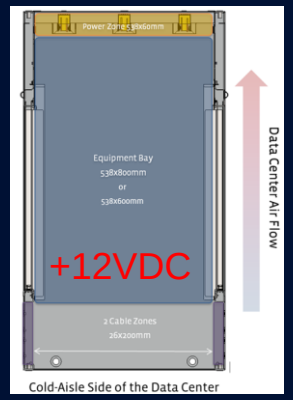
OCP Update & Discussion

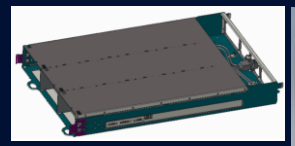
Date: August 1, 2020

Many OCP Gears to Choose, Even just for Compute

✓ Multiple OCP Compute Gear Designs Promoted and Used by Key CSP Players, Optimized for their Own Data Centers

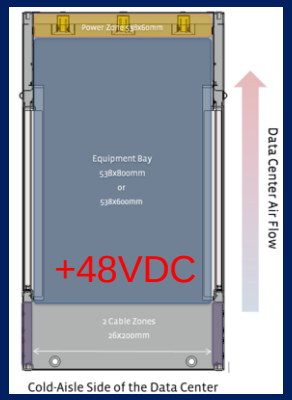
OpenRack V2 by Facebook

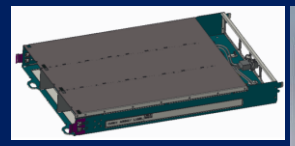


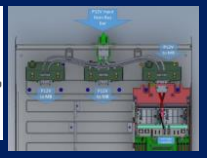


- ✓ 21” Wide Rack w/ 1.1m Depth
- ✓ 48mm OpenU Height Unit
- ✓ Rack Shared 12VDC via Bus Bar, 12VDC to Server Chassis
- ✓ 2-OU Chassis/Shed Powered from Rack Backplane Bus Bar
- ✓ Battery Backup Per Rack

OpenRack V3 by Google etc

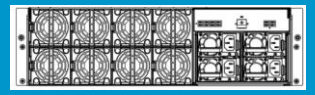






- ✓ 21” Wide Rack w/ 1.1m
- ✓ 48mm OpenU Height Unit
- ✓ Rack Shared 48VDC via Bus Bar, 48VDC to Server Chassis
- ✓ 2-OU Chassis/Shed Powered from Rack Backplane Bus Bar
- ✓ Battery Backup Per Rack

Olympus by Microsoft

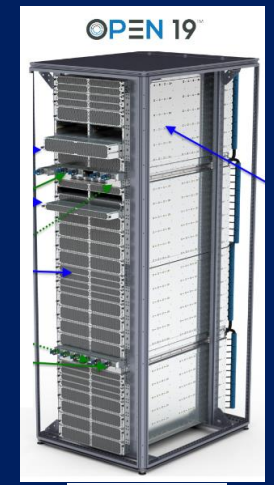


- ✓ 19” Wide Rack w/ 1.2m Depth
- ✓ 1/2/3U Height Server Chassis
- ✓ AC to each Server Chassis
- ✓ Battery Backup Per Server

OpenEdge pushed by AT&T & Nokia etc

- ✓ 19” Standard Rack w/ 600mm or 800mm Depth
- ✓ Based on Standalone 3U Chassis

Open 19



- ✓ 19” Rack for DC
- ✓ Shared Power
- ✓ 1U/2U Server in 12U Cage
- ✓ Backplane ToR Interconnect

