From X86 to ARM

NCBU , 2017 Feb

Andie Yen

Business Development Manager

Taiwan

2017. Feb

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Get a Head Start With GIGABYTE

- About Gigabyte
- Server Product Update
  - X86 Platform Update
  - ARM Platform Update
- X86 / ARM Board Design Advantage

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ABOUT GIGABYTE

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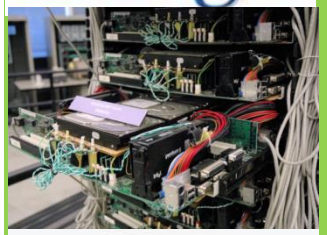
What We Have Been

Google



Channel

ODM

NEC
DELL
HITACHI
FUJITSU
lenovo

ODM + Brand

Cirrascale
sgi
PENGUIN COMPUTING
Яndex

1990~2000 | 2000~2012 | 2012~

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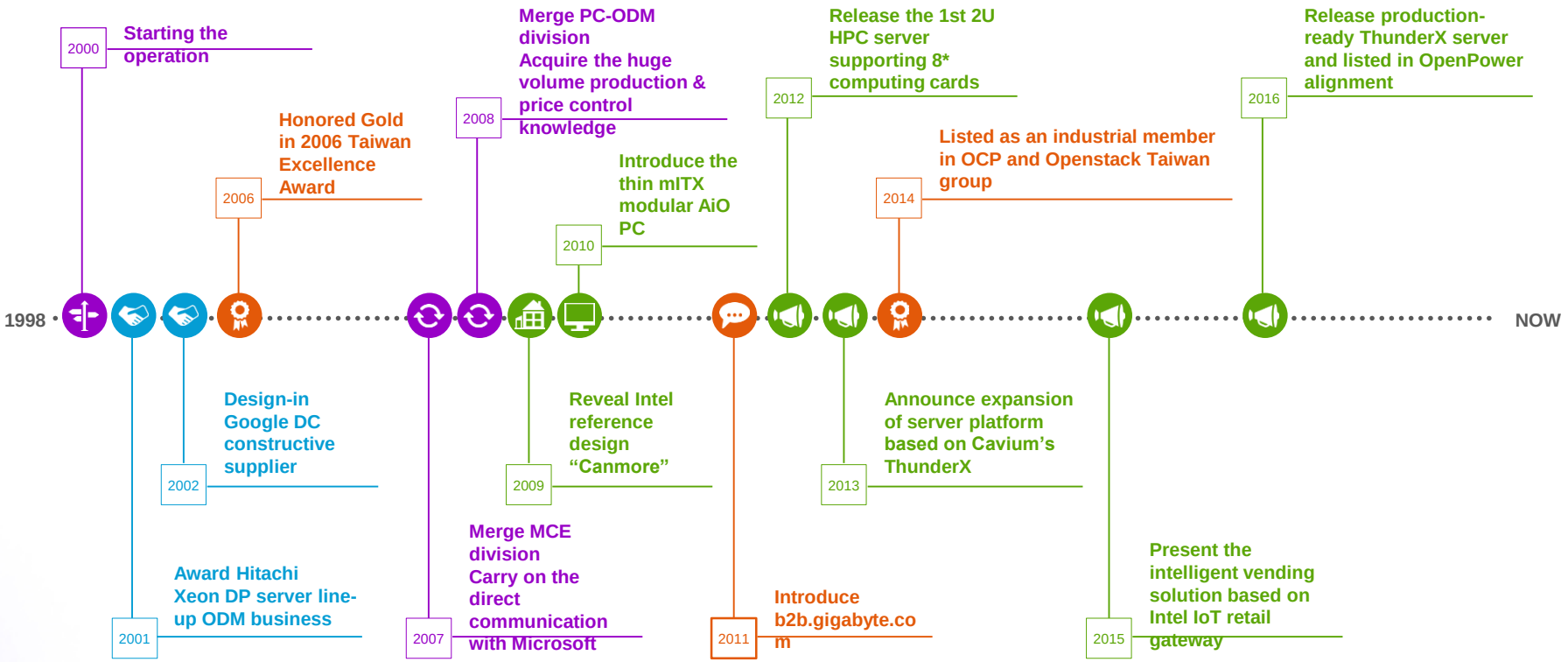
Milestone



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Server Product Line

PC BOARDS

Thin Mini-ITX

Mini-ITX

Proprietary Industrial

SERVER BOARDS

Workstation

Single-Socket

Dual-Socket

SERVER RACKS

1U Rack

2U Rack

High-Density

GPU Server

HIGH DENSITY SYSTEMS

2U – 4 Node High Density System

GPGPU SYSTEMS

1U- 2/4 GPU Server

2U – 2/3/4 GPU Server

DATA CENTER SOLUTION

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ODM/OEM Business Center

- ***The most dependable partner for co-design, co-develop, manufacturing, assembly and after-sales services to global computer leaders from MotherBoard to Datacenter solutions.***

Design

- Electronic Engineering
- Mechanical Engineering
- Software
- System Integration
- Validation & Testing

Manufacturing

- PCB/ Flex Circuits
- SMT Assembly
- Server Board
- Cables
- Barebone/Full System
- IQC & OQC

Logistic

- BTO
- CTO
- Distribution & Direct Fulfillment
- Outbound Logistics & Hubbing

Service

- Marketing
- Retail Technical Service
- Repair/ Refurbishment and Warranty
- Service Parts Logistics

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Business Cooperation Model

Off the shelf	• Select product from GBT standard roadmap
Off the shelf with minor change	• Take GBT standard product with minor modifications & limited NRE.
ODM	• Customization Spec. with NRE for new product development.

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GIGABYTE NCBU Server Solution

intel

intel XEON inside

intel XEON PHI inside

intel ATOM inside

AMD

AMD OPTERON

ARM

CAVIUM

THUNDERX™

apm applied micro™

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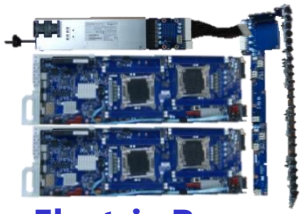
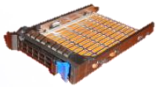
GIGABYTE Server “Building Block”

Mechanical Architecture



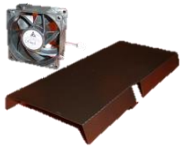
Electric Bone

Accessory



HDD Tray

Chassis



Thermal Solution

PSU

MB

Assembly Board

LAN

Storage

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A Cornerstone of the Industry

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And Empowering the Brand

AAEON
acer
AQUARIUS Best Quality Forever
CARRI Systems
CHECK POINT Software Technologies Ltd.
CRAY Supercomputer
DELL
E4 COMPUTER ENGINEERING
FEC
FORTINET
FUJITSU
HITACHI Inspire the Next
IBM
Kingston TECHNOLOGY
Lanxus
Leap Computing
NEC
NUUO
NVIDIA
PENGUIN COMPUTING
宝德 PowerLeader
PROPHETSTOR
riverbed
VXL
五舟 WUZHOU

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Networking & Communication BU

