

# 2020 Outlook

## The Cloud Has Four Walls

19 December 2019  
Equity Research | Americas



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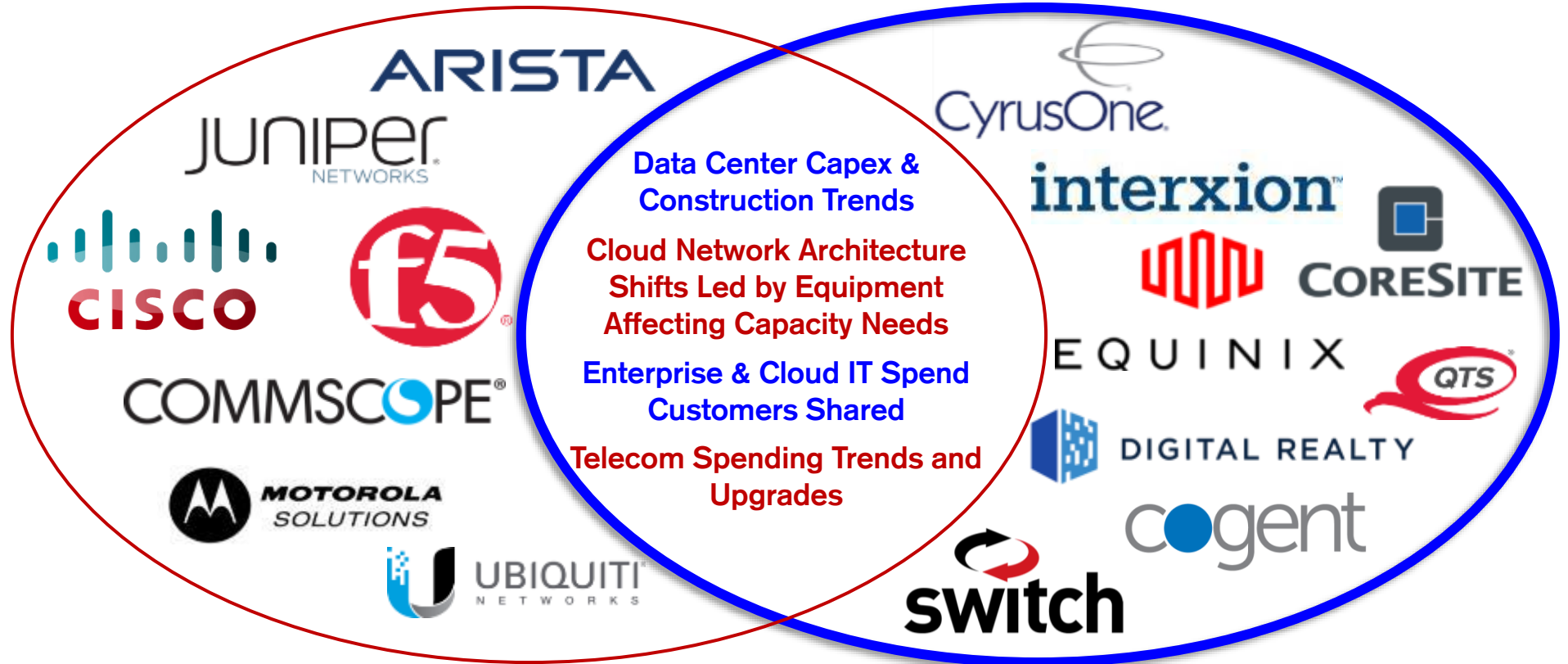
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## Communications Equipment

## Communications Infrastructure



**Coverage Model Structured to Capture Both Communications Sectors with Streamlined IT Spend, Cloud, & Telecom Visibility modeled across both sectors.**

Source: Credit Suisse Research.

# Coverage Summary – Top Picks, Ratings, & Target Prices

2020 Outlook

Ticker	Comm. & Networking Equipment Rating/Thesis	Ticker	Comm. Infrastructure Rating/Thesis
<b>MSI</b>	<b>Top Pick: (Outperform, \$178 Target Price)</b> – MSI is one of very few providers that can offer a true end-to-end solution for customers from first responder radios to full command center communications in one aggregated and auditable system. We see MSI as the leading provider and highly irreplaceable given it is the only true large scale U.S. based end-to-end provider. MSI leads on OM, EPS, and FCF/S Growth in FY20.	<b>CCOI</b>	<b>Top Pick: (Outperform, \$75 Target Price)</b> – CCOI's position as a low-cost pure-play internet provider, with revenue per connection that most competitors' can't match allows it to perform relatively well, even in turbulent environments. We believe that the company will continue to deploy capital at a comparable rate, maintaining its dividend growth levels with the potential for some share repurchases in 4Q19 and 2020. Additionally, we expect salesforce productivity to improve meaningfully in 2020 due to more experienced staff, boosting the topline and improving margins thereon.
<b>COMM</b>	<b>(Outperform, \$21 Target Price)</b> – Despite recent pressures on COMM's end markets, we continue to positively view the company's relevance to overall telecom network densification and data center build-outs over the next five years. The company is in the process of stabilizing its businesses, growing EBITDA, and beginning to pay down debt at a consistent rate, making them attractive from a valuation perspective.	<b>EQIX</b>	<b>(Outperform, \$634 Target Price)</b> - EQIX is the market interconnection leader, which is recurring and high margin long-term. They are the most global and distributed data center REIT with a global brand, a leader in almost every market they operate in and are positioned to benefit from 5G spending and interconnection optimization.
<b>FFIV</b>	<b>(Outperform, \$192 Target Price)</b> – Despite the end market pressures by cloud providers, we continue to see FFIV's relevance in the enterprise customer multi-cloud transition as networking interconnectivity becomes increasingly more complex, requiring superior product solutions like FFIV's ADCs.	<b>SWCH</b>	<b>(Outperform, \$19 Target Price)</b> – SWCH offers immense amounts of power for customer workloads at low power rates, and through its fiber routes, the company passes through tax incentives on data center demand. The recent earnings beats underscore our belief that last year's weakness was transitory and expect strong lease demand into 2020.
<b>ANET</b>	<b>(Neutral, \$153 Target Price)</b> – Despite ANET's relatively successful expansion into the Campus and WLAN markets, its cloud titan procurement shift is likely to be a lingering headwind, and remains a much greater percent of revenue. The shift in procurement, and its pushout of shipment plans for 400GB switching move us to the sidelines for now, as we assess cloud customer spending trends.	<b>CONE</b>	<b>(Neutral, \$70 Target Price)</b> – We remain Neutral on CONE in light of elevated SG&A expenses to ramp European operations, a process that we believe will require two years of continued investments. Despite the solid execution in Europe and in the U.S., we remain on the sidelines due to the significant EBITDA margin drag that will come with the push into Europe, establishing a multi-market enterprise salesforce. All in, CONE is in a transition, putting pressure on margins and compressing ROIC metrics near-term with scope for further equity dilution due to backlog build-outs.
<b>CSCO</b>	<b>(Neutral, \$46 Target Price)</b> – Solid market share position across 5+ market segments but challenged in various areas, as CSCO shifts its business towards a more software/recurring revenue model. Following accounting tailwinds in FY19 and the early phases of the campus switching refresh cycle tapering-off, we believe momentum in CSCO's revenue growth will begin to level-off, pending major SP spending upticks and/or 400GB data center switching wins.	<b>COR</b>	<b>(Neutral, \$101 Target Price)</b> – Although COR has grown well organically and owns a strong interconnection business, we remain Neutral on COR due to its transition year and highly competitive colocation market especially when factoring the elevated leverage into our rationale.
<b>JNPR</b>	<b>(Underperform, \$19 Target Price)</b> – JNPR faces multiple pressures that we believe will lead the stock to Underperform. These include intensifying technological pressures from CSCO – virtual core and new Silicon One/8000 Series offerings – the rise of White Boxes, and slower than expected 5G deployments. We believe the 400G switching opportunity is far from materializing and have our reservations around JNPR's maneuvers to insert themselves into designs despite early customer lab testing.	<b>QTS</b>	<b>(Neutral, \$52 Target Price)</b> – QTS' recent performance has been very strong, indexed to cloud growth and enterprise hybrid growth with solid assets in Georgia and expansions into Arizona, but remains a slow moving asset consolidator. Lease signings were ahead of previous quarters, highlighting the consistency of the company's new core strategy, and a rising backlog is the result of strong demand, particularly from hyperscalers.
		<b>DLR</b>	<b>We are restricted on Digital Realty Trust (DLR).</b>
		<b>INXN</b>	<b>We are restricted on InterXion Holding (INXN)</b>

Source: Credit Suisse Research.



**Interconnection Leaders Strengthen:** For 2020, we see the data center sector as well positioned to continue its rise in relevance and growth, following double digit stock returns in 2019. We identify core interconnection providers (Equinix, Switch) as best positioned to benefit from the proliferation of cloud computing, enterprise multi-cloud adoption, and edge computing with 5G deployments within the next two years. We highlight the following key drivers and observations for 2020E/2021E as follows, pertaining to all communications infrastructure and cloud computing growth as it relates to the data center industry:

- **Multi-Tenant Data Center (MTDC) Market (\$31B TAM) Revenue Growing at ~8% CAGR vs. Interconnection (\$3.1B TAM) Revenue Growing at ~14% CAGR Through 2023E:** Supporting our view that interconnection companies will see further strength in 2020E versus prior years is supported by interconnection growing 50% faster than the total MTDC market on a broad basis, highlighting the opportunity. This growth is being fueled by the majority of the cloud technology ecosystem, including: 1) public cloud providers (AWS, MSFT, GOOGL, IBM, ORCL), 2) internet service providers (VZ, AT&T, CCOI, Others), 3) enterprises adopting multi-cloud architectures (Fortune 2,000), 4) software defined networking providers (PacketFabric, Megaport, Others), and 5) SaaS companies (Cisco, F5 Networks, content delivery networks, Others) all relying more heavily on the well distributed and established colocation footprint of core interconnection providers (Equinix, Switch).
- **Infrastructure as-a-Service (IaaS) and Cloud as-a-Service (CaaS) Growth Rates Support Interconnection Thesis:** The \$85B IaaS market is growing at the same rate as the interconnection market, both at 14% CAGR through 2023E. The \$55B CaaS market, which heavily relies on colocation interconnectivity and application hosting, is growing almost double the interconnection market at ~25% during the same period, outlining the broad market growth of the colocation and interconnection services markets.
- **Cloud and SDN On-Ramps Largely Distributed, SaaS On-Ramps to Add to Momentum:** Highlighted in our report, Cloud and SDN On-Ramps will continue to be growth drivers in 2020E and will be required for SaaS companies to accelerate their revenue growth and new service offerings, seeing SaaS PoPs grow rapidly in 2020E and 2021E. We believe that As-a-Service growth is interconnected to colocation/interconnection businesses being well distributed, allowing for a virtuous cycle of sector cloud development.

### Other Considerations:

- **Hyperscale Capex Spend Projected to Grow 6.5% CAGR Through 2022E:** Hyperscale Capex is a leading indicator for the Multi-Tenant Data Center industry largely because ~40% of all data center space, power, cooling, and interconnection is outsourced to third party data centers rather than built and maintained by the cloud service providers. Based on our discussions with industry professionals, we expect this percent of outsourcing to begin increasing to the ~50% range by 2020 as largely a by-product of the vast scale the MTDC operators have gained over the last three years, driving even more business to MTDCs, especially wholesale providers that have specialized in large scale data center developments across Tier 1, 2, and 3 markets. Notably, across Tier 1 European Markets cloud providers have been reported to outsource 100% of capacity.
- **Mergers & Acquisitions:** 2019 included the largest M&A announcements to date. We see scope for further industry consolidation in 2020, largely driven by strong business dynamics and 30+ data center operators in the private sector, fragmenting the market.
- **Private Market Data Centers:** We do not see any material changes to business performance or valuation in the private market in 2020E due to company formation vintages.
- **Edge Data Centers a 2021E Catalyst:** Edge computing and edge facilities remain 2021 catalysts in our view, not 2020E catalysts. See our Edge thesis video, link enclosed.

### Key Stock Picks:

**Top Pick: CCOI (Outperform, \$75 Target Price)** – CCOI is executing well ahead of its industry peers within the internet service provider industry, consistently delivering organic revenue growth, and the stock price has recently reflected slightly better than expected revenue growth, a metric we believe is going to inflect positively in upcoming quarters driven by salesforce productivity optimizations that have been a core focus of the company in 2019.

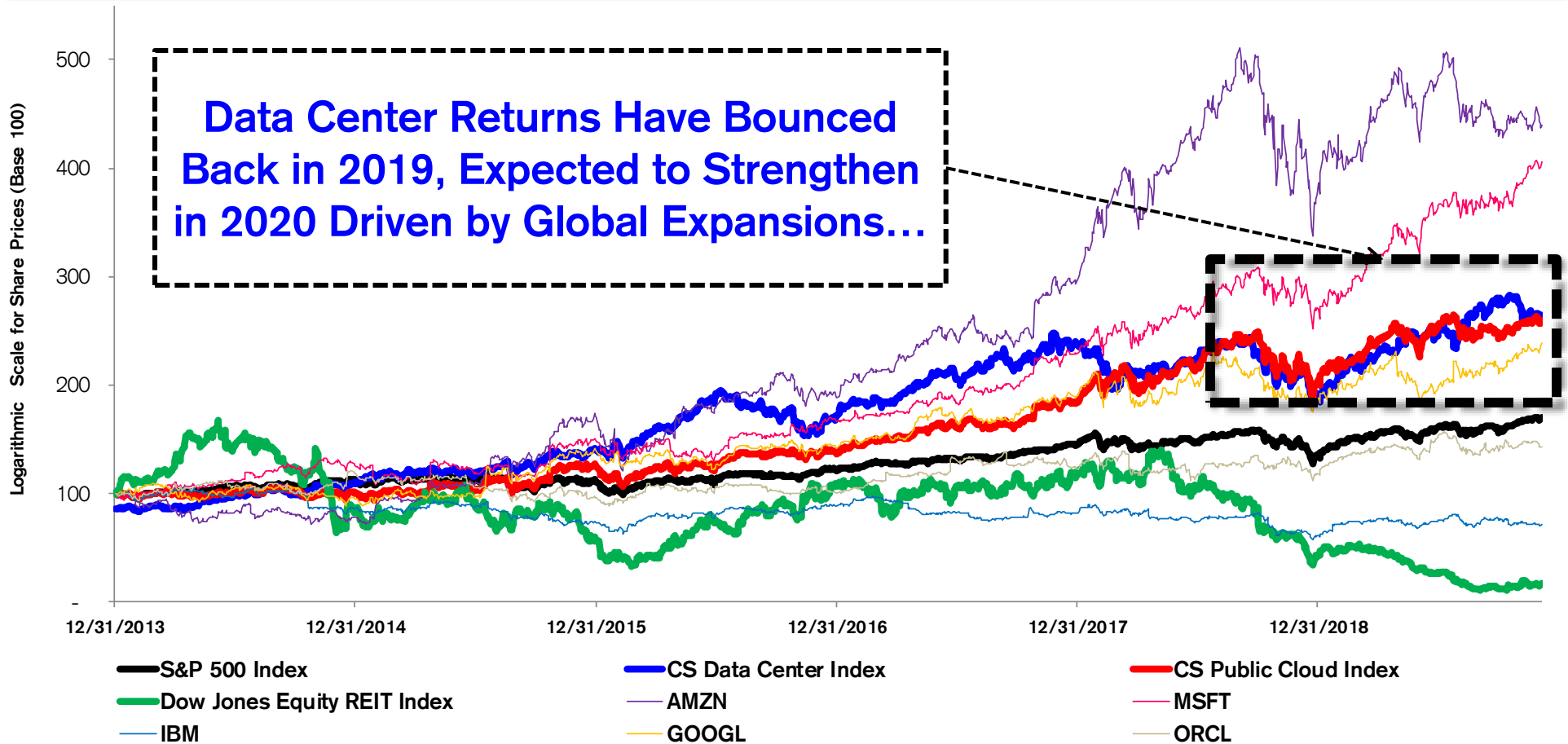
**EQIX (Outperform, \$634 Target Price)** – EQIX is the market interconnection leader (recurring and high margin long-term). They are the most global and distributed data center REIT with a world class brand, a leader in almost every market they operate in and are positioned to benefit from 5G spending and interconnection distribution.

**SWCH (Outperform, \$19 Target Price)** – SWCH offers immense amounts of power for customer workloads at low power rates, and through its fiber routes, the company passes through tax incentives on data center demand. The recent earnings beats underscore our belief that the prior year weaknesses were transitory and the generation of strong lease demand into 2020 is expected to continue, driven by cloud and gaming companies leveraging SWCH's Four Prime data center footprint.

Source: Credit Suisse Research, I.H.S. Markit (used for industry growth data).

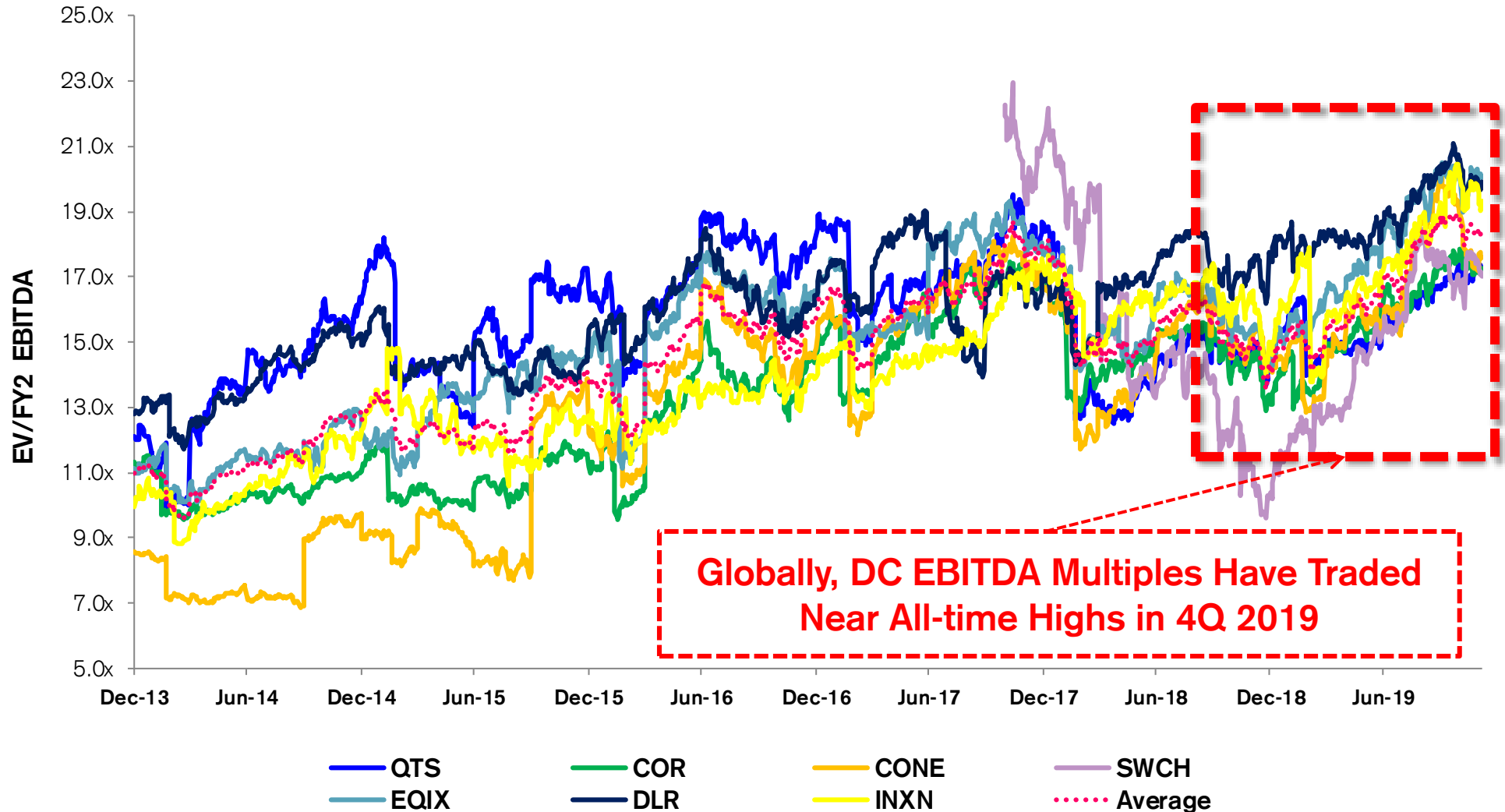
# Data Centers Have Outperformed Major Indices Over Time, Beating Our Public Cloud Index Marginally by Dec. 2019

CS Data Center share price performances have outperformed major benchmarks including the S&P 500 and the Dow Jones Equity REIT index since January 2014. We note the only cloud providers keeping pace, having surpassed the data center REITS in late 2017, are Amazon and Microsoft as shown below. Since mid-2018, the CS Data Center Index average has closely tracked with CS Public Cloud Index the (Amazon, Microsoft, IBM, Google, Oracle). Our Data Center Index includes EQIX, DLR, INXN, COR, CONE, SWCH, and QTS.



Source: FactSet, Credit Suisse Research.

# Data Center EBITDA Multiples Have Expanded Significantly Through 2019 and We Expect Levels to Hold Through 2020...

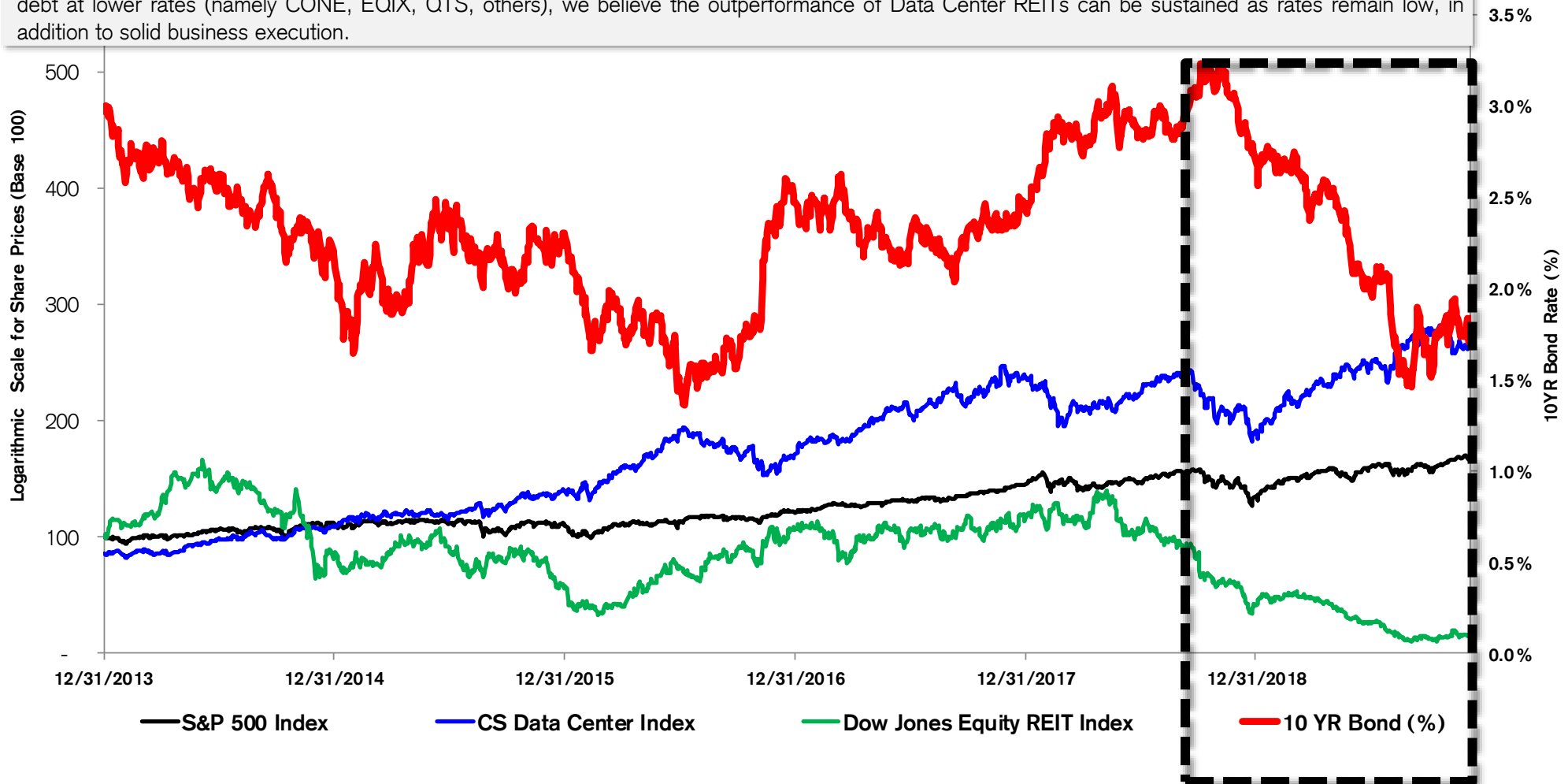


Source: FactSet, Credit Suisse Research.



# Reduced 10YR Rates Have Supported DC REIT Valuations, But Not All Equity REITs Were Supported by Rates in 2019...

Despite 10yr rates coming down to sub-2% levels, most investors and industry constituents have viewed this dynamic as a positive for the entire REITs industry, however, that is not true for all real estate companies as the DJ Equity REIT Index underperformed the S&P 500 Index and CS Data Center Index (that is predominantly made up of data center REITs). In our view, as long as rates hold at current levels and data center operators continue to renew their debt at lower rates (namely CONE, EQIX, QTS, others), we believe the outperformance of Data Center REITs can be sustained as rates remain low, in addition to solid business execution.



Source: FactSet, Credit Suisse Research.

# Cloud SP Market to Outpace MTDC Market Growth Through 2023E

**Data Centers**

Cloud Service Provider Market (\$ millions)										CAGR	
	2015	2016	2017	2018	2019E	2020E	2021E	2022E	2023E	13-'18	18-'23
Infrastructure as a Service (IaaS)	30,717	34,340	41,625	55,753	71,321	84,918	95,230	102,251	106,701	25.9%	13.9%
Y/Y Change	23.4%	11.8%	21.2%	33.9%	27.9%	19.1%	12.1%	7.4%	4.4%		
Cloud as a Service (CaaS)	6,958	12,070	19,109	28,488	41,164	54,967	67,878	78,365	85,942	71.6%	24.7%
Y/Y Change	84.4%	73.5%	58.3%	49.1%	44.5%	33.5%	23.5%	15.4%	9.7%		
Platform as a Service (PaaS)	5,919	10,099	15,962	24,175	34,533	45,404	55,137	62,701	67,962	79.0%	23.0%
Y/Y Change	106.8%	70.6%	58.1%	51.5%	42.8%	31.5%	21.4%	13.7%	8.4%		
Software as a Service (SaaS)	47,193	55,018	65,873	79,947	92,934	106,500	120,267	133,834	146,821	31.7%	12.9%
Y/Y Change	62.5%	16.6%	19.7%	21.4%	16.2%	14.6%	12.9%	11.3%	9.7%		
<b>Total CSP Revenue</b>	<b>90,787</b>	<b>111,527</b>	<b>142,569</b>	<b>188,362</b>	<b>239,952</b>	<b>291,789</b>	<b>338,512</b>	<b>377,150</b>	<b>407,425</b>	<b>35.6%</b>	<b>16.7%</b>
Y/Y Change	49.9%	22.8%	27.8%	32.1%	27.4%	21.6%	16.0%	11.4%	8.0%		

**Cloud Service Provider Revenues Are Growing at a 16.7% CAGR from a \$188bn Base from 2018 to 2023E, Expanding the Market by ~\$44bn per Year Through 2023E:** The most significant attributor to the growth of Data Center REITs (MTDCs) in the past few years has been its indexation to rapid growth of the Cloud Service Providers, building hyperscale data center campuses and interconnecting latency sensitive applications, largely driven by the major Big5 public cloud players Amazon Web Services (AWS), Microsoft Azure, Google Cloud (GCP), IBM Cloud, and Oracle Cloud. **Even though MTDCs are growing at half the rate of CSPs, we do not see the growth rate decelerating within the next 10yrs, largely driven by overall cloud infrastructure demand that is growing faster.**

Multi-Tenant Data Center Market (\$ millions)										CAGR	
	2015	2016	2017	2018	2019E	2020E	2021E	2022E	2023E	13-'18	18-'23
Colocation	16,314	19,121	20,968	23,515	25,662	27,896	30,152	32,379	34,658	11.5%	8.1%
Y/Y Change	8.0%	17.2%	9.7%	12.1%	9.1%	8.7%	8.1%	7.4%	7.0%		
Interconnection	1,643	1,900	2,163	2,428	2,755	3,107	3,492	3,891	4,288	12.9%	12.1%
Y/Y Change	10.8%	15.7%	13.8%	12.3%	13.5%	12.8%	12.4%	11.4%	10.2%		
<b>Total MTDC Revenue</b>	<b>17,957</b>	<b>21,021</b>	<b>23,131</b>	<b>25,943</b>	<b>28,417</b>	<b>31,004</b>	<b>33,645</b>	<b>36,270</b>	<b>38,946</b>	<b>11.7%</b>	<b>8.5%</b>
Y/Y Change	8.2%	17.1%	10.0%	12.2%	9.5%	9.1%	8.5%	7.8%	7.4%		
Total MTDC % of IaaS	58.5%	61.2%	55.6%	46.5%	39.8%	36.5%	35.3%	35.5%	36.5%		
Interconnection Attach To Colo	10.1%	9.9%	10.3%	10.3%	10.7%	11.1%	11.6%	12.0%	12.4%		

**MTDC Market Is Growing at a ~8.5% CAGR from a \$26bn Base from 2018 to 2023E, Expanding the Market by Over ~\$2.6bn Per Year:** Based on our market projections, the MTDC market is projected to maintain the ~8.5% CAGR level not only through 2023 but beyond, driven by a combination of factors including lease price escalators (average at ~2% per year), higher demand for power (that is being passed through to the customer), space, and interconnectivity (cloud on-ramps, SDN on-ramps, Software Co. Pops) to accelerate processes. We note that MTDC revenues comprise of colocation revenues and interconnection revenues. **Given MTDC market's relevance to the cloud ecosystem, we believe our ~8.5% CAGR estimate may prove conservative, especially after considering the overall Cloud Service Provider market is ~16.7% CAGR though 2022 (see above).**

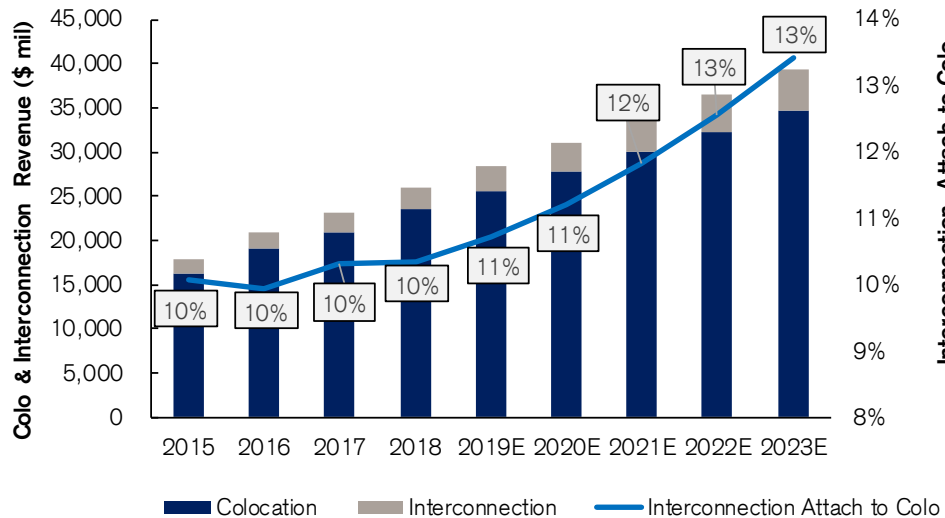
Source: I.H.S. Markit, Credit Suisse Research.

# Interconnection (IX) Growth to Outpace Colocation Growth Through 2023E

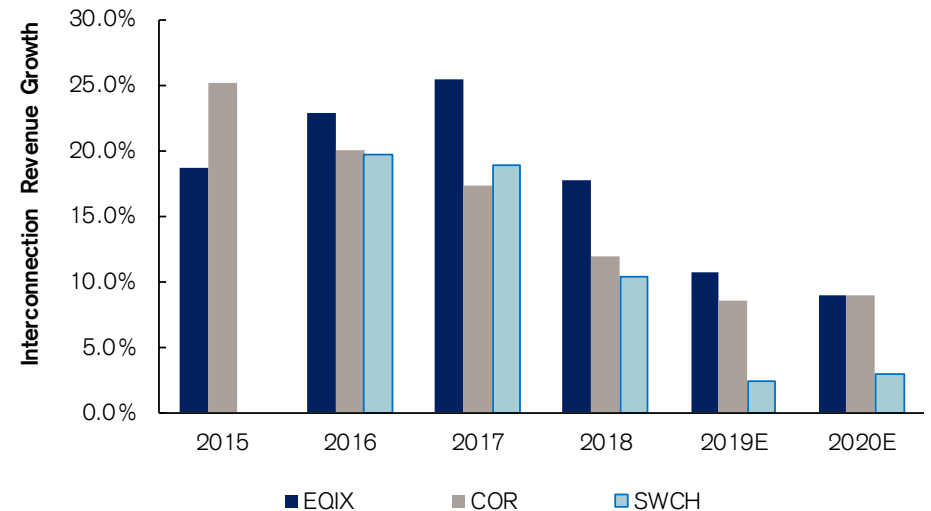
Interconnection Market Across Regions (\$ millions)										CAGR	
	2015	2016	2017	2018	2019E	2020E	2021E	2022E	2023E	15-'18	18-'23
Americas Interconnection Revenue	931	1,088	1,255	1,412	1,610	1,819	2,046	2,282	2,507	14.9%	12.2%
Y/Y Change	-	16.9%	15.3%	12.6%	14.0%	12.9%	12.5%	11.6%	9.8%		
Asia Interconnection Revenue	332	404	450	510	580	659	744	833	927	15.4%	12.7%
Y/Y Change	-	21.7%	11.5%	13.2%	13.7%	13.6%	12.9%	11.9%	11.3%		
EMEA Interconnection Revenue	380	408	458	506	565	630	702	776	854	10.0%	11.0%
Y/Y Change	-	7.3%	12.2%	10.4%	11.7%	11.5%	11.5%	10.6%	10.0%		
<b>Total Interconnection Revenue</b>	<b>1,643</b>	<b>1,900</b>	<b>2,163</b>	<b>2,428</b>	<b>2,755</b>	<b>3,107</b>	<b>3,492</b>	<b>3,891</b>	<b>4,288</b>	<b>13.9%</b>	<b>12.1%</b>
Y/Y Change	-	15.7%	13.8%	12.3%	13.5%	12.8%	12.4%	11.4%	10.2%		

**Interconnection** continues to gain importance to colocation providers, as shown in the chart below. As data integration, Point of Presence (PoP) cross connection, and low latency capabilities become even larger priorities for enterprises, we expect the interconnection market to continue to outpace colocation revenue by ~50%. In light of this view, we are positive on EQIX and SWCH mainly (and would highlight COR's direct indexation to this trend as well), given their established interconnection and colocation revenues, boasting robust customer ecosystems across cloud, service provider and enterprise.

## IX Revenues Have Outpaced Colo Revenues Since 2016



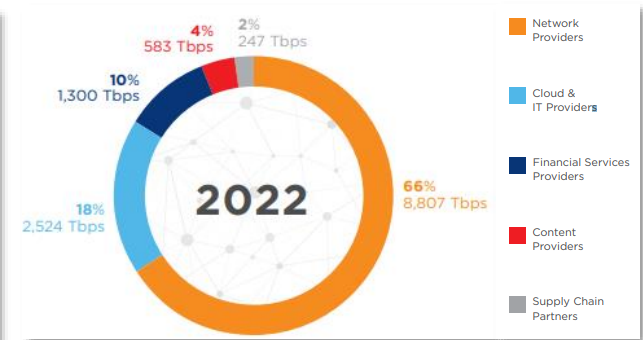
## EQIX, COR, & SWCH Have Seen Robust IX Growth Since 2015



Source: I.H.S. Markit, Credit Suisse Research, Company Data

# Interconnection Growth and Network Node Proliferation Remains Very Significant, Led by Telecoms, Clouds, and Financial Industries...

**Interconnectivity Runway Remains Significant:** Even though interconnection installed base growth across both colocation providers EQIX, COR, MP1, PacketFabric, and others may seem like it has peaked following significant on-ramp adds, the reality is the runway for capacity growth remains significant, highlighted by EQIX's annual interconnection index (chart below). Based on EQIX's projections, almost all industries, across all major regions, will see double digit growth, supporting our view that interconnection and connectivity as a whole will remain a data center catalyst through 2022. We are particularly interested in the fact that even though Telecoms, Clouds and Financial Industries seem optimized/peaked as far as install growth, their projections remain significant through 2022.



Industry	500	1,000	1,500	2,000	2,500	3,000	CAGR 18-22	2022 MIX
Telecommunications	2,524						39%	19%
Cloud & IT Services	2,148						41%	16%
Banking & Insurance	1,891						66%	14%
Manufacturing	1,547						57%	12%
Securities & Trading	1,462						61%	11%
Content & Digital Media	1,143						41%	9%
Business & Prof. Services	717						67%	5%
Energy & Utility	609						77%	5%
Wholesale & Retail	473						68%	4%
Healthcare & Life Sciences	299						71%	2%
Government & Education	106						68%	1%
Other	389						73%	3%

Legend: North America (Red), Europe (Dark Blue), Asia-Pacific (Orange), Latin America (Light Blue)

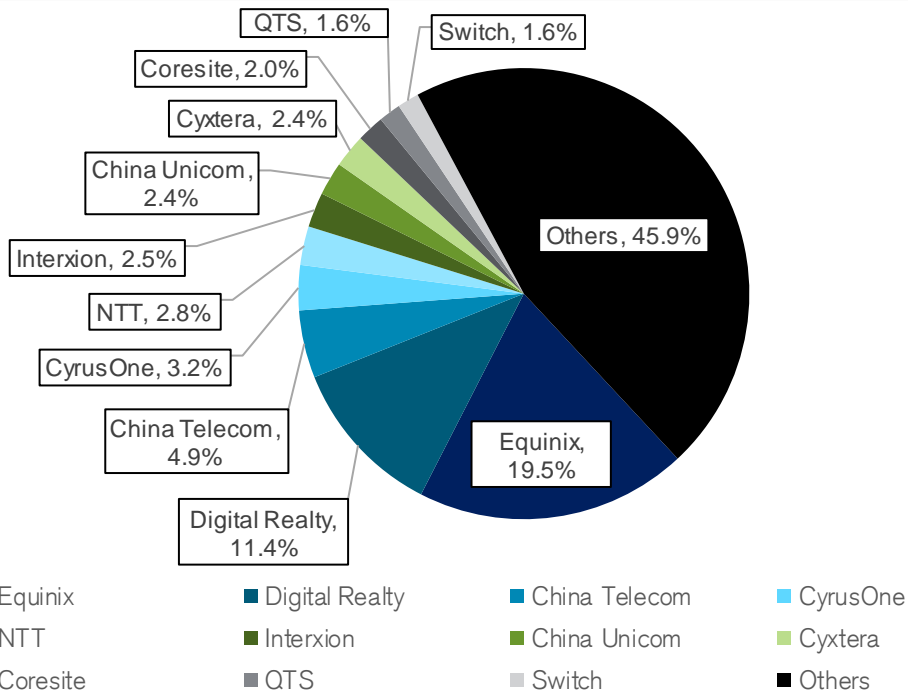
Source: Equinix Interconnection Index (Volume 3), Credit Suisse Research.

# Revenue Market Share by Colo Providers and CSPs as of 1H 2019E

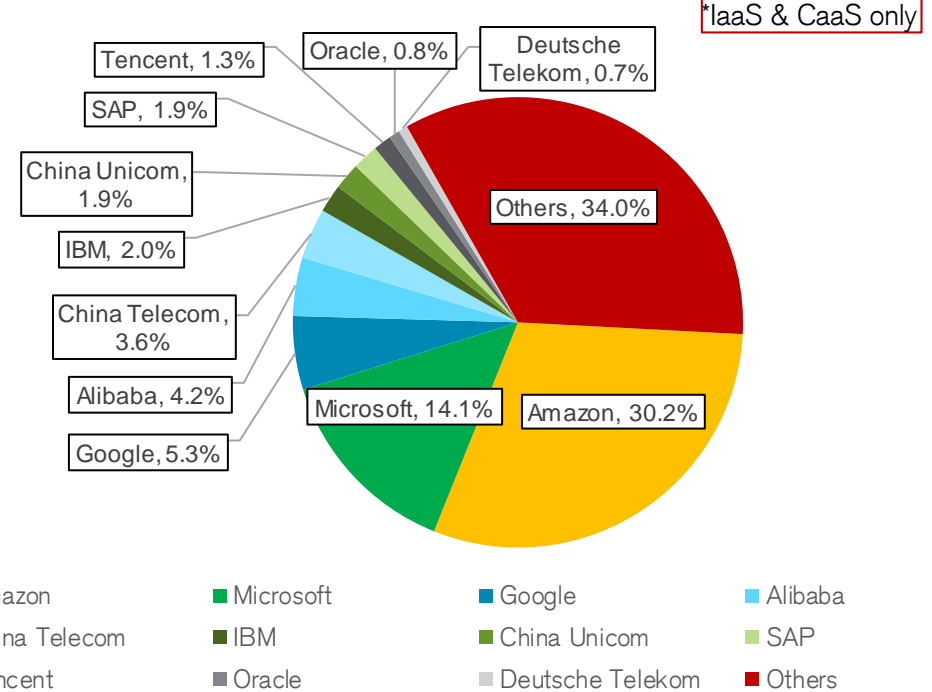
**Colocation Market Share:** We take **no view** on Digital Realty's proposed acquisition of InterXion, but the combination closes the gap slightly at ~14% total share on a combined basis, behind the leading colocation provider, Equinix. That said, the industry still remains significantly fragmented, with many private colocation providers around the world. We believe consolidation is only expected from a base of ~600 individual operators.

**Cloud Service Provider Market Share (IaaS and CaaS Only):** For cloud service providers, Amazon's AWS unit remains the largest industry constituent, but Microsoft (Azure), Google (GCP), and Alibaba (Alibaba Cloud) are all focusing on growing their cloud platforms with industry experts highlighting the various approaches each provider will be executing over the next few years. Notably, most enterprise customers want a variety of public cloud service providers, forcing formidable runner-ups in the CSP sector. For now, AWS, MSFT, and Google are ~50% of the CSP market.

## EQIX is the Largest DC In a Very Fragmented Industry



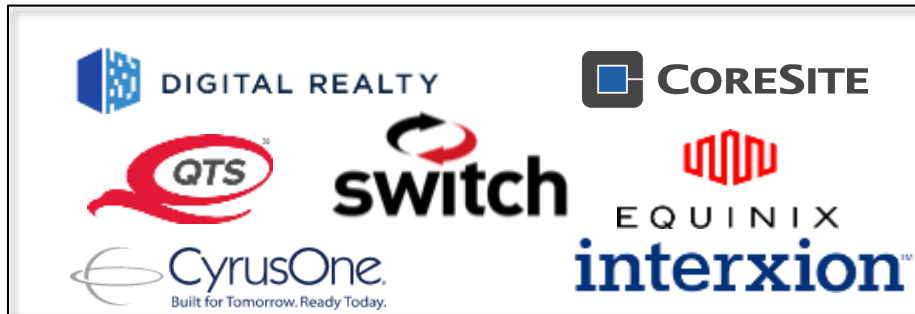
## AWS Remains the Dominant CSP, But Azure is Gaining Ground



Source: I.H.S. Markit, Credit Suisse Research

# Colocation Data Centers Versus Cloud Data Centers

## Multi-Tenant Data Center (Colocation)



**Colocation is about more than just data center facilities.** Some colocation data centers offer a host of services including managed I.T. to the hybrid cloud. They can also provide greater power density, which is key to quickly scaling and supporting new technologies. Several providers even offer a direct connection to the top public cloud providers such as AWS, GCP, Azure, etc.

**Pros:** Great option for the service provider, much cheaper than building own data center, data and electrical power redundancies, data center infrastructure management (DCIM), infrastructure professionals for technical on-site support (remote hands), physical and logical security, interconnection benefits

**Cons:** Managing equipment technologies can be burdensome, requires I.T. staffing, dependent on hosts' network connections, electrical power, HVAC, requires leasing, costly OPEX and CAPEX, I.T. infrastructure become more complex to manage

## Cloud Service Provider (CSP) Data Center



**A CSP data center is generally not directly accessible to the public and connections to the cloud are made typically through colocation.** Much of a CSP's data center is customized and tend to be shrouded in secrecy relative to a colocation facility. These facilities can also be much larger and operate at higher capacities than a typical data center. CSPs tend to be selective with their locations and customers are not allowed in to install their own servers.

**Pros (Pure Cloud Play):** Great option for organizations to focus on delivering solutions, more cost effective, improvements in rolling out cloud services quickly, lowers I.T. operating costs, major driver for outsourcing, outsourcing without losing secure information, and the host is responsible for HVAC, electrical power, and I.T. equipment

**Cons:** Diminished control of I.T. resources, requires SLA agreements, requires OPEX costs, platform and equipment dependent, all hosts not equal security concerns, potential compliance issues regarding security regulations

**Note:** Cloud service providers and colocation companies are “natural allies, not competitors”, as the hybrid I.T. approach is becoming more common, colocation facilities that hosts clouds can improve security, reduce latency, and provide access to public clouds.

# Hyperscale Capex Spend Growth Has Sharply Decelerated Going Into 2019 from 2018 Highs, But Projected to Slightly Recover in 2020E...

**Hyperscale Capex is a leading indicator for the Multi-Tenant Data Center (MTDC) industry** largely because ~40% of all data center space, power, cooling, and interconnection is outsourced to third party data centers rather than built and maintained by the cloud service providers themselves. Based on our discussions with industry professionals, we expect this percent of outsourcing to begin increasing to ~50% range by 2020, which is largely a by-product of the vast scale the MTDC operators have gained over the last three years, driving even more business to MTDCs, especially operators that have focused on wholesale and hyperscale data center developments.

Hyperscale CapEx (\$ millions)	2014	2015	2016	2017	2018	2019E	2020E	2021E	2022E	CAGR (%)	
										14-'18	18-'22
<b>FB</b>	\$1,831	\$2,523	\$4,491	\$6,732	\$13,980	\$16,258	\$19,348	\$19,923	\$20,221	96.9%	13.1%
<b>AMZN</b>	\$4,295	\$4,681	\$5,193	\$9,190	\$9,783	\$11,645	\$13,701	\$14,488	\$15,078	31.6%	15.5%
<b>GOOGL</b>	\$10,959	\$9,915	\$10,183	\$13,184	\$25,139	\$24,399	\$26,292	\$27,326	\$28,386	31.9%	4.1%
<b>MSFT</b>	\$5,294	\$6,696	\$10,208	\$11,400	\$15,800	\$18,131	\$20,858	\$20,858	\$19,947	44.0%	8.1%
<b>ORCL</b>	\$801	\$1,606	\$1,628	\$1,986	\$1,736	\$1,520	\$1,866	\$2,015	\$2,035	29.4%	5.4%
<b>IBM</b>	\$3,740	\$3,579	\$3,567	\$3,229	\$3,395	\$2,798	\$3,528	\$3,631	\$3,538	-3.2%	1.4%
<b>Total U.S. CapEx</b>	<b>\$26,920</b>	<b>\$29,000</b>	<b>\$35,270</b>	<b>\$45,721</b>	<b>\$69,833</b>	<b>\$74,752</b>	<b>\$85,594</b>	<b>\$88,240</b>	<b>\$89,205</b>	<b>37.4%</b>	<b>8.5%</b>
<i>Y/Y Change</i>		<b>7.7%</b>	<b>21.6%</b>	<b>29.6%</b>	<b>52.7%</b>	<b>7.0%</b>	<b>14.5%</b>	<b>3.1%</b>	<b>1.1%</b>		
<b>BABA</b>	\$1,244	\$1,705	\$2,608	\$4,502	\$7,397	\$5,844	\$8,493	\$10,245	\$8,659	81.2%	5.4%
<b>Tencent</b>	\$1,077	\$1,601	\$2,823	\$4,736	\$8,170	\$5,269	\$6,170	\$7,275	\$7,291	96.5%	-3.7%
<b>BIDU</b>	\$1,036	\$1,237	\$1,582	\$2,064	\$3,380	\$1,733	\$2,030	\$2,215	\$2,134	48.3%	-14.2%
<b>Total Chinese CapEx</b>	<b>\$3,357</b>	<b>\$4,543</b>	<b>\$7,013</b>	<b>\$11,302</b>	<b>\$18,947</b>	<b>\$12,847</b>	<b>\$16,693</b>	<b>\$19,735</b>	<b>\$18,084</b>	<b>78.0%</b>	<b>-1.5%</b>
<i>Y/Y Change</i>		<b>35.3%</b>	<b>54.4%</b>	<b>61.2%</b>	<b>67.6%</b>	<b>-32.2%</b>	<b>29.9%</b>	<b>18.2%</b>	<b>-8.4%</b>		
<b>Total Hyperscale CapEx</b>	<b>\$30,277</b>	<b>\$33,543</b>	<b>\$42,283</b>	<b>\$57,023</b>	<b>\$88,780</b>	<b>\$87,599</b>	<b>\$102,286</b>	<b>\$107,975</b>	<b>\$107,289</b>	<b>43.1%</b>	<b>6.5%</b>
<i>Y/Y Change</i>		<b>10.8%</b>	<b>26.1%</b>	<b>34.9%</b>	<b>55.7%</b>	<b>-1.3%</b>	<b>16.8%</b>	<b>5.6%</b>	<b>-0.6%</b>		
<i>% of Revenue</i>	<b>6.8%</b>	<b>6.6%</b>	<b>7.7%</b>	<b>8.3%</b>	<b>9.8%</b>	<b>8.5%</b>	<b>8.7%</b>	<b>8.0%</b>	<b>0.0%</b>		

**Hyperscale Capex** includes Capital Expenditure investments into office space, I.T. equipment, data center infrastructure, land, and other major ticket items. Amazon Web Services and Microsoft Capex figures include both Capex and Capital Leases.

Source: FactSet, Credit Suisse Research. Tencent, Alibaba, Baidu are Consensus Estimates.

# MTDC Capex Spend Growth Decelerated YTD in 2019 from 2018 Highs, Projected to Continue to Decline in 2020

**Multi-Tenant Data Center Capex Forecasted to Decline Through 2022** – We believe this highlights 1) the cyclical nature of the industry, where overbuilding, and therefore pullbacks may occur; and 2) the natural maturation of the data center industry, which clearly grew significantly from 2016-2018. In light of this, we expect returns on investment to continue to improve given the effect of price escalation and general cloud trends.