All are OCP Compute Gears, But Not Compatible

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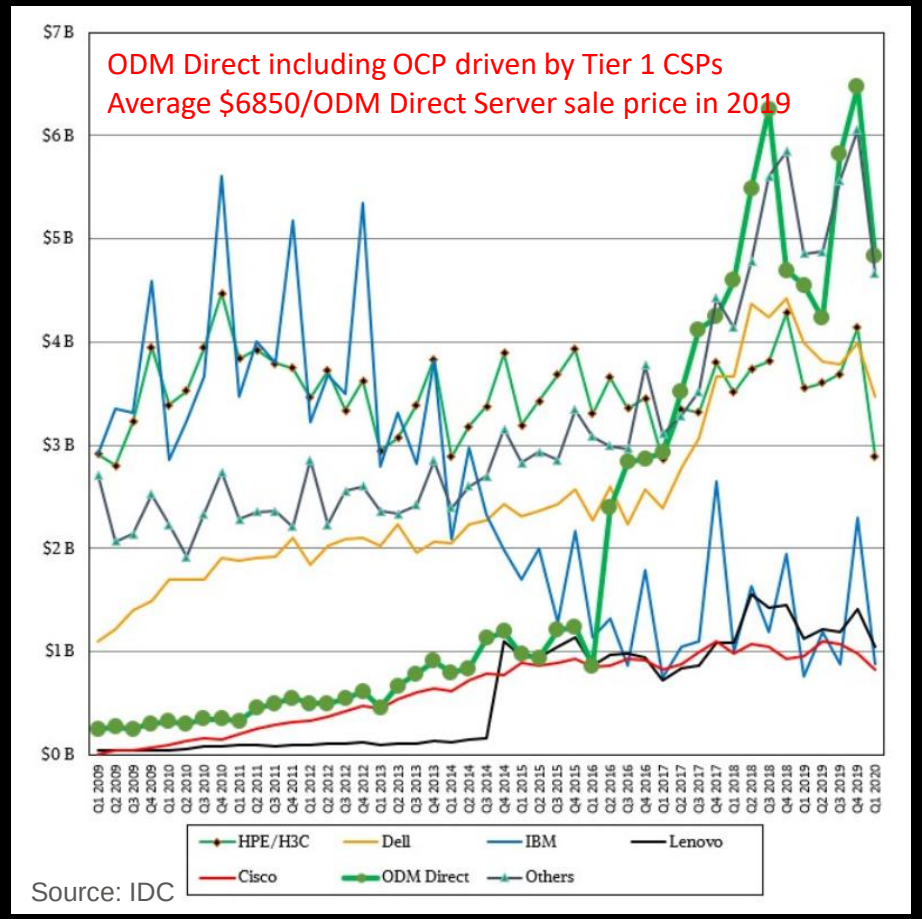
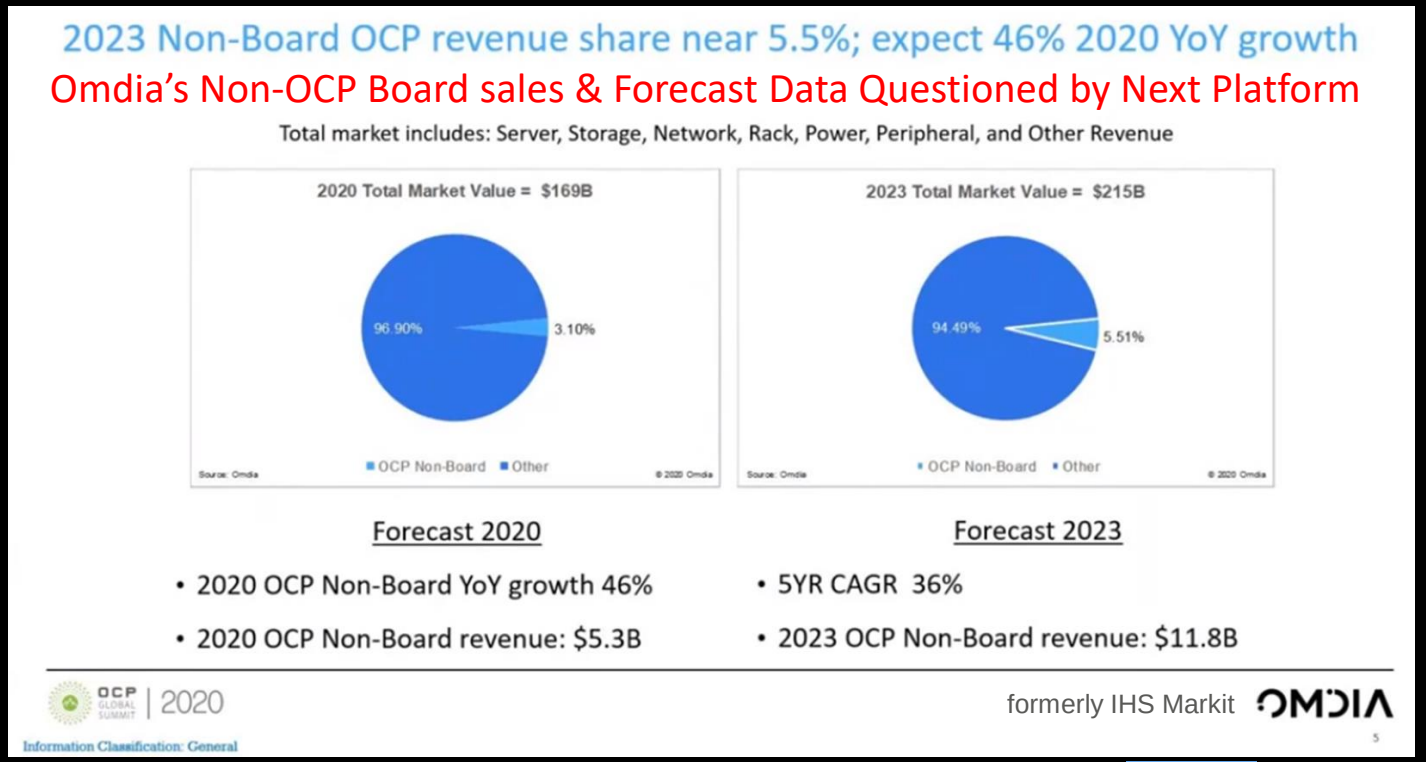
Cloud Service Providers Driving ODM Direct including OCP

