

A Fresh Look at HPC

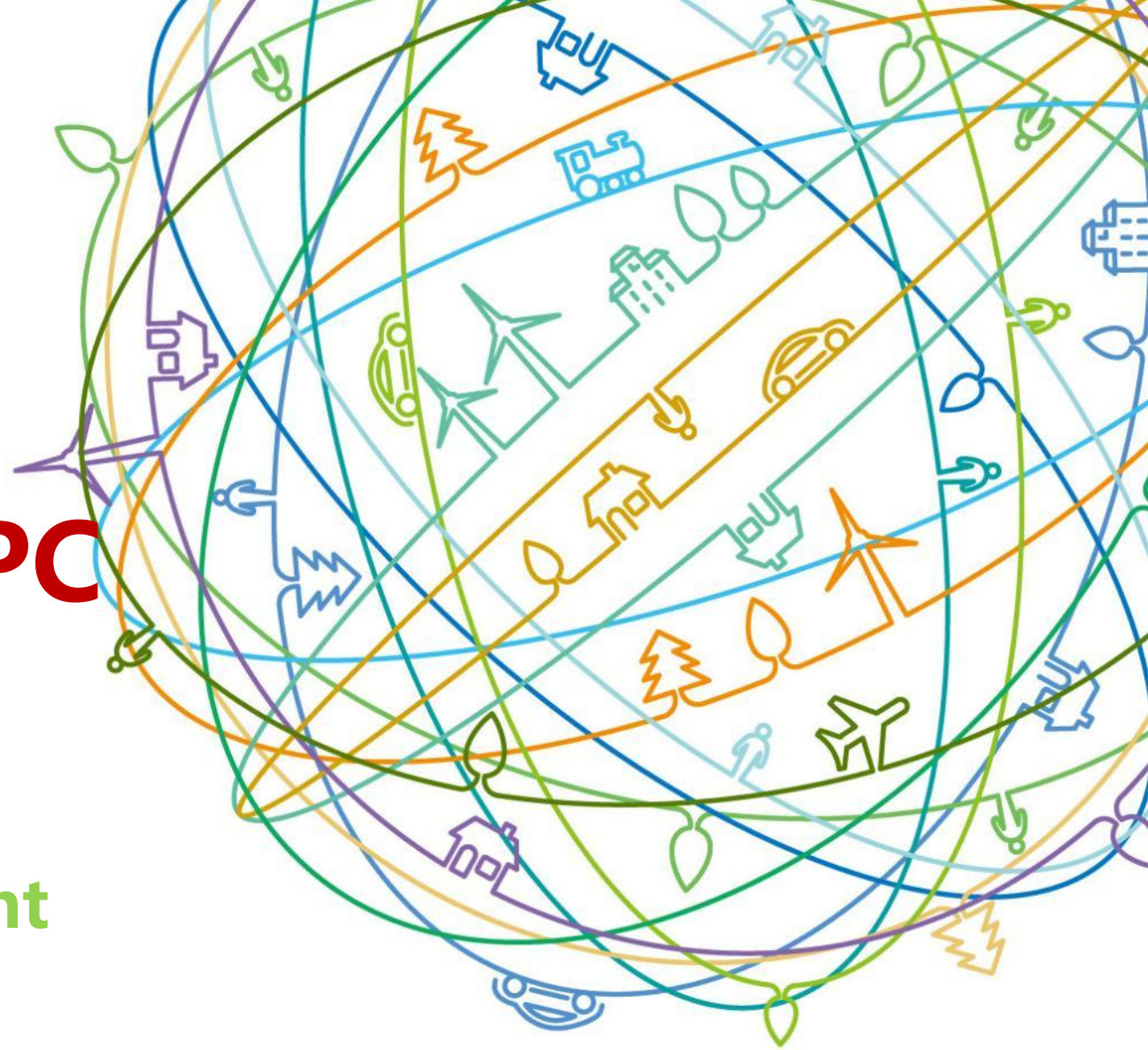
HUAWEI TECHNOLOGIES

Francis Lam
Director, Product Management



HUAWEI TECHNOLOGIES CO., LTD.

www.huawei.com



WORLD CLASS HPC SOLUTIONS TODAY

170+

Countries

\$74.8B

2016 Revenue

14.2%

of Revenue in R&D

79,000

R&D Engineers

16

R&D Centers

36

Joint Innovation
Centers

Huawei FusionServer

Standalone Compute
Node 1P-32P



Modular HPC
Systems



OceanStor



NVMe
SSD

HPC
storage

Big Data
storage

CloudEngine



Network Fabric

Modular & Container
Data center



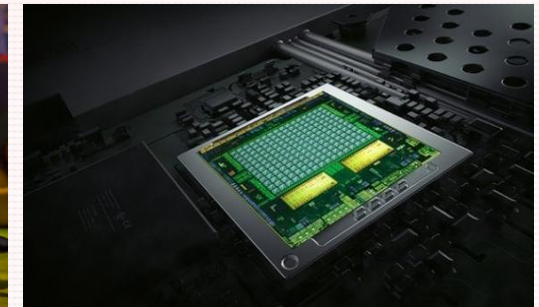
» Petascale System
Direct Liquid Cooling



