Open Compute Project - Market Impact Assessment

Final Deliverable

February 2018

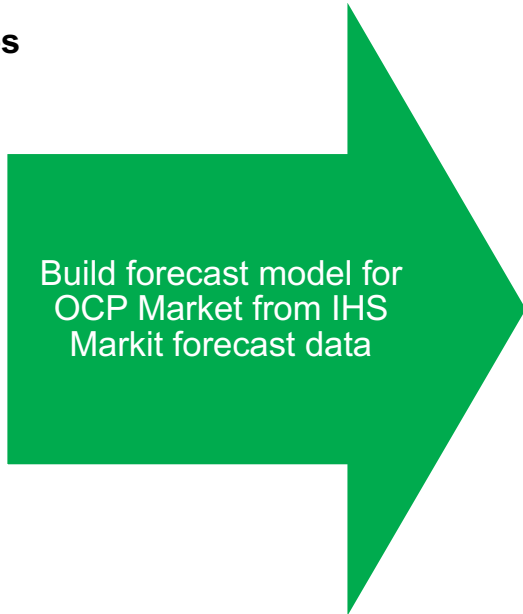## Cloud and Data Center Research Practice

IHS Markit™

Background

The **Open Compute Project (OCP)** commissioned **IHS Markit** to identify the impact the Open Compute Project Foundation community has had and will continue to have on the technology industry and its member organizations. **IHS Markit** is proceeding on two tracks:

Product Categories

Servers

Networking

Storage

Peripherals

Rack

Power

Other

Build forecast model for OCP Market from IHS Markit forecast data

OCP Non-Board Market

Conduct interviews with OCP suppliers and service providers

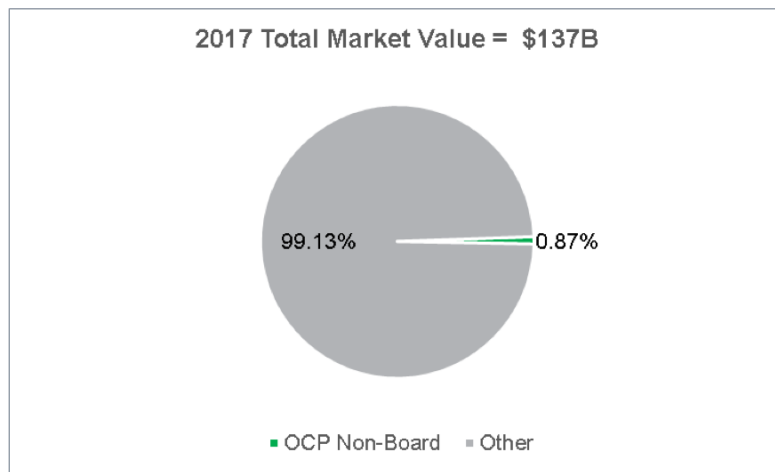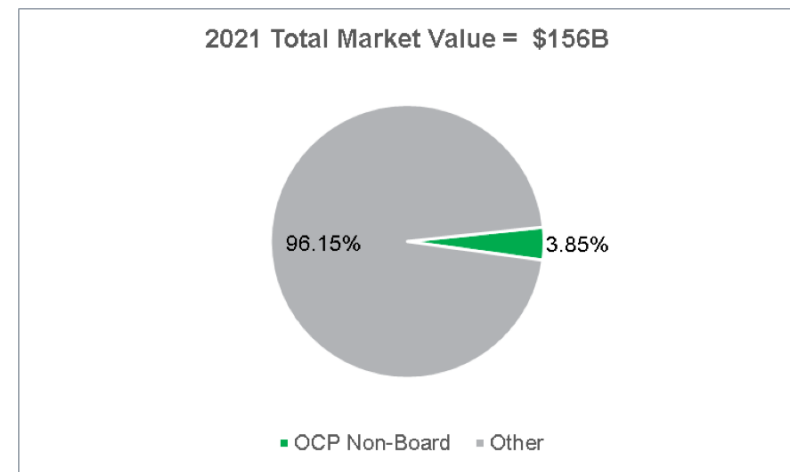**Interviewees**

End-Users
- Competitive Telcos
- Incumbent Telcos
- Colo Providers

Vendors
- OEMs
- ODMs
- Start-ups
- Integrators
- Whitebox

Non-Board OCP revenue pushes past $1B in 2017

Total market includes: Server, Storage, Switches, Rack, Power, Peripheral, and Other Revenue