Workstation Board

Server Board

Server Rackmounts

High Density Servers

High Performance Computing

ARM Base Server

Data Center

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START WITH INTEL

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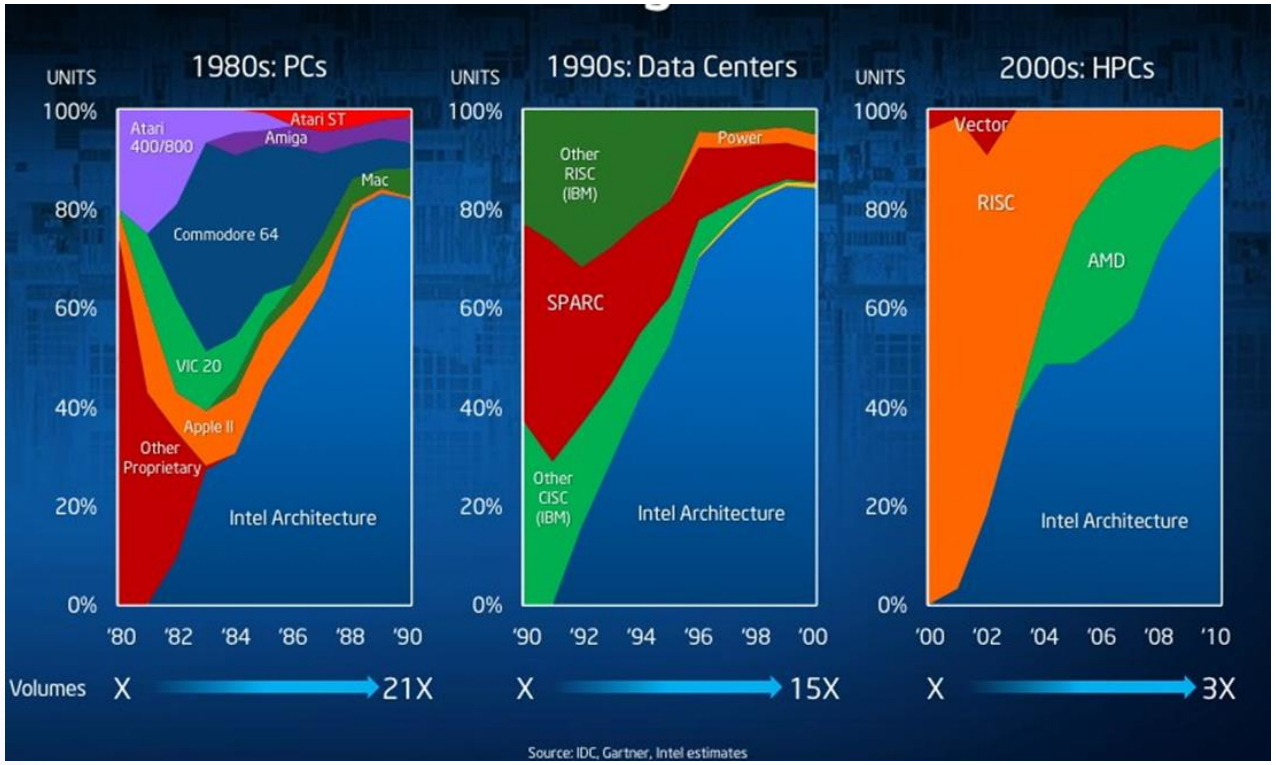
Server Market Overview
Intel's Perspective



- Intel's Move
  - '80s : PC
  - '90s : Data Center
  - '00s : HPC

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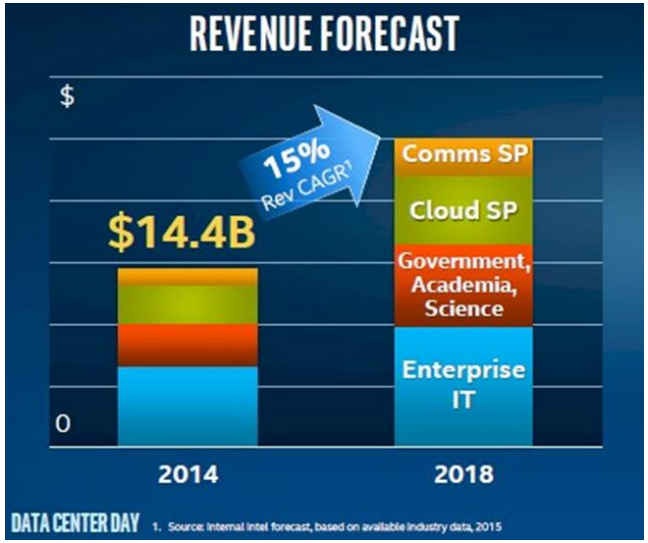
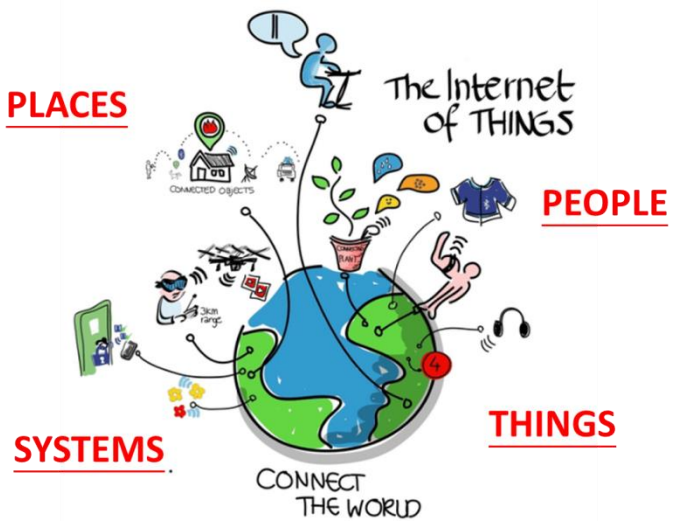
Big Data, and Bigger Data in the Future





- Thanks to big data, server market became a very attractive market in the world.
- Almost all applications including communications, cloud, science and enterprise IT trend to grow 15% from 2014 to 2018.

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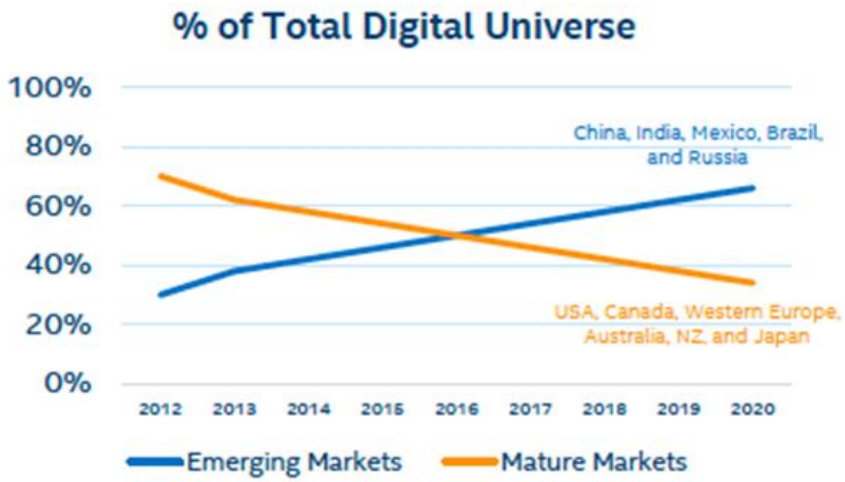
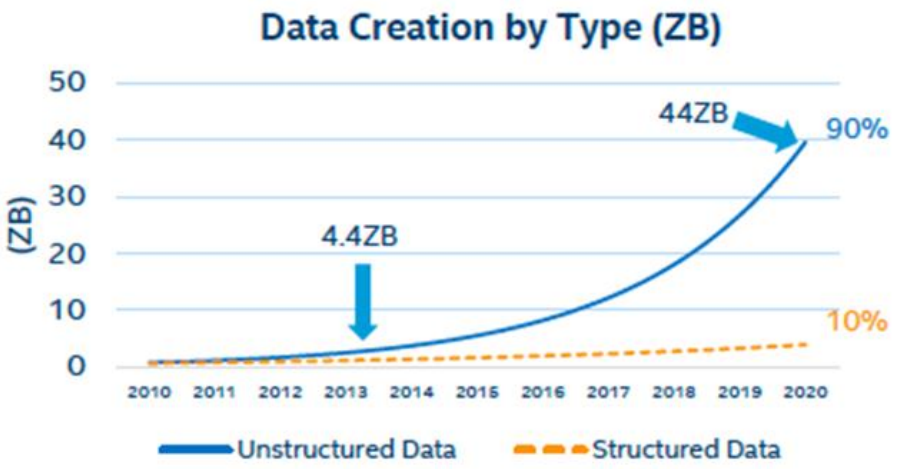
Not Only Mature Market and Not only Structured Data

Emerging Markets will **Surpass Mature Markets** before **2017** regarding data creation.

By 2020, about **90%** of all **data** will be **unstructured,** driven by Consumer Images, Voice, and the Web!



