DATA CENTERS ARE PART OF COMMUNICATIONS INFRASTRUCTURE
What Is Communications Infrastructure?

- **What Is Communications Infrastructure?**
  - The idea that macro towers, data centers, optical fiber, and small cells/DAS represent one asset class whose singular purpose is the enablement of communications, and in so doing have developed business models very similar to one another, and in many cases more similar to the real estate industry than the telecom services industry.

- **Key attributes**
  - Unit pricing increases over time (typically with an escalator)
  - Long-term contracts
  - High contribution margin

- **Think like a real estate company**
  - Dark fiber, colocation, towers, land rights all qualify as REIT assets by the IRS
  - Return-oriented decision making
  - Value of AFFO as a metric

- **Scale matters**
  - Supply chain mgmt. (i.e. cost to build)
  - Geographic diversity
  - Relatively low cost of capital

Source: Cowen and Company
“The Edge” Is The Next Frontier

- Creating new opportunities
  - Fiber routes
  - Small cells
  - Data centers (more locations/smaller footprint per location)

- Where the end-users of digital services reside
  - Compute/storage needs to occur closer to them
  - Tier II/III markets
  - Where wireless infrastructure meets wireline infrastructure

Source: Cowen and Company
Strong Sector Performance

Communications Infrastructure Index: 5-Year Performance
(Indexed to 100 on 01/31/2014)

Comm. Infra. Index Stocks: AMT, COR, CCI, CONE, DLR, EQIX, INXN, UNIT, QTS, SBAC, SWCH, ZAYO

Data Center Index Stocks: COR, CONE, DLR, EQIX, INXN, QTS, SWCH

Source: Thomson Reuters
Strong Sector Performance

Communications Infrastructure Index vs. Data Center Index: 5-Year Performance
(Indexed to 100 on 01/31/2014)

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Source: Thomson Reuters
Mixed Sector Performance

Communications Infrastructure Index: 1-Year Performance
(Indexed to 100 on 02/01/2018)

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Source: Thomson Reuters
Strong Multiple Expansion

Communications Infrastructure Index
FTM EV/EBITDA Multiple

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Source: Thomson Reuters
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Source: Thomson Reuters
Strong Secular Tailwinds

Hyper-Scale Providers (HSPs)
• Building their own networks
• Increasing use of third-party colocation

Enterprises
• Increasing adoption of cloud services
• Increasing dependency on bandwidth

Wireless
• Increasing focus on small cells/5G
• Company-specific network projects

Source: Cowen and Company
THE INDUSTRY BY THE NUMBERS
Outsourced Infrastructure Global Forecast

<table>
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<tr>
<th>Year</th>
<th>Hyperscale</th>
<th>Retail</th>
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Source: Structure Research
Total Infrastructure Forecast

2017

- Hyperscale/Cloud: $30.8 (6%)
- Managed Infrastructure: $41.2 (9%)
- Colocation: $38.7 (8%)
- On-Premise: $369.1 (77%)

2022

- Hyperscale/Cloud: $224.4 (34%)
- Managed Infrastructure: $75.9 (11%)
- Colocation: $82.4 (12%)
- On-Premise: $285.6 (43%)

Source: Structure Research
Historical Bookings

Data Center Annualized Revenue Leased per Quarter in $MM

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DLR = DLR + DFT
Source: Company announcements and Cowen and Company
Notable Data Center M&A The Last Two Years

*Includes booked but not billed leases
Source: Company announcements and Cowen and Company
M&A Trends

1. Deal activity appears to remain high

2. Assets considered strategic are selling at relatively high multiples

3. Increasing focus on global assets by U.S.-based companies

4. Increasing focus on managed services (by a select group of providers)

5. The number and type of investors interested in the space is increasing

Source: Company announcements and Cowen and Company
TRENDS TO BE THINKING ABOUT
Hyper-Scale Demand: What’s Next?

Providers

- Today: Aligned Energy, Cloud HQ, CyrusOne, Digital Realty, EdgeConneX, Raging Wire, Vantage
- Tomorrow: Compass, EdgeCore, QTS, Sabey, SDC, Stack Infrastructure, Stream, Switch, T5 (Cologix, Equinix, Flexential)

U.S. Markets

- Today: Northern California, Northern Virginia, Phoenix/Mesa, San Antonio, Pac NW
- Tomorrow: Atlanta, Chicago, Dallas, Las Vegas/Reno

Customers

- Today: Alibaba, AAPL, CRM, FB, GOOG, MSFT, NFLX, ORCL, Tencent, Uber
- Tomorrow: 2nd tier SaaS companies, XYZ virtual reality companies, select enterprise companies

Deal Size

- Today: FB – 24 MW w/ DLR; MSFT – 30 MW w/ CONE; AAPL – 45 MW w/ SDC
- Tomorrow: 350 MW ??? (in 2022)
Cloud On-Ramps By The Numbers