» Workload Optimization
Ecosystem Partnership

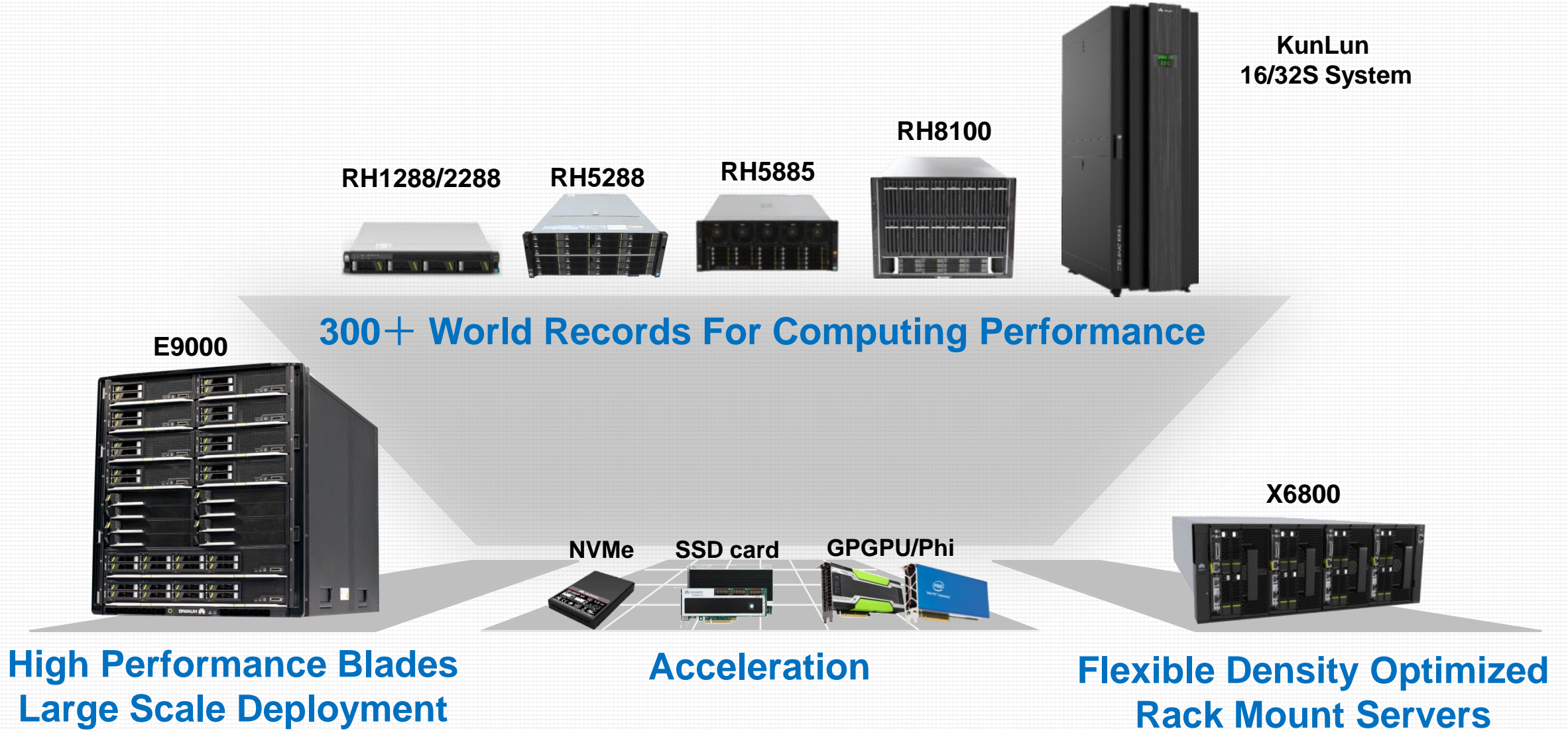


» Reduce Complexity
More Performance / \$



» Design for Growth
HPC Private Cloud

SERVICES FOR HIGH PERFORMANCE COMPUTING



HUAWEI ADVANTAGES

MAXIMIZE EFFICIENCY



MORE COMPUTE LESS SPACE LOWER POWER CONSUMPTION

- End-to-end energy efficient design
- HVDC
- High Ambient Temperature ~40°C
- Direct Liquid Cooling ~ 84% coverage
- Tight integration with Huawei data center infrastructure

ACCELERATE WORKLOAD



MAXIMIZE PERFORMANCE FOR INDIVIDUAL WORKLOAD

- Flexible, modular architecture
- Multiple innovative form factors
- Deep optimization with hardware acceleration
- Super Fat nodes

ADAPT TO CHANGE



FUTURE PROOF

- Solve problem using emerging hardware technologies
- Single HPC cluster and storage system for both traditional HPC MPI workload and Hadoop
- Leverage flexibility and expandability of cloud technology

END-TO-END GREEN HPC DESIGN



Green IT Reduces Energy Bill & CO2 Emission, Extends DC Life, Lowers TCO

POWER EFFICIENT FORM FACTORS

CPU Load	XH620 V3(X6800)	1U Server	Watt Saving Per Node	% Power Saving Per Node
100%	303	313	10	3%
90%	267	283	16	6%
80%	225	235	10	4%
70%	191	206	15	7%
60%	166	183	17	9%
50%	152	164	12	7%
40%	139	151	12	8%
30%	127	138	11	8%
20%	114	125	11	9%
10%	101	112	11	10%
0%	61	73	11.5	16%

