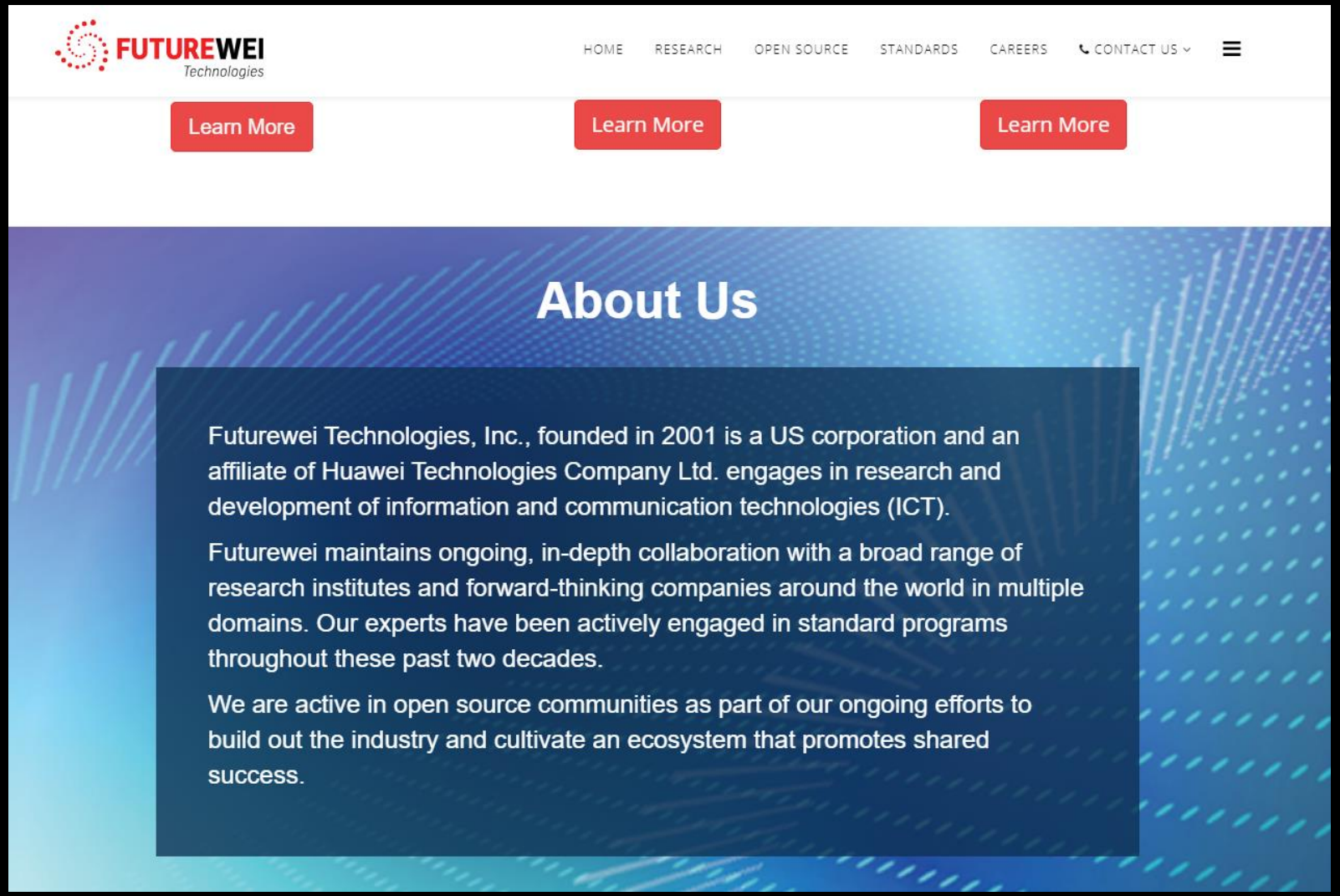
Huawei Intelligent Computing Product & Solutions

Date: March 2021



www.futurewei.com

FUTUREWEI
Technologies

20 Years of Strategic Partnership with Intel Continuously Providing the Latest Technology and Products

Total 5M+ Units Shipped (2012-2020)

2001

In 2001, signed a strategic partnership.

.....

2016

Joint launch of KunLun, 32-socket mission-critical server.

Set up a joint innovation computing center in Hangzhou.

2017

Jointly hold CTO summits to start strategic cooperation in AI, edge computing, and cloud computing.

2019

Jointly released the second-generation Intel Xeon scalable processor-based FusionServer Pro intelligent server.

2020

FusionServer Pro intelligent server based on the third-generation Intel Xeon scalable processor.

Huawei FusionServer Pro Intelligent Server

V5	V6	V7
2017	2020	2022
1st Gen Skylake 2nd Gen Cascade Lake	3rd Gen Cooper Lake (4-8) 3rd Gen Ice Lake (1-2)	NG Sapphire Rapids

Intel's latest technologies and products

Cascade Lake Refresh Processor

Intel® Optane™ Persistent Memory

3rd Generation Intel ® Xeon ® scalable processor

FUTUREWEI Technologies

VMware Continues Compatibility Certification & Technical Support

- ✓ Partners such as **VMware**, **SUSE** and **Ubuntu** will continue to work with Huawei to provide compatibility certification and technical support for **FusionServer Pro** servers.

On May 23, 2020, VMware announced that Huawei FusionServer Pro 2288H V5 and other servers have passed the latest VMware vSphere 7.0 compatibility certification.

***VMware vSphere, vSAN, and vCenter will continue to provide compatibility certification and technical support for Huawei FusionServer Pro servers.**

The latest 2488H V6 (Copper Lake) has been certified

Huawei Technologies Co., Ltd.	2488 V5	Intel Xeon Platinum 8200 (Cascade-Lake-SP) Series	ESXi	7.0 U1	7.0	6.7 U3	6.7 U2
Huawei Technologies Co., Ltd.	2488H V5	Intel Xeon Gold 6100/5100, Silver 4100, Bronze 3100 (Skylake-SP) Series	ESXi	7.0 U1	7.0	6.7 U3	6.7 U2
Huawei Technologies Co., Ltd.	2488H V5	Intel Xeon Gold 6200/5200 (Cascade-Lake-SP/Refresh) Series	ESXi	7.0 U1	7.0	6.7 U3	6.7 U2
Huawei Technologies Co., Ltd.	2488H V5	Intel Xeon Platinum 8100 (Skylake-SP) Series	ESXi	7.0 U1	7.0	6.7 U3	6.7 U2
Huawei Technologies Co., Ltd.	2488H V5	Intel Xeon Platinum 8200 (Cascade-Lake-SP) Series	ESXi	7.0 U1	7.0	6.7 U3	6.7 U2
Huawei Technologies Co., Ltd.	2488H V6	Intel Xeon Gold 6300/5300 (Cooper-Lake-SP) Series	ESXi	7.0 U1			
Huawei Technologies Co., Ltd.	2488H V6	Intel Xeon Platinum 8300 (Cooper-Lake-SP) Series	ESXi	7.0 U1			
Huawei Technologies Co., Ltd.	5288 V5	Intel Xeon Gold 6100/5100, Silver 4100, Bronze 3100 (Skylake-SP) Series	ESXi	7.0 U1	7.0	6.7 U3	6.7 U2
Huawei Technologies Co., Ltd.	5288 V5	Intel Xeon Gold 6200/5200 (Cascade-Lake-SP/Refresh) Series	ESXi	7.0 U1	7.0	6.7 U3	6.7 U2
Huawei Technologies Co., Ltd.	5288 V5	Intel Xeon Platinum 8100 (Skylake-SP) Series	ESXi	7.0 U1	7.0	6.7 U3	6.7 U2
Huawei Technologies Co., Ltd.	5288 V5	Intel Xeon Platinum 8200 (Cascade-Lake-SP) Series	ESXi	7.0 U1	7.0	6.7 U3	6.7 U2
Huawei Technologies Co., Ltd.	5288 V5	Intel Xeon Silver 4200, Bronze 3200 (Cascade-Lake-SP/Refresh) Series	ESXi	7.0 U1	7.0	6.7 U3	6.7 U2
Huawei Technologies Co., Ltd.	5288X V5	Intel Xeon Gold 6200/5200 (Cascade-Lake-	ESXi	7.0 U1	7.0	6.7 U3	6.7 U2

https://www.vmware.com/resources/compatibility/search.php?deviceCategory=server&details=1&partner=242&evcModes=19&page=1&display_interval=50&sortColumn=Partner&sortOrder=Asc

FUTUREWEI Technologies

8+ Years Co-Innovation for Build Industry-Leading HANA Solutions

✓ Our Latest SAP HANA solution is available for our latest 2488H V6 server with Optane Memory for big Applications

Huawei became SAP's first global technical partner in China
July 2012

Huawei and SAP jointly launched Tecal RH5885 V2, the first SAP HANA appliance
Feb. 2013

Strategic alliance partnership: Huawei released the certified SAP HANA FusionCube solution at CeBIT 2014
Mar. 2014

Huawei and SAP signed a MoU at CeBIT 2015 to deepen collaboration in Industry 4.0 and the IOT
Mar. 2015

As a top-level sponsor, Huawei attended the SAPPHIRE NOW 2016 global flagship conference held by SAP in Orlando, USA.
May 2016

Huawei & SAP Co-Innovation Center was inaugurated in Zone G of Huawei HQ, Shenzhen.
Aug. 2018

SAP attended HUAWEI CONNECT 2018 as a diamond sponsor and major partner.
Oct. 2018

Huawei and SAP launched the FusionServer Pro V6 SAP HANA solution at HUAWEI CONNECT 2020.
Sep. 2020

2012 — 2013 — **HANA platform adoption** — 2014 — 2015 — 2016 — **SAP Hybris & Ariba contract signed** — 2017 — **MaxAttention for Hybris Billing LIVE @ CBG** — 2018 — **Hybris Billing Rollout @ CBG & Cloud** — 2019 — 2020

Ren Zhengfei, founder of Huawei, met with Jim Snabe, Co-CEO of SAP.
Sep. 2012

Huawei Day was held at Walldorf, Germany, the SAP headquarter.
July 2014

Huawei and SAP announced the official opening of the Huawei & SAP Co-Innovation Center in Shenzhen.
June 2015

SAP conferred the dkom award on Huawei.
Dec. 2015

Huawei won the SAP HANA® Innovation Award at SAPPHIRE NOW held in Orlando.
May 2017

Huawei attended SAP China Summit as a diamond sponsor to explore market opportunities and innovation.
Sep. 2018

Huawei introduced the persistent memory HANA solution for larger HANA memory capacity.
May 2019

SAP Max. Attention | SAP and Huawei Day | Huawei & SAP Co-Innovation Center

FUTUREWEI Technologies

Fruitful Results from Huawei-SAP Close Cooperation

400+ multiple joint innovations

Since 2012, SAP and Huawei have jointly developed more than 400 technological innovations

One of SAP HANA's largest customers in China

SAP helps Huawei build the largest SAP HANA-based big data platform in Asia to realize real-time insights in Huawei's finance, supply chain and other fields

One of SAP largest market partners

Huawei and SAP work together to jointly develop the SAP market

CEPSA RedBull BELWEST

Deloitte. T··· Telefónica

CNPC TOUS Standard Bank

中国南方电网 中国电网 中石化

1,600+ customers

60+ countries

25+ industries

FUTUREWEI Technologies

Support All three SAP HANA Models for Flexible Deployment

- ✓ All three SAP HANA Delivery models are supported for flexible deployment
- ✓ With the latest 2488H V6 with Optane Memory, up to 18TB memory per node could be supported

Single-node solution

KunLun 9008 V5 (8S)

2488H V5/V6 (4S)

2288H V5 (2S)