2017 Total Market Value = $137B

99.13% 0.87%

■ OCP Non-Board ■ Other

2021 Total Market Value = $156B

96.15% 3.85%

■ OCP Non-Board ■ Other

- 2017 OCP Non-Board YoY growth 103%
- 2017 OCP Non-Board revenue: $1.2B

- 5YR CAGR 59%
- 2021 OCP Non-Board revenue: $6B

Non-Board OCP expands to new equipment markets

- Servers account for almost ¾ of OCP Non-Board revenue in 2017

- Growth rate of OCP Non-Board revenue in high double digits out to 2021

- Total market growing in low single digits

- Rack, power, peripherals, and Other (WiFi & PON) enjoy highest growth rates

OCP Non-Board by Product

Legend: Server, Switches, Storage, Rack, Power, Peripherals, Other, Growth Rate
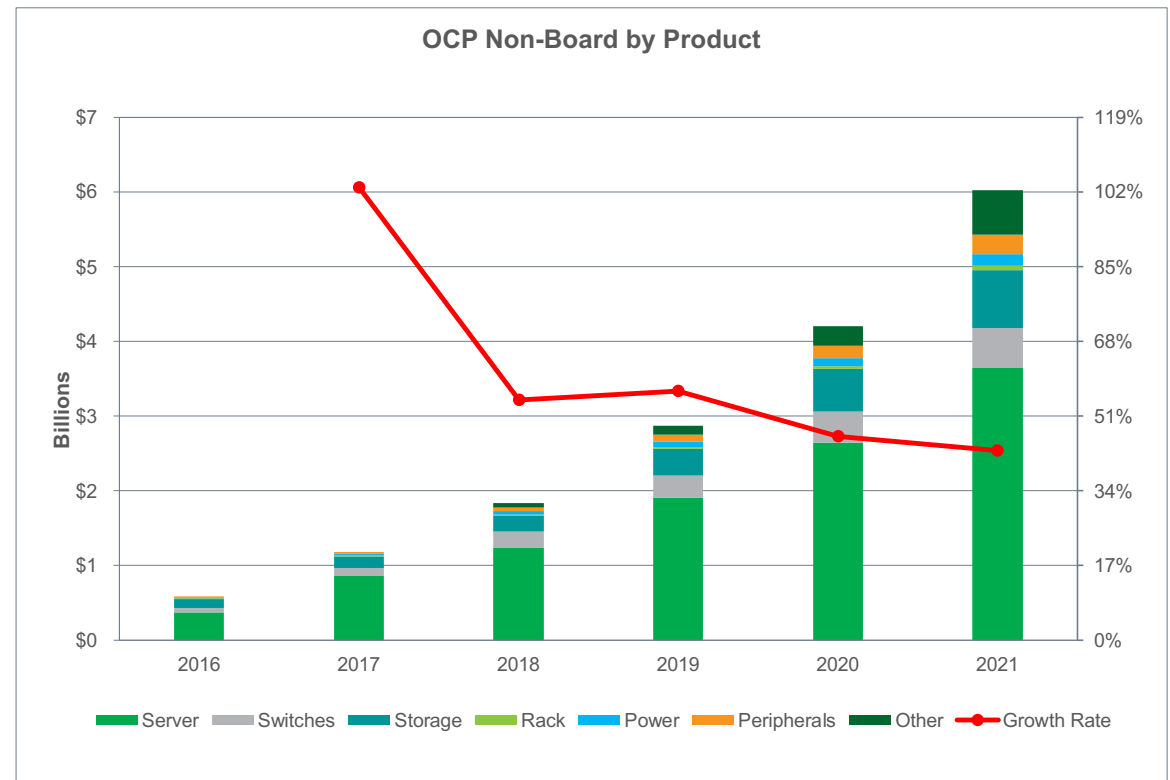
Non-Board OCP expands to include new equipment markets - detailed

Values	Product Category	Period 2016	2017	2018	2019	2020	2021	Grand Total
Amount	Server	$373,587,772	$859,369,867	$1,244,964,312	$1,911,578,643	$2,651,357,797	$3,644,970,400	$10,685,828,791
	Switches	$56,603,336	$102,549,160	$205,285,234	$295,445,897	$407,279,781	$533,135,931	$1,600,299,339
	Storage	$122,677,044	$161,876,242	$218,846,478	$354,528,765	$572,233,173	$776,558,982	$2,206,720,683
	Rack	$4,624,803	$9,871,211	$16,286,207	$27,647,398	$40,642,142	$58,834,572	$157,906,334
	Power	$11,483,501	$19,172,420	$41,225,554	$70,294,141	$103,792,418	$151,531,134	$397,499,167
	Peripherals	$15,256,832	$33,958,799	$54,372,178	$97,036,817	$161,821,560	$263,622,320	$626,068,506
	Other	$0	$0	$54,677,162	$118,447,784	$269,911,787	$594,304,565	$1,037,341,298
% Change YoY	Server		130.0%	44.9%	53.5%	38.7%	37.5%	
	Switches		81.2%	100.2%	43.9%	37.9%	30.9%	
	Storage		32.0%	35.2%	62.0%	61.4%	35.7%	
	Rack		113.4%	65.0%	69.8%	47.0%	44.8%	
	Power		67.0%	115.0%	70.5%	47.7%	46.0%	
	Peripherals		122.6%	60.1%	78.5%	66.8%	62.9%	
	Other				116.6%	127.9%	120.2%	
Total Amount		$584,233,288	$1,186,797,699	$1,835,657,124	$2,874,979,446	$4,207,038,658	$6,022,957,903	$16,711,664,117
Total % Change YoY			103.1%	54.7%	56.6%	46.3%	43.2%	

Americas (US) dominates through 2021

- Americas' early domination due to Non-Board hyperscaler and financial adoption, then driven by telco, CAGR 47%