X6800



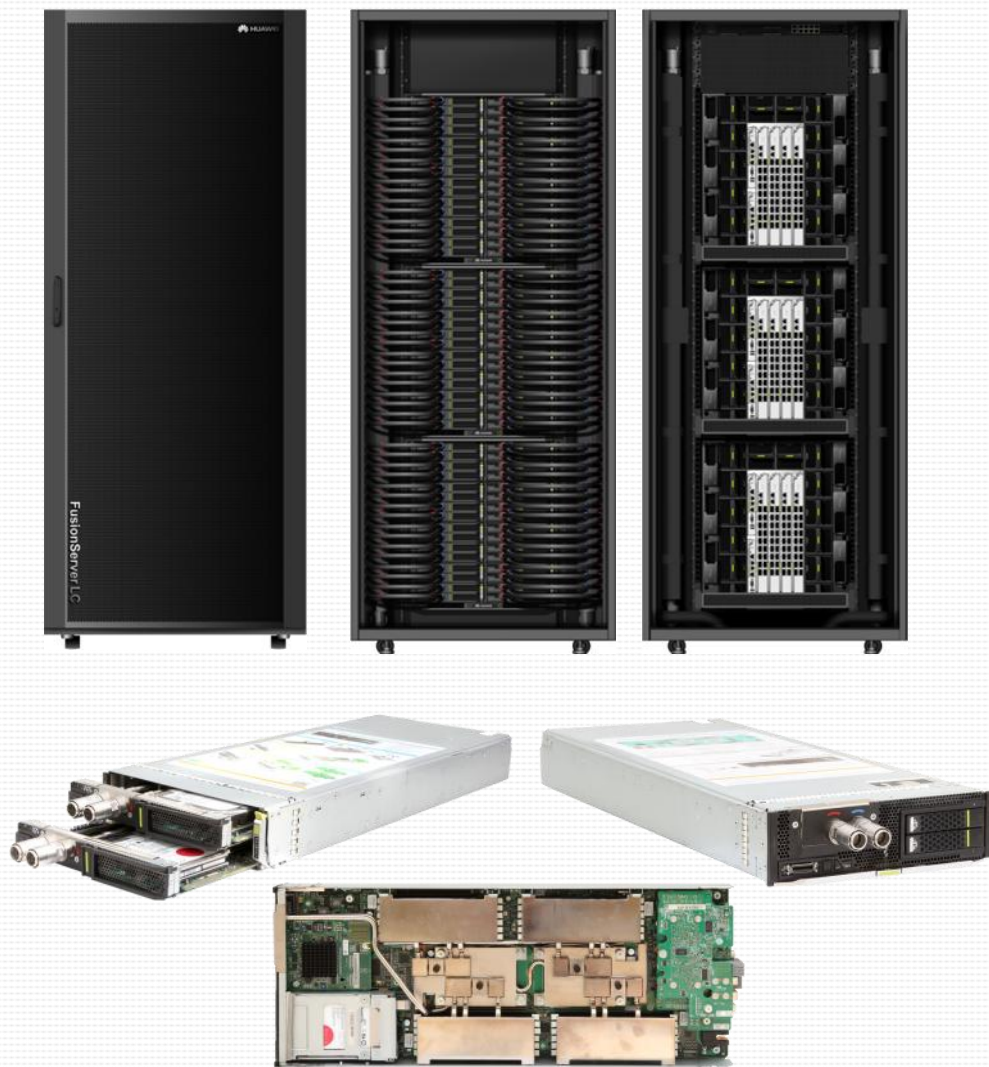
Vs.

1U Server

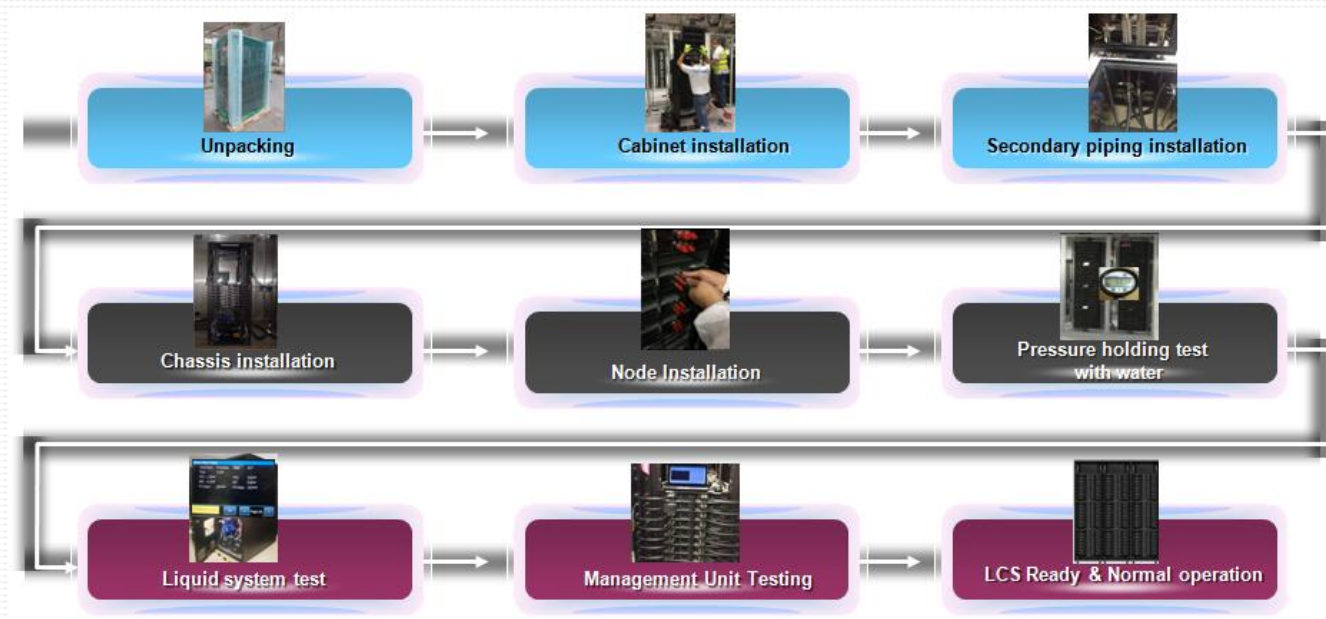


Workload: SPECpower2008, Power Meter: WT210, Thermometer: Digi Watchport/H

HUAWEI FUSIONSERVER LIQUID COOLING SYSTEM



- FusionServer LCS is composed of Liquid Cooling Rack and external CDU
- CPU, Memory and VRD are cooled directly by up to 45 °C water
- Chiller is optional, cooling PUE < 1.1
- Industry leading serviceability

