

## Rising Clouds, Falling Networks: The Cloud Integrated Network

Recent advances in Software Defined Network (“SDN”) and Network Virtualization drive migration to a Cloud Integrated Network (“CIN”)

Technology advances and business case validation in Software Defined Networks and Network Function Virtualization (“NFV”), coupled with the ever-growing demand for secure computing, big data analytics, low latency and high bandwidth will continue to alter the network ecosystem.

Value is shifting within the network ecosystem. The new architecture separating the control plane from the data plane allows new entrants to design and provide functionality that was previously possible only from network service providers.

As SDN and NFV open standards are finalized, established cloud operators and other software vendors will be positioned to offer network service functionality to the enterprise. A shift in value will occur as enterprises move away from spending on hardware and network to data center and cloud services.

**Cloud operators like Amazon Web Services, Microsoft (Azure), IBM and Google potentially will cannibalize services that once were the exclusive domain of telecommunications service providers.**

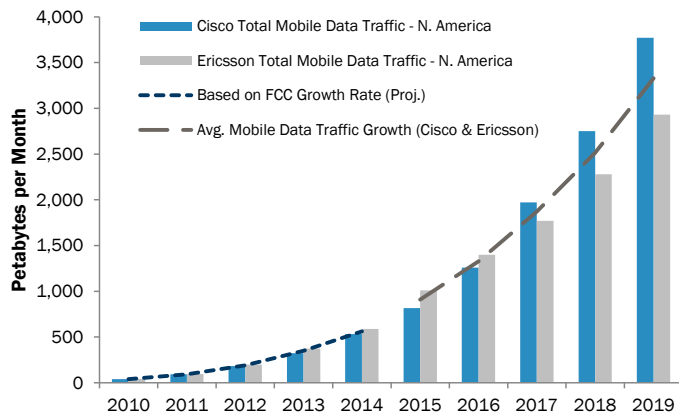


**The confluence of user habits and technology innovation are the impetus for change**

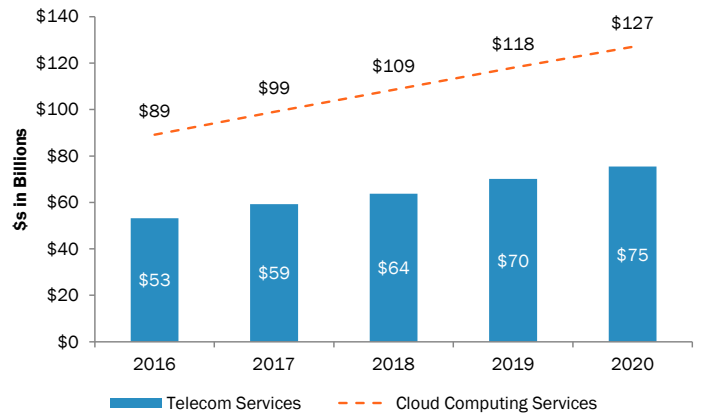
Unprecedented use of technology by enterprises and consumers is setting the foundation for this change. Changing behaviors in how technology is deployed and consumed will require participants in the network ecosystem to rethink their value propositions to capitalize on this shift.

- Mobile traffic is expected to increase to 3.3 million petabytes per month, a 3.7x increase from 2015 (see Exhibit 1).
- Users are demanding anytime/anywhere access to applications, and expect responsiveness, security and reliability. Workloads are shifting from traditional data centers to cloud computing centers as enterprise confidence in the public cloud increases and the economics prove compelling (see Exhibit 2).
- The majority of network subscribers will be machines. This is driving the need for access to and storage of large quantities of unstructured data, processing and analytics.
- Functions that were previously performed only by specifically designed hardware are now available on commodity “white box” hardware. Software will drive services — not hardware.