Sources: IDC,'s Digital Universe Study, 2014



Sources: IDC, 2011 Worldwide Enterprise Storage Systems 2011-2015 Forecast update
IDC, The Digital Universe Study in 2020 Forecasts

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Intel Server System Product Line

1U & 2U Mainstream

w/ NVME

R160-S34, MD50
DP 8 DIMM S-PSU
1 x FHHL

R180-F34 / F28 MD90
24 DIMM R-PSU

R270-R3C, MD70
DP 16DIMM, R-PSU

R280-F38 / F3C / F28 / F2G / F2O , MD90
2 x FHHL & 6 x FHFL
& 1 x Universal I/O
Support 3 GPGPUs

GPGPU

w/ NVME

G250 Family
8 x GPU, PCIe x 16
Tesla/Grid/Titan/GTX

G210-H4G,
6LISL, E3
4 GPU (4 Node)

G190-H44, MG30
4 x PCIe x16 (@Gen 3 x16)
for 4 GPU

G150-B10, MB10
Broadwell-DE
1 x PCIe x16
for 1 x GPU

High Density

w/ NVME

H270 Family, MH70
16 DIMMs; Dual 10GbE LAN Intel 82599
(Option 1 x 40GbE QSFP+ with Fortville)

Storage

D120-C20, MC20
Broadwell-DE
16 x 3.5” HDD

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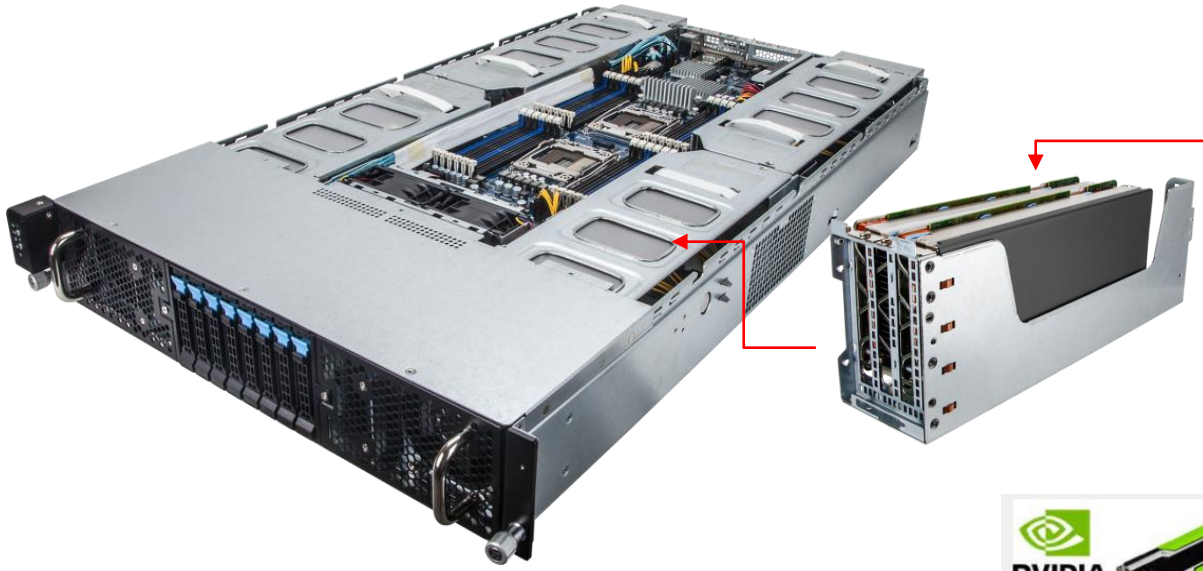
Case Study – G250 GPGPU Server



4 x card trays
Each tray supports 2 x GPU/ MIC cards
Length <266.7mm, Max. power @ 300W

- Intel Xeon E5-2600 V3/V4 Product Family
- Support 8 x Double-slot GPU/MIC cards
- up to 768 GB DDR4 Memory
- 8 x 2.5" Hot-Swappable HDD/SSD
- 1600W/2000W 80 Plus Platinum Redundant PSU

Support 8 x TESLA P100 GPU Cards

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GPU Accelerated Computing

1U GPU Server

1 x GPU

G150-B10 (Broadwell-DE)

4 x GPU

G190-H44 (Grantley)

4 x NVLink

G190-G30 (Grantley)

2U GPU Server

2 or 3 x GPU

G280 – 001 (Grantley)

4 x GPU

G211-H4G (Greenlow)

3 x GPU

R280-G2O (Grantley)

8 x GPU

G250 Series (Grantley)

4U GPU Server

10 x GPU

G450 (X99)

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GPU Accelerated Computing

1U GPU Server

1 x GPU (Dual Slot)

2 x GPU (Single Slot)

G150 Series
(X99 Standard / Overclock)

4 x GPU (Dual Slot)

G191-H44 (Purley)

2U GPU Server

2017

8 x GPU (Dual Slot)

G291 Series (Purley)

Value – 8 x GPU cards (by 2 x CPU)
2 * UPI
No NVMe

Standard – 8 x GPU cards (by 2 x CPU)
3 * UPI
NVMe Support. OCP Mezz

Performance – 8 x GPU cards (by 1 x CPU)
3 * UPI
NVMe Support. OCP Mezz

3 x GPU (Dual Slot)

R281-3G0 (Purley)

6 x GPU (Dual Slot)
w/ 16 * GbE LAN Port

G291 Value Sku
(Purley)

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Case Study

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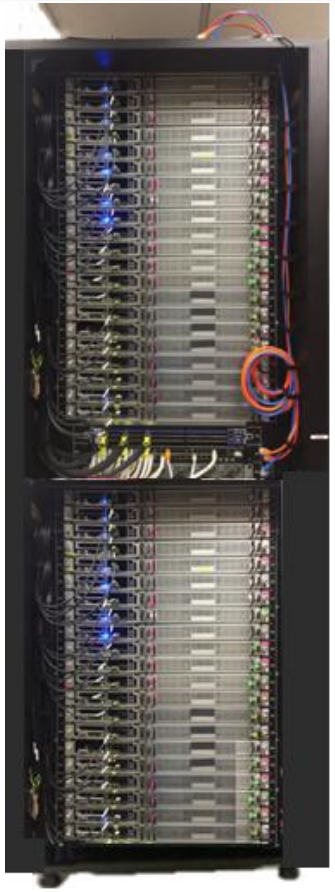
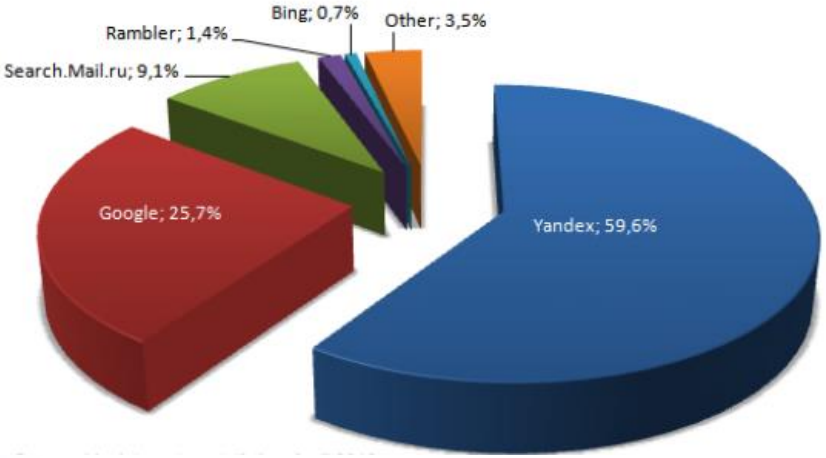
Case Study – Yandex Open Rack 2.5

1U 1 Compute Node

1U 2 Compute Nodes



Search engine market shares in Russia



Яндекс

Google Россия

поиск@mail.ru

Rambler

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G250 – UK BGN Events

BGN (UK) is using G250 with 8 x Nvidia Quadro K2000 GPU cards to set up in Live Broadcasting in F1 Race.

1st setting up in May @ Barcelona, Spain.

Following with F1 Race, G250 system will be installed in Singapore, Malaysia, and Monaco.

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G250 – Dundee University

GPGPU – G250 WITH PASSIVE GTX1080

Simulations + Newer High-Performance Analytics

EXCLUSIVE

GEFORCE GTX VR READY

Feedback & Testimonials

"As promised, I can feedback that the [G250-G52] system is running well and my end customer is pleased. As a combination of this hardware and the update of the software he uses to compute on GPU now from CPU, he sees a computation step has reduced from about 10hrs runtime to 15mins. This is a major step in improving how much research work he can get done."

Thanks again
Chris Scott
Research Computing Manager
School of Life Sciences, University of Dundee

- **Chris Scott, Research Computing Manager, School of Life Sciences, University of Dundee**

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Cloud Gaming – Taiwan / Japan

ubitus
Enrich your cloud

Ubitus Gaming Cloud Extends DRAGON QUEST X to Nintendo 3DS

【Japan, July 9th 2014】Ubitus Inc., the worldwide cloud gaming technology leader, is proud to announce the availability of blockbuster MMORPG title DRAGON QUEST X published by Square Enix Co., Ltd. on Nindendo's most popular portable gaming console Nintendo 3DS™, enabled by its cloud game streaming platform.