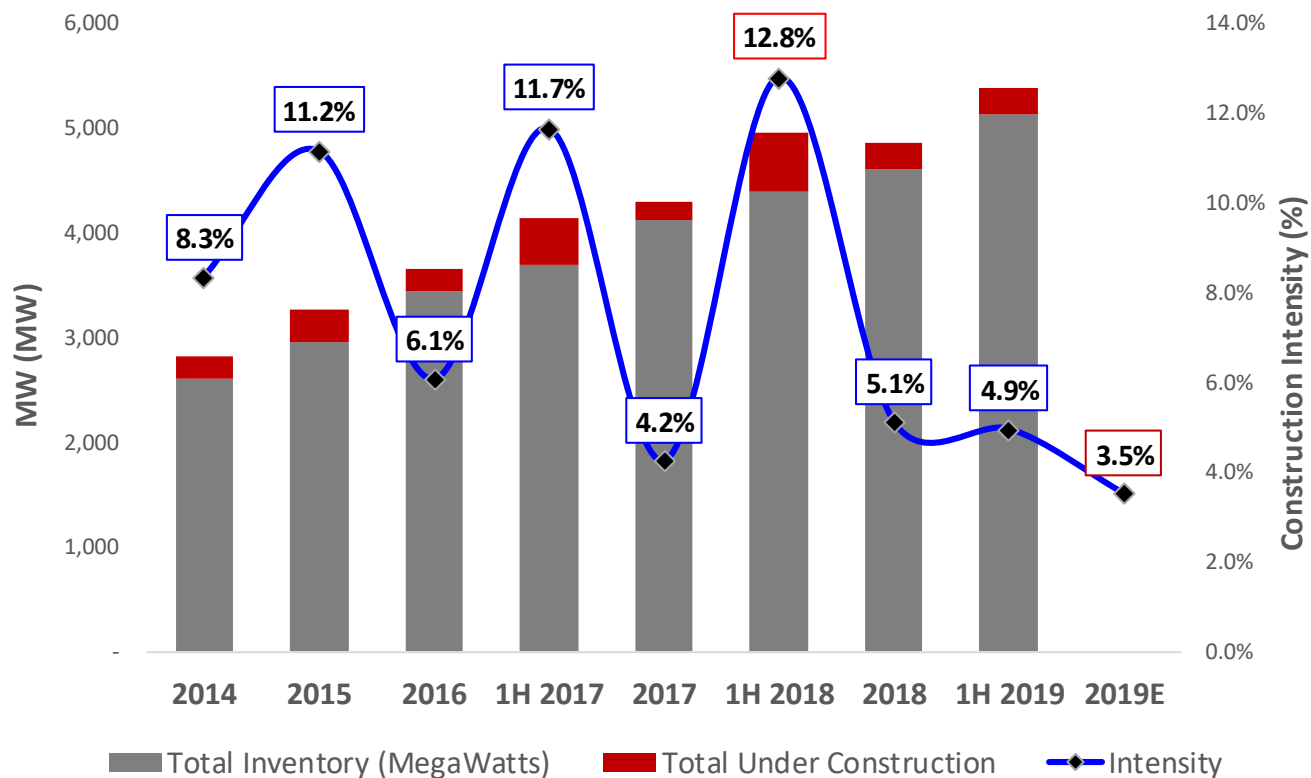
MTDC CapEx (\$ millions)	2014	2015	2016	2017	2018	2019E	2020E	2021E	2022E	CAGR (%)	
										14-'18	18-'22
EQIX	\$660	\$868	\$1,100	\$1,379	\$2,096	\$1,997	\$2,044	\$1,885	\$1,818	47.0%	-4.6%
DLR	\$805	\$682	\$733	\$1,127	\$1,318	\$1,515	\$1,378	\$1,452	\$1,435	17.9%	2.9%
QTS	\$201	\$312	\$279	\$408	\$554	\$404	\$499	\$364	\$340	40.2%	-15.0%
CONE	\$287	\$217	\$600	\$915	\$866	\$912	\$790	\$767	\$768	44.5%	-3.9%
COR	\$4	\$6	\$313	\$187	\$266	\$437	\$333	\$335	\$314	292.3%	5.7%
SWCH	-	-	-	\$403	\$276	\$269	\$255	\$233	\$231	-	-5.8%
INAP	\$74	\$56	\$46	\$36	\$42	\$30	\$32	\$47	\$44	-17.3%	1.9%
<b>Total U.S. CapEx</b>	<b>\$2,031</b>	<b>\$2,140</b>	<b>\$3,072</b>	<b>\$4,454</b>	<b>\$5,418</b>	<b>\$5,565</b>	<b>\$5,331</b>	<b>\$5,082</b>	<b>\$4,949</b>	<b>38.7%</b>	<b>-3.0%</b>
<i>Y/Y Change</i>		<i>5.4%</i>	<i>43.5%</i>	<i>45.0%</i>	<i>21.6%</i>	<i>2.7%</i>	<i>-4.2%</i>	<i>-4.7%</i>	<i>-2.6%</i>		
INXN	\$259	\$209	\$265	\$318	\$498	\$634	\$597	\$405	\$368	24.2%	-9.5%
GDS	-	-	\$144	\$271	\$634	\$586	\$691	\$671	\$609	-	-1.4%
NXT-ASX	\$103	\$25	\$101	\$159	\$283	\$378	\$279	\$246	\$233	39.8%	-6.2%
<b>Total Int'l CapEx</b>	<b>\$363</b>	<b>\$234</b>	<b>\$509</b>	<b>\$747</b>	<b>\$1,414</b>	<b>\$1,598</b>	<b>\$1,568</b>	<b>\$1,322</b>	<b>\$1,210</b>	<b>57.4%</b>	<b>-5.1%</b>
<i>Y/Y Change</i>		<i>-35.5%</i>	<i>117.8%</i>	<i>46.7%</i>	<i>89.3%</i>	<i>13.0%</i>	<i>-1.9%</i>	<i>-15.7%</i>	<i>-8.4%</i>		
<b>MTDC CapEx</b>	<b>\$2,394</b>	<b>\$2,374</b>	<b>\$3,581</b>	<b>\$5,201</b>	<b>\$6,832</b>	<b>\$7,163</b>	<b>\$6,899</b>	<b>\$6,403</b>	<b>\$6,159</b>	<b>41.8%</b>	<b>-3.4%</b>
<i>Y/Y Change</i>		<i>-0.8%</i>	<i>50.8%</i>	<i>45.2%</i>	<i>31.4%</i>	<i>4.9%</i>	<i>-3.7%</i>	<i>-7.2%</i>	<i>-3.8%</i>		
<i>% of Revenue</i>		<i>42.3%</i>	<i>37.5%</i>	<i>44.3%</i>	<i>51.7%</i>	<i>57.7%</i>	<i>55.0%</i>	<i>48.3%</i>	<i>40.2%</i>		

Source: FactSet, Credit Suisse Research, Company Data. Forecasts are consensus estimates.



# U.S. MTDC Construction Intensity at 4.9% in 1H19, Compressing to ~3.5% by End of 2019 Based on Top 12 U.S. Markets

**U.S. Construction Intensity Estimated to Reach 3.5% by YE 2019E:** One of the most holistic metrics used to assess U.S. MTDC industry health is the construction intensity ratio, computed by taking Construction in Progress and dividing it by Total Inventory in that respective market(s). Construction intensity can explain overall industry trajectory and relative magnitudes of anticipated growth. For instance, the U.S. data center industry (based on the top 12 U.S. data center markets) hit an intensity ratio of 12.8% in 1H18 when hyperscale capex spending growth in 2018 was +50% y/y, explaining the material growth seen in the industry. Conversely, by the end of 2019 expected construction intensity is projected to be 3.5% where hyperscale capex spending is ~5% for the year. Looking ahead, we expect the U.S. market to remain relatively muted in growth in the top 12 U.S. cities given the spending forecasts of the major hyperscale operators.



**Top 12 U.S. Markets:**  
 Atlanta, Austin/San Antonio, Chicago, Dallas/Fort Worth, Denver, Las Vegas/Reno, Los Angeles, New Jersey, New York City, Northern California, Northern Virginia, and Phoenix.

Source: JLL Research, Credit Suisse Research.

# Top 12 U.S. Markets Inventory Levels – Power Density Have Outpaced Physical Facility Growth, 74% vs. 27% Growth Since 2015 (MW vs. Sq.Ft.)

Total Inventory (MegaWatts)	2014	2015	2016	1H 2017	2017	1H 2018	2018	1H 2019	Growth '15-1H'19
Atlanta	150	160	194	207	210	215	219	230	44%
Austin and San Antonio	-	56	61	95	105	144	144	142	156%
<b>Chicago</b>	420	426	502	538	538	546	555	555	30%
<b>Dallas/Fort Worth</b>	361	335	403	458	465	505	517	527	57%
Denver	-	98	114	128	141	130	130	364	271%
Las Vegas & Reno	115	128	130	157	417	416	456	457	257%
<b>Los Angeles</b>	210	210	210	210	210	210	210	210	0%
<b>New Jersey</b>	324	334	327	327	340	342	342	342	2%
<b>New York City</b>	-	122	166	164	160	152	152	152	25%
<b>Northern California</b>	348	376	424	424	560	581	581	581	55%
<b>Northern Virginia</b>	498	592	774	853	788	920	1,061	1,306	121%
Phoenix	174	112	143	145	197	245	254	270	141%
<b>Total North American Core Markets</b>	<b>2,600</b>	<b>2,949</b>	<b>3,447</b>	<b>3,706</b>	<b>4,131</b>	<b>4,407</b>	<b>4,620</b>	<b>5,137</b>	<b>74%</b>

Total Inventory (Sq Ft in Thousands)	2014	2015	2016	1H 2017	2017	1H 2018	2018	1H 2019	Growth '15-1H'19
Atlanta	1,500	1,500	1,650	1,730	1,750	1,797	1,807	1,873	25%
Austin and San Antonio	-	366	401	526	556	736	736	776	112%
<b>Chicago</b>	3,300	3,400	3,900	3,800	4,000	4,299	4,299	4,299	26%
<b>Dallas/Fort Worth</b>	2,700	2,900	2,912	3,420	3,490	3,730	3,640	3,710	28%
Denver	-	660	661	750	865	864	864	857	30%
Las Vegas & Reno	988	1,100	1,117	2,100	3,100	3,580	3,962	3,792	245%
<b>Los Angeles</b>	4,000	2,300	2,300	2,300	2,300	2,300	2,300	2,300	0%
<b>New Jersey</b>	3,200	3,200	3,100	3,100	3,300	3,400	3,400	3,200	0%
<b>New York City</b>	-	889	1,210	1,170	1,080	1,020	1,020	1,020	15%
<b>Northern California</b>	3,600	3,900	4,600	4,600	3,700	3,876	3,876	3,876	-1%
<b>Northern Virginia</b>	2,400	6,600	11,200	12,600	11,500	5,578	6,557	7,514	14%
Phoenix	1,300	1,000	1,100	1,150	1,500	1,746	1,725	2,141	114%
<b>Total North American Core Markets</b>	<b>22,988</b>	<b>27,815</b>	<b>34,151</b>	<b>37,246</b>	<b>37,141</b>	<b>32,925</b>	<b>34,186</b>	<b>35,358</b>	<b>27%</b>

Source: JLL Research, Credit Suisse Research.

# Tier 1 Data Center Markets Generally Have Improving Power Rates and Very Large Total Data Center Inventories...

Average Power Rates (cents/kWh)	2014	2015	2016	2017	2018	1H 2019	Trendline	Total Inventory (MW)	CS Market Tier
<b>North America</b>									
Atlanta	4.70	4.80	4.80	4.80	4.70	4.70		230	Tier 2
Austin and San Antonio	7.00	7.20	7.40	7.40	7.20	7.20		142	Tier 2
Boston	18.00	22.00	20.00	16.00	15.00	16.00		160	Tier 3
Chicago	7.00	6.80	6.50	6.50	6.00	5.80		555	Tier 1
Dallas/Fort Worth	5.80	5.60	5.40	4.50	4.30	4.20		527	Tier 1
Denver	7.50	7.40	7.10	7.10	7.20	7.20		364	Tier 2
Houston	6.60	6.50	6.50	6.50	6.50	6.50		143	Tier 3
Las Vegas & Reno	9.70	9.50	9.30	9.20	9.20	6.10		457	Tier 2
Los Angeles	13.50	13.50	14.00	14.50	14.50	14.50		210	Tier 1
Northern New Jersey	9.00	9.00	8.50	8.50	8.40	8.40		342	Tier 1
New York City	16.10	15.50	14.60	14.30	13.60	13.50		152	Tier 1
Northern California	11.90	12.70	12.90	13.40	13.40	13.80		581	Tier 1
Northern Virginia	5.70	5.70	5.20	5.20	5.20	5.20		1306	Tier 1
Northwest U.S.	4.70	4.80	4.80	4.80	4.80	4.90		316	Tier 2
Phoenix	6.70	6.70	6.60	6.40	6.40	6.40		270	Tier 2
Greater Montreal Area*	3.50	3.50	3.60	3.70	3.90	4.00		N/A	Tier 3
Greater Toronto Area*	13.80	9.20	13.00	14.60	12.50	12.50		N/A	Tier 2
Western Canada (Vancouver / Calgary)*	6.80	7.30	7.50	7.50	8.00	8.00		N/A	Tier 3
<b>Europe</b>									
Amsterdam	8.10	8.10	9.20	9.20	9.20	9.20		N/A	Tier 1
Dublin	12.70	12.70	13.90	13.90	13.90	13.90		N/A	Tier 2
Frankfurt	17.40	17.40	17.40	17.40	17.40	17.40		N/A	Tier 1
London	6.90	8.10	9.20	9.20	10.40	10.40		N/A	Tier 1
Paris	8.10	8.10	9.20	9.20	9.20	9.20		N/A	Tier 1
<b>APAC</b>									
Australia	6.80	7.30	8.00	9.70	12.50	12.50		220	N/A
Hong Kong*	14.30	14.30	14.30	14.30	14.30	14.30		299	N/A
Singapore*	16.80	11.60	10.60	11.50	14.40	13.50		376	N/A

Exceptions to Tier 1 Market Trend: Los Angeles and Northern California. \*Credit Suisse Estimates for cents/kWh

# We Don't See Colocation Adoption Slowing – U.S. Data Center Growth Stable, Supported by Next Wave of Enablers, Including As-a-Service Cos...

**2018 Drivers:** Main 2018 growth drivers included public cloud and software defined networking (SDN) on-ramps being key enablers for sector-wide, strengthening retail colocation data centers first and furthering the asset class from a relevance perspective for hyperscale and enterprise customers.

**2019 Drivers:** SDN providers such as Megaport, PacketFabric, Console Connect, and IX Reach accelerated enterprise adoption of colocation capacity, easing the adoption of multi-clouds, lowering latencies, and enabling next generation technologies at the right points of presence.

**2020 Drivers:** 2020 will include as-a-Service on-ramps proliferating, further extending the dependency on interconnection facilities and services given the mix of service providers and enterprises. Carrier neutral facilities have become key SaaS company target zones for their rich ecosystems.

## 2018 Drivers



## 2019 Drivers



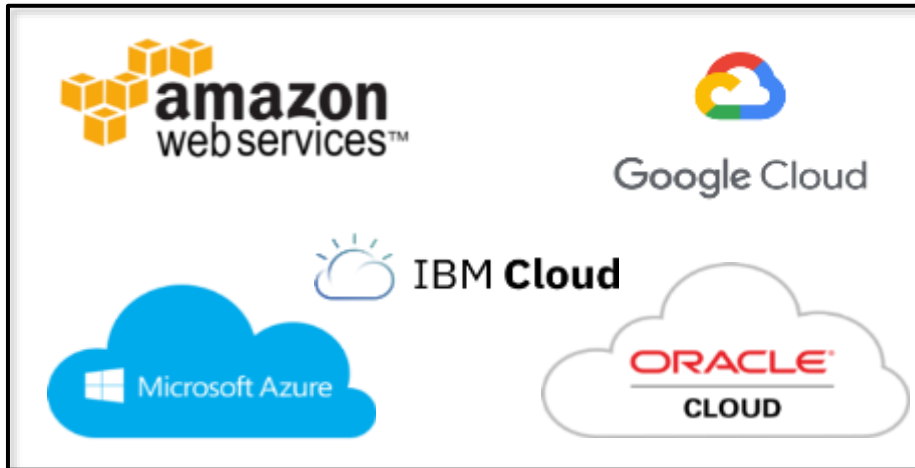
## 2020 Drivers

**2020 business drivers will include as-a-Service on-ramps, further extending the dependency on interconnection facilities and services. Companies heavily dependent on dense colocation facilities include F5 Networks, Cisco, Salesforce, CDNs, among many others...**

Source: Company data, Credit Suisse Research.

# Cloud On-Ramps Versus SDN On-Ramps...

## Cloud On-Ramps



### *What is a Cloud On-Ramp?*

A Cloud On-Ramp is when an AWS, a GCP, an Azure, an IBM SoftLayer, or Oracle Cloud leases a small sized area (10-20 cabinets) within a MTDC to establish a Point of Presence or "On-Ramp" to make it very easy and seamless for other tenants within that facility to directly connect into public cloud platforms. This drastically reduces connectivity bottlenecks, constraints, and general engineering issues. Cloud on-ramps should not be confused with a public cloud data center facility, since that is a completely different type of data center deployment and may also be deployed into an MTDC.

## Software Defined Networking (SDN)

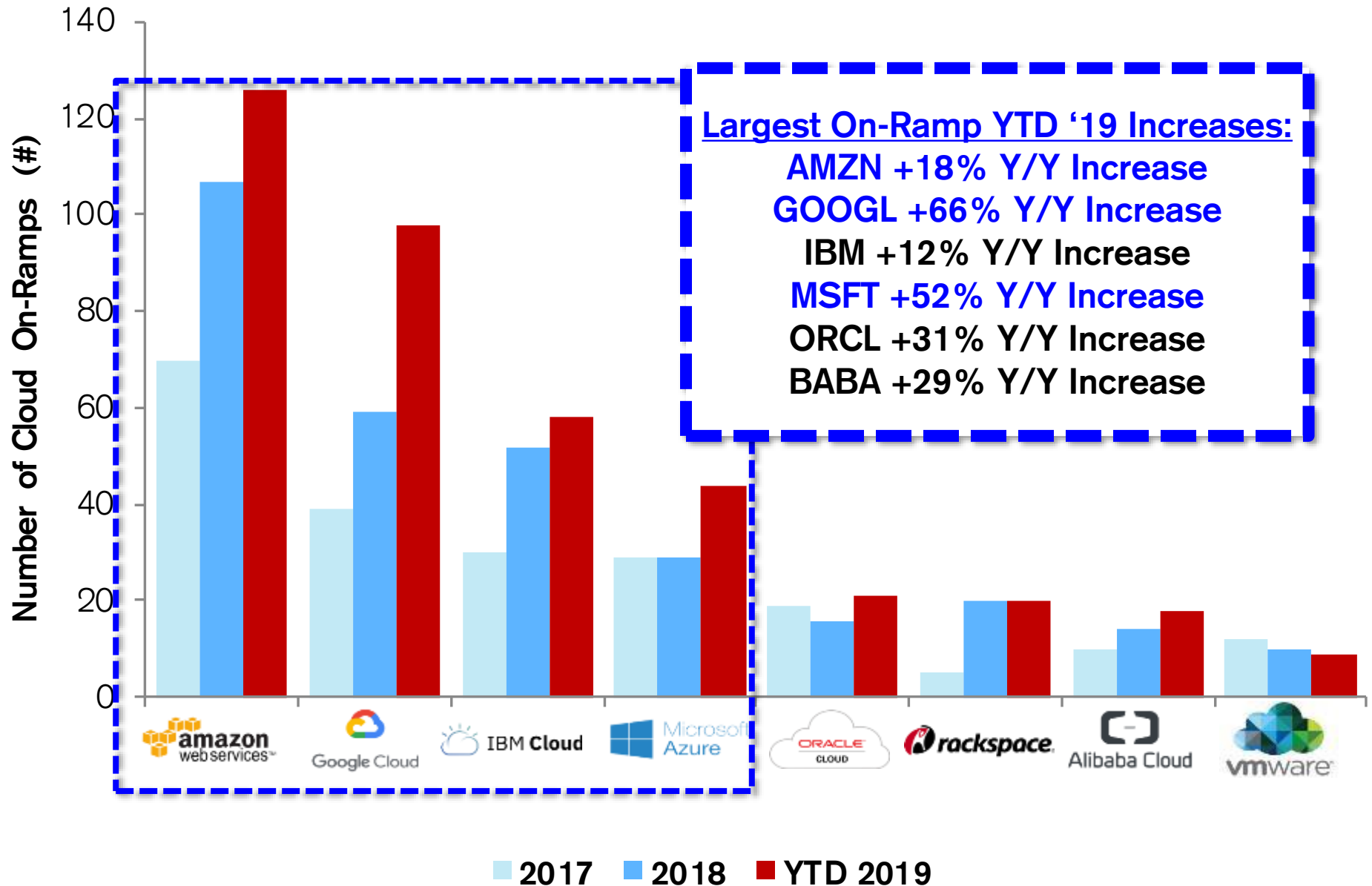


### *What is a SDN Fabric?*

Similar to Cloud On-Ramps, SDN fabric service providers, such as companies like Megaport and PacketFabric, enable dynamic, real-time connectivity services between major carrier-neutral colocation centers. This allows enterprises to virtually connect their IT infrastructures through internet routing tables rather than purchasing millions of dollars' worth of IT equipment, and relieves enterprises of network issues, IT spending budget constraints, and engineering expertise required to launch a complex technology, like software-defined networking.

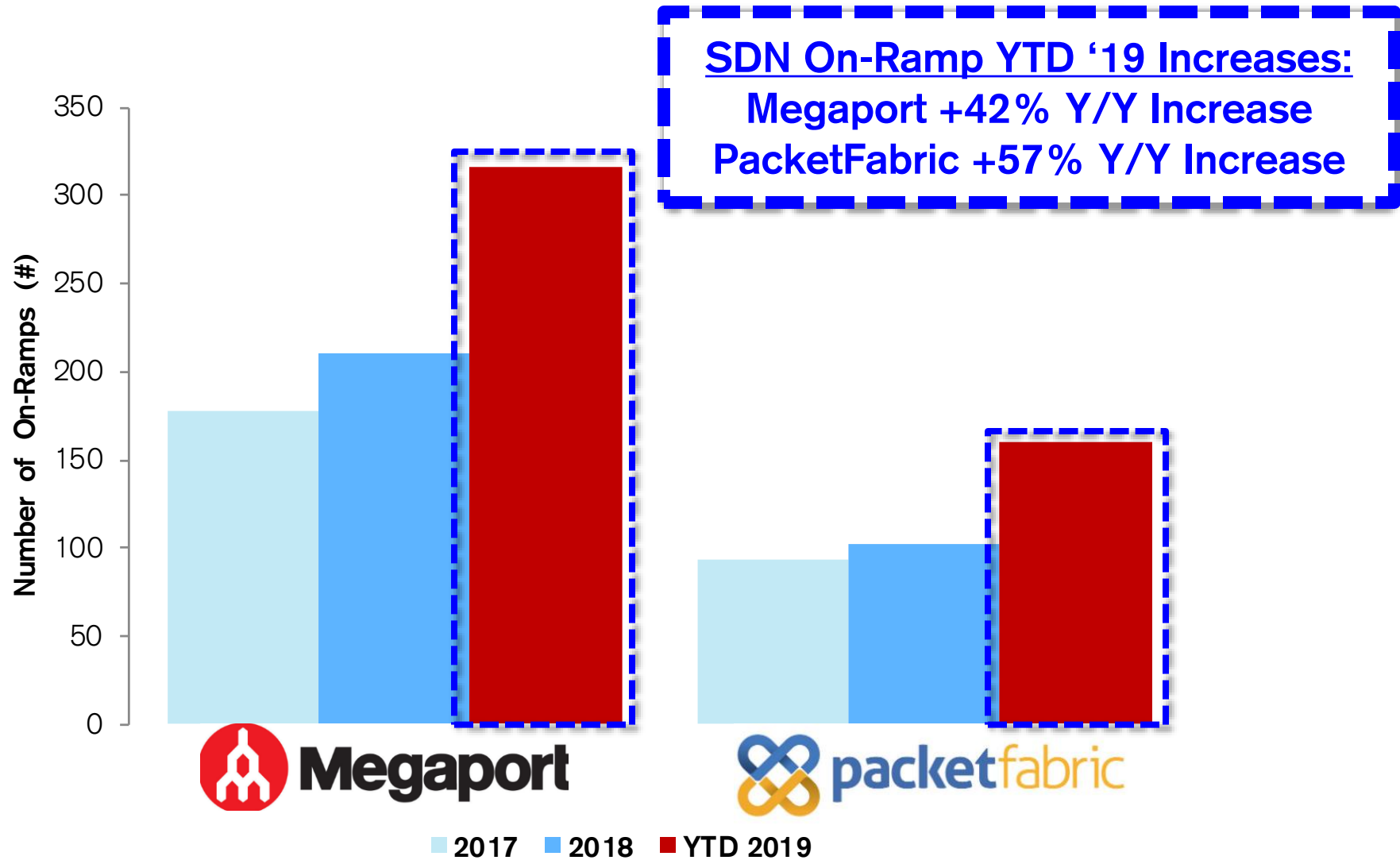
**Cloud On-Ramps and SDN Fabrics provide greater incentives for enterprises to use MTDCs, drawing in enterprise clients and interconnection networks. They act as enablers to further push the MTDC to new heights.**

# Cloud On-Ramps Have Reached Critical Mass Deployment....



Source: Credit Suisse Estimates, Cloudscene, Inflect, Company data.

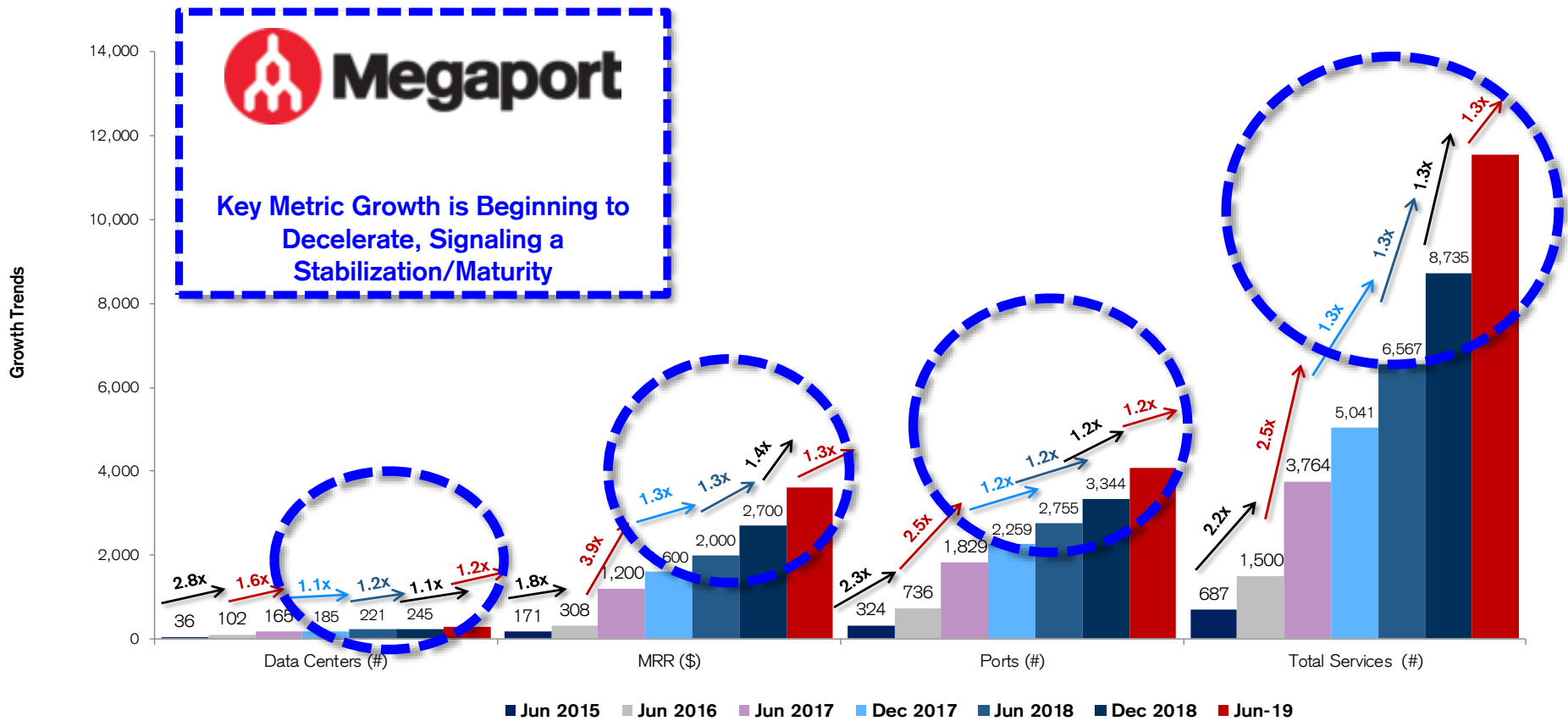
# SDN On-Ramps Have Also Scaled Dramatically....



Source: Credit Suisse Estimates, Cloudscene, Company data.

# Software Defined Networking Fabrics Are Now Ramped and Positioned, Easing Enterprise Colocation Deployment Plans...

Although still in their early stages of growth, network fabric businesses are now ramped and expected to further push the data center market to new heights. Taking a deeper dive into Megaport, its hyper growth is beginning to decelerate, as shown below, and we see this as a positive indicator that enterprises are increasingly using interconnection services through MTDCs and the industry is stabilizing.



Note: Total services comprise of Ports, Virtual Cross Connections (VXCs), and Internet Exchange (IX)

Source: Company data, Credit Suisse Research.



# PacketFabric Growing in Relevance to Global Cloud Ecosystem

**PacketFabric (PF) is a Leading Network-as-a-Service Provider:** It's a next generation network service provider that re-architects how companies build and use network services. The PacketFabric Network-as-a-Service platform provides instant connectivity between colocation facilities (EQIX, DLR, CONE, COR, INXN, QTS, etc.), to major cloud providers (AMZN, MSFT, GOOGL, ORCL, IBM, CRM, etc.), and internet exchanges.

**PacketFabric is Scaling Quickly:** PF manages 160+ physical and virtual on-network nodes with the fair majority of nodes located within the United States. Network providers like PF are critical to the viability of the network given that installed interconnection bandwidth capacity is expected to reach 13,300Tbps+ with a 51% CAGR by 2022 based on EQIX's latest 2019 Interconnection Index Report.

**Credit Suisse Take:** SDNs, similar to PF, are core to an enterprise's multi-public cloud and multi-colocation (hybrid) deployments, given their position in the network. Providers like PF will serve as key network service providers allowing enterprises to consume both colocation capacity and network resources more reliably, at larger scale, and with less downtime to adoption. We believe this bodes well for most of our data center coverage across wholesale and retail, but is especially beneficial to the dense interconnection providers (EQIX, COR, SWCH) given the customer type mixes within their facilities.



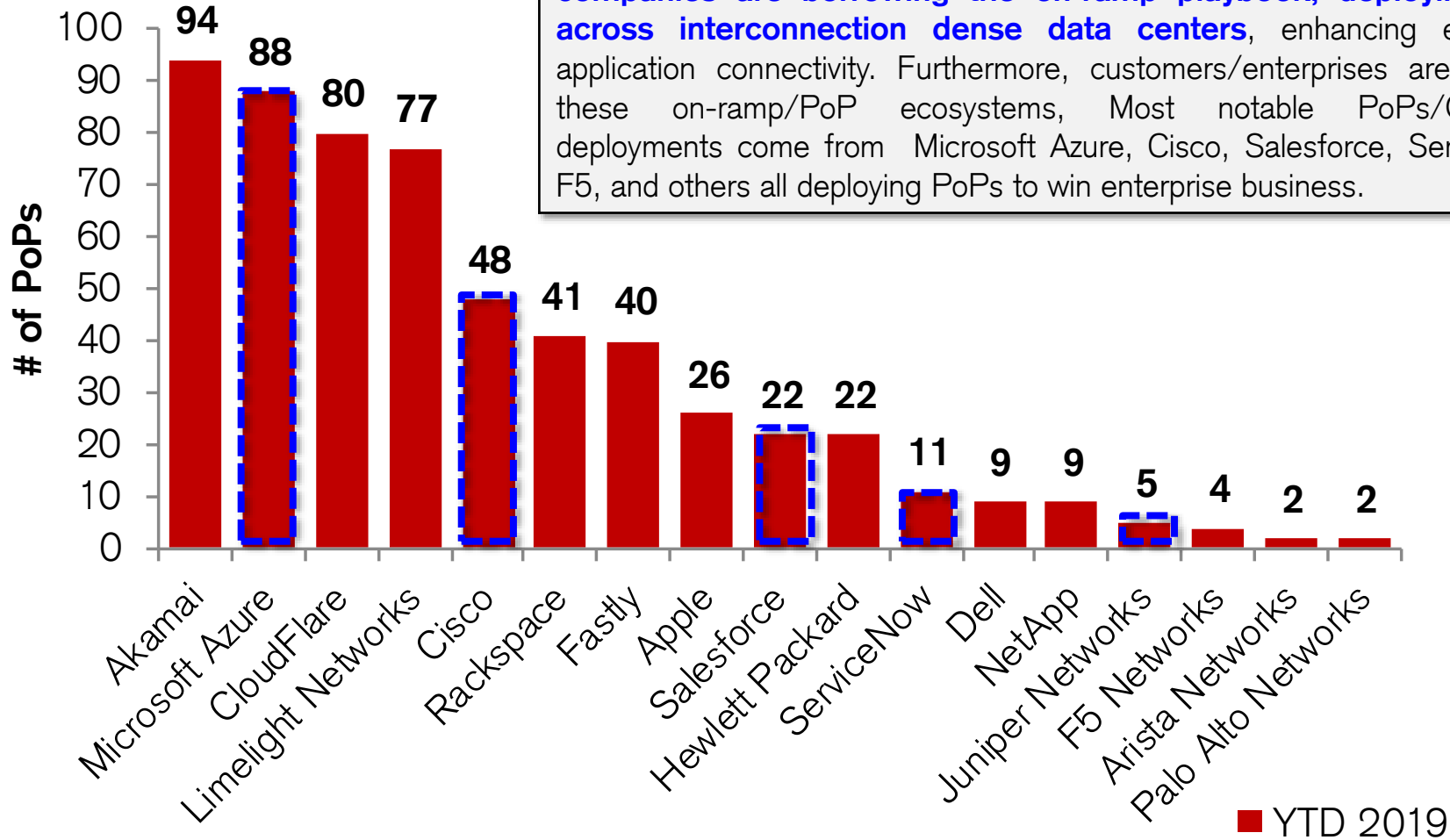
## Data Center Deployments / On-Ramps



Source: Credit Suisse Research, Company Data.

# Colocation Adoption Has Accelerated Driven by New Software Companies, Enhancing Cloud/SDN On-Ramp Deployments...

Like Cloud and Software Defined Networking Providers, **As-a-Service companies are borrowing the on-ramp playbook, deploying PoPs across interconnection dense data centers**, enhancing enterprise application connectivity. Furthermore, customers/enterprises are seeking these on-ramp/PoP ecosystems, Most notable PoPs/On-Ramp deployments come from Microsoft Azure, Cisco, Salesforce, ServiceNow, F5, and others all deploying PoPs to win enterprise business.

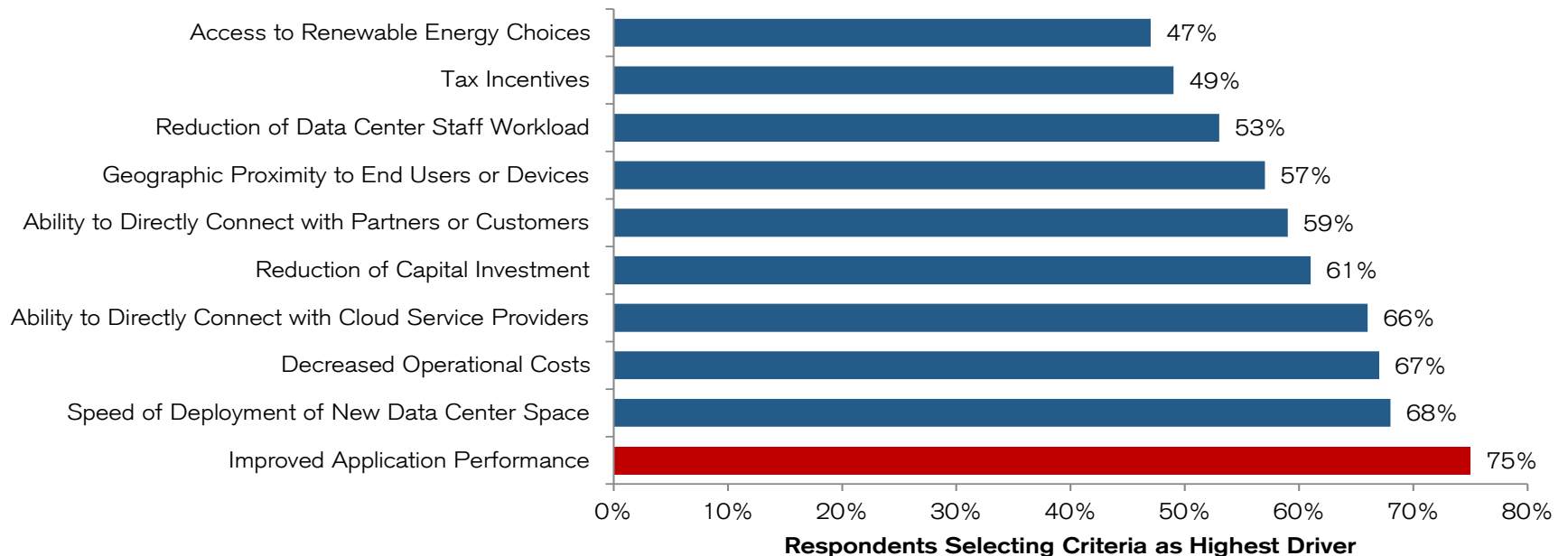


Source: Credit Suisse Estimates, Cloudscene, Company data.

# Improved Application Performance A Key Focus for Colo. Deployments...

Through an IHS Markit (December 2018) industry survey with 114 responses, colocation capacity is set to grow meaningfully in 2019 vs. 2018. The survey was answered by major existing colocation customers that have at least 101 employees in their respective organizations.

## Improved Application Performance Continues to Be a Leading Reason to Use Colocation Capacity



The leading driver for using colocation services was the improved application performance enabled by moving workloads to a colocation data center. Because of the ability to directly connect over high bandwidth cross connects with network providers and cloud service providers, the applications can have more reliable and consistent performance. **We believe this dynamic will become increasingly a driver through 2020 as Cloud On-Ramps and SDN On-Ramps continue their expansions/deployments into interconnection dense data centers (carrier hotels).**

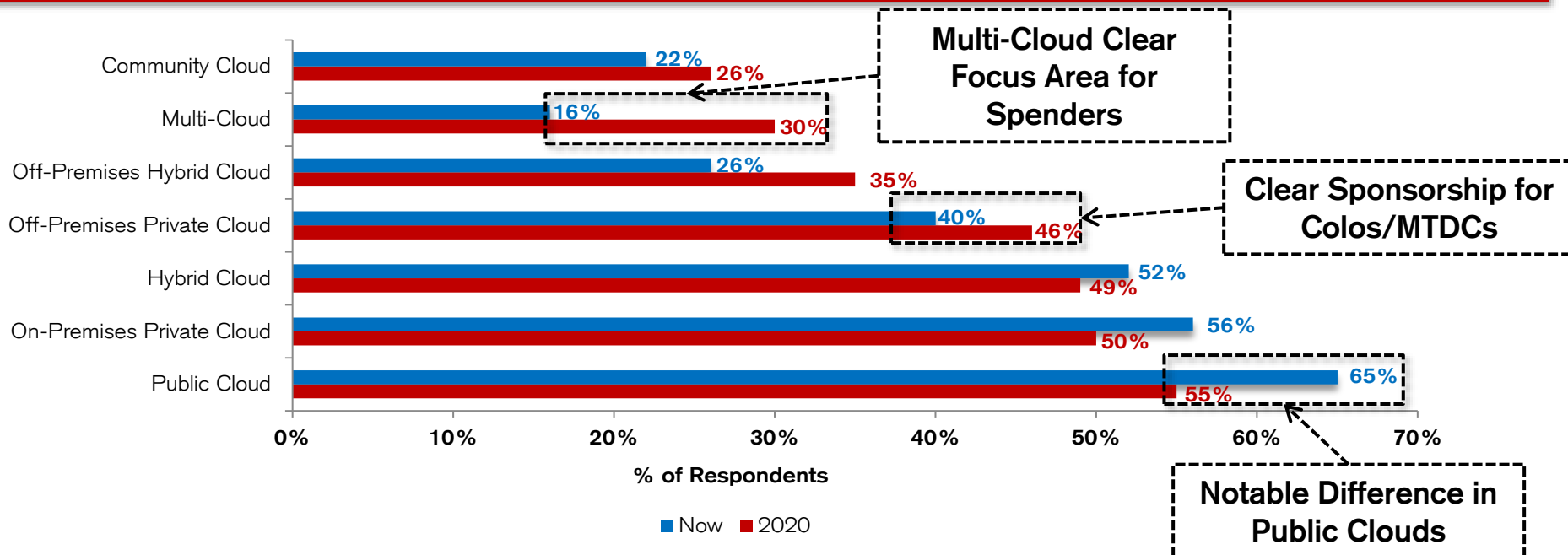
Speed of deployment and decreased operational costs are two benefits that come from enterprises not having to build their own data center space. It takes much less time to sign a contract for new space and power in a colocation facility than it does to build an entirely new data center on premises. The operational costs of running a colocation data center should be less since colocation data centers tend to be more efficiently designed and run, given that this is colocation providers' core business. **Enterprises will be more compelled to outsource to colos because of this factor.**

Source: I.H.S. Markit, Credit Suisse Research.

# Trends in Public, Private, and Multi-Cloud Usage Are Changing by 2020...

Through an IHS Markit (December 2018) industry survey with 164 responses, user preferences for cloud service architectures are expected to change between 2018 and 2020. The survey was answered by IT decision-makers from North Am. Org. with at least 101 employees and subscribe to off-premises cloud services.

## Shifting Preferences in Cloud Service Architectures Favoring Multi-Tenant Data Center Business Models...



Respondents indicated what types of cloud service architectures they use now and will use by July 2020. Off-premises private cloud, off-premises hybrid cloud, multi-cloud, and community cloud are all anticipating increases by 2020. **We believe this dynamic of rapid adoption of multi-cloud and off-premises hybrid cloud show promise for the multi-tenant data center sector as I.H.S. notes that cloud service providers are more aware of the acceptance of multi-clouds and are aggressively adding capabilities to enable integrated solutions.**

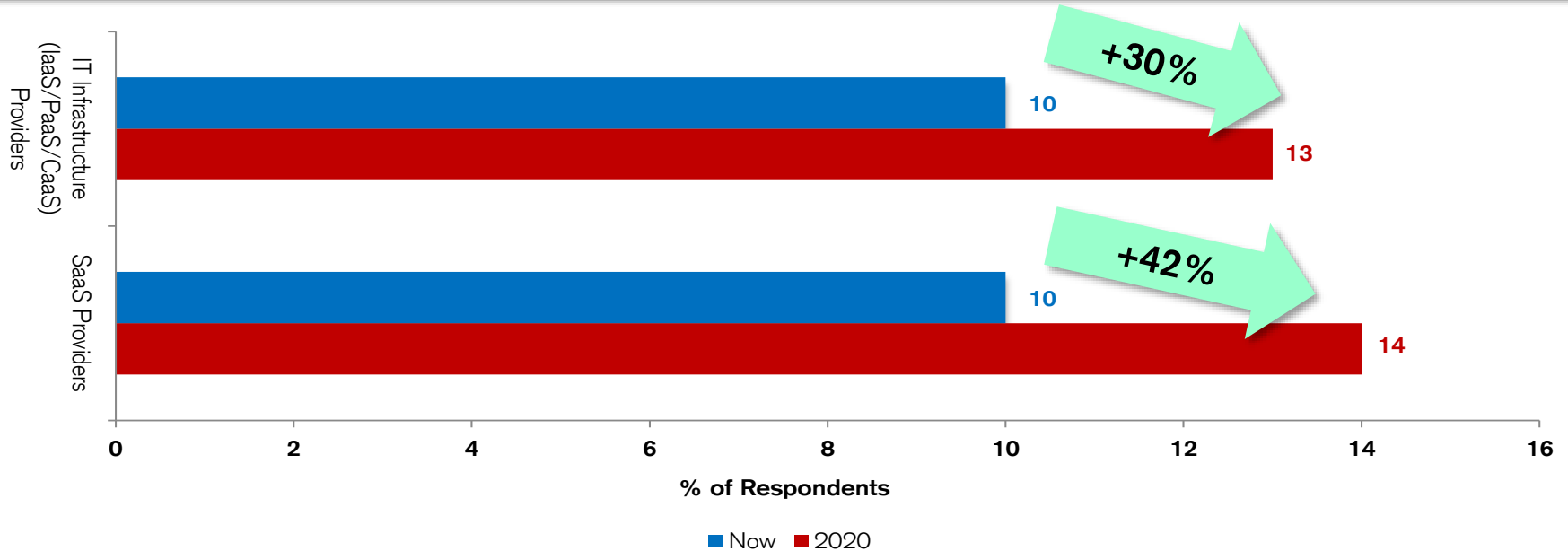
**Public clouds saw the greatest decline in anticipated usage by 2020 from 65% now to 55% in 2020.** The survey reported that public cloud architectures are most likely to be adopted by smaller and startup business looking for a low-cost solution. Those that are reducing public cloud adoption are doing so because it becomes too costly with scale. **We believe the shift from public clouds will be more than offset by the increase in multi-cloud as fewer organizations overall rely on public clouds, but the organizations that do will utilize several cloud providers.**

Source: I.H.S. Markit, Credit Suisse Research.

# Usage of Multiple Cloud Service Providers Continuing to Expand by 2020...

Through an IHS Markit (December 2018) industry survey with 164 responses, usage of multiple cloud service providers is expected to change between 2018 and 2020. The survey was answered by IT decision-makers from North American organizations with at least 101 employees and subscribe to off-premises cloud services.

**Number of Cloud Service Providers Used Is Only Increasing with a +30% in Infrastructure, +42% in SaaS Providers**



Respondents indicated how many cloud service providers for SaaS and how many providers for infrastructure they use now and by July 2020. Respondents are using 10 different CSPs for SaaS (growing to 14 by 2020) and 10 for infrastructure (growing to 13 by 2020). This result is not surprising given last year's study, where respondents were using an average of 8 CSPs in 2017 with plans to use 11 by 2019.. **We believe this dynamic is extremely beneficial to colos. and multi-tenant data centers especially as it requires additional on-ramps and connectivity.**

I.H.S. noted that one key opportunity multi-clouds offer is that enterprises consuming cloud services from different providers will seek support from CSPs to manage the delivery of their services from multiple platforms, ultimately avoiding adding the extra burden to their in-house IT teams. **We believe the trend of providing a single connection via which the enterprise can access CSPs is an opportunity for data centers, as the report highlighted Digital Realty's recent extension of connections of Digital Realty Service Exchange to leading CSPs.**

Source: I.H.S. Markit, Credit Suisse Research.

# The Industry Remains Fragmented, with Many Sizeable Players in the Private Data Center Market...

## Public Data Centers



## Private Data Centers (30+ Operators)



Source: Credit Suisse Research, Company data.



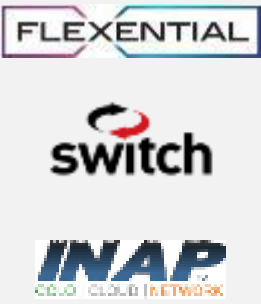
# Key Differences Between Public and Privately Held Data Centers, Publicly Traded Operators in Position of Strength Currently...

Given the formations of recent private data centers from a variation of larger company divestitures (telecoms), mergers (managed services, colocation), and demand surges from wholesale and retail providers, inquiries from private equity, asset manager and fixed income institutional investors have increased significantly with a common theme across all the inquires is to understand the key differences between the private and publicly traded data center operators. Below we highlight the five key differences between the two types of providers based on our industry contacts and our general sector observations, collected through industry conferences, reported metrics, and some other sources.

Factor	Details on Public / Private Operators Offering Retail & Wholesale Colocation
<b>1) Business Segments</b>	Almost all publicly traded data center operators primarily offer space, power, cooling, and interconnection. Private operators offer these services in addition to web/cloud hosting, managed services, security services, construction services, and other. This means private operators generally have higher OPEX levels to support the extra staff to service these extra segments in cases that the services are more OPEX intensive than the standard colocation business, pertaining mainly to web hosting and managed services. Wholesale is lean.
<b>2) Location &amp; Markets</b>	Publicly traded operators predominantly focus/deploy into Tier 1 or 2 markets given enterprise customer and cloud availability zone concentrations. Tier 1 & 2 markets are also more interconnection dense compared to lower tier metros/markets. Private operators deploy similarly for both retail and wholesale builds, but have a larger presence in Tier 3 markets (Charlotte, Orlando, Minneapolis, Montreal, Seattle, Nashville, etc.). Tier 3 markets are more complex to scale with enterprise and cloud customers, ramping slower and smaller.
<b>3) Age of Facilities &amp; Power Distribution Capabilities</b>	Publicly traded data center operators have a healthy combination of new capacity from facility expansions and net-new campus builds while maintaining older facility vintages given consistent non-recurring CapEx investments for retail/wholesale facility sites. Private operators in retail on average have much older data centers, with lower power capacities supporting older IT hardware & networking equipment deployments, and in some cases have not seen non-recurring CapEx investments for several years. New private wholesale builds are generally in good shape given their recent development standards, using experienced facility design engineering firms.
<b>4) Type of Colocation</b>	Publicly traded operators are balanced well between retail and wholesale data centers and have robust retail capabilities with cloud and SDN On-Ramps whereas private operators have lower On-Ramp capabilities, forming less capable customer/cloud/SDN tenant ecosystems. Public operators have a material scale and connectivity advantage compared to private operators in this factor.
<b>5) Access to Financing &amp; Capital</b>	Publicly traded operators have several capital financing options including: 1) follow-on equity raises/public markets, 2) credit facilities, 3) senior debt notes (investment grade, high yield), 4) variety of joint venture partnership opportunities, and 5) other forms of funding at high public equity valuations. Private companies have combinations of public company sources (debt, credit facilities, etc.), but at lower valuations, lower scale, usually lower than investment grade rated debt options, more complex JV partnership agreements, and private operators do not have access to equity raise capabilities from public markets (especially not at REIT valuations), restricting cash injections to private/pension/sovereign equity or new investor funding sources, which is usually an unfavorable course of action for more private market investors if the new capital is not going towards new facility developments or expansions.