- APAC will surpass EMEA on strength of hyperscaler adoption, CAGR 103%

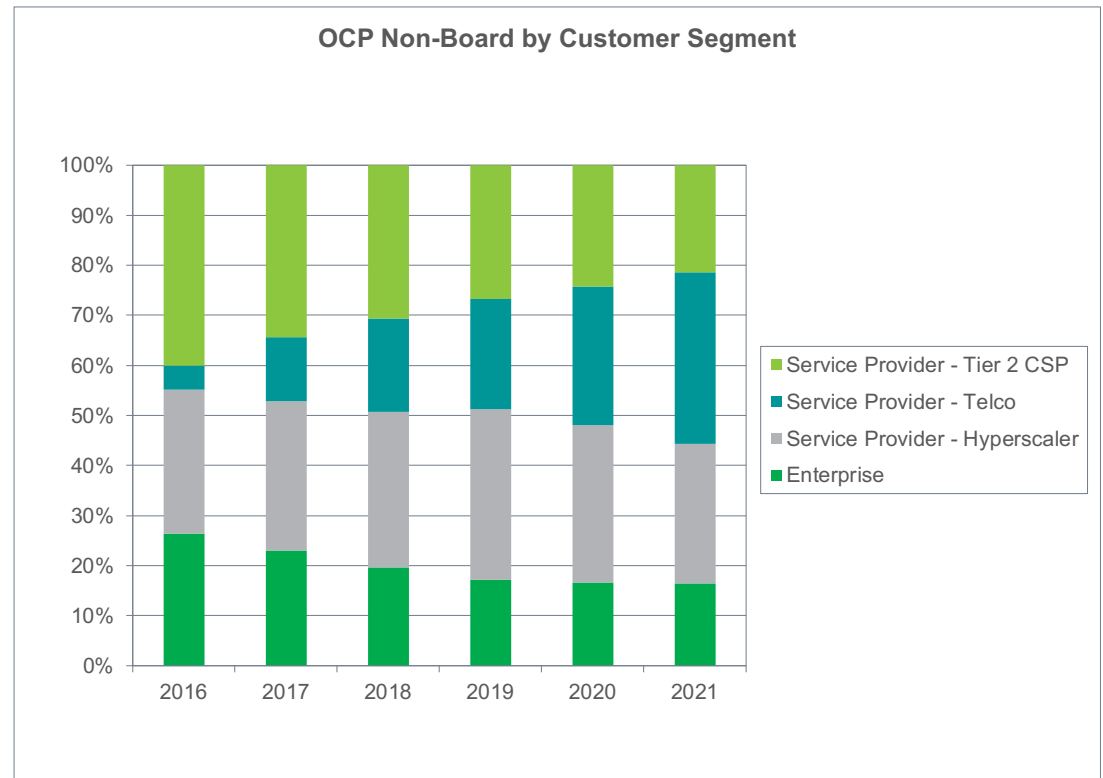- EMEA growth driven by telco, CAGR 70%

OCP Non-Board by Region
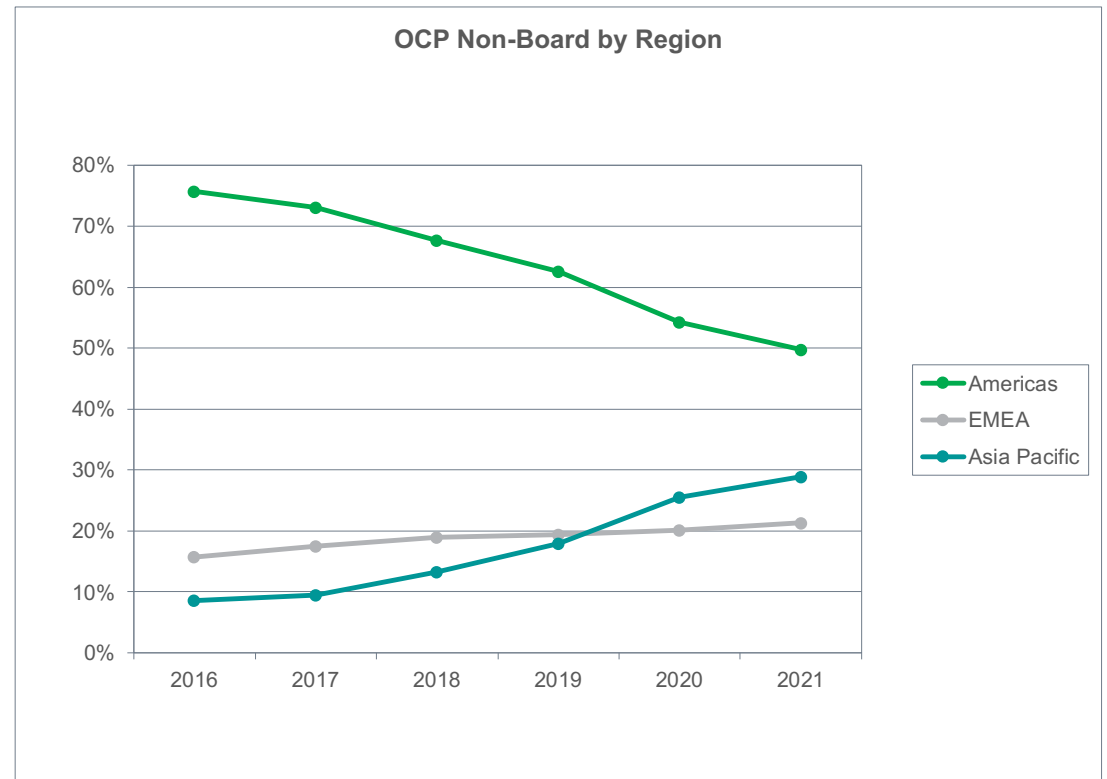
Americas (US) dominates through 2021 - detailed

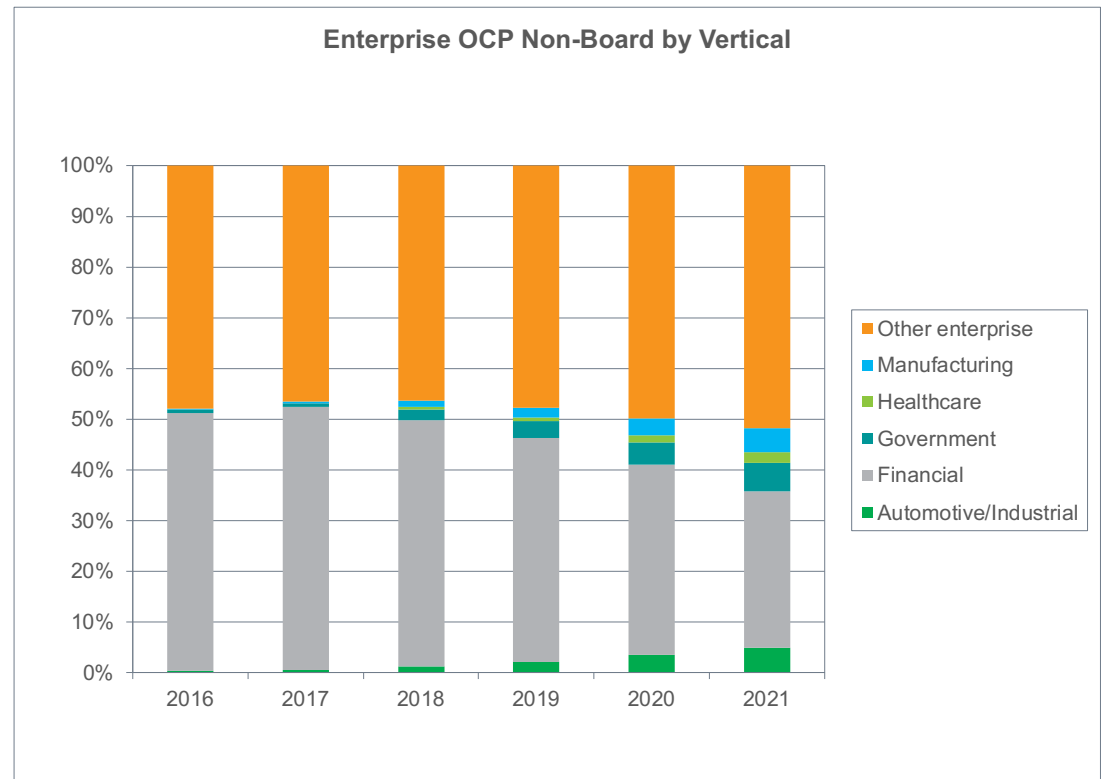| Values	Region	Period 2016	2017	2018	2019	2020	2021	Grand Total
Amount	Americas	$442,371,306	$867,481,632	$1,243,406,163	$1,799,987,731	$2,283,703,694	$2,996,876,152	$9,633,826,677
	EMEA	$91,800,263	$206,934,422	$348,717,861	$559,452,960	$847,198,186	$1,285,495,349	$3,339,599,041
	Asia Pacific	$50,061,719	$112,381,645	$243,533,100	$515,538,755	$1,076,136,778	$1,740,586,402	$3,738,238,399
% Change YoY	Americas		96.1%	43.3%	44.8%	26.9%	31.2%	
	EMEA		125.4%	68.5%	60.4%	51.4%	51.7%	
	Asia Pacific		124.5%	116.7%	111.7%	108.7%	61.7%	
Total Amount		$584,233,288	$1,186,797,699	$1,835,657,124	$2,874,979,446	$4,207,038,658	$6,022,957,903	$16,711,664,117
Total % Change YoY			103.1%	54.7%	56.6%	46.3%	43.2%	