- ✓ ODM Direct Servers including OCP driven by Mega CSPs is about 26% total server units shipped WW in 2019, per IDC
- ✓ Per Next Platform estimation, In 2019, 2.2M Units & $14.65B and of Servers consumed by OCP Board Members Not including Google; 400K Units by Non-Board Users (Omdia estimated $2.8B >> $7000/Server vs. IDC estimated average ODM Direct $6850/Unit)
- ✓ Omdia's OCP Non-Board Sales & Forecast Numbers Questioned by The Next Platform to be overestimated.



Source: IDC



OCP Boards: facebook Microsoft Google rackspace intel Goldman Sachs

https://www.nextplatform.com/2020/05/26/still-open-for-business-after-all-these-years/

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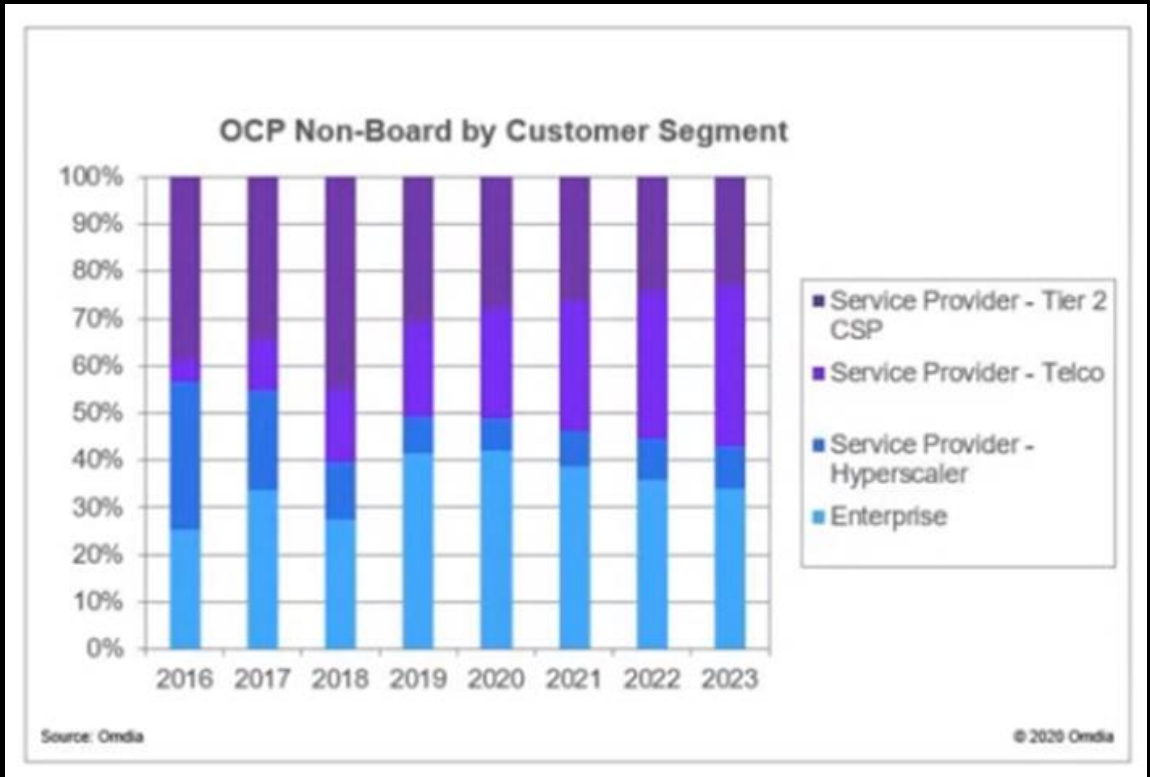
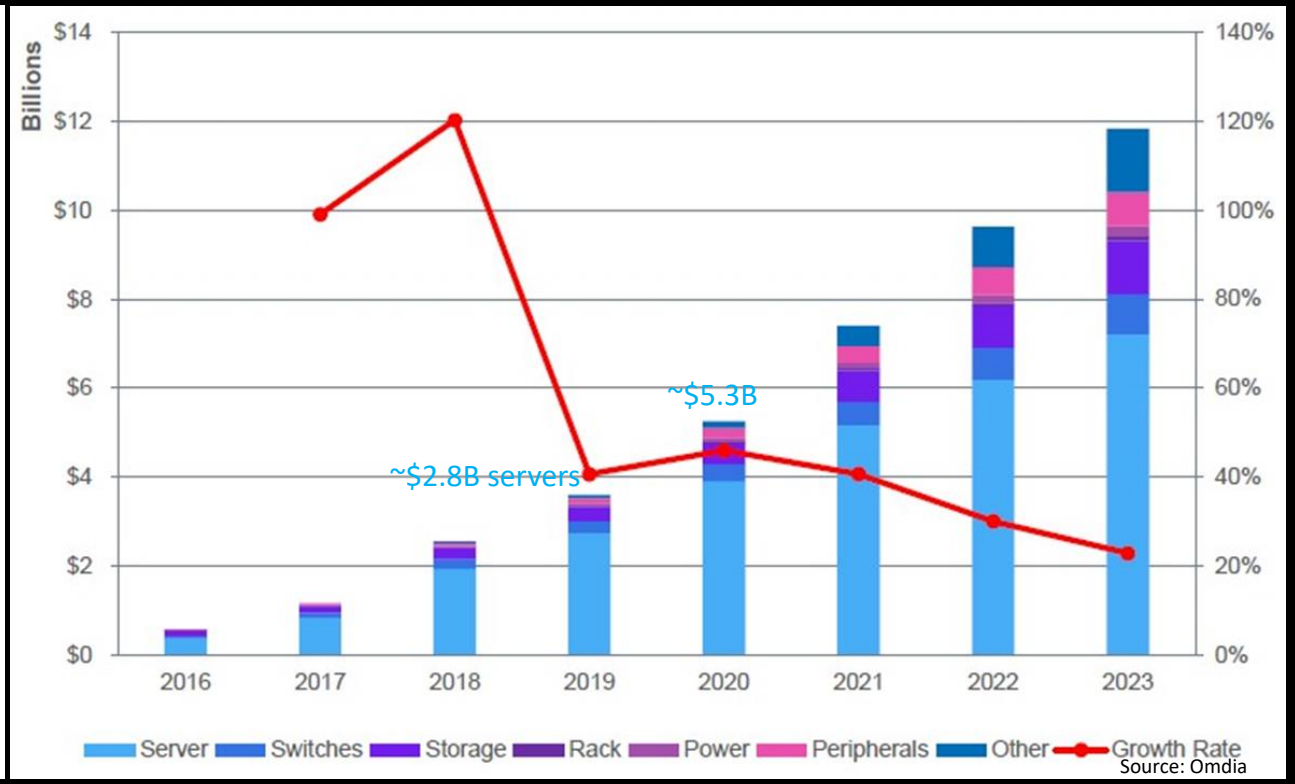
OCP Server Adoption in Telco Data Centers Still Slow