Cluster solution

FusionServer Pro & KunLun

OceanStor

TDI solution

FusionServer Pro & KunLun

OceanStor /Dorado

KunLun 9008 V5

2S/1.5 TB

2S/3 TB

4S/3 TB

4S/6 TB

6S/4.5 TB

6S/9 TB

8S/6 TB

8S/12 TB

2488H V5/V6

2S/1.5 TB

2S/3 TB

4S/3 TB

4S/6 TB

Up to 18TB memory/Node with 2488H V6

FusionServer Pro V6 SAP HANA Solution is READY

FusionServer Pro 2488H V6 SAP HANA solution
(Single-node solution/Cluster solution/TDI solution)

SAP® Certified
Hardware for SAP HANA®

112 cores
Stronger computing power

18 TB
Larger memory

NVMe SSD
Higher performance

Stronger computing power, improving SAPS performance by 10%*

- ✓ 4 x 3rd Gen Intel® Xeon® Scalable processors with a TDP of up to 250 W/CPU and 112 cores, improving SAP BWH Benchmark performance by over 10%

Larger memory, reducing CAPEX by 20%

- ✓ 48 DIMM slots, supporting the Intel® Optane™ persistent memory (PMem) 200 series for up to 18 TB memory capacity

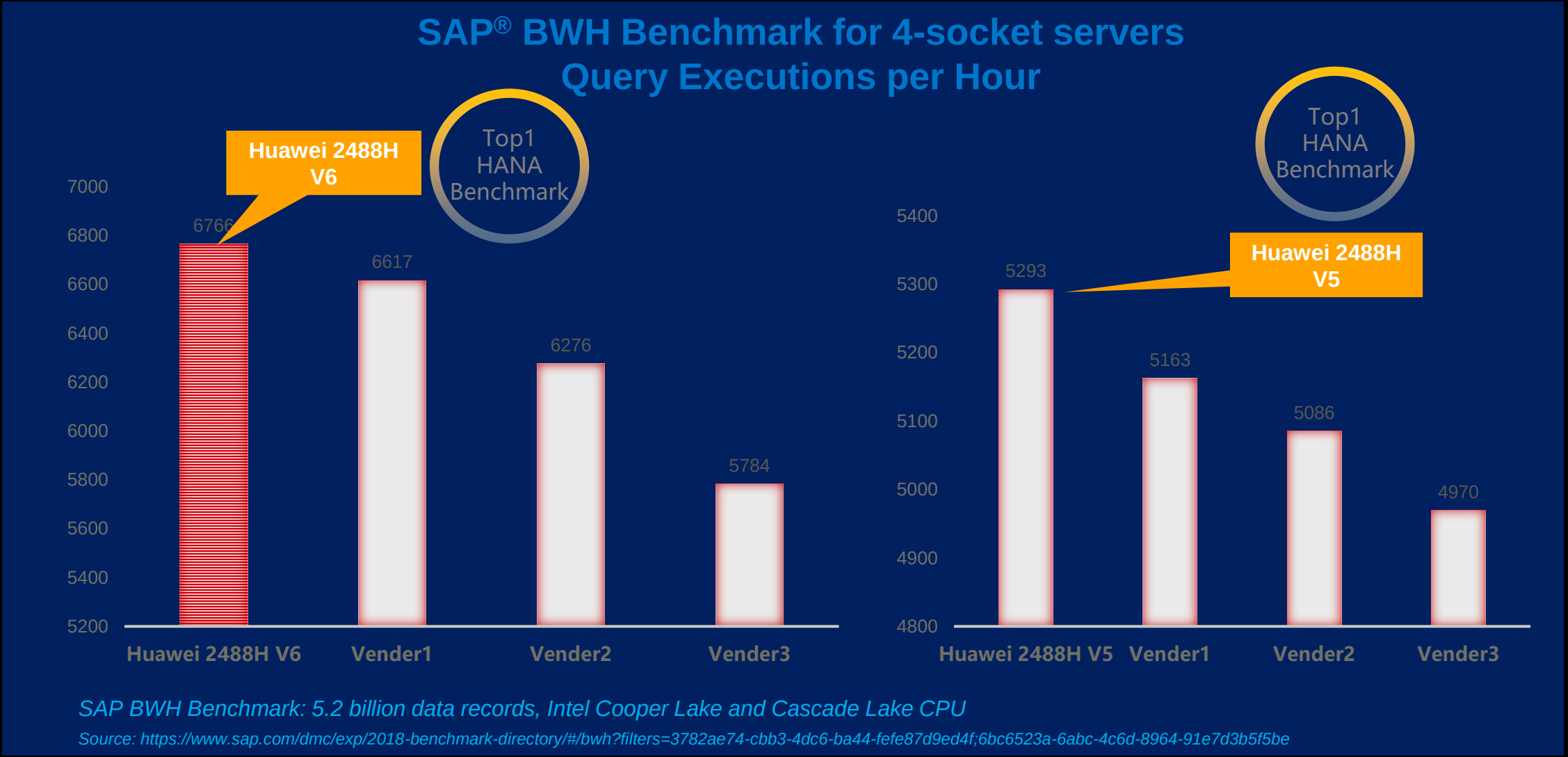
NVMe SSD, boosting performance by 30%

- ✓ Supporting HANA appliances with NVMe SSDs and SAS SSDs, NVMe SSDs yield a 30% higher performance over SAS SSDs.

*SAP Application Performance Standard (SAPS) is an authoritative performance indicator in the SAP industry. Generally, SAPS in HANA projects refers to the score in the SD2 benchmark test. In technical terms, 100 SAPS is equivalent to 2,400 SAP transactions per hour, or 6,000 dialog steps (screen changes) and 2,000 postings per hour.

FUTUREWEI Technologies

Huawei X86 Servers Leading SAP HANA Performance Benchmark



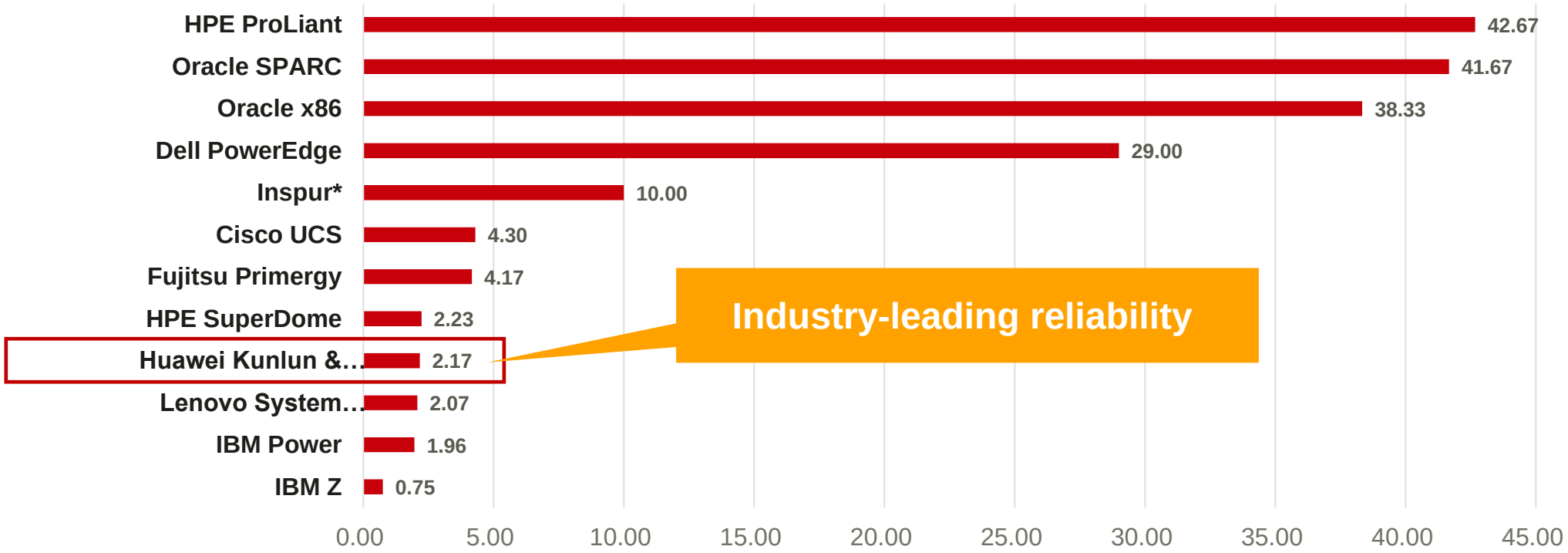
SAP BWH Benchmark: 5.2 billion data records, Intel Cooper Lake and Cascade Lake CPU

Source: https://www.sap.com/dmc/exp/2018-benchmark-directory/#/bwh?filters=3782ae74-cbb3-4dc6-ba44-fefe87d9ed4f;6bc6523a-6abc-4c6d-8964-91e7d3b5f5be

FUTUREWEI Technologies

Huawei KunLun X86 Servers Leading Reliability for SAP HANA

Unplanned Downtime Due to Inherent system or component flaws per Minute/per Server (2018~2020)



Source: ITIC 2018~2020 Global Server Hardware Server OS Reliability Survey Results

https://itic-corp.com/blog/2018/08/itic-2018-server-reliability-mid-year-update-ibm-z-ibm-power-lenovo-system-x-hpe-integrity-superdome-huawei-kunlun-deliver-highest-uptime/

https://itic-corp.com/blog/2019/11/ibm-lenovo-hpe-and-huawei-servers-maintain-top-reliability-rankings-cisco-makes-big-gains-ibm-lenovo-hardware-up-to-24x-more-reliable-28x-more-economical-vs-least-reliable-white-box-servers/

https://itic-corp.com/blog/2020/05/itic-2020-reliability-poll-ibm-lenovo-hpe-huawei-mission-critical-servers-deliver-highest-uptime-availiability/

* *Inspur has the data of 2020 only*

FUTUREWEI Technologies

Huawei Server Winning Extensive Customer Recognition

211 of the Fortune Global 500 companies and 48 of the Top 100 companies have chosen Huawei as their digital transformation partner. Our service products and solutions are widely used in the energy, transportation, finance, and manufacturing industries.

170+
Power companies

211
G500

48
G100

300+
Financial institutes

1,000+
Manufacturing companies

260+
Oil and Gas

5+ Million Units

shipped

(2012 - 2020)

FUTUREWEI Technologies

Huawei Server Honor List

400+

New SPEC test records

15%

lower failure rate than industry average*

Trusted & Recognized

Best Supplier**

Gartner MQ Challenger

10000+ Customers

across 25+ industries

* Source: internal statistics of key accounts in the Internet and finance industries
** Awarded by Tencent and Alibaba

FUTUREWEI Technologies

Rich Portfolio to Meet Your Every Intelligent Computing Need

- ✓ Rich Product Portfolio to meet your needs for different application scenarios:
  - Balanced, Computing or Storage Intensive, Air or Liquid Cooling, Rack or Blade, etc.
- ✓ Full series upgraded to the latest Intel Cascade Lake Refresh / Cooper processor, synchronous to Intel CPU Release Schedule

Mission Critical

KunLun 9008 V5

Full Liquid Cooling Solution for HPC

X6000 XH321L V5

E9000 CH121L V5

Converged Blade Servers

E9000

General

CH121 V5

Compute-intensive

CH242 V5

10/25/40/100GE
8/16G FC, FDR/EDR IB

Rack Servers

General

1288H V5

Balanced

2288H V5

Storage-intensive

2298 V5

Compute-intensive

5288 V5

2488/H V6

Mission critical

5885H V5

High-Density Servers

2U 4-node

X6000

Compute-intensive

XH321 V5

XH321L V5

4U 4-node

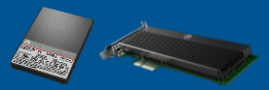
X6800

Storage-intensive

XH628 V5

Intelligent Acceleration Engine

NVMe SSD

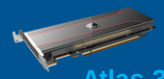


ES3000 V5

Intelligent NIC

IN200/300

AI accelerator card



Atlas 300

Intelligent Management Engine

FusionDirector

5 intelligent management features

Heterogeneous Servers

G5500 full-width server

G5500 half-width server

Nvidia V100 GPU shipping
Ampere GPU coming

FUTUREWEI Technologies

Continuous Evolution Roadmap Synchronous to Intel Release Schedule

HUAWEI

What Customers Considered When Choosing Huawei Computing

✓ Quality Products
- DNA of Telecomm Products, E2E Quality Control

✓ Innovative Product Features
- Enabled by Self-Developed ASICs for Management, Perf, Deployment & Diagnosis