Source: Credit Suisse Research.

# Different Data Center Business Models and Strategies

Company	Strategy	Description	Pros Versus Cons
	<p><b>Retail / Colocation</b> (Interconnection Density)</p>	<p>Retail / Colocation businesses focus on smaller customer deployments, oftentimes having dense interconnection activity and two to 50 cabinets per customer per multi-tenant data center.</p>	<p><b>Pros:</b> Higher colocation price points and higher interconnection revenue streams per cabinet, lifts returns on invested capital yields (~15% to 25%) for businesses. High moat businesses, requires solid balance sheet and assets to compete effectively. Can upsell into other services and connectivity offerings given tech industry position.</p> <p><b>Cons:</b> Retail Colocation Market is not high growth; market generally growing ~8% CAGR for the next five years. Stable ROICs in existing markets but fluctuations in international markets with regulations impacting interconnectivity. Short term leases/contracts (~2yrs).</p>
	<p><b>Wholesale / Hyperscale</b> (Cloud Targeted)</p>	<p>Wholesale / Hyperscale data center businesses are generally leased by one customer/tenant per data center facility. Customers are generally cloud providers (AMZN, MSFT, FB, CRM) or large enterprises seeking to exit their older enterprise facilities and outsource infrastructure needs.</p>	<p><b>Pros:</b> High market growth during high IT spend cycles, indexed to hyperscale capex growth that is almost double retail colocation growth rates over the next five years. Long lease maturities, lower churn rates, and solid repeat business. Balance Sheet is strategic, longer leases can lock-in better costs of debt (Invest. Grade ratings).</p> <p><b>Cons:</b> Customer has sizeable bargaining power during renewal process and returns on invested capital can generally be low (~9% to ~11% per year). Often times regarded as a commoditized business and sensitive to power rates per market. Small number of target customers to achieve high growth. Tech. obsolescence is a big risk.</p>
	<p><b>Various and Mixed Strategies</b> (Enterprise, Hosting, Connectivity, Cyber Security)</p>	<p><b>Various strategies include:</b></p> <ol style="list-style-type: none"> <li>1) Targeting Tier 2 and 3 data center markets (international markets, etc.);</li> <li>2) Cyber security Offerings with colocation services;</li> <li>3) Colocation, Web Hosting, and Connectivity offered together for customer deployments (Flexential, Switch, INAP).</li> </ol>	<p><b>Pros:</b> Higher price points for colocation price points with upsell opportunities into cloud hosting, cyber security, and connectivity offerings, lifts return on invested capital yields to 11% to ~15% range. Tier 2 and 3 markets can be more profitable than Tier 1 markets, given limited competition.</p> <p><b>Cons:</b> Market growth for mixed strategy businesses are lower than ~8% CAGR for the next five years, largely because customers are legacy enterprises managing private cloud workloads. Mixed strategy businesses receive lower valuations given their mixed offerings and difficult to understand business models compared to Retail/wholesale businesses that have a good number of publicly traded comps.</p>

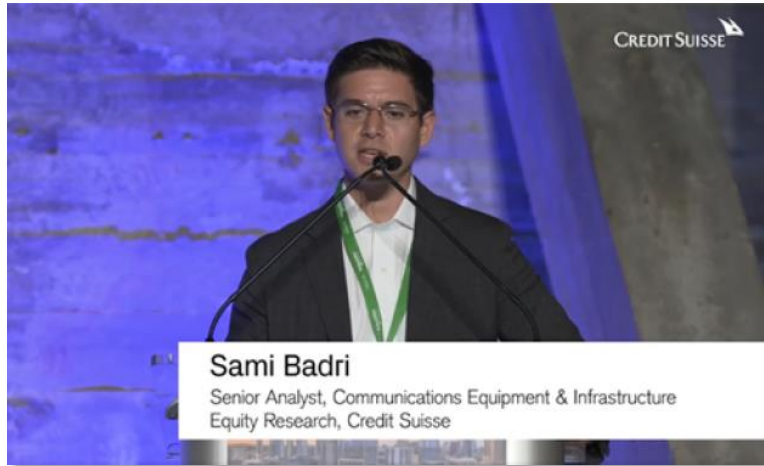
Source: Credit Suisse Research, Company Data.



# Edge Thesis – Edge Proliferation by 2021 ([Click Here for Video](#))

**Edge Computing and Edge Data Centers in Focus:** Throughout 2019 there has been a consistent narrative ramp in edge computing and data centers, and this ramp was finally topped by Amazon Web Services at Re:Invent in the first week of December 2019 with the announcements pertaining to their new partnership with Verizon to deliver 5G Edge Cloud Computing services and AWS Outposts. Incorporating sub-sector technology capex spend cycle views across Hyperscale, Multi-Tenant Data Centers, Telecom, and Cable companies, we presented our views on the edge compute and the micro data center landscape at Edge Congress (November 2019, Austin, TX). We believe the physical edge/micro data center opportunity will materialize in a more meaningful way in 2021, following more telecom capex spending ramps in preparation for 5G, cable company network core re-distributions (and virtualization core completions), further hyperscale capex spending trends, and the emergence of more edge application use cases, discussed in our keynote with projections and supporting observations.

[Click Here for Link to Video](#)



## Timeline for Edge Proliferation – 2021-2022 Critical for Edge Ramps

### Hyperscalers, Telecoms, and Cable Providers Densify

#### 2018–2022+

- Hyperscalers Continue to Scale Globally and add more Colocation deployments
- Telecoms Densify 5G Target Markets
- Cable Providers Execute Core Expansion Projects

### Complete New Network Cores

#### 2021–2022+

- Telecoms Complete New 5G Network Cores
- Cable Providers Complete Network Cores Adds
- Cloud Providers Extend Footprints Globally
- More Edge Data Center Use Cases Emerge

### Edge UCs Up

#### 2022+

- Edge Data Center investment returns come in center focus.
- More Edge Data Center Use Cases Are Deployed

Source: Credit Suisse Research.

# Enterprise Data Center Divestitures to Continue (Credit Suisse Ex.)

**Credit Suisse Example—IRM-CS Transaction:** In 2017, Iron Mountain Incorporated (IRM) announced plans to make its first international acquisition by purchasing two data centers owned by Credit Suisse (CS) in London and Singapore for \$100 million. As part of the transaction, CS will enter into a long-term lease with IRM to maintain their existing data center operations. The two data centers would add a total of 273,000 square feet and over 14 MW of capacity (including future expansions) to IRM's portfolio of which 4.2 MW will be leased back to CS. The London data center totals 120,000 square feet and is located in the Slough Trading Estate, while the Singapore data center totals 153,000 square feet and is located in Serangoon. Both facilities provide access to large power networks and an ability to serve numerous enterprises in the respective data center markets. Designed to meet the security requirements of a highly regulated financial services firm, the data centers comply with IRM's standards for security and compliance. Additionally, after accounting for the 4.2MW leased to Credit Suisse, IRM will have additional expansion capacity of approximately 10MW in these two attractive data center markets.

- **Why Did CS Divest Their Data Centers?** CS found that it was very expensive to maintain its two data center facilities where they were only utilizing ~30% of capacity. Therefore, it made more economical sense to sell these locations to avoid the recurring capex and overall costs of maintaining a data center facility while being able to still use the facilities through a leaseback deal. Ultimately, CS built these data centers overestimating for capacity it never used and by leasing back through a third-party data center provider, CS will only need to pay for what it uses, rather than for the whole facility.
- **Why Did IRM Acquire CS' Facilities?** IRM is continuing to build out its data center business and this transaction enabled IRM to establish an international presence at an affordable price (we believe the price point of ~\$7million per MW, is at or below traditional build levels). In addition, CS serving as IRM's anchor tenant in these facilities is an added bonus and with an anchor tenant signed and excess gross power available, IRM will be able to expand its colocation expertise on the facility and increase the facility's utilization, leasing the entire facility's available gross power.

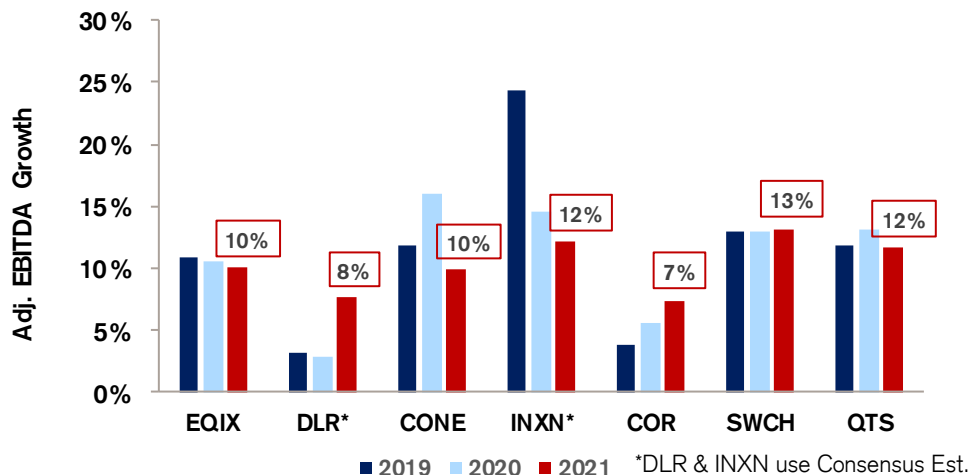
**Win-Win Transaction:** In summary, we view enterprise data center facility divestitures to MTDCs as a win-win transaction, giving the enterprises access to interconnection services that MTDCs specialize in at lower overall OPEX and giving MTDCs facilities at price tags below their and the market's average cost basis for similar facilities. We do not see a reason for the rate of enterprise data center facility divestitures to drop.



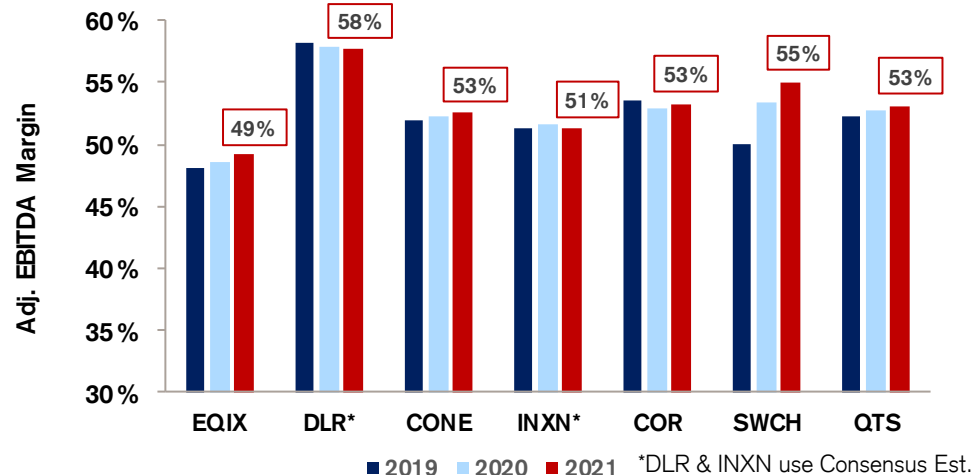
Source: Credit Suisse Research.

# Data Center Fundamentals Remain Attractive

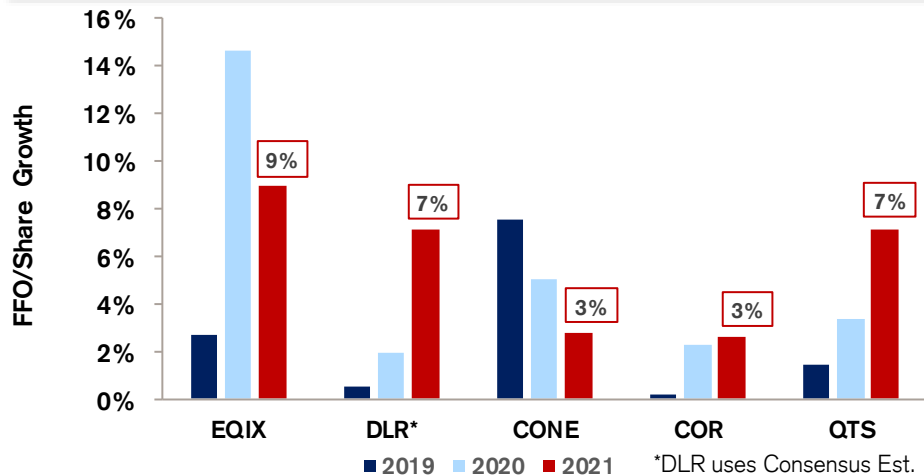
## Adj. EBITDA Growth Led by Smaller Cap. DCs – QTS, SWCH



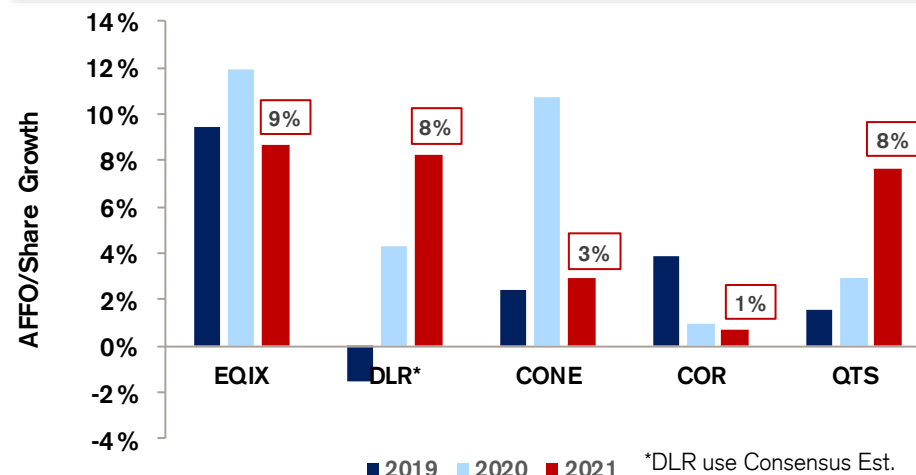
## Adj. EBITDA Margins – Our O/Ps Have Space to Expand



## FFO/Share Growth – Led by O/P EQIX, Neutral Rated QTS



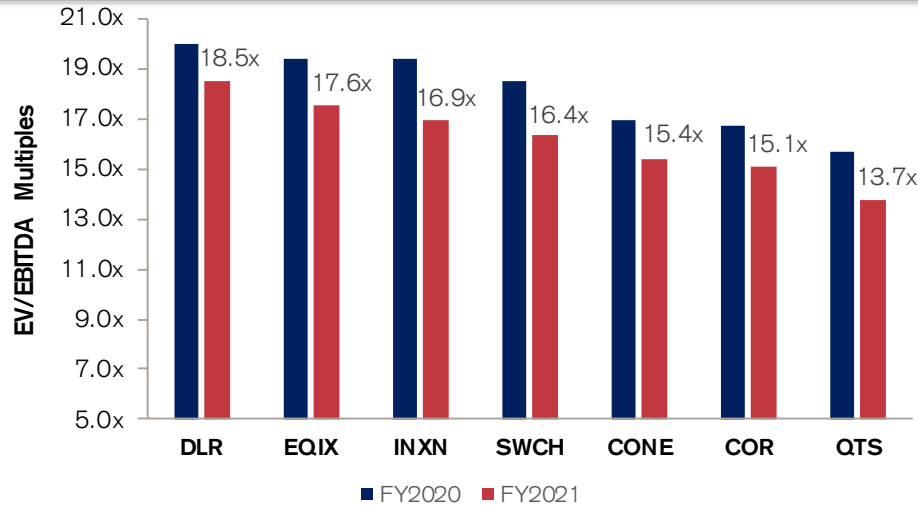
## AFFO/Share Growth – Led by O/P EQIX, Neutral Rated QTS



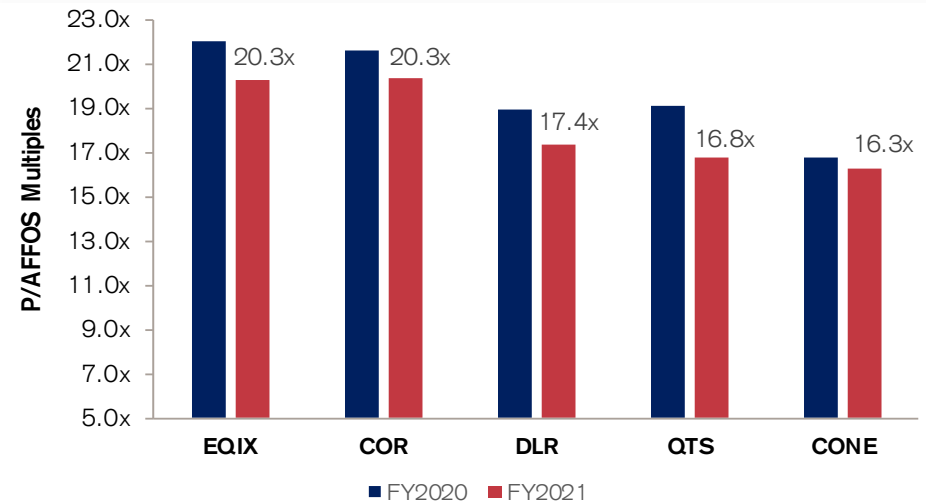
Source: Credit Suisse Research estimates, Company Data, FactSet (DLR and INXN uses Consensus Est.).

# Data Center Comps Remain Compelling Given Growth Prospects...

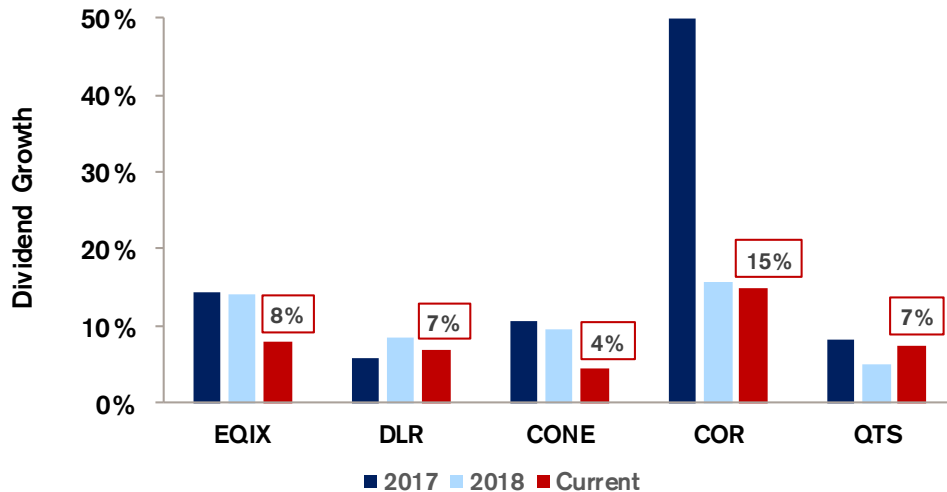
## DLR & EQIX Trade at a Premium on EV/EBITDA



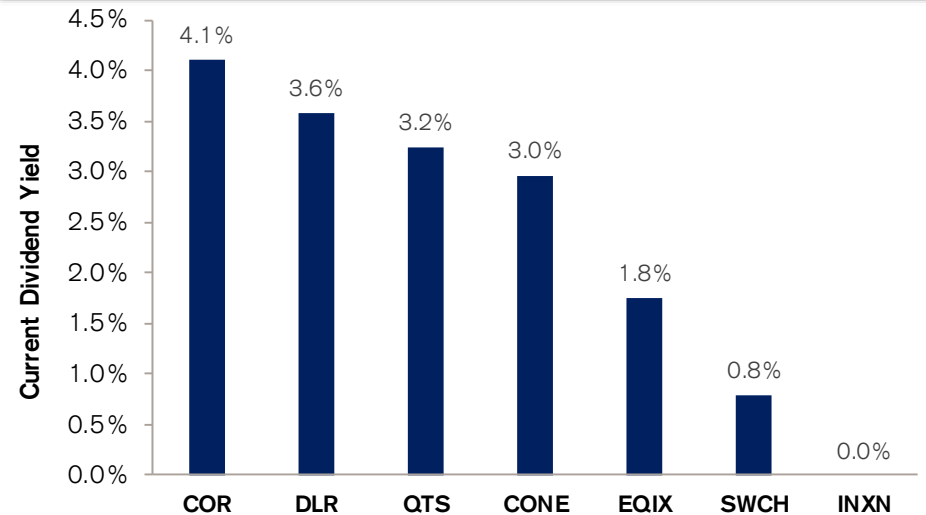
## QTS & CONE Least Expensive on FY21 AFFO Basis



## Dividend Growth



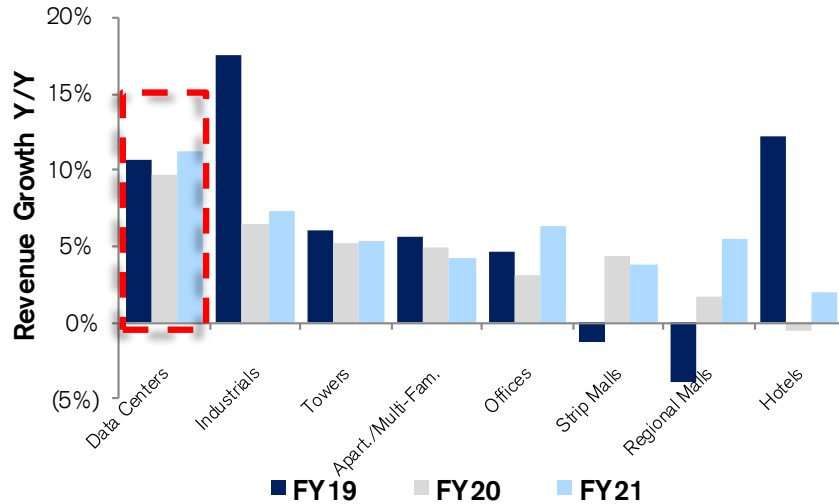
## Dividend Yields Remain Healthy Amidst EBITDA Growth



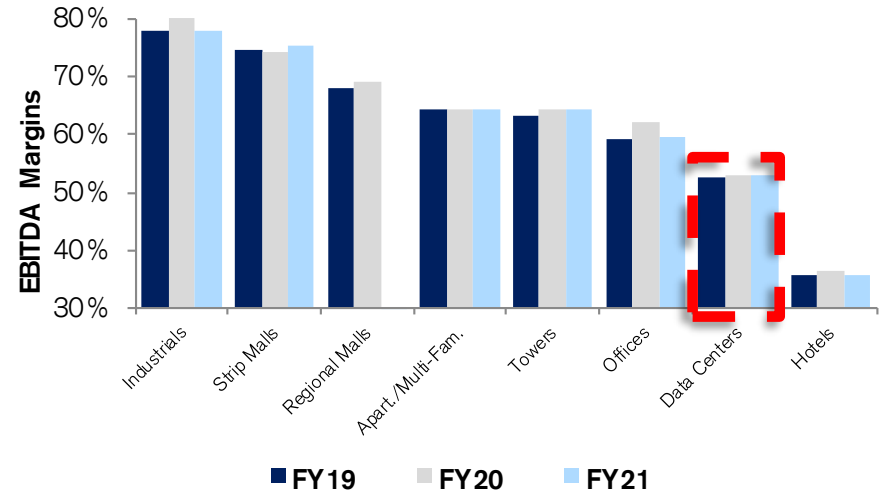
Source: Credit Suisse Research estimates, FactSet for all estimates.

# Data Center REITs vs. Other REIT Asset Classes

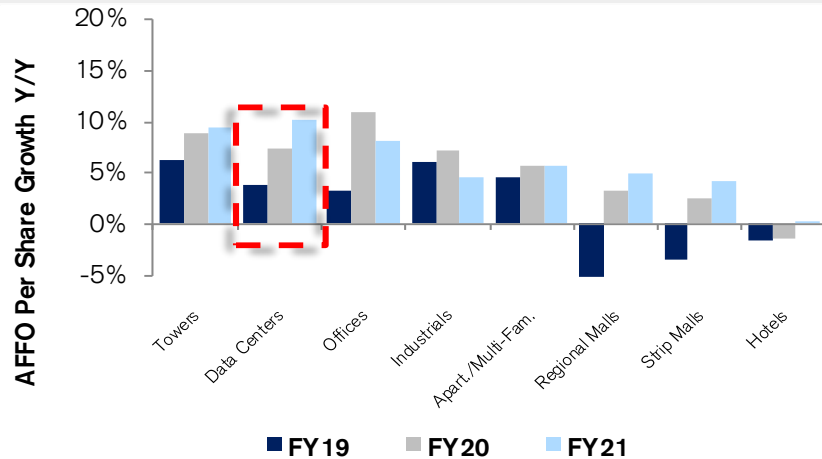
## DCs Boast Consistently Higher Revenue Growth Across REITs



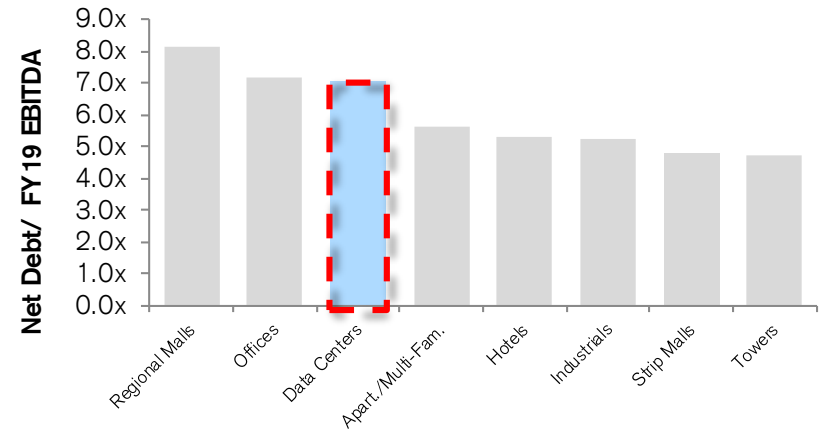
## Although EBITDA Margins Are On The Lower End



## AFFO Per Share Growth Exceeds Most REIT Classes



## DCs Are More Levered, But Long Lease Terms Reduce Risk



Source: FactSet, Credit Suisse Research estimates

# Networking and Communications Equipment

## Challenging Macro Dynamics to Consider



2020 Outlook -- The Cloud Has Four Walls

# 2020 Communications Equipment Outlook – Executive Summary

**Top Fundamentals Performance (Margin, EPS, and FCF Growth) to Lead Outperformance in 2020:** Throughout 2019 different networking equipment providers underperformed from a return perspective for a variety of different reasons, largely tied to declining or slowing end market revenue opportunities, including **1)** Slowed macro IT spending environment (CSCO, FFIV); **2)** Declining cable capex spend (COMM, CSCO), **3)** Rapid shifts in hyperscale capex spending trends displacing concentrated equipment vendors (ANET), **4)** Declining telecom/service provider capex spending (JNPR, CSCO, COMM), and **5)** M&A integrations and implications to per share metrics (FFIV, COMM). Conversely, across our coverage, equity fundamental (Margin, EPS, and FCF Growth) performance was relatively stable, however, given elevated levels of expectations around 5G and cloud to accelerate end market revenue growth opportunities, comm. equipment multiples compressed as CapEx spending levels either declined slightly (telecom and cable capex) or decelerated rapidly (ANET). The outperforming communications equipment providers of 2019 (MSI and UI) saw strength due to their indexation to customers disconnected from the aforementioned end markets. Going into CY20, end market revenue growth expectations are relatively low, following the aforementioned CapEx spending declines/decelerations and aggregated company guidance for 1H 2020. From here we expect fundamental performance to lead returns, highlighting our top pick MSI, expanding operating margins by ~180bps, growing EPS by 9.1%, and FCF per share by 10.8% in 2020, executing ahead of the communications equipment peer group.

**Across the Comm. Equipment End Markets, we would highlight the following:**

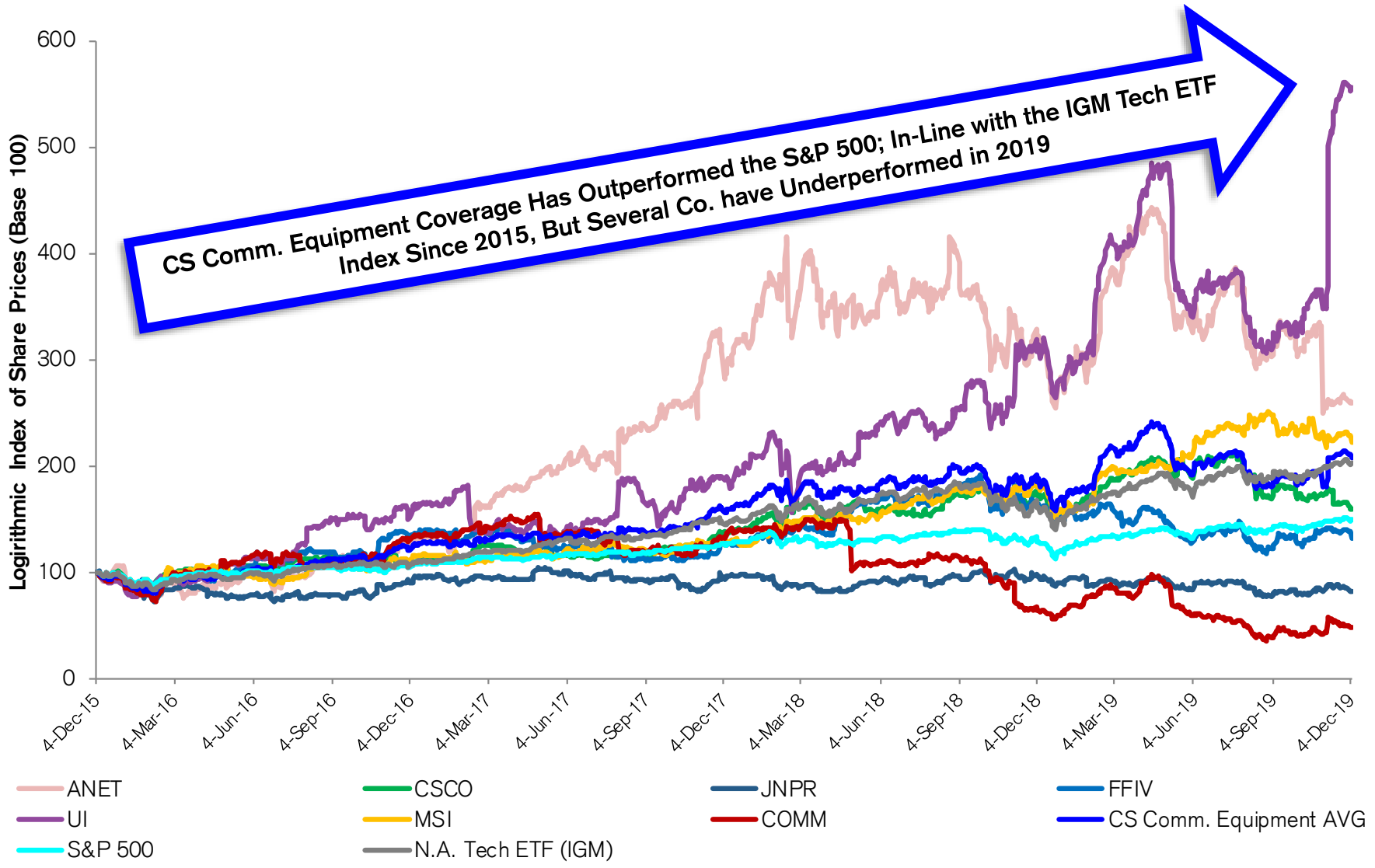
- **Core Networking Market Growth of +3.2%/+2.7% in CY20/21:** Across the core networking market, including Switching (DC, Campus, Carrier), Routing (SP and Enterprise), ADCs, WLAN, Optical, and SAN Equipment, CY20E/21E growth rates of 3.2%/2.7% are decelerations in aggregate versus CY18E/19E growth levels of +4.1%/+2.6%, respectively. This supports our view that end market revenue expectations are low, projecting growth decelerations across the industry, highlighting the need for fundamental performance of individual companies to deliver equity return performance.
- **Data Center Switching Market:** Despite the initial expectations that 400G was going to be a key contributor to DC switching market growth in CY20, step-up growth has been pushed out to CY21, with market growth accelerating to +7.0% in CY21 versus +5.8% in CY20 following CY18/19 growth of +2.8%/+1.7%, respectively. Companies indexed to this pressured market are ANET, JNPR, and CSCO, ranked in order of concentration and we believe industry market projections are too elevated in the wake of decelerating hyperscale capex and macro IT enterprise spending that is highlighted in the prior section. On 400G, based on our industry checks, 400G switches shipping at scale mid-2021 is looking unlikely based on what some industry engineers and end users had to say regarding the 400G switching opportunity. Our industry checks highlighted that most of the 2016 to 2018 data center build vintages do not need to be upgraded to 400G switching speeds from 100G until mid-2021 or early 2022 (~5yrs in operation versus the suspected ~3yrs in our prior sector outlook) given their optimized electrical efficiencies and lower overall costs with 100G. This aligns with the dynamics that ANET and other technology hardware companies have discussed on their earnings calls relating to cloud customers running their equipment longer/hotter than they have previously. Given this we would also note that industry data may only reflect part of this industry commentary.
- **Service Provider Routing Market:** SP Routing has been an area of material weakness across our coverage companies for the past two years, led by CSCO's reported product orders coming in at -21%/-13% in its two most recent quarters and JNPR's constant declines in SP customer activity. We do not see SP routing dynamics changing in CY20E versus CY19 despite the 5G narrative accelerating. For SP routing, the market is projected to grow +1.2%/+1.1% in CY20E/21E, an improvement versus CY18/19 levels of -3.0%/+0.9%, respectively, and would note that the majority of the incremental growth is expected to flow into white box solutions rather than branded routing providers based on our industry checks.

**Credit Suisse Outperformers and Underperformers:**

- 1. Top Pick: Motorola Solutions (Outperform, \$178 Target Price) – Unchallenged Leading End-to-End Public Safety Equipment/Solutions Provider:** We see MSI as the leading provider and highly irreplaceable in the public safety/first responders' communications market, given it is the only true large scale U.S. based end-to-end provider. We also identify MSI as our fundamental top performer, projected to deliver operating margin expansion, high single digit EPS growth, and high FCF Per share growth.
- 2. F5 Networks (Outperform, \$192 Target Price) – Highly Levered to Benefit from Hybrid Cloud Transitions:** FFIV has been an Outperform rated since our sector launch. Despite revenue pressures from general technological changes in the sector, we identify FFIV's technology as superior and highly relied upon across its customer base. FFIV boasts highly recurring revenues, a solid market position, effective capital usage, and solid free cash flow (FCF) metrics, enabling the company to stand out versus its comparable peer group.  
**CommScope Inc. (Outperform, \$21 Target Price) – Attractive at Current Levels:** Despite recent pressures on COMM's end markets, we continue to positively view the company's relevance to overall telecom network densification and data center build-outs over the next five years. The company is in the process of stabilizing its businesses, growing EBITDA, and beginning to pay down debt at a consistent rate, making them attractive from a valuation perspective.
- 3. Juniper Networks (Underperform, \$19 Target Price) – Competitive Pressures Only Intensifying With CSCO:** JNPR faces multiple pressures that we believe will lead the stock to Underperform. These include intensifying technological pressures from CSCO and SP customer spending weakness.

Source: Credit Suisse Research, I.H.S Markit (Used for industry end market growth rates).

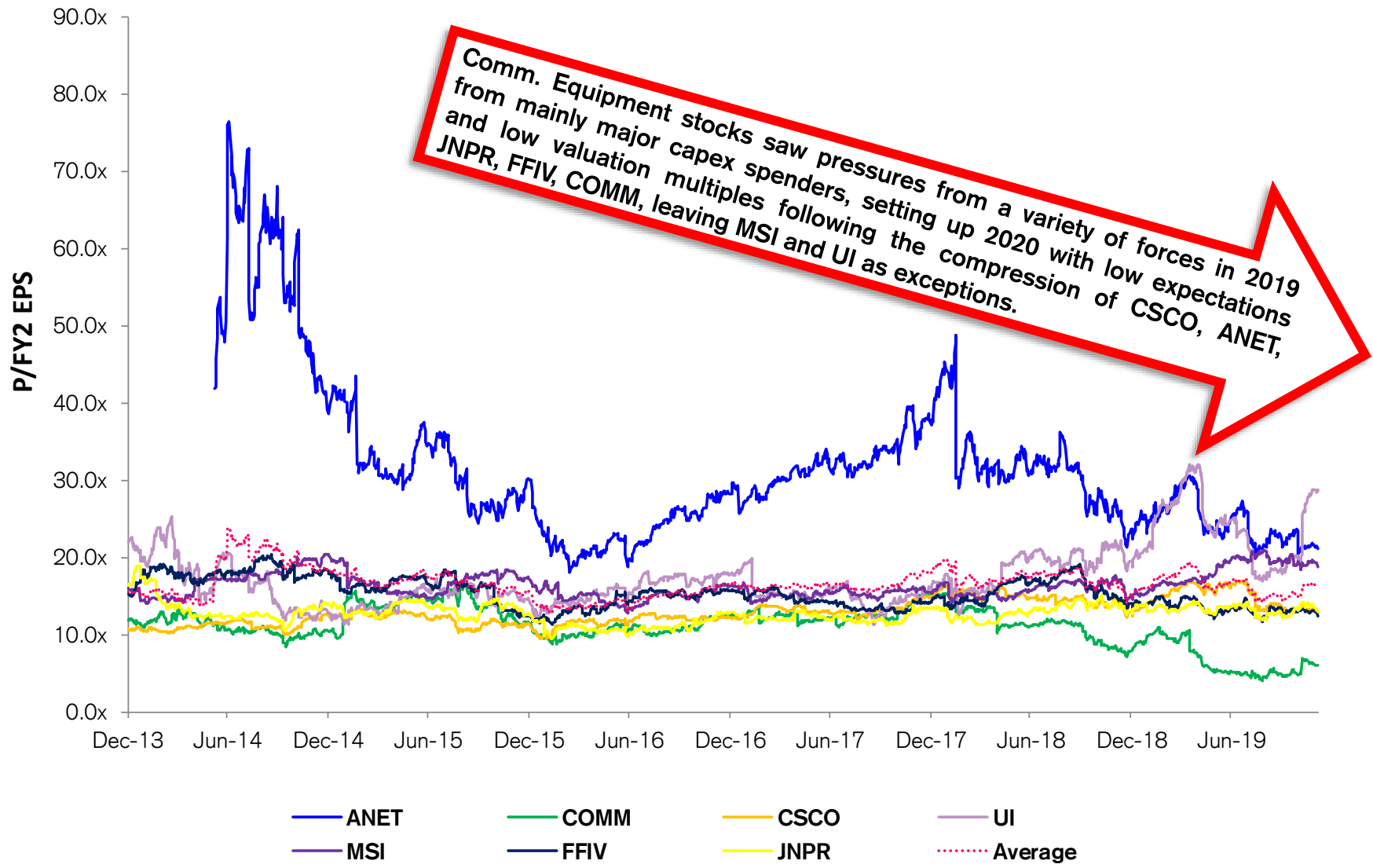
# CS Comm. Equipment Performance Versus Major Indices



Source: FactSet, Credit Suisse Research.



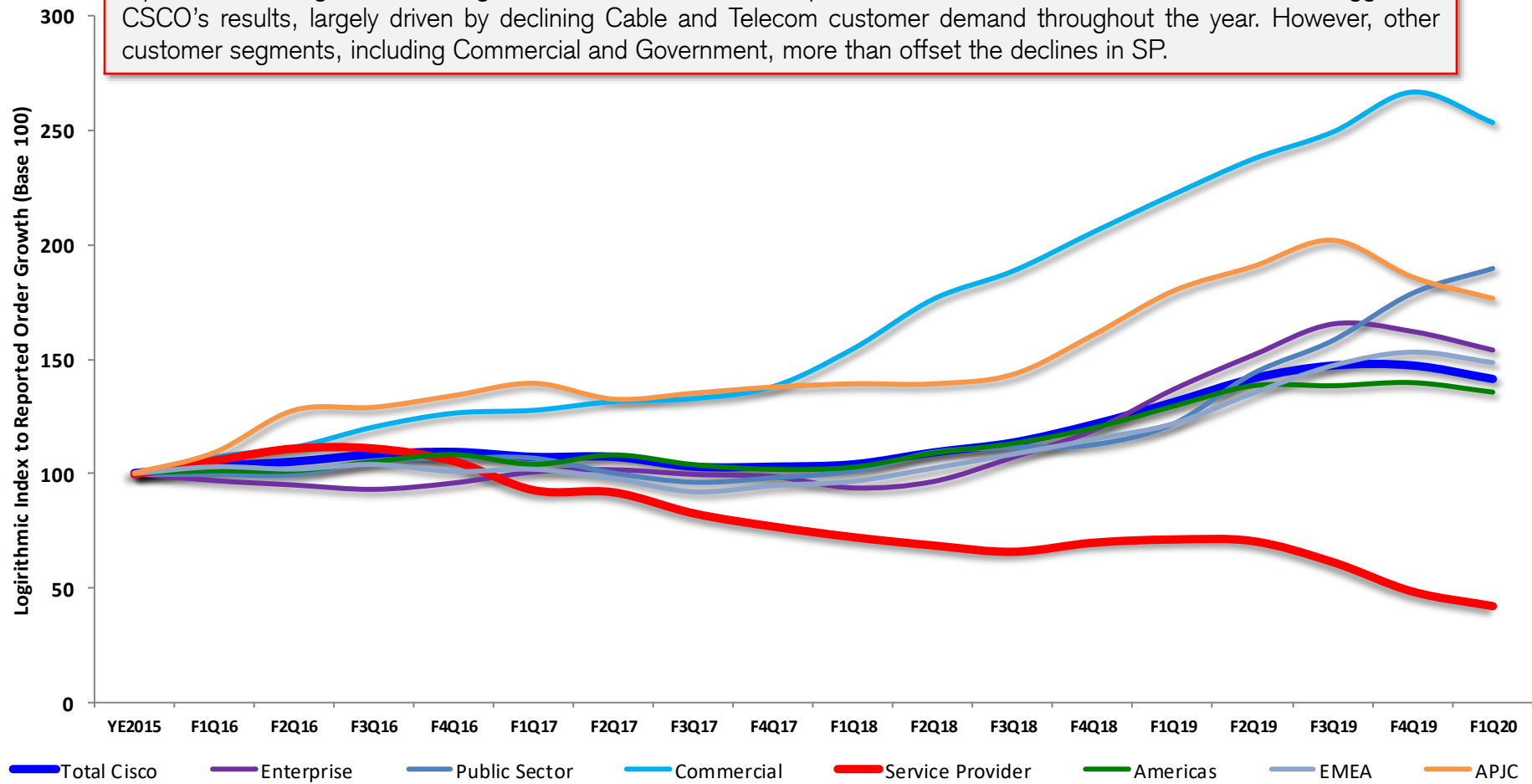
# Comm. Equipment Forward EPS (FY2) Multiples Have Not Advanced and See a Variety of Pressures Into 2020E...



Source: FactSet, Credit Suisse Research.

# CSCO Service Provider Product Orders Materially Impacted by Decelerating Trends Since 2015, Pronounced in 2019...

**Despite High Expectations for 5G Equipment Upgrades and SP Capex Spending, Service Provider Order Demand Was Down Materially in 2019:** When charting CSCO's product orders on a logarithmic basis (across all reported order segments and regions), it is clear that service provider customer demand has been the clear laggard in CSCO's results, largely driven by declining Cable and Telecom customer demand throughout the year. However, other customer segments, including Commercial and Government, more than offset the declines in SP.



Source: Company data, Credit Suisse Research.

# Total Networking Market Continues to Grow in the Mid-Single-Digit Range; Lifted by DC Switching, SAN, and WLAN Equipment...

Networking Market (\$millions)	2015	2016	2017	2018	2019E	2020E	2021E	2022E	2023E	CAGR	
										'14-'18	'18-'23
<b>Switching</b>											
Carrier Switching	2,511	2,372	2,413	2,178	2,136	2,088	1,999	1,905	1,816	(4.8%)	(3.6%)
Data Center Switching	8,999	10,123	11,454	11,774	11,978	12,669	13,558	14,223	14,628	8.8%	4.4%
50GB & Below	8,840	9,298	8,989	7,799	6,746	6,008	5,238	4,689	4,222	(1.6%)	(11.5%)
100GB & Above	159	825	2,464	3,975	5,232	6,661	8,320	9,534	10,405	167.1%	21.2%
Campus Switching	13,594	12,862	13,487	15,342	15,155	15,255	14,982	15,098	15,111	3.5%	(0.3%)
<b>Total Switching</b>	<b>25,105</b>	<b>25,357</b>	<b>27,353</b>	<b>29,294</b>	<b>29,269</b>	<b>30,012</b>	<b>30,539</b>	<b>31,226</b>	<b>31,555</b>	<b>4.7%</b>	<b>1.5%</b>
Y/Y Growth	2.8%	1.0%	7.9%	7.1%	-0.1%	2.5%	1.8%	2.3%	1.1%		
<b>SAN Equipment</b>											
	<b>2,369</b>	<b>2,189</b>	<b>2,088</b>	<b>2,755</b>	<b>3,157</b>	<b>3,383</b>	<b>3,497</b>	<b>3,523</b>	<b>3,503</b>	<b>2.4%</b>	<b>4.9%</b>
Y/Y Growth	-5.5%	-7.6%	-4.6%	32.0%	14.6%	7.2%	3.3%	0.8%	-0.6%		
<b>Application Delivery Controllers</b>											
Hardware	1,581	1,462	1,348	1,214	1,065	954	844	735	640	(7.6%)	(12.0%)
Virtual	412	500	515	577	650	687	723	755	774	20.6%	6.0%
<b>Total ADC Market</b>	<b>1,993</b>	<b>1,962</b>	<b>1,862</b>	<b>1,791</b>	<b>1,715</b>	<b>1,641</b>	<b>1,567</b>	<b>1,490</b>	<b>1,413</b>	<b>(2.0%)</b>	<b>(4.6%)</b>
Y/Y Growth	2.7%	-1.6%	-5.1%	-3.8%	-4.3%	-4.3%	-4.5%	-4.9%	-5.1%		
<b>Routing</b>											
Service Provider Routing	12,746	12,927	13,171	12,770	12,884	13,039	13,179	13,325	13,465	0.3%	1.1%
Core Routers	2,850	3,289	3,471	3,564	3,561	3,690	3,823	3,950	4,082	7.9%	2.8%
Edge Routers	9,896	9,638	9,700	9,206	9,323	9,349	9,357	9,374	9,383	(2.0%)	0.4%
Enterprise Routing	3,033	3,046	2,920	2,873	3,288	3,285	3,255	3,220	3,169	(0.5%)	2.0%
Optical Networking	12,923	13,887	14,496	14,649	15,448	16,181	16,830	17,591	18,428	3.7%	4.7%
<b>Total Routing Market</b>	<b>28,701</b>	<b>29,861</b>	<b>30,587</b>	<b>30,291</b>	<b>31,620</b>	<b>32,504</b>	<b>33,264</b>	<b>34,135</b>	<b>35,062</b>	<b>1.8%</b>	<b>3.0%</b>
Y/Y Growth	1.6%	4.0%	2.4%	-1.0%	4.4%	2.8%	2.3%	2.6%	2.7%		
<b>WLAN</b>											
Access Points	4,014	4,339	4,654	5,016	5,156	5,855	6,548	7,216	7,840	8.0%	9.3%
Controllers	971	953	1,207	1,383	1,421	1,263	1,258	1,310	1,405	6.4%	0.3%
<b>Total WLAN Market</b>	<b>4,986</b>	<b>5,292</b>	<b>5,862</b>	<b>6,399</b>	<b>6,577</b>	<b>7,117</b>	<b>7,806</b>	<b>8,525</b>	<b>9,245</b>	<b>7.6%</b>	<b>7.6%</b>
Y/Y Growth	4.5%	6.1%	10.8%	9.2%	2.8%	8.2%	9.7%	9.2%	8.4%		
<b>Overall Networking Market</b>	<b>63,154</b>	<b>64,660</b>	<b>67,752</b>	<b>70,531</b>	<b>72,339</b>	<b>74,658</b>	<b>76,672</b>	<b>78,900</b>	<b>80,778</b>	<b>3.3%</b>	<b>2.8%</b>
Y/Y Growth	2.1%	2.4%	4.8%	4.1%	2.6%	3.2%	2.7%	2.9%	2.4%		

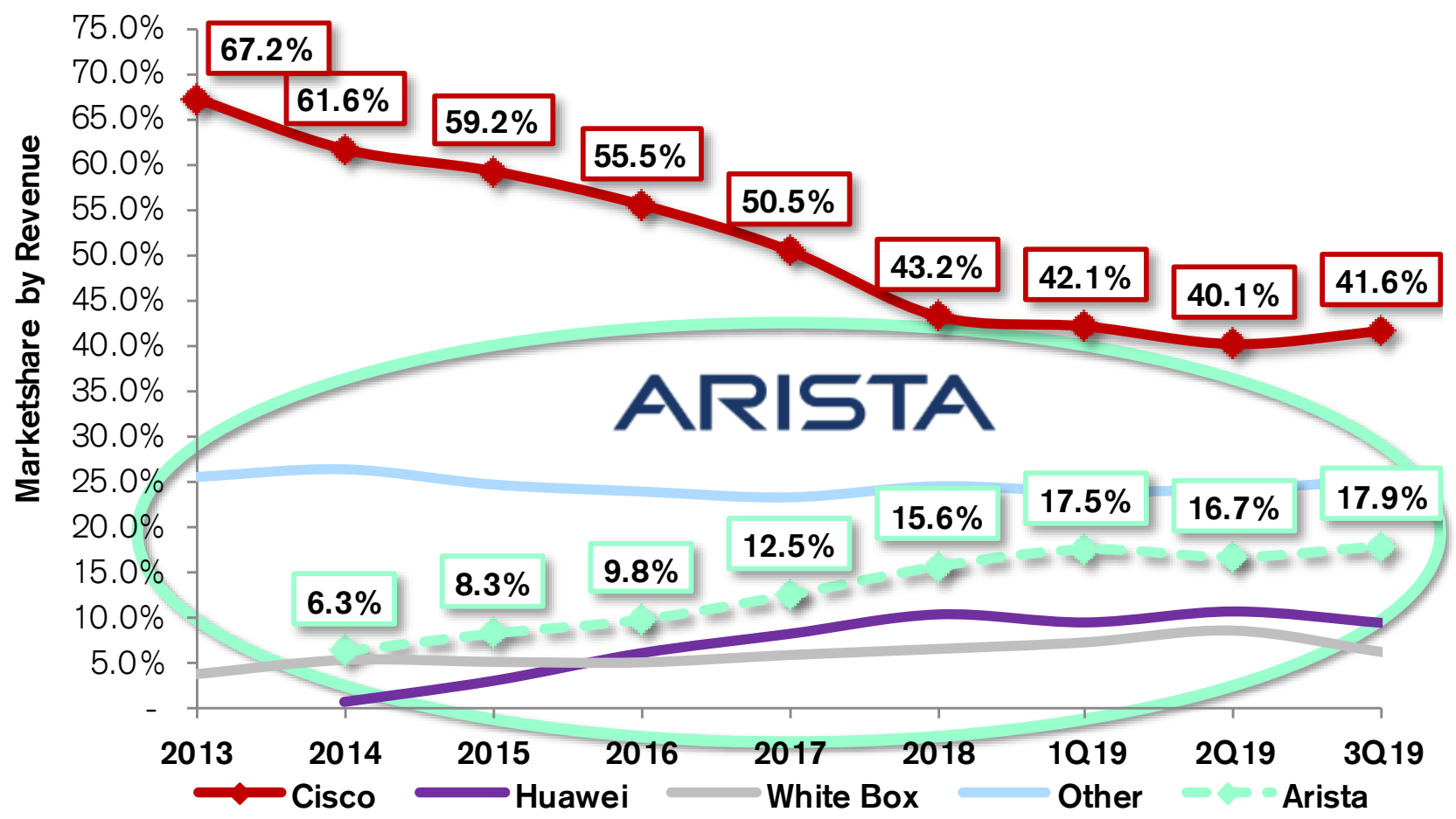
Source: Credit Suisse Research, I.H.S. Markit data & estimates

# Total Networking Market Units/Ports Continues to Grow in the Mid-Single-Digit Range Across Core Segments Led by DC/WLAN...

