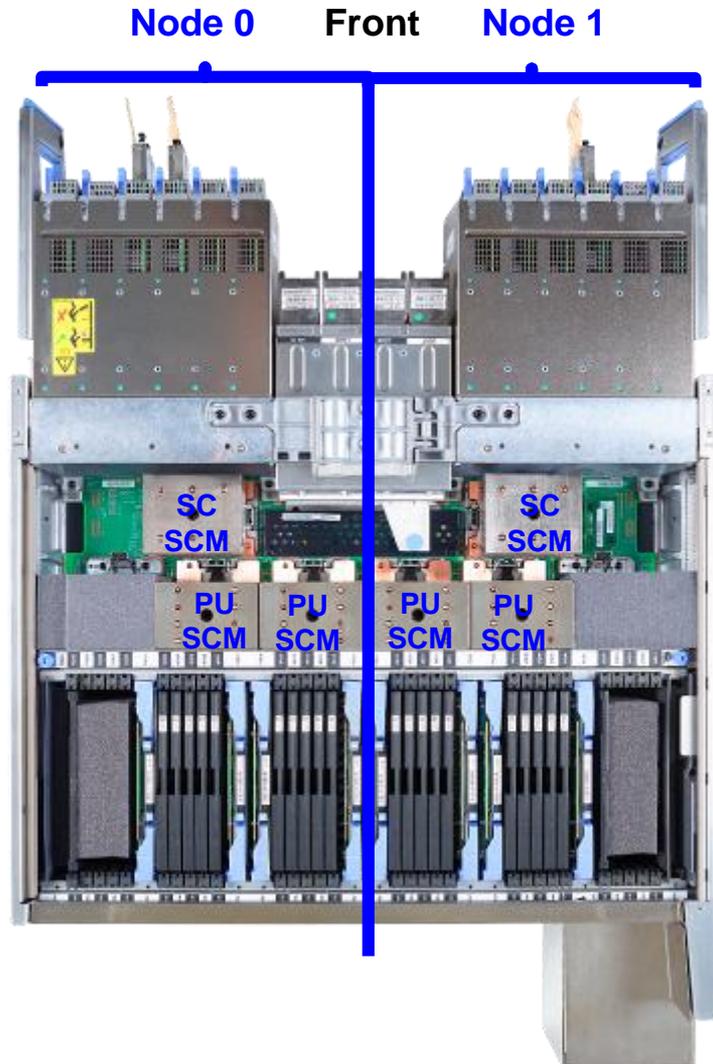


## z13s Model N10 CPC Drawer (Top View)



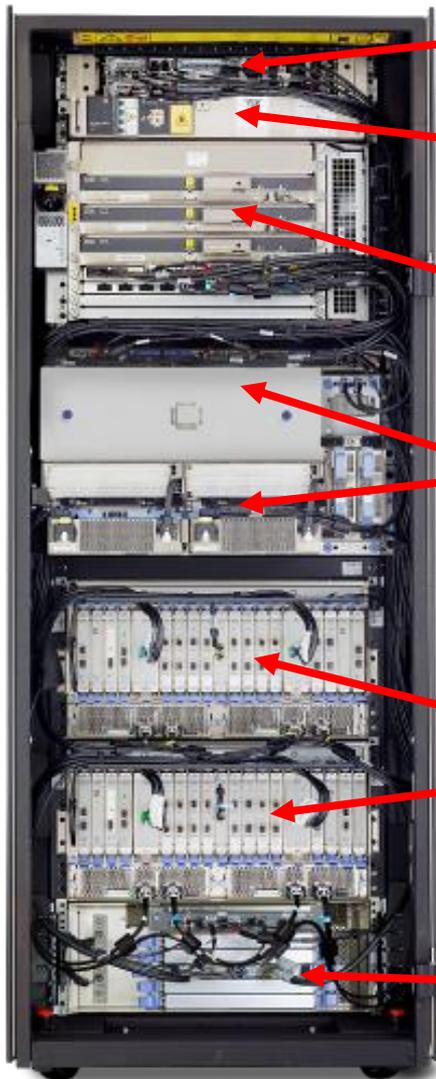
- **Model N10 supports a single Node (Node 0)**
- **Each Node Supports:**
  - One System Control (SC) chip (480 MB L4 cache)
  - Two Processing Units (PU) chips running at 4.3GHz
    - Eight-core per PU chip design
    - Six or seven active cores per PU chip
  - One memory controller per PU chip (two per node)
  - Five DDR3 DIMM slots per memory controller: 10 total per node (up to 1024GB per node)
  - Two Flexible Service Processors
  - Four PCIe fanout slots
  - Two slots for IFB fanouts or PSIFB coupling link fanouts

## z13s Model N20 CPC Drawer (Top View)



- **Model N20 CPC drawer has two nodes: Node 0 and Node 1**
- **Each node:**
  - One System Control (SC) chip (480 MB L4 cache)
  - Two Processing Units (PU) chips running at 4.3GHz
    - Eight-core per PU chip design
    - Up to seven active cores per PU chip
  - One memory controller per PU chip (two per node)
  - Five DDR3 DIMM slots per memory controller: 10 total per node (up to 1024GB per node)
  - Two Flexible Service Processors
  - Four PCIe fanout slots
  - Two slots for IFB fanouts or PSIFB coupling link fanouts

## z13s Model N20 (One CPC Drawer) – Under the Covers



Rear View

Support Elements

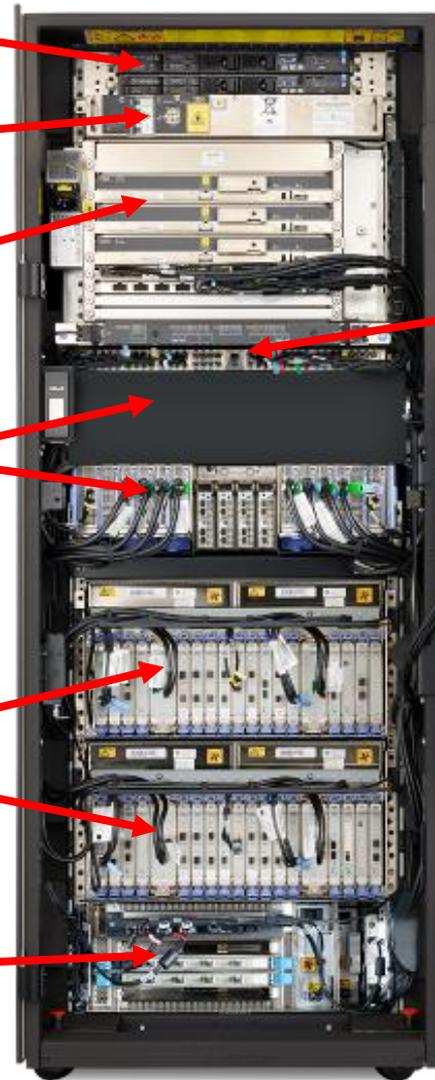
Internal Batteries (optional)

Power Supplies

1 x CPC Drawer + slot for 2<sup>nd</sup> CPC Drawer  
Memory & Fanouts

PCIe I/O Drawers

I/O Drawer



Front View

Ethernet cables for internal System LAN connecting Flexible Service Processor (FSP) cage controller cards (not shown)

SCH (x2)

Monitors + keyboards for SEs

Note: A 2 CPC drawer N20 can only support a maximum of 2 PCIe I/O Drawers OR one PCIe I/O Drawer and one I/O Drawer

## z13s Processor Unit Allocation and Usage (2:1 zIIP to CP ratio)

Model*	Drawers /PUs	CPs	IFLs uIFLs	zIIPs	ICFs	Std SAPs	Optional SAPs	Std. Spares	IFP
N10	1/13	0-6	0-10	0-6	0-10	2	0-2	0	1
N20	1/26	0-6	0-20	0-12	0-20	3	0-3	2	1
N20	2/26	0-6	0-20	0-12	0-20	3	0-3	2	1

\* See speaker notes

z13s N20 model is a one- or two- drawer system with same processor feature counts for both configurations.