By overcoming the challenges of server side GPU virtualization and scalability, portable console computing architecture and the wireless network quality management, Nintendo 3DS users can now enjoy the high quality MMORPG gaming experience on Nintendo 3DS, playing in the game world together with Wii®, Wii U™ and Windows PC, in addition to Android mobile devices that has also been enabled by Ubitus' cloud gaming technology.

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Surveillance System - Taiwan

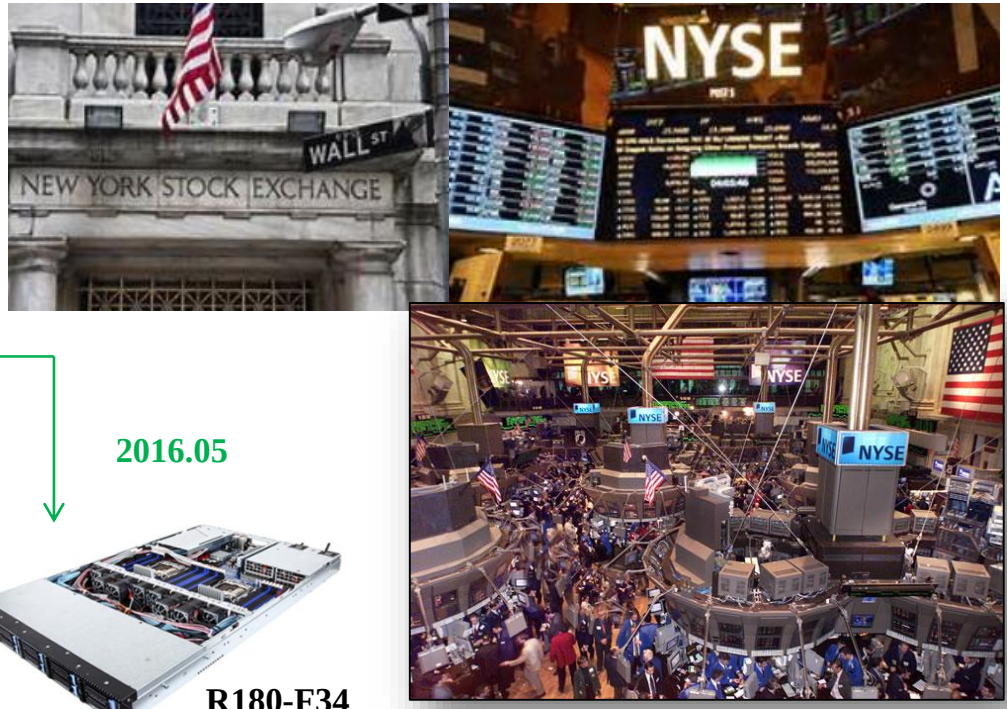
Application for

- Surveillance System
- Recognition System of Vehicle License Plates
- Face Detection
- MULTI-TIER Storage

High Frequency Trading

High Frequency Trading Server

2017



2016.05

R180-F34

SOLARFLARE

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ARM Solution

- Emergence of new H/W Players

open arms

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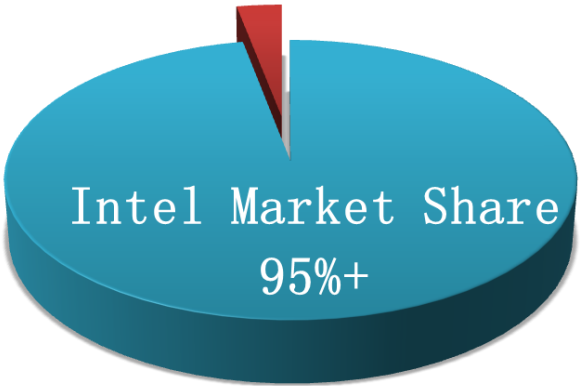
Big Year for Server Market - 2017

New Challenger (2017 Launch)



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Why ARM?

Did You Know?

Percent Power Used: Typical x86 Server

65%

Doing Nothing

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ARM Server Product Line

Applied Micro X-Gene 1 Server

- World's 1st ARMV8 Server-on-a-chip Solution

Annapurna Labs Alphe

- The largest storage interface on one chip

Cavium Thunder X

- The best 48 cores Data Center / Enterprise Processor

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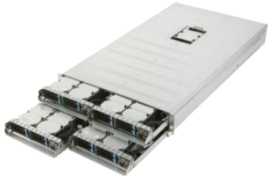
ARM Server System Product Line

Cavium Thunder X Platform

R120-T30, MT30
Cavium Thunder X UP
1U Enterprise

R150-T60/T61, MT60
Cavium Thunder X DP
1U Enterprise

R270-T60 / T61, MT60
Cavium Thunder X DP
2U Enterprise



H270-T70, MT70
Cavium Thunder X DP
2U-4Node, High Density
384 cores / per system

Annapurna Platform

D120-S3G, ML00
Alpine
16 x 3.5" HDD

Applied Micro Platform

R120-P30, MP30
X-Gene1
1U Web Server

G220-P30, MP30
X-Gene1
2U GPU Server w/ NV
Tesla K40

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ARM Server Board Product Line

Cavium Thunder X Platform

MT30-CR0
Cavium Thunder X UP uATX.
40G QSFP+, 8DIMM

MT60-SC0
Thunder X DP, EATX
16DIMM (2400MHz) , 2 x QSFP+

MT70-HD0
Cavium Thunder X CN8890
16DIMM (2400MHz) , 2 x QSFP+

CAVIUM NETWORKS

Annapurna Platform

Annapurna Alpine AL5140
Proprietary M/B
16 x SATA III 6Gb/s ports

annapurnalabs an amazon company

Applied Micro Platform

APM Xgene X3-408
8 DIMM (DDR3), uATX
World 1st 64-bit ARM SoC

apm applied micro™

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ARM High Performance Computing Server (w/ Cavium Thunder X)

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Cavium Thunder X

Standard form factor mother boards, chassis, PSU, Rack/Stack

Managed like x86

SBSA & SBBR – Boot & BIOS like x86

Same SW Development environment

Same OS, Hypervisors & Applications

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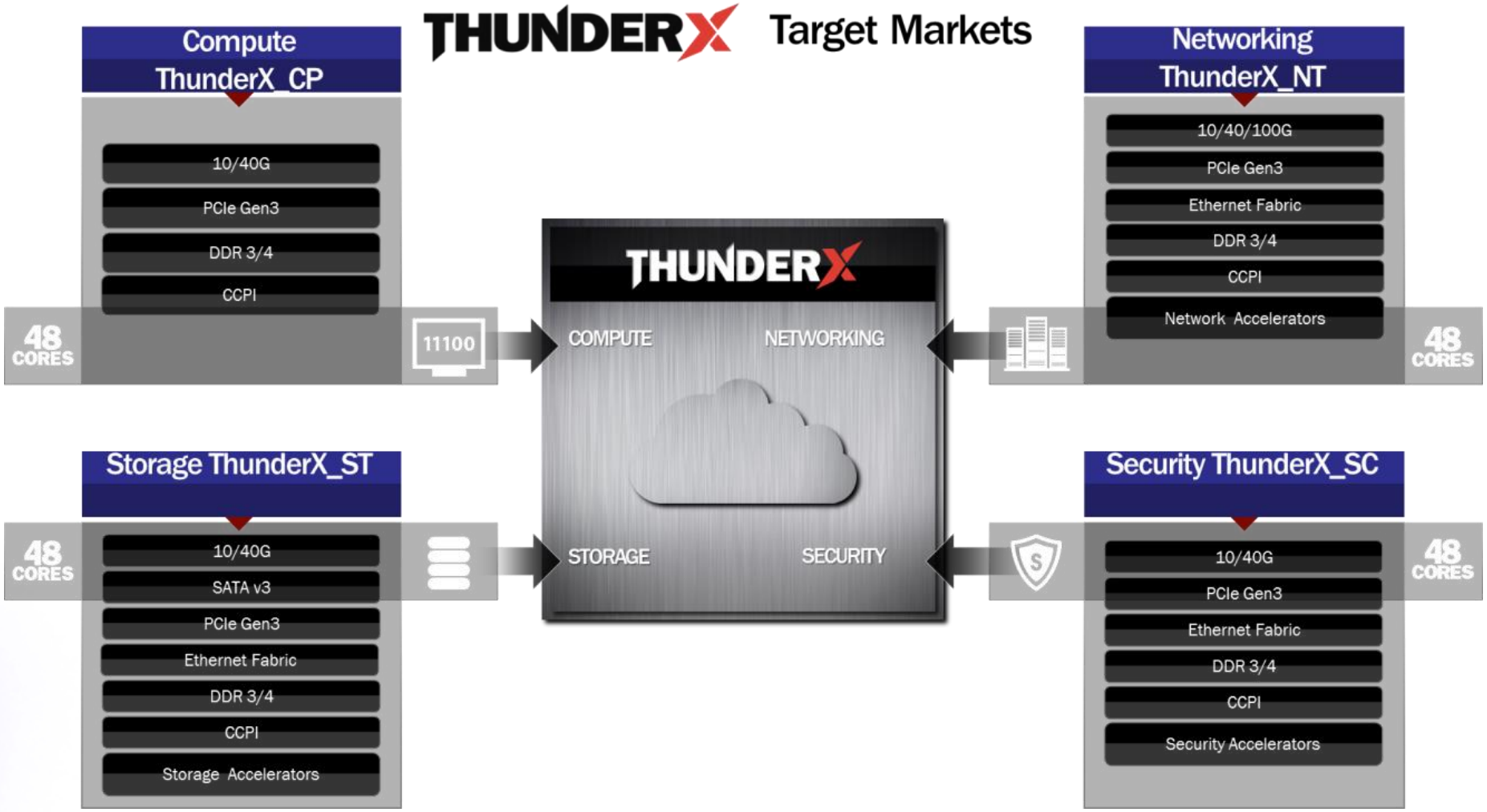
Cavium Thunder X