Networking Market (Unit/Ports in millions)	2015	2016	2017	2018	2019E	2020E	2021E	2022E	2023E	CAGR	
										'14-'18	'18-'23
<b>Switching (Ports)</b>											
Carrier Switching	7.725	8.638	10.030	10.148	9.485	9.169	9.049	8.798	8.555	9.9%	(3.4%)
Data Center Switching	37.008	40.735	52.644	57.247	60.551	64.950	70.257	76.225	82.897	13.3%	7.7%
50GB & Below	36.944	39.792	44.728	42.844	40.952	40.664	41.036	41.710	42.667	5.4%	(0.1%)
100GB & Above	0.065	0.943	7.916	14.403	19.599	24.287	29.221	34.515	40.230	487.9%	22.8%
Campus Switching	513.576	547.914	585.779	633.134	651.900	696.735	732.023	766.964	791.874	6.1%	4.6%
<b>Total Switching</b>	<b>558.309</b>	<b>597.286</b>	<b>648.453</b>	<b>700.528</b>	<b>721.936</b>	<b>770.854</b>	<b>811.329</b>	<b>851.987</b>	<b>883.326</b>	<b>6.6%</b>	<b>4.7%</b>
Y/Y Growth	3.0%	7.0%	8.6%	8.0%	3.1%	6.8%	5.3%	5.0%	3.7%		
<b>SAN Equipment (Ports)</b>											
	<b>8.098</b>	<b>7.395</b>	<b>7.033</b>	<b>8.522</b>	<b>9.254</b>	<b>9.753</b>	<b>10.069</b>	<b>10.297</b>	<b>10.490</b>	<b>(0.8%)</b>	<b>4.2%</b>
Y/Y Growth	-8.0%	-8.7%	-4.9%	21.2%	8.6%	5.4%	3.2%	2.3%	1.9%		
<b>Application Delivery Controllers (Units)</b>											
Hardware	0.061	0.057	0.051	0.044	0.034	0.031	0.027	0.024	0.021	(8.9%)	(13.7%)
Virtual	0.060	0.069	0.067	0.074	0.080	0.084	0.087	0.090	0.091	14.7%	4.4%
<b>Total ADC Market</b>	<b>0.120</b>	<b>0.127</b>	<b>0.118</b>	<b>0.117</b>	<b>0.114</b>	<b>0.114</b>	<b>0.114</b>	<b>0.114</b>	<b>0.112</b>	<b>2.6%</b>	<b>(0.9%)</b>
Y/Y Growth	13.7%	5.4%	-6.8%	-0.8%	-2.8%	0.5%	-0.1%	-0.5%	-1.6%		
<b>Routing (Ports)</b>											
Service Provider Routing	7.066	8.314	8.320	8.218	8.227	8.230	8.155	8.090	8.030	4.9%	(0.5%)
Core Routers	0.442	0.617	0.602	0.619	0.619	0.628	0.627	0.629	0.640	6.7%	0.7%
Edge Routers	6.624	7.696	7.718	7.599	7.608	7.602	7.527	7.462	7.390	4.7%	(0.6%)
<b>Total SP Routing</b>	<b>7.066</b>	<b>8.314</b>	<b>8.320</b>	<b>8.218</b>	<b>8.227</b>	<b>8.230</b>	<b>8.155</b>	<b>8.090</b>	<b>8.030</b>	<b>4.9%</b>	<b>(0.5%)</b>
Y/Y Growth	4.0%	17.7%	0.1%	-1.2%	0.1%	0.0%	-0.9%	-0.8%	-0.7%		
<b>Enterprise Routing (Ports)</b>											
	<b>6.800</b>	<b>9.013</b>	<b>8.036</b>	<b>6.904</b>	<b>8.048</b>	<b>8.206</b>	<b>8.173</b>	<b>8.220</b>	<b>8.174</b>	<b>(1.7%)</b>	<b>3.4%</b>
Y/Y Growth	-8.2%	32.6%	-10.8%	-14.1%	16.6%	2.0%	-0.4%	0.6%	-0.6%		
<b>WLAN (Units)</b>											
Access Points	19.649	23.279	26.718	28.686	30.676	33.870	37.301	40.700	43.930	13.8%	8.9%
Controllers	0.213	0.200	0.191	0.222	0.196	0.168	0.170	0.171	0.170	0.1%	(5.2%)
<b>Total WLAN Market</b>	<b>19.861</b>	<b>23.479</b>	<b>26.909</b>	<b>28.908</b>	<b>30.871</b>	<b>34.038</b>	<b>37.471</b>	<b>40.871</b>	<b>44.101</b>	<b>13.6%</b>	<b>8.8%</b>
Y/Y Growth	14.5%	18.2%	14.6%	7.4%	6.8%	10.3%	10.1%	9.1%	7.9%		

Source: Credit Suisse Research, I.H.S. Markit data &amp; estimates

# ANET Share Rising Rapidly in the Data Center Switching Market

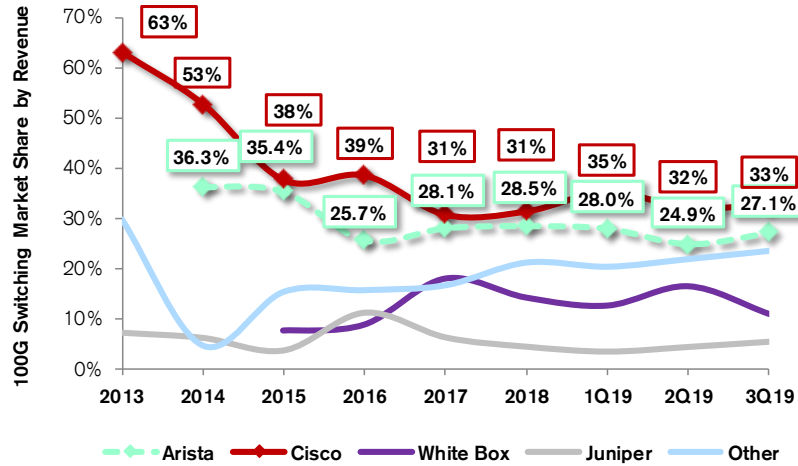


**ANET's Extensible Operating System (EOS) Continues to Be One of the Most Compelling Sales Propositions for the Cloud Service Providers:** Its customer ease-of-use and breadth of flexibility has enabled ANET to take market share away from the other companies (most notably CSCO); ANET has more than doubled its market share by revenue from 6.3% in 2014 to 17.9% as of 3Q19. We see scope for ANET's market position to continue improving given its product and the incoming 400G product upgrade cycle that should payout after 2020.

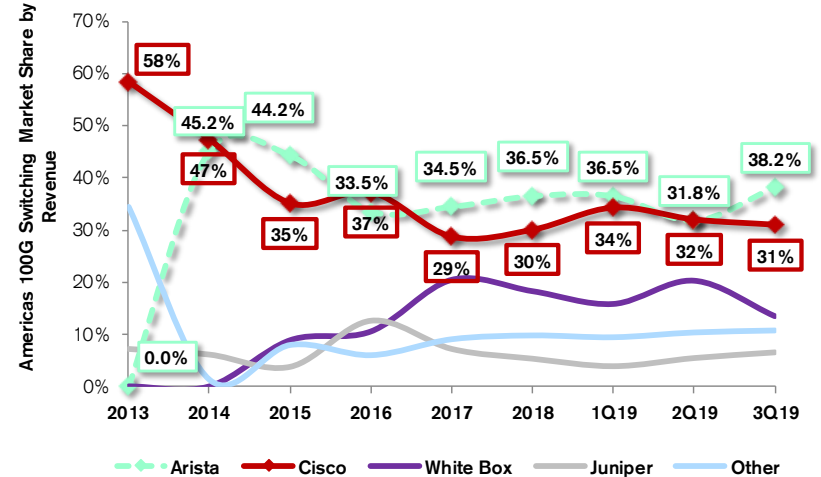
Source: I.H.S. Markit, Credit Suisse Research.

# 100G DC Switching Market Split by CSCO/ANET across Enterprise/Hyperscale with ANET Gaining Fastest in Americas

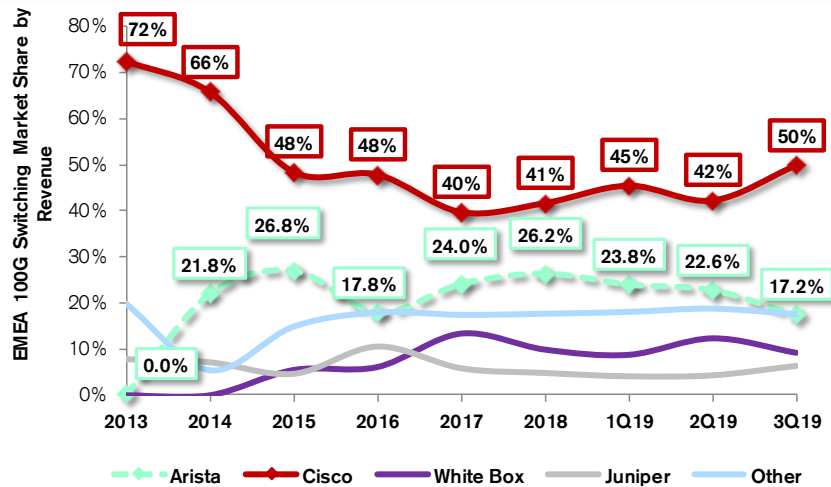
Global 100G Switching Market Shares



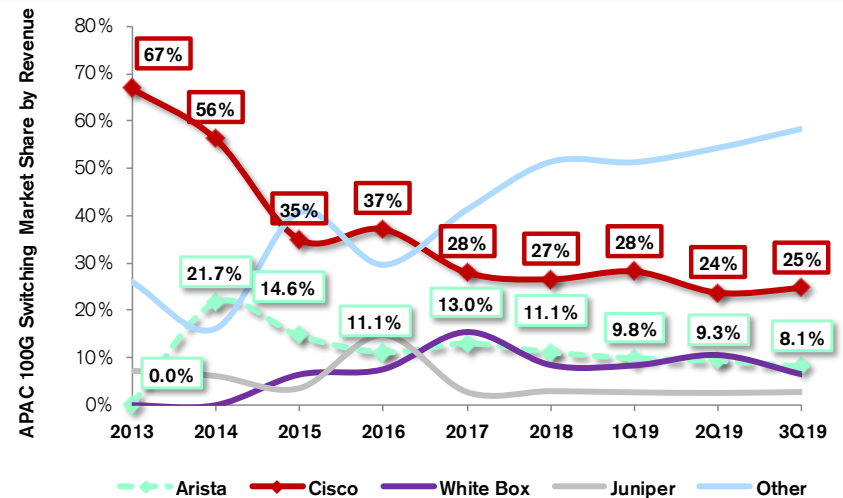
Americas 100G Switching Market Shares



EMEA 100G Switching Market Shares



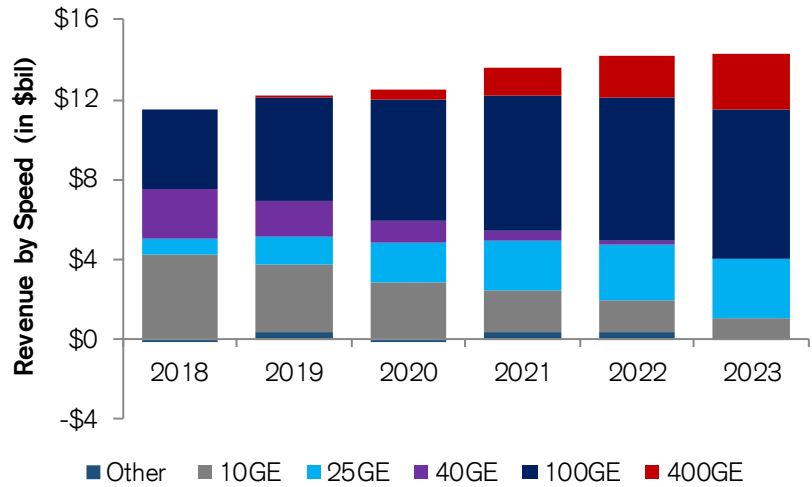
APAC 100G Switching Market Shares



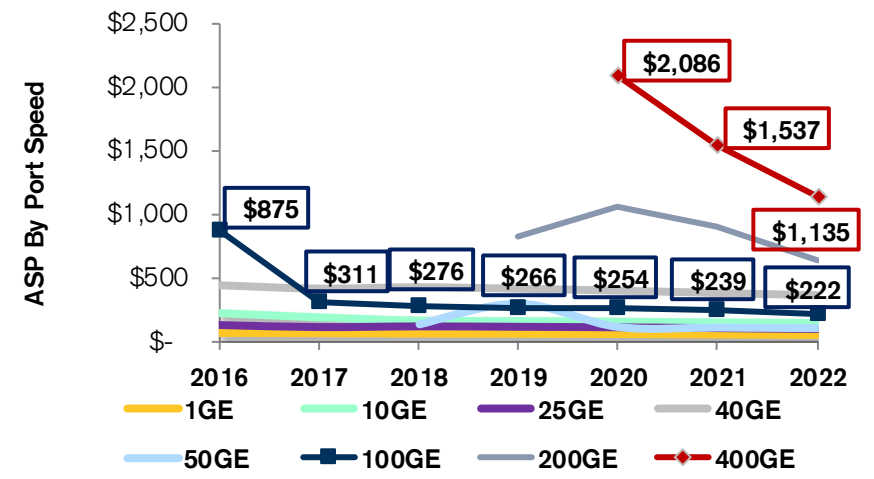
Source: I.H.S Markit, Credit Suisse Research.

# 400G DC Switching Ramp Slow, 100G Remains the Bulk of Market...

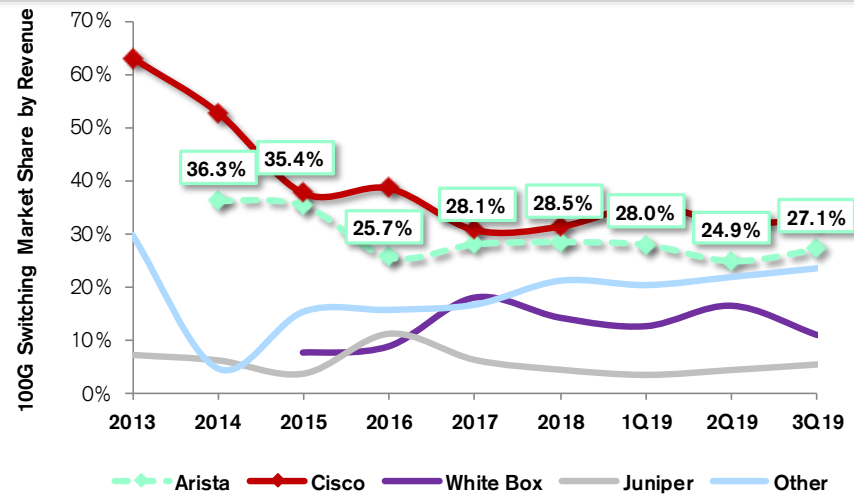
**Total DC Switching Growing 4.4% CAGR Through '23**



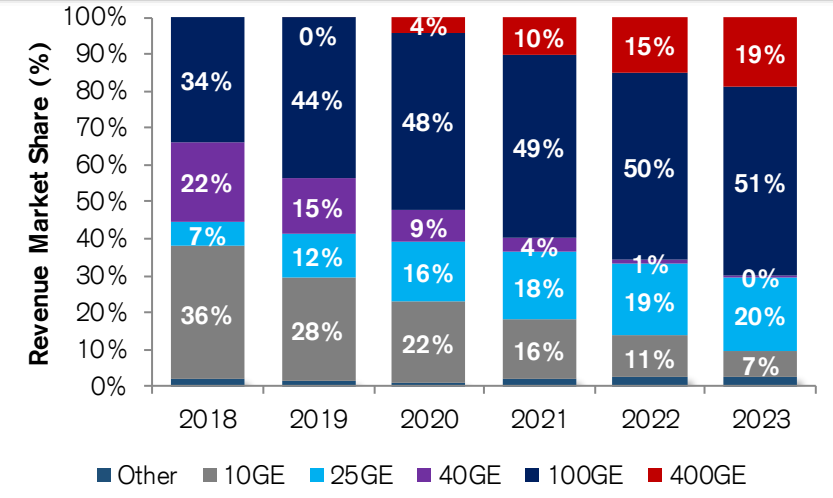
**Average Selling Price By Port Speed Stable for 100G**



**ANET Capturing Fair Share of 100G+ DC Switching Market**



**400G Only ~4%/~10% of DC Switching Market '20/'21**



Source: I.H.S. Markit, Credit Suisse Research.

# CS Out of Consensus View: 400G Shipping at Scale in Mid-2021 Unlikely

## ANET Guidance & Industry Expectations

*"We are shipping 400G products for initial trials this year (2019), but the initial deployments have shifted by more than a year to second half 2020, and we think mainstream production will be 2021. So the change in customers extending their investments and the deployment of 400G is causing us to be more muted about 2020... But there won't be a wholesale change from 100G to 400G in the spine until 2021."* -**Jayshree Ullal, CEO of Arista, 3Q19 Earnings Call**

*"On the 400G side, the industry delays are in general because we haven't seen the entire ecosystem. And many of these optics companies forgot about backlog compatibility, we're still in work with the cloud companies because 400 has to work with 2 by 100 on the other side and so on."* -**Anshul Sadana, COO of Arista, 3Q19 Earnings Call**

## Cloud Infra. Technology Industry Engineers and End Users

### Summarized Comments:

- Intend on expanding major data center campuses in excess of 100 megawatts on 100G speeds through early 2022.
- Engineering standardization (operating system interconnectivity) efforts outweighing speed/bandwidth.
- Cost vs. bandwidth not there yet with 400G (100G cheaper till '22)
- Data Center power (electricity/redundancy) remains the biggest bottleneck in the network and with 100G switching speeds they can optimize power efficiency dramatically across core nodes in both the Americas and Europe.
- Testing will take 1+ years and will not compel infra engineers to refresh until the 100G switches reach end of life.
- Expecting 2022 for a infrastructure-wide switching refresh.

### 400G Shipping at Scale in 2021 May be Too Soon Given Industry Data Center Build Vintages and Useful Life of 100G Equipment:

Based on our industry checks, 400G switches shipping at scale by 2021 is starting to look unlikely based on what some industry engineers and end users had to say regarding the 400G switching opportunity. Most of our industry checks highlighted that most of the 2016 to 2018 data center build vintages do not need to be upgraded to 400G switching speeds from 100G until 2H 2021 or early 2022 (~5yrs in operation versus the suspected ~3yrs in our prior sector outlook, see *"ANET Tarrificly Positioned"* research note for more detail on this) given their optimized electrical efficiencies, aligning with the dynamics that ANET and other technology hardware companies have discussed on their earnings calls relating to cloud customers running their equipment longer and hotter than they have previously.

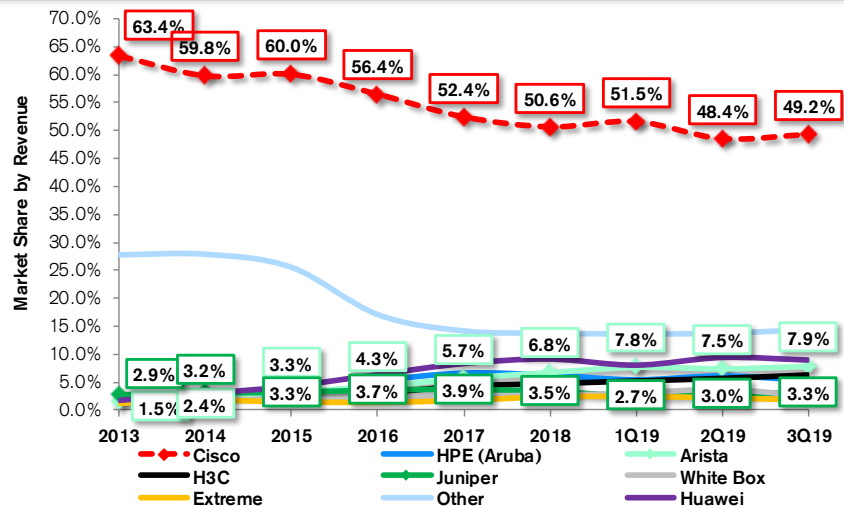
**Negative Read-Through for ANET, JNPR, and Others:** Given these dynamics, we believe it is more likely that 400G switches shipping at scale is a 2022 catalyst rather than a 2021 catalyst. We acknowledge this is not the consensus view given Arista Networks' management commentary around switching upgrade cycles ramping in 2021, but wanted to identify the dislocation in operational narratives. In turn, this is negative for ANET, JNPR, and others with hyperscale/cloud customers expecting to deploy 400G switches at scale by 2021.

Source: Credit Suisse Research, Company data.

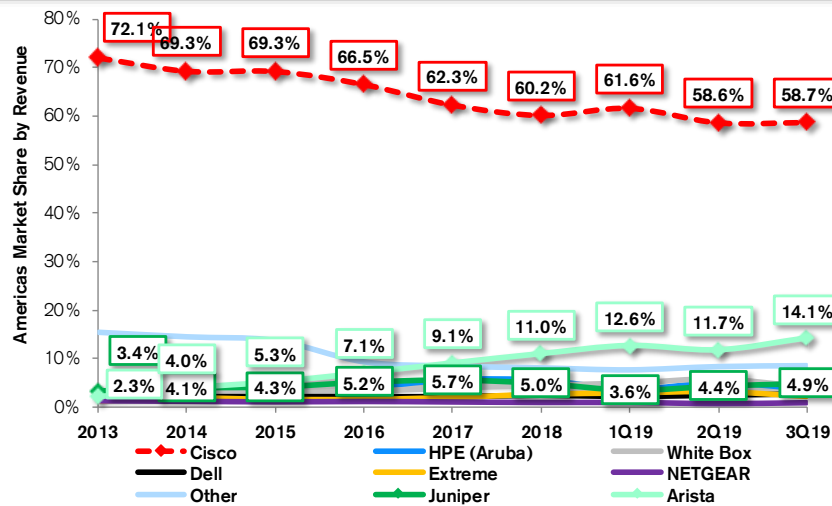


# Total Enterprise Switching Remains CSCO's Court Globally

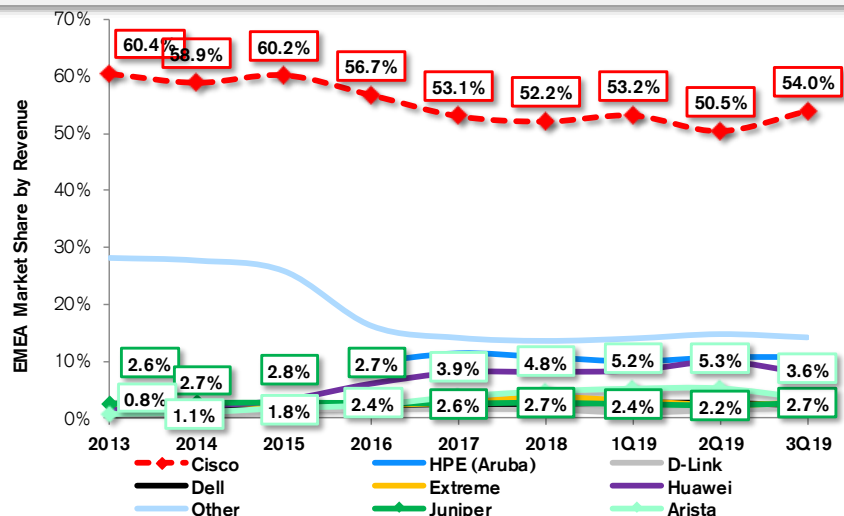
## Global Enterprise Switching Market Shares



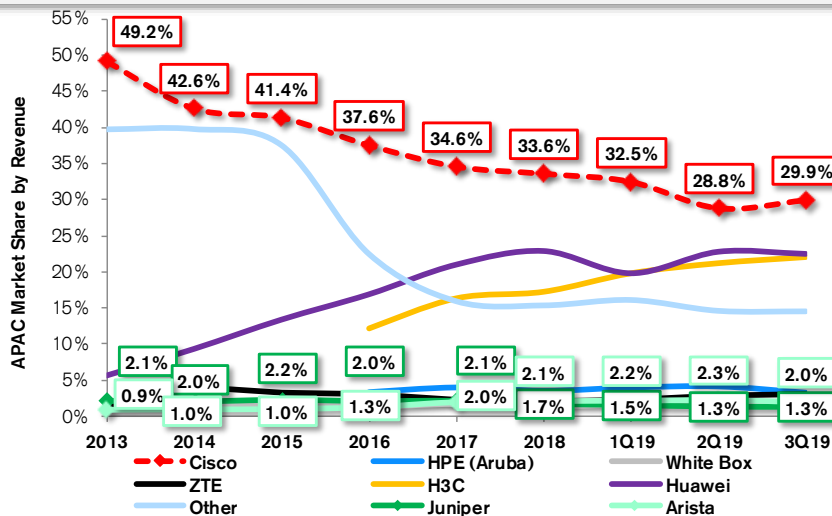
## Americas Enterprise Switching Market Shares



## EMEA Enterprise Switching Market Shares



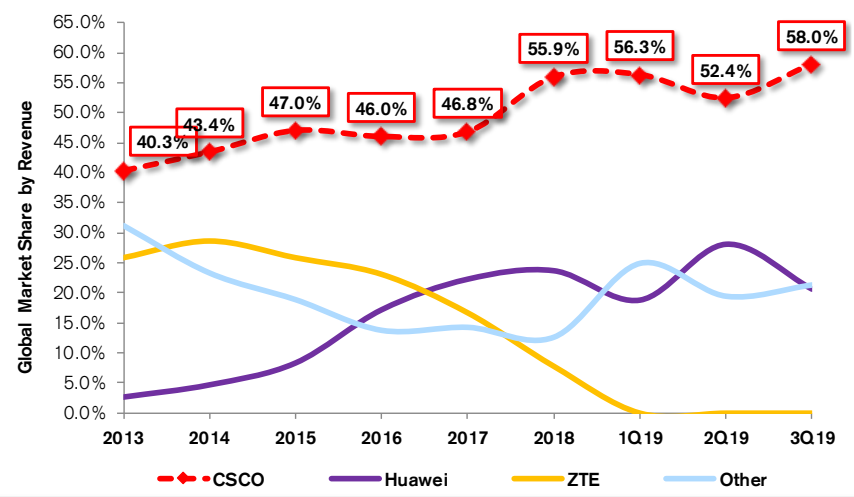
## APAC Enterprise Switching Market Shares



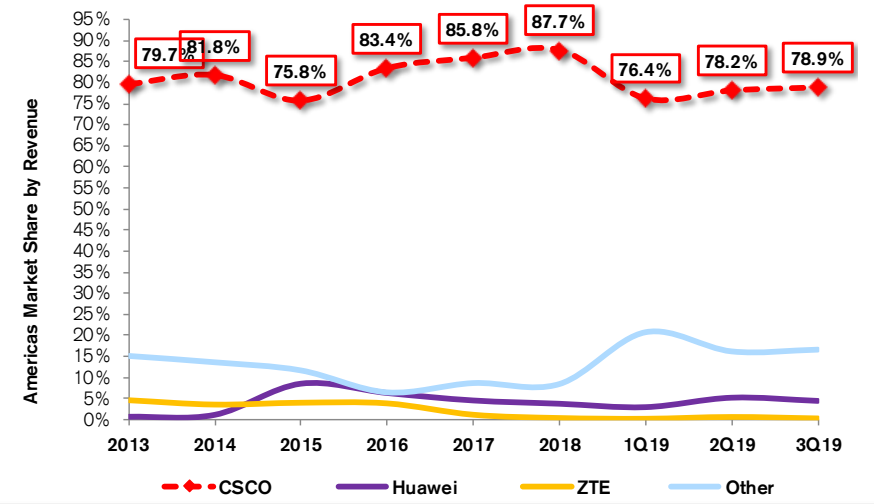
Source: I.H.S. Markit, Credit Suisse Research.

# Carrier Switching Market Remains CSCO's Strength

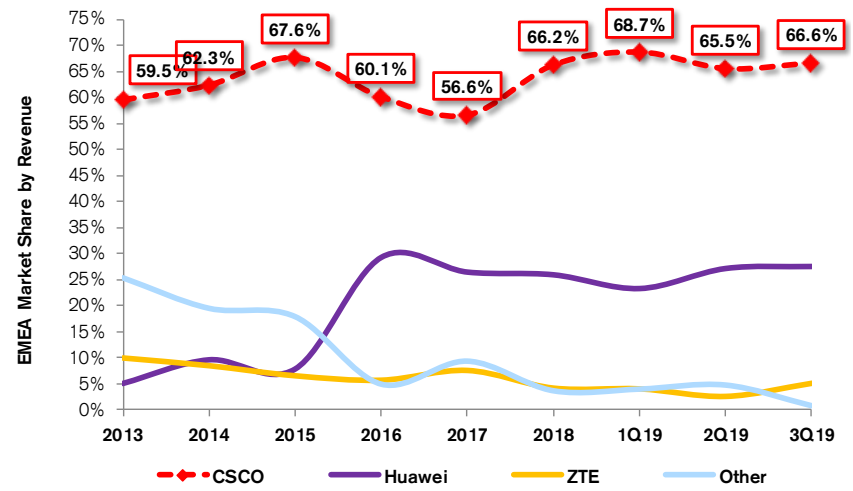
## Global Carrier Switching Market



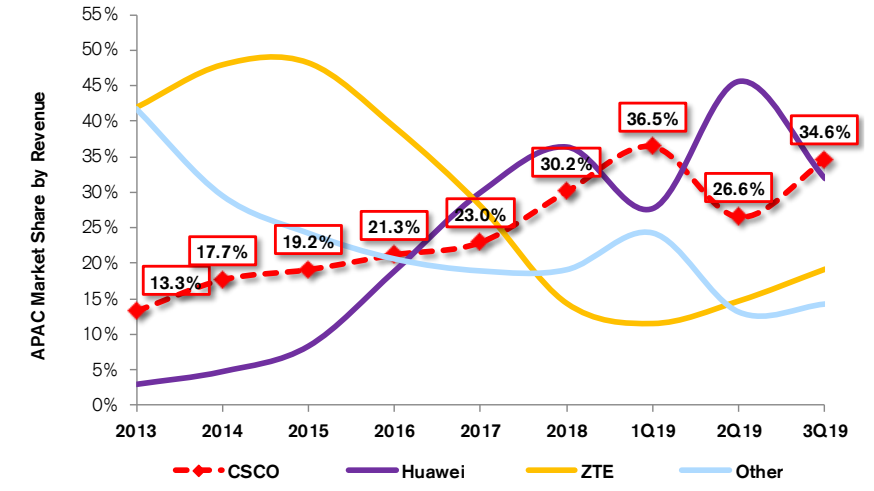
## Americas Carrier Switching Market



## EMEA Carrier Switching Market



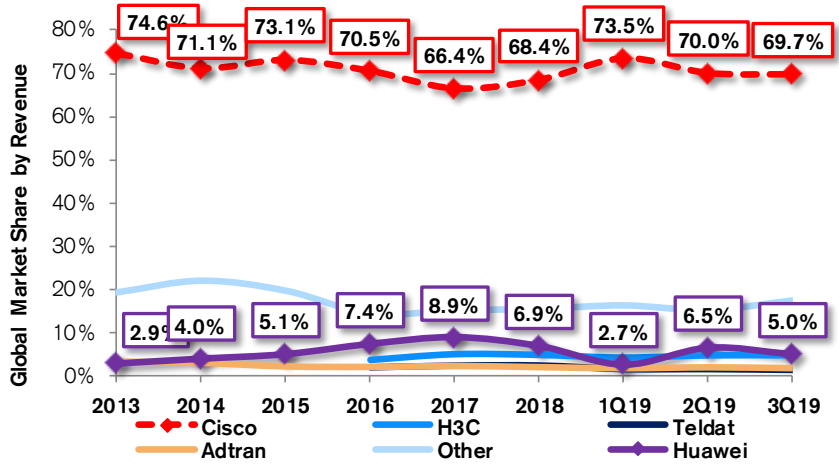
## APAC Carrier Switching Market



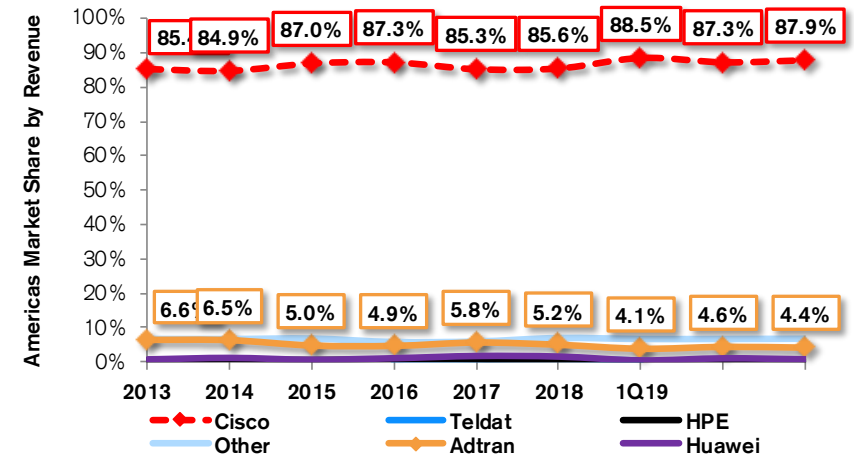
Source: I.H.S. Markit, Credit Suisse Research.

# CSCO Remains the Dominant Force in the Enterprise Routing Market

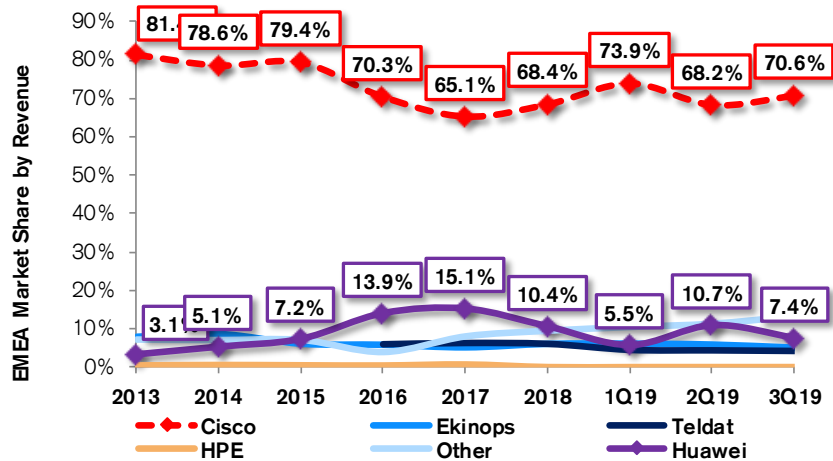
### Global Enterprise Routing Market Shares



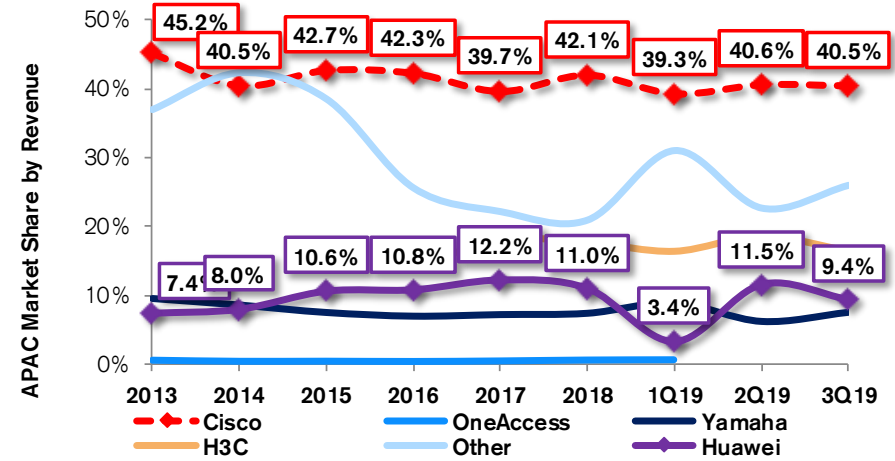
### Americas Enterprise Routing Market Shares



### EMEA Enterprise Routing Market Shares



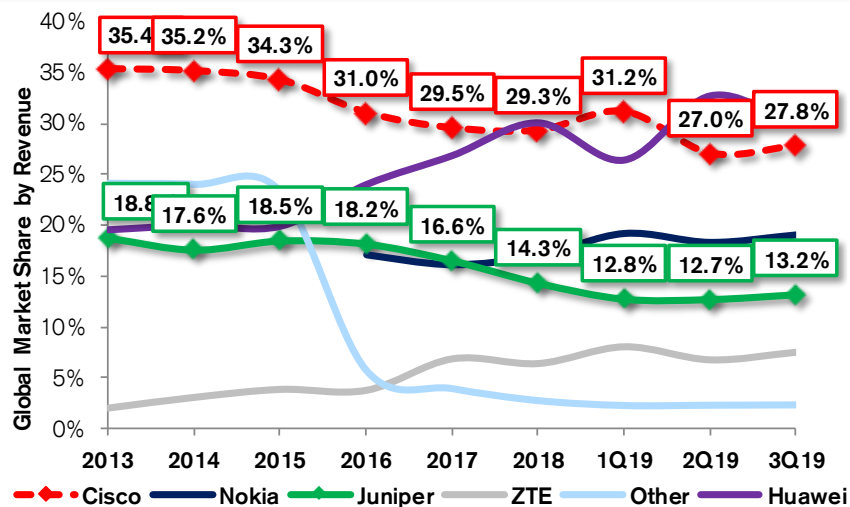
### APAC Enterprise Routing Market Shares



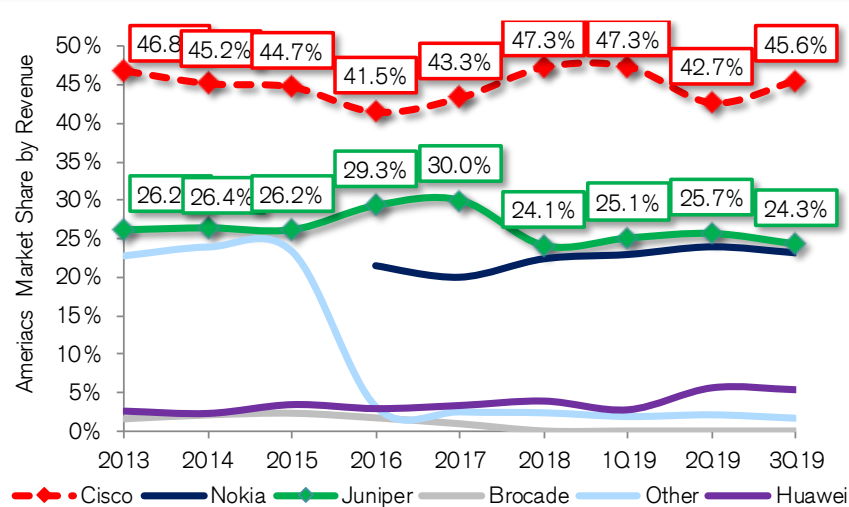
Source: I.H.S. Markit, Credit Suisse Research.

# CSCO Gradually Rebounding in the Service Provider Routing Market

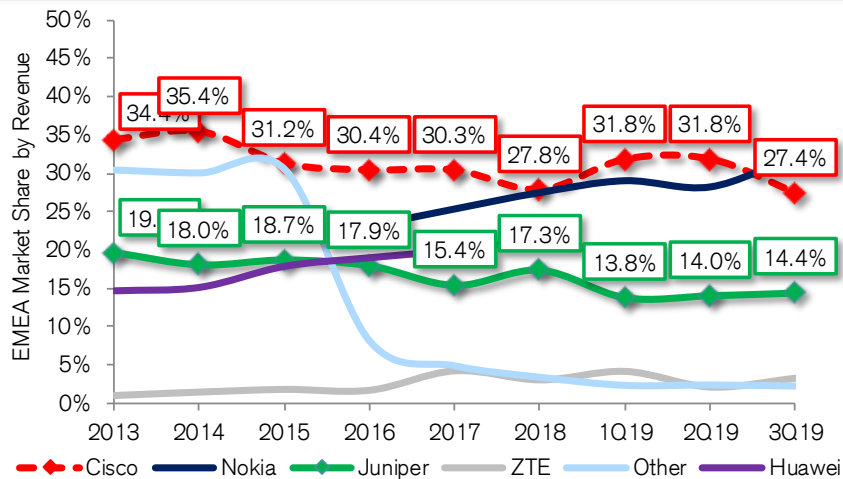
### Global Carrier Routing Market Shares



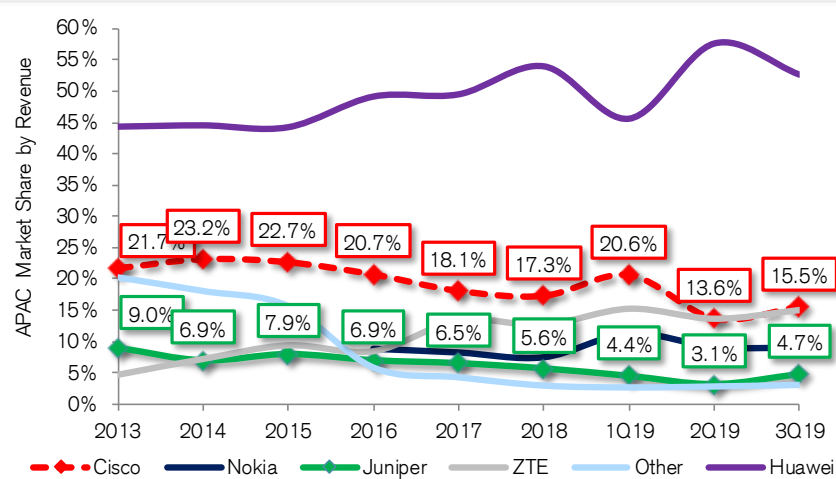
### Americas Carrier Routing Market Shares



### EMEA Carrier Routing Market Shares



### APAC Carrier Routing Market Shares



Source: I.H.S. Markit, Credit Suisse Research.

# Recent Cisco News Negatively Impacts SP Routing Outlook for JNPR

## Cisco Silicon One, 8000 Series Router, and Flexible Buying Options:

CSCO introduced the Cisco Silicon One December 2019, which is a networking silicon architecture developed for the rapidly growing networking needs of global content and web scale customers that has the versatility to address numerous use cases. CSCO says that this is the industry's first networking chip designed to be universally adaptable across service provider (SP) and web-scale customer markets. Designed for both fixed and modular platforms, it can manage challenging requirements that have evolved materially across the routing market. First, CSCO announced the Silicon One 'Q100' model and how it surpasses the 10Tbps routing milestone for network bandwidth without sacrificing programmability, buffering, power efficiency, scale or feature flexibility. Second, the company released the new Cisco 8000 Series, its new carrier class router, built on the new Cisco Silicon One Q100 architecture with a new operating system, the IOS XR7. XR7 is designed to be lightweight, highly programmable, and optimized for 400GB networking. Finally, CSCO announced new purchasing options that enable customers to consume the company's technology through disaggregated business models, including non-CSCO applications, which has generally not been par for the course at CSCO.

**Addressing Traffic and Network Cost Surges:** CSCO plans on leveraging its silicon, routing appliance, and optics to differentiate itself ahead of broad based 5G deployments to address the network bottlenecks that have been created across the industry due to surging video streaming traffic. Importantly, CSCO says that innovation has not kept up with rising traffic loads, and this has led to elevated levels of OPEX and TCO for SP customers.

**JNPR Implications Negative:** Based on what CSCO is addressing, we believe this is more negative for Credit Suisse Underperform-rated JNPR given the direct overlap in both silicon innovations and SP routing capabilities.

## New Cisco 8000 Series Routers

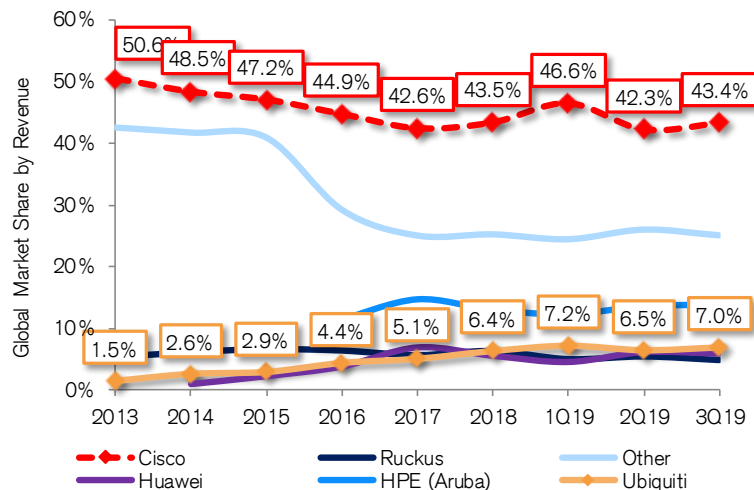


## Cisco's Pluggable Announced

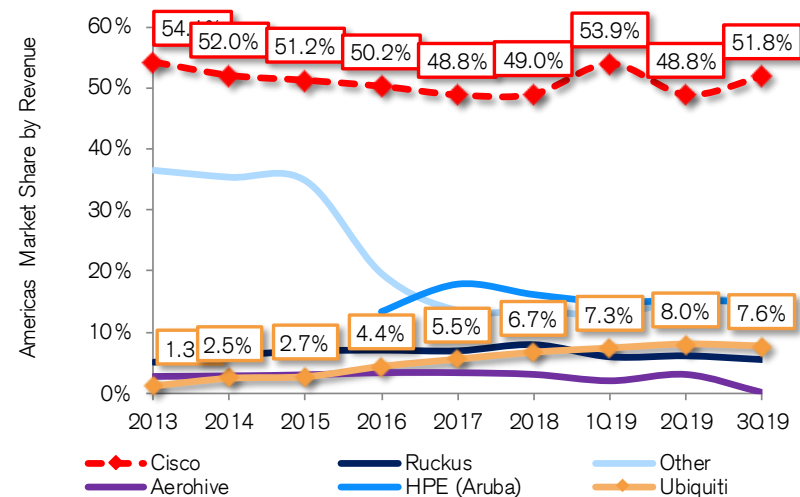


# CSCO Gradually Rebounding in the WLAN Market

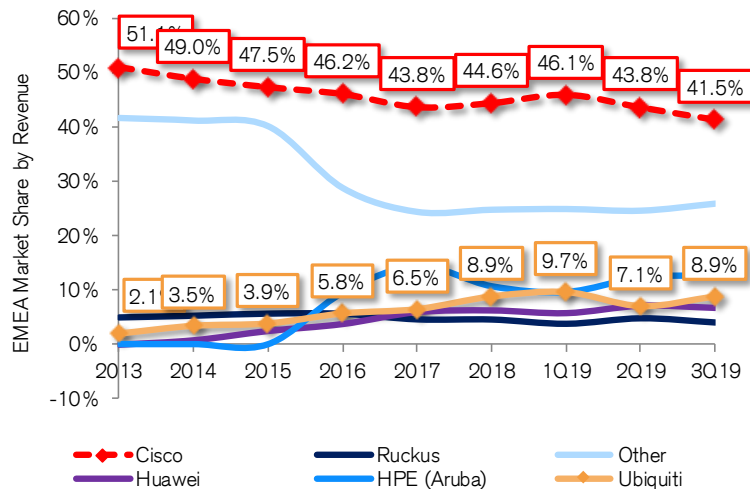
### Global WLAN Market Shares



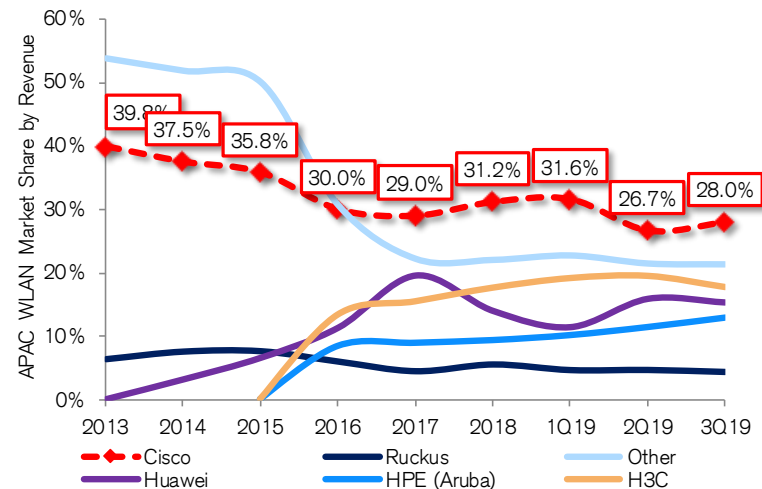
### Americas WLAN Market Shares



### EMEA WLAN Market Shares












### APAC WLAN Market Shares



Source: I.H.S. Markit, Credit Suisse Research.