N20 - second drawer is added when additional fanouts or more than 2TB memory are needed;

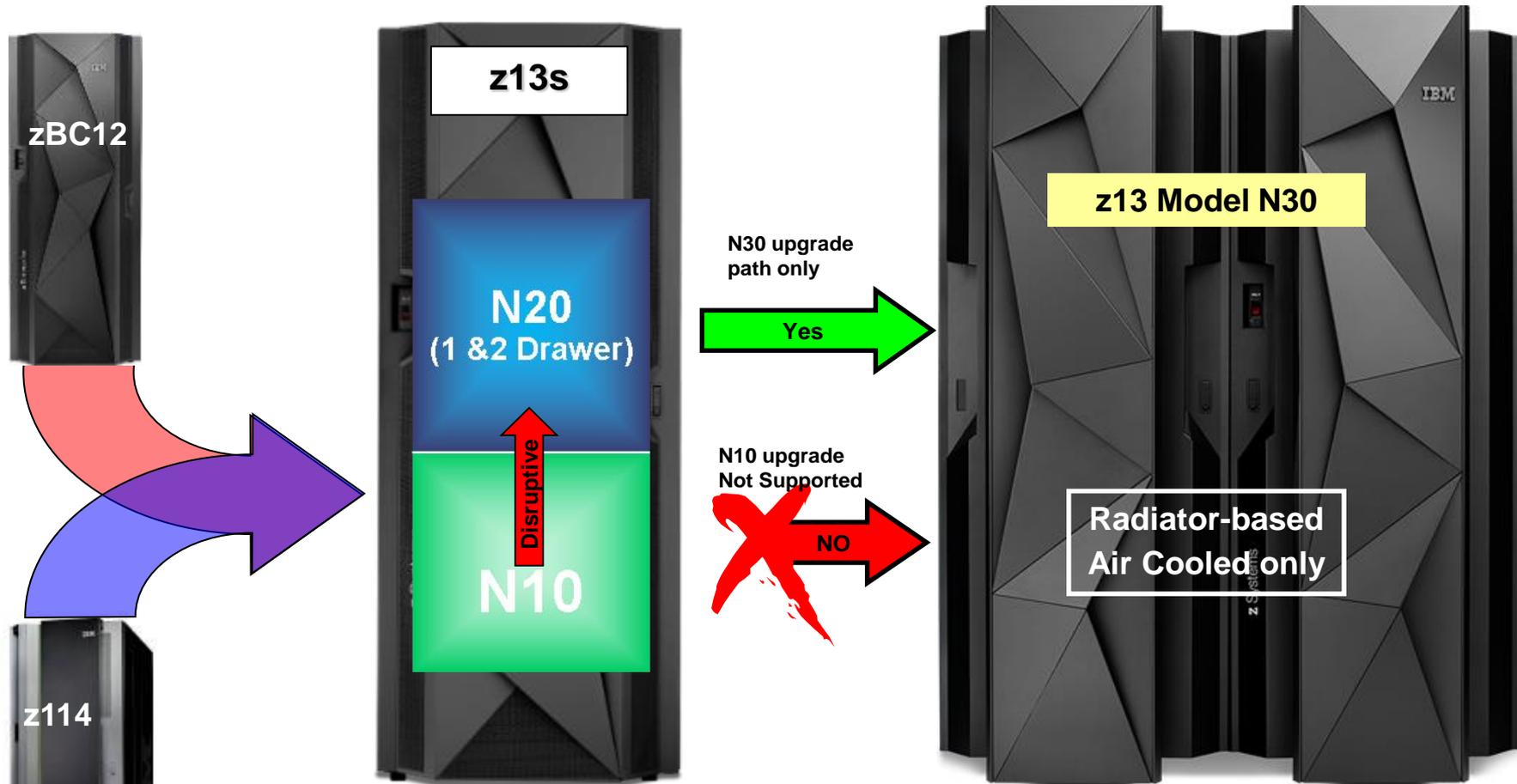
The maximum number of logical ICFs or logical CPs supported in a CF logical partition is 16

The integrated firmware processor (IFP) is used for native PCIe I/O support functions

Upgrades from N10 to N20 and N20(1) to N20(2) are disruptive

SMT is supported with processor type IFL, zIIP.

# z13s Upgrade Paths



- Upgrade paths from z114 and zBC12 (Frame Roll)
- Upgrade path to z13 Model N30 (Radiator-based Air cooled only)
- Disruptive upgrade N10 to N20 and from N20 to z13 N30
- Disruptive Upgrade N20 (1 drawer) to N20 (2 drawer)

## LinuxONE Processor Unit Allocation and Usage

Model	Drawer /PUs	CPs	IFLs uIFLS	zIIPs	ICFs	Std SAPs	Optional SAPs	Std Spares	IFP
L10	1/13	0	1-10	0	0	2	0-2	0	1
L20	1/26	0	1-20	0	0	3	0-3	2	1
L20	2/26	0	1-20	0	0	3	0-3	2	1

LinuxONE L20 model is a one- or two- drawer system with same processor feature counts for both configurations.

L20 - second drawer is added when additional fanouts or more than 2TB memory are needed;

The integrated firmware processor (IFP) is used for native PCIe I/O support functions

Upgrades from L10 to L20 and L20(1) to L20(2) are disruptive

SMT is supported with the processor type IFL.

# Protecting your investment in technology – Mid Range systems

## • Upgrades (Serial number preserved) allowed

- From z114 and zBC12 to the z13s
- From LinuxONE Rockhopper (2828) to the zBC12
- From LinuxONE Rockhopper (2965) to the z13s

## • Migration Offerings allowed

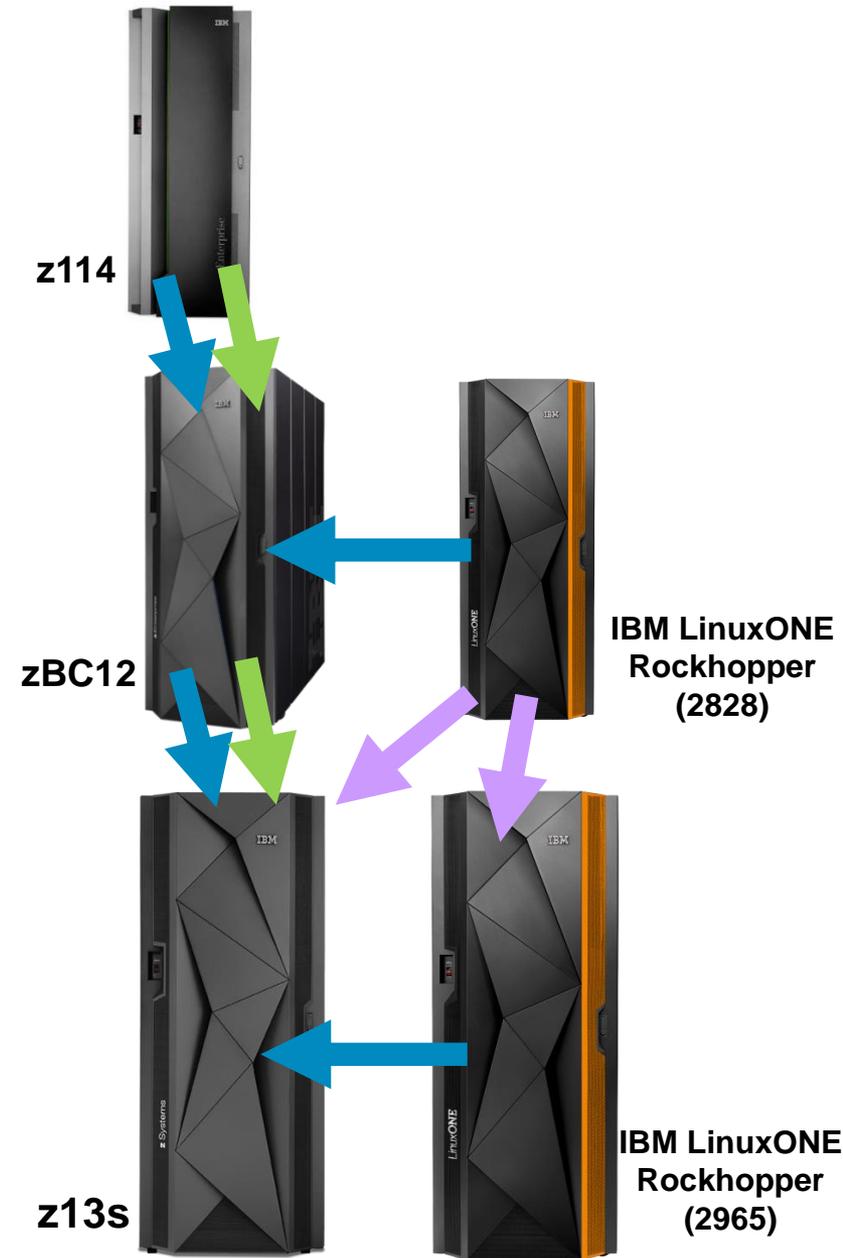
- From z114 and zBC12 to the z13s

## • Net New with trade-in<sup>1</sup>

- From LinuxONE Rockhopper (2828) to the LinuxONE Rockhopper (2965)
- From LinuxONE Rockhopper (2828) to the z13s