- ✓ OCP OpenEdge Servers Initialized by AT&T Could be the main OCP Gear Growth Adopted by Telcos
- ✓ Omdia's OCP Non-Board OCP Gears growth estimate is 3X of TAM, questioned by the Next Platform

OCP Non-Board Customer Segments – Telcos Growing



Non-Board Member OCP Revenue Projection by Gear Types – OpenEdge could be the Biggest



Omdia's Non-OCP Board sales & Forecast Data Questioned by Next Platform

https://www.nextplatform.com/2020/05/26/still-open-for-business-after-all-these-years/

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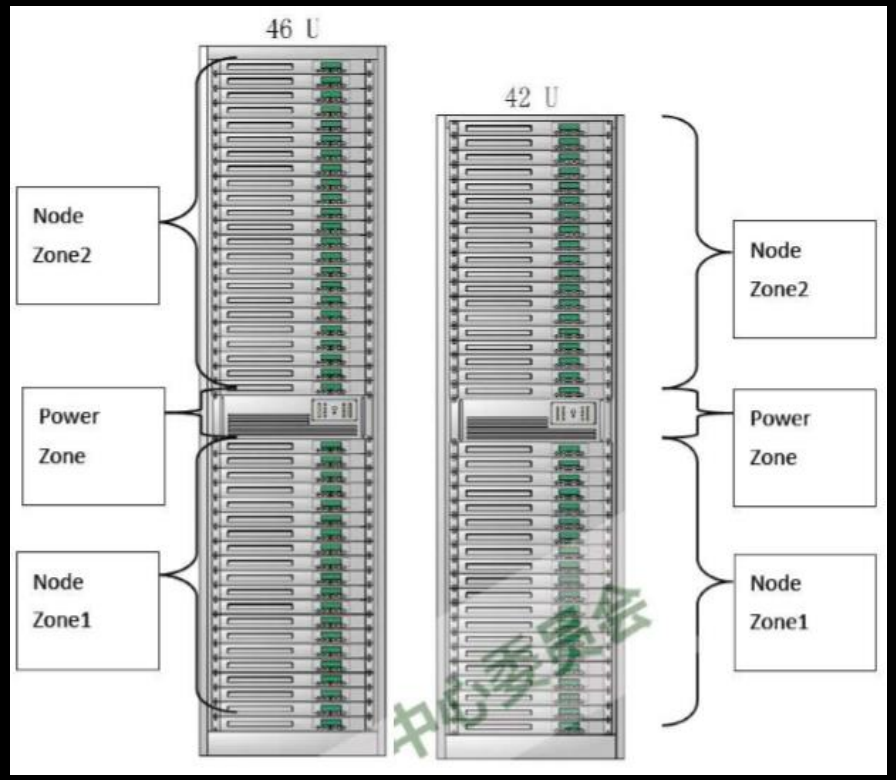
CMCC Continues Standardizing on OEM Servers

- ✓ Not too Many Deployment of the China OCP-Equivalent “Project Scorpio” Promoted by Alibaba, Baidu, Tencent, China Telecom & China Mobile (CMCC)
- ✓ CMCC has been trying to standardize on 9 models of OEM 2U/4U Rack Servers since 2019

China Project Scorpio Open Server Design(ODCC)



Models & Configurations for CMCC 2020-2021 Server Purchase

Config #	Name	Unit	Detailed Configuration
#01	Computing Model 1	38160	2U 2S+24-DIMM, 2x10GE, small local data SSD
#02	Computing Model 2	10985	4U 4S+48-DIMM, 2x10GE, small local data SSD
#03	Computing Model 3	8637	4U 4S+48-DIMM, 2x25GE medium local data SSD
#04	Balanced Model 2A	4998	2U 2S+24-DIMM, 2x10GE, medium local data SSD
#05	Balanced Model 2B	6000	2U 2S+24-DIMM, 2x10GE, medium local data HDD
#06	Balanced Model 3	10021	2U 2S+24-DIMM, 2x10GE, medium local data HDD
#07	Storage Model 1	13850	2U 2S+12/24-DIMM, 2x10GE, large local Data HDD/SSD
#08	Storage Model 2	18220	4U, 2S+12/16-DIMM, 2x10GE, Large local data HDD
#09	Storage Model 3	4401	2/4U, 1/2S+12-DIMM, 2x10GE, Large local data HDD
Total		115272	