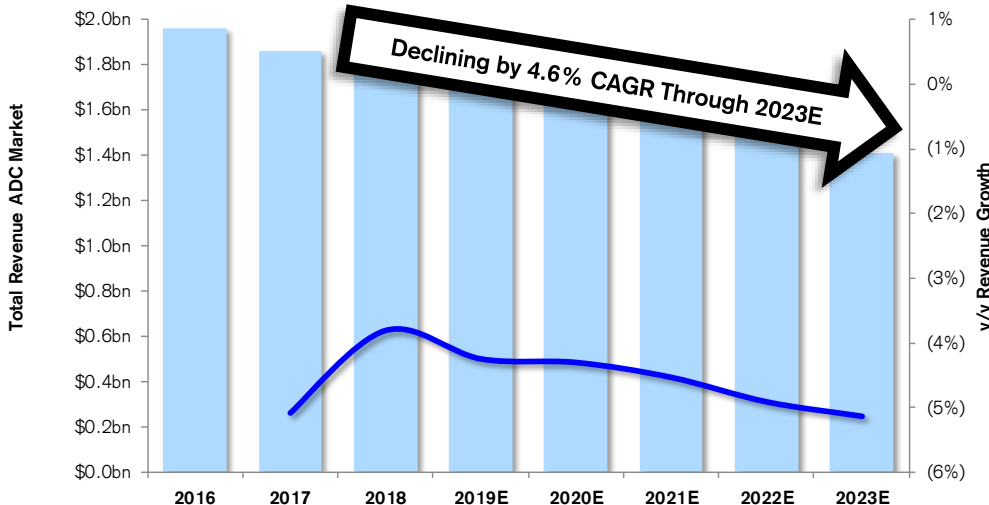
# Recent WLAN Consolidation Intensifying Market Competition Before WiFi 6 Ships at Scale...

Acquirer	Target	Date	Market Share / Revenue Estimates / Comments
		<b>Date Announced:</b> August 2, 2018  <b>Date Closed:</b> August 2, 2018	<p>Arista acquired Mojo Networks to strategically address industry changes as enterprises move to Internet of things (IoT) ready campuses. Mojo Networks, a leader in cloud-managed wireless networking, created its own cloud-managed proprietary technology, cognitive WiFi. We estimate that Mojo will contribute \$44mil/\$48mil to ANET total revenues in FY20/21. This reflects less than 1% market share of the WLAN market.</p>
		<b>Date Announced:</b> March 4, 2019  <b>Date Closed:</b> April 1, 2019	<p>Juniper added Mist Systems to its portfolio for its cloud-managed wireless networks powered by artificial intelligence (AI). The acquisition strengthened Juniper's best-in-class wired LAN, SD-WAN and security solutions with Mist's next-generation wireless LAN (WLAN) platform. We estimate that Mist will contribute \$36mil/46mil to JNPR total revenues in FY20/21, this represents less than 1% market share of the WLAN market.</p>
	 	<b>Date Announced:</b> November 8, 2018  <b>Date Closed:</b> April 4, 2019	<p>CommScope acquired ARRIS for its strong leadership positions in customer premise equipment (CPE), Network &amp; Cloud (N&amp;C), and enterprise networks (Rukus Wireless). The business combination enables end-to-end wired and wireless communications infrastructure solutions giving COMM access to new and growing markets. We estimate that Rukus will contribute \$585/\$628M to COMM total revenues in FY20/21, translating to ~5%/5% WLAN market share.</p>
		<b>Date Announced:</b> June 26, 2019  <b>Date Closed:</b> August 9, 2019	<p>The acquisition of Aerohive adds critical cloud management and edge capabilities to Extreme's portfolio of end-to-end, edge to cloud networking solutions. Aerohive was one of first companies to offer controller-less Wi-Fi and cloud network management, including cloud-managed Wi-Fi and network access control (NAC). Management estimates that Aerohive will contribute \$108M in revenue for our FY20. The combined companies now represent ~5% in the WLAN market.</p>

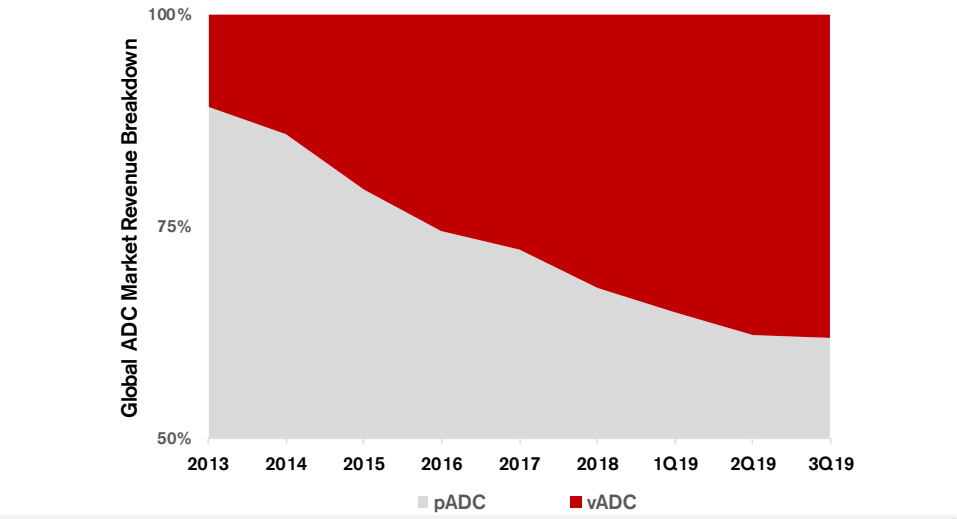
Source: Credit Suisse Research, Company data.

# ADC Market Contracting, FFIV Market Share Expanding...

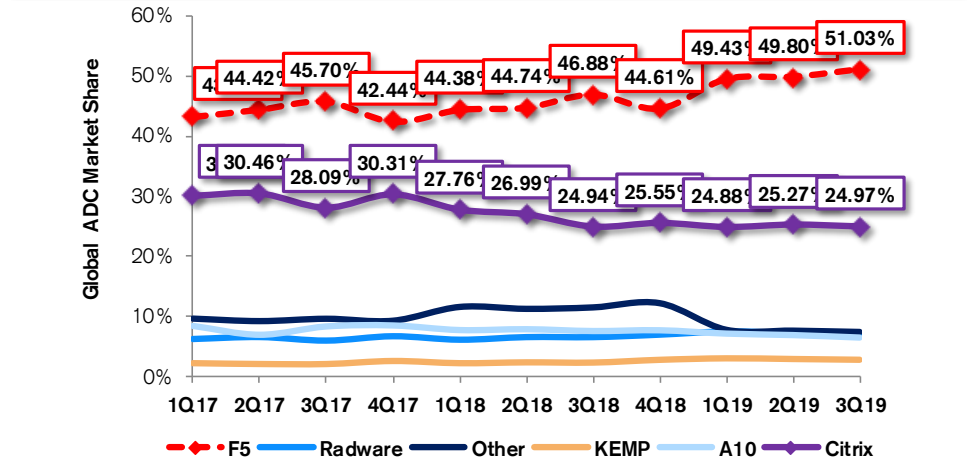
Global ADC Market Continues to Contract at High Single Digits



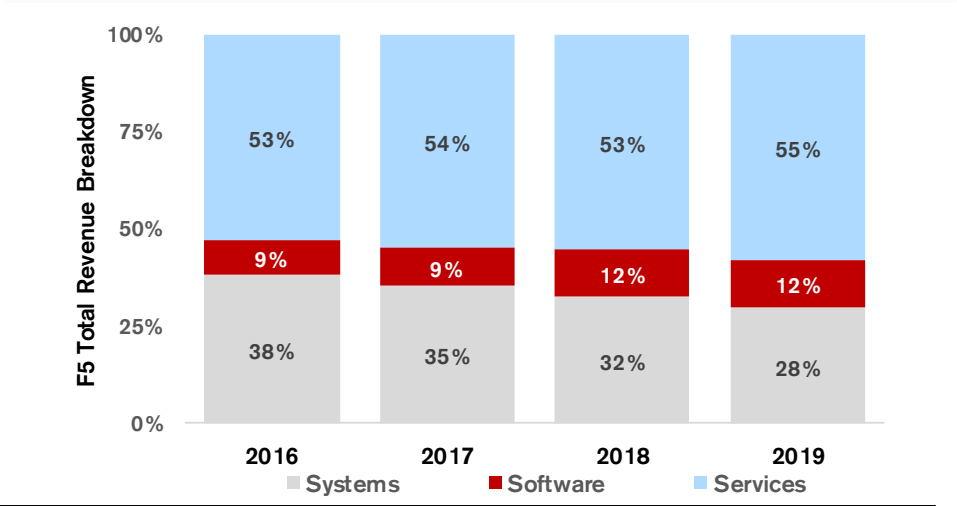
vADCs Starting to Make up ~30% of Total Market Revenues



FFIV Continues to Dominate Market Share at 51% As of CY3Q19



FFIV Transitioning Business to Virtual Gradually, at 12% in FY19

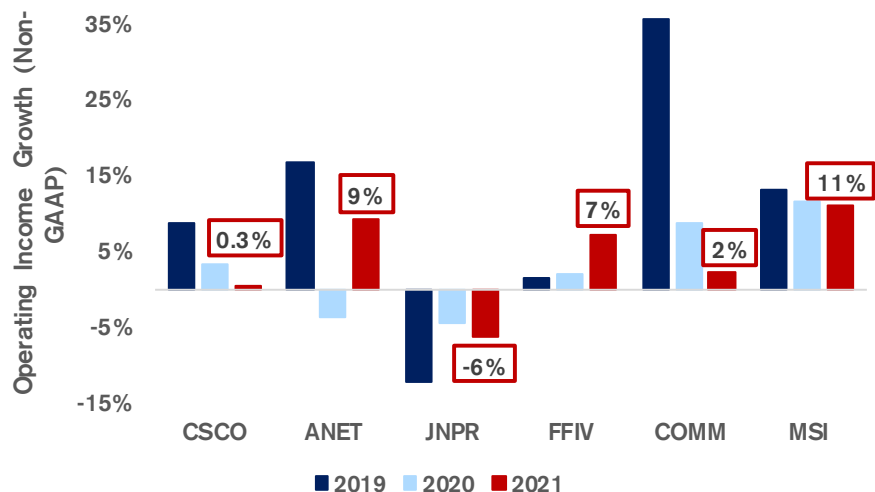


Source: I.H.S. Markit, Credit Suisse Research.

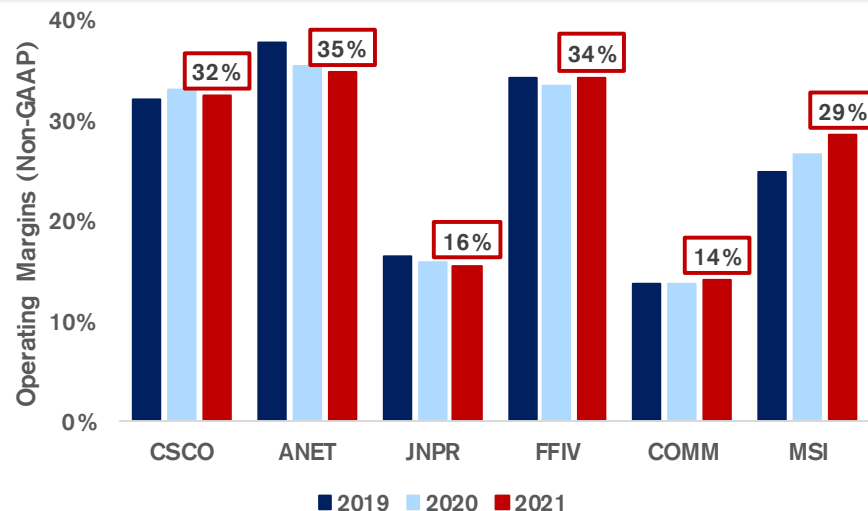


# Operating Income Growth & Margin Expansion Opp. Led by Top Pick MSI

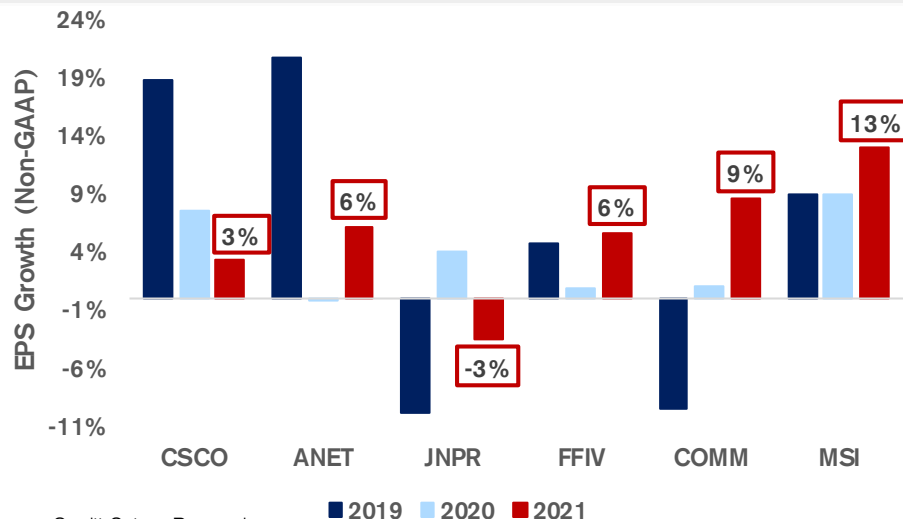
## Operating Income (Non-GAAP) YoY Growth – MSI Leads



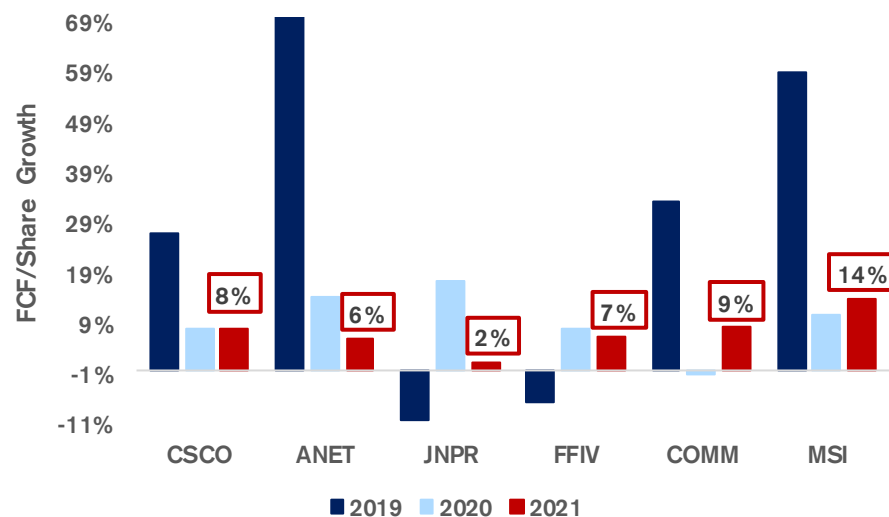
## Operating Margins (Non-GAAP) – MSI Expansion Runway Solid



## EPS YoY Growth Led by Our O/Ps – MSI, COMM, FFIV









## FCF/Share YoY Growth Led by Our O/Ps – MSI, COMM



Source: Credit Suisse Research.

# SDN Focus on CSCO, ANET, and JNPR

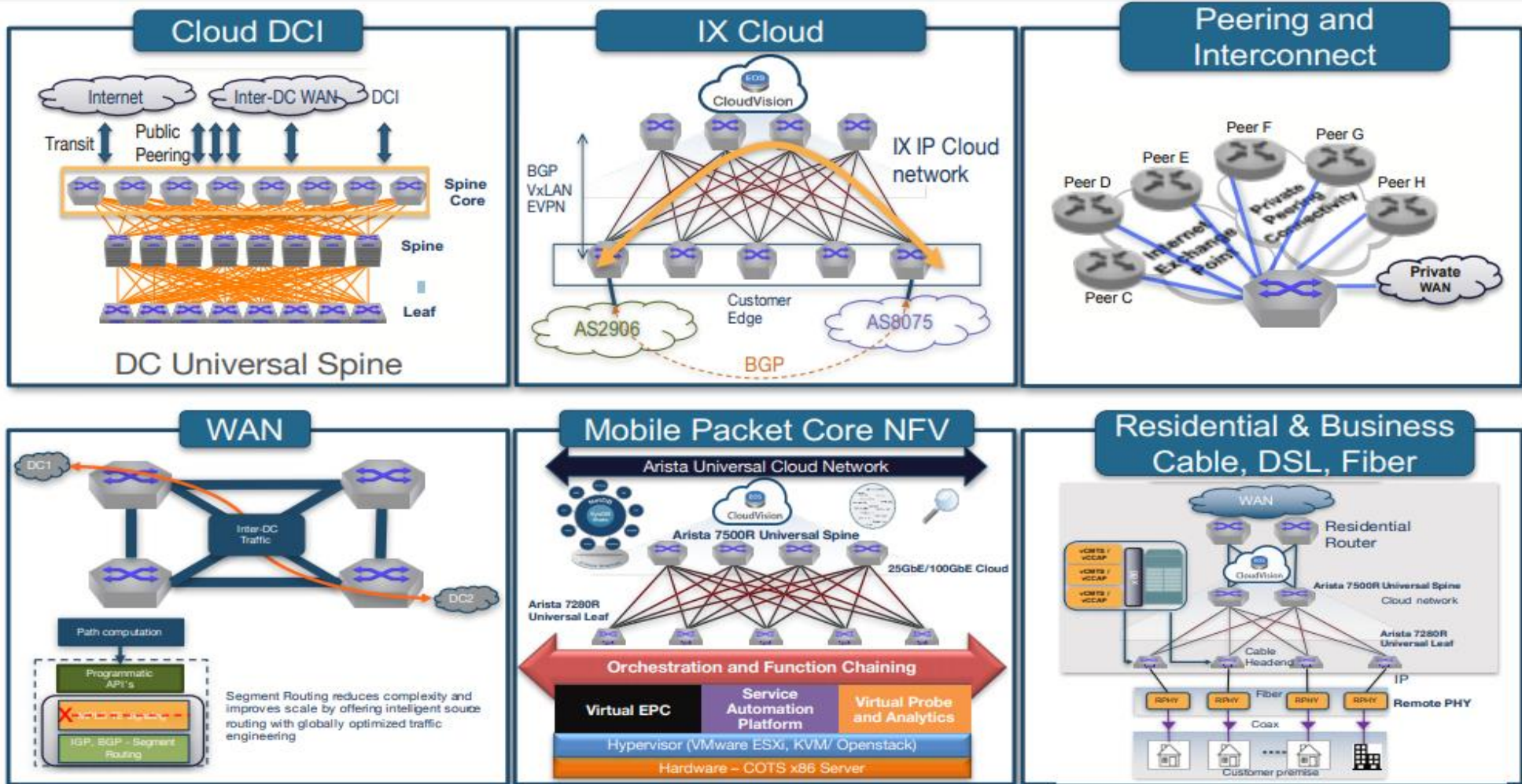
Company	SDN	Description	Comments
		<p>Application-centric infrastructure (ACI) is a programmable Ethernet fabric that supports a centralized policy-based model versus a traditional device-centric command line interface (CLI)-based approach.</p>	<p><b>Pros:</b> Focuses on the data center components and leverages high-end equipment; also the largest installed base vendor, leading to highest number of enterprise personnel.</p> <p><b>Cons:</b> High-priced solution; platform provides limited investment protection for the existing installed base of Nexus and Catalyst equipment, or for UCS server architectures; lacks features such as FCoE support and external data center interconnect capabilities that many organizations have adopted.</p>
		<p>Extensible operating system (EOS) is a scalable network operating system (OS) that offers high availability, streamlines maintenance processes, and enhances network security.</p>	<p><b>Pros:</b> Works extremely well with industry standard approaches; is flexible allowing customers freedom of choice without lock-in to any one architecture; tends to be more cost-efficient than other vendors.</p> <p><b>Cons:</b> Although EOS is a very flexible and sound network foundation, organizations looking for a dynamic orchestration systems will need to integrate it into an external orchestration system.</p>
		<p>Juniper Contrail Networking is a simple, open, and agile cloud network automation product that implements an SDN architecture.</p>	<p><b>Pros:</b> Strong track record in supporting demanding, mid- to large-scale data center environments in both enterprise and service provider environments; aggressively prices its solutions; offers an open and interoperable architecture.</p> <p><b>Cons:</b> Still primarily network- and security-focused, limiting its market to those looking for an independent network layer.</p>

**Software-defined networking (SDN) is an approach to using open protocols, such as OpenFlow, to apply globally aware software control at the edges of the network to access network switches and routers that typically would use closed and proprietary firmware.** SDN offers numerous benefits including on-demand provisioning, automated load balancing, streamlined physical infrastructure, and the ability to scale network resources in lockstep with application and data needs. Coupled with the ongoing virtualization of servers and storage, SDN ushers in no less than the completely virtualized data center, in which end-to-end compute environments will be suddenly deployed and decommissioned on a whim.

Source: Company data, Gartner, Tech Target, Credit Suisse Research.

# Network Workload Use Cases Only Growing as Cloud Networking Fabric Architectures Proliferate

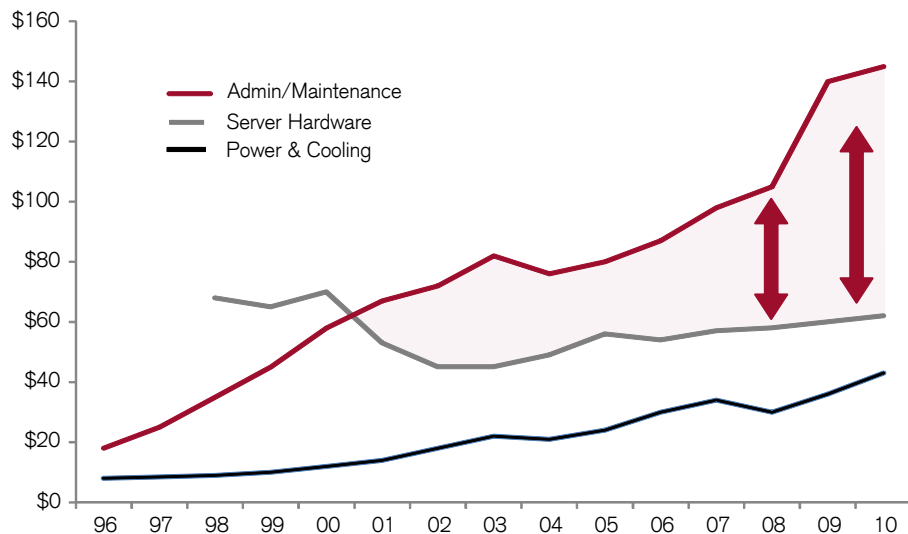
As robust Cloud Networking Fabrics (SDNs) continue scaling, the number of use cases grow as networking efficiencies are gained. In this slide, we highlight some of the most common use cases across Cloud, Interconnection, Wide Area Networks, and Consumer connectivity from Arista Networks.



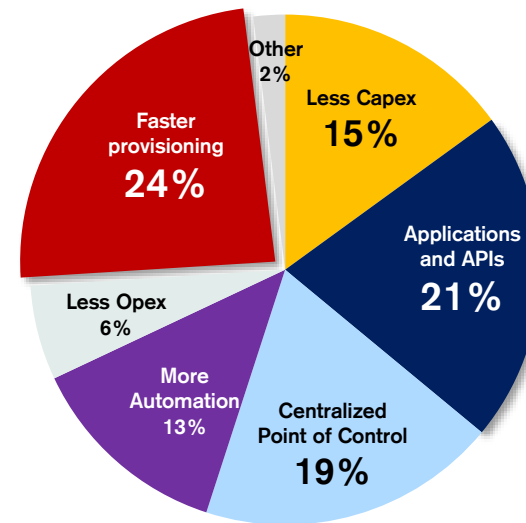
Source: Arista Networks, Credit Suisse Research.

# IT Overhead Costs Require IT Spenders to Watch Hardware/Architectures Costs Closely... SDN Alleviates Constraints

## Administration Overhead Can Be Onerous



## Faster Provisioning & Applications Drive SDN



**“We should be able to treat a switch like a server in the rack....We should be able to load a Linux-based operating system, and that server just happens to have a lot of I/O ports on it.”**

— Frank Frankovsky Vice President, Hardware Design and Supply Chain Operations at [Facebook](#)

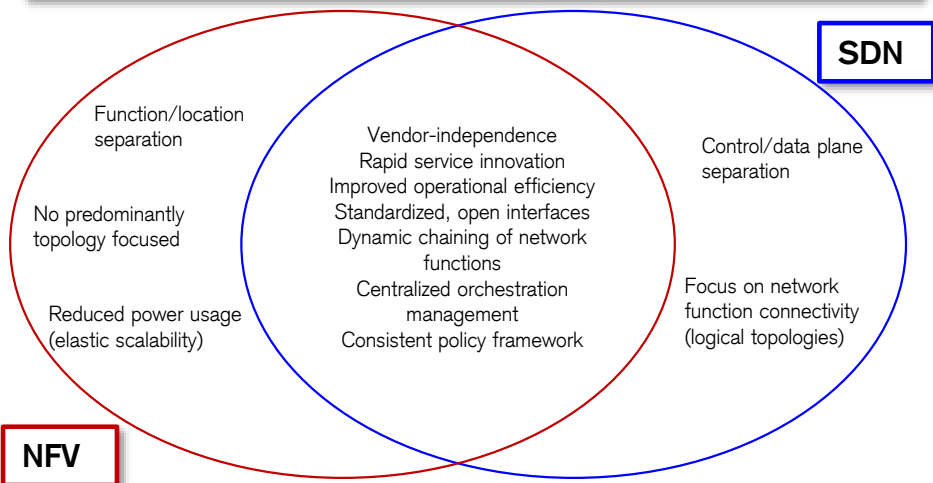
**“Because networking gear is complex and, despite them all implementing the same RFCs, equipment from different vendors (and sometimes the same vendor) still interoperates poorly. It’s very hard to deliver reliable networks at controllable administration costs from multiple vendors freely mixing and matching. The customer is locked in, the vendors know it, and the network equipment prices reflect that realization.”**

— James Hamilton of [Amazon Web Services](#)

Source: Credit Suisse Networking Survey, August 2013

# NFV and SDN Are Transforming Networks... but What's the Difference?

## SDN and NFV Synergies



## Description

**Network function virtualization (NFV)** and **software-defined networks (SDN)** are closely related, complementary technologies that address different elements of a software-driven solution. Both are driven by the desire to transform today's networking infrastructure into more cost-effective, flexible, robust solutions through:

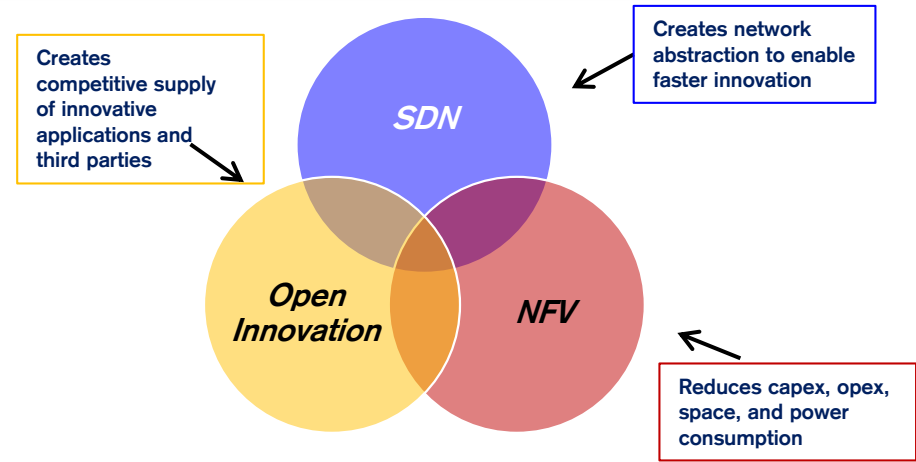
- **SDN** can be thought of as a series of network objects (e.g., switches, routers, and firewalls) that can be deployed in a highly automated manner
- **NFV** can be thought of as the process of moving services, such as firewalls and load balancing, away from dedicated hardware into a virtualized environment

**Timeline?** For **SDN**, a trickier decision for vendors – a greenfield opportunity, as no enterprise-wide standard, many unknowns. **NFV** is certainly coming and is carrier driven.

## Both Provide New Approaches to Network Management

	SDN	NFV
Focus	Data Center	Service Providers
Strategy	Split control and data forwarding planes	Replace network devices with software
Protocol	OpenFlow	Not determined yet, does support OpenFlow
Applications run	On industry-standard servers or switches	On industry-standard servers
Customer Benefit	Drives down complexity and cost, increases agility	Drives down complexity and cost, increases agility
Prime Initiative Supporters	Enterprise networking software and hardware vendors	Telecom service providers
Business Initiator	Corporate IT	Service Provider

## Complementary, Open, and Software-Driven



Source: Credit Suisse Networking Survey, August 2013

# White Box Versus Proprietary Silicon

	Bare Metal Switch	Branded Bare Metal (BBM)	White-box (WB) Switch	Proprietary Switch
<b>Definition</b>	Hardware only with basic support from original design manufacturer	Hardware only with original equipment manufacturer branding and warranty/support/services	Commodity hardware and Network Operating System preloaded	Proprietary hardware and Network Operating System
<b>Hardware Cost</b>	<b>Low</b>	<b>Low</b>	<b>Low</b>	<b>High</b>
<b>Type of Hardware Components</b>	Off-the-shelf components including ASIC	Off-the-shelf components including ASIC	Off-the-shelf components including ASIC	Proprietary (Custom ASIC)
<b>Network Operating System</b>	None (customer can load PicOS/Cumulus/Big Switch)	Non (customer can load PicOS/Cumulus/Big Switch)	Vendor's own or 3rd party already loaded (Example: Arista EOS)	Vendor's own Network Operating System (Cisco ACI, Arista EOS, etc.)
<b>Examples / Vendors</b>	Accton AS5712 (Broadcom) Penguin 4800 (Broadcom) Quanta 3048 (Broadcom)	Dell S4810-ON/S6000-ON (Broadcom) HP 5700/5712/6700 (Broadcom) HP 5700/5712/6700 (Broadcom)	Arista 7250x (Broadcom) Dell S6000 (Broadcom) HP 5930 (Broadcom)	Nexus 7000 / 9000 HP 3500/5400/8200 (HP ProVision) Juniper 9200 (Trio)

## White Box Switch Vendors



Source: Forester, Credit Suisse estimates, Company data

# Environmental, Sustainability, Governance (ESG)

## ESG Now a Priority for Data Center Operators



2020 Outlook -- The Cloud Has Four Walls

# What is ESG?

- **E: Environmental criteria** – This includes the energy a company takes in and the waste it discharges, the resources it needs, and the consequences for living beings as a result.
  - This includes: carbon emissions and climate change
- **S: Social criteria** – This addresses the relationships a company has and the reputation it fosters with people and institutions in the communities where you do business.
  - This includes: labor relations, diversity, and inclusion.
- **G: Governance** – The internal system of practices, controls, and procedures your company adopts in order to govern itself, make effective decisions, comply with the law, and meet the needs of external stakeholders.



Source: FactSet, Credit Suisse Research, McKinsey, Switch.

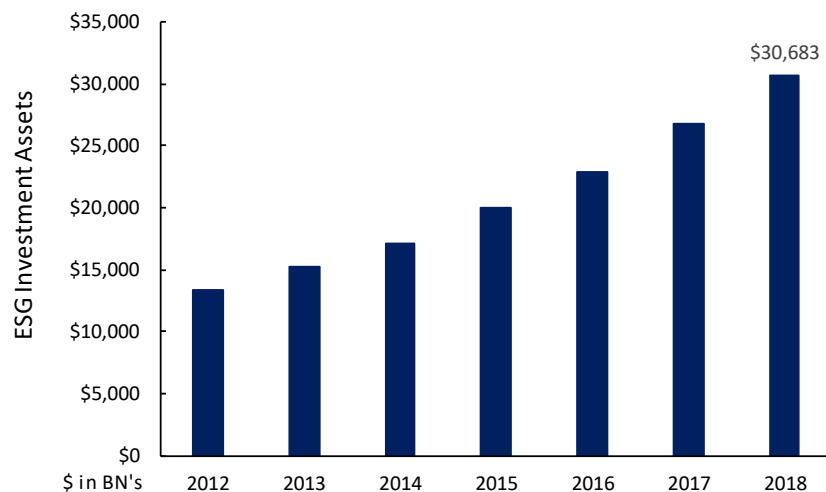


# Why Comply With ESG Standards?

## It Pays to Be ESG

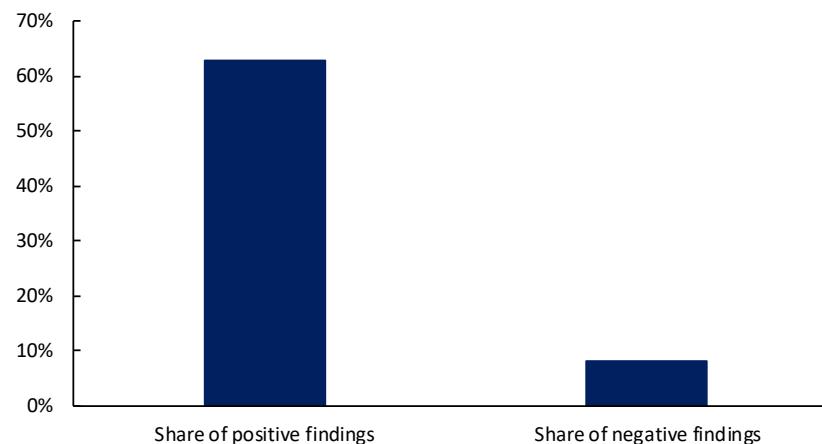
- **More investors continue to put money into sustainable investing:** Global ESG investment now tops \$30 trillion, up 68% since 2014 & 10x since 2004.
- **Recent studies (McKinsey: “5 Ways ESG Creates Value” November 2019) have found that ESG is a benefit to equity returns:** 63% of equity returns were positively impacted by ESG. Only 8% were negatively impacted.
- **ESG reduces downside risk:** 1) Higher credit ratings, and 2) Lower loan and credit default swap spreads

### ESG Assets Under Mgmt. Continue to Increase



### Being ESG Boosts Returns for Shareholders

#### Results of >2,000 studies on the impact of ESG on equity returns



Source: FactSet, Credit Suisse Research, McKinsey, GSIR, Company Data

# ESG Helps More Than Just Companies' Investors

## Topline Growth

70% of surveyed consumers noted they would pay 5% more for a green product, proving that sustainability does not have to hinder revenue growth.

## Cost Savings

Operating profits can be impacted 60% from ESG initiatives. Also, many ESG products/services are created in an effort to save costs.

## Regulations

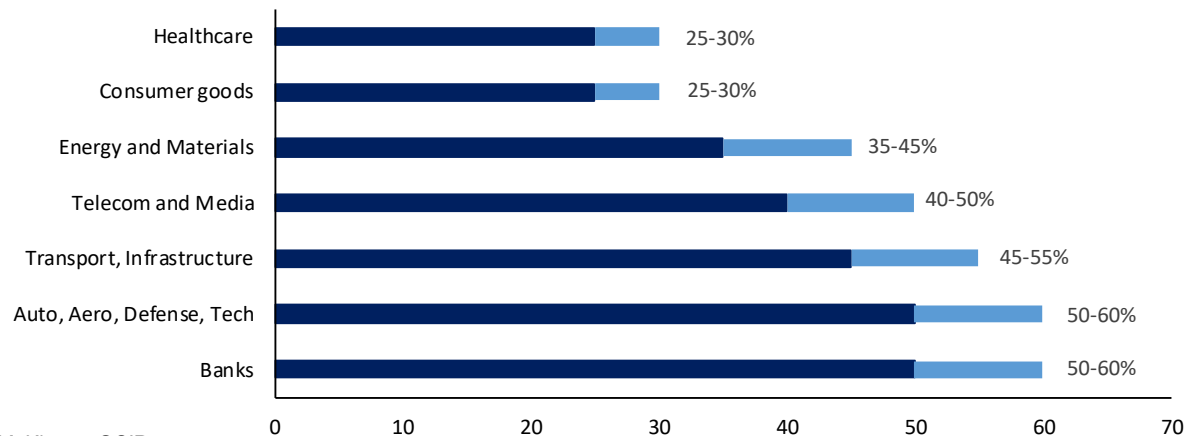
EBITDA at risk of state intervention are minimized. Within Infrastructure specifically, the value at stake is estimated to be 45-55% of EBITDA.

## Productivity

Companies that made Fortune's "100 Best Companies to Work For" list generated ~3% higher stock returns per year over a 25+ year horizon.

**ESG can reduce companies' risk of adverse government action. On average ~1/3 of corporate profits are at risk from government intervention. In the Infrastructure industry, where government subsidies are common, the share of EBITDA at stake from state intervention can be as high as 55%, highlighting the importance of proper governance.**

Share of EBITDA at Stake

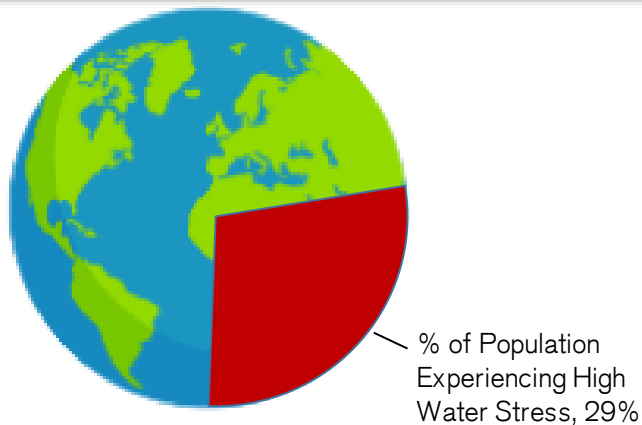


Source: FactSet, Credit Suisse Research, McKinsey, GSIR

# Data Center ESG Outlook

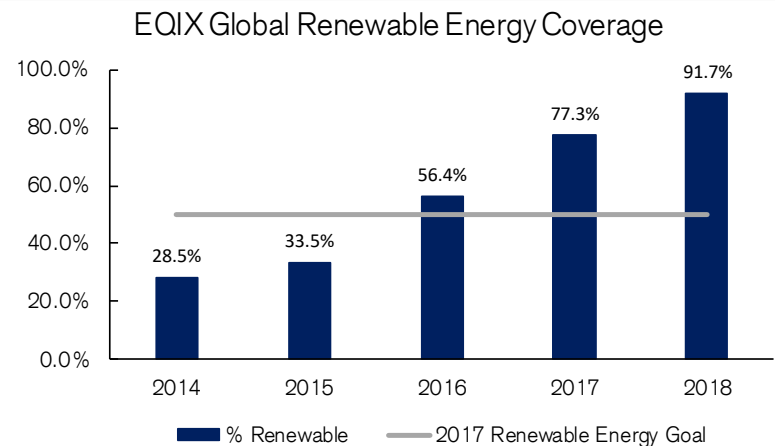
Data Center ESG Angle	How ESG Helps
Data Centers' Energy Efficiencies	Data centers represented <b>~3%</b> of the world's energy consumption in 2018. If enterprises kept their own data centers, the energy used would have been even higher.
Renewable Energy Progress	DCs are setting goals to utilize more renewable energy, with some even aiming for <b>100% long-term</b> . Green data center facilities.
Water Scarcity and Conservation	DCs use significant amounts of energy, generate lots of heat, and must be cooled down to operate. They are making strides to <b>minimize their water consumption</b> .
Sustainable Partnerships	Cloud service providers have some of the <b>highest sustainability standards</b> in any industry.

## Almost 1/3 of the Global Population Experiences Water Scarcity

















Source: FactSet, Credit Suisse Research, McKinsey, GSIR, Company Data

## DC's Like EQIX Are Making Strides in Sustainability



# Comparing Data Centers' ESG Profiles

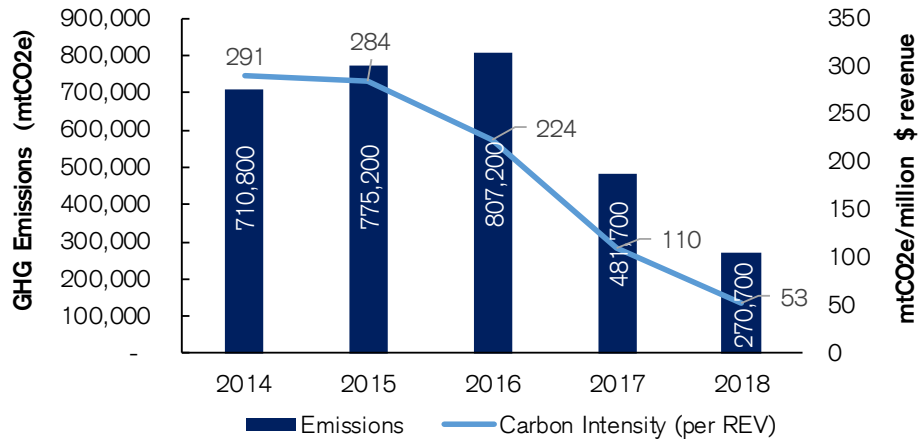
Company	ESG Outlook	Details
 <b>EQUINIX</b>		<p>EQIX is a leader in ESG, with goals in renewable energy progress, sustainable offices, governance &amp; ethics, and privacy &amp; security. Today, EQIX utilizes <b>~90% of its energy from renewable sources</b>, helping customers green their grid. EQIX direct and indirect greenhouse gas (GHG) <b>emissions have fallen over 71% since 2015</b>.</p>
 <b>DIGITAL REALTY</b>		<p>Sustainability Policy includes – providing DC solutions that are resource efficient, empowering clients in resource efficiency, and sustainability transparency to stakeholders.  <b>Objective of 100% renewable energy for EMEA portfolio has been met.</b></p>
 <b>CyrusOne</b>		<p>Committed to a three-pronged sustainability mission – water &amp; energy conservation, building sustainable data centers, and being a sustainable partner with clients.  <b>CONE's newest data centers are Zero Water Consumption Cooling Facilities.</b></p>
 <b>interxion</b>		<p>Tech committee &amp; advisory council member of The Green Grid.  <b>Over 90% of INXN's power comes from sustainable sources, including 100% of German DC power.</b></p>
 <b>CORESITe</b>		<p>Three cornerstones of sustainability – energy efficient data centers, a culture of responsibility &amp; transparency, and create communities of customers that work seamlessly.  <b>37,056 MWH powered by 100% wind in 2018, up from 18,942 MWH in 2017.</b></p>
 <b>QTS</b>		<p>QTS's ESG goals include – procure 100% of power from renewables by 2025, conserve at least 10mil gallons of water/year, install EV charging stations at 30% of QTS facilities by 2025.  <b>Since 2015, QTS saved 63,436 tons of carbon.</b></p>
 <b>switch</b>		<p>SWCH's DC's are sustainable by design, with leading power and cooling efficiency.  <b>Two solar power stations in Las Vegas have been able to power all SWCH DCs with 100% renewable energy since 2016.</b></p>

Source: FactSet, Credit Suisse Research, Company Data

# Data Center ESG Data Points to Highlight

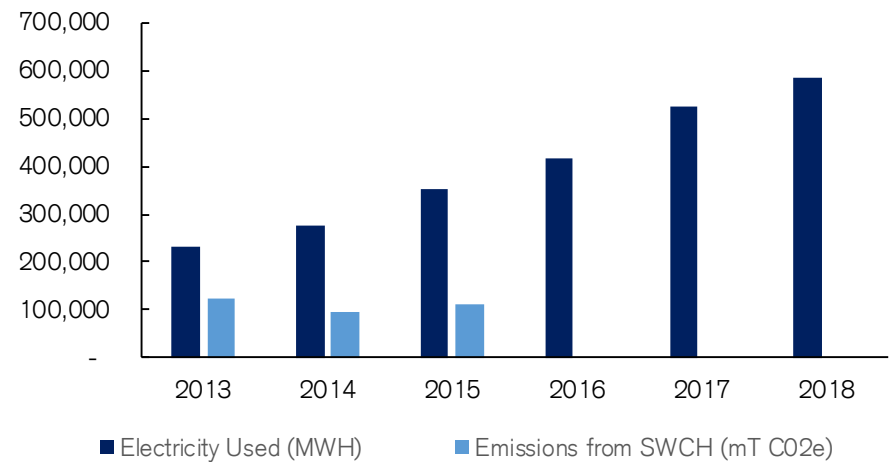
## EQIX Has Lowered Its Total Emissions Since 2016 By ~2/3

EQIX GHG Emissions and Carbon Intensity



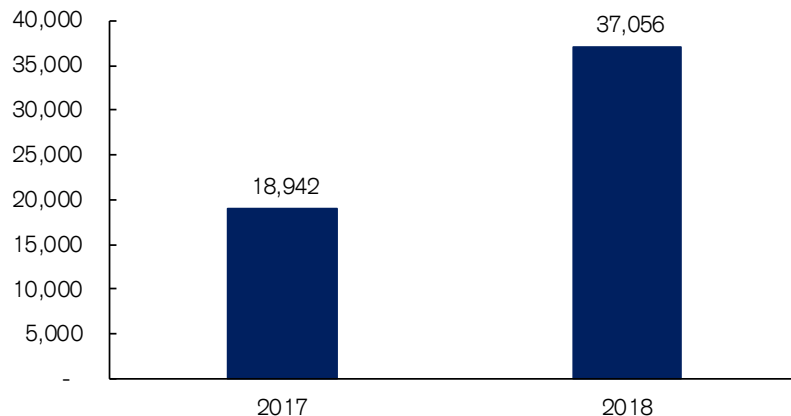
## SWCH Data Centers Run Entirely on Renewable Energy

SWCH Electricity and Emissions



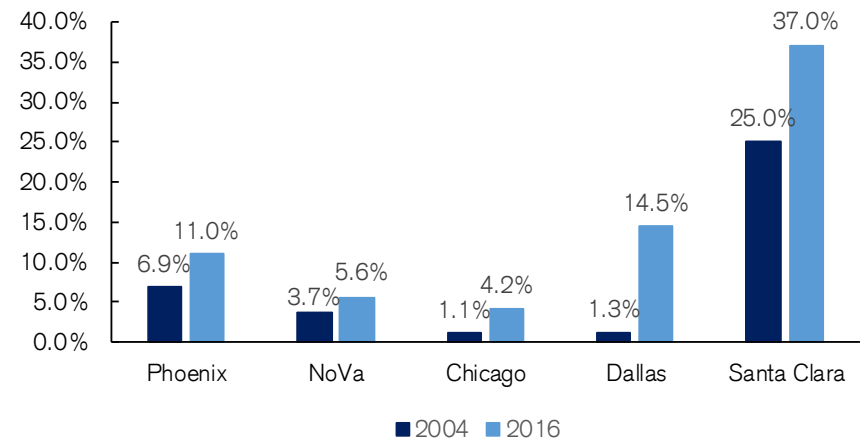
## COR Almost Doubled its Energy Use from Wind Power in 2018

COR MWH Powered by 100% Wind



## CONE Continues to Utilize More Renewable Energy

CONE Renewable Energy Consumption



Source: FactSet, Credit Suisse Research, Company Data





# Company Ratings & Target Prices

## Top Picks and Company Summary Sheets



2020 Outlook -- The Cloud Has Four Walls

# Top Data Center & Networking Equipment Stock Picks

Company	Investment Thesis & Rationale ( <u>Rated Outperform</u> )
	<p><b>Top Communications Infrastructure Pick</b></p> <p><b>Thesis:</b> CCOI's position as a low-cost pure-play internet provider, with revenue per connection that most competitors' can't match allows it to perform relatively well, even in turbulent environments. We believe that the company will continue to deploy capital at a comparable rate, maintaining its dividend growth levels with the potential for some share repurchases in 4Q19 and 2020. Additionally, we expect salesforce productivity to improve meaningfully in 2020 due to more experienced staff, boosting the topline and improving margins thereon.</p> <p><b>Valuation:</b> Our target price of \$75 is based on a dividend yield basis, using a 2019 yield of 3.7% and a projected dividend growth rate of 13% y/y in 2020.</p>
	<p><b>Top Data Center Pick</b></p> <p><b>Thesis:</b> EQIX is the market interconnection leader, which is recurring and high margin long-term. They are the most global and distributed data center REIT with a world class brand, a leader in almost every market they operate in and are positioned to benefit from 5G spending and interconnection optimization. SaaS on-ramps to accelerate interconnection business through 2020 supported by enhanced average interest expense following investment grade rating.</p> <p><b>Valuation:</b> Our target price of \$634 is based on a P/AFFO multiple on FY21 AFFO per share.</p>
	<p><b>Top Communications Equipment Pick</b></p> <p><b>Thesis:</b> MSI is one of very few providers that can offer a true end-to-end solution for customers from first responder radios to full command center communications in one aggregated and auditable system. We see MSI as the leading provider and highly irreplaceable given it is the only true large scale U.S. based end-to-end provider. Across all comm. Equipment peers, MSI leads EPS and FCF/share growth across all peers, positioning them well.</p> <p><b>Valuation:</b> Our target price of \$178 is based on a P/E multiple on FY21 EPS per share.</p>
	<p><b>Top Networking Equipment Pick</b></p> <p><b>Thesis:</b> Despite the end market pressures by cloud providers, we continue to see FFIV's relevance in the enterprise customer multi-cloud transition as networking interconnectivity becomes increasingly more complex, requiring superior product solutions like FFIV's ADCs. We believe FFIV can unleash material deep value from current levels.</p> <p><b>Valuation:</b> Our target price of \$192 is based on a method using P/E and our proprietary HOLT® DCF.</p>

Source: Credit Suisse Research.

### Key Points

- CCOI is growing faster than the highly competitive and challenged Internet Service Provider industry.
- Salesforce productivity is set to inflect upwards following extensive training and salesforce maturation (current low average tenure).
- CCOI has consistently returned in excess of 100% of free cash flow in the form of dividends and share repurchases. We expect the company to continue to deploy capital at a comparable rate for the foreseeable future.
- CCOI has raised its dividend 29 consecutive quarters, and we project +18% y/y growth in dividend per share in 2019.

### Valuation

**\$75 Target Price:** Our target price is based on a dividend yield and growth, using a 2019 yield of 3.7% and projecting +13% y/y dividend per share growth in FY20.

**Risks:** Key executive, technological disruption, FX headwinds, market competition, and net neutrality laws.

[CCOI: Healthy 3Q19 Results; 2020 Productivity In Focus](#)

[Link Initiation: High Dividend Growth in a Challenged Market](#)

[Link Sector Primer: The Cloud Has Four Walls](#)

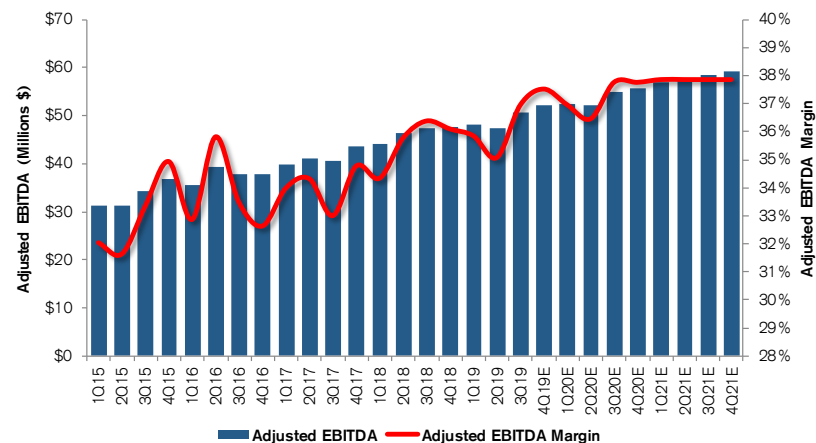
Source: Company Data, FactSet, CS Research.