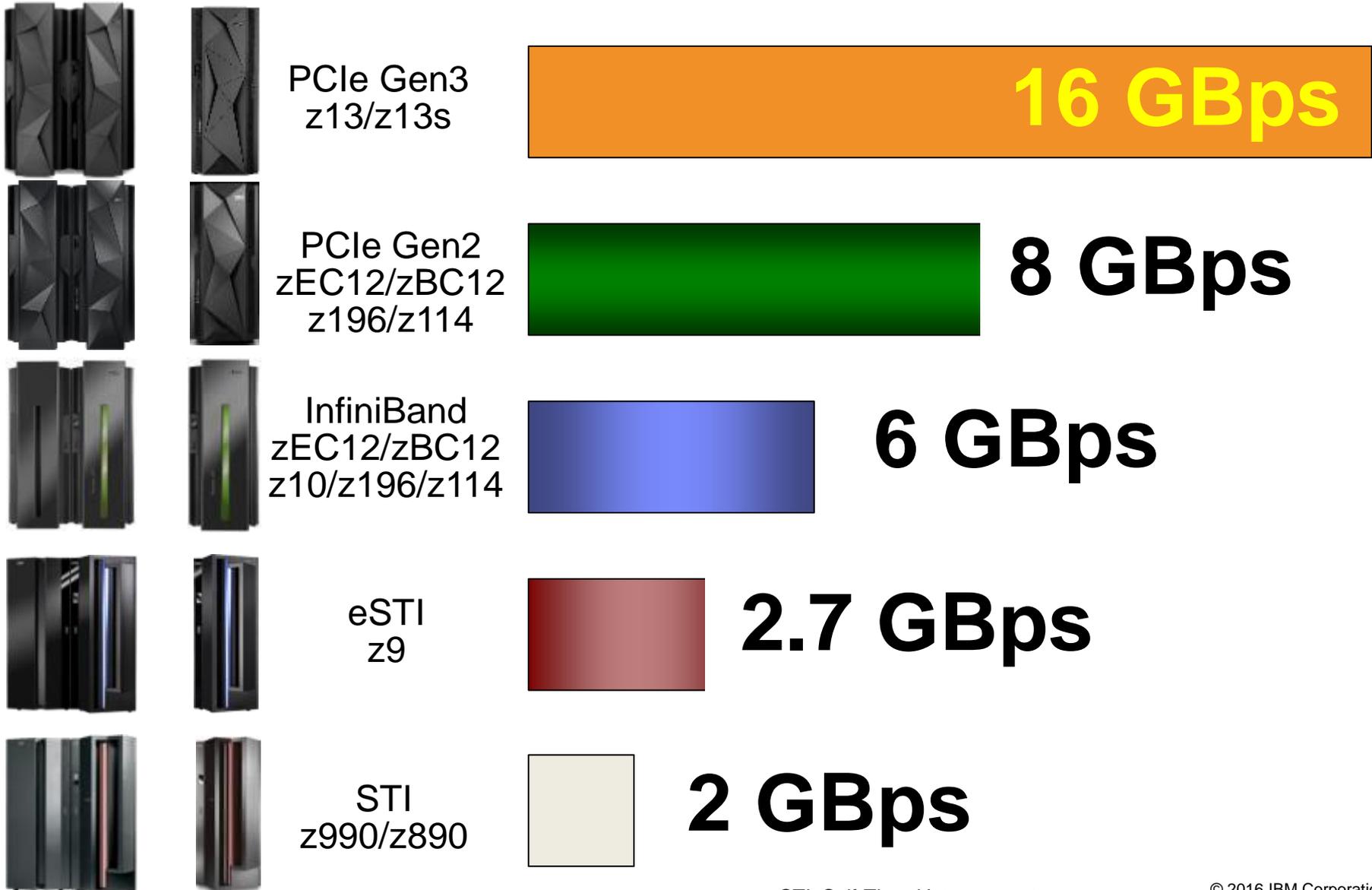
## • Technology Exchange/Hybrids not supported

- **Elastic pricing available for LinuxONE Rockhopper (2828 & 2965)**
  - Clients can pay for what they use and cancel after one year with no capital depreciation impact
- **On demand offerings offer temporary or permanent growth when you need and are available for both z Systems and LinuxONE**



<sup>1</sup>IBM's intent is to deliver its LinuxONE server client's with a level of investment protection that simply recognizes a trade-in value for a client's existing LinuxONE Emperor or LinuxONE Rockhopper that can be applied towards the purchase of a new Emperor or Rockhopper. The trade-in option, where needed, will be special bid based on affordability and is not guaranteed.

## z Systems I/O Subsystem Internal Bus Interconnect Speeds



# z13s “New Build” I/O and MES Features Supported

## New Build Features

### ▪ Features – PCIe I/O drawer

FICON Express16S (SX and LX, 2 SFPs, 2 CHPIDs)

FICON Express8S (SX and LX, 2 SFPs, 2 CHPIDs)

OSA-Express5S

10 GbE LR and SR (1 SFP, 1 CHPID)

GbE SX, LX, and 1000BASE-T (2 SFPs, 1 CHPID)

10 GbE RoCE Express (2 supported SR ports)

zEDC Express

Crypto Express5S

Flash Express (Technology Refresh)

PCIe I/O drawer



32 I/O slots

### ▪ Integrated Coupling Adapter (ICA) Fanout

ICA SR two 8 GBps PCIe Gen3 Coupling Link

### ▪ InfiniBand Coupling Feature Fanouts

HCA3-O two 12x 6GBps InfiniBand DDR Coupling Links

HCA3-O LR four 1x 5Gbps InfiniBand DDR or SDR Coupling Links

Note: The link data rates do not represent the actual performance of the link. The actual performance is dependent upon many factors including latency through the adapters, cable lengths, and the type of workload.

## z13s “Carry Forward” I/O Features Supported

### Carry Forward Features

#### ▪ Features – PCIe I/O drawer

FICON Express8S (SX and LX, 2 SFPs, 2 CHPIDs)

OSA-Express5S (All)

OSA-Express4S (All)

10 GbE RoCE Express (Both ports supported on z13s)

zEDC Express

Flash Express

Not Supported: Crypto Express4S

PCIe I/O drawer 32 I/O slots



#### ▪ Features – I/O drawer (No MES adds)

FICON Express8 (SX and LX, 4 SFPs, 4 CHPIDs)

Maximum of One 8 Slot I/O Drawer

Not Supported: ESCON, FICON Express4, OSA-Express3,  
ISC-3, Crypto Express3,

I/O drawer 8 I/O slots



#### ▪ InfiniBand Coupling Features (Fanouts)

HCA3-O two 12x 6GBps InfiniBand DDR Coupling Links

HCA3-O LR four 1x 5Gbps InfiniBand DDR or SDR Coupling Links

NOT Supported: HCA2-O 12x, HCA2-O LR 1x InfiniBand Coupling Links

**Note:** The link data rates do not represent the actual performance of the link. The actual performance is dependent upon many factors including latency through the adapters, cable lengths, and the type of workload.

# FICON Express16S – SX and 10KM

For FICON, zHPF, and FCP environments

CHPID types: FC and FCP

Two PCHIDs/CHPIDs

Auto-negotiates to 4, 8, or 16 Gbps

2Gbps connectivity NOT supported

FICON Express8S will be available

to order for 2Gbps connectivity

Increased I/O Devices (subchannels) per channel for all FICON features:

TYPE=FC: Increased from 24k to 32k to support more base and alias devices

Increased bandwidth compared to FICON Express8S

10KM LX - 9 micron single mode fiber

Unrepeated distance - 10 kilometers (6.2 miles)

Receiving device must also be LX

SX - 50 or 62.5 micron multimode fiber

Distance variable with link data rate and fiber type

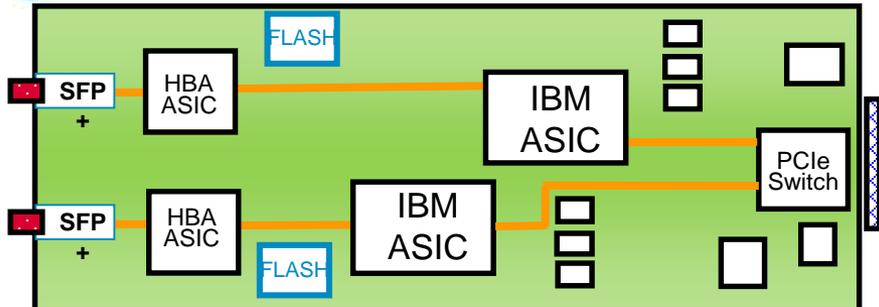
Receiving device must also be SX

Two channels of LX or SX (no mix)