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Cavium SW Integration

- ✓ Development Environment
- ✓ Operating Systems
- ✓ Firmware, Boot, Systems Mgt

Built on a Thriving Open Source Community

2U H270-T70 Specification

384 Cores

H270-T70 / H260-T70

Dimensions	447W x 87.2H x 780D mm
Weight	29.8 Kg without packing (65.7 lb)
CPU	Per node 2 x Cavium ThunderX-AAP Total 8 x Cavium ThunderX-AAP processors 384 cores in a rack
Memory	Per node 16 x DIMM slots Total 64 x DDR4 RDIMM/ ECC UDIMM Single and dual rank @ 2400MHz Quad rank up to 2133MHz
LAN	Per node 2 x 40GbE QSFP+ Per node 1 x 10/ 100/ 1000 management LAN
Storage	H270-T70: Front access 4 x 2.5” hot-swap HDD bays per node H260-T70: Rear access 4 x 2.5” hot-swap HDD bays per node Total 16 x 2.5” hot-swap HDD bays per rack supports SATA III 6Gb/s
Expansion Slots	Per node 1 x half-length low-profile PCIe x16 (3.0 x8) Per node 1 x mezzanine PCIe x8 (3.0 x8)
Power Supply	1+1 1,600W PSU 80 PLUS Platnium
Management	Aspeed AST2400 controller
OS Supported	CentOS 7.2 Fadora 21 RedHat 7.2 Ubuntu 15.10

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New Platform Schedule

ARM v8.1

ARM v8.2

ThunderX I
28 nm 2.0GHz; **48 Cores**;
DDR3 / 4
PCIe Gen3 (x8)
10G SFP+ / 40G QSFP+
SATA3

ThunderX II
14 nm; **54 Cores**; 2S
DDR4
PCIe Gen4 (x16)
10/25/40/50/100G Fiber
SATA3

X-Gene I
40 nm 2.4GHz; 8 Cores; 1S
DDR3
PCIe Gen3 (x8)
10G SFP+
SATA3

X-Gene II

X-Gene III
16 nm 3.0GHz; 32 Cores; 1S
DDR4
PCIe Gen3 (x16)
TBD (By PCIe)
SATA3

Case Study

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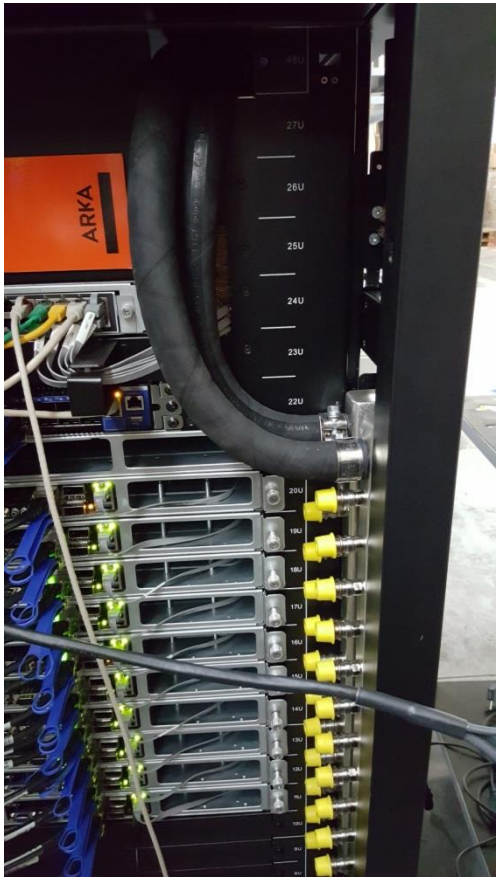
Case Study – PRACE PCP Rack

E4 COMPUTER ENGINEERING

Liquid Cooling Open Rack

- Cavium Thunder X (48 cores)
- Nvidia K40/K80 GPGPU card
- CoolIT Water Cooling System



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INTEL X86 VS. ARM CAVIUM BOARD DESIGN ADVANTAGE

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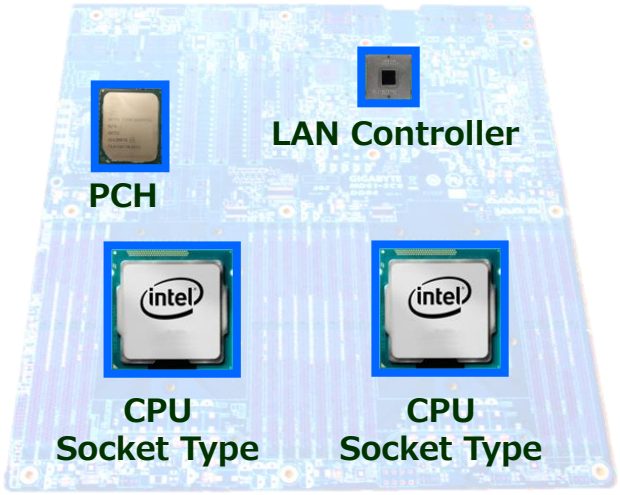
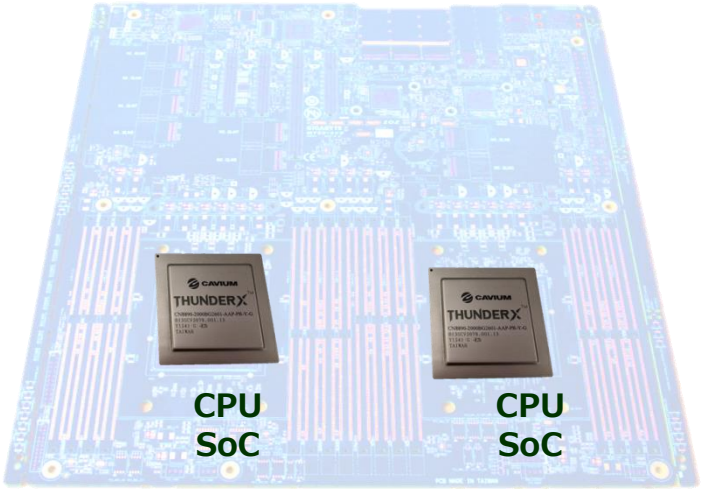
X86 vs. ARM64 Board Design Advantage



VS.