➢ About 80,000 Units with similar configurations purchased in 2019.10

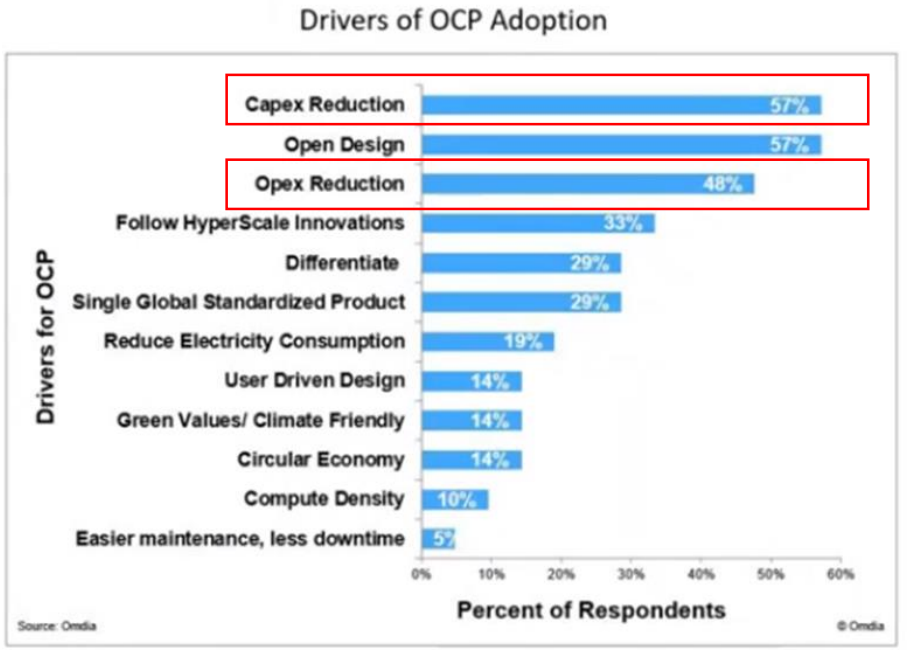
Drivers of OCP Adoption

✓ Lower TCO, Secure & Reliable Supply Chain are always two Key Factors

Market looking to benefit from hyperscale innovations, and reduce costs

Q: What are the top reasons for adopting Open Compute certified products?

- There is a strong need to take costs out of the equation
- Customization at scale, ability to choose or change suppliers
- OCP certification is becoming a differentiator
- Global companies want a single WW SKU
- Automation simplifying maintenance; less downtime
- Emerging circular economy, and desire to go green



Data from only 21% Respondents

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Factors for Considering Adopting OCP Gears: Capex

- OPEX is more significant than Capex in TCO
- OCP-based Servers could be a little cheaper due to fewer BOM Components, Higher Volume, Rack as Delivery Unit and less R&D & Technical Support Effort, but More factors than BOM Impacting the Capex
  - ✓ 80% of BOM cost on CPU, Memory, HDD/SSD

Lower Capex

1. Are Your Workloads Similar to Large CSP's?
   - ✓ Evaluation required: CPU models (SKU), Memory Slots, Storage, Network (especially FC)
2. Do You Need to mix Non-OCP Gear on the same Rack?
   - ✓ OpenRack uses OU and 12/48VDC to equipment
3. Does Your Software (such as VMware, SAP Hana) required certificated Hardware?
   - ✓ Typically no OCP Gear Certificated by ODM vendors
4. Do You need to trouble-short the root cause in case of service outage?
   - ✓ If Yes, You would like VGA/KVM & Advanced BMC that OCP gears not – simple BMC for OCP
5. Do You Accept Rack as the PO & Delivery Unit?
   - ✓ If YES, You could get lower Capex by packaging more items
6. Could your data center handle 9KW-12KW/Rack?
   - ✓ If Not, then rack infrastructure cost amortization is Higher
7. Would you adopt Rack or Server-based Distributed Power Backup?
   - ✓ Significant Saving claimed by OCP CSPs with Rack or Server based Battery backup
   - ✓ Centerized UPS Power Backup has been used by Telcos and Enterprise, significant changes required