✓ Knowledgeable & Experienced Team
- Both Hardware & Software, Applications & Operations

✓ Long-Term Commitment & Support
- Both spare Parts & Software

✓ Local Support
- Quick response & Easy to reach

✓ Competitive Pricing for TCO
- Not Only CAPEX, but also OPEX

✓ Partnership & Ecosystem
- Strategic Partnership with key players, X86 ecosystem

✓ Rich Product Portfolio
- No One Fits All, Rich Models to choose

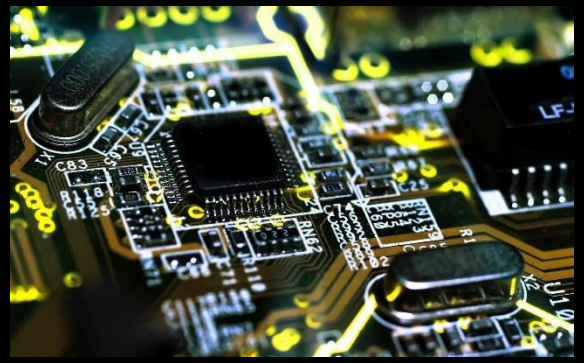
✓ Consolidation of Suppliers
- The same supplier for CT & IT, fewer suppliers to Manage

HUAWEI

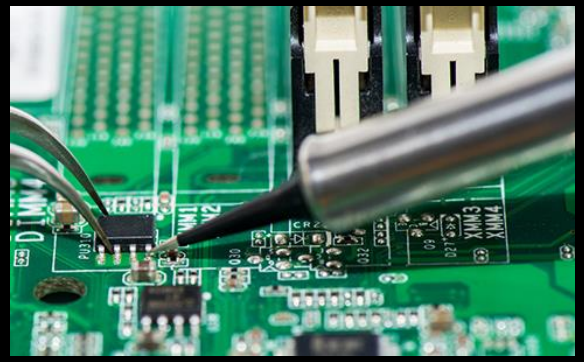
Quality Product by Design, Process, Sourcing and Testing

Over 30 years of hardware design, development, and manufacturing capabilities coupled with complete product R&D and test processes to maximize server reliability, reduce downtime and data loss, and enhance device maintainability

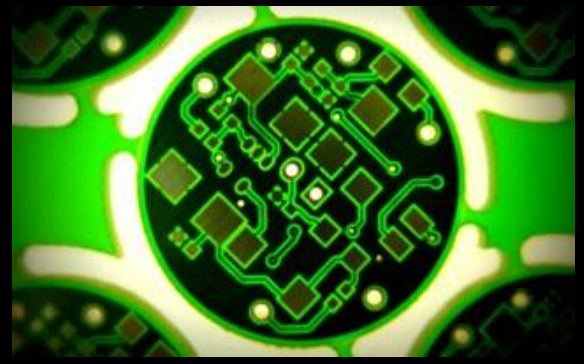
Component Selection and Process Technique



High Reliability Design



Strict Test and Certification



Enhanced O&M Features

Hard Disk Failure rate

40%⬇

Source: Per Internal Testing & O&M Data Collections

Working Temperature

45°C

Source: Internal Lab Tested for most products

Machine Failure rate

15%⬇

Source: Per a Large Customer Statistics

Efficient Heat Dissipation, Stable Operation at 45°C

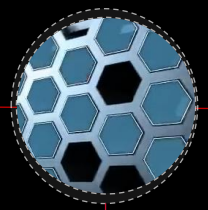
The strict electronic component selection, flow-dividing air ducts and independent air channels, and end-to-end heat dissipation design improve heat dissipation efficiency and prolong the service life of electronic components, allowing servers to run stably even when the air conditioners in equipment room are faulty.

≥30%

Reserved margin for component derating design

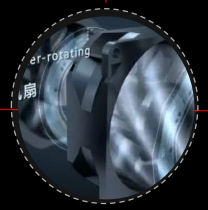
75%

Cellular board design increases porosity rate of the front panel



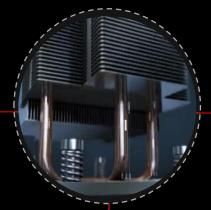
30%

Counter-rotating fans for higher wind speeds



3%

3D VC heat dissipation with higher efficiency than common VC heat dissipation



9%

Flow-dividing air duct and independent air channels for BIO modules improve heat dissipation efficiency

45°C

Stable running at high temperature

For most models

Related Videos "Efficient Heat Dissipation"

FUTUREWEI Technologies

Triple Anti-Vibration Designs Reduce HDD Failure Rate by 60%

Triple anti-vibration designs for hard drives: Mechanical hard drives have the highest failure rate among server components. The triple anti-vibration designs for hard drives improve stability and reduce the hard drive failure rate.

0.78%

Industry server drive failure rate

Vibration-damping screws

Vibration source: 8 vibration-damping screws reduce impact of fan vibration on the fan tray

Enhanced rigidity

Vibration path: enhanced chassis rigidity mitigates vibration transfer

Metallic spring washer & high-damping cushion

Receptor protection: vibration-absorbing components added to drive trays

0.31%*

Huawei server drive failure rate

* Based on the fault statistics of 26,000 hard drives from the data center of a major financial customer.

FUTUREWEI Technologies

FusionDirector: 5 Intelligent Management Features Reduce OPEX

Intelligent Asset Management

Server model, configuration, inventorying, and retirement
Inventorying in seconds, improving space utilization by 10%+

Intelligent Deployment Management

Automatic deployment in data center cabinets
10x device rollout efficiency

FusionDirector

Intelligent Management Engine

Intelligent Version Management

Automatic version matching, one-click update
Preparation done in seconds, reducing update steps from 20 to 3

Intelligent Fault Management

Fault prewarning, diagnosis, and locating
7–30 days in advance for fault prediction,
93% fault locating accuracy

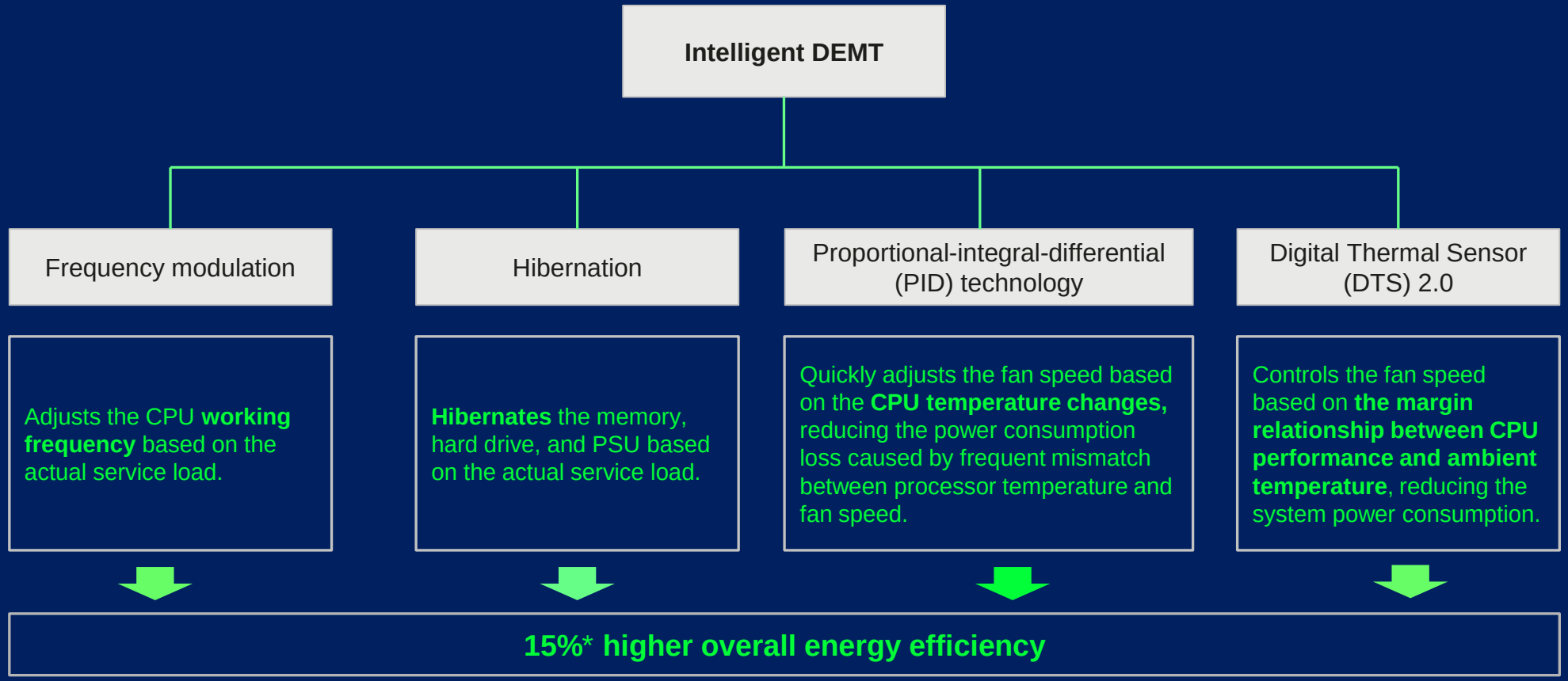
Intelligent Energy Efficiency Management

Server DEMT, cabinet power capping, and data center linked control
10% server energy saving, 20% higher deployment density

HUAWEI

Huawei Server DEMT for 15% higher overall energy Efficiency

The Dynamic Energy Management Technology (DEMT) is a set of technologies that intelligently adjust the power consumption of each component in real time, according to multiple input parameters such as load and ambient temperature.



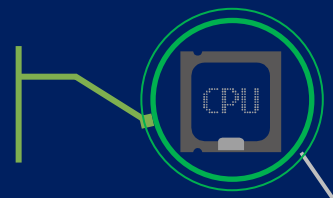
*Data source: Huawei Server Performance Tuning Lab

FUTUREWEI Technologies

Huawei FDM Delivers up to 93% Fault Locating Accuracy*

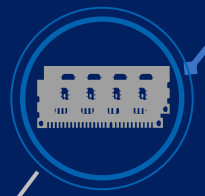
Fault Diagnosis & Management (FDM) is a set of processes and mechanisms for automatic fault information collection (in-band and out-of-band), analysis, diagnosis, and alarm/pre-warning. This greatly improves the fault handling efficiency and shortens the impact of faults on services.