SOC = SYSTEM ON CHIP

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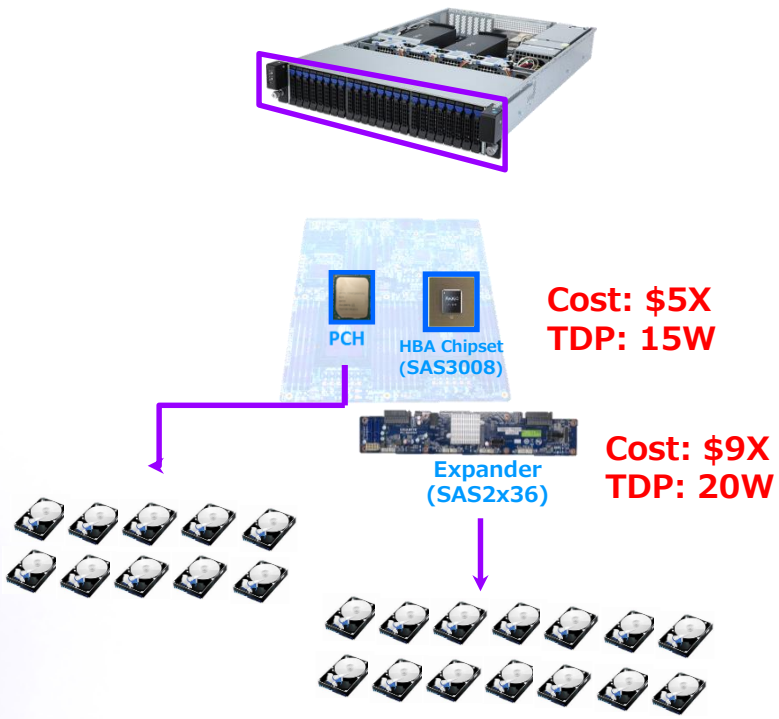
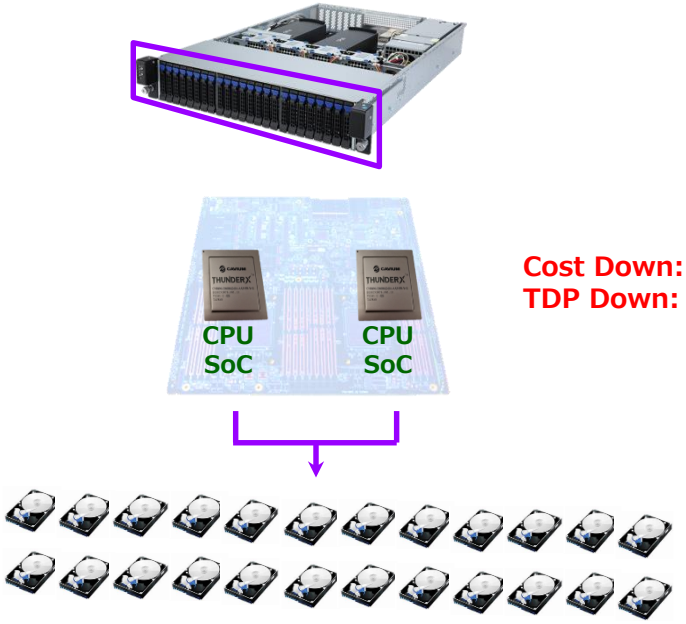
X86 vs. ARM64 2U Storage Advantage



VS.



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INTEL E5-2690 V3 V.S. CAVIUM THUNDER X PERFORMANCE BENCHMARK

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CPU Cost Performance

Intel E5-2690 V3

Cavium Thunder X

40 Gigabit LAN Inside

X

X – 50%

Price Gap :
US$950

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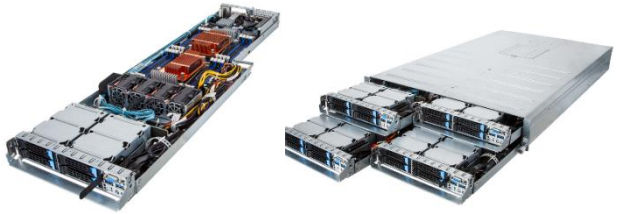
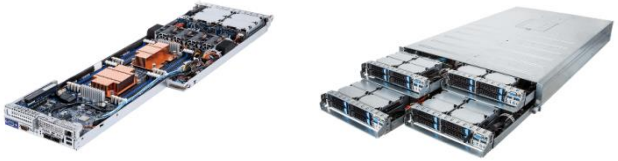
System Cost Performance

Intel Multi-Node
Intel E5-2690 V3
8 x CPUs



CPU = X * 8

Cavium Multi-Node
Cavium Thunder X
8 x CPUs



40 Gigabit LAN Inside

CPU = X – *50% * 8*

Price Gap :
US$7,600

***. Special discount will be offered separated by specific volume.**

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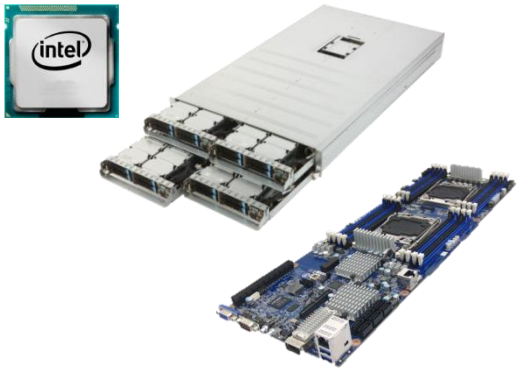
CPU Benchmark

		Intel Xeon E5-2690-v3	Cavium ThunderX AAP Sku
Platform	CPU		
	Type	Dual Processor	Dual Processor
	Frequency	2.6 GHz	2.0 GHz
	# of Cores	12	48
Configuration	System	H270-F4G (2U 4 Node Front-access)	H270-T70 (2U 4 Node Front-access)
	Memory	Hynix DDR4	Hynix DDR4
	HDD	Seagate SATA3	Seagate SATA3
	SSD	Kingston HyperX Savage SSD	Kingston HyperX Savage SSD
	OS	Ubuntu-14.04.4 (LTS)	Ubuntu-14.04 (Cavium performance Version)
	BIOS (GIGABYTE)	R02	T02
	BMC (GIGABYTE)	4.13	761



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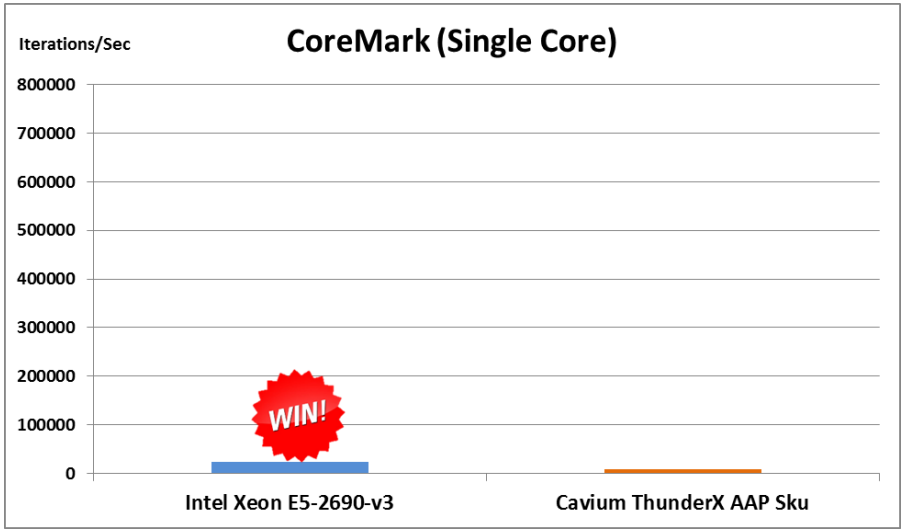
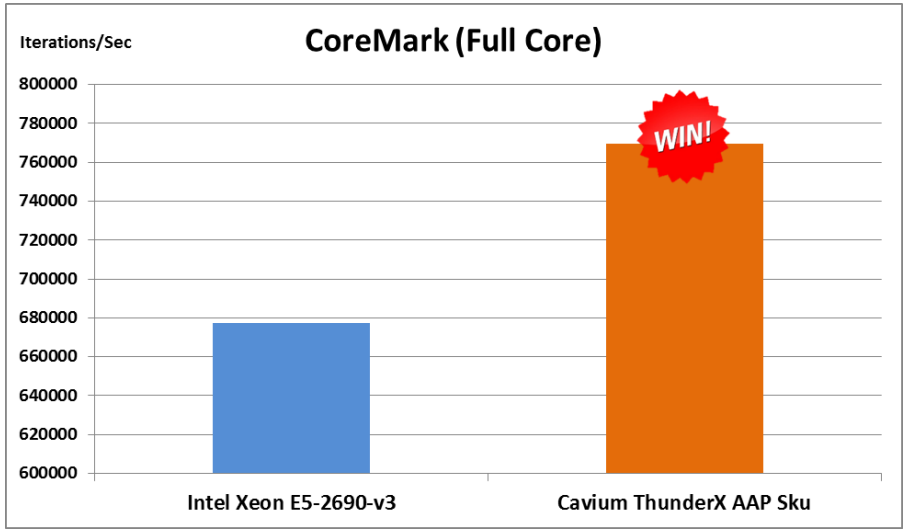
CoreMark