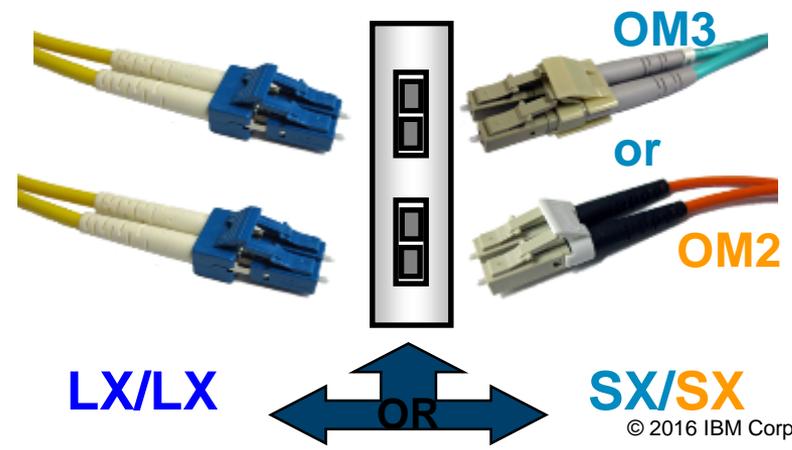
Small form factor pluggable (SFP) optics

Concurrent repair/replace action for each SFP

4, 8, 16 Gbps



FC 0409 – 10KM LX, FC 0410 – SX





# IBM z Systems Single Frame Comparison

	z114 M05	z114 M10	zBC12 H06	zBC12 H13	z13s N10	z13s N20 <sup>(1)</sup>
Uniprocessor Performance	782 MIPS		1064 MIPS		1430 MIPS (+34%)	
Frequency	3.8 GHz		4.2 GHz		4.3 GHz	
z/OS Capacity	26 - 3139 MIPS		50 - 4958 MIPS		80 to 7123 MIPS	
Total System Memory	120 GB	248 GB	240 GB	496 GB	1TB	4TB
Configurable Specialty Engines	5	10	6	13	10	20
Configurable CPs	0-5		0 - 6		0 to 6	
LPARS/LCSS	30/2		30/2		40/3	
HiperSockets	32		32		32	
PCIe I/O drawer, I/O drawer, Max	2, 2, 3	2, 2, 3	2, 1, 3	2, 1, 3	1, 1, 2 <sup>(2)</sup>	2, 1, 3 <sup>(2)</sup>
I/O slots per I/O drawers/ PCIe I/O drawers	8/32		8/32		8/32	
FICON® Channels	128		128		64 <sup>(3)</sup>	128 <sup>(3)</sup>
OSA Ports	96		96		64 <sup>(3)</sup>	96 <sup>(3)</sup>
ESCON® Channels	240		0 <sup>(4)</sup>		0 <sup>(4)</sup>	
IFB host bus Bandwidth, PCIe Bandwidth	6.0 GB/sec (IFB), 8.0 GB/sec (PCIe Gen2)		6.0 GB/sec (IFB), 8.0 GB/sec (PCIe Gen2)		6.0GB/sec(IFB), 16.0 GB/sec (PCIe Gen3)	
ISC-3, PSIFB, PCIe	48, 8 -16, 0	48, 16 - 32, 0	32, 8 -16 0	32, 16- 32 0	0 <sup>(5)</sup> , 4-8 <sup>(6)</sup> , 8	0 <sup>(5)</sup> , 16-32 <sup>(7)</sup> , 16
zIIP/zAAP Maximum Qty	2	5	Up to 4 / 3	Up to 8 / 6	Up to 6 <sup>(8)</sup> / 0	Up to 12 <sup>(8)</sup> / 0
IFL Maximum Qty	5 (3139 MIPS)	10 (5390 MIPS)	6 (4958 MIPS)	13 (8733 MIPS)	10 (10767 MIPS)	20 (18335 MIPS)
ICF Maximum Qty	5	10	6	13	10	20
Capacity Settings	130	130	156	156	156	156
Upgradeable	M05 to M10, to zBC12 or to z13s		H06 to H13, H13 to zEC12 H20 (Radiator-based air cooled only) or to z13s		Within z13s (N10 to N20), N20 to z13 N30 (Radiator-based /air cooled only)	

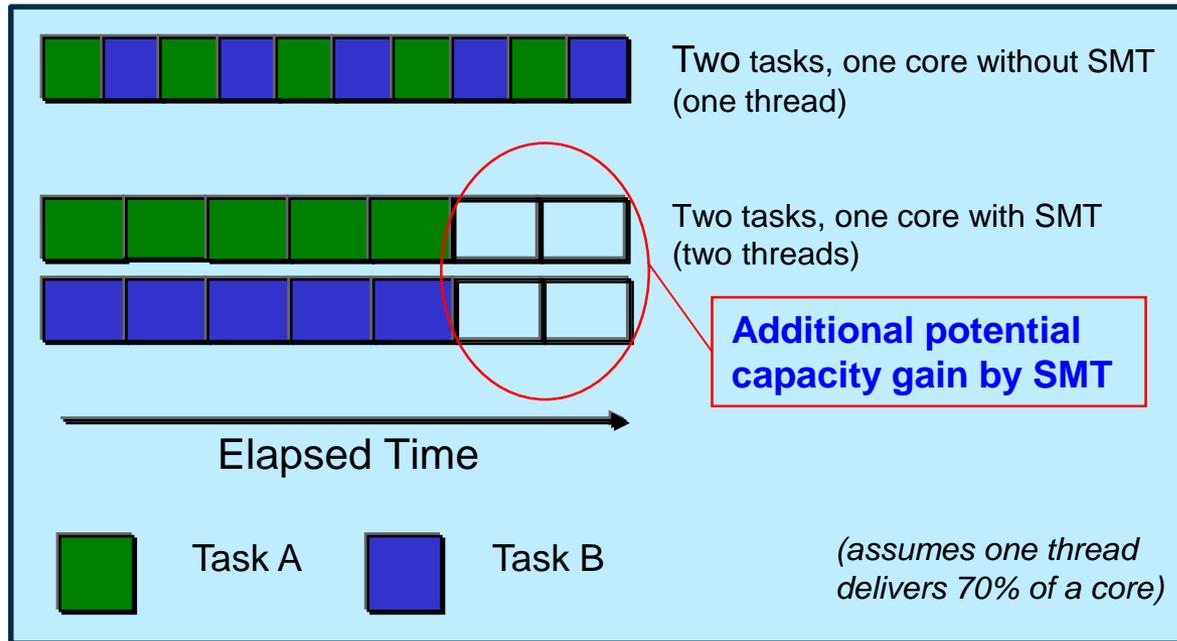


(\* )See next page for Notes

## What is Simultaneous Multithreading (SMT)?

- Prior generations' z Systems CPUs support a single instruction stream
  - z Systems workloads tend to receive a nontrivial number of cache misses
  - CPU generally unproductive while resolving cache miss
- z13/z13s SMT makes PU Core productive during cache misses and fills other pipeline gaps
  - z13/z13s supports two way SMT (two instruction streams [threads]) per core
    - Each thread has its own unique state information (Registers, PSW, etc.)
    - Cannot necessarily execute instructions instantly and must compete and win the use of desired core resources shared between threads
    - z13/z13s insures that one thread can't lock out the other
  - Current z13/z13s implementation allows following engine types to run in SMT mode
    - zIIPs under z/OS
    - IFLs under z/VM
- READY TO RUN Threads share core
  - Threads NOT READY TO RUN still unproductive while resolving cache miss
  - Core resources are productive when either READY TO RUN thread is executing

## SMT Value Example



### Driver:

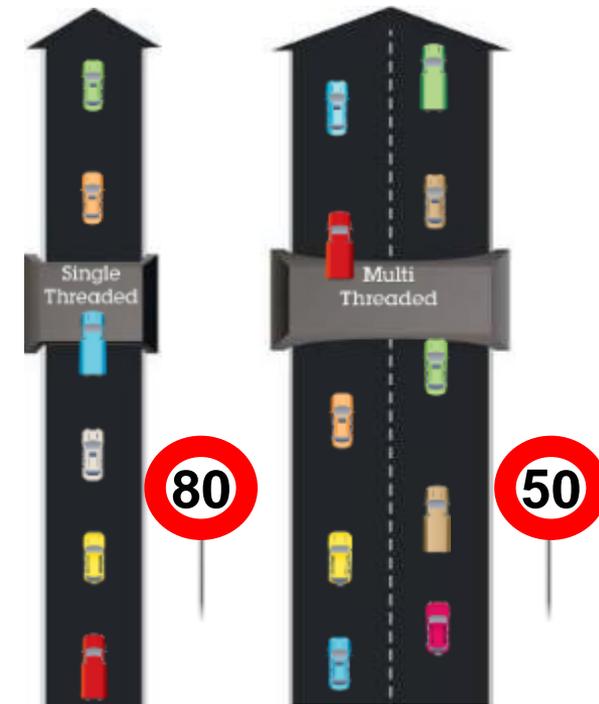
**The cloud** compute capacity required to serve dynamic workloads for hypervisors, operating systems, and applications.