Telco cloud is the next wave

- Non-Board hyperscaler and Tier 2 CSPs explored OCP servers in 2016 and start larger deployments in 2017-2019

- Telcos increase POCs in 2017, production trials ramp in 2018, scale deployments 2019+

- Non-Board hyperscalers are largest OCP switches customers thru CY21

- Telco total OCP spend will surpass Non-Board hyperscalers in 2021

OCP Non-Board by Customer Segment

Legend:
- Service Provider - Tier 2 CSP
- Service Provider - Telco
- Service Provider - Hyperscaler
- Enterprise

(Stacked bar chart showing percentage by customer segment for years 2016–2021, y-axis 0%–100%)

Finance yields to other (retail and education)

- Financials deploying largest number of Non-Board enterprise OCP products

- E-commerce and web-based enterprises such as travel fare aggregator websites the next biggest opportunity

- Other enterprise (incl. Retail & Education) expected to become largest enterprise switching sub-segment in CY21

- Enterprise customers continue to use AC power at rack, making OCP power the smallest component of their OCP spend

Enterprise OCP Non-Board by Vertical

Legend:
- Other enterprise
- Manufacturing
- Healthcare
- Government
- Financial
- Automotive/Industrial

Vertical split details

Values	Customer Segment	Customer Vertical	2016	2017	2018	2019	2020	2021	Grand Total
			Period						
Amount	⊟Service Provider	Hyperscaler	$168,567,432	$354,498,968	$576,183,192	$985,764,277	$1,333,077,313	$1,693,400,970	$5,111,492,152
		Telco	$27,853,040	$151,662,687	$344,159,203	$634,150,676	$1,174,643,878	$2,073,058,173	$4,405,527,656
		Tier 2 CSP	$233,760,016	$409,490,970	$563,384,477	$774,322,960	$1,024,163,306	$1,293,944,839	$4,299,066,569
	Service Provider Total		$430,180,488	$915,652,625	$1,483,726,871	$2,394,237,913	$3,531,884,497	$5,060,403,982	$13,816,086,377
	⊟Enterprise	Automotive/Industrial	$540,064	$1,436,033	$4,327,178	$10,551,336	$24,854,552	$48,853,556	$90,562,718
		Financial	$78,201,246	$142,337,640	$174,987,455	$218,904,955	$262,098,331	$306,647,105	$1,183,176,731
		Government	$1,073,069	$2,324,756	$7,968,956	$16,542,163	$31,422,232	$56,015,385	$115,346,561
		Healthcare	$0	$0	$1,529,202	$3,604,428	$9,480,403	$21,441,986	$36,056,019
		Manufacturing	$338,369	$999,533	$4,684,296	$9,720,930	$22,925,528	$46,754,184	$85,422,840
		Other enterprise	$73,900,051	$127,679,707	$167,310,615	$237,195,218	$349,344,063	$514,657,988	$1,470,087,643
	Enterprise Total		$154,052,800	$274,777,669	$360,807,701	$496,519,030	$700,125,109	$994,370,205	$2,980,652,513
% Change YoY	⊟Service Provider	Hyperscaler		110.3%	62.5%	71.1%	35.2%	27.0%	
		Telco		444.5%	126.9%	84.3%	85.2%	76.5%	
		Tier 2 CSP		75.2%	37.6%	37.4%	32.3%	26.3%	
	Service Provider Total			112.9%	62.0%	61.4%	47.5%	43.3%	
	⊟Enterprise	Automotive/Industrial		165.9%	201.3%	143.8%	135.6%	96.6%	
		Financial		82.0%	22.9%	25.1%	19.7%	17.0%	
		Government		116.6%	242.8%	107.6%	90.0%	78.3%	
		Healthcare		#DIV/0!	#DIV/0!	135.7%	163.0%	126.2%	
		Manufacturing		195.4%	368.6%	107.5%	135.8%	103.9%	
		Other enterprise		72.8%	31.0%	41.8%	47.3%	47.3%	
	Enterprise Total			78.4%	31.3%	37.6%	41.0%	42.0%	
Total Amount			$584,233,288	$1,190,430,294	$1,844,534,572	$2,890,756,944	$4,232,009,606	$6,054,774,187	$16,796,738,890
Total % Change YoY				103.8%	54.9%	56.7%	46.4%	43.1%	

OCP vendor survey results
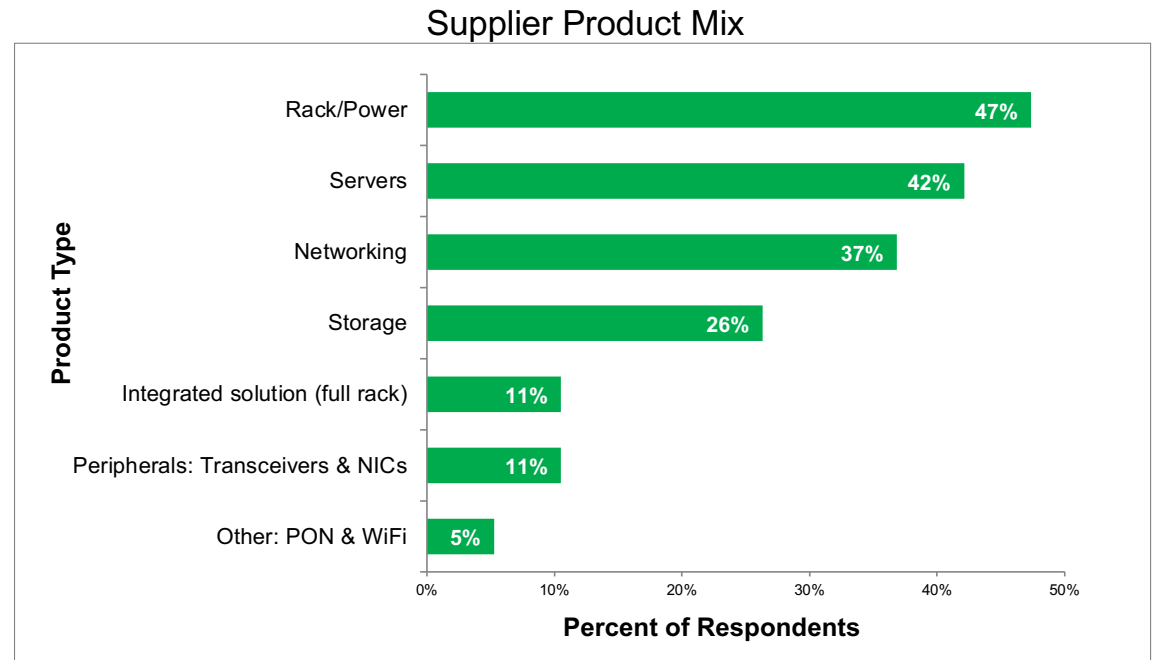
The following slides present findings from interviews with vendors of OCP products.