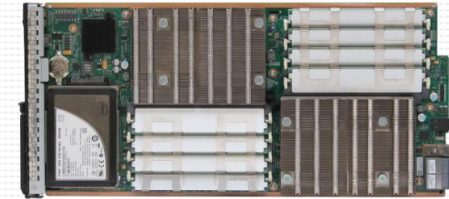
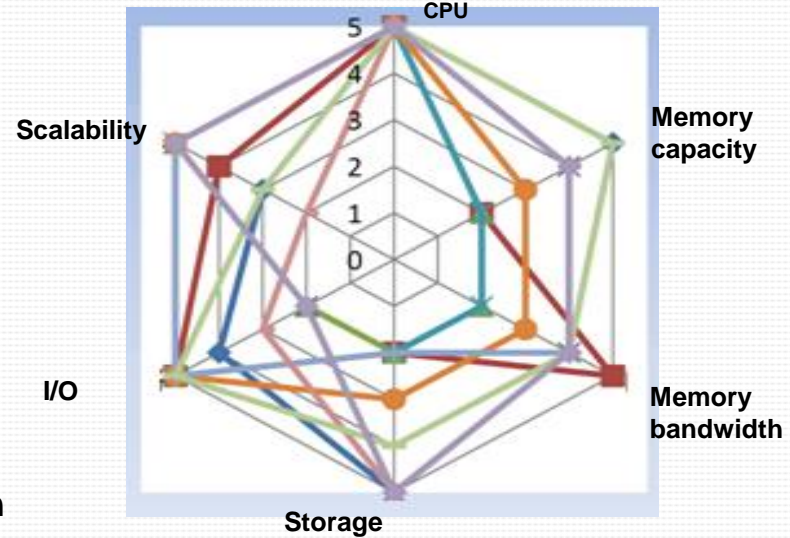


WORKLOAD OPTIMIZED HIGH PERFORMANCE BLADES

Workload Characteristics



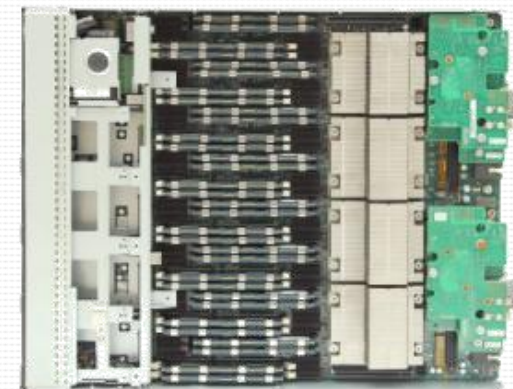
Maximize I/O, Hardware Acceleration



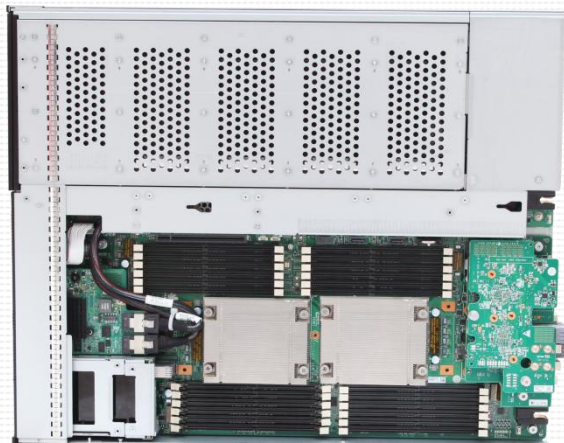
Maximize CPU compute density



Maximize Memory Per Core



Maximize Memory Bandwidth























Maximize Local Storage Per Node



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E9000 HIGH PERFORMANCE BLADE SYSTEM

Chassis	Chassis									
			E9000 chassis Adopts a modular design for computing, storage, switching, power supply, and cooling. 12-U-high chassis, providing 8 full-width or 16 half-width slots. Supports next 3 generations of high-performance Intel CPUs. Supports next-decade network technology evolution.							
Compute node	Compute node									
	CH121 V3	CH140 V3	CH220 V3	CH222 V3	CH225 V3	CH226 V3	CH242 V3			
Switch module	 Half-width 2-socket compute node High density Large memory capacity		 Half-width 2*2-socket twin compute nodes Super high density Outstanding computing capability	 Full-width I/O expansion compute node Large memory 6*PCIe slots	 Full-width storage node Large memory 15*2.5" HDDs/SSDs	 Full-width storage node All-flash 12*NVMe SSDs	 Full-width storage node Large memory 6*3.5" HDDs	 Full-width 4-socket compute node Outstanding computing capability (E7 v2, E7 v3) Superb storage and I/O expansion capability		
	Switch module									
	GE		8G/16G FC		10GE/FCoE converged Ethernet		IB FDR/EDR	40GE	Multi-plane switch module	
	 CX110  CX111  CX116 pass-through		 CX210 8G FC  CX220 16G FC		 CX310  CX311  CX317/CX318 pass-through		 CX611	 CX710	 10GE+FC CX912  GE+FC CX915	