**SMT on z13s** provides significant throughput improvement with real-time measurements and repeatable metrics for capacity.

## Simultaneous Multithreading (SMT) on z13s

- SMT support one or two threads to execute on a zIIP or IFL.
- Capacity improvement is variable depending on workload. For AVERAGE workloads the estimated capacity of a z13s zIIP/IFL with exploitation of the SMT option is:
  - A z13s zIIP is up to **68%** greater than a zBC12 zIIP
  - A z13s IFL is up to **61%** greater than a zBC12 IFL
  - A z13s zIIP is up to **129%** greater than a z114 zIIP
  - A z13s IFL is up to **119%** greater than a z114 IFL
- SMT exploitation:
  - z/VM V6.3 + PTFs, or z/VM 6.4 for IFLs ([GA 4Q2016](#))
  - z/OS V2.1 + PTFs, or z/OS V2.2 in an LPAR for zIIPs
  - KVM for IBM z V1.1.1 ([3/2016](#))
  - For recommended Linux distribution levels refer to: <http://www.ibm.com/systems/z/os/linux/resources/testedplatforms.html>
- The use of SMT mode can be enabled on an LPAR by LPAR basis via operating system parameters.
  - When enabled, z/OS can transition dynamically between MT-1 and MT-2 (multi thread) modes with operator commands.
- Notes: 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.

(\* ) 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 .



*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*

# 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

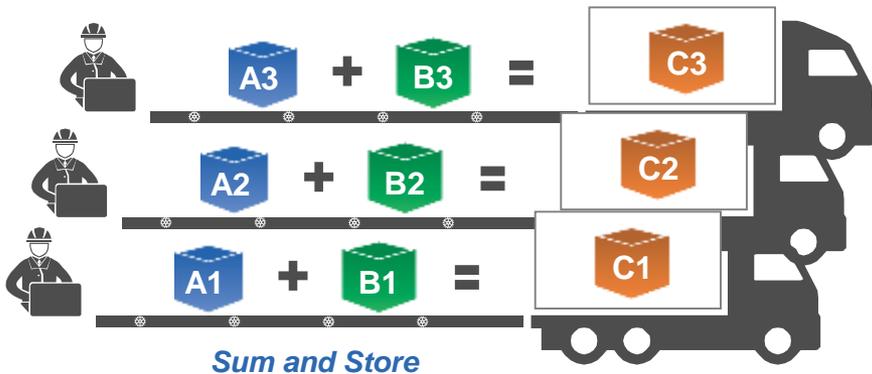


### Value

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

### Scalar

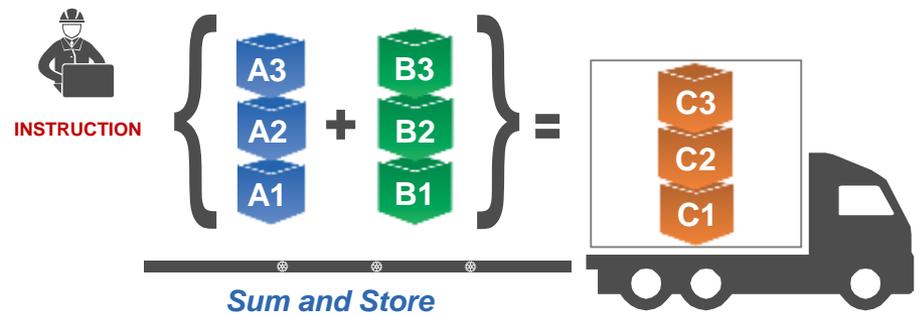
SINGLE INSTRUCTION, SINGLE DATA



Instruction is performed for every data element

### SIMD

SINGLE INSTRUCTION, MULTIPLE DATA



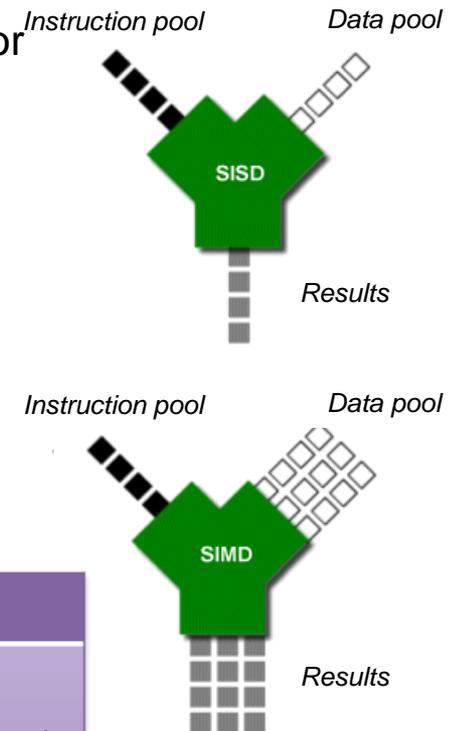
Perform instructions on every element at once

# SIMD Vector Processing Support on z Systems

## OS/Hypervisor & Software Support for SIMD:

- z/OS V2.2, or z/OS: 2.1 + PTFs
- Linux: IBM is working with its Linux Distribution partners to support new functions/features
- z/VM V6.3 SIMD support will be delivered in 1Q2016 via PTFs for APAR VM65733; z/VM 6.4 (4Q2016)
- KVM for IBM z **V1.1.1 enables guests to exploit SIMD** (1Q2016)
- Compiler exploitation
  - IBM Java 8
  - z/OS XL C/C++ V2R1M1, V2.2 (added AUTOSIMD option)
  - XL C/C++ for Linux on z Systems, V1.1
  - Enterprise COBOL for z/OS v5.2
  - Enterprise PL/I for z/OS v4.5

**Increase throughput  
with IBM CPLEX  
Optimizer V12.6.1**



Workloads		
Java 8	C/C++ Compiler built-ins for SIMD operations (z/OS and Linux on z Systems)	MASS & ATLAS Math Libraries (z/OS and Linux on z Systems)
SIMD Registers and Instruction Set		

MASS - Mathematical Acceleration Sub-System / ATLAS - Automatically Tuned Linear Algebra Software

## z/VM Release Status Summary (as of February 2016)



z/VM Level	GA	End of Service	End of Marktg.	Minimum Processor Level	Maximum Processor Level	Security Level
6.4	Q4/2016 <sup>[4]</sup>			IBM System z114, z196		
6.3	7/2013	12/2017 <sup>[3]</sup>		IBM System z10 <sup>®</sup>	-	EAL 4+ OSPP-LS
6.2	12/2011	6/2017 <sup>[2]</sup>	7/2013	IBM System z10 <sup>®</sup>	z13(s) <sup>[4]</sup>	-
6.1	10/2009	4/2013	12/2011	IBM System z10 <sup>®</sup>	zEC12	EAL 4+ OSPP-LS
5.4	9/2008	12/2016 <sup>[1]</sup>	3/2012	IBM eServer zSeries 800& 900	zEC12	-
5.3	6/2007	9/2010	9/2010	z800, z900	z196	EAL 4+ CAPP/LSPP

[1] Or later until z9 EOS (Announced August 6, 2014)

[2] Extended from original date (Announced revised February 2, 2016)

[3] Announced February 3, 2015

[4] Preview announced February 16, 2016

Marketed & Serviced

Serviced, but not Marketed

End of Service & Marketing

EAL - Evaluation Assistance Level

## Supported Linux on z Systems Distributions

Distribution	LinuxONE Emperor	LinuxONE Rockhopper			
	z13	z13s	zEnterprise - zBC12 and zEC12	zEnterprise - z114 and z196	System z10 and System z9
RHEL 7	✓ (1)	✓ (1)	✓ (3)	✓ (3)	✗
RHEL 6	✓ (1)	✓ (1)	✓ (4)	✓	✓
RHEL 5	✓ (1)	✗ (10)	✓ (5)	✓	✓
RHEL 4 (*)	✗	✗	✗	✓ (8)	✓
SLES 12	✓ (2)	✓ (2)	✓	✓	✗
SLES 11	✓ (2)	✓ (2)	✓ (6)	✓	✓
SLES 10 (*)	✗	✗	✓ (7)	✓	✓
SLES 9 (*)	✗	✗	✗	✓ (9)	✓
Ubuntu 16.04	✓	✓	✓	✗	✗



Indicates that the distribution (version) has been tested by IBM on the hardware platform, will run on the system, and is an IBM supported environment. Updates or service packs applied to the distribution are also supported. Please check with your service provider which kernel-levels are currently in support.