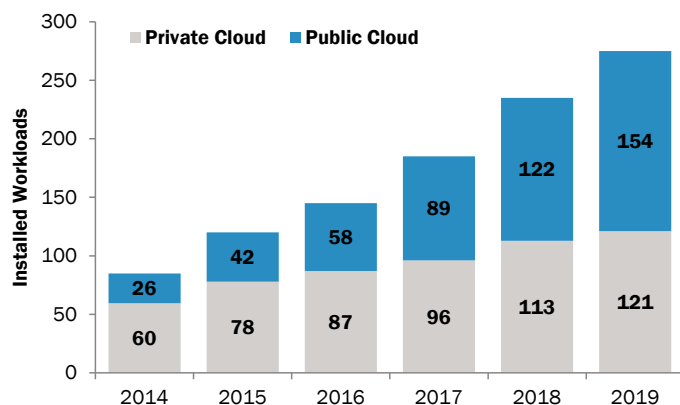
**EXHIBIT 1**  
**Projected / Measured North American Mobile Data Traffic (2010 – 2019)<sup>1</sup>**



**EXHIBIT 3**  
**Forecasted Cloud Growth Vs. Telecom Services Growth<sup>3</sup>**



**EXHIBIT 2**  
**Growth In Public And Private Cloud<sup>2</sup>**  
 Public Cloud, 44% CAGR & Private Cloud, 16% CAGR



**There are certain early indicators that FTI Consulting believes have started to show the impact of these trends**

- Enterprise IT spend is increasingly directed toward cloud services relative to network services.
- Revenue trajectory for advanced telecommunications services is starting to plateau and flatten (see Exhibit 3).
- Public cloud spend is starting to exceed private cloud spend in advance of the inflection point in installed workloads (see Exhibit 2).
- Most, if not all, large telecommunications carriers are virtualizing certain network elements. At the same time, cloud providers are developing their own network virtualization and SDN capabilities to expose to the enterprise.



**There are five key changes that will materially impact the network ecosystem**

**Key Change #1 | The traditional wide area network (“WAN”) will be fundamentally altered and its wide-scale adoption will decline**

The cloud will provide the primary network functions for the enterprise via SDN; a virtualized WAN will become the de facto standard for enterprises. Enterprises will be able to order Layer 2 services to connect securely to their cloud provider of choice. With the separation of the control and data planes via SDN, cloud providers will provide location neutral virtualized connectivity on demand.

**Key Change #2 | Increasing intelligence at the network edge**

Internet of Things (“IoT”) and machine to machine (“M2M”) devices with limited computing abilities will continue to proliferate. Access to data, storage, computational power, high bandwidth and low latency connectivity will be required. This will drive the need for intelligence to the edge of the network, closer to the user.

**Key Change #3 | Security needs will change as network connections will be treated as untrusted and inherently unsecure**

With the increase in the number of devices (IoT, mobile, M2M), traditional perimeter based security will be inadequate. Future security needs will require management of secure and unsecure endpoints, each accessing enterprise data. This will drive the need for encryption, secure application-level connections and other forms of security separate from the network.

<sup>1</sup> CTIA Mobile Data Demand: Growth Forecasts Met

<sup>2</sup> Cisco Global Cloud Index: Forecast and Methodology, 2014-2019 White Paper

<sup>3</sup> TIA's 2016-2020 ICT Market Review and Forecast (Telecom Services includes: Business Metro Ethernet Services, Leased Circuits, Network Virtualization Technologies, Intelligent Transport Services and IP VPN)

## Key Change #4 | Last mile access will be diverse and ubiquitous

Last mile access has traditionally been the principal strategic advantage for incumbent carriers. This is changing as more companies build out fiber in key metro areas or are willing to build on demand. DOCSIS 3.1 is enabling cable providers to deliver symmetrical gigabit speeds. Implementation of wireless 5G (fixed first, then mobile) will enable these same speeds.

## Key Change #5 | Cloud providers will significantly marginalize and commoditize network services

Cloud providers have been building their own SDN stack and, increasingly, network functions such as switching, routing, load balancing and DDoS protection. These services are offered as application programming interfaces (“APIs”) that enterprises can select a la carte based on need. The pricing framework offered by cloud providers for these incremental services is competitive and bundled as part of the offering in certain cases.

## The impacts of Cloud Integrated Network providers on the current value chain

There are a number of participants in the network ecosystem who will be impacted by the migration to Cloud Integrated Network providers. This will shift value from current providers to new entrants in the evolving ecosystem. As shown in Exhibit 4, ecosystem suppliers other than telecom carriers are well positioned to provide certain value chain elements.