### Key Exhibits

#### CCOI Mini P&L

(\$ millions)	FY 18	FY 19E	FY 20E	FY 21E
On-Net	374.55	395.35	420.66	447.99
Off-Net	145.00	149.20	156.93	164.37
Non-Core	0.63	0.44	0.31	0.22
<b>Total revenues</b>	<b>520.19</b>	<b>544.99</b>	<b>577.90</b>	<b>612.58</b>
y/y growth	7.2%	4.8%	6.0%	6.0%
<b>Gross Profit</b>	<b>301.56</b>	<b>326.16</b>	<b>344.86</b>	<b>366.32</b>
Gross Margin	58.0%	59.8%	59.7%	59.8%
<b>Adjusted EBITDA</b>	<b>185.50</b>	<b>198.19</b>	<b>215.22</b>	<b>231.90</b>
Adj EBITDA Margin	35.7%	36.4%	37.2%	37.9%
<b>Net income</b>	<b>28.67</b>	<b>40.93</b>	<b>46.76</b>	<b>61.32</b>
Sharecount	45.78	46.12	46.67	46.35
<b>EPS</b>	<b>0.63</b>	<b>0.89</b>	<b>1.00</b>	<b>1.32</b>
y/y growth	379.2%	41.7%	12.9%	32.1%

#### EBITDA Margins to Extend Rise Through 2021





### Key Points

- EQIX is the market interconnection leader, with highly recurring revenues and margin expansion potential long-term. They are the most globally distributed data center with a world class brand.
- 2020 catalysts will include the ramp of SaaS company/customer on-ramps, accelerating interconnection growth across EQIX's vast portfolio.
- Lower average interest expense from newly issued investment grade debt will support higher AFFOS growth long-term.
- EQIX's Hyperscale Infrastructure Team has been ramping throughout 2019, expanding the addressable market for EQIX.
- We believe EQIX is best positioned as a global interconnection leader given its business moat, global distribution, and strategically executed acquisitions to expand into new markets.

### Valuation

**\$634 Target Price:** Our target price is based upon a 23.0x P/AFFO multiple our 2021 AFFOS of \$27.55.

**Risks:** Technological disruption, market competition, rising interest rates, and REIT qualification loss.

[Recent Link: EQIX: Strong Stabilized Growth Continues](#)

[Link Initiation: Pioneering the Interconnection of Things](#)

[Link Sector Primer: The Cloud Has Four Walls](#)

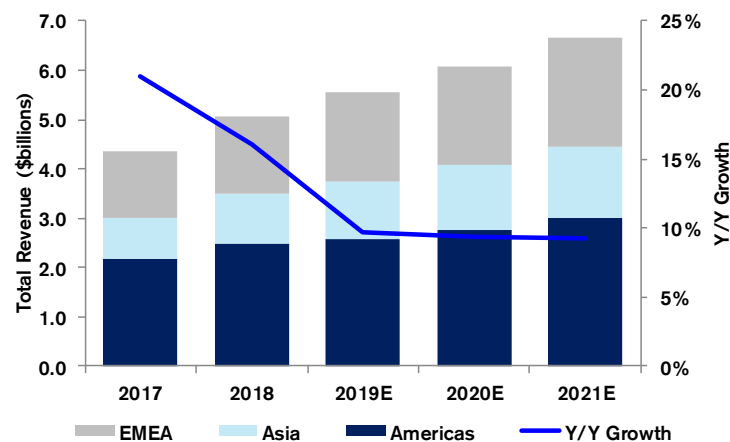
Source: Company Data, FactSet, CS Research.

### Key Exhibits

#### EQIX Mini P&L

(in \$ millions)	FY 18	FY 19E	FY 20E	FY 21E
Co-location Revenue	3,670.2	4,029.0	4,410.3	4,830.8
Interconnection Revenue	802.0	888.0	967.9	1,043.5
Managed Infrastructure Revenue	279.6	296.5	324.7	355.8
Rental & Other	24.7	27.3	24.1	24.1
<b>Total Recurring Revenue</b>	<b>4,776.5</b>	<b>5,240.7</b>	<b>5,727.1</b>	<b>6,254.3</b>
Non-Recurring Revenue	295.2	316.9	339.4	370.9
<b>Total Revenues</b>	<b>5,071.7</b>	<b>5,557.6</b>	<b>6,066.5</b>	<b>6,625.2</b>
Total Revenue Y/Y Growth (%)	16.1%	9.6%	9.2%	9.2%
<b>Adjusted EBITDA</b>	<b>2,413.2</b>	<b>2,674.0</b>	<b>2,956.5</b>	<b>3,256.0</b>
Adjusted EBITDA Margin	47.6%	48.1%	48.6%	49.0%
<b>FFO</b>	<b>1,253.1</b>	<b>1,359.8</b>	<b>1,648.9</b>	<b>1,870.5</b>
FFO per share (diluted)	15.61	16.03	18.39	20.03
<b>Adjusted FFO</b>	<b>1,659.1</b>	<b>1,919.6</b>	<b>2,272.4</b>	<b>2,572.8</b>
<b>Adjusted FFO per share (diluted)</b>	<b>20.71</b>	<b>22.65</b>	<b>25.35</b>	<b>27.55</b>
AFFO Y/Y Growth	12.0%	9.4%	11.9%	8.7%

### Revenues Growth Remains Inline or Above MTDC Market Rates



# Switch (SWCH)

**OUTPERFORM** | Target Price \$19 | Mkt Cap \$3.7bn

## Key Points

- SWCH is growing at the data center market rate. They are offering immense amounts of power for customer workloads at low power rates, and through their fiber routes, the company passes through tax incentives on data center demand.
- Recent earnings have been strong, showing recovery from earnings misses in the back half of 2018.
- In 3Q19, SWCH had new contract signings of more than 16MW compared to over 10MW in 2Q19.
- The vast majority of revenues remain sourced in Las Vegas, but growth will continue as the Reno, Grand Rapids, and Atlanta campuses ramp.

## Valuation

**\$19 Target Price:** Our target price is based on our SWCH DCF model, with a WACC of 6.9% (reflecting a 25% debt-to-capital ratio) and a terminal growth of 2.75%.

**Risks:** Revenue concentration, share ownership control, dependency on future plans, and intellectual property protection ability.

[Recent Link: SWCH: Strong 3Q Results, Stronger Guidance](#)

[Link Initiation: More Data Center Power For Less](#)

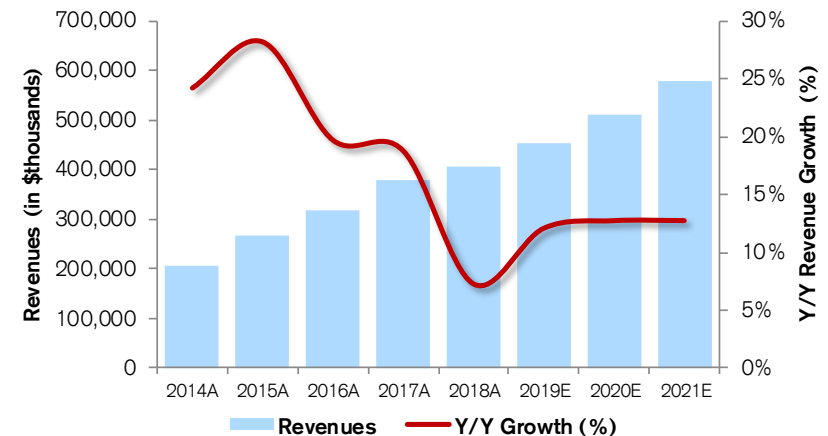
[Link Sector Primer: The Cloud Has Four Walls](#)

## Key Exhibits

### SWCH Mini P&L

(in \$ millions)	FY18	FY19E	FY20E	FY21E
Colocation	324.2	367.3	413.9	467.5
Connectivity	74.0	80.9	91.8	103.7
Professional services & Other	7.6	6.7	7.4	7.4
<b>Total Revenue</b>	<b>405.9</b>	<b>455.0</b>	<b>513.1</b>	<b>578.6</b>
<i>Total Revenue Y/Y Growth (%)</i>	<i>7.3%</i>	<i>12.1%</i>	<i>12.8%</i>	<i>12.8%</i>
<b>Income from continuing operations</b>	<b>136.7</b>	<b>165.2</b>	<b>205.7</b>	<b>248.3</b>
<i>Margin</i>	<i>33.7%</i>	<i>36.3%</i>	<i>40.1%</i>	<i>42.9%</i>
<b>Adjusted EBITDA</b>	<b>201.7</b>	<b>227.8</b>	<b>257.4</b>	<b>291.3</b>
<i>Adjusted EBITDA Margin</i>	<i>49.7%</i>	<i>50.1%</i>	<i>50.2%</i>	<i>50.3%</i>
<b>AFFO</b>	<b>173.9</b>	<b>172.0</b>	<b>192.3</b>	<b>216.1</b>
<b>AFFO Per Share</b>	<b>0.69</b>	<b>0.70</b>	<b>0.78</b>	<b>0.87</b>
<i>AFFOS Y/Y Growth</i>	<i>1.4%</i>	<i>1.6%</i>	<i>11.3%</i>	<i>11.3%</i>

### Revenues To Grow Double Digits Through 2021E



Source: Company Data, FactSet, CS Research.

# CyrusOne (CONE)

Neutral | Target Price \$70 | Mkt Cap \$7.3bn

Data Centers

## Key Points

- CONE's major expansions in Europe in 2019 are causing an Adjusted EBITDA margin decline of ~300bps.
- Wholesale data center operators like CONE will require more equity dilution to fund backlog of projects for hyperscale customers, putting pressure on per share economics.
- CONE is ramping its sales funnel, targeting Fortune 1,000 enterprises and delivering record new leasing activity through the cloud/hyper-scale opportunity. Of note, ~18% of CONE revenues are from Microsoft for hyperscale leasing activity.
- Major power density hyperscale customers' demand has slowed from previous highs, lowering pricing per signed kW. Despite this fact, meter power revenues are still reaching all-time highs.

## Valuation

**\$70 Target Price:** Our target price is based on a 18.0x P/AFFO multiple our 2021 FFOS of \$3.89.

**Risks:** Technological disruption, market competition, rising interest rates, and REIT qualification loss.

[Recent Link: CONE: Europe & Interconnection Show Strength](#)

[Initiation: Driving the Colo. Boom with the Fortune 1,000](#)

[Link Sector Primer: The Cloud Has Four Walls](#)

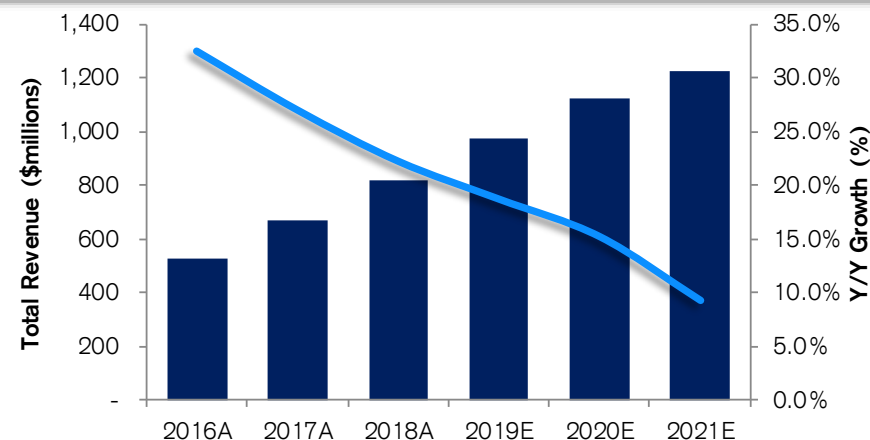
Source: Company Data, FactSet, CS Research.

## Key Exhibits

### CONE Mini P&L

(in \$ millions)	FY 18	FY 19E	FY 20E	FY 21E
Base Revenue	717.2	839.5	966.9	1,056.3
Meter Power Reimbursement Revenue	104.2	135.5	156.2	170.7
<b>Total Revenue</b>	<b>821.4</b>	<b>975.0</b>	<b>1,123.2</b>	<b>1,227.0</b>
Total Revenue Y/Y Growth (%)	22.2%	18.7%	15.2%	9.2%
<b>Net Operating Income (CONE defined)</b>	<b>529.0</b>	<b>588.3</b>	<b>679.9</b>	<b>747.5</b>
NOI Margin	64.4%	60.3%	60.5%	60.9%
<b>Adjusted EBITDA</b>	<b>452.1</b>	<b>505.6</b>	<b>586.8</b>	<b>645.1</b>
Adjusted EBITDA Margin	55.0%	51.9%	52.2%	52.6%
<b>FFO</b>	<b>332.3</b>	<b>399.9</b>	<b>442.0</b>	<b>489.8</b>
FFO Per Share	3.31	3.56	3.74	3.84
<b>AFFO</b>	<b>335.1</b>	<b>383.4</b>	<b>446.7</b>	<b>495.6</b>
<b>AFFO Per Share</b>	<b>3.33</b>	<b>3.41</b>	<b>3.78</b>	<b>3.89</b>
AFFO Y/Y Growth	9.1%	2.4%	10.7%	2.9%

### Revenues Growth Ahead of the Market Rate Through 2021



# CoreSite Realty (COR)

Neutral | Target Price \$101 | Mkt Cap \$4.3bn

Data Centers

## Key Points

- 2019 has been an investment year for COR as it spends ~\$425-500 million on capex despite requiring additional leverage, albeit in a dovish interest rate environment. We believe this will set up COR for stronger growth in 2020.
- COR has solid execution across businesses, especially in interconnection, often being compared to EQIX.
- COR is focused on the U.S. data center markets with well-integrated facilities.
- They are not an active acquirer or consolidator of industry participants, but rather a builder of in-house development capacity.
- COR is growing well organically with a strong interconnection business for 5G, AI, Cloud, and Network growth.

## Valuation

**\$101 Target Price:** Our target price is based on an 19.0x multiple on our FY21E FFO/share of \$5.32.

**Risks:** Technological disruption, market competition, rising interest rates, and REIT qualification loss.

[3Q19 Results In Line, 2019 Investment Year Continues Ahead](#)

[Link Initiation: Fairly Valued, Upside Priced In](#)

[Link Sector Primer: The Cloud Has Four Walls](#)

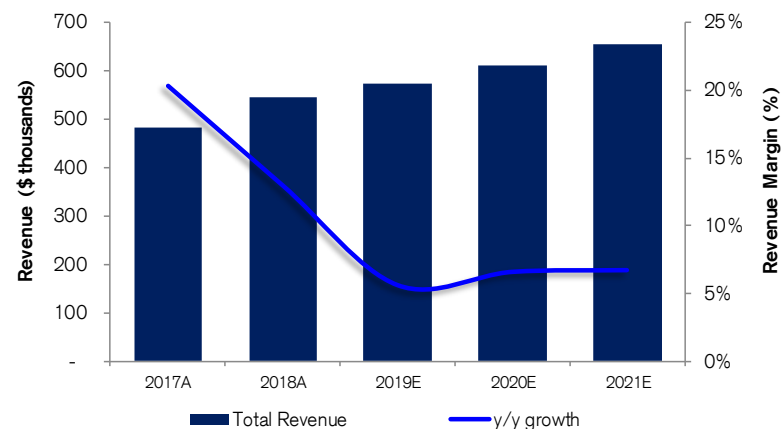
Source: Company Data, FactSet, CS Research.

## Key Exhibits

### COR Mini P&L

(in \$ millions)	FY18	FY19E	FY20E	FY21E
Rental Revenue	293.8	308.8	328.8	347.9
Power Revenue	158.0	166.9	179.0	192.3
Interconnection Revenue	69.7	75.7	80.6	88.7
Tenant Reimbursement & other	11.3	11.5	14.0	14.9
Total Data Center Revenue	532.8	562.9	602.5	643.7
Office, light-industrial and other revenue	11.6	12.1	10.5	10.5
<b>Total Revenue</b>	<b>544.4</b>	<b>575.0</b>	<b>613.0</b>	<b>654.2</b>
y/y growth	13.0%	5.6%	6.6%	6.7%
<b>Adjusted EBITDA</b>	<b>296.1</b>	<b>307.6</b>	<b>324.6</b>	<b>348.6</b>
EBITDA Margin	54.4%	53.5%	53.0%	53.3%
FFO per share / OP unit	5.06	5.07	5.18	5.32
AFFO per share / OP unit	4.84	5.03	5.08	5.11
AFFO Y/Y Growth	26.2%	3.9%	1.0%	0.7%

### Growth to Reaccelerate in 2020 After 2019 Investment Year



# QTS Realty (QTS)

Neutral | Target Price \$52 | Mkt Cap \$3.0bn

## Key Points

- QTS' recent performance has been very strong, indexed to cloud growth and enterprise hybrid growth with solid assets in Georgia and expansions into Arizona, but is a slow moving asset consolidator.
- Lease signings ahead of previous quarters highlight the consistency of the company's new core strategy, and a rising backlog is the result of strong demand.
- Broad sector strength can cause QTS to rise with the tide, and low churn shows positive potential for the future.
- Incremental data on strong performance indicators may drive performance higher on earnings results.

## Valuation

**\$52 Target Price:** Our target price is based on our FY21 AFFO of \$2.81 and a P/ FY3 AFFO multiple of 18.5x.

**Risks:** Technological disruption, market competition, rising interest rates, and REIT qualification loss.

[QTS: Continued Solid Execution, Robust Backlog Into 2020](#)

[Link Initiation: Secular Growth Is Not Enough](#)

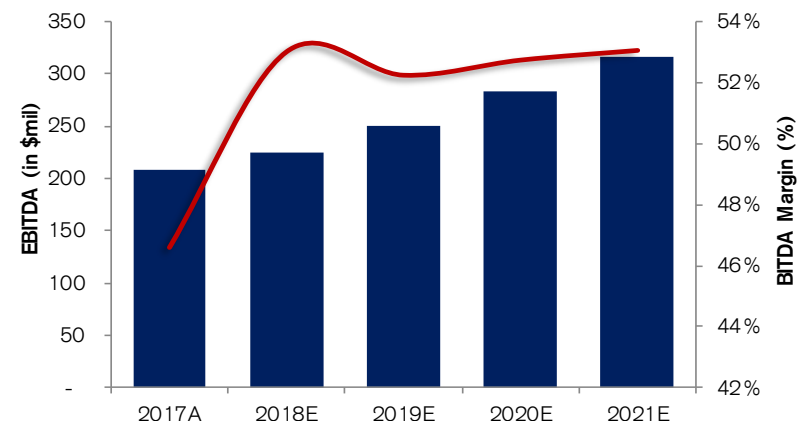
[Link Sector Primer: The Cloud Has Four Walls](#)

## Key Exhibits

### QTS Realty Mini P&L

(in \$ millions)	FY 18	FY 19E	FY 20E	FY 21E
Rental	360.83	407.28	466.10	514.39
Recoveries from customers	45.39	57.54	54.44	63.11
Cloud and managed services	35.71	-	-	-
Other	8.60	15.00	16.96	18.72
<b>Total revenues</b>	<b>450.52</b>	<b>479.82</b>	<b>537.51</b>	<b>596.22</b>
<i>y/y growth</i>	<i>0.9%</i>	<i>6.5%</i>	<i>12.0%</i>	<i>10.9%</i>
<b>Adjusted EBITDA</b>	<b>224.21</b>	<b>250.76</b>	<b>283.58</b>	<b>316.46</b>
<i>Adjusted EBITDA Margin (%)</i>	<i>49.8%</i>	<i>52.3%</i>	<i>52.8%</i>	<i>53.1%</i>
Operating FFO	151.16	165.03	189.22	216.71
Operating FFO per share (diluted)	2.60	2.64	2.73	2.92
Operating AFFO	145.12	158.56	181.11	208.39
Operating AFFO per share (diluted)	2.50	2.54	2.61	2.81
<i>AFFO Y/Y Growth</i>	<i>-6.8%</i>	<i>1.6%</i>	<i>2.9%</i>	<i>7.6%</i>

### EBITDA Margin to Resume Expansion in 2020



Source: Company Data, FactSet, CS Research.

# Motorola Solutions Inc. (MSI)

Comm. Equipment

**TOP PICK: OUTPERFORM** | Target Price \$178 | Mkt Cap \$27.3bn

## Key Points

- Motorola Solutions possesses the only true end-to-end solution in the first responders and public safety market, launching “Command Center” for full automation, big data, and auditable system install, materially enhancing functionality for customers.
- Revenues are also transitioning to a recurring revenue model, allowing for a potential multiple re-rating as the shift continues.
- Expansive revenue synergy opportunities exist from the Avigilon acquisition, particularly within the government and first responder customer segments where MSI is under-indexed.
- “Nine & Ten” Plan, implies solid long-term revenue growth and significant share repurchases ahead.

## Valuation

**\$178 Target Price:** Our target price is based on 18.5x our 2021E EPS of \$9.60.

**Risks:** Execution of strategy, technological disruption, timing of refresh cycles, dependency on U.S. government contracts.

[Recent Link: MSI: Solid F3Q19 Earnings Results](#)

[Link Initiation: Leading End-to-End Public Safety Provider](#)

[Link Sector Primer: Cloud Networking Fabrics to Proliferate](#)

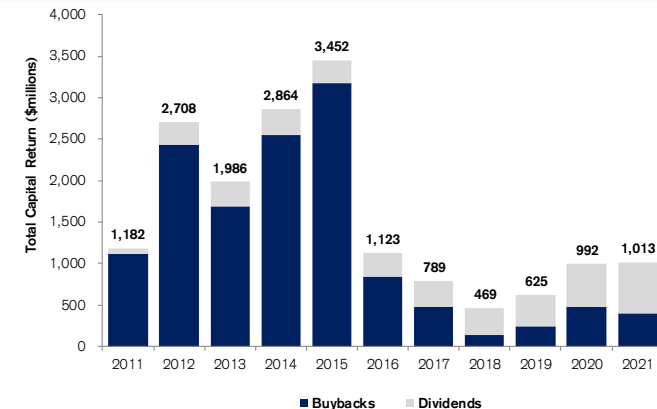
Source: Company Data, FactSet, CS Research.

## Key Exhibits

### MSI Mini P&L

(\$ millions)	FY18	FY19E	FY20E	FY21E
Products	5,099.0	5,372.7	5,526.6	5,670.3
Services	2,245.0	2,513.1	2,679.3	2,866.7
<b>Total revenues</b>	<b>7,344.0</b>	<b>7,885.8</b>	<b>8,205.9</b>	<b>8,537.0</b>
y/y growth	15.1%	7.4%	4.1%	4.0%
<b>Gross Profit</b>	<b>3,568.0</b>	<b>3,888.6</b>	<b>4,143.7</b>	<b>4,441.7</b>
Gross Margin	48.6%	49.3%	50.5%	52.0%
<b>Operating Expense</b>	<b>1,890.0</b>	<b>1,918.7</b>	<b>1,944.9</b>	<b>2,002.1</b>
<b>Operating Profit</b>	<b>1,740.0</b>	<b>1,969.8</b>	<b>2,198.8</b>	<b>2,439.6</b>
Operating Margin	23.7%	25.0%	26.8%	28.6%
<b>Net income</b>	<b>1,230.0</b>	<b>1,369.6</b>	<b>1,490.1</b>	<b>1,670.7</b>
Sharecount	172.1	175.8	175.4	174.1
<b>EPS</b>	<b>7.15</b>	<b>7.79</b>	<b>8.50</b>	<b>9.60</b>
y/y growth	31.0%	9.0%	9.1%	13.0%

**Since 2011, MSI Has Returned over \$14bn to Shareholders, and Strong Capital Returns Are Expected to Continue**



# F5 Networks Inc. (FFIV)

## OUTPERFORM | Target Price \$192 | Mkt Cap \$8.5bn

### Key Points

- F5 Networks remains the ADC market leader, commanding over 40% market share in the past five years and an expanding lead.
- High software revenue growth and traction are expected to continue, fueled by customer readiness for software solutions and FFIV's efforts to reduce adoption friction.
- Large enterprises will adopt hybrid clouds given their network complexities and compliance, and FFIV provides products and services essential for this transition.
- The company has highly recurring revenue (~60%+) streams and sector-leading gross and operating margins.
- F5 as-a-Service offering began in 1H 2019 which is driving recurring revenues to new peak levels.

### Valuation

**\$192 Target Price:** Our target price is based on an average of a 15.0x price multiple on our 2021 EPS of \$11.08 (\$166) and our proprietary HOLT® DCF model (\$217).

**Risks:** Changes to competitive position, execution of strategy, ADC market evolution, and technological obsolescence.

**FFIV: Solid F4Q19—Another Impressive Software Growth Quarter**

**Link Initiation: Highly Levered to Hybrid Cloud Transitions**

**Link Sector Primer: Cloud Networking Fabrics to Proliferate**

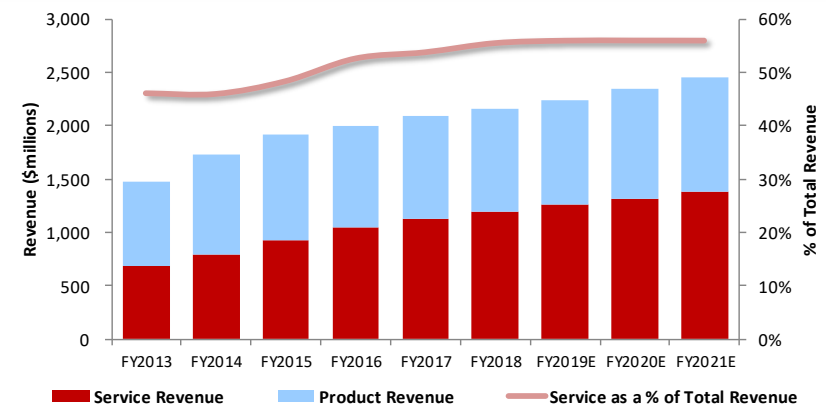
Source: Company Data, FactSet, CS Research.

### Key Exhibits

#### FFIV Mini P&L

(\$ millions)	FY18	FY19	FY20E	FY21E
Products	960.1	985.6	1,028.8	1,078.8
Services	1,201.3	1,256.9	1,313.7	1,376.2
<b>Total revenues</b>	<b>2,161.4</b>	<b>2,242.4</b>	<b>2,342.5</b>	<b>2,455.1</b>
<i>y/y growth</i>	3.4%	3.7%	4.5%	4.8%
<b>Gross Profit</b>	<b>1,829.0</b>	<b>1,916.7</b>	<b>2,010.4</b>	<b>2,112.3</b>
<i>Gross Margin</i>	84.6%	85.5%	85.8%	86.0%
<b>Operating Expense</b>	<b>1,069.4</b>	<b>1,146.7</b>	<b>1,225.1</b>	<b>1,269.7</b>
<b>Operating Profit</b>	<b>759.7</b>	<b>770.0</b>	<b>785.4</b>	<b>842.6</b>
<i>Operating Margin</i>	35.1%	34.3%	33.5%	34.3%
<b>Net income</b>	<b>611.9</b>	<b>626.3</b>	<b>638.3</b>	<b>683.6</b>
Sharecount	61.8	60.3	60.9	61.7
<b>EPS</b>	<b>9.90</b>	<b>10.38</b>	<b>10.48</b>	<b>11.08</b>
<i>y/y growth</i>	17.8%	4.8%	1.0%	5.7%

**Revenue Mix to Stabilize After Services Revenue reaches ~56% of Total Revenue, Product Recur. Rev at ~10%.**



### Key Points

- COMM's management has a history of achieving cost synergies and reducing leverage ahead of schedule, a major positive in the minds of investors as COMM integrates ARRS.
- MetroCell and OneCell are compelling long-term opportunities for COMM in a 5G-ramping world, as COMM is one of the few vendors that can offer an end-to-end solution set for customers.
- The opportunity for ARRS to utilize COMM's sales channel is a revenue synergy opportunity that is not modeled into our assumptions.
- COMM revenue mix remains skewed towards the enterprise-owned data centers versus hyperscale highlighting the significant opportunity that remains.

### Valuation

**\$21 Target Price:** Our target price is computed from a P/EPS multiple of 9.5x on our 2021 EPS estimates of \$2.25

**Risks:** Changes to competitive position, execution of strategy, leverage, and technological obsolescence.

[Recent Link: COMM: SF NDR Takeaways From Mgmt Meetings](#)

[Link Initiation: Increasingly Indexed to Cloud Capex Trends](#)

[Link Sector Primer: Cloud Networking Fabrics to Proliferate](#)

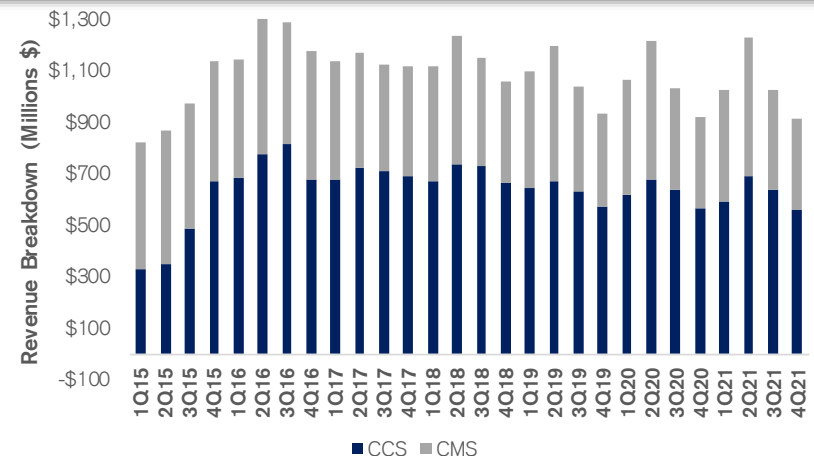
Source: Company Data, FactSet, CS Research.

### Key Exhibits

#### COMM (ARRIS Deal Accretion) Mini P&L

(\$ millions)	FY18	FY19E	FY20E	FY21E
Connectivity Solutions	2,812.7	2,525.0	2,506.7	2,489.6
Mobility Solutions	1,755.8	1,748.2	1,732.7	1,717.7
CPE	3,923.9	3,312.7	2,683.3	2,667.3
Network & Cloud	2,156.6	1,514.4	1,490.1	1,447.6
Enterprise Networks (Mainly Ruckus)	675.4	533.1	585.7	628.2
<b>Total revenues</b>	<b>11,324.2</b>	<b>9,633.5</b>	<b>8,998.5</b>	<b>8,950.4</b>
y/y growth	1.3%	20.2%	1.1%	(0.5%)
<b>Gross Profit</b>	<b>3,651.5</b>	<b>3,717.3</b>	<b>3,995.5</b>	<b>4,010.4</b>
Gross Margin	32.2%	38.6%	44.4%	44.8%
<b>Operating Profit</b>	<b>1,556.1</b>	<b>1,606.8</b>	<b>1,760.8</b>	<b>1,826.0</b>
Operating Margin	13.7%	16.7%	19.6%	20.4%
<b>Net income</b>	<b>962.2</b>	<b>551.3</b>	<b>529.9</b>	<b>618.9</b>
Sharecount	194.6	268.6	272.4	278.4
<b>EPS (Combined)</b>	<b>4.98</b>	<b>2.06</b>	<b>1.95</b>	<b>2.23</b>
y/y growth	4.7%	(58.6%)	(5.3%)	14.2%
<b>EPS of COMM Standalone</b>	<b>2.27</b>	<b>2.05</b>	<b>2.07</b>	<b>2.25</b>
y/y growth	6.1%	(9.6%)	1.1%	8.6%
<b>Accretion %</b>		<b>0.5%</b>	<b>(5.8%)</b>	<b>(1.0%)</b>

#### COMM Faces Exposure to Data Center and Connectivity Growing in Total Mix





# Arista Networks (ANET)

Neutral | Target Price \$153 | Mkt Cap \$15.3bn

Comm. Equipment

## Key Points

- The hyperscale market provides a growing end market for ANET to continue scaling revenues.
- Pushout of shipment plans for 400G switching upgrades is another factor moving us to the sidelines to assess cloud spending trends. 400G remains the core opportunity for ANET, but management does not see that ramping up until 2021. Our industry contacts do not see 400G ramping until 2022.
- Cloud titan customer's shift in procurement likely to be a significant headwind through 2020.
- Campus & WLAN gaining traction (key wins in 3Q), however these revenues are not yet material.

## Valuation

**\$153 Target Price:** Our target price is based off of a 15.0x Price/FY2 EPS of \$10.20.

**Risks:** Increased technological and competitive pressures, product refresh cycle timing, delays in equipment component suppliers, and more.

[Recent Link: ANET: Downgrading to Neutral](#)

[Link Initiation: Levered to Surging Hyperscale Capex](#)

[Link Sector Primer: Cloud Networking Fabrics to Proliferate](#)

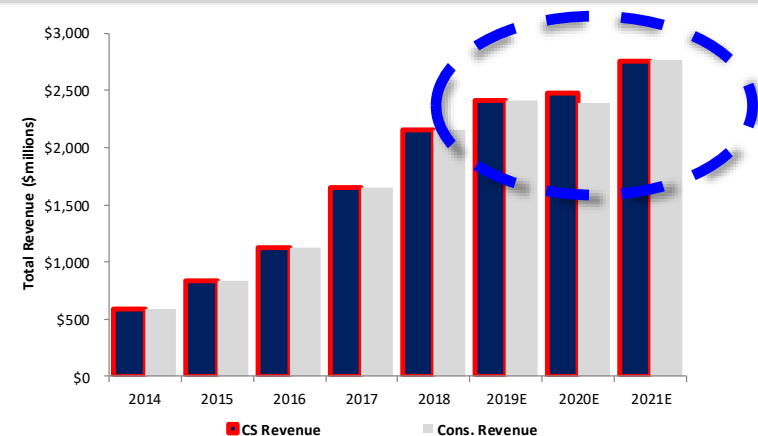
Source: Company Data, FactSet, CS Research.

## Key Exhibits

### ANET Mini P&L

(\$ millions)	FY18	FY19E	FY20E	FY21E
Product	1,841.1	2,016.4	2,035.7	2,271.1
Services	310.3	395.5	444.3	482.0
<b>Total revenues</b>	<b>2,151.4</b>	<b>2,411.9</b>	<b>2,480.0</b>	<b>2,753.2</b>
<i>y/y growth</i>	<i>30.7%</i>	<i>12.1%</i>	<i>2.8%</i>	<i>11.0%</i>
<b>Gross Profit</b>	<b>1,385.4</b>	<b>1,557.9</b>	<b>1,590.2</b>	<b>1,753.1</b>
<i>Gross Margin</i>	<i>64.4%</i>	<i>64.6%</i>	<i>64.1%</i>	<i>63.7%</i>
<b>Operating Expense</b>	<b>608.9</b>	<b>645.6</b>	<b>711.2</b>	<b>793.1</b>
<b>Operating Profit</b>	<b>783.1</b>	<b>913.8</b>	<b>879.0</b>	<b>960.0</b>
<i>Operating Margin</i>	<i>36.4%</i>	<i>37.9%</i>	<i>35.4%</i>	<i>34.9%</i>
<b>Net income</b>	<b>643.3</b>	<b>777.5</b>	<b>752.6</b>	<b>816.6</b>
Sharecount	80.9	80.9	78.4	80.1
<b>EPS</b>	<b>7.95</b>	<b>9.61</b>	<b>9.60</b>	<b>10.20</b>
<i>y/y growth</i>	<i>42.2%</i>	<i>20.8%</i>	<i>(0.1%)</i>	<i>6.2%</i>

### CS Model Relatively in-line Consensus View



# Cisco Systems Inc. (CSCO)

NEUTRAL | Target Price \$46 | Mkt Cap \$197.9bn

Comm. Equipment

## Key Points

- CSCO remains a dominant leader across numerous networking equipment end markets, but has seen pressure from predominantly service provider spending.
- ANET and JNPR entry into campus switching and WLAN have not been reported to be threatening to CSCO's very high market share in both segments.
- Tariffs are not having a large impact on CSCO's results, however numerous end markets for CSCO are experiencing slowdowns into 2020, incl. Service Providers, where we don't expect recovery near-term.
- EPS Growth Remains in high single digits in FY20E, driven by software/services revenue growth.

## Valuation

**\$46 Target Price:** Our target price is based on FY21E EPS of \$3.44 at a 13.5x FY2 multiple.

**Risks:** Disruption to distribution model, reliance on suppliers, heavy market competition, industry consolidation, and more.

[Recent Link: CSCO: Macro Effects Impact CSCO in F1Q20](#)

[Link Initiation: Transitioning into a Recurring Place](#)

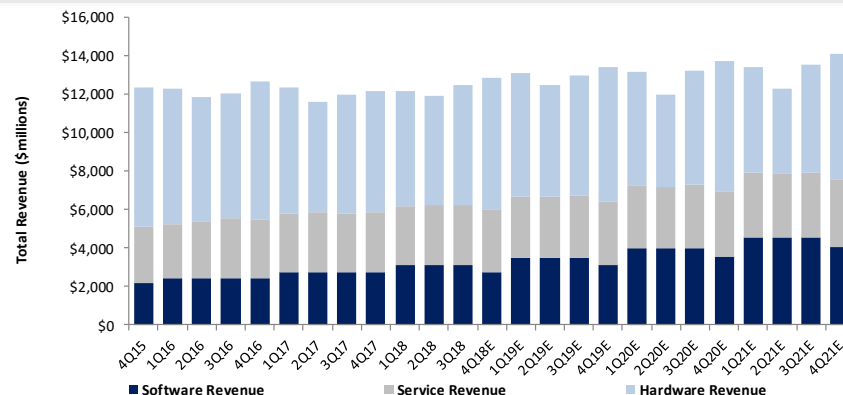
[Link Sector Primer: Cloud Networking Fabrics to Proliferate](#)

## Key Exhibits

### CSCO Mini P&L

(\$ millions)	FY18	FY19	FY20E	FY21E
<b>Key I/S Items (Non-GAAP)</b>				
<b>Products</b>	<b>36,709</b>	<b>39,005</b>	<b>38,913</b>	<b>39,829</b>
Infrastructure Platforms	28,270	30,191	29,666	29,918
Applications	5,035	5,802	6,102	6,407
Security	2,353	2,730	3,035	3,392
Other Products	1,050	281	111	111
<b>Services</b>	<b>12,621</b>	<b>12,899</b>	<b>13,177</b>	<b>13,440</b>
<b>Total revenues</b>	<b>49,330</b>	<b>51,904</b>	<b>52,090</b>	<b>53,269</b>
y/y growth	2.8%	5.2%	0.4%	2.3%
<b>Gross Profit</b>	<b>31,463</b>	<b>33,479</b>	<b>34,138</b>	<b>34,550</b>
Gross Margin	63.8%	64.5%	65.5%	64.9%
<b>Operating Profit</b>	<b>15,358</b>	<b>16,716</b>	<b>17,256</b>	<b>17,309</b>
Operating Margin	31.1%	32.2%	33.1%	32.5%
<b>Net income</b>	<b>12,703</b>	<b>13,787</b>	<b>14,106</b>	<b>14,148</b>
Sharecount	4,876	4,455	4,239	4,117
<b>EPS</b>	<b>2.61</b>	<b>3.09</b>	<b>3.33</b>	<b>3.44</b>
y/y growth	8.9%	18.8%	7.5%	3.3%

**50% of Revenues are Expected to be Recurring Across Software and Services Within the Next two years**



Source: Company Data, FactSet, CS Research.

# Juniper Networks (JNPR)

**UNDERPERFORM** | Target Price \$19 | Mkt Cap \$8.1bn

Comm. Equipment

## Key Points

- JNPR continues to deal with tariffs, which are having a sizeable impact with price increases in light of the recent incremental Chinese tariff.
- CSCO advancing into JNPR's turf with 8000 Series SP routers intensifies JNPR's already struggling SP segment.
- New Mist Systems acquisition to be met with new competitive WLAN mergers and Wifi6 rollouts.
- White boxes/vRouters another JNPR pressure point since ~43% of revenues are from Telecom customers.
- Solutions have historically been more levered to the telecom service providers (carriers), and we note that the telco capex outlook remains unclear and if it directly benefits JNPR.

## Valuation

**\$19 Target Price:** Our target price is based on an average of a 12.0x P/EPS multiple on our FY21 estimates of \$1.70 (\$20) and our proprietary HOLT DCF model (\$18).

**Risks:** Technological advancements, increased customer spend, increasing market share, increasing capital returns.

[Recent Link: JNPR: 3Q19 Results – Topline Softness Remains](#)

[Link Initiation: Competitive Pressures Only Intensifying](#)

[Link Sector Primer: Cloud Networking Fabrics to Proliferate](#)

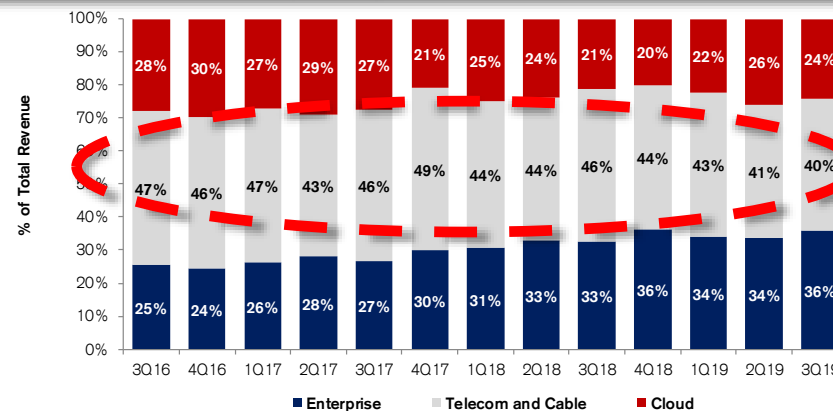
Source: Company Data, FactSet, CS Research.

## Key Charts

### JNPR Mini P&L

(\$ millions)	FY18	FY19E	FY20E	FY21E
Product	3,176.8	2,979.6	3,054.6	3,133.1
Service	1,540.4	1,416.8	1,385.0	1,420.7
Routing	1,839.7	1,670.8	1,610.6	1,557.2
Switching	934.4	824.2	807.7	732.5
Security	333.0	362.2	373.6	375.5
Services	1,540.4	1,575.9	1,604.1	1,556.8
<b>Total revenues</b>	<b>4,647.5</b>	<b>4,433.2</b>	<b>4,396.0</b>	<b>4,221.9</b>
y/y growth	(7.6%)	(4.6%)	(0.8%)	(4.0%)
<b>Gross Profit</b>	<b>2,782.3</b>	<b>2,667.3</b>	<b>2,645.5</b>	<b>2,542.3</b>
Gross Margin	59.9%	60.2%	60.2%	60.2%
<b>Operating Expense</b>	<b>1,942.4</b>	<b>1,930.6</b>	<b>1,941.9</b>	<b>1,884.3</b>
<b>Operating Profit</b>	<b>839.9</b>	<b>736.7</b>	<b>703.6</b>	<b>658.1</b>
Operating Margin	18.1%	16.6%	16.0%	15.6%
<b>Net income</b>	<b>666.4</b>	<b>587.7</b>	<b>583.7</b>	<b>550.9</b>
Sharecount	354.4	346.5	330.9	323.5
<b>EPS</b>	<b>1.88</b>	<b>1.70</b>	<b>1.76</b>	<b>1.70</b>
y/y growth	(11.0%)	(9.8%)	4.0%	(3.5%)

### JNPR Is Heavily Levered to Telco and Cable Customers, Comprising ~40% of Revenues



# Communications Infrastructure Comp Sheet

Basic Information																						
Company / Group	Ticker	Price	Current Market Cap (\$mil)	Net Debt (\$mil)	EV (\$mil)	Rating / Consensus	Target Price	Upside / Downside	EV/Revenue		EV/EBITDA		P/FFO		P/AFFO		Net Debt/EBITDA		Capex/Revenue		Div. Yield Current	
									2020E	2021E	2020E	2021E	2020E	2021E	2020E	2021E	2020E	2021E	2020E	2021E		
Equinix	EQIX	\$565	\$48,223	\$9,616	\$57,839	Outperform	\$634	12.1%	9.5x	8.7x	19.6x	17.8x	30.8x	28.2x	22.3x	20.5x	3.3x	3.0x	36%	35%	9.8%	
CyrusOne	CONE	\$64	7,271	2,769	10,040	Neutral	\$70	9.0%	8.9x	8.2x	17.1x	15.6x	17.2x	16.7x	17.0x	16.5x	4.7x	4.3x	73%	86%	2.0%	
CoreSite Realty	COR	\$113	4,249	1,376	5,624	Neutral	\$101	-10.4%	9.2x	8.6x	17.3x	16.1x	21.8x	21.2x	22.2x	22.1x	4.2x	3.9x	49%	47%	4.9%	
QTS Realty	QTS	\$52	3,009	1,382	4,391	Neutral	\$52	0.7%	8.2x	7.4x	15.5x	13.9x	18.9x	17.7x	19.8x	18.4x	4.9x	4.4x	104%	95%	1.8%	
<b>Data Center REITs AVG</b>			<b>\$17,411</b>	<b>\$5,190</b>	<b>\$22,601</b>				<b>8.9x</b>	<b>8.2x</b>	<b>17.4x</b>	<b>15.8x</b>	<b>22.2x</b>	<b>21.0x</b>	<b>20.3x</b>	<b>19.4x</b>	<b>4.3x</b>	<b>3.9x</b>	<b>75%</b>	<b>76%</b>	<b>2.9%</b>	
GDS Holdings	GDS	\$51	\$7,166	1,374	\$8,540	Consensus			14.5x	10.1x	32.8x	22.1x					5.3x	3.6x	102%	121%	#N/A	
Switch, Inc.	SWCH	15	3,665	1,090	4,699	Outperform	\$19	50.3%	9.7x	0.0x	18.3x	16.1x					4.2x	3.7x	57%	54%	0.1%	
NextDC	NXT	5	2,331	329	2,660	Consensus			22.0x	19.2x	46.4x	37.4x					5.7x	4.6x	211%	159%	#N/A	
Internap	INAP	1	26	725	751	Consensus			2.6x	2.5x	7.9x	7.7x					7.6x	7.5x	10%	11%	#N/A	
<b>Non-REIT Data Centers AVG</b>			<b>\$3,891</b>	<b>\$947</b>	<b>\$4,827</b>				<b>11.9x</b>	<b>7.9x</b>	<b>28.5x</b>	<b>20.8x</b>					<b>5.7x</b>	<b>4.8x</b>	<b>95%</b>	<b>86%</b>	<b>0.1%</b>	
American Tower	AMT	\$218	\$96,694	\$26,958	\$123,652	Consensus			16.3x	15.4x	26.2x	24.5x	27.7x	25.2x	27.6x	25.1x	5.7x	5.3x	14%	13%	3.8%	
Crowne Castle	CCI	137	57,043	23,306	80,349	Consensus			13.6x	13.0x	23.5x	22.4x	23.0x	21.5x	23.0x	21.5x	6.8x	6.5x	35%	30%	4.5%	
SBA Comm.	SBAC	234	26,386	12,093	38,480	Consensus			19.2x	18.2x	27.3x	25.4x	27.7x	25.2x	27.7x	25.2x	8.6x	8.0x	8%	10%	1.5%	
<b>Tower REITs AVG</b>			<b>\$60,041</b>	<b>\$20,786</b>	<b>\$80,827</b>				<b>16.4x</b>	<b>15.5x</b>	<b>25.7x</b>	<b>24.1x</b>	<b>26.1x</b>	<b>24.0x</b>	<b>26.1x</b>	<b>23.9x</b>	<b>7.0x</b>	<b>6.6x</b>	<b>19%</b>	<b>18%</b>	<b>3.3%</b>	
Zayo	ZAYO	34	8,154	6,272	14,426	Consensus			5.6x	5.6x	11.2x	11.2x					4.9x	4.9x	31%	33%	0.0%	
Cogent Communications	CCOI	62	2,923	566	3,489	Outperform	\$75	20.2%	6.0x	5.7x	16.2x	15.0x					2.6x	2.4x	11%	11%	2.5%	
GTT Communications	GTT	11	599	3,503	4,102	Consensus			2.4x	2.4x	9.3x	9.2x					7.9x	7.9x	6%	5%	0.0%	
<b>Fiber/ Comm. REITs AVG</b>			<b>\$3,892</b>	<b>\$3,447</b>	<b>\$7,339</b>				<b>4.7x</b>	<b>4.6x</b>	<b>12.3x</b>	<b>11.8x</b>					<b>5.2x</b>	<b>5.1x</b>	<b>16%</b>	<b>16%</b>	<b>0.8%</b>	
Akamai	AKAM	\$85	\$13,715	\$637	\$14,352	Consensus			5.0x	4.7x	11.9x	10.9x					0.5x	0.5x	20%	17%	0.0%	
LimeLight Networks	LLNW	4	463	(3)	460	Consensus			2.3x	2.0x	26.4x	14.7x					-0.2x	-0.1x	15%	13%	0.0%	
Fastly	FSLY	19	1,759	(179)	1,580	Consensus			8.0x	6.2x	N.M.	N.M.					N.M.	N.M.	10%	14%	#N/A	
Cloudflare	NET	17	5,222	(635)	4,587	Consensus			16.3x	12.2x	N.M.	N.M.					N.M.	N.M.	16%	18%	#N/A	
<b>CDN AVG</b>			<b>\$7,089</b>	<b>\$637</b>	<b>\$14,352</b>				<b>3.7x</b>	<b>3.4x</b>	<b>19.2x</b>	<b>12.8x</b>					<b>0.2x</b>	<b>0.2x</b>	<b>20%</b>	<b>21%</b>	<b>0%</b>	
CenturyLink	CTL	\$13	\$14,413	\$35,488	\$49,901	Consensus			2.2x	2.3x	5.5x	5.6x					3.9x	4.0x	16%	16%	1.0%	
Zayo	ZAYO	34	8,154	6,272	14,426	Consensus			5.6x	5.6x	11.2x	11.2x					4.9x	4.9x	31%	33%	0.0%	
Uniti Group	UNIT	8	1,593	4,981	6,573	Consensus			6.2x	6.4x	8.0x	8.4x	4.0x	4.8x	3.3x	4.0x	6.1x	6.4x	28%	19%	0.2%	
Cogent Communications	CCOI	62	2,923	566	3,489	Outperform	\$75	20.2%	6.0x	5.7x	16.2x	15.0x					2.6x	2.4x	11%	11%	2.5%	
Consolidated Comm.	CNSL	4	281	2,335	2,615	Consensus			2.0x	2.0x	5.0x	5.2x					4.5x	4.6x	17%	16%	0.0%	
Frontier Comm.	FTR	1	66	16,930	16,996	Consensus			2.1x	2.2x	5.1x	5.4x					5.0x	5.4x	15%	14%	0.0%	
Windstream	WIN	0	5	3,148	3,153	Consensus			0.6x	0.6x	2.9x	2.9x					2.9x	2.9x	15%	14%	0.0%	
<b>Fiber AVG</b>			<b>\$3,919</b>	<b>\$9,960</b>	<b>\$13,879</b>				<b>3.5x</b>	<b>3.5x</b>	<b>7.7x</b>	<b>7.7x</b>	<b>4.0x</b>	<b>4.8x</b>	<b>3.3x</b>	<b>4.0x</b>	<b>4.3x</b>	<b>4.4x</b>	<b>19%</b>	<b>18%</b>	<b>0.5%</b>	
AT&T	T	\$39	\$283,400	\$184,212	\$467,612	Consensus			2.6x	2.6x	7.8x	7.8x					3.1x	3.1x	12%	12%	2.0%	
Verizon	VZ	61	251,952	126,675	378,627	Consensus			2.9x	2.8x	7.9x	7.7x					2.6x	2.6x	13%	13%	2.5%	
T-Mobile	TMUS	76	65,328	41,304	106,632	Consensus			2.4x	2.3x	8.1x	7.7x					3.2x	3.0x	14%	15%	0.0%	
Sprint	S	5	21,643	40,548	62,191	Consensus			1.9x	2.0x	5.7x	5.6x					3.7x	3.6x	36%	N.M.	0.0%	
U.S. Cellular	USM	35	2,991	2,004	4,995	Consensus			1.2x	1.2x	5.0x	5.0x					2.0x	N.M.	17%	18%	0.0%	
Cincinnati Bell	CBB	7	373	2,008	2,381	Consensus			1.5x	1.5x	5.9x	5.7x					5.0x	N.M.	15%	15%	0.0%	
<b>Telecoms AVG</b>			<b>\$104,281</b>	<b>\$66,125</b>	<b>\$170,406</b>				<b>2.1x</b>	<b>2.1x</b>	<b>6.7x</b>	<b>6.6x</b>					<b>3.3x</b>	<b>3.1x</b>	<b>18%</b>	<b>14%</b>	<b>0.8%</b>	
Comcast	CMCSA	\$43	\$196,323	107,056	\$303,379	Consensus			2.8x	2.6x	8.9x	8.4x					3.1x	3.0x	9%	10%	0.8%	
Charter Communications	CHTR	467	100,221	75,592	175,813	Consensus			3.8x	3.7x	10.5x	9.9x					4.5x	4.2x	15%	15%	0.0%	
Liberty Global	LBTA	22	13,614	20,624	34,239	Consensus			3.0x	3.0x	6.9x	7.4x					4.1x	4.5x	15%	18%	0.0%	
Dish	DISH	36	18,623	12,942	31,565	Consensus			2.5x	2.6x	13.3x	14.0x					5.5x	5.7x	5%	5%	0.0%	
Cable One	CABO	1468	8,381	1,164	9,546	Consensus			8.2x	7.4x	17.0x	15.1x					2.1x	1.8x	21%	21%	9.0%	
WideOpenWest Inc.	WOW	7	548	2,327	2,875	Consensus			2.5x	2.5x	6.6x	6.4x					5.3x	5.2x	22%	21%	0.0%	
<b>Cable AVG</b>			<b>\$56,285</b>	<b>\$36,618</b>	<b>\$92,903</b>				<b>3.8x</b>	<b>3.6x</b>	<b>10.5x</b>	<b>10.2x</b>					<b>4.1x</b>	<b>4.1x</b>	<b>15%</b>	<b>15%</b>	<b>1.6%</b>	
<b>Credit Suisse Defined TMT AVG</b>			<b>\$32,101</b>	<b>\$17,964</b>	<b>\$50,892</b>				<b>8.0x</b>	<b>5.6x</b>	<b>14.5x</b>	<b>12.4x</b>	<b>21.4x</b>	<b>20.1x</b>	<b>23.2x</b>	<b>21.7x</b>	<b>4.3x</b>	<b>4.2x</b>	<b>31%</b>	<b>30%</b>	<b>1.2%</b>	

Source: Company data, FactSet, Credit Suisse estimates.