See [www.ibm.com/systems/z/os/linux/resources/testedplatforms.html](http://www.ibm.com/systems/z/os/linux/resources/testedplatforms.html) for latest updates and details.

## z/VSE hardware support status, ALS to IBM System z10

**z/VSE V5.2 will be the last release that supports IBM System z9. Future releases of z/VSE will support IBM System z10 and higher.**

- Remember:

- z/VM V6 requires System z10 and higher
- z/VM V6.4 requires zEnterprise 196 and higher
- SLES 12 and RHEL 7 require zEnterprise 196 and higher
- Ubuntu 16.04 requires zEC12 and higher

IBM z Systems	z/VSE	z/VSE	z/VSE	z/VSE
	V6.1	V5.2	V5.1	V4.3 (EoS)
IBM z13 & z13s	✓	✓	✓	✓
IBM zEnterprise EC12 & BC12	✓	✓	✓	✓
IBM zEnterprise 196 & 114	✓	✓	✓	✓
IBM System z10 EC & z10 BC	✓	✓	✓	✓
IBM System z9 EC & z9 BC	✗	✓	✓	✓
IBM eServer zSeries 990 & 890	✗	✗	✗	✓
IBM eServer zSeries 900 & 800	✗	✗	✗	✓

**Note:** IBM's statements regarding its plans, directions, and intent are subject to change or withdrawal without notice at IBM's sole discretion. Information regarding potential future products is intended to outline our general product direction and it should not be relied on in making a purchasing decision. The information mentioned regarding potential future products is not a commitment, promise, or legal obligation to deliver any material, code, or functionality. Information about potential future products may not be incorporated into any contract. The development, release, and timing of any future features or functionality described for our products remains at our sole discretion.

## z/VSE Linux Growth Offering

- **Objective:** Provide z/VSE customers to extent the z/VSE with Linux for z Systems for new workloads such as **C**loud, **A**nalytics, **M**obile, **S**ecurity, etc.
  - For z/VSE customers acquiring a z13s F01 / A02 or larger and z/VSE V5 or V6, the customer can receive all of the following components with the z13s and z/VSE V5 or V6 at the same price as the z13s and z/VSE V5 or V6:
    - one IFL\*
    - incremental up to 32 GB memory (incremental to memory ordered for the z13s)
    - z/VM Option
      - z/VM V6 (base and features) for the IFL (up to 10 Value Units)
      - IBM Wave\*\* for the IFL (up to 10 Value Units)
      - z/VM S&S and IBM Wave S&S for the IFL for 3 years
    - KVM Option
      - KVM for IBM z for 1 IFL
      - KVM for IBM z S&S for 1 IFL
  - **Requirements:**
    - Applicable to z13s F01 / A02 (150 Mips) or larger
    - All components must be ordered at the same time
    - z/VSE V5 or V6 must be licensed at the same time as the server purchase (or earlier)
- \* Maintenance is not included in this offering
- \*\* Instead of Wave ordering of Infrastructure Suite for z/VM and Linux (5698-IS2) is possible (additional charges)

## IBM zEnterprise BC12 wird vom Markt genommen



### Was bedeutet das für eine IBM zBC12 in Deutschland?

Bis einschließlich **29. Juni 2016**

können noch IBM zBC12-Modelle / **Upgrades von IBM z10 BC / z114** bei der IBM **bestellt werden.**

Bis **21.07.2016** müssen alle neuen zBC12 **geliefert** sein.

Ab **30.06.2016** ist das nicht mehr möglich!

Bis einschließlich **30. Dezember 2016** sind **noch physische**

**HW-Erweiterungen** an bestehenden zBC12s wie OSA-/ FICON-Karten, zusätzl. Memory, etc. **möglich.**

Ab **31.12.2016** sind **KEINE physischen HW-Erweiterungen** mehr möglich!

## IBM zEnterprise BC12 wird vom Markt genommen

### Was bedeutet das für $\mu$ Code-Änderungen?

**LIC-Änderungen sind noch 1 Jahr länger möglich!**

Bis einschließlich **30. Dezember 2017**

können noch LIC-Änderungen ( **$\mu$ Code-Änderungen**) auf der zBC12 **durchgeführt werden:**

- installierten Hauptspeicher aktivieren
- Prozessoren und –kapazitäten ändern (CP, IFL,...)
- Capacity on Demand (CoD)-Features / Records bestellen

Ab **31.12. 2017** sind auch **KEINE  $\mu$ Code-Änderungen mehr möglich!**

Speziell für **Capacity on Demand (CoD)-Features** gelten die Fristen auf der nächsten Seite.

LIC : machine's Licensed Internal Code



## IBM zEnterprise BC12 wird vom Markt genommen



### Fristen für CoD-Feature/Records bei einer IBM zBC12:

Alle CoD-Records können **letztmalig am 30.12. 2017** bestellt werden.

Bestellte Records müssen innerhalb **90 Tage runtergeladen** werden, d.h. spätestens am **30.03. 2018**, sonst verfallen sie.

Postpaid On/Off CoD-Records haben eine Laufzeit von 180 Tagen

- durch „*Option auto renewal*“ automatische Verlängerung letztmalig am **30.12.2017**
- d.h. Postpaid OOCOD kann noch bis **28.06.2018** genutzt werden

Prepaid On/Off CoD-Records haben kein „Expiration Date“ und sind bis zum Verbrauch gültig

Kostenpflichtige Feature für CBU (Capacity BackUp), können bis zur Ihrem „Expiration Date“ genutzt werden

Details im Resource Link

<https://www-304.ibm.com/servers/resourcelink/hom03010.nsf/pages/archivedNews?OpenDocument>

# Agenda

- IBM z13s – Hardware - Betriebssysteme
- • Hypervisor / Virtualisierung für z Systeme
- IBM Dynamic Partition Manager
- z Appliance Container Infrastructure (zACI)
- IBM z Systems und Speicher Synergie



## Hypervisors and Virtualization for z Systems

### PR/SM-LPARs



- **Virtualization capabilities built into the system**
- PR/SM manages and virtualizes all the installed and enabled system resources as a single large SMP system
- **Full sharing of the installed resources** with high efficiency and very low overhead
- **High scalability** with support for up to 40 (for z13s) or 85 (for z13) logical partitions
- IBM Dynamic Partition Manager **simplifies management experience**
- Ensured **workload separation** based on highest EAL5+ security certification

### z/VM v6.4 (preview)



- **Enables extreme scalability, security and efficiency** creating cost savings opportunities
- **Ease Migration** with upgrade in place infrastructure provides a seamless migration path from previous z/VM releases (z/VM 6.2 and z/VM 6.3) to the latest version
- **Operational improvements** by enhancing z/VM to provide ease of use
- **Improved SCSI support** for guest attachment of disk and other peripherals, and hypervisor attachment of disk drives
- IBM Wave for z/VM **simplifies the management** of virtual Linux servers from a single user interface
- Provides the foundation for cognitive computing on z Systems

### IBM Wave for z/VM



- **Support new analytics workloads** with Single Instruction Multiple Data (SIMD) for competitive advantage
- **Deliver higher compute capacity** with support for Simultaneous Multithreading (SMT) to meet new business requirements
- **RAS support enhanced for problem determination and high availability** setup to reduce down time and quickly react to business needs
- **Secure and protect** business data with Crypto exploitation