Many OCP designs are customized by end-users

- Good coverage on racks, servers and networking, storage limited to disk and SSD

- PON equipment is new to the OCP line-up and currently offered by a single vendor, can expect more

- Vendors now fielding requests about OCP products daily

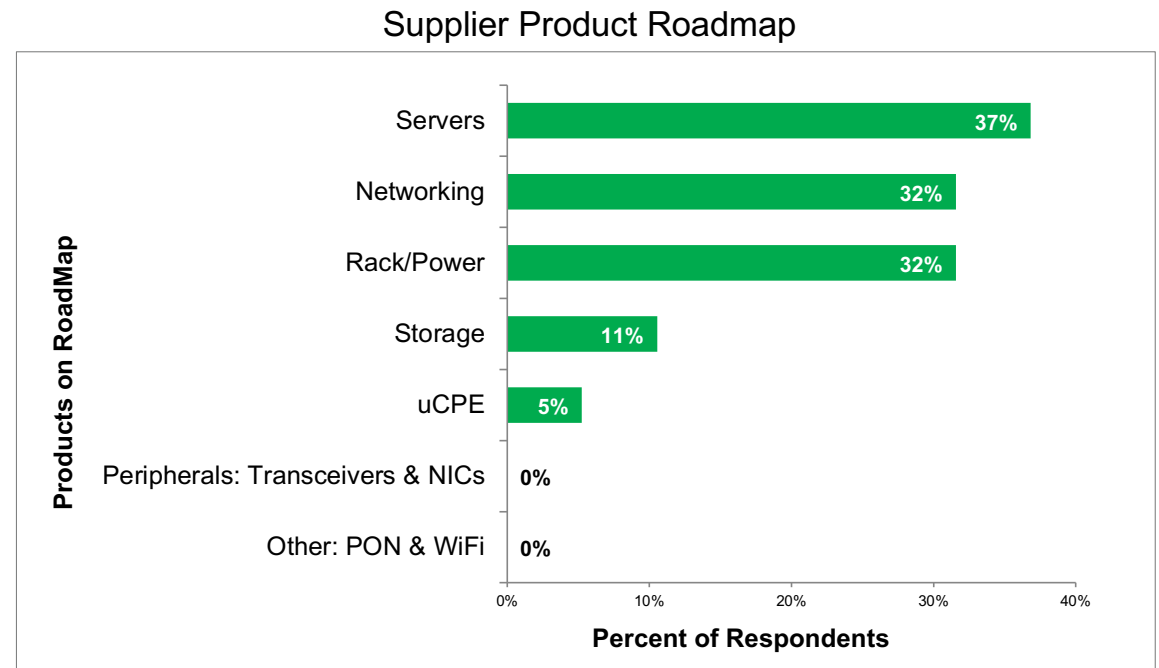- Software ecosystem and maturity still lags behind hardware

Supplier Product Mix

Product Type	Percent of Respondents
Rack/Power	47%
Servers	42%
Networking	37%
Storage	26%
Integrated solution (full rack)	11%
Peripherals: Transceivers & NICs	11%
Other: PON & WiFi	5%

Many vendors supply more than one OCP product.

Vendors target AI & ML, 200/400GE with Intel Skylake, AMD EPYC, and ARM

- Whitebox uCPE recently added to the mix targeting Telco cloud

- Compute will be enhanced with Intel Skylake, AMD EPYC, ARM and options for parallel compute in support of AI and ML

- Efforts ongoing to improve power distribution options (including DC), efficiency and battery backup

- Expect to see 200/400GE switching with deep buffering for DC spine
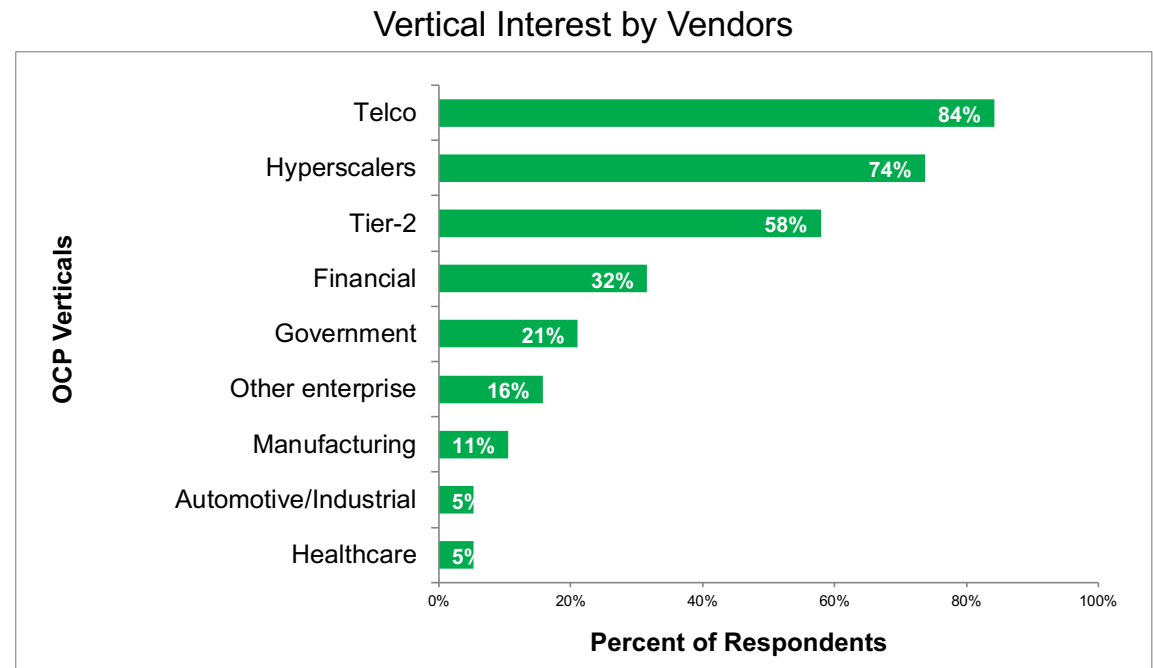
Supplier Product Roadmap