Market Share of Global Cloud On-Ramps by 3rd Party DC Provider

Equinix, 41%
Rackspace, 13%
CyrusOne, 5%
CoreSite, 5%
Digital Realty, 5%
Interxion, 4%
Global Switch, 3%
Cologix, 2%
NEXTDC, 2%
Other, 20%

Market Share of Global Cloud On-Ramps by CSP

AWS, 28.5%
Alibaba Cloud, 5.9%
Google Cloud, 19.7%
IBM Cloud, 14.3%
Oracle Cloud, 3.8%
Rackspace, 9.0%
VMware, 3.3%

Source: Cloudscene
The Reawakening of Managed Services

Today: 77% on premise, 6% public cloud, 17% managed/colo

Long-term: 10% on premise, 60% public cloud, 30% managed/colo

- MSP + Colo: Cyxtera, DataBank, Flexential, TierPoint, Rackspace
- MSP: Ensono, Faction, Hosting, LogicWorks, Reliam

What do you want to do

- Cloud migration/onboarding
- Managed Cloud (ex: Application/platform mgmt., DevOps Automation)
- Managed security/compliance
- Private Cloud
- Professional services/strategy/consulting

What don’t you want to do

- Simple retail colocation
- Simple managed

Source: Structure Research, Company announcements, and Cowen and Company
5G Is What Will Ultimately Drive the True “Edge”

Three key attributes of 5G

- Enhanced Mobile Broadband
- Massive Machine Type Communications
- Ultra-Reliable/Low-Latency Communications

Identifying the business model is the issue

- 2G gave us email
- 3G gave us the Internet
- 4G gave us apps (video, ride sharing, delivery services, dating apps)

Role of Cloud

- 5G first G built with cloud in mind
- Low latency solutions will require data be computed/stored closer to end-user devices
- Create interesting partnerships/M&A

Timing

- Late 2017 certain EMB aspects released
- Release 15 in March 2019 (EMB/New Radio/fixed wireless focused)
- Release 16 in June 2020 (MMTC/UR/LL mobile focused)

Source: Company announcements and Cowen and Company
5G Will Require a New Type of Network Topology

Macro Sites vs. Non-Macro Outdoor Sites (in Thousands)

- Macro Sites
- Non-Macro Outdoor Sites

Source: Atlantic-ACM
Notable Research

- Takeaways from Metro Connect: Three Thought Provoking Topics (February 12, 2019)
- Takeaways from PTC: The Secret’s Out (January 29, 2019)
- Top 10 Potential Surprises for 2019 (January 2, 2019)
- GDS - Takeaways from NDR: Fundamental Outlook Remains Positive (December 7, 2018)
- Conviction List – Post 3Q18 Update (November 23, 2018)
- Takeaways from The NAREIT Investor Forum (November 13, 2018)
- Data Center Sell-Off Appears Exaggerated (October 26, 2018)
- Data Centers: An Industry Overview + CowenVision Video (October 12, 2018)
- DLR - Digital to Buy Ascenty: Growing Rapidly, Paying Handsomely (September 24, 2018)
- COR – Downgrade: We Expect Lack of Capacity To Again Limit Growth in 2019 (September 24, 2018)
- DLR – Takeaways from Investor Meeting: Demand Momentum Continues (September 17, 2018)
- GDS – Initiation: A Way to Invest in Rapid Hyper-Scale/Cloud Adoption in China (September 10, 2018)
- Takeaways from Communications Infra. Summit; Company Presentations (August 13, 2018)
- Takeaways from Communications Infra. Summit; Megaport Keynote (August 10, 2018)
- EQIX – Takeaways from Analyst Day; Pressing Its Scale Advantage (June 21, 2018)
- INXN – Takeaways from NDR; Ready and Loaded (June 15, 2018)
- Cowen TMT Conference: Comm. Infra. and Telecom Services Takeaways (June 1, 2018)
- DLR – Takeaways from HQ Visit; Strong Demand Expected to Continue (April 6, 2018)
- EQIX – Takeaways from HQ Visit; Shifting the Narrative (April 6, 2018)
- COR – Takeaways from HQ Visit; Positioning for Reacceleration in Growth (March 19, 2018)
- Bookings Data Point – Salesforce.com (March 6, 2018)
- CONE: Takeaways from Investor Meeting; One Quarter Doesn’t Make a Trend (March 5, 2018)
- SWCH – Initiation: Previous Success Will Likely Be Difficult To Replicate (January 19, 2018)
- DLR – Takeaways from Analyst Day; Bigger, Better, Faster (December 6, 2017)
- INXN – Upgrading to Outperform; Momentum Continues to Build (August 2, 2017)