X6800 HIGH DENSITY RACK MOUNT SERVERS

High Density Compute Node



XH620 V3

Big Data Storage Node



XH628 V3


Hardware acceleration Node




XH622 V3




BROAD RANGE OF NVME SSD SERVERS




4 × NVMe RH2288(H) V3




12 × NVMe RH2288H V3




24 × NVMe RH2288H V3




4 × NVMe 5288 V3




4 × NVMe RH5885(H) V3



8 × NVMe RH8100 V3




NVMe SSD Disk




4 × NVMe RH1288 V3

High-Density Server




X6800(4U8)
2 × NVMe XH620 V3

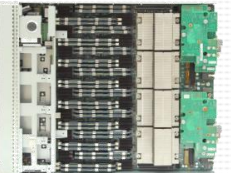


X6000(2U4)
6 × NVMe XH321 V3


Blade Server E9000



12 × NVMe CH225 V3



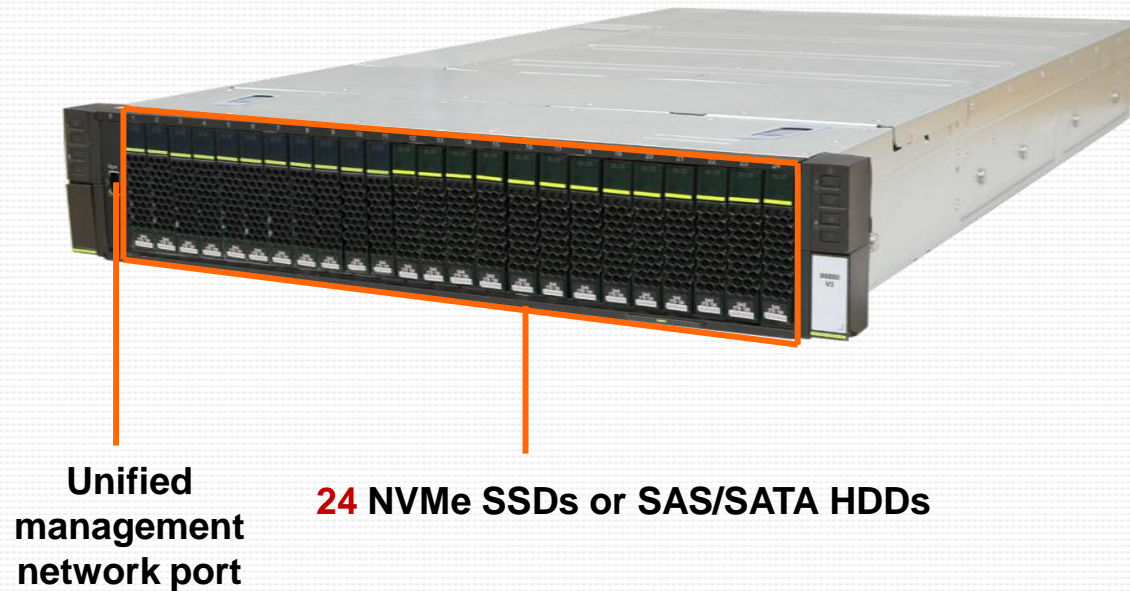
4 × NVMe CH242 V3



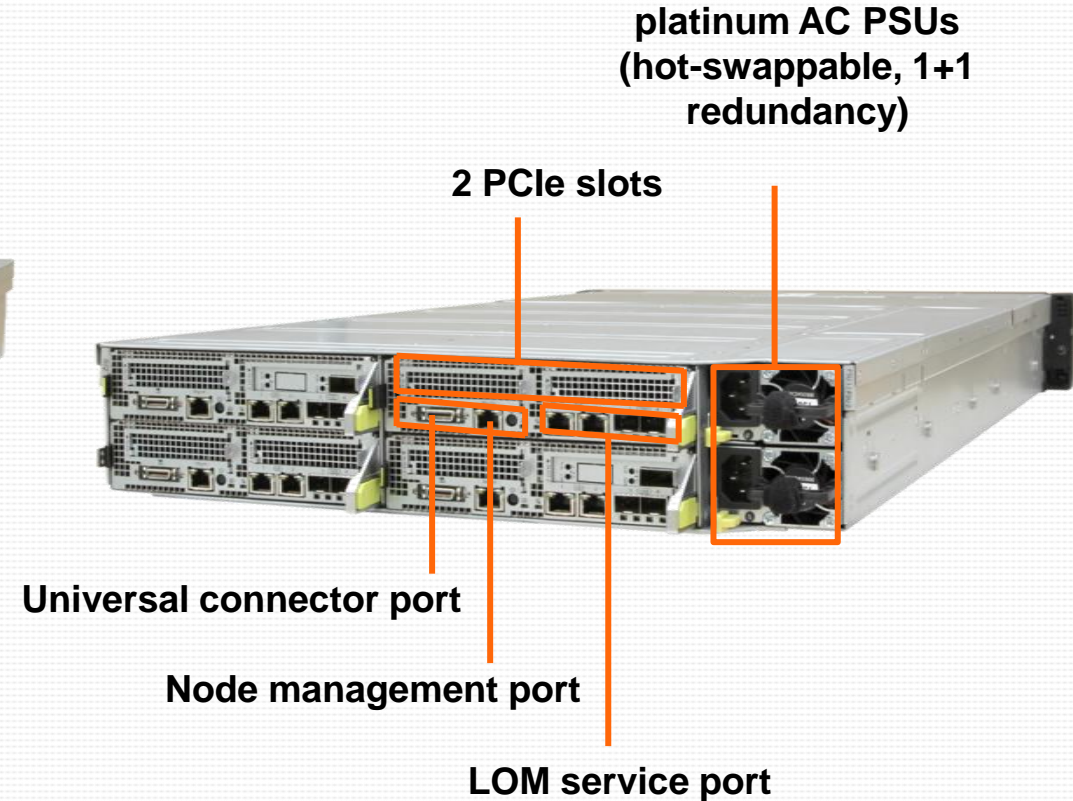
2 × NVMe CH121 V3

FUSIONSERVER X6000 — HIGH-DENSITY SERVER

Front View



Rear View



ACCELERATE HIGH MEMORY BANDWIDTH WORKLOAD WITH FAT NODES

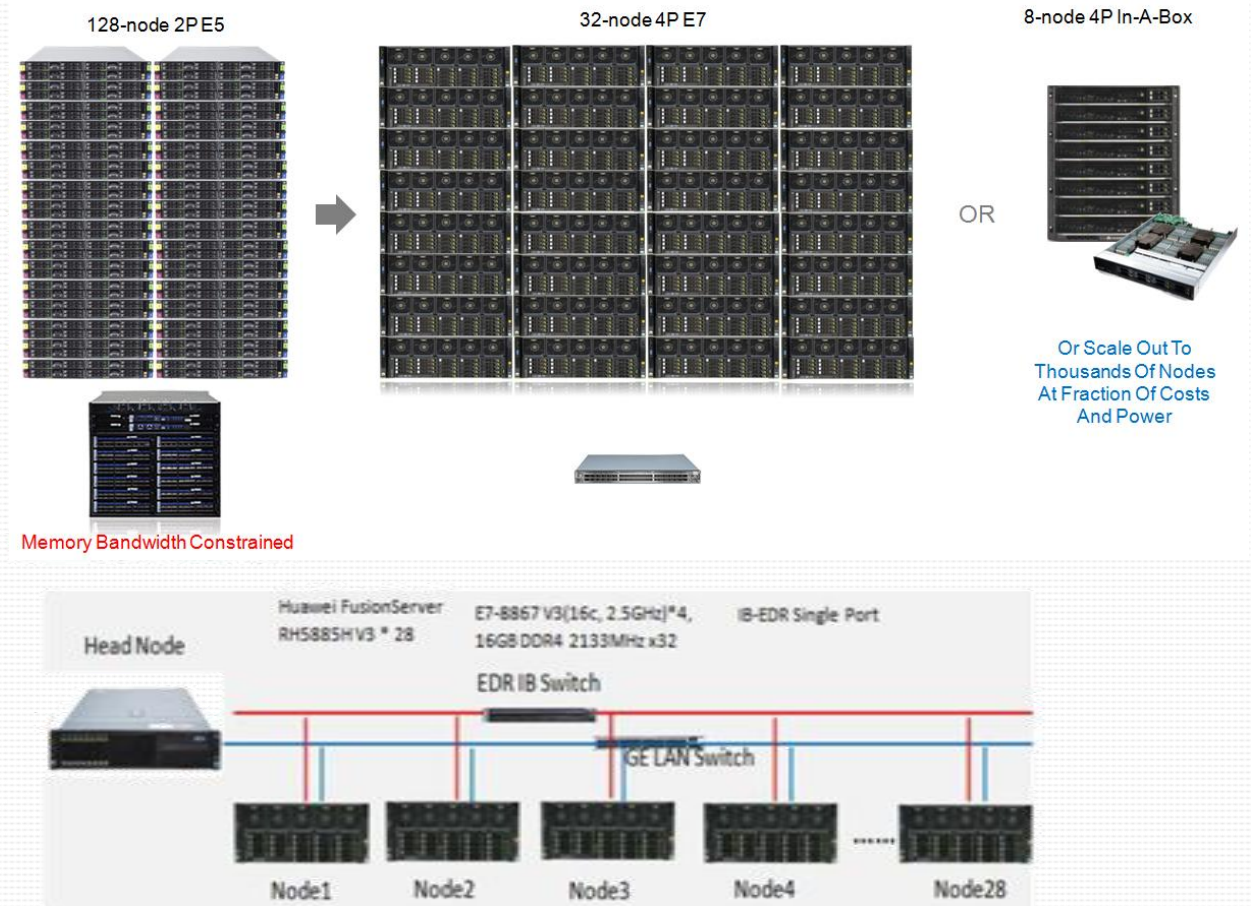
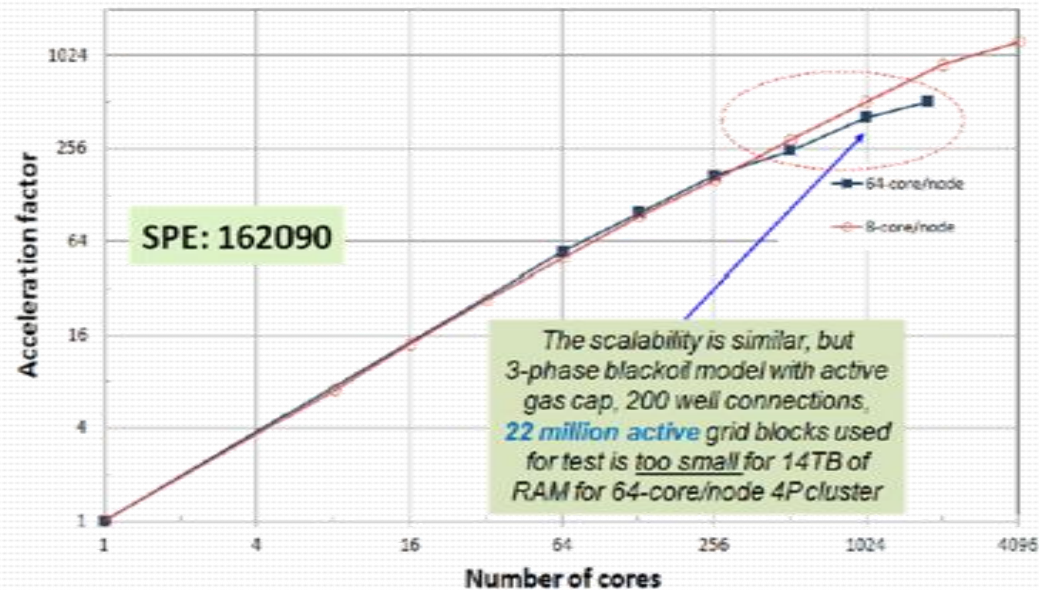
RFD's tNavigator has superior scalability but memory bandwidth constrained

Huawei and RFD collaborated to design and benchmark a new cluster system with Intel E7 4-Socket high memory bandwidth node