- Out-of-band collection of CATERR fault information
- Precise locating of MCERR and IERR
- Diagnosis logs



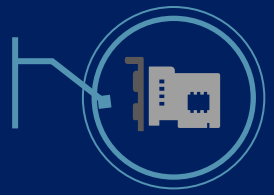
CPU

- Memory address error parsing
- Correctable error storm suppression
- Fault locating of the memory link/slot

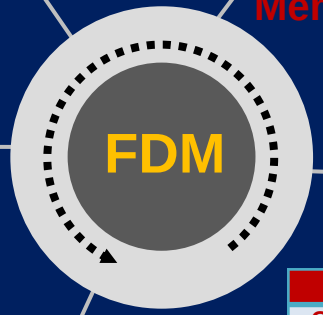


Memory

- Accurate diagnosis of PCIe card faults



PCIe



Others

- Fault diagnosis of multiple links, such as network switching links and SAS links
- OS crash information collection

- Storage medium fault alarm and pre-diagnosis
- Storage link diagnosis
- HDD/NVMe/SSD/M.2

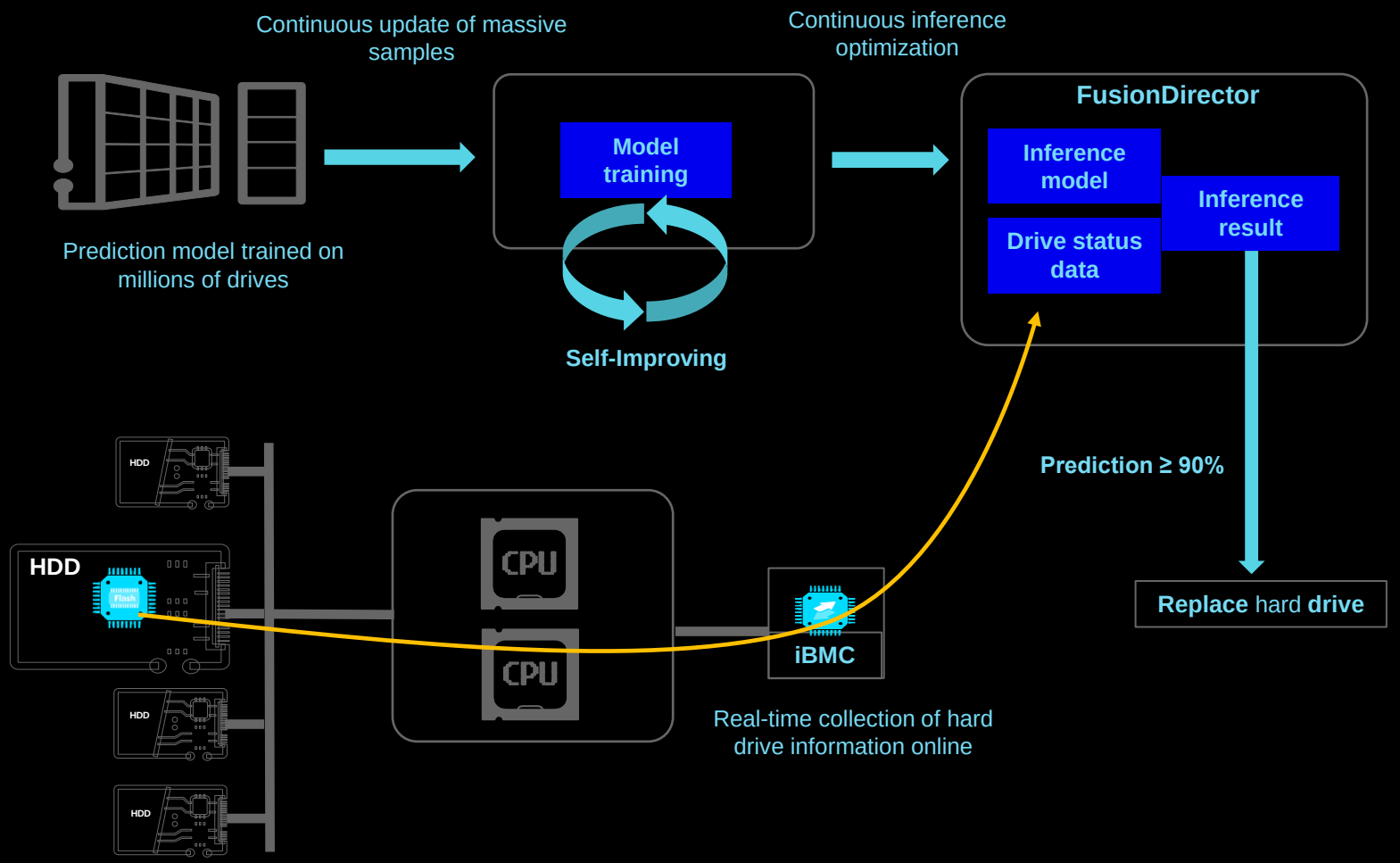
Storage components

Comparison with Competitors

Comparison Item	Competitor	Huawei FDM
CATERR error collection	Live-network faults cannot be collected onsite.	Fault information is automatically collected comprehensively at a time on site. The information collection does not rely on fault reproduction.
CATERR fault locating	Manual analysis, low success rate	Automatic fault locating: The automatic locating success rate is 80%, the total locating success rate is 93%, and the diagnosis scope is wide.
Other troubleshooting capabilities	Rely on the common fault handling capabilities of the OS; no prewarning capabilities.	Automatic collection, expert system fault alarm, memory correctable error storm parsing and prewarning

* Source of data: CATERR fault statistics of the Huawei server O&M team

Intelligent Fault Prediction: Predicts Risky Hard Drives 7–30 Days in Advance



Real-time — Real-time collection of drive SMART information for model analysis on the cloud

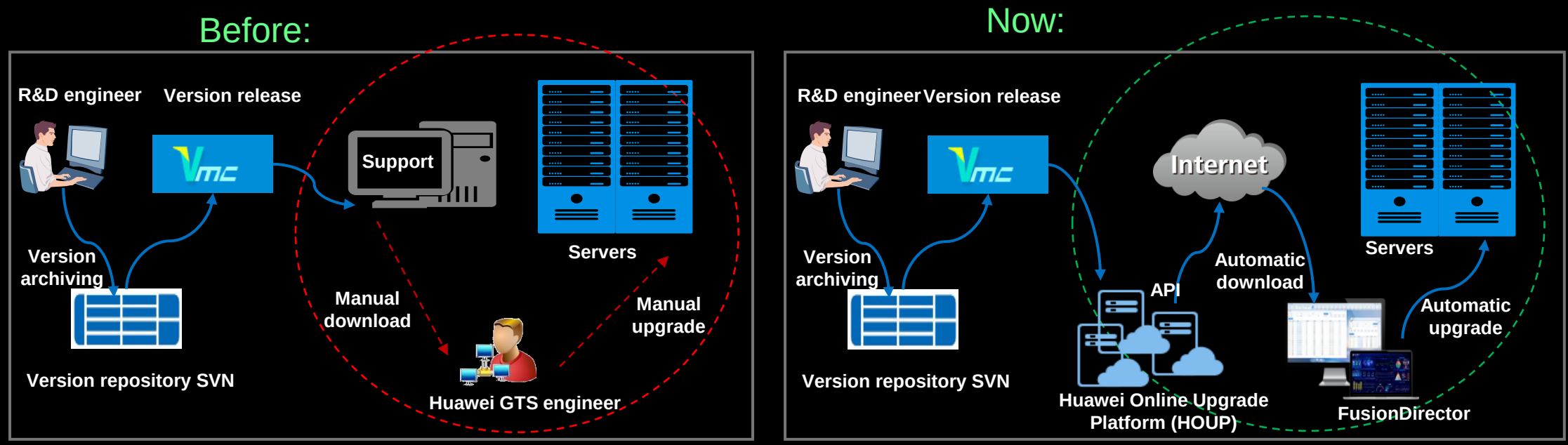
Accurate — Prediction Accuracy ≥ 90%

Reliable — Lower multi-drive simultaneous failure rate

Efficient — 90% less manpower for fault locating

HUAWEI

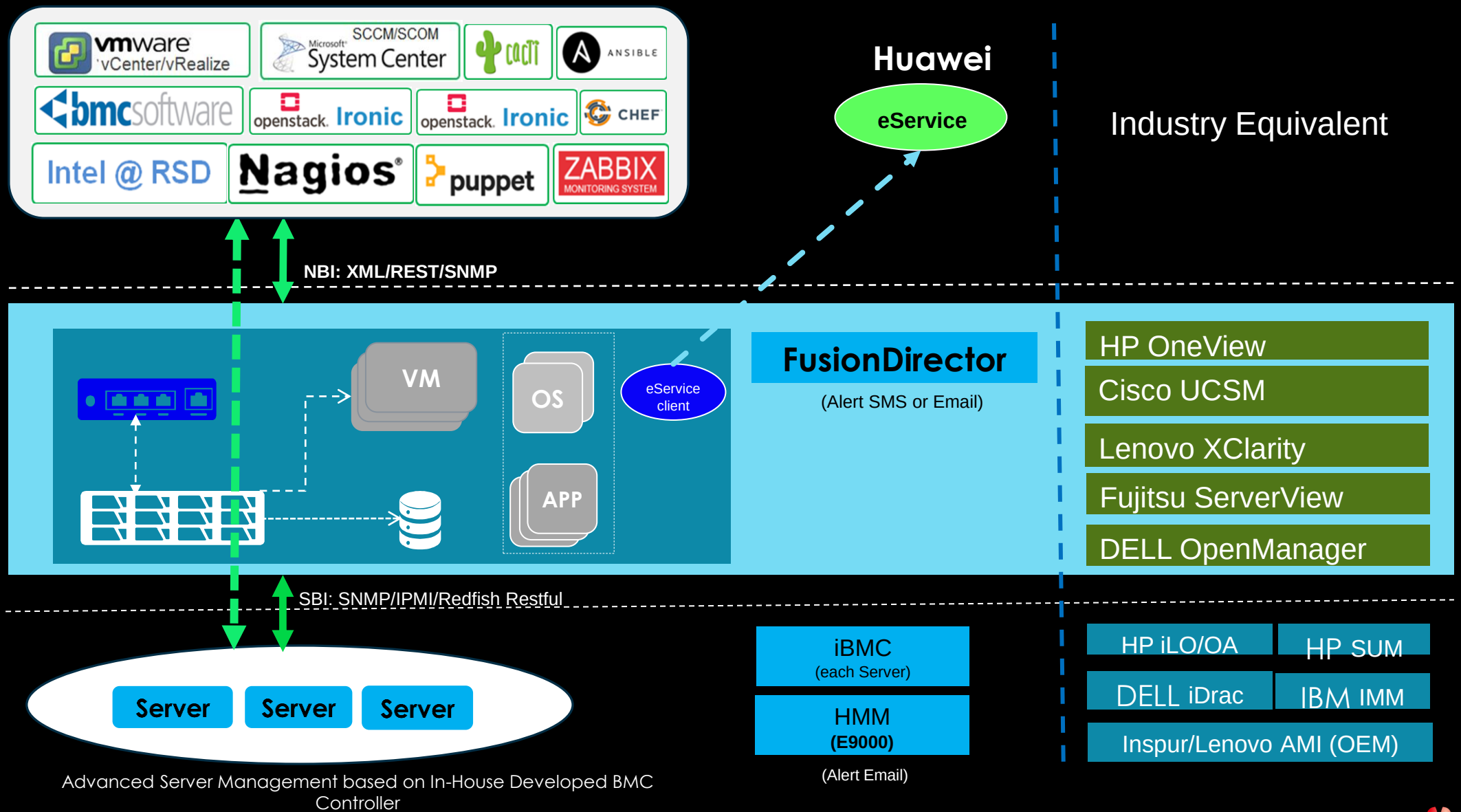
Intelligent Version Management: Automatic Upgrade Of Device Software



- Automatic download: Automatically detects the firmware and drivers of servers of different models and manages firmware versions comprehensively
- O&M engineers do not need to manually download, upload, or upgrade firmware
- Independent out-of-band upgrade, without occupying service bandwidth

HUAWEI

Open & Standard-Based Server Management



Advanced Server Management based on In-House Developed BMC Controller

HUAWEI

Accelerating X86 Server Performance

ES3000 series intelligent SSDs

- Optimal performance: PCIe Gen4 1.66M Random read IOPS, 7.0GB/s sequential read bandwidth
- All-scenarios: low latency, high performance, large capacity
- Service-aware: intelligent multi-stream, SR-IOV, atomic write

Performance 100% up

Service life 20% longer

IN200/300 series intelligent NICs

- Converged: 10GE/25GE/40GE/100GE, 8G/16G/32G FC
- Accelerated: RoCE
- Reliable: industry unique to support firmware upgrade without service interruption