Products on RoadMap	Percent of Respondents
Servers	37%
Networking	32%
Rack/Power	32%
Storage	11%
uCPE	5%
Peripherals: Transceivers & NICs	0%
Other: PON & WiFi	0%

Many vendors have plans to introduce more than one new OCP product.

Telcos top explorer of OCP for Telco cloud (CO and uCPE deployments)

Q: From which types of customers (verticals, sizes) are you seeing the greatest **interest** in Open Compute products?
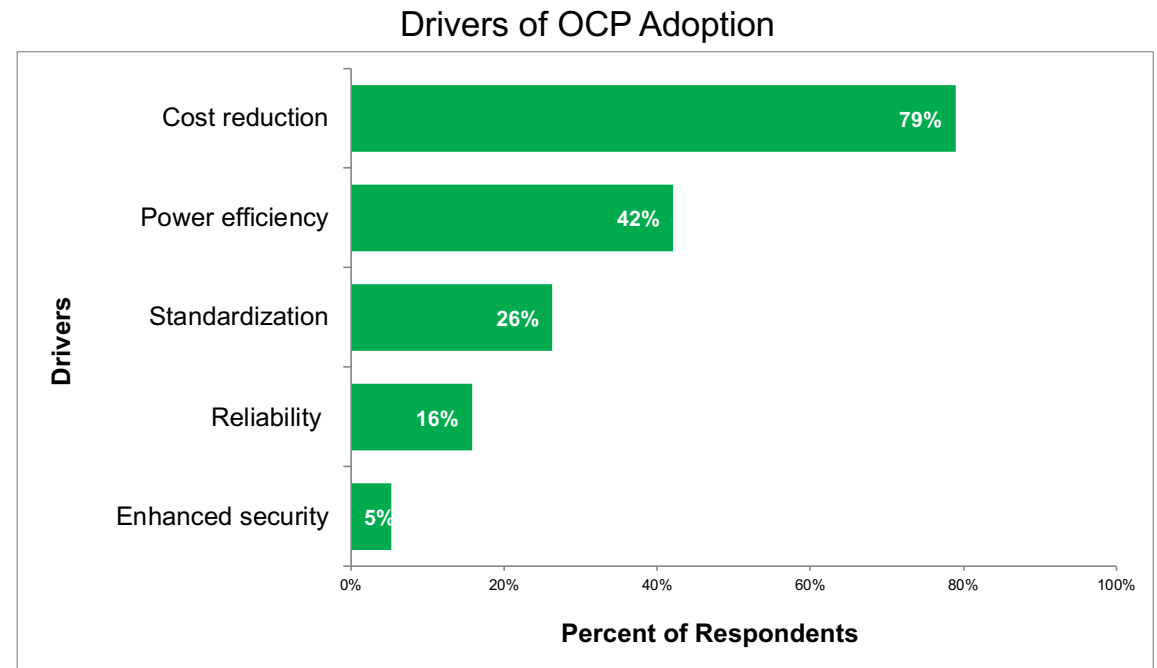
- Hyperscalers led the way for Tier-2 CSPs and Telco

- Telcos see OCP helping with 5G

- Governments looking to apply OCP in research and defense; believe open systems can be made more secure

- Organizations deploying are large, but interest exists across the board

Vertical Interest by Vendors

OCP Verticals	Percent of Respondents
Telco	84%
Hyperscalers	74%
Tier-2	58%
Financial	32%
Government	21%
Other enterprise	16%
Manufacturing	11%
Automotive/Industrial	5%
Healthcare	5%

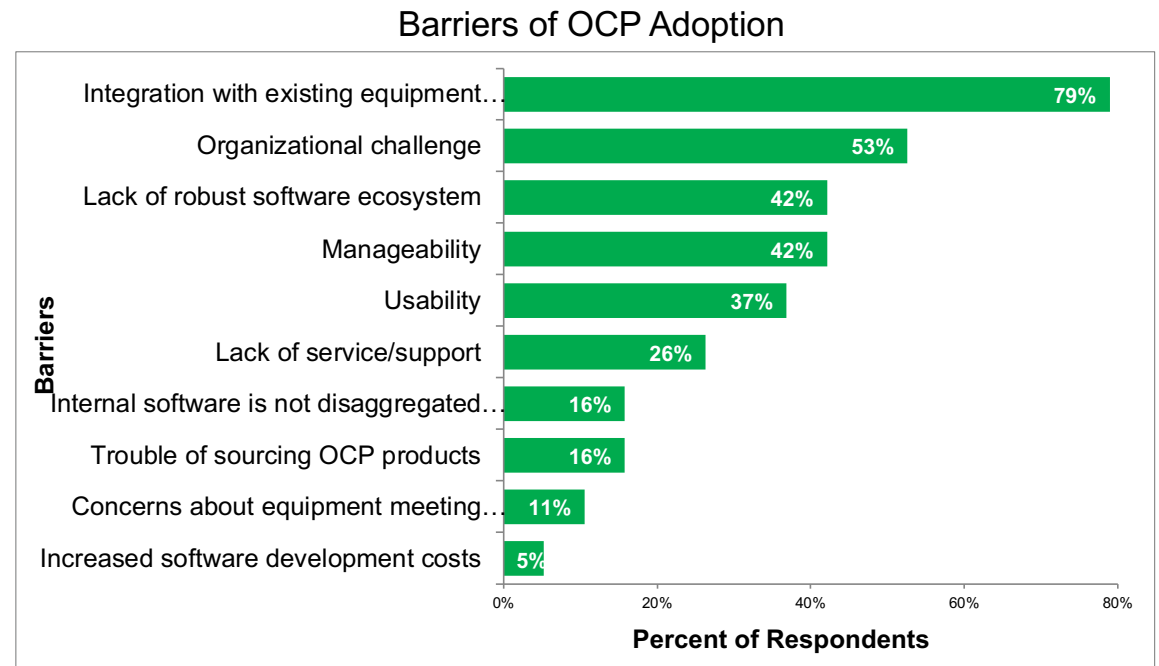# Top adoption drivers: Cost and power consumption reduction