Excellent benchmark results



- ~ 30% lower hardware costs
- ~ 50% lower software costs
- ~ 80% lower power



Large Memory Fat Node



SnapVX: <http://snap.stanford.edu/snapvx>



Huawei FusionServer RH8100 V3

12TB RAM

8 Intel Xeon E7 v3 processors

High RAS capability

High serviceability

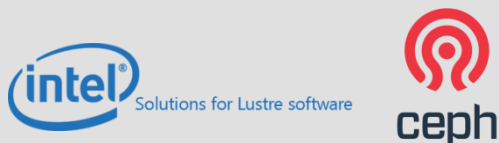
HUAWEI OCEANSTOR STORAGE PORTFOLIO

Virtualization, SSD, Distributed Storage, Software Defined Storage

Unified Storage V3
5300, 5500, 5600, 5800, 6800
Block + File



Unified block & file storage

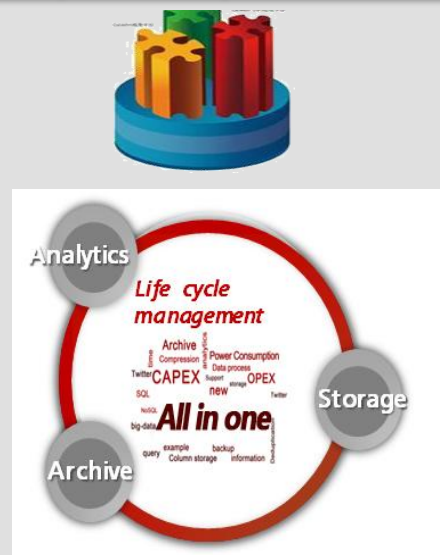


All flash Storage
Dorado 2100G2 & 5100
Block



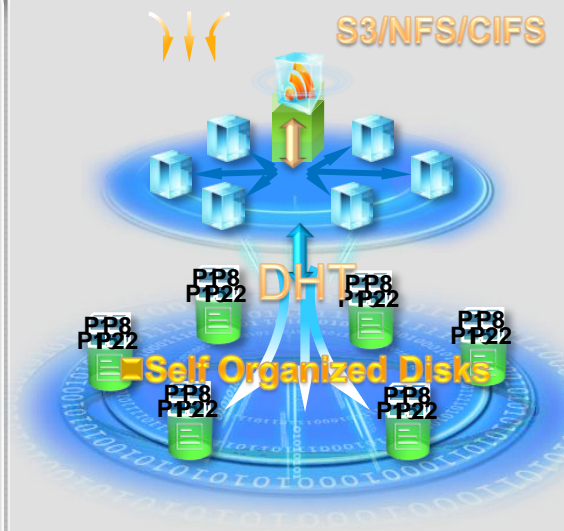
Full flash storage: best ratio of performance/price

All-in-one Mass Data Storage
OceanStor 9000
File + Object + Analysis + Archiving



All-in-One storage solution simplifying data lifecycle management

Mass Data Storage
UDS
Object for Near line & Offline



For global cloud data centers: Decentralized & distributed architecture & highly efficient global data sharing

LEAP FORWARD WITH HUAWEI INNOVATIONS

Enabling HPC Cloud



Open Telekom Cloud

Big Data Acceleration



Performance Optimized Spark



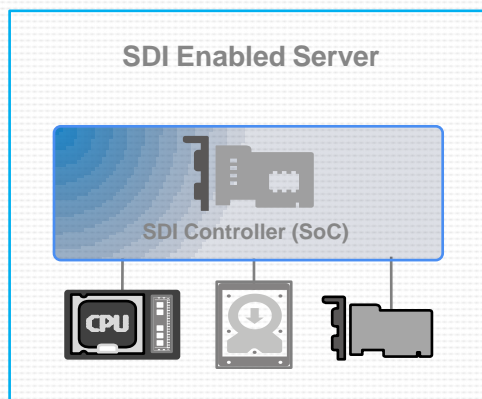
FusionInsight
Big Data >>>>



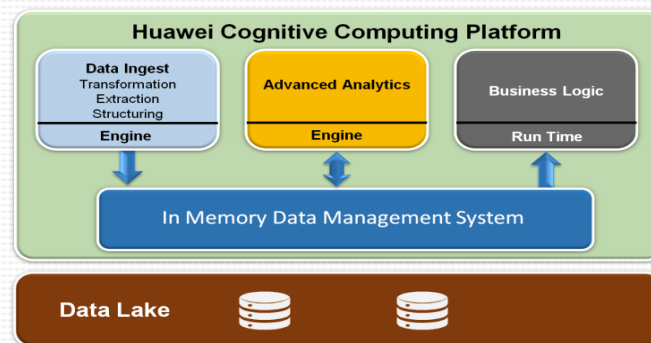
ManageOne
Management software >>>>



Software Defined



Deep Learning



FusionSphere
Cloud OS >>>>



FusionStorage
Software Defined Storage Pool >>>>



NEWSLETTER ON CERN HPC PROJECT

Accelerating science: Open Telekom Cloud in use at CERN
<http://www.telekom.com/media/enterprise-solutions/307124>

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T . . LIFE IS FOR SHARING. Search

Company
Innovation
Responsibility
Investor Relations
Media
Enterprise Solutions
Careers

Telekom TV
DAX 9,950.8
T-Aktie 15.82€ ↑
Time: Fri., Mar. 18 2016
05:45:00 PM CET

Accelerating science: Open Telekom Cloud in use at CERN

Mar 18, 2016

- Deutsche Telekom is awarded a CERN contract for its new service, Open Telekom Cloud, to be used for physics data processing
- 1,000 simultaneous virtual machines and associated cluster storage of more than 500 TB
- Test run for future dynamic cloud provisioning model fully compliant with the EC Data Protection and Data Processing Regulations

CERN, the European Organization for Nuclear Research, has awarded a contract to Deutsche Telekom for its new service, Open Telekom Cloud, launched at CeBIT 2016 to be used for physics data processing. CERN will use, 1,000 simultaneous virtual machines and associated cluster storage of more than 500 Terabyte, for a three months period, to validate if physics data processing can be flexibly out-tasked to a commercial cloud provider. Services will be provided by T-Systems, corporate customers unit of Deutsche Telekom.

CERN will be able to manage its deployment through a user-friendly interface as well as OpenStack APIs for maximum resource customization and flexibility. CERN will benchmark commissioning, service and reporting performance for such large-scale deployments.

This contract will allow Deutsche Telekom to show the capabilities and strength of its new public cloud services, a market segment that up to now has been dominated by its U.S. competitors. The high-capacity connectivity required will be supported by Deutsche Telekom's multi-award-winning network providing at least 10G bandwidth and peering options with the German and European Research Networks.

T . . Registrieren | Anmelden

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Home > Cloud Infrastructure > Open Telekom Cloud

OPEN FOR YOUR INNOVATION

CLOSED FOR EVERYBODY ELSE

Operated by T-Systems Hosted in Germany openstack

Open Telekom Cloud
from T-Systems International GmbH
Category: Cloud Infrastructure

Scalable and cost-effective infrastructure from Germany

With Open Telekom Cloud, Deutsche Telekom is offering a secure Infrastructure as a Service solution on the basis of OpenStack.