# Telecom & Networking Equipment Comp Sheet

Basic Information																
Company / Group	Ticker	Current Price	Market Cap. (\$mil)	Net Debt (\$mil)	Enterprise Value (\$mil)	Rating / Consensus	Target Price	Upside / Downside	P/Revenue		P/E		P/FCF		EV/FCF	
									2020E	2021E	2020E	2021E	2020E	2021E	2020E	2021E
Cisco Systems	CSCO	\$46.01	195,187	(9,538)	185,649	NEUTRAL	46.0	(0.0%)	3.7x	3.7x	13.8x	13.4x	12.9x	12.2x	12.2x	11.6x
Arista Networks	ANET	\$199.25	15,223	(2,447)	12,775	NEUTRAL	153.0	(23.2%)	6.1x	5.5x	20.8x	19.5x	15.7x	14.4x	13.2x	12.1x
Juniper Networks	JNPR	\$24.22	8,107	(1,139)	6,968	UNDERPERFORM	19.0	(21.6%)	1.8x	1.9x	13.7x	14.2x	11.5x	11.6x	9.9x	9.9x
F5 Networks	FFIV	\$139.35	8,472	(1,331)	7,141	OUTPERFORM	192.0	37.8%	3.6x	3.5x	13.3x	12.6x	12.0x	11.1x	10.1x	9.4x
Extreme Networks	EXTR	\$7.10	850	288	1,138	Consensus			0.8x	0.7x	11.2x	8.2x				
<b>Networking AVG</b>			<b>56,747</b>		<b>53,133</b>				<b>3.8x</b>	<b>3.6x</b>	<b>15.4x</b>	<b>14.9x</b>	<b>13.0x</b>	<b>12.3x</b>	<b>11.4x</b>	<b>10.8x</b>
Apple	AAPL	\$325.29	1,222,564	7,467	1,230,031	Consensus			4.4x	4.1x	25.1x	21.9x	19.5x	18.2x	19.6x	18.3x
Microsoft Corp	MSFT	\$155.39	1,178,879	(50,662)	1,128,217	Consensus			8.4x	7.5x	28.8x	25.7x	29.1x	25.3x	27.8x	24.2x
Alphabet	GOOGL	\$1,359.31	866,608	(107,429)	759,179	Consensus			4.5x	3.9x	24.9x	21.7x	23.8x	20.1x	20.9x	17.6x
Tencent Holdings	700	\$46.16	442,387	2,161	444,548	Consensus			6.7x	5.5x	28.2x	23.2x	23.2x	20.1x	23.3x	20.2x
Facebook	FB	\$197.68	467,120	(42,713)	424,407	Consensus			5.4x	4.6x	21.6x	18.1x	20.6x	16.9x	18.7x	15.3x
Intel	INTC	\$58.10	251,387	17,621	269,008	Consensus			3.5x	3.4x	12.5x	12.5x	15.6x	15.7x	16.7x	16.8x
<b>Cisco Systems</b>	<b>CSCO</b>	<b>\$46.01</b>	<b>195,187</b>	<b>(9,538)</b>	<b>185,649</b>	<b>NEUTRAL</b>	<b>46.0</b>	<b>(0.0%)</b>	<b>3.7x</b>	<b>3.7x</b>	<b>13.8x</b>	<b>13.4x</b>	<b>12.9x</b>	<b>12.2x</b>	<b>12.2x</b>	<b>11.6x</b>
Oracle	ORCL	\$54.08	178,930	26,209	205,139	Consensus			4.4x	4.3x	12.8x	11.9x	13.6x	12.4x	15.6x	14.2x
IBM	IBM	\$134.42	118,861	60,536	179,397	Consensus			1.5x	1.5x	10.1x	9.4x	9.4x	9.0x	14.2x	13.5x
Broadcom	AVGO	\$325.29	125,118	27,743	152,861	Consensus			5.0x	4.7x	14.0x	12.7x	11.7x	10.3x	14.3x	12.6x
Texas Instrument	TXN	\$127.87	118,380	1,080	119,460	Consensus			8.4x	7.8x	25.5x	22.6x	24.6x	22.7x	24.8x	22.9x
Applied Materials	AMAT	\$60.37	55,305	1,695	57,000	Consensus			3.4x	3.1x	16.2x	13.8x	16.3x	15.6x	16.8x	16.0x
VMware	VMW	\$150.73	16,629	3,533	20,162	Consensus			1.5x	1.4x	21.4x	19.2x	4.2x	3.8x	5.1x	4.6x
HPE	HPE	\$16.22	20,743	9,744	30,487	Consensus			0.7x	0.7x	8.7x	8.2x	10.5x	8.8x	15.4x	13.0x
Symantec	SYMC	\$25.93	16,204	2,806	19,010	Consensus			6.5x	6.4x	25.4x	17.5x	15.3x	10.6x	18.0x	12.4x
<b>Large Cap. Internet AVG</b>			<b>364,404</b>		<b>360,460</b>				<b>4.6x</b>	<b>4.2x</b>	<b>19.5x</b>	<b>16.9x</b>	<b>17.1x</b>	<b>14.9x</b>	<b>17.9x</b>	<b>15.6x</b>
Salesforce	CRM	\$161.95	142,922	(36)	142,886	Consensus			6.8x	5.7x	52.2x	41.3x	33.2x	27.6x	33.2x	27.6x
VMware	VMW	\$150.73	16,629	3,533	20,162	Consensus			1.5x	1.4x	21.4x	19.2x	4.2x	3.8x	5.1x	4.6x
Citrix Systems	CTXS	\$111.62	14,370	462	14,832	Consensus			4.6x	4.4x	20.4x	17.6x	15.7x	13.8x	16.2x	14.3x
Cloudera	CLDR	\$11.17	3,170	(179)	2,991	Consensus			3.7x	3.4x						
<b>Arista Networks</b>	<b>ANET</b>	<b>\$199.25</b>	<b>15,223</b>	<b>(2,447)</b>	<b>12,775</b>	<b>NEUTRAL</b>	<b>153.0</b>	<b>(23.2%)</b>	<b>6.1x</b>	<b>5.5x</b>	<b>20.8x</b>	<b>19.5x</b>	<b>15.7x</b>	<b>14.4x</b>	<b>13.2x</b>	<b>12.1x</b>
<b>Next Gen. Data Center AVG</b>			<b>38,463</b>		<b>38,729</b>				<b>4.5x</b>	<b>4.1x</b>	<b>31.5x</b>	<b>26.7x</b>	<b>17.2x</b>	<b>14.9x</b>	<b>16.9x</b>	<b>14.7x</b>
<b>Arista Networks</b>	<b>ANET</b>	<b>\$199.25</b>	<b>15,223</b>	<b>(2,447)</b>	<b>12,775</b>	<b>NEUTRAL</b>	<b>153.0</b>	<b>(23.2%)</b>	<b>6.1x</b>	<b>5.5x</b>	<b>20.8x</b>	<b>19.5x</b>	<b>15.7x</b>	<b>14.4x</b>	<b>13.2x</b>	<b>12.1x</b>
VMware	VMW	\$150.73	16,629	3,533	20,162	Consensus			1.5x	1.4x	21.4x	19.2x	4.2x	3.8x	5.1x	4.6x
Fortinet	FTNT	\$106.94	18,068	(1,899)	16,169	Consensus			7.3x	6.4x	39.4x	34.4x	24.2x	17.9x	21.7x	16.1x
Zscaler	ZS	\$46.69	5,883	(343)	5,540	Consensus			14.3x	11.1x						
Palo Alto Networks	PANW	\$229.75	22,235	(984)	21,251	Consensus			6.4x	5.4x	46.3x	36.7x	22.4x	17.4x	21.5x	16.6x
Netscout Systems	NTCT	\$23.82	1,777	227	2,005	Consensus			1.9x	1.9x	14.5x	13.0x	10.8x	9.7x	12.2x	10.9x
<b>F5 Networks</b>	<b>FFIV</b>	<b>\$139.35</b>	<b>8,472</b>	<b>(1,331)</b>	<b>7,141</b>	<b>OUTPERFORM</b>	<b>192.0</b>	<b>37.8%</b>	<b>3.6x</b>	<b>3.5x</b>	<b>13.3x</b>	<b>12.6x</b>	<b>12.0x</b>	<b>11.1x</b>	<b>10.1x</b>	<b>9.4x</b>
<b>Ubiquiti Networks</b>	<b>UBNT</b>	<b>\$187.70</b>	<b>12,173</b>	<b>526</b>	<b>12,699</b>	<b>NEUTRAL</b>	<b>115.0</b>	<b>(38.7%)</b>	<b>9.0x</b>	<b>8.0x</b>	<b>32.1x</b>	<b>26.5x</b>	<b>40.6x</b>	<b>29.6x</b>	<b>42.4x</b>	<b>30.8x</b>
<b>High Growth Networking AVG</b>			<b>11,515</b>		<b>11,193</b>				<b>6.3x</b>	<b>5.4x</b>	<b>26.8x</b>	<b>23.1x</b>	<b>18.6x</b>	<b>14.9x</b>	<b>18.0x</b>	<b>14.4x</b>
<b>Motorola Solutions</b>	<b>MSI</b>	<b>\$161.73</b>	<b>27,710</b>	<b>4,589</b>	<b>32,299</b>	<b>OUTPERFORM</b>	<b>178.0</b>	<b>10.1%</b>	<b>3.4x</b>	<b>3.2x</b>	<b>19.0x</b>	<b>16.8x</b>	<b>17.5x</b>	<b>15.5x</b>	<b>20.4x</b>	<b>18.0x</b>
<b>CommScope</b>	<b>COMM</b>	<b>\$14.31</b>	<b>2,779</b>	<b>9,524</b>	<b>12,303</b>	<b>OUTPERFORM</b>	<b>21.0</b>	<b>46.8%</b>	<b>0.3x</b>	<b>0.3x</b>	<b>6.9x</b>	<b>6.3x</b>	<b>4.2x</b>	<b>3.8x</b>	<b>18.7x</b>	<b>16.8x</b>
L3Harris	LHX	\$200.74	44,253	6,925	51,178	Consensus			2.3x	2.2x	17.5x	15.2x	16.7x	14.9x	19.3x	17.3x
Nokia	NOK	\$9.29	20,205	686	20,890	Consensus			0.8x	0.7x	32.9x	28.7x	7.2x	7.5x	24.0x	
Ericsson	ERIC	\$9.29	30,203	(830)	29,373	Consensus			1.2x		16.1x		31.3x		30.4x	
<b>Telco. Equipment AVG</b>			<b>24,542</b>		<b>29,036</b>				<b>1.6x</b>	<b>1.6x</b>	<b>18.0x</b>	<b>16.8x</b>	<b>18.0x</b>	<b>8.5x</b>	<b>22.6x</b>	<b>19.0x</b>
<b>CS Telco &amp; Networking AVG</b>			<b>63,965</b>		<b>64,481</b>				<b>4.2x</b>	<b>3.8x</b>	<b>22.2x</b>	<b>19.7x</b>	<b>16.8x</b>	<b>13.1x</b>	<b>17.4x</b>	<b>14.9x</b>

Source: Company data, FactSet, Credit Suisse estimates.

# HOLT® Insights

## Communications Equipment: Industry Overview

*Prepared for Sami Badri*



18 December 2019  
HOLT | Americas



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**2020 Outlook -- The Cloud Has Four Walls**

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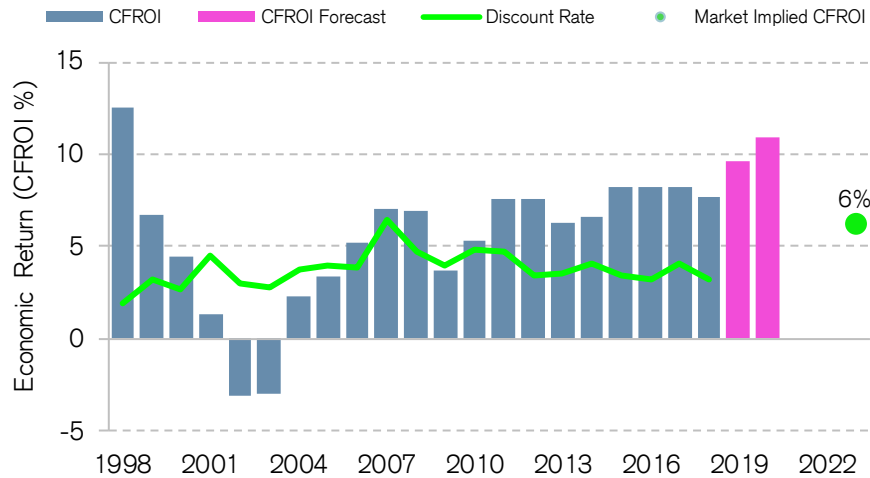
# U.S. Tech Industry Valuation: Relative to other industries, the market has the lowest expectations (green dot) for Comm Equipment. Further, Comm Equipment has vastly lagged other Tech industries this past year.



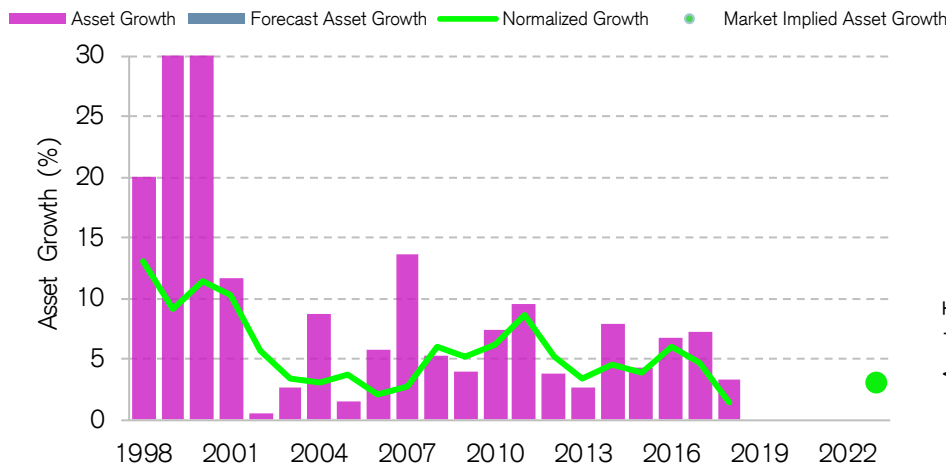
Note: Sourced from CS HOLT. Charts sorted by CFROI forecasts minus market implied CFROI. 52 Week Price Performance sourced from FactSet, S&P 500 Industry Indices. US industry aggregates are median weighted. Data as of 12 December 2019.

**U.S. Communications Equipment in HOLT:** Over the past 4 years, operating margins have expanded to all-time highs. CFROI declined by 60bps in 2018 due to lower asset efficiency. In term of longer term expectations, the market is pricing for CFROI of ~6%.

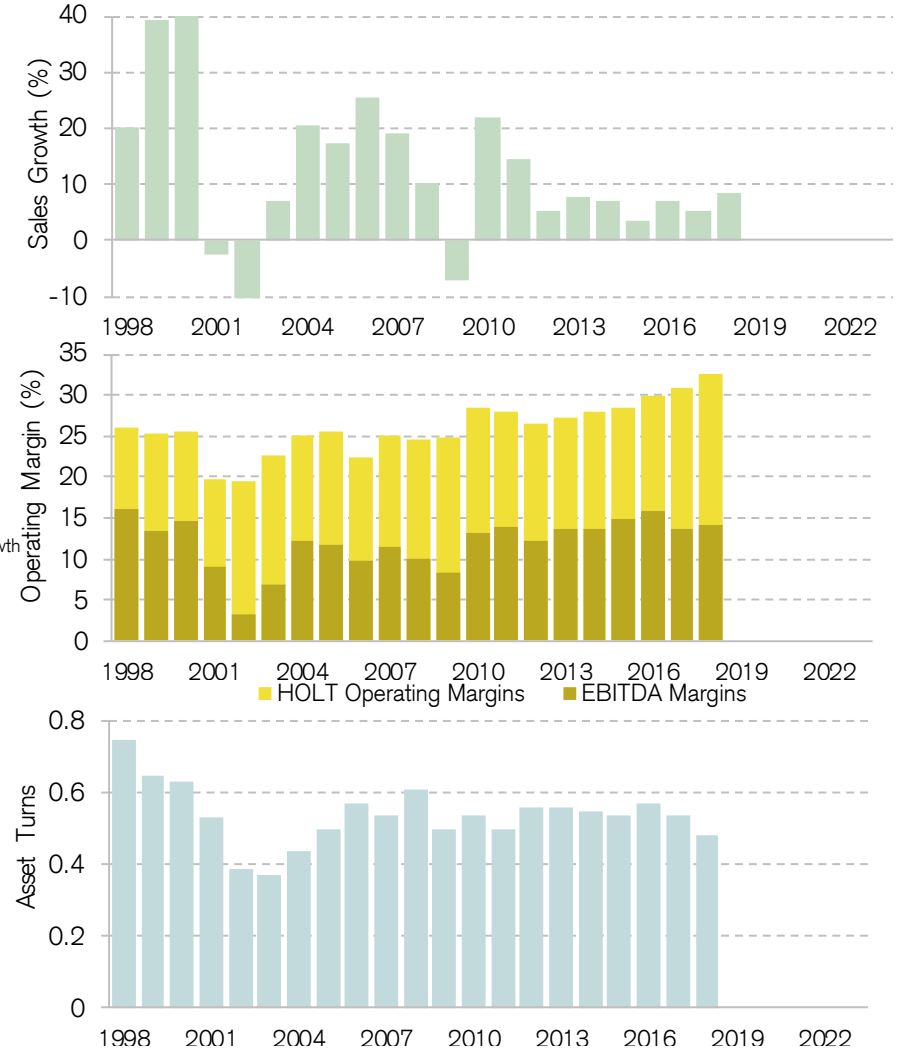
### Relative Wealth Chart



### Asset Growth



### Operating Drivers

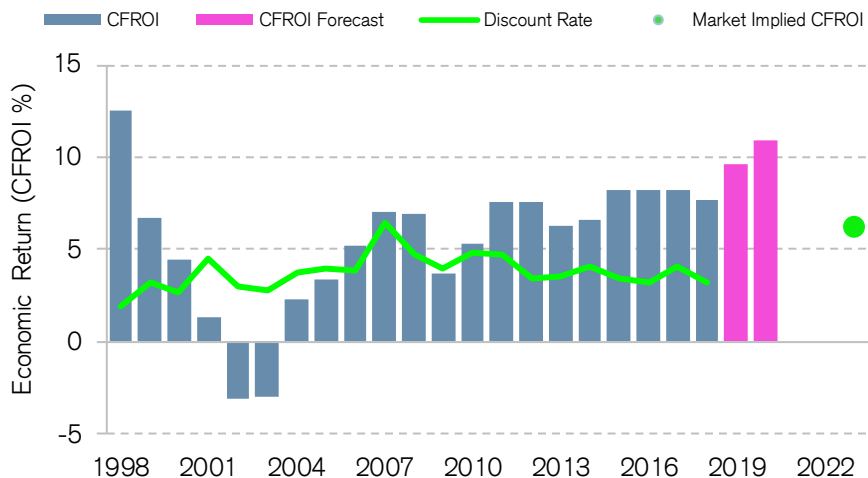


Note: Sourced from CS HOLT. Metrics shown are median weighted for the US Communications Equipment industry aggregate. HOLT Operating Margin adds back R&D and rent expense. Data as of 12 December 2019.

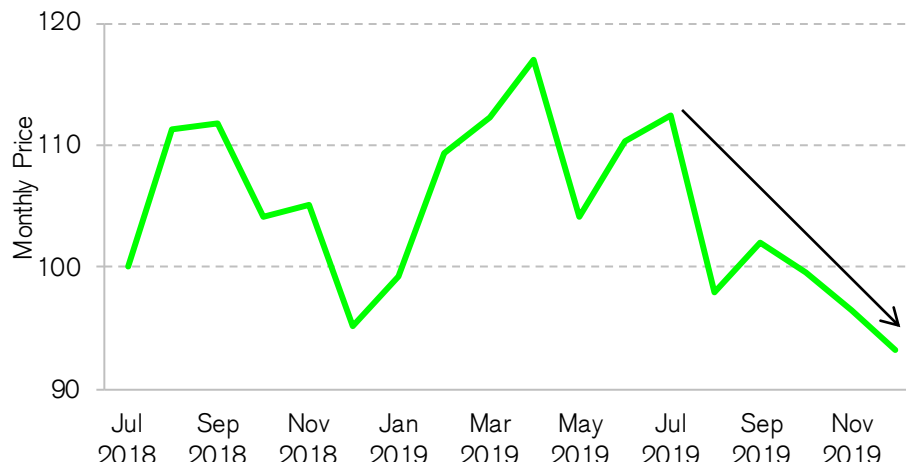


**Momentum:** Since July, the Comm Equipment industry has experienced weak price momentum, lagging the broader U.S. Tech sector.

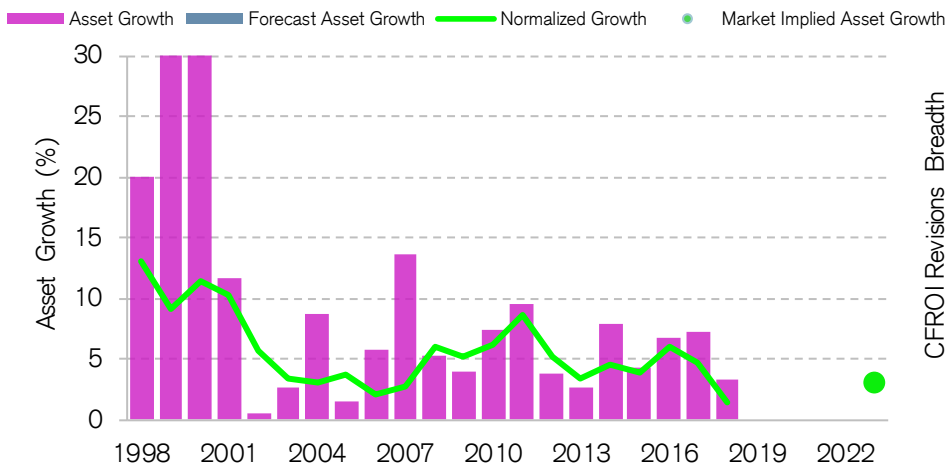
### Relative Wealth Chart



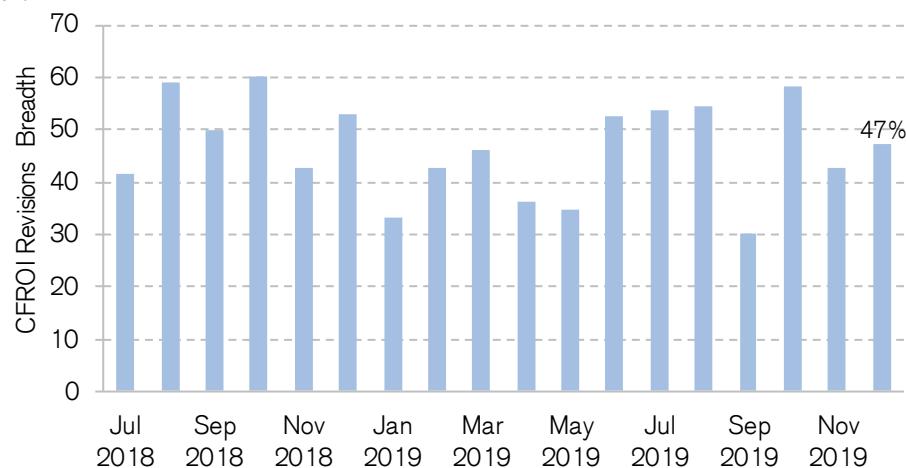
### Monthly Price



### Asset Growth



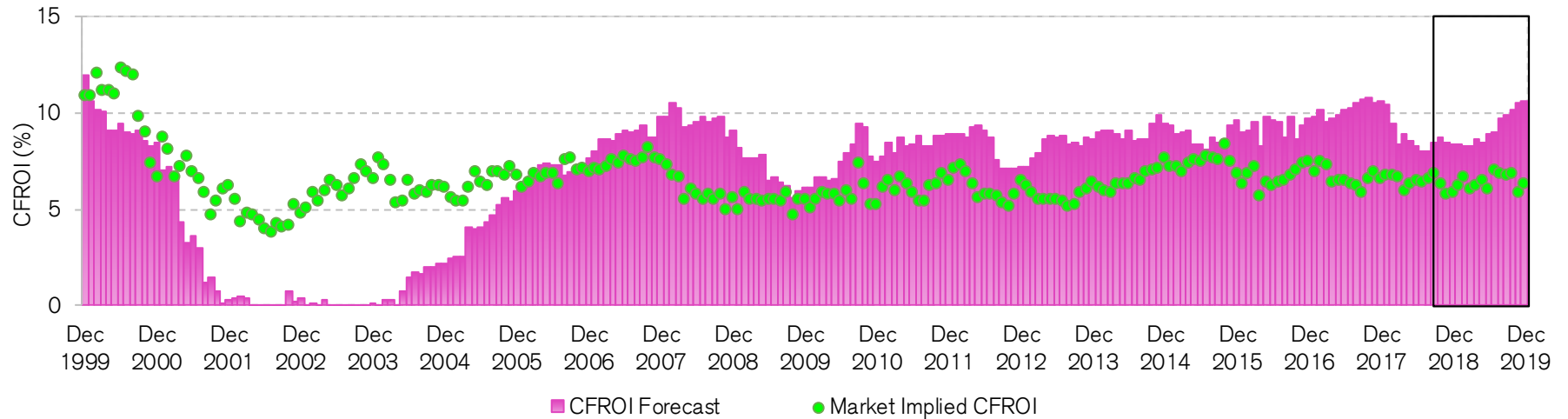
### CFROI Revisions Breadth (Positive Revisions / Total)



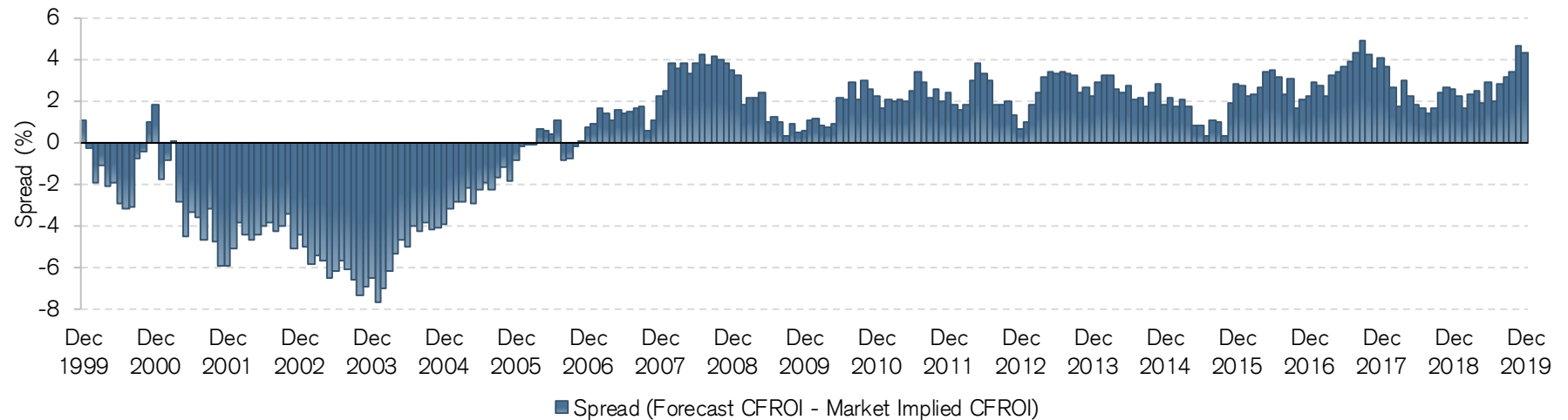
Note: Sourced from CS HOLT. Metrics shown are median weighted for the US Communications Equipment industry aggregate. Operating Margin = HOLT Operating Margin. HOLT Operating Margin adds back R&D and rent expense. Data as of 12 December 2019.

**Historical Expectations:** Analysts forecasts (pink bars) have risen over the past few months and the current spread between market implied CFROI levels (green dot) and near-term forecasts is the largest it has been since 2017.

### Historical Expectations (HEAT)

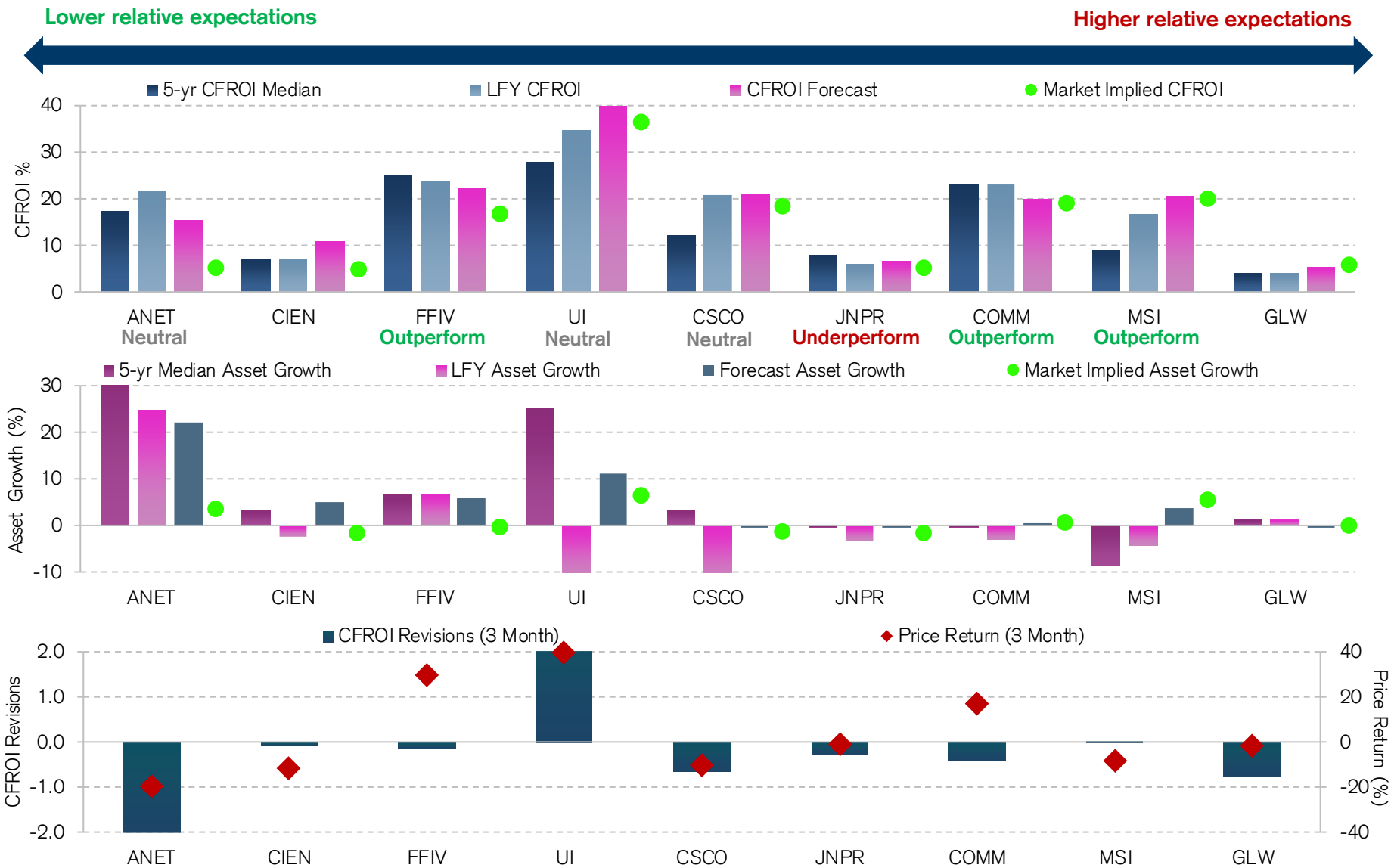


### Spread (T+1 CFROI Forecast – Market Implied CFROI)



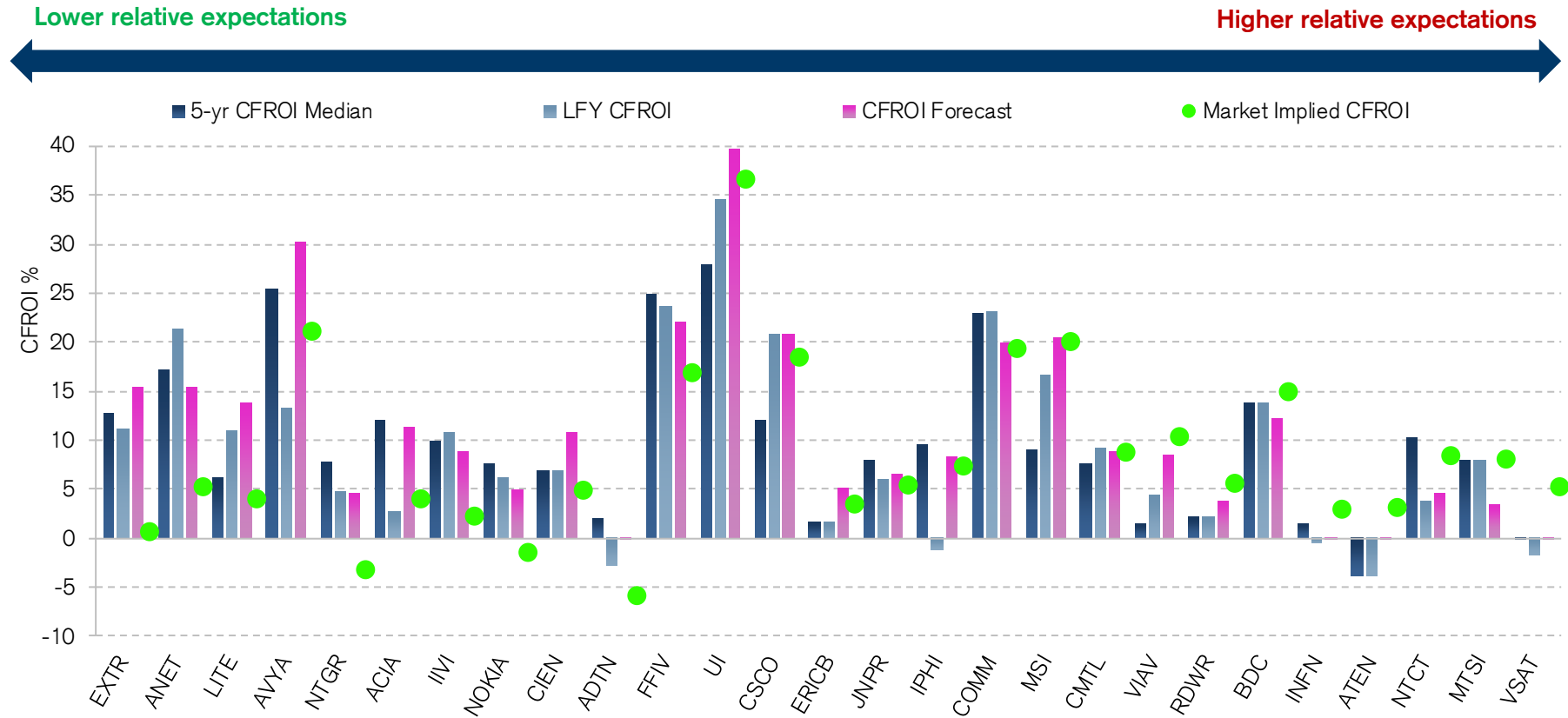
Note: Sourced from CS HOLT. Historical Expectations Note: This chart is a monthly time series comparing near-term CFROI forecasts (based on EPS estimates) vs. long-term market-implied CFROI (implied by equity prices). Communications Equipment is median weighted aggregate. Data as of 12 December 2019.

# Large Cap Relative Valuation: Amongst Communications Equipment peers, ANET, CIEN and FFIV are priced for the sharpest decline relative to near-term CFROI forecasts.



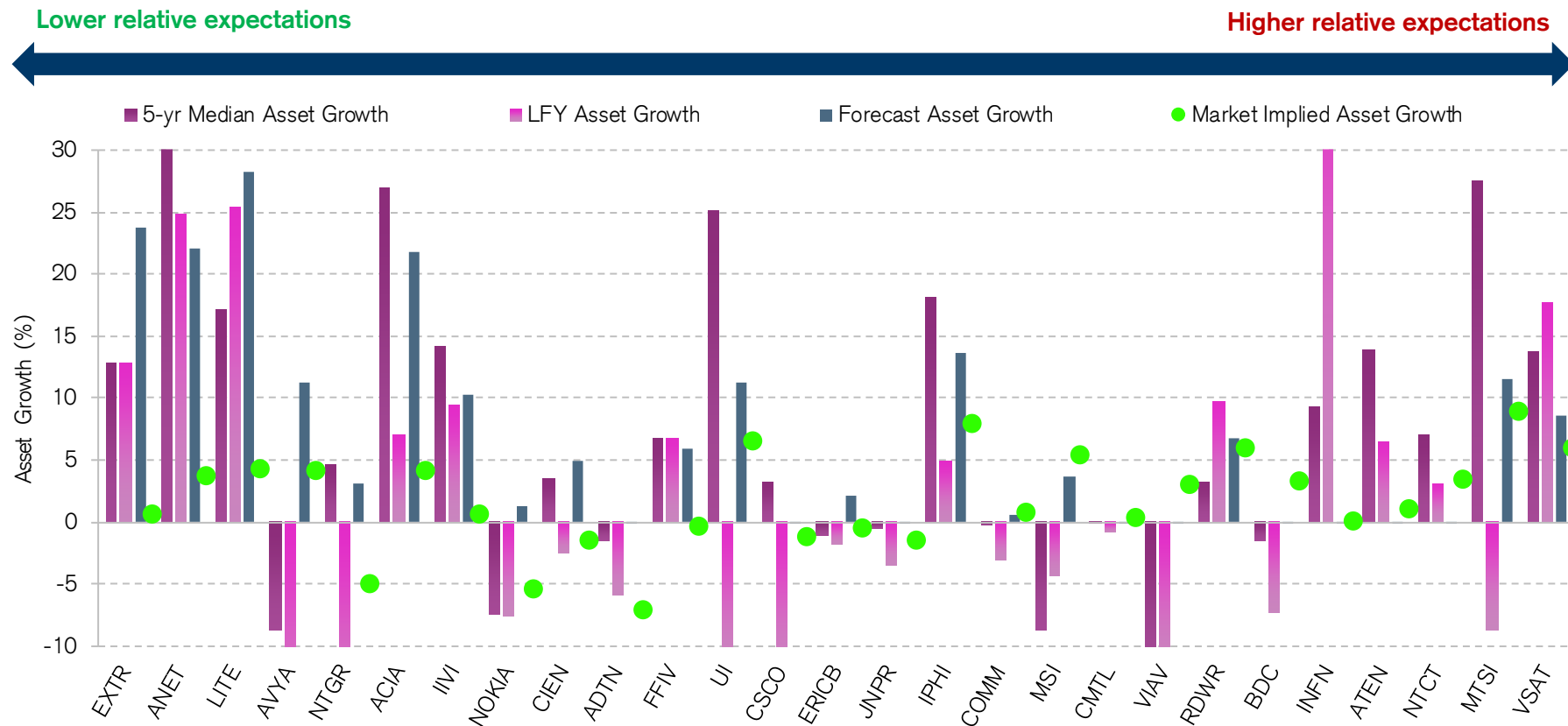
Note: Sourced from CS HOLT. Charts sorted by CFROI forecasts minus market implied CFROI. Data as of 12 December 2019.

**Industry Relative Valuation - CFROI:** Within the broader Communications Equipment universe, EXTR and ANET are priced for the lowest CFROI expectations, while MTSI and VSAT have more elevated expectations.



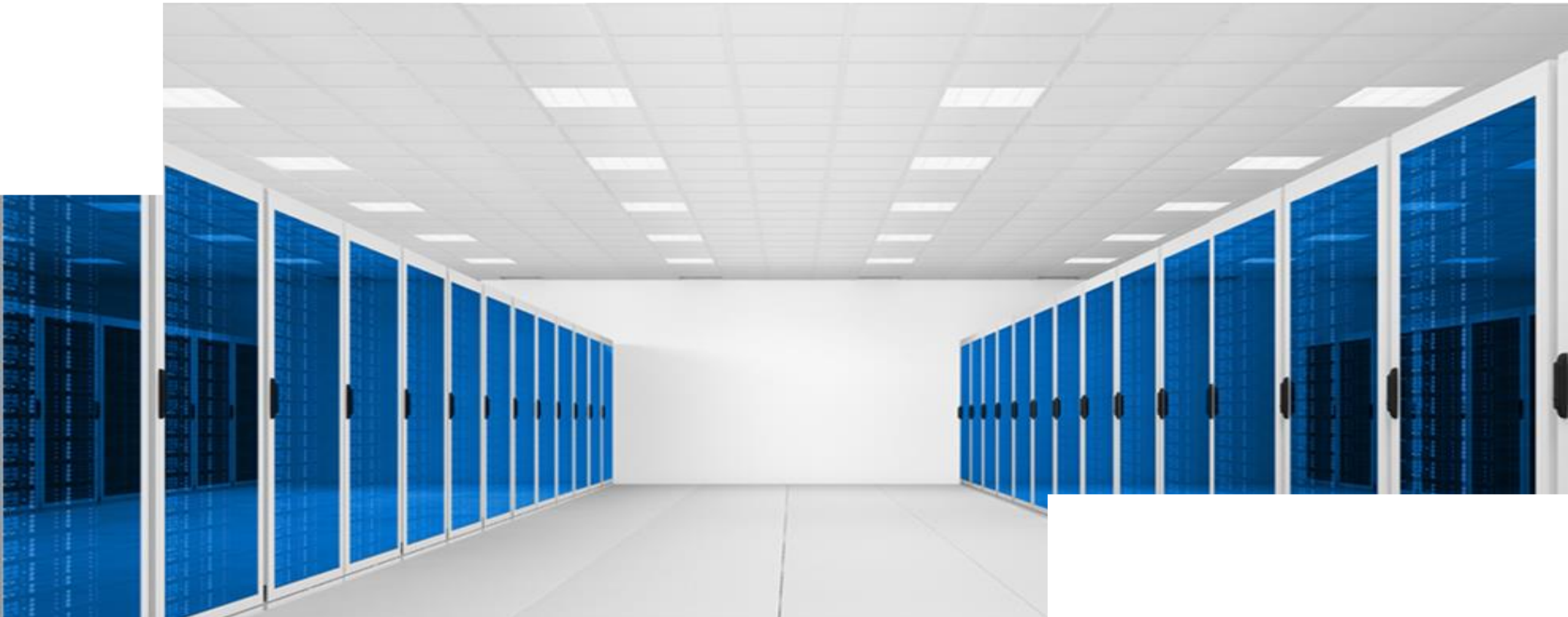
Note: Sourced from CS HOLT. Charts sorted by CFROI forecasts minus market implied CFROI. Companies shown are Communications Equipment focused companies. Data as of 12 December 2019.

**Industry Relative Valuation – Asset Growth:** The market expectations for asset growth (green dots) for EXTR, ANET and LITE are low relative to near-term forecasts (pink bars).



Note: Sourced from CS HOLT. Charts sorted by CFROI forecasts minus market implied CFROI (prior page). Companies shown are Communications Equipment focused companies. Data as of 12 November 2019.

# Appendix

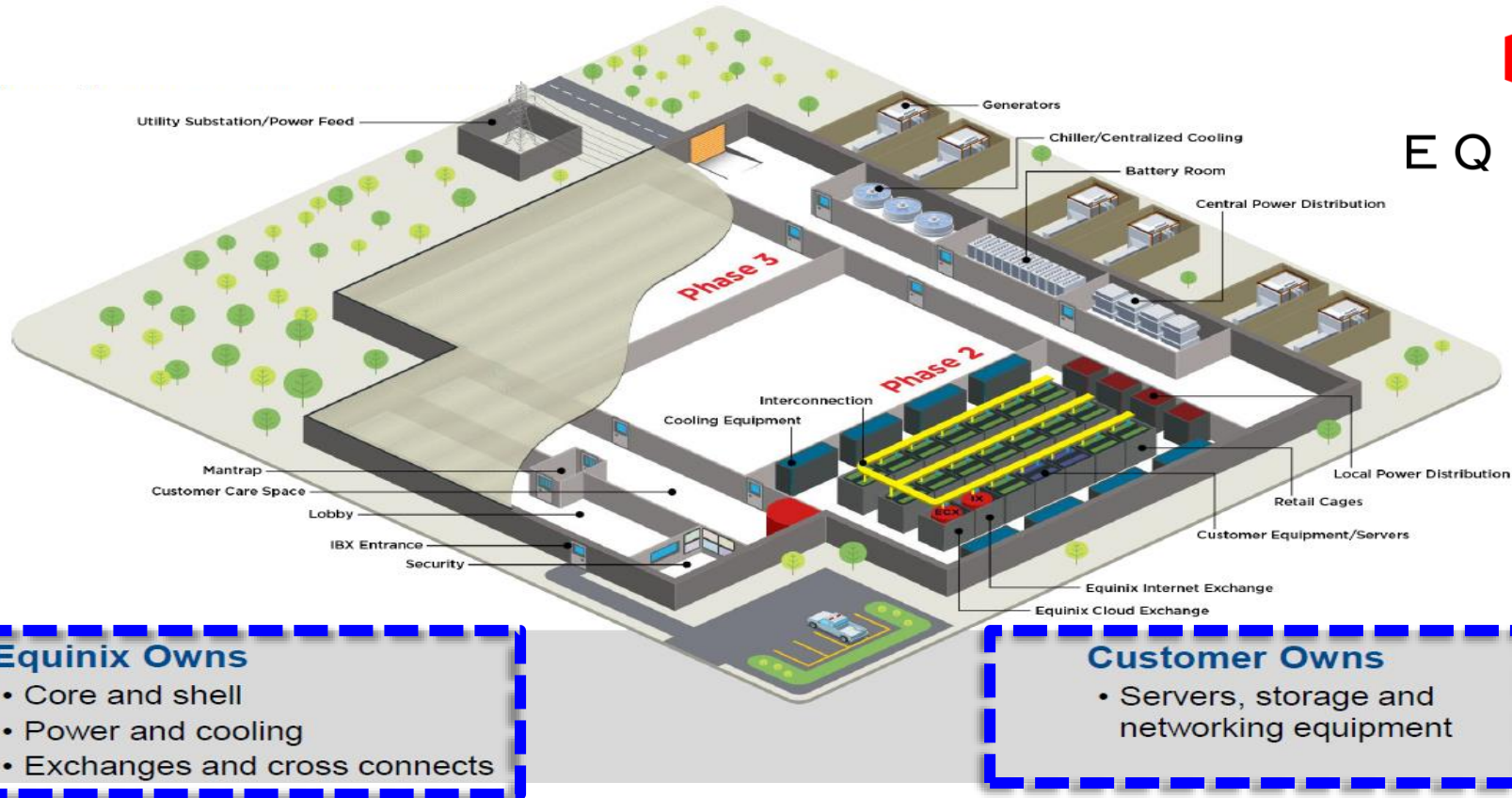


2020 Outlook -- The Cloud Has Four Walls

# What Is a Multi-Tenant Data Center?

## Equinix Data Centers At A Glance.

MTDCs are facilities that power, interconnect, and house I.T. hardware for multiple customers in a single data center facility, including multiple public cloud vendors, private cloud focused enterprises, Internet-connected content providers, and telecom networks. The business of leasing data center space, capacity, and power is referred to as “colocation.” Note: enterprise owned and cloud provider owned data centers are not multi-tenant, but single tenant facilities.