### KVM on z Systems v1.1



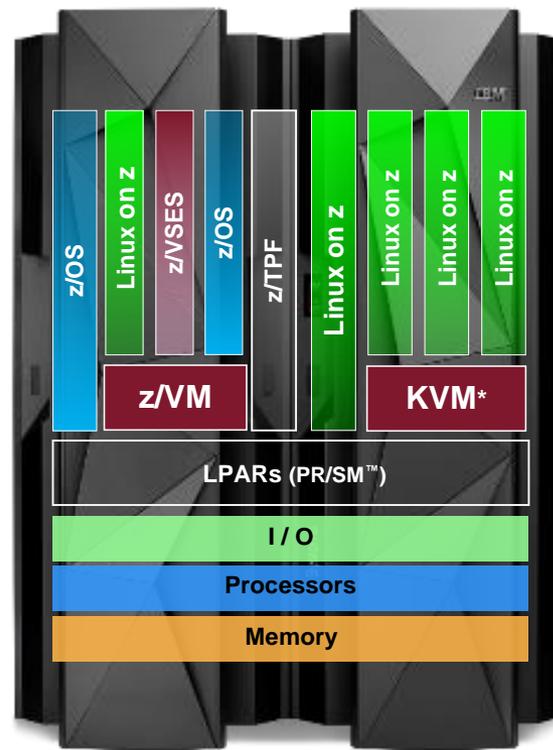
## IBM z/VM and KVM for IBM z

### z/VM

- World class quality, security, reliability - powerful and versatile
- Extreme scalability creates cost savings opportunities
- Exploitation of advanced technologies, such as:
  - Shared memory (Linux kernel, executables, communications)
- Highly granular control over resource pool
- Valuable tool for resiliency and Disaster Recovery
- Provides virtualization for all z Systems operating systems

### KVM

- Simplifies configuration and operation of server virtualization
- Leverage common Linux administration skills to administer virtualization
  - Flexibility and agility leveraging the Open Source community
  - Provides an Open Source virtualization choice
  - Easily integration into Cloud/OpenStack environments



# Agenda

- IBM z13s – Hardware - Betriebssysteme
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# IBM Dynamic Partition Manager

## *Simplified configuration for Linux users*



- Allows quick configuration and management of system resources as easily as other virtualized environments
- Developed for servers with KVM on z and/or Linux as a partition-hosted operating system

### ***Benefits for users new to z Systems:***

- Quickly create a new partition, including the I/O configuration, from a single management end-point
- Modify system resources without disrupting running workloads
- Monitor sources of system failure incidents and conditions or events which might lead to workload degradation
- Create alarms for events, conditions, and state changes
- Update individual partition resources to adjust capacity, redundancy, availability, or isolation

- *Provides the technology foundation that enables IaaS and secure, private clouds*
- *Quickly configure and manage system resources using an industry standard UI*



- Not available for z/OS, z/VM, z/VSE or z/TPF
- Does not support IBM zAware
- Used with FCP Storage only

## How DPM helps in a new Linux Environment

- z Systems and PR/SM require a HW definition
- Dynamic IO – one of the key differentiator of the platform would be nice
- Having the option to have a GUI-based administration
- Overcome the prejudice: z is old school and complicated
- Everything is scripted (that's why we need GUIs)

```

ICP ICP070I SEARCH FOR '*ICP' TO FIND EACH IOCP MESSAGE
ID MSG1='IODF00',MSG2='SYS1.IODF00 - 2014-07-22 16:19', *
SYSTEM=(2828,1),LSYSTEM=P008B857, *
RESOURCE PARTITION=((CSS(0),(ZOS1,2),(ZVM1,1),(*,3),(*,4),(*,5*
),(*,6),(*,7),(*,8),(*,9),(*,A),(*,B),(*,C),(*,D),(*,E),*
(*,F)),(CSS(1),(*,1),(*,2),(*,3),(*,4),(*,5),(*,6),(*,7)*
,(*,8),(*,9),(*,A),(*,B),(*,C),(*,D),(*,E),(*,F)))
CHPID PATH=(CSS(0),25),SHARED,PARTITION=((ZOS1,ZVM1),(=)), *
PCHID=160,TYPE=FC
CHPID PATH=(CSS(0),26),SHARED,PARTITION=((ZOS1,ZVM1),(=)), *
PCHID=11C,TYPE=FC
CHPID PATH=(CSS(0),27),SHARED,PARTITION=((ZOS1,ZVM1),(=)), *
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PCHID=17C,TYPE=OSD
CHPID PATH=(CSS(0),F9),SHARED,PARTITION=((ZOS1,ZVM1),(=)), *
PCHID=104,TYPE=OSD
CNTLUNIT CUNUMBR=0030,PATH=((CSS(0),F8)),UNIT=OSA
IODEVICE ADDRESS=(030,064),UNITADD=00,CUNUMBR=(0030),UNIT=OSA
CNTLUNIT CUNUMBR=0070,PATH=((CSS(0),F9)),UNIT=OSA
IODEVICE ADDRESS=(070,064),UNITADD=00,CUNUMBR=(0070),UNIT=OSA
CNTLUNIT CUNUMBR=0300,PATH=((CSS(0),25,26)), *
UNITADD=((00,032)),CUADD=3,UNIT=2105
IODEVICE ADDRESS=(300,032),CUNUMBR=(0300),STADET=Y,UNIT=3390
CNTLUNIT CUNUMBR=0320,PATH=((CSS(0),25,26)), *
UNITADD=((00,032)),CUADD=2,UNIT=2105
IODEVICE ADDRESS=(320,032),UNITADD=00,CUNUMBR=(0320),STADET=Y,*
UNIT=3390
CNTLUNIT CUNUMBR=0340,PATH=((CSS(0),25,26)), *
UNITADD=((00,032)),CUADD=4,UNIT=2105
IODEVICE ADDRESS=(340,032),UNITADD=00,CUNUMBR=(0340),STADET=Y,*
UNIT=3390
CNTLUNIT CUNUMBR=0360,PATH=((CSS(0),25,26)), *
UNITADD=((00,032)),CUADD=6,UNIT=2105
IODEVICE ADDRESS=(360,032),UNITADD=00,CUNUMBR=(0360),STADET=Y,*
UNIT=3390
CNTLUNIT CUNUMBR=0380,PATH=((CSS(0),25,26)), *
UNITADD=((00,032)),CUADD=8,UNIT=2105
IODEVICE ADDRESS=(380,032),UNITADD=00,CUNUMBR=(0380),STADET=Y,*
UNIT=3390
CNTLUNIT CUNUMBR=0400,PATH=((CSS(0),25,26)), *
UNITADD=((00,032)),CUADD=A,UNIT=2105
IODEVICE ADDRESS=(400,032),CUNUMBR=(0400),STADET=Y,UNIT=3390

```

short version: No Texteditor  
required to get started, dynamic IO available

# System Requirements

- IBM LinuxONE Rockhopper™ or IBM LinuxONE Emperor™
  - IBM Dynamic Partition Manager feature code 0016
  - Two dedicated OSA-Express5S 1000BASE-T Ethernet #0417 features
  - Server can be in standard PR/SM mode or Dynamic Partition Manager mode – set at initial IML
- Only supports Fibre Communication Protocol (FCP)
- IBM KVM and/or Linux without a hypervisor
- **Does not support**
  - Any hypervisor other than IBM KVM
  - ECKD™ disk
  - IBM zAware
  - GDPS® Virtual Appliance



<sup>1</sup>Requires firmware level 27 (GA2)

# Agenda

- **IBM z13s – Hardware - Betriebssysteme**
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- **IBM Dynamic Partition Manager**
- • **z Appliance Container Infrastructure (zACI)**
- **IBM z Systems und Speicher Synergie**



# z Appliance Container Infrastructure (zACI)

*For secure deployment of software virtual appliances*

New for  
z13 too!

- A software virtual appliance is a solution where all the components (except hardware) are bundled together
- A new zACI partition mode (LPAR) enables hosting a software virtual appliance
- The first exploiter will be the firmware offering IBM zAware which will use the zACI LPAR
- The first software virtual appliance will be z/VSE Network Appliance - used by z/VSE® for faster connection to Linux middleware

## **Potential future appliances:**

- Integrated Analytics – Investigate and diagnose problems faster, predict and prevent problems and optimize the systems within the z IT environment \*
- Security – provide remote crypto functions in an easy to deploy appliance that allows client to leverage z Systems cryptographic hardware across platforms\*