CPU offload 15%

Latency 30% less

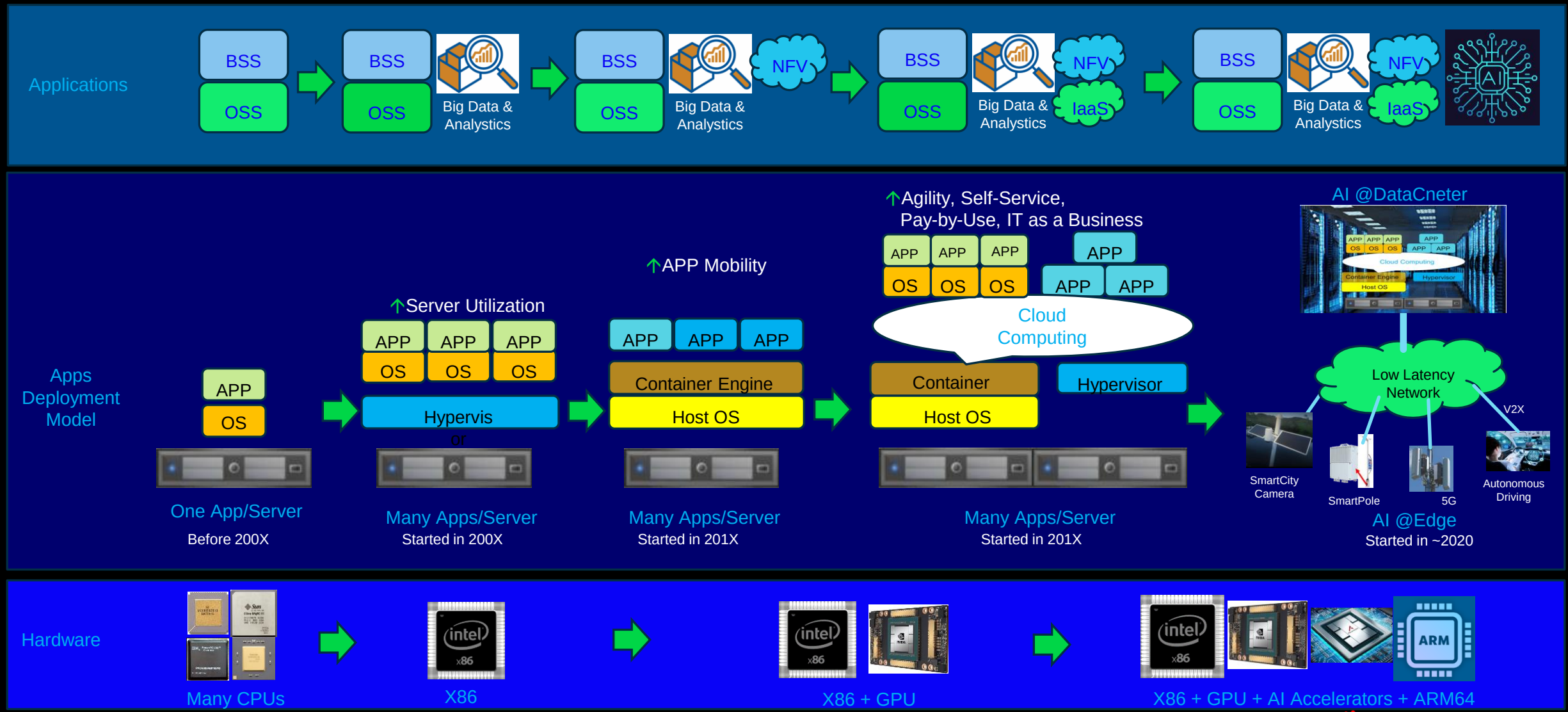
Atlas 300 AI accelerator card

- Powerful computing: 64 TOPS of INT8
- High-density video parsing: 64-channel HD video real-time analytics

CPU offload 15%

Performance 64-Ch HD

Telco Computing Evolution: Cloud, 5G, AI, Intelligent Edge



Huawei FusionServer 1288H V5: High-Density Deployment

- ✓ 1RU 2S+24-DIMM Compact w/ medium Storage & I/O Options
- ✓ For General Computing Applications w/o Need for very large local storage

- Virtualization
- Cloud computing
- High-performance computing (HPC)
- Web application
- Software-defined storage (SDS)
- AI inference

High reliability

- Carrier-class component specifications and 100% derating design
- Redundancy design: PSU modules in 1+1 mode, fan modules in N+1 mode, and memory module sparing/mirroring
- 99.99% availability
- 15% fewer failures than the industry average

Ultimate performance

- 2 x 2nd Gen Intel® Xeon® Scalable processors, up to 28 cores and TDP 205 W per CPU
- 24 DDR4 DIMMs, up to 2933 MT/s; a maximum of 12 Optane™ Persistent Memory (PMem), up to 2666 MT/s; total memory capacity up to 7.5 TB on a single server
- No. 1 in SPECint®_base2006 and SPECfp®_base2006 performance tests
- No. 1 in SPECpower ssj2008 Benchmark energy efficiency test

Unique value

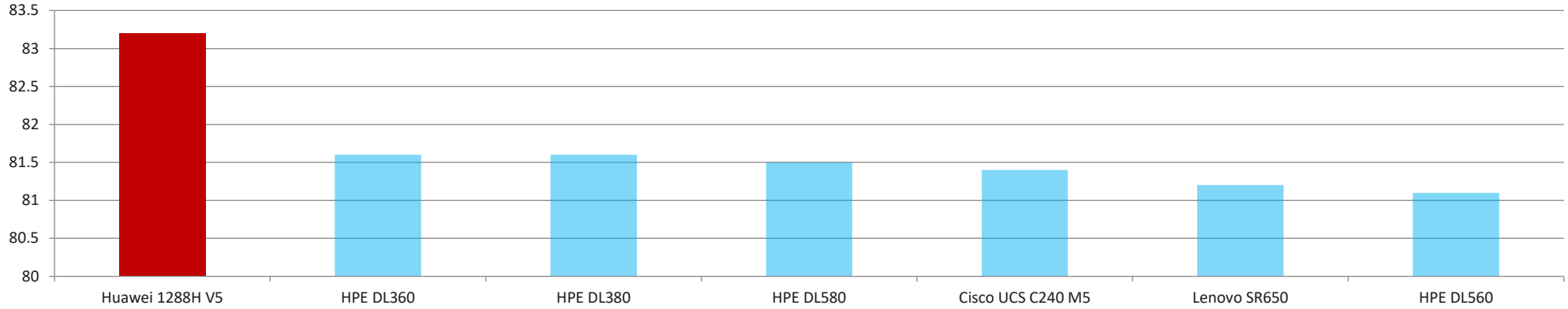
- **FDM:** The patented Fault Diagnosis & Management (FDM) technology provides the fault locating accuracy up to 93% and predicts a fault 7 to 30 days before it occurs, reducing OPEX
- **DEMT:** The patented Dynamic Energy Management Technology (DEMT) reduces energy consumption by 15% without compromising services
- **BSST:** Boot Speedup Storage Technology (BSST), 2 M.2 SSDs as high-speed OS boot drives, industry-unique hot plug and hardware RAID

Innovative design

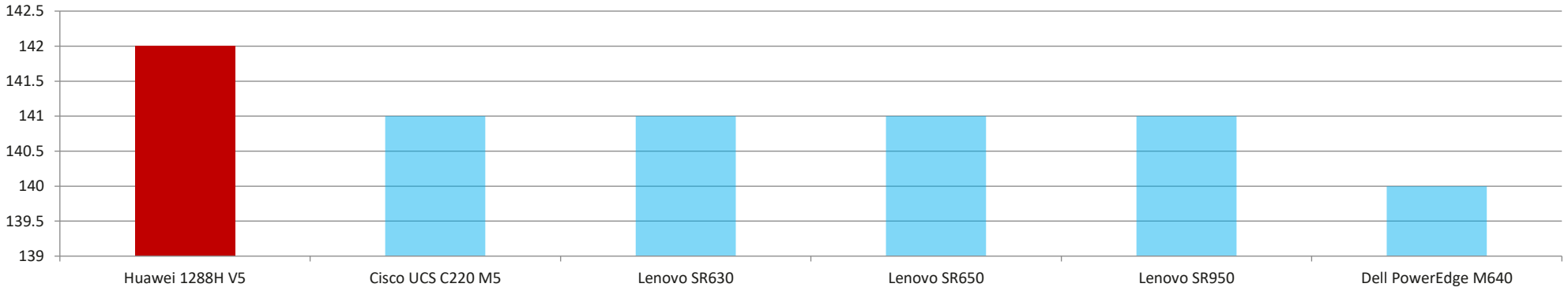
- 2 x 10GE and 2 x GE LOM ports, reducing CAPEX
- Flexible NICs for higher networking capabilities
- 10 x 2.5'' SSAS/SATA HDDs or SSDs, providing ultra-large storage capacity
- 8 NVMe SSDs for optimal service experience
- 2 NVIDIA Tesla T4 GPUs for AI inference

Huawei 1288H V5: Multiple New SPEC Performance Records

SPECint_base2006 Test Result



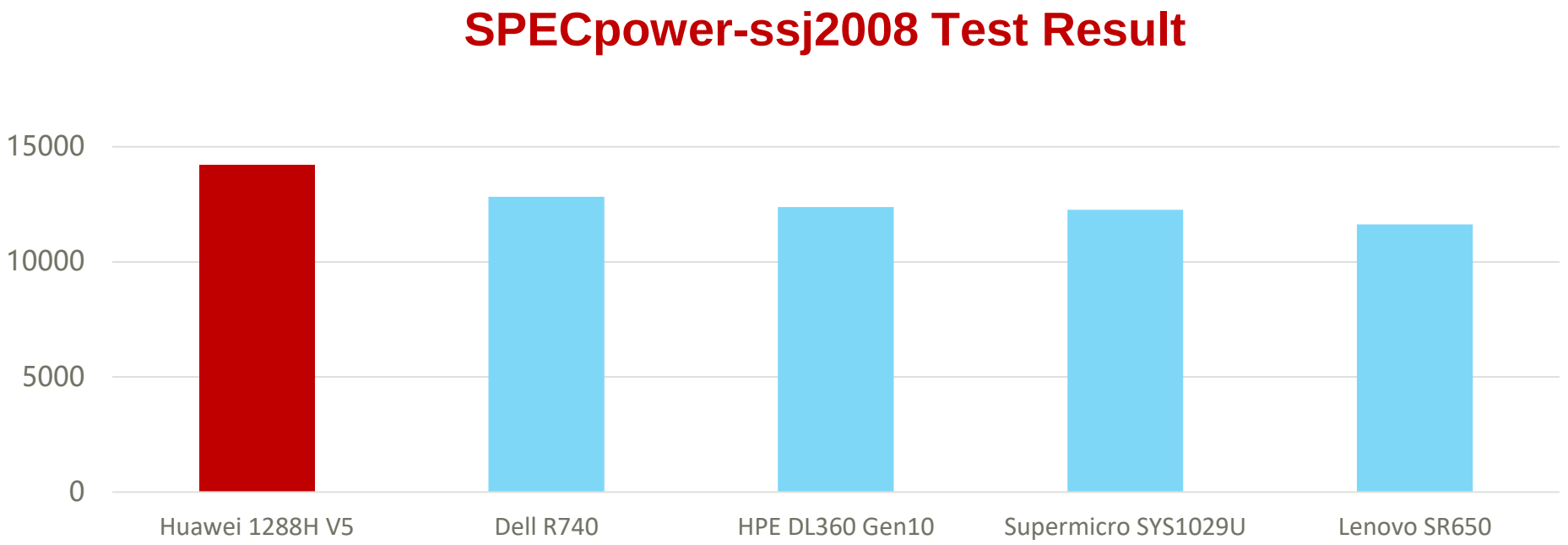
SPECfp®_base2006 Test Result



Data released on http://www.spec.org/ as of Apr 2018

FUTUREWEI Technologies

Huawei 1288H V5: New SPEC Energy Efficiency Records



Data released on http://www.spec.org/ as of Apr 2019

FUTUREWEI Technologies

2288H V5:Flexible Configurations Adaptive to Various Workloads

- ✓ 2RU 2S+24-DIMM Ultimate Performance w/ very flexible Storage & I/O Options
- ✓ Many Storage Configurations Available
- ✓ For General Computing Applications Requiring Balanced Compute & Storage