- Server and storage at the press of a button
- Hosting in highly secure Telekom computing centres in Germany
- Favourable prices and maximum flexibility

Find out more or Configuration

Create your individual IaaS solution



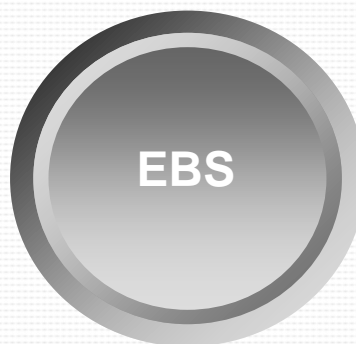
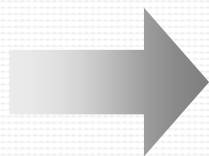
Open Telekom Cloud

06.02.2017

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HPC CLOUD CASE STUDY

Key Requirements



HPC resource pool

- 1000VMs (\geq 4vCPU /8GB MEM /100GB local disk)
- No CPU/RAM **overcommitment**
- **KV Performance:** $\leq 1.2s/event$

Low latency block disk

- **500TB** block disk
- From VM to block storage roundtrip access **RTT** $\leq 5ms$

High bandwidth network

- Bandwidth from in-house OpenStack data center to VPC on OTC: **10Gbps**
- **NAT** to internet for VMs = **1:1**
- **20TB/per day** data transmission from in-house OpenStack Cloud to OTC

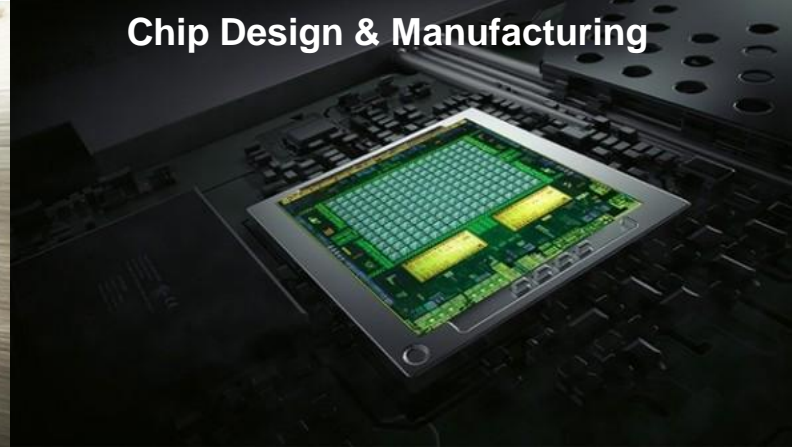
1000VMs on OTC at the first stage. Potentially 10000 VMs on OTC in the future

HUAWEI HPC MOMENTUM

Manufacturing CAE/CFD



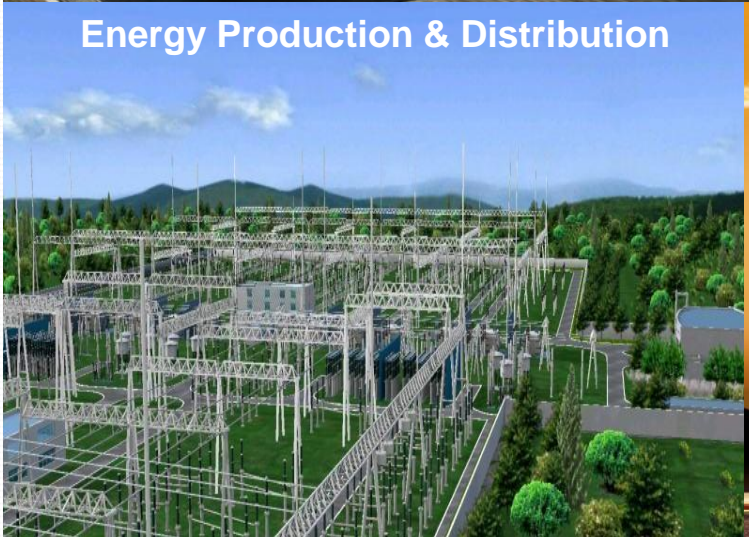
Chip Design & Manufacturing



Education/Research/Supercomputing



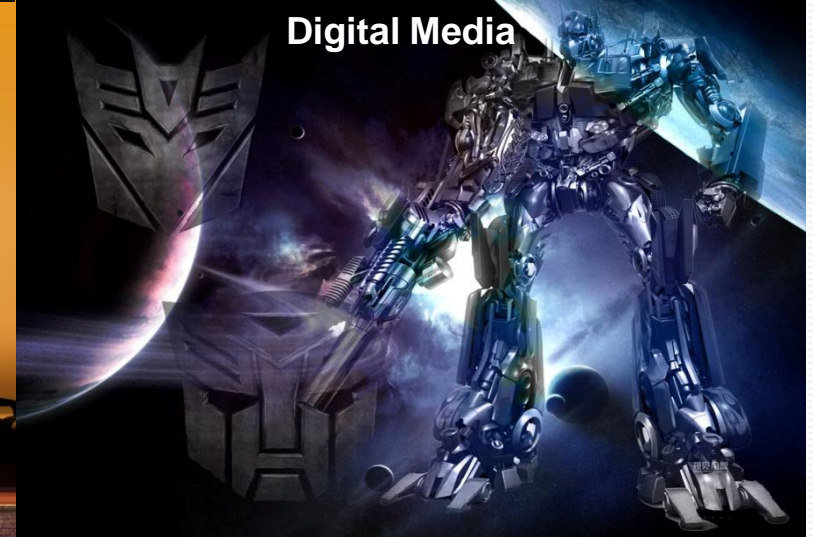
Energy Production & Distribution



Oil & Gas Exploration



Digital Media



HUAWEI HPC SOLUTIONS

MAXIMIZE ACCELERATE ADAPT