## **Value of zACI:**

*Simplifies usage – no management of the individual component members*

*zACI protects the solution – appliance can not be altered*

*Easy configuration with APIs and web interfaces*



= available on Linux for z and LinuxONE

## Use Cases

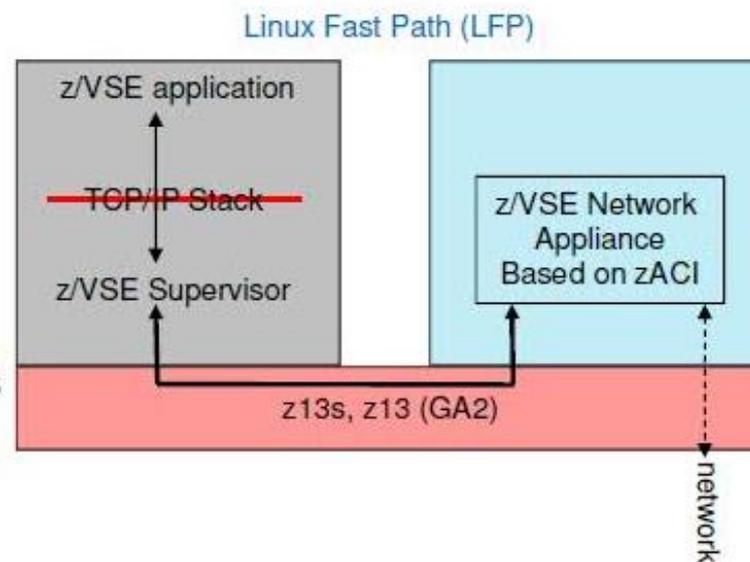
- **Firmware IBM zAware will remain available for z13 GA2 and z13s**
  - Will run in zACI LPAR on z13 GA2 and z13s
  - Existing zAware LPAR (on z13) will be converted to zACI
  - No changes required to zAware
- **z/VSE Network Appliance**
  - Planned Availability in June 30, 2016\*
- **More software appliances will be available in the future**

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

# Use Cases

## z/VSE Network Appliance (VNA)

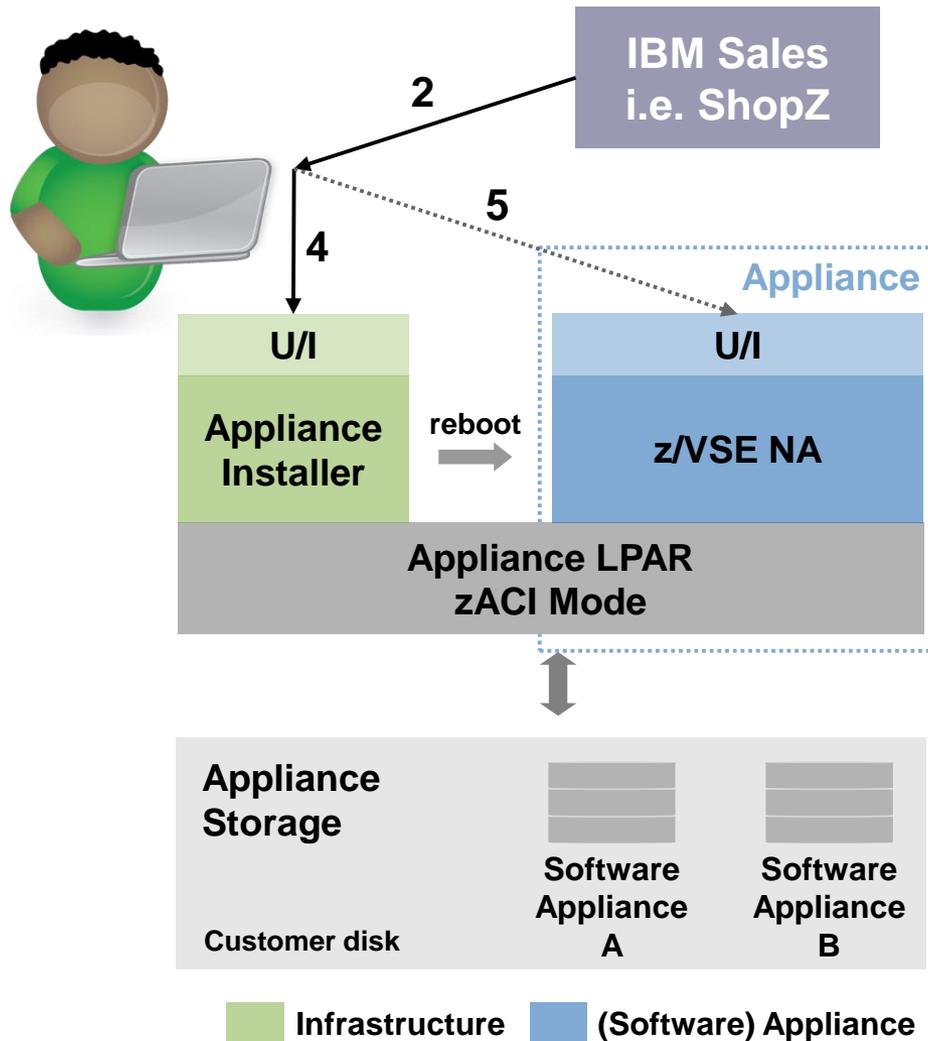
- New with z13 GA2 / z13s, available **June 30, 2016**
  - VNA acts as a router for z/VSE
  - TCP/IP application uses Linux Fast Path (LFP) and connects through HiperSockets to VNA
  - Based on z Appliance Container Infrastructure (zACI) delivered with z13s and z13 GA2
  - z/VSE is first exploiter of zACI
- 
- No Linux license,  
No TCP/IP stack required on z/VSE,  
No z/VM required to connect to the network
- 
- Supported on z/VSE 6.1, 5.2 and 5.1
- 
- VNA for LPAR only
- 
- zVSE - z/VM IP Assist (VIA) for z/VM environments



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

# zACI Software Appliances

Deployment in 5 Steps



- 1) Buy a Software Appliance (e.g. z/VSE Network Appliance)
- 2) Download the installation image
- 3) Create and activate an appliance (zACI) LPAR
- 4) Deploy appliance using Appliance Installer
- 5) Configure and use appliance through REST API or web U/I

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# IBM DS8884

## Entry-level storage for z13s

### IBM DS8884 Model

- 19" 40U rack
- 2x P8 2U CEC's single processor socket
- 2x IO Bay Pairs
  - 1x IO Bay Pair in A Rack
  - 1x IO Bay Pair in B Rack (B Rack can be ordered with out IO bay Pair)
- Max of Host 64 Ports
  - 4 port 16Gbps FCP / FICON
  - 4 port and 8 port 8GbpsFCP / FICON adapters
  - max 16 ports per I/O Bay
- Max 4 DA Pairs
- Max of 768 DDMs/32 Gigapack drawers
- Max of 4 High Performance Flash Enclosures -120 flash drives
  - 2 HPFE Drawers in A Rack
  - 2 HPFE Drawers in B Rack
- 2x 8U DC-UPS 60A Single Phase
- 1 or 2 HMC option
- Max of 3 Racks

SSD/DDM Media Enclosure

High Performance Flash Enclosure

I/O Bay Enclosure

P8 Servers

DC-UPS

Base Rack

Expansion Rack



SSD/DDM Media Enclosure

High Performance Flash Enclosure

I/O Bay Enclosure

DC-UPS

# z Systems and Storage synergy

*Designing, developing and testing together is key to unlocking true value*

		Large enterprise	Midrange offerings	Linux offerings 
<b>New IBM System Storage® DS8880</b>	<ul style="list-style-type: none"> <li>• zHPF and Extended Address Volumes</li> <li>• GDPS®/PPRC HyperSwap™</li> <li>• zDAC on z/OS for easy configuration</li> <li>• zHyperWrite for accelerated DB2 writes</li> <li>• FICON Express16S with Forward Error Correction Codes, FICON Dynamic Routing, Fabric Priority Read Diagnostic Parameters, Enhanced Write Protocol</li> </ul>	✓	✓ (DS8884)	✓
<b>TS7700</b>	<ul style="list-style-type: none"> <li>• Library Automation Integration (i.e. OAM in z/OS)</li> <li>• z/OS, z/VM, z/TPF and z/VSE support</li> <li>• Linux on z requires z partition</li> </ul>	✓	✓	✓
<b>XIV® Storage Systems</b>	<ul style="list-style-type: none"> <li>• For Linux on System z - FCP connectivity only</li> </ul>			✓
<b>Storwize® V7000</b>	<ul style="list-style-type: none"> <li>• For z/VSE, KVM, z/VM and Linux on System z - FCP connectivity only</li> </ul>		✓	✓
<b>SVC</b>	<ul style="list-style-type: none"> <li>• For z/VSE, KVM, z/VM and Linux on System z - FCP connectivity only</li> </ul>		✓	✓
<b>IBM FlashSystem™</b>	<ul style="list-style-type: none"> <li>▪ For Linux on z - FCP connectivity only</li> </ul>			✓
<b>TS1150 , TS4500</b>	<ul style="list-style-type: none"> <li>• FCP can attach to Linux on z</li> <li>• Support for z/OS, Linux on System z, z/VM, and z/VSE via FICON if TS7700 is front end</li> </ul>	✓	✓	✓

Thank You

# Questions



Please forward your questions or remarks to  
[zvse@de.ibm.com](mailto:zvse@de.ibm.com)  
[albert.gebhart@de.ibm.com](mailto:albert.gebhart@de.ibm.com)

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ECKD	IMS	RMF	z/VM*
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