- Virtualization and cloud computing
- Virtual desktop interface (VDI)
- SDS
- HPC
- Big data and hyper-convergence
- Entry-level in-memory database (SAP HANA)
- AI inference or training

High reliability

- Carrier-class component specifications and 100% derating design
- Redundancy design: PSU modules in 1+1 mode, fan modules in N+1 mode, and memory module sparing/mirroring
- 99.99% availability
- 15% fewer failures than the industry average

Ultimate performance

- 2 x 2nd Gen Intel® Xeon® Scalable processors, up to 28 cores and TDP 205 W per CPU
- 24 DDR4 DIMMs, up to 2933 MT/s; a maximum of 12 Optane™ Persistent Memory (PMem), up to 2666 MT/s; total memory capacity up to 7.5 TB on a single server
- No. 1 in SPECint®_base2006 performance test
- No. 1 in SPECpower ssj2008 Benchmark energy efficiency test

Unique value

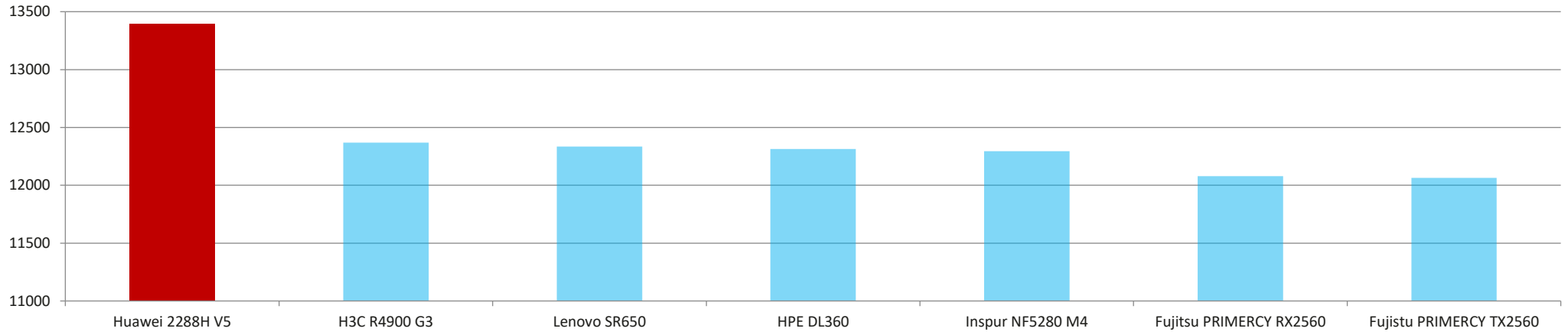
- **FDM:** The patented Fault Diagnosis & Management (FDM) technology provides the fault locating accuracy up to 93% and predicts a fault 7 to 30 days before it occurs, reducing OPEX
- **DEMT:** The patented Dynamic Energy Management Technology (DEMT) reduces energy consumption by 15% without compromising services
- **BSST:** Boot Speedup Storage Technology (BSST), 2 M.2 SSDs as high-speed OS boot drives, industry-unique hot plug and hardware RAID

Innovative design

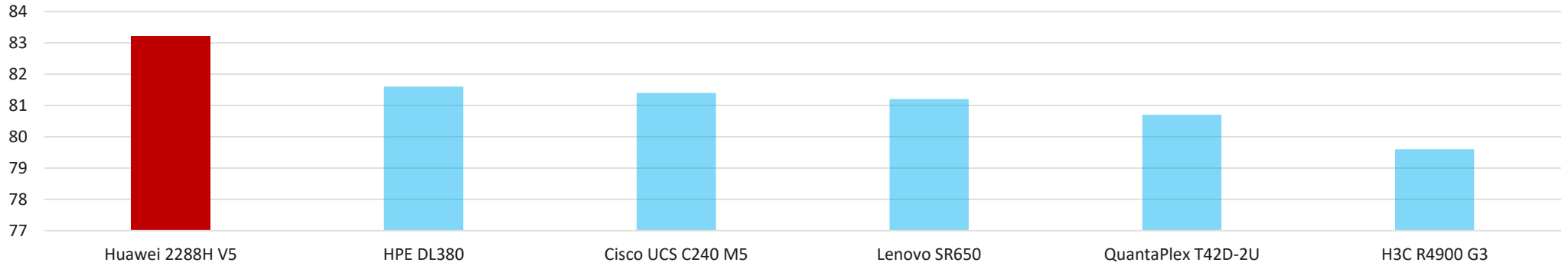
- 2 x 10GE and 2 x GE LOM ports, reducing CAPEX
- Flexible NICs for higher networking capabilities
- 20 x 3.5" or 31 x 2.5" drives for industry-leading storage capability
- 28 NVMe SSDs for optimal service experience
- 7 Atlas 300 inference cards/NVIDIA Tesla T4 GPUs for AI inference
- 2 NVIDIA Tesla V100 cards for AI training

Huawei 2288H V5: New SPEC Energy Efficiency & Perf Records

SPECpower-ssj2008 Test Result



SPECint®_base2006 Test Result



Data released on http://www.spec.org/ as of Apr 2018

FUTUREWEI Technologies

5288 V5: Ultra-Large Storage Capacity

- Tiered storage of hot, warm, and cold data
- Historical data archiving
- Video surveillance, CDN, and big data
- E-mail OA application

✓ 4RU 2S+24-DIMM High Performance w/ Ultra-Large Storage Capacity
✓ Dual RAID controller cards for High IOPS
✓ For Computing Applications Requiring Extreme Large Local Storage

High reliability

- Carrier-class component specifications and 100% derating design
- Redundancy design: PSU modules in 1+1 mode, fan modules in N+1 mode, and memory module sparing/mirroring
- 99.99% availability
- 15% fewer failures than the industry average

Ultra-large capacity design

- Hybrid storage architecture for tiered data storage
- 44 x 3.5'' SAS/SATA drives + 4 x 2.5'' SAS/SATA/NVMe SSDs in a 4U space, providing ultra-large local storage capacity
- Industry-leading storage capacity, up to 765 TB on a single server

Unique value

- **FDM:** The patented Fault Diagnosis & Management (FDM) technology provides the fault locating accuracy up to 93% and predicts a fault 7 to 30 days before it occurs, reducing OPEX
- **DEMT:** The patented Dynamic Energy Management Technology (DEMT) reduces energy consumption by 15% without compromising services
- **BSST:** Boot Speedup Storage Technology (BSST), 2 M.2 SSDs as high-speed OS boot drives, industry-unique hot plug and hardware RAID

Innovative design

- 2 x 10GE LOM ports, reducing CAPEX
- Flexible NICs for higher networking capabilities
- 6 Atlas 300 inference cards/NVIDIA Tesla T4 GPUs for AI inference, an industry-leading feature
- Dual RAID controller cards, doubling IOPS

Huawei 2488 V5H: High Performance Computing

- Virtualization
- Cloud computing
- HPC
- Database
- In-memory database (SAP HANA)
- AI inference

✓ 4S+48-DIMM in 2RU for Ultimate Computing Performance w/ Large Memory
✓ 25x2.5” HDDs or NVMe SSDs for high performance storage
✓ For Computing Applications Requiring 4-Socket & Large Memory in 2RU Space

High reliability

- Carrier-class component specifications and 100% derating design
- Redundancy design: PSU modules in 1+1 mode, fan modules in N+1 mode, and memory module sparing/mirroring
- 65 RAS features
- 99.99% availability
- 15% fewer failures than the industry average

Ultimate performance

- 4 x 2nd Gen Intel® Xeon® Scalable processors, up to 28 cores and TDP 205 W per CPU
- 48 DDR4 DIMMs, up to 2933 MT/s; a maximum of 24 Optane™ Persistent Memory (PMem), up to 2666 MT/s; total memory capacity up to 15 TB on a single server
- No.1 in SPECrate2017_int_base/SPECvirt_sc 2013 benchmark/SAP B4H benchmark tests
- Full mesh CPU architecture design, improving performance by 14.9%

Unique value

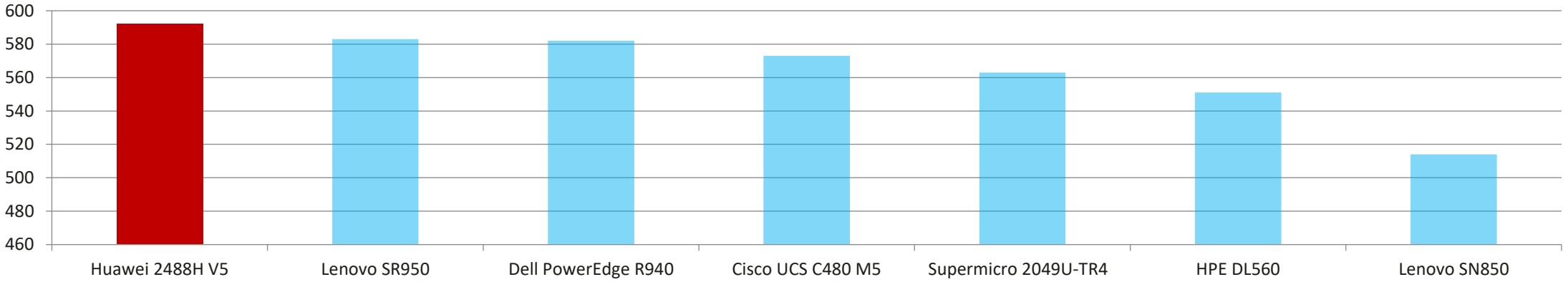
- **FDM:** The patented Fault Diagnosis & Management (FDM) technology provides the fault locating accuracy up to 93% and predicts a fault 7 to 30 days before it occurs, reducing OPEX
- **DEMT:** The patented Dynamic Energy Management Technology (DEMT) reduces energy consumption by 15% without compromising services
- **BSST:** Boot Speedup Storage Technology (BSST), 2 M.2 SSDs as high-speed OS boot drives, industry-unique hot plug and hardware RAID

Innovative design

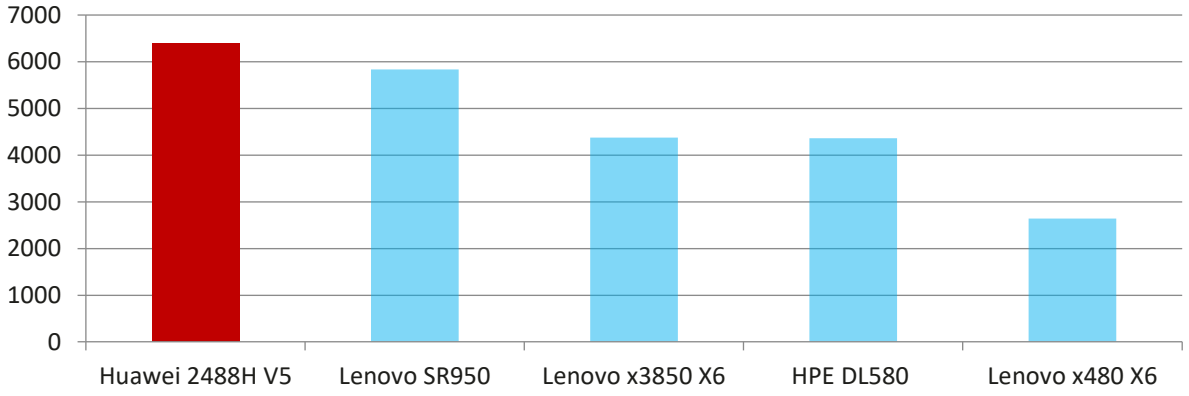
- 2 x 10GE and 2 x GE LOM ports, reducing CAPEX
- Flexible NICs for higher networking capabilities
- 25 x 2.5'' drives, providing the industry's largest storage capacity
- 3 NVIDIA Tesla T4 GPUs for image and video inference and analytics
- Up to 11 PCIe 3.0 slots, the most in the industry for diverse applications