- Quick deployments due to integrated racks and power efficiency are significant drivers for OCP rack and power

- Cost reduction and power efficiency biggest drivers for OCP servers

- Standardization and cost reduction are biggest influencers of OCP adoption for switches

Drivers of OCP Adoption

Driver	Percent
Cost reduction	79%
Power efficiency	42%
Standardization	26%
Reliability	16%
Enhanced security	5%

Drivers (y-axis) vs Percent of Respondents (x-axis, 0% to 100%)

Top adoption barriers: Integration and organizational challenges

Q: What are the top barriers your customers and/or target customers raise when evaluating use of OCP products?

- Education is a challenge, customers don't know where to buy OCP equipment and need mechanism to trial it to determine fit in their environment

- Manageability of OCP switch hardware w/ 3rd party software and competition from Chinese incumbents are adoption inhibitors

- Trouble sourcing compatible OCP products are a primary barrier

Barriers of OCP Adoption

Barrier	Percent of Respondents
Integration with existing equipment…	79%
Organizational challenge	53%
Lack of robust software ecosystem	42%
Manageability	42%
Usability	37%
Lack of service/support	26%
Internal software is not disaggregated…	16%
Trouble of sourcing OCP products	16%
Concerns about equipment meeting…	11%
Increased software development costs	5%

Vendors currently take direct approach to OCP product sales

Q: How do you bring Open Compute products to market?

- Many suppliers report that scale and custom-nature of OCP requests require direct contact with client

- Customers new to OCP products want guidance from vendors or SIs when purchasing

- 7 of 18 respondents reported using same channel strategy as for standard product line

Go to Market Strategy

Strategy	Percent of Respondents
Direct	89%
SI partner	42%
Software bundling	26%
Re-sellers & VARS	21%
Develop full rack integrated systems	11%

Strategies

Percent of Respondents
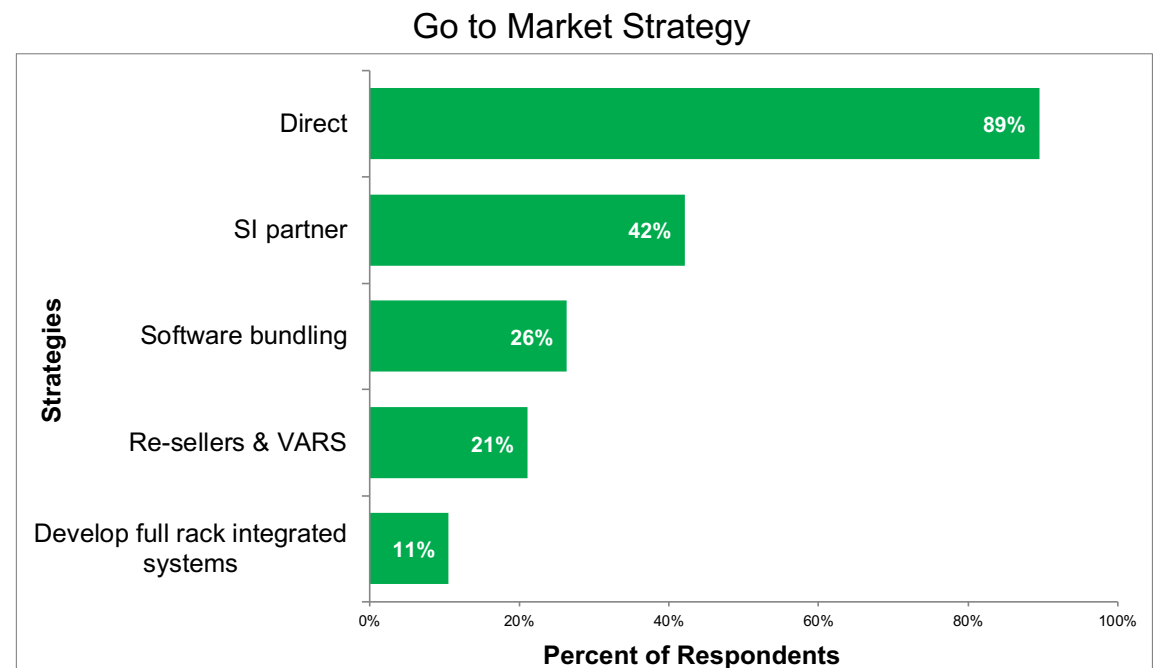
Vendors team up to provide total OCP solution

- Vendors seek multiple partnerships; which helps to bolster exposure to entire data center ecosystem

- OCP partnerships based on customer preferences and previous vendor relationships

- Vendor partner often differs based on geography; aids in entering new regions and reduces cost by local integration