EQUINIX

Source: Equinix.

# Who are Multi-Tenant Data Center Customers and Competitors?

MTDCs lease their data center space, interconnectivity, and pass through the cost of electricity (power, cooling) to their customers, generating a profit.

## Digital Realty Example:



**Customers:** The largest customers include Public Cloud Service Providers, Network Providers, Communication Infrastructure providers, enterprises, and Internet hyper-scalers.

**Competitors:** Competitors include any company offering data center capacity, power, and interconnection services in a facility. As of FY2016, there were ~1,500 different MTDCs, globally.



TOP 20 CUSTOMERS							
Customer Rank	Customer	Locations	% of ABR <sup>(1)</sup>	Customer Rank	Customer	Locations	% of ABR <sup>(1)</sup>
1	IBM	24	7.7%	11	Fortune 50 Software Company	6	1.4%
2	CenturyLink	49	5.7%	12	AVAILABILITY SERVICES	9	1.4%
3	EQUINIX	20	3.3%	13	NTT Communications	14	1.3%
4	ORACLE	14	3.2%	14	TATA COMMUNICATIONS18		1.3%
5	LinkedIn	6	2.5%	15	rackspace	4	1.2%
6	at&t	46	2.4%	16	Hewlett Packard Enterprise	5	1.2%
7	facebook	9	2.2%	17	amazon	14	1.1%
8	JPMORGAN CHASE & CO.	16	1.9%	18	UBER	4	1.1%
9	Morgan Stanley	9	1.4%	19	NaviSite	2	1.1%
10	verizon	53	1.5%	20	Level(3)	72	0.9%
<b>Total Annualized Base Rent</b>							<b>43.7%</b>

Source: Digital Realty, I.H.S. Markit, Credit Suisse Research.



# Different Types of Data Center Facilities

## Enterprise Owned

### In-House Data Center

An in-house data center is a facility that is designed, built, and operated by an enterprise internally. This approach limits or omits involvement from a third party, wherein the business takes it upon themselves to provide the space, power, cooling and equipment necessary to sustain operations. In-house hosting typically requires a long term commitment and investment. They are more common among larger organizations and companies already in the tech industry, as an experienced technical support is necessary to maintain the complex architecture.







## Third-Party (MTDC) Leasing

### Wholesale Data Center

Wholesale providers lease space and power in larger capacities than a colocation model, and as such, typically house fewer customers per facility. The concept is similar to leasing a warehouse or office space in which the landlord provides facility maintenance to the tenant. In these facilities, private suites and large cages are standard. In some cases, a company may rent out an entire facility for its own dedicated use. These facilities offer more control over design space than a standard facility, but still require a large commitment in terms of energy use and overall expenses.

### Colocation Facilities

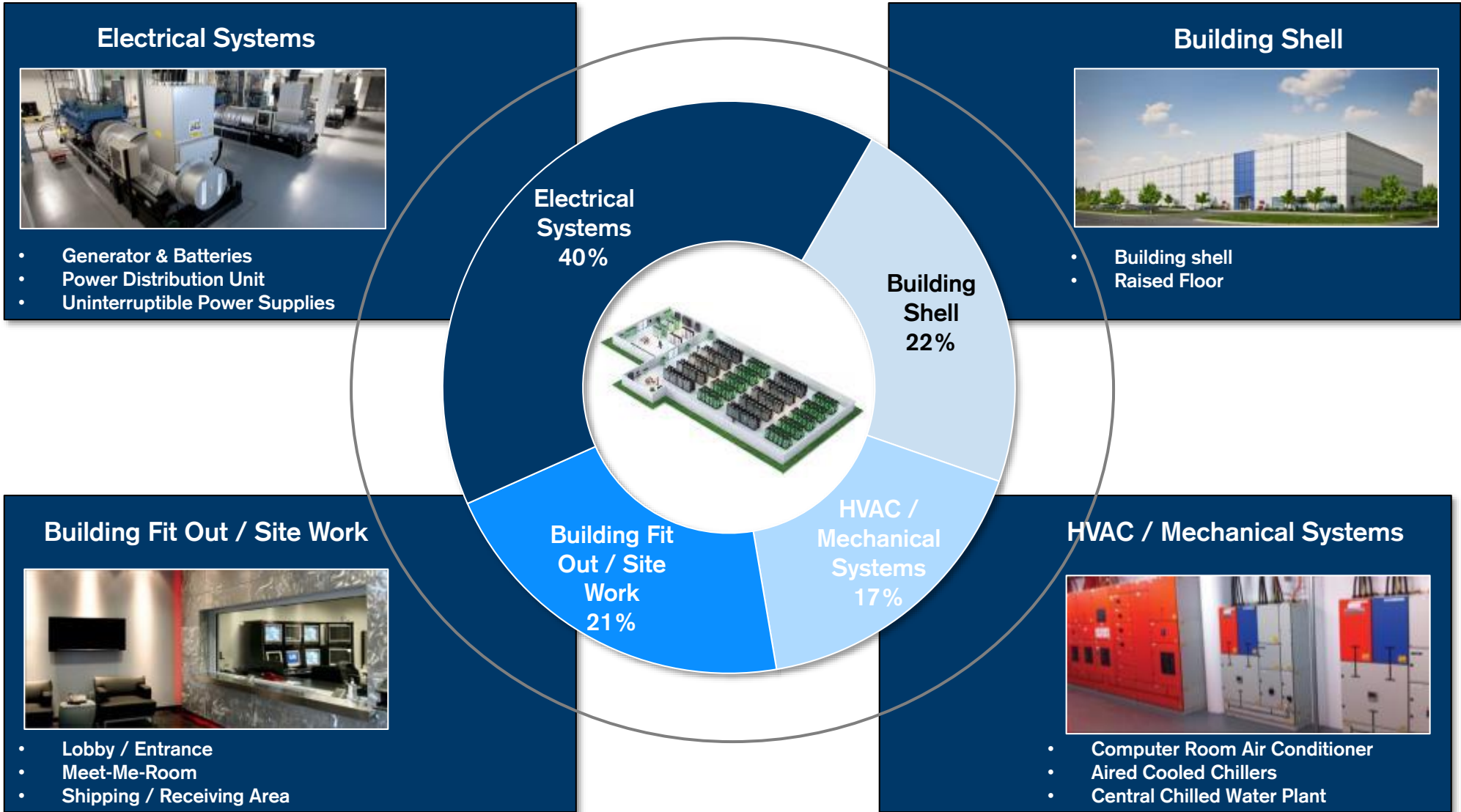
Colocation facilities are third party organizations that are multi-tenant accessible, meaning that multiple businesses of any size or industry may house their equipment within the data center. Customers are able to select from a variety of solutions to accommodate the specific requirements for their business. Companies of all types and sizes, from small- and medium-sized businesses to Fortune 500 firms, benefit from colocation services. Customers maintain control over their hardware, but outsource facility and internal systems maintenance to the provider.

Power Requirement per Tenant	300kW to 5+ MW	20 to 300kW
Avg. Contract Term	5 to 7 years	2 to 4 years
Mechanical Infrastructure Owned	Turn-Key = Yes / Powered Shell = No	Yes
Avg. Number of Customers/Location	1 to 10	50+
Owns Server Equipment	No	No
Interconnection Dense Environment	No	Yes
Choice of Network Service Providers	Limited	Many
Tenant Ability to Expand	Limited	Often
Service Level	Limited to None	Remote Hands Available
Sales Channels	Direct & Brokers	Mostly Direct
Property Ownership	Owned by Wholesale DC	Owned or Leased by Colocation DC
Example Logos	 	   

Source: Equinix, CyrusOne, ColoHouse, Credit Suisse Research.

# What Goes into Building a Data Center?

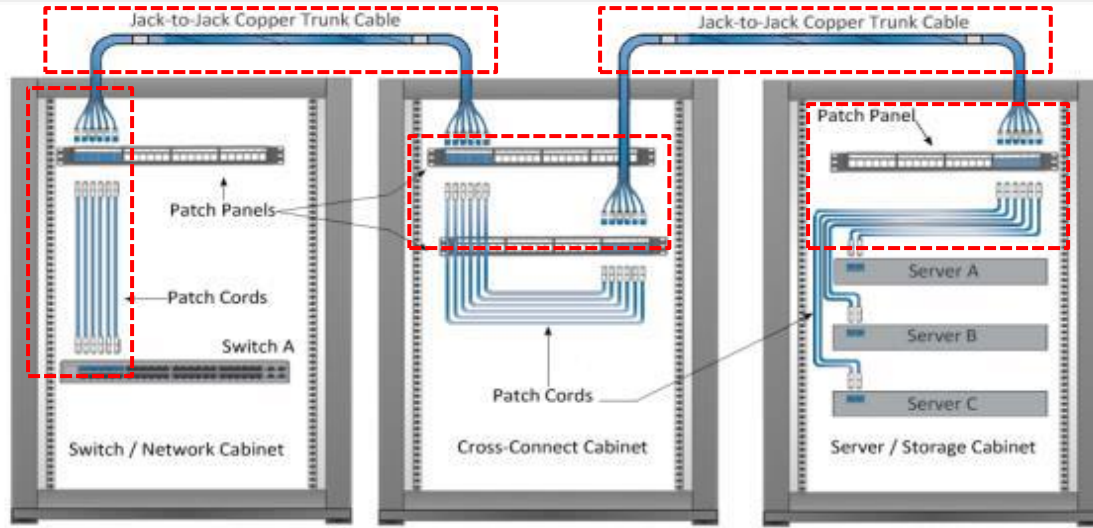
Data Center Facility Average Cost Distribution



Source: Digital Realty, Credit Suisse Research.

# MTDC Dynamics Are Strengthening – Led by Interconnection

## Cross Connections Can Be Connected to as Many Cabinets as Needed



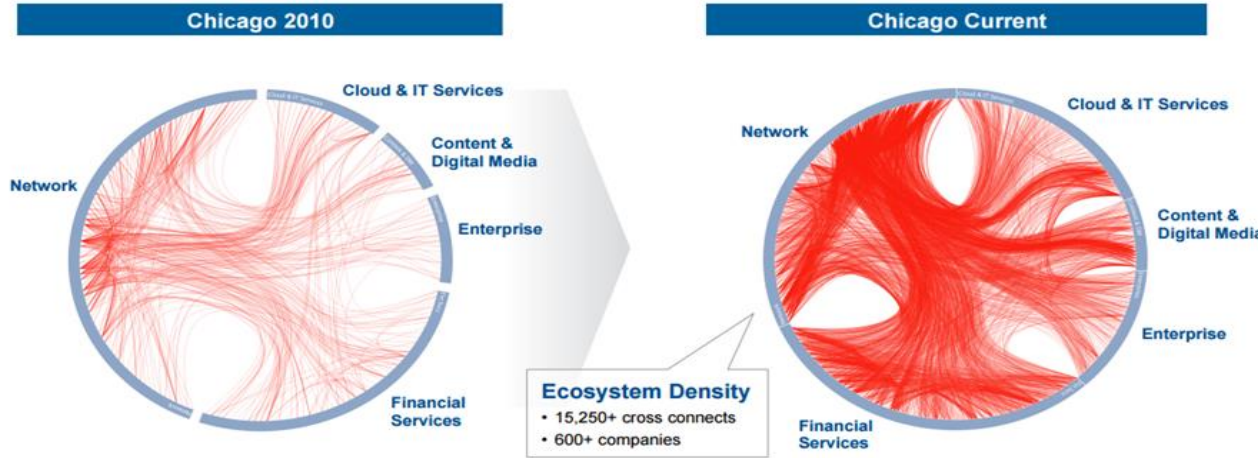
## What Are Interconnection and Cross-Connections-as-a-Service (CCaaS)?

Data center interconnection is a business involving connecting various tenants within the same MTDC to each other and charging a recurring fee per cross connect monthly. Cloud customers generally connect to numerous counterparts within the MTDC, such as their customers, whereas other types of customers, such as health care or oil & gas companies, have generally less cross connections.

## 5x Cross Connection Density over Five to Six Years in a Single International Business Exchange (IBX) Data Center.

Once a facility starts to fill up, interconnection density grows significantly, attracting more enterprises, clouds, content providers, and clouds of various types to be at the epicenter of data transmission, partly to achieve the lowest latencies.

## 5x Cross Connect Density over Five to Six Years of MTDC Operation



## Various Types of Cross Connects for Various Speeds and Latencies Are Offered by MTDCs.

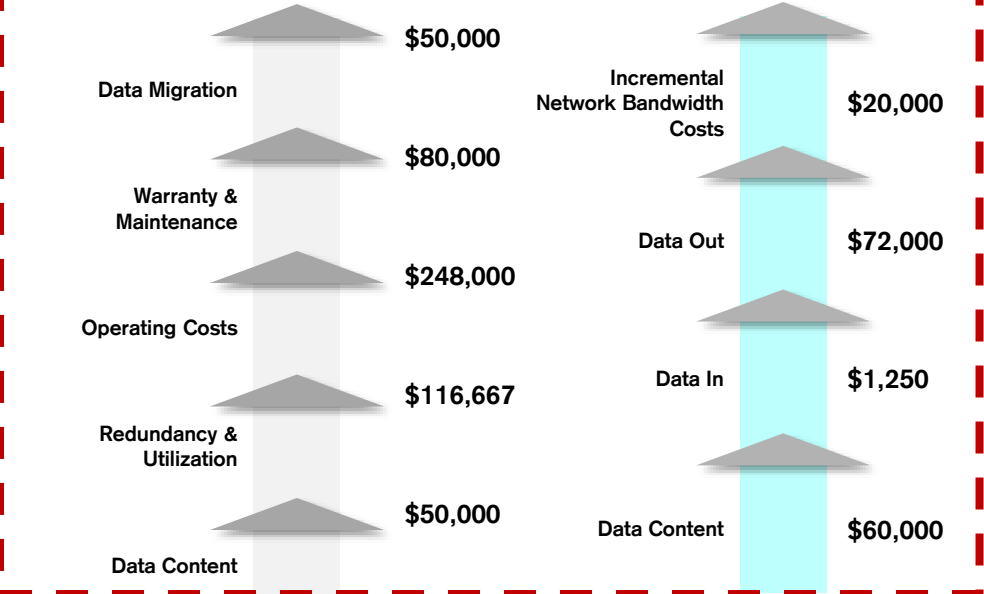
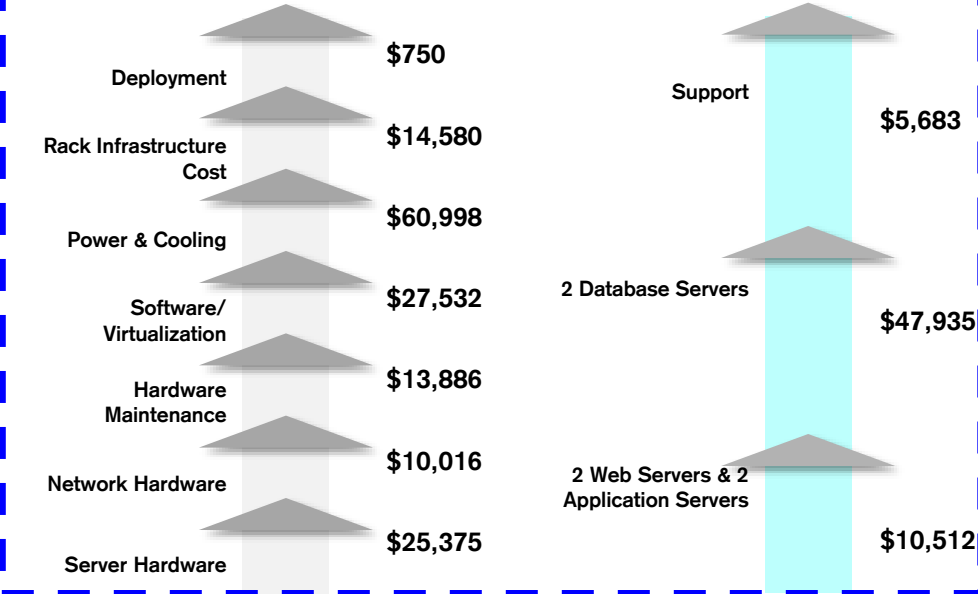
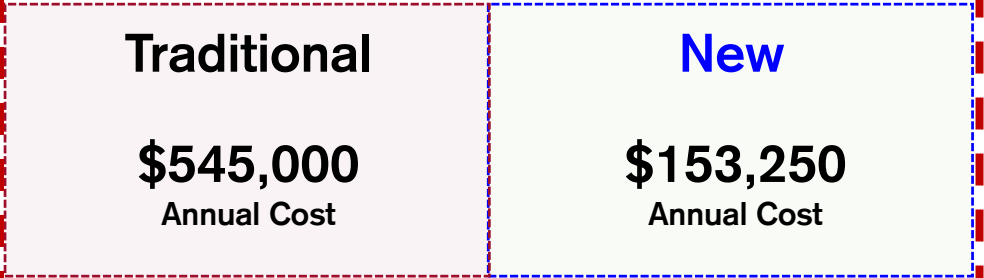
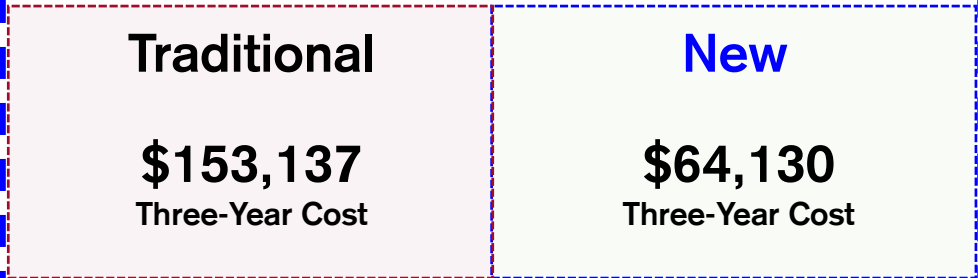
The cross connect services vary from vendor to vendor, including copper & fiber hardware cables and software & services products. Equinix’s cross connection platform is unquestionably the most complete and global in the MTDC industry, followed by Digital Realty’s offering through its recently acquired Telx assets and CyrusOne’s recent rollout of National IX.

Source: Equinix, Credit Suisse Research

# Clouds Are Materially More Economical Than Traditional IT

**Compute TCO Is ~60% Cheaper than Traditional Steady State Web Application Scenario**

**Cloud TCO Is ~70% Lower than Traditional Storage**

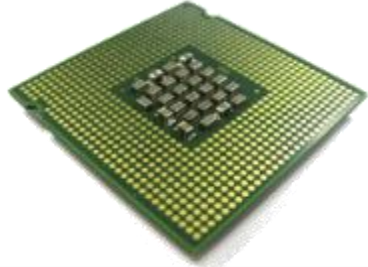


**Amazon Significantly Cheaper, Even in Steady-State Usage:** With respect to the use case of a web application that requires steady-state usage of six servers, Amazon’s AWS can be significantly cheaper than deploying resources on-premises. The TCO gap becomes even greater as usage exhibits “peaky” or unpredictable patterns.

Source: AWS TCO Calculator, Credit Suisse Research.

# Chip Processing Comparisons

*Flexibility*



## Central Processing Unit (CPU)

**A CPU is a general purpose processor**, it can in principle do any computation, but not necessarily in an optimal fashion for any given computation. They are used everywhere from smartphones to washing machines and also control input/output instruments of a PC. CPUs are the computer component that are responsible for interpreting and executing most of the commands from the computer's other hardware and software.

**Strengths:** CPUs are cheaper, easier to get, have customizable motherboards (with more RAM or other parts) and can blend anything.

**Weaknesses:** CPUs evolve slower. Different types, such as x86 and ARM are incompatible at the binary level and software needs to be optimized/recompiled (or rewritten) for each of type of CPU.

Source: Forbes, Geekboots, Quora, Credit Suisse Research



## Graphics Processing Unit (GPU)

**A GPU is a special purpose processor**, optimized for calculations commonly (and repeatedly) required for Computer Graphics, particularly single instruction, multiple data (SIMD) operations. GPUs have far more processor cores than CPUs, but because each GPU core runs significantly slower than a CPU core and do not have the features needed for modern operating systems, they are not appropriate for performing most of the processing in everyday computing. They are most suited to compute-intensive operations such as video processing and physics simulations.

**Strengths:** GPUs are much faster in graphics-related and massively parallel jobs.

**Weaknesses:** If a software contains very chaotic code flow, the GPU becomes even slower than the CPU. GPUs cannot drive themselves and need a CPU to be controlled.

*Processing Power*



## Tensor Processing Unit (TPU)

**A TPU is a custom purpose processor** developed specifically for machine learning and tailored for TensorFlow, Google's open-source machine learning framework. TPUs have been powering Google datacenters since 2015, however Google still uses CPUs and GPUs for other types of machine learning. TPUs are specialized to process neural network simulations. They only do this, therefore they are better at artificial intelligence (AI). So they are better at artificial intelligence. This is very advanced and used in AI related super computers/servers .

**Strengths:** TPUs are also very parallel while even more power efficient for their only job.

**Weaknesses:** TPUs are not easily found in local markets. They may be expensive and probably limited to work for only one operating system directly. TPUs have almost no flexibility when it comes to computing tasks, although they compute the one task they are assigned to well.

# Prior Industry Primers & Reports

- 1) [2020 Outlook – The Cloud Has Four Walls – Published December 20, 2018](#)
- 2) [2018 Data Center Outlook: The Cloud Has Four Walls – Published January 17, 2018](#)
- 3) [Comm. & Networking Equipment: Cloud Networking Fabrics to Proliferate – Published May 9, 2018](#)
- 4) [Data Center REITs Initiation: Enterprises Fueling the Next Colocation Boom – Published June 29, 2017](#)

Source: Credit Suisse Research.

# Investment Risks

We identify a number of investment risks in Data Center REITs ("the companies") including:

1. **Technological Disruption:** Currently, the market environment is pushing enterprises and I.T. customers to outsource and decentralize their I.T. operations (specifically workloads), and we acknowledge that this theme could flip, pushing companies back to insourcing their operations, decreasing demand for data center space.
2. **Data Center Space Demand & Supply:** Space and power pricing have led to significant increases and decreases in lease pricing per square foot, which we believe is a risk, given some I.T. infrastructure operators may decide to flood the market with capacity in a speculative fashion, depressing market prices and challenging a data center REIT's ability to deploy capital at the right returns on investment.
3. **Heavy Market Competition:** Currently, the market is favoring data center REITs for their expertise and ecosystems; however, expertise, general technology, and ecosystems are becoming critical table stakes to operate in the industry, increasing the competition and differentiation and inevitably compressing prices.
4. **Reliable Infrastructure:** Data center REITs generally operate in locations that have direct, or close proximity to, dark fiber for Internet connectivity. If these infrastructure connections break or are rendered obsolete, they will challenge data center REITs from a latency perspective, making them less attractive solutions for I.T. customers.
5. **Power Reliability and Cost:** Power costs are currently stable and declining; however, it is possible that costs may increase, driven primarily by rising interest rates, affecting margins and valuation for the data center REIT group.
6. **Macro and FX Risk:** The companies may generate revenues or underwrite leases denominated in non-U.S. currency, exposing themselves to non-U.S. headwinds such as currency fluctuations in the international markets.
7. **Political/Regulatory Risks:** Data sovereignty is a major issue across continental, regional, national, and state borders, making some data center operators completely irrelevant to certain types of businesses or entities, specifically government entities, or companies that are domiciled in strictly regulated countries.
8. **Rising Interest Rates:** The general interest rate environment is trending upward based on the Fed's reviews, and even though data center REITs are not as levered as other assets such as utilities, interest rates may still have an adverse effect on equity valuations.
9. **REIT Qualification Loss:** The companies must abide by several complex rules to qualify for their tax-free status including the distribution of 90%+ of REIT taxable income (before dividends) or risk being subject to statutory tax rates. Of the value of assets, 75% must be cash equivalents or real estate assets. Further, no more than 50% of a data center REIT's shares may be owned by less than five owners. This structure may prevent data center REITs from funding future opportunities. Dividends payable by REIT's generally are not eligible for the preferential tax rates on qualified dividend income, which could make data center REIT shares less attractive than normal corporations that pay dividends. The company's REIT structure gives it the ability to limit investor ownership above 9.8% of outstanding shares and prevent a change in control. The company also cannot merge unless 35%+ of holders of its common and long-term incentive units agree. Further, holders of preferred shares can convert their holdings into common stock during a change of control.

Source: Credit Suisse estimates, Company data

# IMPORTANT LEGAL INFORMATION

## HOLT Valuation Methodology and Risks

The HOLT methodology does not assign ratings or a target price to a security. It is an analytical tool that involves use of a set of proprietary quantitative algorithms and warranted value calculations, collectively called the HOLT valuation model, that are consistently applied to all the companies included in its database. The HOLT valuation model is a discounted cash flow model. Third-party data (including consensus earnings estimates) are systematically translated into a number of default variables and incorporated into the algorithms available in the HOLT valuation model. The source financial statement, pricing, and earnings data provided by outside data vendors are subject to quality control and may also be adjusted to more closely measure the underlying economics of firm performance. These adjustments provide consistency when analyzing a single company across time, or analyzing multiple companies across industries or national borders.

The default scenario that is produced by the HOLT valuation model establishes a warranted price that represents the expected mean value for a security based upon empirically derived fade algorithms that forecast a firm's future return on capital and growth rates over an extended period of time. As the third-party data are updated, the warranted price updates automatically. A company's future achieved return on capital or growth rate may differ from HOLT default forecast. Additional information about the HOLT methodology is available upon request.

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Past performance should not be taken as an indication or guarantee of future performance, and no representation or warranty, expressed or implied is made regarding future performance. Backtested, hypothetical or simulated performance results have inherent limitations. Simulated results are achieved by the retroactive application of a backtested model itself designed with the benefit of hindsight. The backtesting of performance differs from the actual account performance because the investment strategy may be adjusted at any time, for any reason and can continue to be changed until desired or better performance results are achieved. Alternative modeling techniques or assumptions might produce significantly different results and prove to be more appropriate. Past hypothetical backtest results are neither an indicator nor a guarantee of future returns. Actual results will vary from the analysis.

Investment principal on securities can be eroded depending on sale price or market price. In addition, there are securities on which investment principal may be eroded due to changes in redemption amounts. Care is required when investing in such instruments.

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The European Market Abuse Regulation requires that Investment Recommendations are identified and Credit Suisse policy is to ensure any recommended or suggested investment strategy is classified accordingly. For the Purposes of MAR, HOLT Investment Recommendations will have the following meanings:

Relative Buy : Applying the HOLT framework and valuation model, the stock shows upside potential on a relative basis.

Hold : Applying the HOLT framework and valuation model, the stock looks fairly valued on a relative basis.

Relative Sell : Applying the HOLT framework and valuation model, the stock shows downside potential on a relative basis.

For date and time of production, dissemination and history of recommendation for the subject company(ies) featured in this material, disseminated within the past 12 months, please refer to this link:

<https://rave.credit-suisse.com/disclosures/view/content/holt>.

Source: Credit Suisse HOLT.



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- Alibaba Group Holding Limited (9888.HK, HK\$202.6)
- Alphabet (GOOGL.OQ, \$1351.91)
- Amazon.com Inc. (AMZN.OQ, \$174.03)
- Arista Networks (ANET.N, \$200.02, NEUTRAL[V], TP \$153.0)
- Cable ONE (CABO.N, \$1469.16)
- CenturyLink (CTL.N, \$13.24)
- Charter Communications (CHTR.OQ, \$466.52)
- Cincinnati Bell (CSB.N, \$7.33)
- Cisco Systems (CSCO.OQ, \$46.64, NEUTRAL, TP \$46.0)
- Cogent Communications Holdings Inc. (CCOI.OQ, \$62.53)
- Comcast Corp. (CMCSA.OQ, \$43.19)
- CommScope Inc. (COMM.OQ, \$13.98, OUTPERFORM[V], TP \$21.0)
- Consolidated Com (CNLS.OQ, \$3.9)
- CoreSite Realty Corp. (COR.N, \$112.82, NEUTRAL, TP \$101.0)
- Crown Castle (CC.N, \$197.2)
- CyrusOne Inc. (CONE.OQ, \$64.16, NEUTRAL, TP \$70.0)
- Digital Realty Trust, Inc. (DLR.N, \$116.42)
- Dish Network (DISH.OQ, \$35.61) - \$229.42
- Equinix, Inc. (EQIX.OQ, \$565.45, OUTPERFORM, TP \$634.0)
- F5 Networks, Inc. (FFIV.OQ, \$140.35, OUTPERFORM, TP \$192.0)
- Facebook Inc. (FB.OQ, \$202.5)
- Fasly (FSL.Y.N, \$18.76)
- Frontier Commn (FTR.OQ, \$0.63)
- GTT Comms (GTT.N, \$10.58)
- Hewlett Packard Enterprise (HPE.N, \$15.91)
- International Business Machines (BM.N, \$134.41)
- Interxion Holding (INXN.N, \$81.8)
- Juniper Networks (JNPN.N, \$24.22, UNDERPERFORM, TP \$19.0)
- Libert (LBT.A.WA, #0.528)
- Limelight (LLNW.OQ, \$3.97)
- Megaport (MP.AX, \$519.91)
- Microsoft (MSFT.OQ, \$154.37)
- Motorola Solutions (MSLN, \$159.39, OUTPERFORM, TP \$178.0)
- Oracle Corporation (ORCL.N, \$53.39)
- Palo Alto Networks, Inc. (PANW.N, \$229.42)
- QTS Realty Trust, Inc. (QTS.N, \$51.65, NEUTRAL, TP \$52.0)
- Rackspace Hosting Inc. (RAX.N, \$16.16)
- SBA Comms (SBAC.OQ, \$233.898)
- Salesforce.com (CRM.N, \$161.48)
- ServiceNow, Inc. (NOW.N, \$277.45)
- Switch, Inc. (SWCH.N, \$14.62, OUTPERFORM[V], TP \$19.0)
- T-MOBILE (TMUS.OQ, \$76.31)
- Tencent Holdings (0700.HK, HK\$377.6)
- U.S. Cellular (USMN, \$34.74)
- Ubiquiti Networks (U.N, \$188.29, NEUTRAL, TP \$115.0)
- Uniti Group (UNIT.OQ, \$8.2)
- VMware Inc. (VMW.N, \$149.0)
- Verizon Communications (V.Z.N, \$60.86)
- WideOpenWest, Inc. (WOW.N, \$6.53)
- Windstream Hidg (WIN.OQ, \$19)
- Zayo Op (ZAYO.N, \$34.44)

CSCO.OQ	Closing Price	Target Price		
Date	(US\$)	(US\$)	Rating	
16-Feb-17	33.60	27.00	U	
27-Apr-17	33.75	40.00	O	
15-Aug-17	32.09		NC	
09-May-18	46.04	41.00	N *	
16-Aug-18	45.16	43.00		
15-Nov-18	46.77	44.00		
14-Feb-19	48.40	47.00		
16-May-19	55.93	52.00		
14-Aug-19	50.61	50.00		
05-Nov-19	47.76	49.00		
14-Nov-19	44.91	46.00		



\* Asterisk signifies initiation or assumption of coverage.  
Effective July 3, 2016, NC denotes termination of coverage.

3-Year Price and Rating History for CommScope Inc. (COMM.OQ)

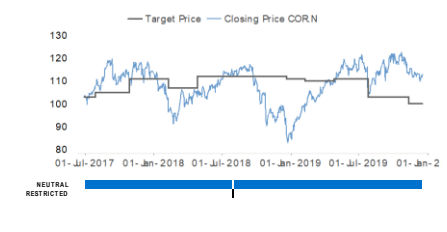
COMM.OQ	Closing Price	Target Price		
Date	(US\$)	(US\$)	Rating	
15-Feb-17	38.98	45.00	O	
04-Aug-17	32.61	37.00		
15-Aug-17	32.84		NC	
09-May-18	29.58	31.00	N *	
20-Dec-18	16.05	20.00		
02-Apr-19	22.83	34.00	O	
10-May-19	19.09	30.00		
23-Jul-19	14.61	27.00		
08-Aug-19	12.95	23.00		
04-Dec-19	13.01	21.00		



\* Asterisk signifies initiation or assumption of coverage.  
Effective July 3, 2016, NC denotes termination of coverage.

3-Year Price and Rating History for CoreSite Realty Corp. (COR.N)

COR.N	Closing Price	Target Price		
Date	(US\$)	(US\$)	Rating	
29-Jun-17	102.95	103.00	N *	
28-Jul-17	107.92	105.00		
27-Oct-17	110.53	111.00		
08-Feb-18	96.37	107.00		
27-Apr-18	106.00	112.00	R	
30-Jul-18	113.03			
03-Aug-18	114.30	112.00	N	
20-Dec-18	87.00	111.00		
08-Feb-19	100.02	110.00		
26-Apr-19	109.49	111.00		
26-Jul-19	105.18	103.00		
11-Nov-19	113.83	100.00		



\* Asterisk signifies initiation or assumption of coverage.

## Disclosure Appendix

### Analyst Certification

I, Sami Badri, certify that (1) the views expressed in this report accurately reflect my personal views about all of the subject companies and securities and (2) no part of my compensation was, is or will be directly or indirectly related to the specific recommendations or views expressed in this report.

3-Year Price and Rating History for Arista Networks (ANET.N)

ANET.N	Closing Price	Target Price		
Date	(US\$)	(US\$)	Rating	
17-Feb-17	119.06	125.00	O	
08-Mar-17	123.53	140.00		
27-Apr-17	139.65	140.00	N	
04-Aug-17	172.05	160.00		
15-Aug-17	170.59		NC	
09-May-18	259.42	303.00	O *	
03-Aug-18	257.54	305.00		
04-Oct-18	257.74	311.00		
02-Nov-18	257.77	315.00		
15-Feb-19	263.95	317.00		
25-Apr-19	318.11	347.00		
03-May-19	278.41	344.00		
07-Jun-19	246.44	340.00		
02-Aug-19	244.12	312.00		
01-Nov-19	185.30	144.00	N	



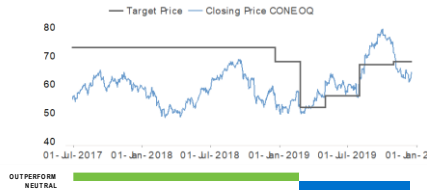
\* Asterisk signifies initiation or assumption of coverage.  
Effective July 3, 2016, NC denotes termination of coverage.



### 3-Year Price and Rating History for CyrusOne Inc. (CONE.OQ)

CONE.OQ	Closing Price (US\$)	Target Price (US\$)	Rating
29-Jun-17	54.90	73.00	O *
20-Dec-18	54.85	68.00	
25-Feb-19	51.64	52.00	N
03-May-19	61.11	56.00	
02-Aug-19	63.02	67.00	
01-Nov-19	71.11	68.00	

\* Asterisk signifies initiation or assumption of coverage.



### 3-Year Price and Rating History for Equinix, Inc. (EQIX.OQ)

EQIX.OQ	Closing Price (US\$)	Target Price (US\$)	Rating
29-Jun-17	421.28	510.00	O *
02-Nov-17	488.68	515.00	
17-Jan-18	441.90	524.00	
15-Feb-18	407.31	519.00	
27-Apr-18	421.15	525.00	
09-Aug-18	444.99	520.00	
02-Nov-18	392.43	500.00	
20-Dec-18	358.21	467.00	
14-Feb-19	420.59	474.00	
02-May-19	465.01	506.00	
11-Jul-19	523.88	556.00	
09-Oct-19	575.00	581.00	

\* Asterisk signifies initiation or assumption of coverage.

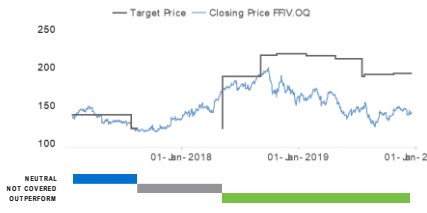


### 3-Year Price and Rating History for F5 Networks, Inc. (FFIV.OQ)

FFIV.OQ	Closing Price (US\$)	Target Price (US\$)	Rating
26-Jan-17	133.72	138.00	N
27-Jul-17	119.02	120.00	
15-Aug-17	118.56		NC
09-May-18	172.00	188.00	O *
05-Sep-18	189.72	216.00	
25-Oct-18	171.47	218.00	
24-Jan-19	156.09	215.00	
25-Apr-19	162.47	211.00	
18-Jul-19	145.59	188.00	
25-Jul-19	147.69	191.00	
24-Oct-19	145.94	192.00	

\* Asterisk signifies initiation or assumption of coverage.

Effective July 3, 2016, NC denotes termination of coverage.



### 3-Year Price and Rating History for Juniper Networks (JNPR.N)

JNPR.N	Closing Price (US\$)	Target Price (US\$)	Rating
27-Jan-17	26.67	31.00	O
15-Aug-17	27.53		NC
09-May-18	26.17	21.00	U *
30-Jan-19	25.83	20.00	

\* Asterisk signifies initiation or assumption of coverage.

Effective July 3, 2016, NC denotes termination of coverage.



### 3-Year Price and Rating History for Motorola Solutions (MSI.N)

MSI.N	Closing Price (US\$)	Target Price (US\$)	Rating
03-Feb-17	81.60	90.00	O
05-May-17	84.44	95.00	
04-Aug-17	90.37	99.00	
15-Aug-17	87.92		NC
09-May-18	105.78	129.00	O *
20-Aug-18	124.99	137.00	
08-Jan-19	119.51	134.00	
08-Feb-19	135.37	148.00	
03-May-19	143.62	153.00	
02-Aug-19	170.08	189.00	
31-Oct-19	166.32	179.00	
11-Nov-19	161.15	177.00	

\* Asterisk signifies initiation or assumption of coverage.

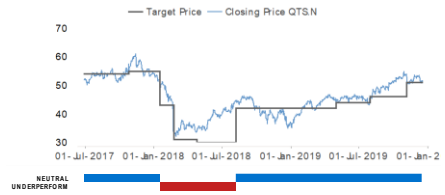
Effective July 3, 2016, NC denotes termination of coverage.



### 3-Year Price and Rating History for QTS Realty Trust, Inc. (QTS.N)

QTS.N	Closing Price (US\$)	Target Price (US\$)	Rating
29-Jun-17	52.01	54.00	N *
26-Oct-17	55.35	55.00	
17-Jan-18	50.00	43.00	U
23-Feb-18	33.37	31.00	
26-Apr-18	34.50	30.00	
08-Aug-18	44.34	42.00	N
02-May-19	44.34	44.00	
31-Jul-19	46.28	46.00	
06-Nov-19	53.17	51.00	

\* Asterisk signifies initiation or assumption of coverage.



### 3-Year Price and Rating History for Switch, Inc. (SWCH.N)

SWCH.N	Closing Price (US\$)	Target Price (US\$)	Rating
31-Oct-17	19.13	22.00	O *
16-May-18	13.20	19.00	
14-Aug-18	10.85	14.00	
07-Aug-19	13.75	15.00	
09-Oct-19	15.51	18.00	
11-Nov-19	15.57	19.00	

\* Asterisk signifies initiation or assumption of coverage.



### 3-Year Price and Rating History for Ubiquiti Networks (UI.N)

UI.N	Closing Price (US\$)	Target Price (US\$)	Rating
10-Feb-17	53.43	44.00	U
04-Aug-17	65.13	54.00	
15-Aug-17	65.96		NC
09-May-18	73.35	74.00	N *
11-May-18	81.72	73.00	
27-Aug-18	85.04	79.00	
12-Nov-18	105.96	86.00	
08-Feb-19	124.53	103.00	
13-May-19	130.95	115.00	

\* Asterisk signifies initiation or assumption of coverage.

Effective July 3, 2016, NC denotes termination of coverage.



As of December 10, 2012 Analysts' stock rating are defined as follows:

**Outperform (O)** : The stock's total return is expected to outperform the relevant benchmark\* over the next 12 months.

**Neutral (N)** : The stock's total return is expected to be in line with the relevant benchmark\* over the next 12 months.

**Underperform (U)** : The stock's total return is expected to underperform the relevant benchmark\* over the next 12 months.

*\*Relevant benchmark by region: As of 10th December 2012, Japanese ratings are based on a stock's total return relative to the analysts' coverage universe which consists of all companies covered by the analyst within the relevant sector, with Outperforms representing the most attractive, Neutrals the less attractive, and Underperforms the least attractive investment opportunities. As of 2nd October 2012, U.S. and Canadian as well as European (excluding Turkey) ratings are based on a stock's total return relative to the analyst's coverage universe which consists of all companies covered by the analyst within the relevant sector, with Outperforms representing the most attractive, Neutrals the less attractive, and Underperforms the least attractive investment opportunities. For Latin America, Turkey and Asia (excluding Japan and Australia), stock ratings are based on a stock's total return relative to the average total return of the relevant country or regional benchmark (India - S&P BSE Sensex Index); prior to 2nd October 2012 U.S. and Canadian ratings were based on (1) a stock's absolute total return potential to its current share price and (2) the relative attractiveness of a stock's total return potential within an analyst's coverage universe. For Australian and New Zealand stocks, the expected total return (ETR) calculation includes 12-month rolling dividend yield; An Outperform rating is assigned where an ETR is greater than or equal to 7.5%, Underperform where an ETR less than or equal to 5%. A Neutral may be assigned where the ETR is between -5% and 15%. The overlapping rating range allows analysts to assign a rating that puts ETR in the context of associated risks. Prior to 18 May 2015, ETR ranges for Outperform and Underperform ratings did not overlap with Neutral thresholds between 15% and 7.5%, which was in operation from 7 July 2011.*

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**Overweight** : The analyst's expectation for the sector's fundamentals and/or valuation is favorable over the next 12 months.

**Market Weight** : The analyst's expectation for the sector's fundamentals and/or valuation is neutral over the next 12 months.

**Underweight** : The analyst's expectation for the sector's fundamentals and/or valuation is cautious over the next 12 months.

*\*An analyst's coverage sector consists of all companies covered by the analyst within the relevant sector. An analyst may cover multiple sectors.*

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Rating	Versus universe (%)	Of which banking clients (%)
Outperform/Buy*	47%	(32% banking clients)
Neutral/Hold*	38%	(26% banking clients)
Underperform/Sell*	13%	(22% banking clients)
Restricted	2%	

*\*For purposes of the NYSE and FINRA ratings distribution disclosure requirements, our stock ratings of Outperform, Neutral, and Underperform most closely correspond to Buy, Hold, and Sell, respectively; however, the meanings are not the same, as our stock ratings are determined on a relative basis. (Please refer to definitions above.) An investor's decision to buy or sell a security should be based on investment objectives, current holdings, and other individual factors.*

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The analyst(s) responsible for preparing this research report received compensation that is based upon various factors including Credit Suisse's total revenues, a portion of which are generated by Credit Suisse's investment banking activities

#### Target Price and Rating

Valuation Methodology and Risks: (12 months) for Arista Networks (ANET.N)

**Method:** Our \$153 target price and Neutral rating for ANET are based on 15.0x our FY20 EPS estimate of \$10.20. We rate ANET Neutral as we are cautious on its performance and see its risks potentially materializing in the near future.

**Risk:** Risks to our \$153 Target Price and Neutral Rating for ANET are 1) Customer concentration could cause quarterly fluctuations in sales, 2) cloud targets may add to GM volatility, 3) increased competition in switching market pressuring market share, and 4) increase in competition from private companies

#### Target Price and Rating

Valuation Methodology and Risks: (12 months) for Cisco Systems (CSCO.OQ)

**Method:** Our Target Price of \$46 and Neutral rating for CSCO are based on a 13.5x P/E multiple on our 2021 Non-GAAP EPS estimate of \$3.44. We rate CSCO Neutral as we expect it to perform in line with its peers.

**Risk:** Risks to our \$46 target price and Neutral rating for CSCO are a weaker than expected macroeconomic recovery, failure to repatriate off-shore cash, and a faster than anticipated SDN development.

#### Target Price and Rating

Valuation Methodology and Risks: (12 months) for CommScope Inc. (COMM.OQ)

**Method:** Our \$21 target price and Outperform rating for CommScope are derived from our 2021 EPS estimate of \$2.25 multiplied by 9.5x. We rate CommScope Outperform as we expect it to appreciate more than its peers.

**Risk:** We see three risks to CommScope's achievement of our \$21 target price and Outperform rating. 1) If wireless capex spending completely shifts away from equipment spend and becomes focused on other aspects of the telecom infrastructure the company will likely not experience the revenue growth that we currently forecast. 2) Intensified competition for data center facility business may grow, impacting our growth projections of the company. 3) Net leverage and lack of recurring revenues raise some concerns as interest rates and commodity prices (copper mainly) may potentially rise on a relative basis, eroding business segment margins.

#### Target Price and Rating

Valuation Methodology and Risks: (12 months) for CoreSite Realty Corp. (COR.N)

**Method:** Our \$101 target price and Neutral rating for CoreSite is based on an 19.0x P/FY3 FFO multiple on our 2021 FFO per share estimate of \$5.32.

**Risk:** Risks to our \$101 target price and Neutral rating for CoreSite are 1) changes in I.T. architecture displacing CoreSite's technology and real estate, 2) speculative data center developments that may compress market pricing and impact CoreSite's margins and profits, 3) economic risk associated with a slowdown in overall I.T. spending, 4) regulatory risks associated with changes in data sovereignty laws, requiring companies to own and manage their own data centers rather than leasing from multi-tenant data centers, and 5) REIT qualification risk where the company must abide by numerous complex rules to qualify for its tax free status.

#### Target Price and Rating

Valuation Methodology and Risks: (12 months) for CyrusOne Inc. (CONE.OQ)

**Method:** We value CyrusOne at a \$70 target price, arriving to a Neutral rating, based on 18.0x our 2021 P/AFFOS estimate of \$3.89.

**Risk:** We identify five major risks to our \$70 target price and Neutral rating, including: 1) change in I.T. architecture displacing CyrusOne's technology, 2) speculative data center developments that may compress market pricing and impact CyrusOne's profits, 3) macro-economic risk associated with a slowdown in overall I.T. spending, 4) regulatory risks associated with changes in data sovereignty laws, requiring companies to own and manage their own data centers rather than leasing from CyrusOne, and 5) REIT qualification risk where the company must abide by several complex rules to qualify for its tax free status including the distribution of 90%+ of REIT taxable income (before dividends) or risk being subject to statutory tax rates.

#### Target Price and Rating

Valuation Methodology and Risks: (12 months) for Equinix, Inc. (EQIX.OQ)

**Method:** Our Outperform rating and Target Price of \$634 for Equinix are based on 23.0x our 2020E AFFO per share estimate of \$27.55. We rate Equinix Outperform as we expect its total return to exceed its peers.

**Risk:** Risks to our \$634 target price and Outperform rating for Equinix are 1) changes in I.T. architecture displacing Equinix's technology and real estate, 2) speculative data center developments that may compress market pricing and impact Equinix's margins and profits, 3) economic risk associated with a slowdown in overall I.T. spending, 4) regulatory risks associated with changes in data sovereignty laws, requiring companies to own and manage their own data centers rather than leasing from multi-tenant data centers, and 5) REIT qualification risk where the company must abide by numerous complex rules to qualify for its tax free status.

#### Target Price and Rating

Valuation Methodology and Risks: (12 months) for F5 Networks, Inc. (FFIV.OQ)

**Method:** Our \$192 target price and Outperform rating for FFIV are based on a 50-50 weighting of 15.0x our 2021 Non-GAAP EPS estimate of \$11.08 and our proprietary HOLT Discounted Cash Flow analysis with a 2.1% Long-Term Revenue Growth rate and 37% GAAP EBITDA Margin.

**Risk:** Risks to our \$192 target price and Outperform for FFIV are 1) the transition to virtual appliances and the resulting compression in economics; 2) SDN incorporating "good enough" F5 ADC functionality; 3) transition to DevOps and converged infrastructures, eroding traditional F5 buying centers; and 4) security initiatives failing to garner market traction.

#### Target Price and Rating

Valuation Methodology and Risks: (12 months) for Juniper Networks (JNPR.N)

**Method:** We value the company at \$19 per share and an Underperform rating based on an average of P/E multiple of 12.0x on our 2021E EPS of \$1.70 and our proprietary HOLT Discounted Cash Flow analysis with a 3.6% Long-Term Revenue Growth rate and 18.5% GAAP EBITDA Margin.

**Risk:** The investment risks to our \$19 target price and Underperform include technological disruption in the scenario new technologies arise making JNPR's products/ services necessary. Buybacks and dividends may also drive upwards pressure on the stock.

Target Price and Rating  
Valuation Methodology and Risks: (12 months) for Motorola Solutions (MSI.N)

**Method:** Our \$178 target price and Outperform rating for MSI are based on 18.5x our 2021 Non-GAAP EPS estimate of \$9.60.

**Risk:** Risks to our \$178 target price and Outperform rating for MSI are i) Macroeconomics risks, particularly U.S. exposure, ii) exposure to the U.S. government's spending trends, iii) Risk of a large acquisition, and iv) disruptive technology. While we believe Motorola is currently well-positioned in the solutions they provide on current standards and technologies, we acknowledge the possibility of new standards and technologies having a negative impact on the demand for the company's current product portfolio.

Target Price and Rating  
Valuation Methodology and Risks: (12 months) for QTS Realty Trust, Inc. (QTS.N)

**Method:** We apply a P/AFFO multiple of 18.5x to our 2021 AFFO per share estimate of \$2.81 leading us to our \$52 target price and Neutral rating.

**Risk:** The largest risks to our \$52 target price and Neutral rating include technological disruption, market competition, rising interest rates, and REIT qualification loss.

Target Price and Rating  
Valuation Methodology and Risks: (12 months) for Switch, Inc. (SWCH.N)

**Method:** Our \$19 target price and Outperform rating based on our discounted cash flow model with a WACC of 6.9% and a terminal growth rate of 2.8%.

**Risk:** Risks to our Outperform rating and \$19 target price for Switch are: 1) changes in I.T. architecture displacing Switch technology, 2) speculative data center developments that may compress market pricing and impact profits, 3) revenue concentration, 4) management and board structure, and 5) share ownership control.

Target Price and Rating  
Valuation Methodology and Risks: (12 months) for Ubiquiti Networks (UI.N)

**Method:** Our target price of \$115 for UBNT is derived from a blended average of a P/E multiple and our proprietary HOLT DCF analysis. We rate the stock Neutral, as margin pressure continues, and we anticipate a return less than the typical stock in our coverage.

**Risk:** Risks to our \$115 target price and Neutral rating on UBNT are uncertainty in revenue growth and profitability, uncertain market conditions in SP and Enterprise end markets which could affect the revenue growth rates, and margin profile effects as the company pursues various pricing strategies.

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