Huawei 2488H V5: New SPEC/SAP HAHA Performance Records

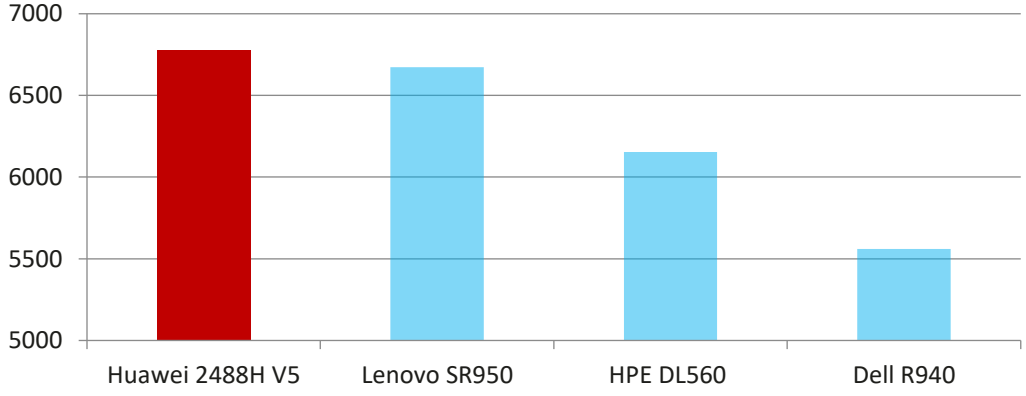
SPECrate2017_int_base Test Result



SPECvirt_sc2013 Test Result



SAP B4H Benchmark Test Result



Data released on http://www.spec.org/ as of Apr 2018

FUTUREWEI Technologies

2488H V6: Stable and Reliable Mission Critical Server

- Virtualization
- Cloud computing
- High-performance computing (HPC)
- Database
- In-memory database (SAP HANA)
- AI inference and training

✓ 4S+48-DIMM in 2RU w/ Intel latest Xeon CPUs for Ultimate Computing Performance
✓ 25x2.5” HDDs or NVMe SSDs for high performance storage
✓ For Computing Applications Requiring 4-Socket & Large Memory in 2RU Space

High reliability

- Carrier-class component specifications and 100% derating design
- Redundancy design: PSUs in 1+1 mode, fan modules in N+1 mode, and memory module sparing/mirroring
- 69 RAS features
- 99.999% availability
- 15% fewer failures than the industry average

Ultimate performance

- 4 x 3rd Gen Intel® Xeon® Scalable processors, up to 28 cores and TDP 250 W per CPU
- 48 DDR4 DIMMs, up to 3,200 MT/s; 24 Intel® Optane™ persistent memory (Optane™ PMem) modules (200 series), up to 2,666 MT/s; total memory capacity of a single server up to 18 TB
- 2 x 300 W high-performance dual-width GPU accelerator cards, providing powerful computing for AI inference and training

Unique value

- **FDM:** The patented Fault Diagnosis & Management (FDM) technology provides the fault locating accuracy up to 93% and predicts a fault 7 to 30 days before it occurs, reducing the OPEX
- **DEMT:** The patented Dynamic Energy Management Technology (DEMT) reduces energy consumption by 15% without compromising services
- **BSST:** The Boot Speedup Storage Technology (BSST) uses 2 M.2 SSDs as high-speed OS boot drives, supporting the hardware RAID and the industry-unique hot plug for M.2 SSDs

Innovative design

- 2 FHFL dual-width GPU AI accelerator cards, such as Tesla V100
- 4 HHHL single-width GPU AI accelerator cards, such as Tesla T4
- 11 PCIe 3.0 slots, including one dedicated PCIe slot for the OCP 3.0 NIC (hot-swappable)
- 25 x 2.5" SAS/SATA drives, up to 24 NVMe SSDs[1]
- Access to iBMC using Type-C, enabling agile O&M

[1] The configuration of 24 NVMe SSDs is estimated to be released in Q4 2020.

5885H V5: High Performance and Scalability

- Virtualization
- Cloud computing
- HPC
- Database
- AI inference or training

✓ 4RU 4S+48-DIMM Scalable Ultimate Performance & Large Memory Capacity
✓ 15x PCIe Expansion slot for 4x T4 or 2x V100 Nvidia GPU cards for AI
✓ For Computing Applications Requiring 4-Socket, Large memory & Scalability

High reliability

- Carrier-class component specifications and 100% derating design
- Redundancy design: PSU modules in 1+1 mode, fan modules in N+1 mode, and memory module sparing/mirroring
- Maintenance of front fan modules without opening the chassis cover
- 65 RAS features
- 99.99% availability
- 15% fewer failures than the industry average

Ultimate performance

- 4 x 2nd Gen Intel® Xeon® Scalable processors, up to 28 cores and TDP 205 W per CPU
- 48 DDR4 DIMMs, up to 2933 MT/s; a maximum of 24 Optane™ Persistent Memory (PMem), up to 2666 MT/s
- Full mesh CPU architecture design, improving performance by 14.9%

Unique value

- **FDM:** The patented Fault Diagnosis & Management (FDM) technology provides the fault locating accuracy up to 93% and predicts a fault 7 to 30 days before it occurs, reducing OPEX
- **DEMT:** The patented Dynamic Energy Management Technology (DEMT) reduces energy consumption by 15% without compromising services
- **BSST:** Boot Speedup Storage Technology (BSST), 2 M.2 SSDs as high-speed OS boot drives, industry-unique hot plug and hardware RAID

Innovative design

- 2 x 10GE and 2 x GE LOM ports, reducing CAPEX
- Flexible NICs for higher networking capabilities
- 4 NVIDIA Tesla T4 GPUs for image and video inference and analytics
- 2 NVIDIA Tesla V100 cards for AI training
- Up to 15 PCIe 3.0 slots, the most in the industry for diverse applications

Some Use Cases

Huawei Servers: Honored On Orange Procurement Short-List

Orange Group (French: Orange SA, Orange), formerly known as France Télécom SA, is France's leading telecommunications company with more than 220,000 employees worldwide and approximately 90 million customers. (including the overseas provinces of France).

Why Huawei?

- ✓ High Performance, Reliability, Scalability & Quality
- ✓ Second Source to Break Monopoly
- ✓ To Lower TCO

Huawei Servers Honored on the Short-List

- ✓ FusionServer Pro 1288 V5, 2288 V5 for IT & B2B
- ✓ E9000 V5 for NFV

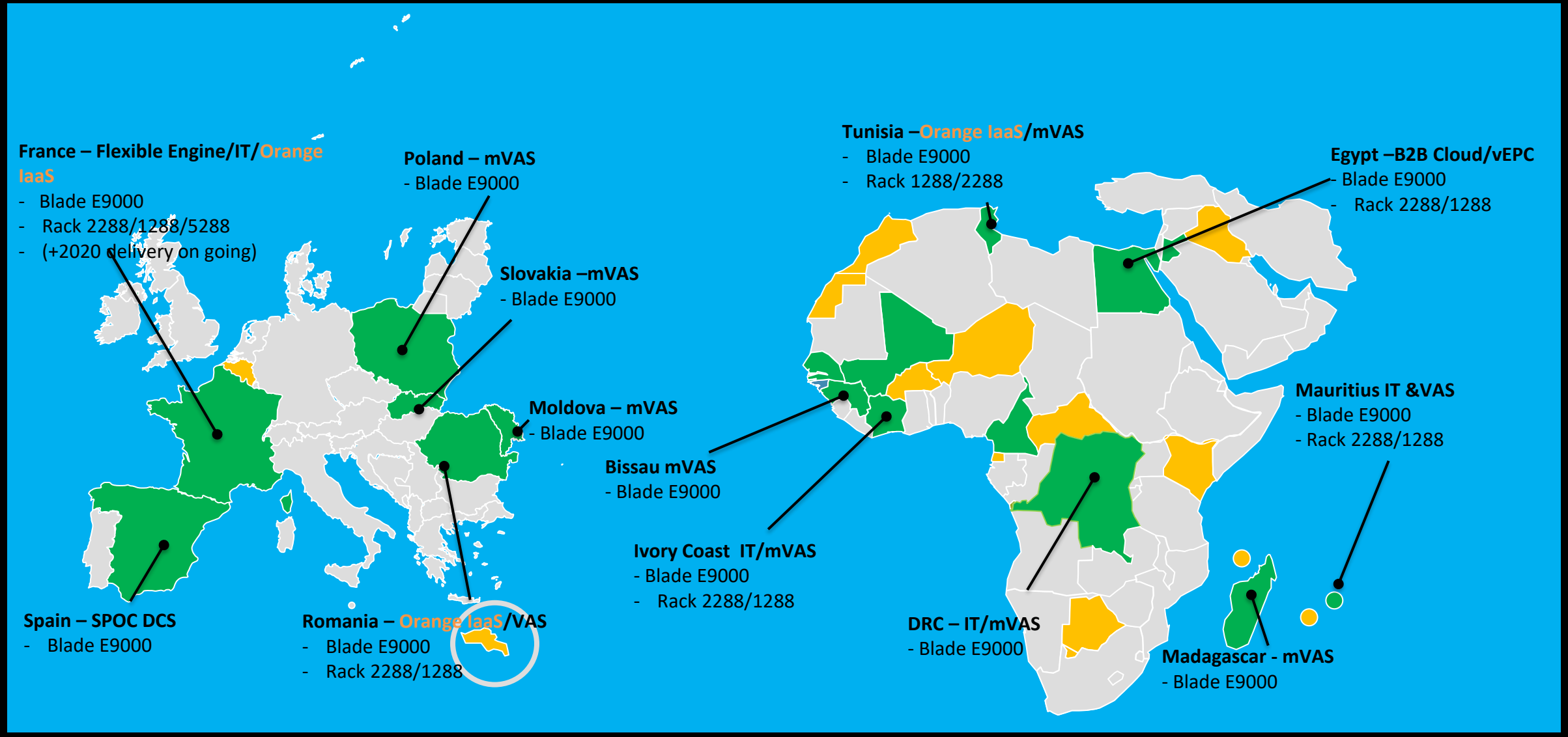

RH1288 V5


RH2288 V5


E9000 V5

FUTUREWEI Technologies

Huawei Servers Have Been Powering Orange Networks



FUTUREWEI Technologies

Huawei Servers Powering Telekom Malaysia NFV Services

Founded in 1984, Telekom Malaysia (TM) is the largest fixed network provider in Malaysia. It provides customers with fixed network, data access, Internet services, and value-added service solutions based on fixed networks.

Why Huawei?

- ✓ Long-Term Partner & E2E NFV Solution Provider
- ✓ Worked Closely with TM to Deliver Successful POC
- ✓ High Performance, Reliability, Scalability & Quality
- ✓ Easy O&M

Huawei Servers Deployed in 2019

- ✓ FusionServer RH2288 V5 with Intel 1st Xeon SP Processors
- ✓ Huawei Cloud Stack (HCS) Software

RH2288 V5

FUTUREWEI Technologies

Huawei Helping Telefonica Accelerate CDN Services

Telefonica is short for Telefónica of Spain. Founded on April 19, 1924, Telefónica is an international telecommunications company that provides comprehensive services, including fixed-line, mobile, Internet, data, and cable TV services. It has a significant presence in Spanish-speaking and Portuguese-speaking countries. In October 2019, Telefónica ranked No. 22 in the Forbes Digital 100 List.

Why Huawei?