Target	Intel Xeon E5-2690-v3	Cavium ThunderX AAP Sku
Single Core (Iterations/Sec)	23744	8847
Full Core (Iterations/Sec)	677360	769792

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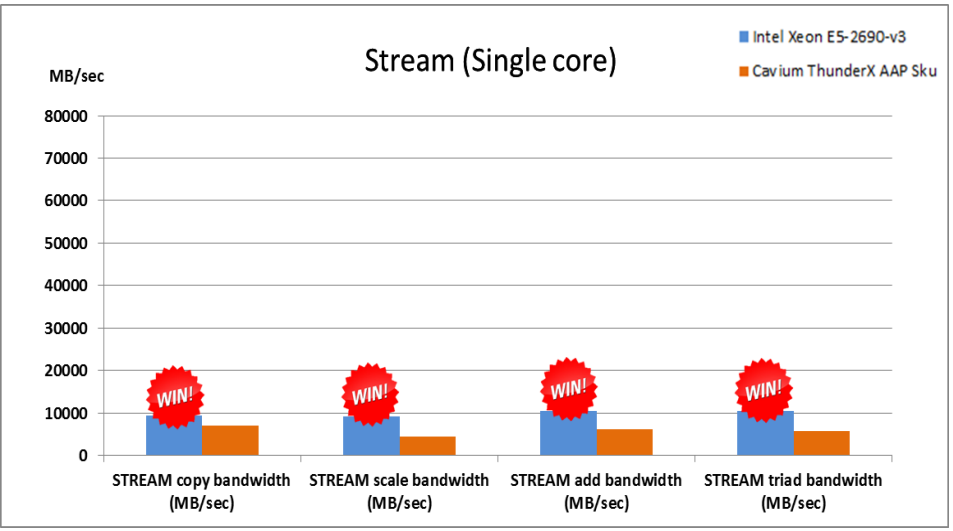
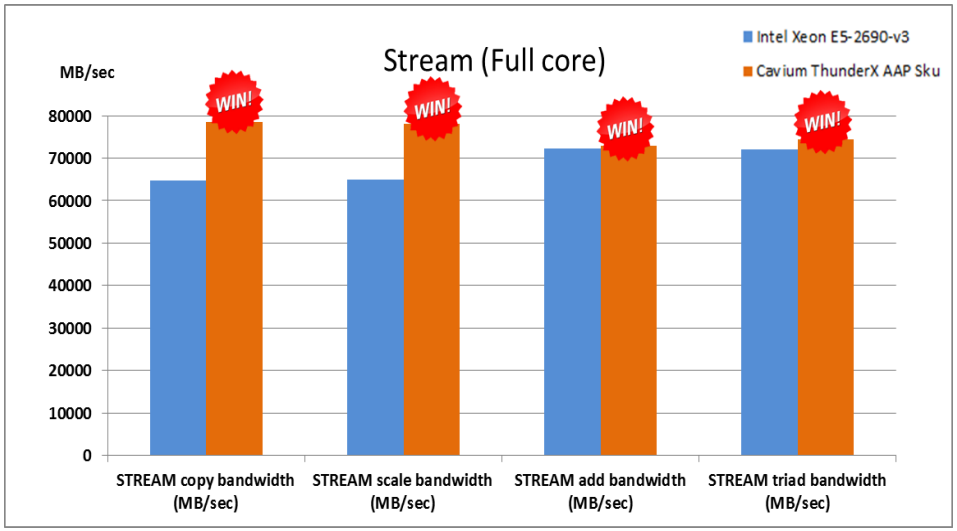
Stream





Target	Intel Xeon E5-2690-v3	Cavium ThunderX AAP Sku
STREAM copy bandwidth (MB/sec)	9328	7141
STREAM scale bandwidth (MB/sec)	9238	4482
STREAM add bandwidth (MB/sec)	10541	6075
STREAM triad bandwidth (MB/sec)	10435	5672

Target	Intel Xeon E5-2690-v3	Cavium ThunderX AAP Sku
STREAM copy bandwidth (MB/sec)	64683	78580
STREAM scale bandwidth (MB/sec)	64899	78041
STREAM add bandwidth (MB/sec)	72198	73007
STREAM triad bandwidth (MB/sec)	72070	74390

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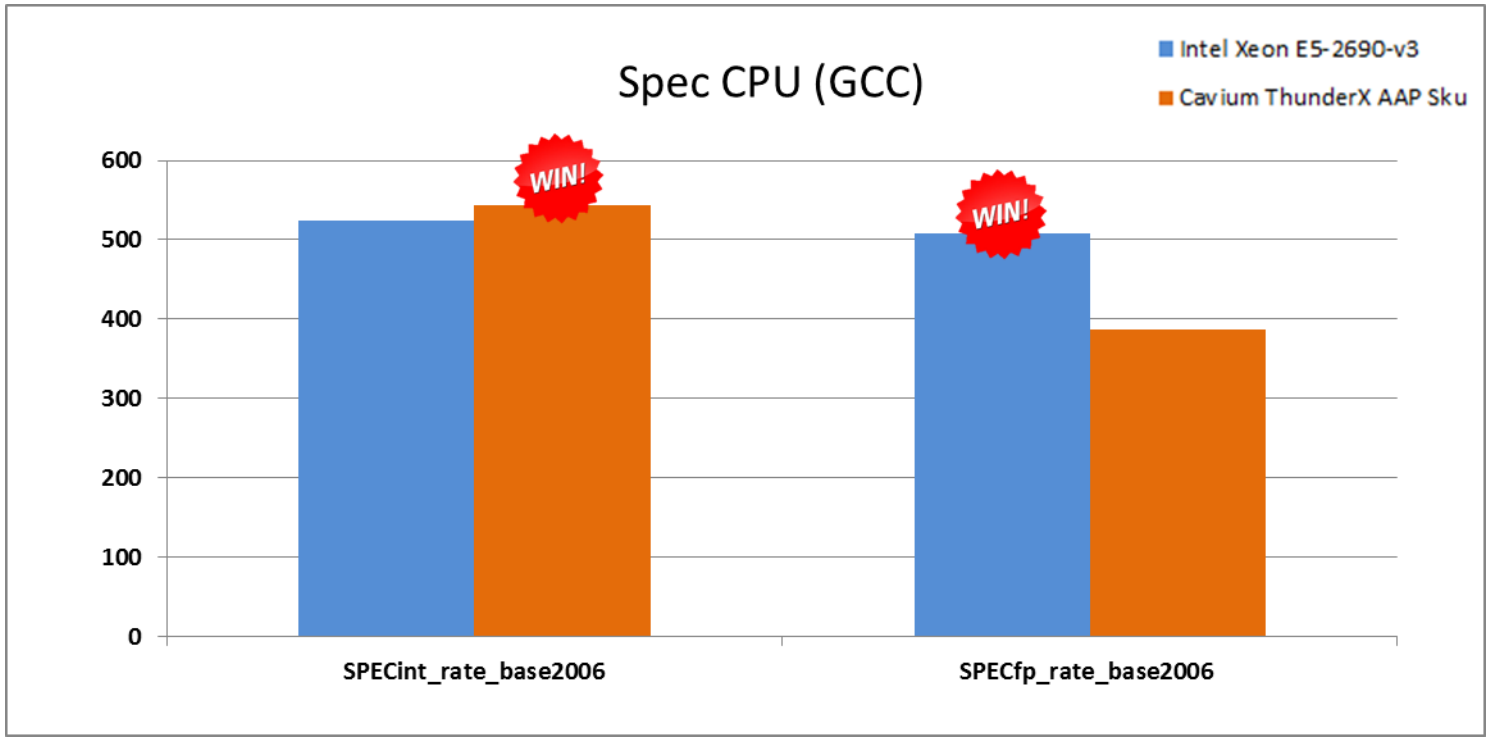
SPEC CPU (GCC)



Target	Intel Xeon E5-2690-v3	Cavium ThunderX AAP Sku
SPECint_rate_base2006	524	543
SPECfp_rate_base2006	508	388