EXHIBIT 4  
Addressing The Network Ecosystem<sup>4</sup>

**SDN, NFV, Public Cloud, Distributed Cloud and access will be elements of the value chain critical in a Cloud Integrated Network.**

Value Chain Elements	Telecom Carriers	Large Cloud Operators	Equipment Companies	Virtualization Companies	Pure-Play SDN
Network Equipment		<----- n/a ----->	■	●	●
Central Office	■		<----- n/a ----->	●	●
Traditional Network	■	●	●	●	●
Last Mile Access	■	●	●	●	●
SDN	●	■	■	●	■
NFV	●	■	■	■	●
Public Cloud	●	■	●	●	●
Distributed Cloud	●	●	●	●	●

■ Current Capability  
● Supplier Barrier to Entry: ○ Low ● High

FTI Consulting’s primary research done with chief information officers (“CIOs”) indicates that enterprises will begin adopting SDN and virtualized services en masse within the next two to three years. This blurring of lines between the network and the cloud, along with the expected timeline for enterprise adoption provides runway for public cloud providers. With this runway, public cloud providers will refine and aggressively compete to provide a broader solution that includes network functionality.

<sup>4</sup> FTI Primary Research and Analysis

<sup>5</sup> Internet as a Service, Platform as a Service

## How will suppliers to the network ecosystem be impacted?

**Telecommunications service providers** will be challenged by non-traditional competitors for higher margin Layer 3 services such as IP VPN / MPLS. Network functions historically managed with purpose-built hardware and specialized expertise will be managed via open source SDN and user intuitive management portals. This suggests margins on such services will compress. There is opportunity in the new ecosystem for telecommunications providers that strategically align with the right cloud partner. Doing so will enable them to offset revenue loss through wholesale offerings packaged by cloud operators. This new ecosystem is a tectonic shift for telecom service providers but high volumes at lower margins should still be available. Organizational readiness and training will be critical for successfully managing this change.

**Data center operators** with traditional colocation and managed services offerings will need to compete with much more cost effective virtualized services (e.g., IaaS, PaaS)<sup>5</sup>. Space and power as valued features will be marginalized. Operators with infrastructure to support cloud computing at the edge will capitalize on the criticality of a distributed cloud infrastructure. Cloud proximity to the customer becomes a strategic imperative.

**Equipment manufacturers** reliant on providing purpose-built hardware will suffer without an open flow solution. The CIN will be driven by white box systems capable of initiating any number of functions based on demand. Virtualization standards are developing more quickly than SDN standards. This presents a threat to original equipment manufacturer (“OEM”) top line as that technology replaces purpose-built solutions.

**Cloud providers** have been developing SDN and NFV capabilities in their own data centers for a decade in order to efficiently manage enormous amounts of data. Cloud companies are now extending those capabilities as enterprise services (e.g., Google Andromeda and MS Azure), sometimes for free or at an advantageous price point. Current trends favor cloud providers and they could potentially become the largest piece of the network services value chain.

The network value chain will be re-shaped. SDN and NFV deployments will be integral to participate in the CIN ecosystem and will drive down internal costs for telecommunications service providers.



## What are the key questions and considerations that need to be addressed to sustain or capitalize on migration to Cloud Integrated Networks?

Here are a few key questions that should be considered based on FTI Consulting's experience in the telecommunications, technology, data center and cloud sectors:

- Does our current strategy adequately account for the technological trends driving change in our sector?
- Based on value chain positioning, at what pace should current revenue streams be cannibalized in favor of new revenue from CIN-related services?
- Is organizational readiness in place to drive more agile operating environments within the CIN ecosystem?
- What is the appropriate build vs. buy strategy to participate in the CIN ecosystem?
- Does my current network infrastructure or product portfolio provide a strategic advantage in the CIN ecosystem?

The entire value chain will be impacted by these technology trends resulting in tectonic shifts in the competitive landscape. Understanding those impacts and positioning strategically and operationally should be a key focus for all participants in the Cloud Integrated Network ecosystem.

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