- ✓ Long-Term CDN Partner for E2E Solution to Reduce TCO
- ✓ High Performance, Reliability, Scalability & Quality
- ✓ 2288H V5 supports long-term stable running at 45°C with Cascade Lake processors (28 cores/processor) of full power consumption

Huawei Servers Deployed

- ✓ FusionServer RH2288 V5 with Intel Xeon Cascade Processors

RH2288 V5

FUTUREWEI Technologies

Italian TIM Accelerates DIGITIM Strategy with Huawei Servers

Telecom Italia is the largest telecommunications operator in Italy, with operations in the fixed, mobile, media and Internet sectors. The Italian Telecom Group has inherited the electronic communication business that has been in development for more than 100 years, and is also involved in media, network and cutting-edge information technology. The Group is committed to the research and development of future technologies.

Why Huawei?

- ✓ High Performance, Reliability, Scalability & Quality
- ✓ Working up to 45°C to Save Energy & Cost
- ✓ eSight management system for unified management in the data center for O&M improvement & 10% Cost Saving

Huawei Servers Deployed

- ✓ FusionServer Pro 1288 V5 w/ Intel Xeon Cascade Lake CPU
- ✓ eSight Unified Data Center Device Management Software

RH1288 V5

FUTUREWEI Technologies

Huawei Servers: Honored on Vodafone Procurement Short-List

Vodafone Group, the world's second largest mobile communications company, is a multinational mobile phone operator. Headquartered in Newbury, Berkshire, UK and Düsseldorf, Germany. It is one of the world's largest mobile operators, with a network covering 26 countries and providing network services with its partners in 31 other countries. Vodafone has the world's most complete enterprise information management system and customer service system, and has a strong advantage in increasing customers, providing services and creating value. Vodafone's global strategy is to cover voice, data, Internet access services and provide customer satisfaction. Vodafone Group has more than 100,000 employees worldwide

Why Huawei?

- ✓ High Performance, Reliability, Scalability & Quality
- ✓ Working up to 45°C to Save Energy & Cost
- ✓ Second Source for Breaking Monopoly

Huawei Servers Deployed

- ✓ FusionServer RH1288 V5 for general & Virtualization
- ✓ FusionServer RH2288 V5 for Virtualization & Big-Data
- ✓ FusionServer E9000 V5 for Converged Solutions for Critical Business Applications via Resource Pooling

RH1288 V5

RH2288 V5

E9000 V5
2S & 4S Blades

FUTUREWEI Technologies

Huawei Servers Help Vodafone Spain Build 5G Core Network

The Vodafone Group, the world's second largest mobile communications company, is a multinational mobile phone operator. Headquartered in Newbury, Berkshire, UK and Düsseldorf, Germany. It is one of the world's largest mobile operators, with a network covering 26 countries and providing network services with its partners in 31 other countries. Vodafone has the world's most complete enterprise information management system and customer service system, and has a strong advantage in increasing customers, providing services and creating value. Vodafone's global strategy is to cover voice, data, Internet access services and provide customer satisfaction. Vodafone Group has more than 100,000 employees worldwide

Why Huawei?

- ✓ High Performance, Reliability, Scalability & Quality
- ✓ Working up to 45°C to Save Energy & Cost
- ✓ Second Source for Breaking Monopoly
- ✓ Modular Blade Server greatly simplifies maintenance & allows for flexible expansion
- ✓ Heterogeneous computing expansion saves investment
- ✓ eSight Mgnt software enhances O&M with Unified Compute, Storage and Network Mgnt for Higher O&M efficiency

Huawei Servers Deployed

- ✓ FusionServer Pro RH1288 V5
- ✓ FusionServer E9000 V5 Blade

RH2288H V5

E9000 V5

FUTUREWEI Technologies

Huawei Servers Power VEON Online Digital Services Development

Founded in 1992, VEON Ltd. is headquartered in Amsterdam, the Netherlands. With 41,994 full-time employees, VEON is the world's seventh largest telecom operator and the world's sixth largest mobile network operator. It provides a series of voice and data services, including traditional, mobile broadband, and fixed network services. As a world-class network carrier, VEON has subnets in seven countries and strives to rank top 2 in the market of all subnets. The digital transformation goal is to transform from a network carrier to an Internet service provider. Since the end of 2017, VEON APP has gone online on all 12 networks and become the B2B/2C platform. VEON also develops APP partners and the big data analytics platform DMP.

Why Huawei?

- ✓ High Performance, Reliability, Scalability & Quality
- ✓ Working up to 45°C to Save Energy & Cost
- ✓ FusionDirector for quick server installation & deployment & visualized O&M of massive devices, reducing the OPEX.

Huawei Servers Deployed

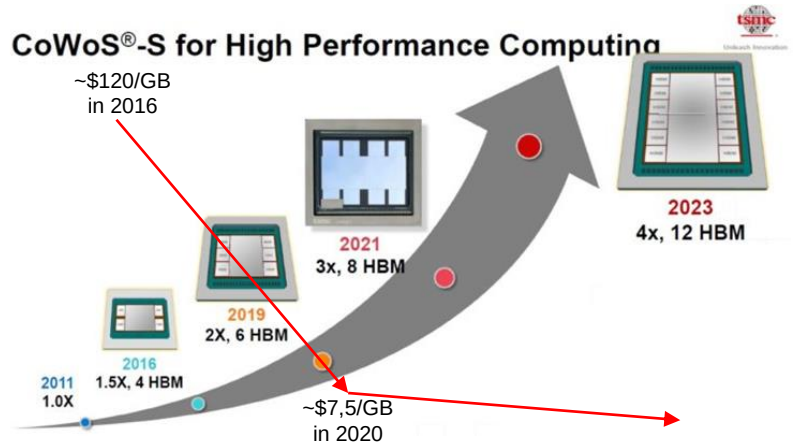
- ✓ FusionServer Pro RH1288 V5 for general-purpose & Virtualization
- ✓ FusionServer Pro 2288 V5H for VMware vSAN & Microsoft S2D SDS with large storage capacity
- ✓ FusionServer Pro 2488H V5 & 5885H V5 for Mission-Critical Applications

RH1288 V5 | RH2288 V5 | RH2488H V5 | RH5885H V5

FUTUREWEI Technologies

HBM is Enabling Interactive Analysis on Massive Datasets

- ✓ HBM is becoming CPU main memory for HPC, AI & HPDA, enabling Interactive Analysis on Massive Datasets
- ✓ For 768GB & 10TB/s & 64B Logs, max 300B-Record-Scans/s & 24B Records per CPU w/ 2x Compression in 3-5 Years
- ✓ OmniSCI is delivering an Amazing Interactive Analysis Platform for massive log datasets with Location-time information on HBM (GPU)



With 12 HBM stacks on package and 64GB/Stack running at 6.4Gbps, up to 768GB & ~10TB/s could be delivered.

GB/Stack	Data Rate	# of Stacks	GB/SoC	BW/SoC
32	4.0Gbps	8	256GB	4096GB/s
32	4.0Gbps	12	384GB	6144GB/s
32	6.4Gbps	8	256GB	6553GB/s
32	6.4Gbps	12	384GB	9830GB/s
64	4.0Gbps	8	512GB	4096GB/s
64	4.8Gbps	12	768GB	7372GB/s
64	6.4Gbps	12	768GB	9830GB/s

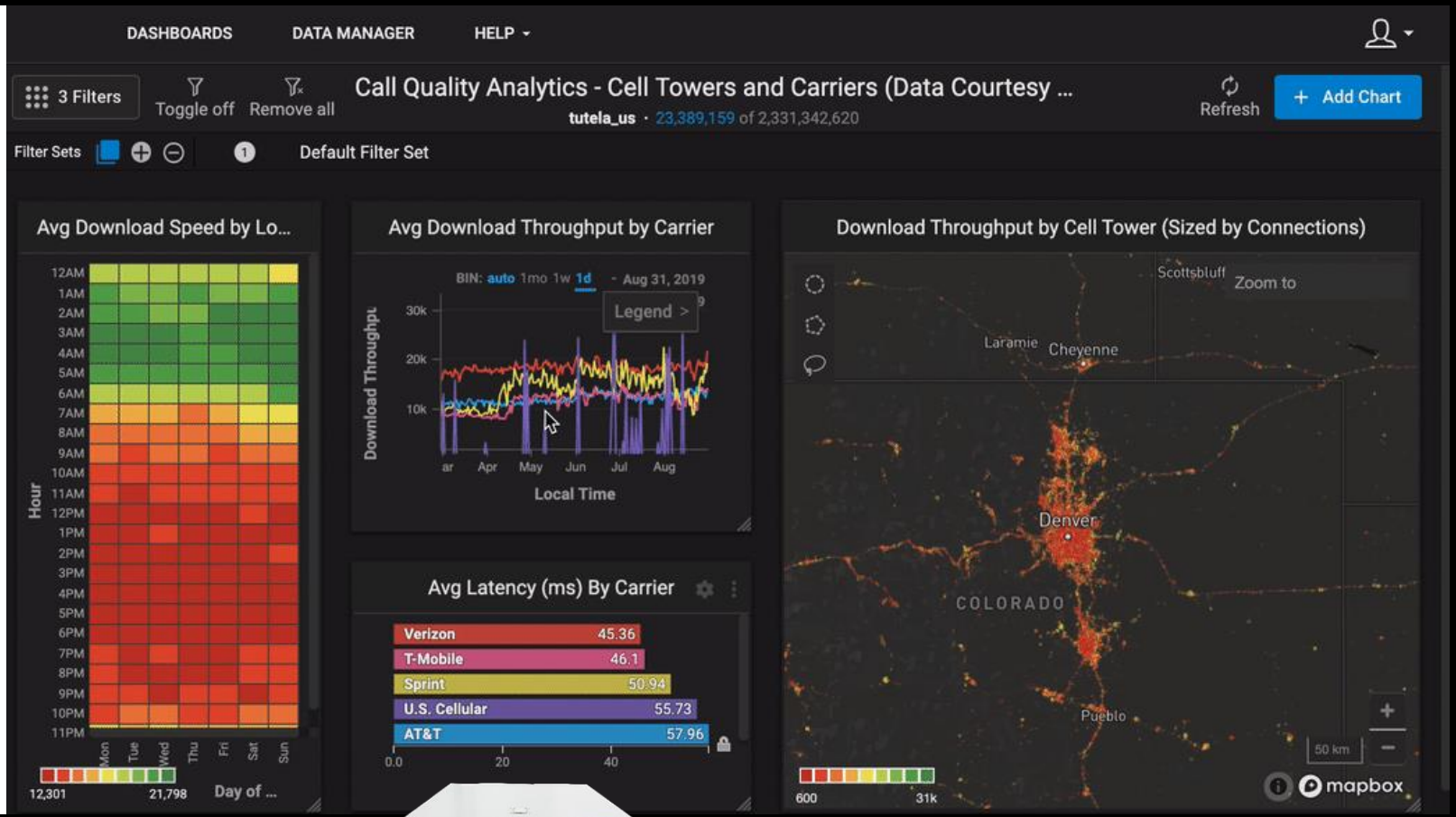
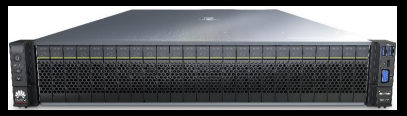


Image source & credit: https://www.omnisci.com/industries/telecom

RH2288 V5



RH2488H V6

RH5885H V5

FUTUREWEI Technologies

Take-Aways

1. Telco Data Centers have been transforming from supporting Siloed BSS/OSS applications to IaaS, Cloudification, AI-Driven and Real-Time High Performance Big Data Analytics for Business Agility, Fast Time to Services, Better User Experiences and Lower TCO.
2. Huawei FusionServer & FusionServer Pro X86 Servers Deliver Industry Leading High Performance, High Reliability, High Scalability, High Quality and High Security, and most models could work reliably at 45°C ambient temperature for higher availability in case of AC failure; and could meet your digital transformation's needs.

Thank you