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Factors for Considering Adopting OCP Gears: OPEX

- OPEX is more significant than Capex in TCO
- OCP-based Servers are Customized designs with focus on lowering OPEX based on each CSP contributor's workload and data center environment – Co-Design of IT Gear and Data Center

Lower OPEX

1. Does Your Data Center use Free-Air Cooling up to 9-12KW/Rack?
   - ✓ Free Air-Cooling is the NO.1 contributor for lower Data Center TCO per OCP CSP Promoters
   - ✓ DC Region Average temperature, humidity, air-quality, water-supply, electricity Cost, Land cost
2. Do You Accept Rack as the PO & Delivery Unit?
   - ✓ Rack as a PO & Delivery Unit for Faster Time To Services, Lower OPEX
3. Are You Using 208 VAC Power Supply in your Data Center?
   - ✓ If Yes, then use of 277VAC PSUs will Get rid of 277VAC to 208VAC transformers and Achieve 2-3% higher AC-DC conversion efficiency
4. Would you adopt Rack or Server-based Distributed Power Backup?
   - ✓ Synchronized with Power Grid and Backup Generator could reduce battery backup time from minutes to dozens of seconds
   - ✓ Battery Backup Failure has much smaller impact for lower outage and recovery cost
5. Do You have ODM local supply chain for Quick & Reliable Supply?
   - ✓ Most ODMs focus on Large CSPs & Lack Global Presence
6. Do You need ODM local technical support?
   - ✓ Large CSPs need little technical support and ODM typically lack in-depth capabilities

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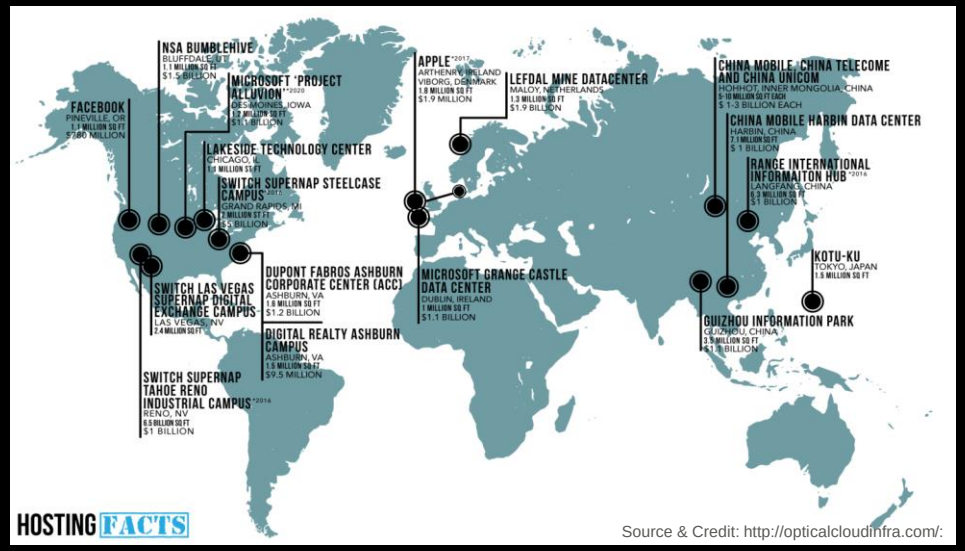
Free Air-Cooling is the Key for Low Data Center OPEX

- ✓ Build Mega Data Centers in Cold and Good Air Quality Areas to Support Free Air-Cooling



Source & Credit: http://opticalcloudinfra.com/:

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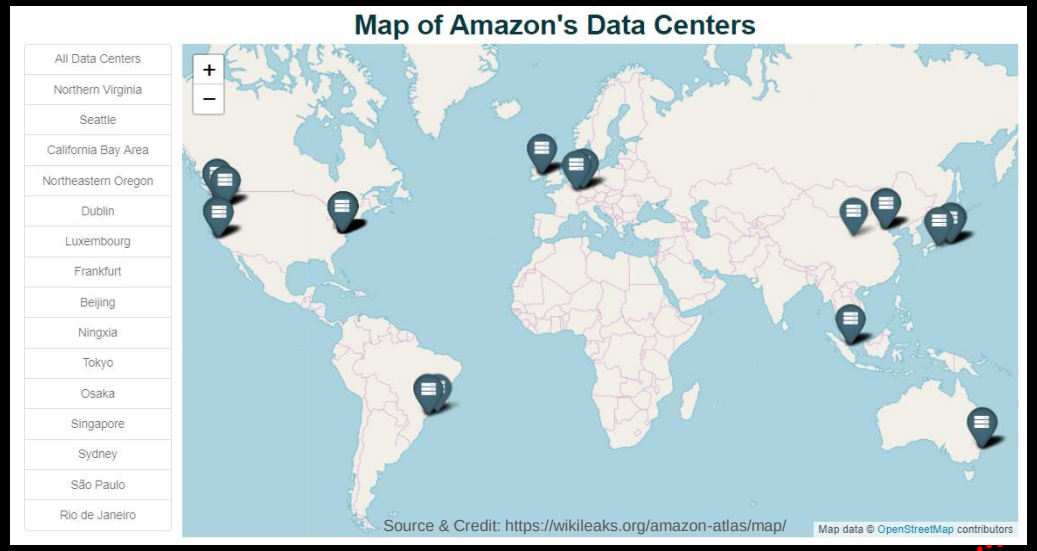

Source & Credit: https://wikileaks.org/amazon-atlas/map/

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Huawei's Position for OCP

https://www.opencompute.org/membership/membership-organizational-directory

1. Huawei has been an OCP Platinum Member, Supporting and Promoting Open & Collaborative Innovation, and Sharing Data Center Best Practices
   - ✓ Participate in & Contribute to 48VDC OpenRack V3, OAI, Battery Blade, etc
   - ✓ Some Disruptions after Middle of 2019
2. Why doesn't Huawei offer any OCP Compute Gear? – Lack of Strong Market demand:
   - ✓ Separate Procurements for Compute, Network and Storage
   - ✓ Procurement in Unit of Servers, Not in the Unit of Rack
   - ✓ Not able to adopt free-air cooling to fully leverage the advantage
   - ✓ Some Data Centers Only 5-6KW/Rack, not able to fully populate
   - ✓ Need detailed root-cause analysis in case of service outage / failure
   - ✓ Not able or unwilling to change to distributed battery backup due to existing Data Center Infrastructure
   - ✓ Need Flexible Configurations and strong technical support
3. We are looking at 48VDC-based Rack Scale Solutions(Similar to or Based on OpenRack V3) -- FusionPoD
   - ✓ 48VDC to Meet ever increasing CPU, GPU & AI ASIC power need
   - ✓ Announced in early 2019, but disrupted in 2019
   - ✓ FusionPoD Release May be in 2021

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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**

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 V5

Mission critical

5885H V5

High-Density Servers

2U 4-node

X6000

Compute-intensive

XH321 V5

XH321L V5

4U 4-node

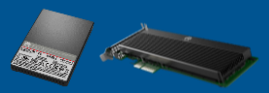
X6800

Storage-intensive

XH628 V5

Intelligent Acceleration Engine

NVMe SSD

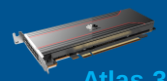


ES3000 V5

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

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Continuous Evolution Roadmap Synchronous to Intel Release Schedule

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Take-Aways

- ✓ Huawei has been an OCP Platinum Member, Supporting and Promoting Open & Collaborative Innovations and Sharing of Data Center Best Practices; and may have a 48VDC to server Rackscale Solution FusionPoD in 2021
- ✓ OCP Gears adoption in Telcos is still slow, and OpenEdge Gears will have the biggest potential as it was initialized by Telcos and is optimized for Telco Center Offices and Cell Office.
- ✓ To fully leverage the claimed OCP Data Center gears (assuming the OpenRack One) TCO advantages would need a lot of changes:
  - ❖ Rack as the Basic unit
  - ❖ Free air-cooling data center
  - ❖ Distributed & synchronized battery power backup
  - ❖ Accommodate to lack of detailed root cause analysis capability
  - ❖ Etc.,
- ✓ Huawei offers a rich Product Portfolio to Meet Your Intelligent Computing Needs

Thank you