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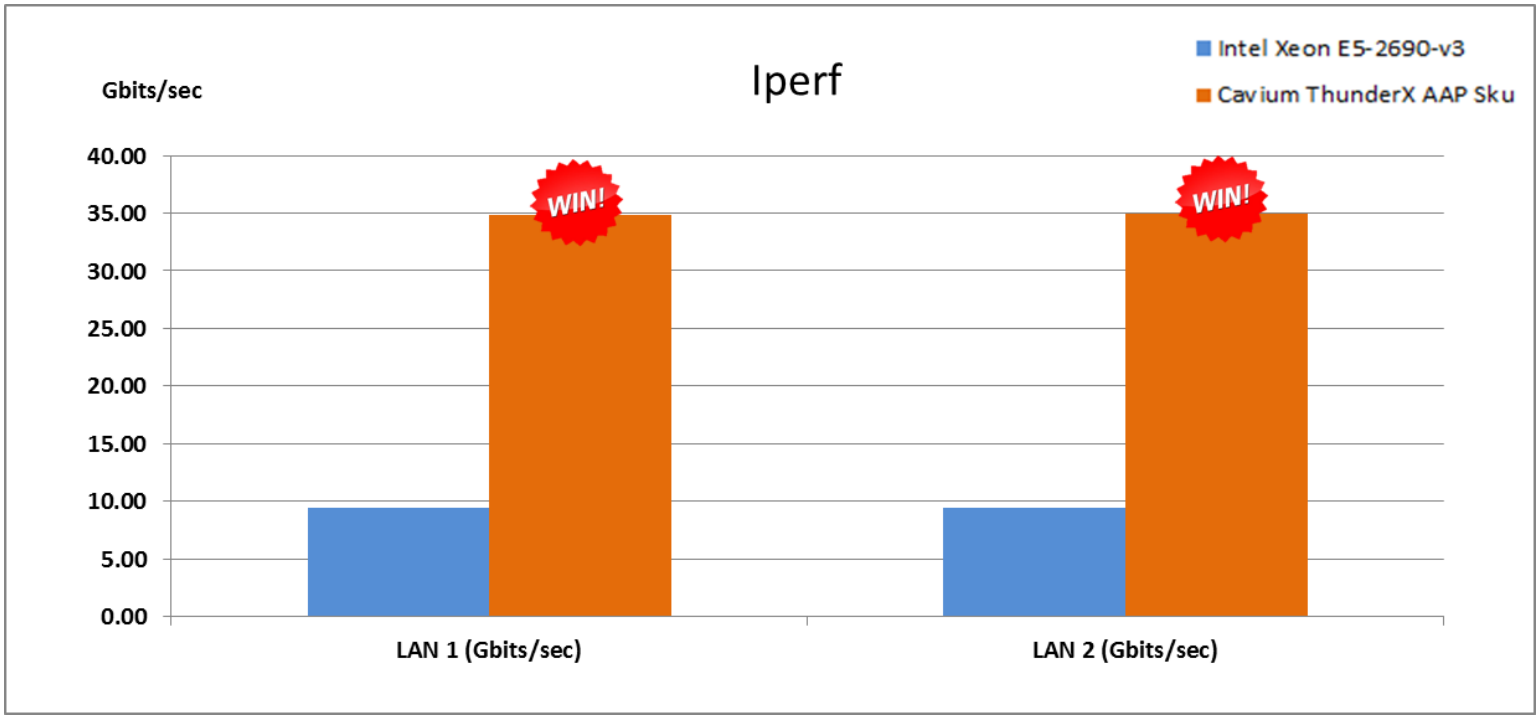
Iperf



Target	Intel Xeon E5-2690-v3 (Intel 82599ES 10G SFP+)	Cavium ThunderX AAP Sku (XLAUI + Inphi Cortina 40G QSFP+)
LAN 1 (Gbits/sec)	9.42	34.80
LAN 2 (Gbits/sec)	9.42	34.90

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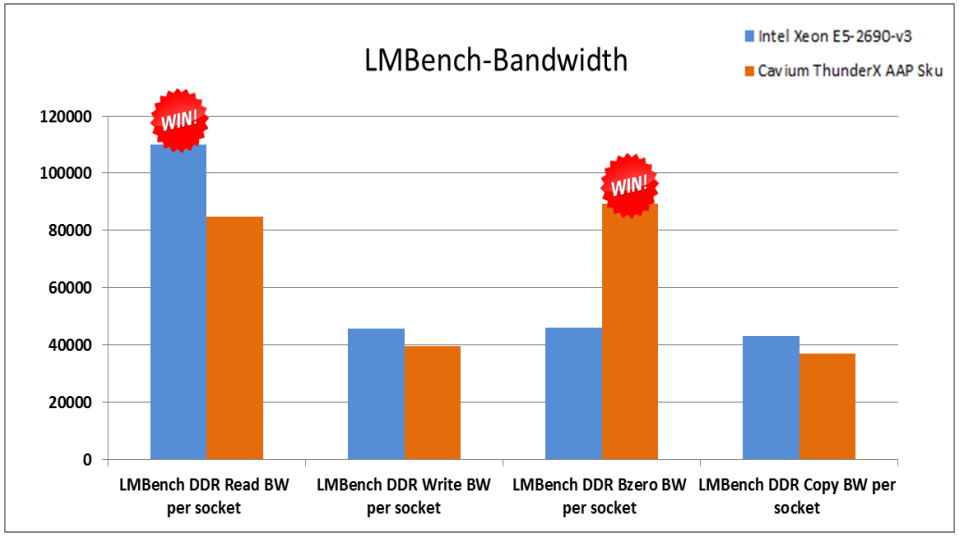
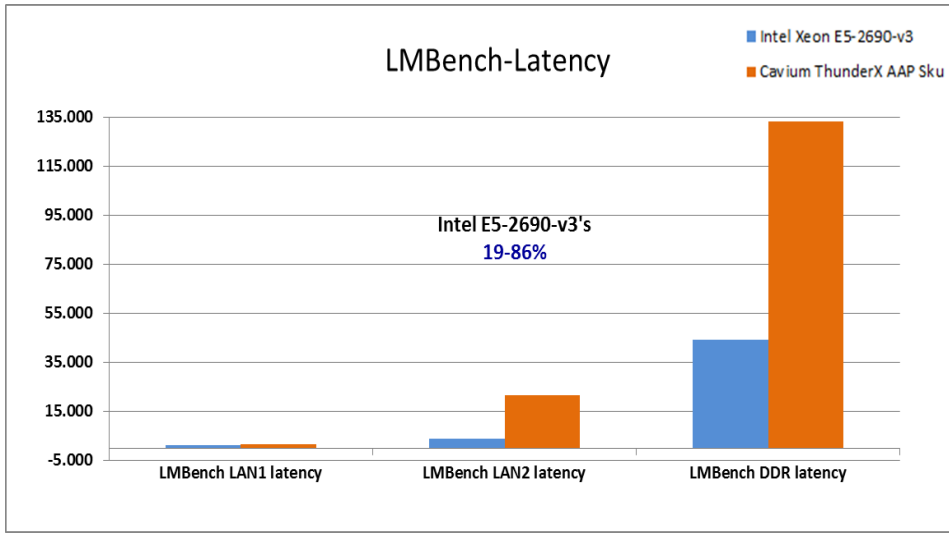
LMBench





Target	Intel Xeon E5-2690-v3	Cavium ThunderX AAP Sku
LMBench DDR Read BW per socket	110149	84715
LMBench DDR Write BW per socket	45785	39613
LMBench DDR Bzero BW per socket	45921	89478
LMBench DDR Copy BW per socket	43046	37175

Target	Intel Xeon E5-2690-v3	Cavium ThunderX AAP Sku
LMBench LAN1 latency	1.293	1.501
LMBench LAN2 latency	4.067	21.518
LMBench DDR latency	44.061	133.218

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- Romania
- Serbia

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- Egypt
- Iraq
- South Africa

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- Hong kong
- India
- Indonesia
- Japan
- Korea
- Singapore
- Sri Lanka
- Thailand
- Viet Nam

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- Hsintien
- Junghe
- Kaoshiung
- Taipei
- Taoyuan
- Taichung
- Tainan

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- UK

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- Fuzhou
- Guangzhou
- Guiyang
- Haikou
- Hangzhou
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- Shenzhen
- Shijiazhuang
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