Vendor Partnerships

Horizontal bar chart — Vendor Partners (y-axis) vs Percent of Respondents (x-axis):
- Other OCP hardware vendors: 82%
- System integrators: 29%
- Software vendors: 24%
- Re-sellers & VARS: 24%
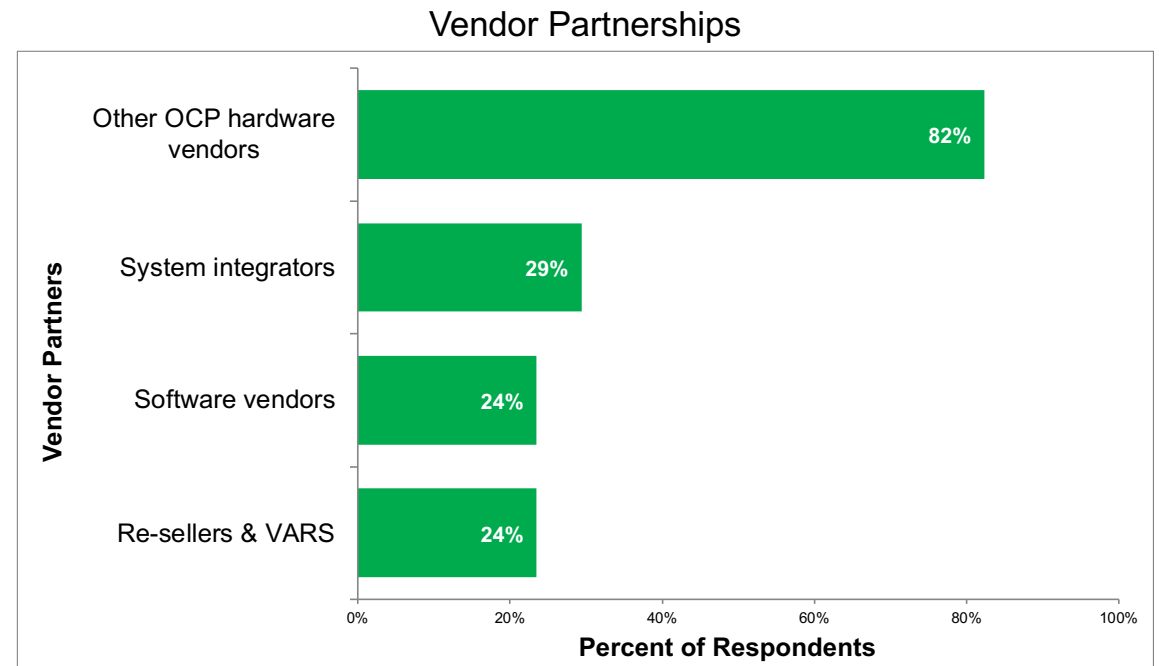
OCP vendor discussions

- Hyperscaler deployments are the current majority

- Telco (all sizes) and financials are still exploring, deployments still to come

- 7 key verticals: Telco, Web-scale Cloud, High Tech, Education, Manufacturing, Financial Services, Transportation.

- Biggest value is standard capabilities from open networking features

- Customers needs a software division and a "secret recipe" to really make the most of OCP

- Customers don't want to pay features they are not going to use.

- Open integration is a challenge.

- Education is a challenge and a big barrier - need to educate the customers on suppliers, how to try, will it integrate

- With OCP you have to plan out your data center purchases long in advance.

- You essentially get what is provided and it's up to you (the customer) to figure the rest out.

OCP end-user discussions

The following slides present findings from interviews with end-users of OCP products.

Next frontier for disaggregation is optical transport

- Current telco deployments are on a smaller scale; usually less than a dozen racks, sometimes as little as a half rack

- All interviewees have plans for expanded deployments; one said their mantra is "look at using OCP first, and only if it's not suitable to the purpose, do we then choose different equipment."

- Major OCP use cases cited by telco companies include: video on demand, voice, data and VPN for enterprise.

- Purchasing at scale will be from existing vendors being asked to supply OCP equipment

- Common manageability and disaggregation of hardware and software were two important drivers for end-user adoption

- Delay in software development for OCP hardware is causing some hesitation in adoption

- Tier 2 service providers cite distribution (purchasing from Taiwanese vendor for Brazilian deployment, for example) of OCP products as a barrier to adoption

- Looking for more variations on uCPE (ARM, coprocessors), improved software ecosystems and maturity and options for edge compute

Definitions

Definitions

Product Scope

Open Compute: equipment certified (OCP-ACCEPTED™ and OCP-INSPIRED) by OCP; includes equipment in certification process

Manufacturers' revenue (US$): reported for units shipped for revenue recognized during the calendar year. OEM revenue is attributed to the original manufacturer. We do not include revenue from service and support, product maintenance, managed services, and professional services

Product Categories

Servers: A networked physical device that provides shared compute functionality; typically contains a central processing unit (CPU), random access memory (RAM), storage, physical network interface, power supply, and management

Switches: Ethernet switches that forward traffic based on layer 2 information; used to build LANs enterprise/ service provider data center networks; does not include switches deployed for carrier metro Ethernet applications

Storage: A set of storage elements where data is held in an electromagnetic, digital circuitry, or optical form and can be loaded into server memory to be used for computation; can include hard disk and solid state storage devices and can be located within a server or a separate enclosure

Racks: Physical support infrastructure designed to hold power, cooling and IT equipment (servers, storage and network)

Definitions Continued

Power: Power delivery at the rack level that can include power distribution, battery back-up, and power conversion

Peripherals: Includes optical transceivers and Ethernet network adaptors

- Optical transceivers: pluggable modules supporting a single logical connection with an electrical system interface and an optical or electrical TX/RX line interface;

- Ethernet network adaptors: I/O cards used to connect servers and storage devices to Ethernet networks; can provide CPU offload; include stand-up and piggyback cards

Others: Includes passive optical and WiFi network equipment

- Passive optical network equipment: Including OLTs [optical line terminals] and ONTs [optical network terminals]

- WiFi network equipment: Enterprise-class wireless networking devices based on the 802.11 standard, including WiFi access points and controllers

Definitions Continued

Verticals

Market Segment: Organizations purchasing Open Compute Certified (Accepted and Inspired) equipment

Service Provider: Provide IT, communications or physical data center infrastructure services

Cloud: Provide IT and communications services over 3rd party networks; typically does not own end user access networks

Hyperscaler - Operate data centers totaling to >3 million square feet

Tier 2 - Operate data centers totaling to <3 million square feet

Telco: Traditional telecommunication network providers including MSOs and mobile carriers

Enterprise: Provides products and services to target select markets

Healthcare: organizations that provide medical and healthcare goods or services; this sector includes hospital management firms, health maintenance organizations (HMOs), biotechnology and pharmaceutical firms.

Financial: companies that provide financial services to commercial and retail customers; this sector includes banks, investment funds, insurance companies and real estate firms.

Government: provides municipal, state and country wide services to its citizens

Manufacturing: companies engaged in the fabrication, processing, or preparation of products from raw materials and commodities. This includes all foods, chemicals, textiles, machines, and equipment.

Automotive/Industrial: companies that produce goods used in the manufacture of automotive products as well as goods used for construction and manufacturing; specifically aerospace and defense equipment as well as industrial machinery, tools, lumber production, construction, waste management, manufactured housing, cement and metal fabrication.

Other: all other enterprise verticals, such as hospitality, education, retail, etc.

Questions? Please feel free to email us

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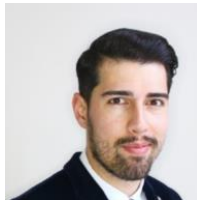
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