

# *MOVING TELECOM TO A WEB-SCALE PLATFORM*

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**The Future of Scalable Software-defined  
Access (SD-Access)**

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# OUTLINE AND KEY FINDINGS

## Introduction

Why service providers see the need to build a flexible access platform that can manage billions of users who want more bandwidth and services on demand.

## Digital Apps Drive The Bandwidth Boom

How the insatiable demand for digital applications, social media and video platforms has put more pressure on access networks than ever before – and how they will respond.

## From Pipelines to Platforms: Engineering for Success

“Platform” businesses have displaced “pipeline” businesses with their inherently scalable nature. The service provider industry needs to emulate this model by building access as a platform.

## Requirements for the SD-Access Platform

Emerging cloud architectures and standards will form the foundation of flexible, programmable, and open access networks that will help deliver SD-Access to the service provider community.

## How to Find ROI for SD-Access

Cloud providers have already presented a clear path for return on investment (ROI) on Software-Defined Networking (SDN) and Network Function Virtualization (NFV) technologies. SD-Access will deliver similar returns by reducing operational expenses (OPEX) with automated orchestration and improved service velocity.

## Conclusion: Enabling an SD-Access Platform for Growth

Top reasons why service providers need to build an SD-Access platform model for deploying new services.

## Solution Highlight: What is ADTRAN Mosaic?

A quick overview of the ADTRAN Mosaic Cloud Platform as a version of an SD-Access platform.

## Introduction

The telecommunications market is undergoing the most rapid shift in technology in its history as infrastructure migrates to a software-defined, programmable model that was pioneered by the leading cloud providers. How the leading telecommunications companies engineer and execute this transition will define their business success or failure for the next decade.

SDN and NFV technologies could, in theory, be used to create exciting new business models. Their flexibility and openness enable more integration with adjacent software technologies and a wider range of hardware, but will they be used for this? Or, will service providers retreat to their conservative and plodding mantra of, “We will launch no service before its time.”

Nowhere will this be more important than in the access network, the tendrils of bandwidth that connect the core of the network to the end user, where important consumer and business applications are accessed.

To succeed, service providers need to adopt the open platform model of the cloud – where the value of the software and applications is far more important than the actual network connection itself. Open and flexible technologies, such as SDN and NFV, were pioneered by Web-scale cloud providers like Amazon, Google, and Netflix, who needed to respond faster to rapidly scaling customer demands. By building open ecosystems, they were able to create compelling applications that drew users to their platforms.

This has created major dilemmas for service providers looking to upgrade their infrastructures to take advantage of growing markets. Service providers must continually upgrade their networks to provide for their customers, but at the same time, the management of the infrastructure consumes so many resources that they continue to struggle at the “plumbing” level, rather than inventing new value-added services.

Next-generation access networks could be the linchpin to transform this business model. Access networks were built over many decades on a patchwork of incompatible legacy technologies to deploy services such as circuit-switched voice, Ethernet, MPLS, mobile data, and broadband Internet. But imagine the jump to the telco cloud model of NFV, service providers could instead build an open platform that could accommodate the rapid deployment of access services, without requiring a new hardware architecture every step of the way.

SD-Access will be a key element in building a new platform for customers. This requires an integrated software platform that can adapt to quickly changing infrastructure needs – and integrate with a variety of access media.

## Digital Apps Drive the Bandwidth Boom

So, why do carriers need to rethink how they buildout access networks and services? Why do they need an SD-Access platform? The answer is that they need a more flexible and scalable way to respond to demand for more bandwidth and services – and to manage these services while lowering OPEX.

The demand for bandwidth is insatiable, and it is increasing daily with the never-ending onslaught of bandwidth-hungry apps like Netflix, Facebook, Snapchat, and NextCo.

One only needs to look at the history of Netflix, the over-the-top (OTT) video company, to see how fast new digital services grab market share and grow. Remember that the telecommunications industry scoffed at early incarnations of Netflix, which now literally rules the Internet – accounting for up to 40 percent of all Internet bandwidth consumption on fixed networks, according to some estimates.

*“It’s a little bit like, is the Albanian army going to take over the world?”*

*-- Jeffrey Bewkes, the CEO of Time Warner, quoted in the New York Times when asked about the competitive threat of Netflix, 2012.*

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On mobile networks, the story is similar, with Facebook and YouTube ruling the roost regarding consumption, as data provided by Sandvine shows below (2H 2016 data).

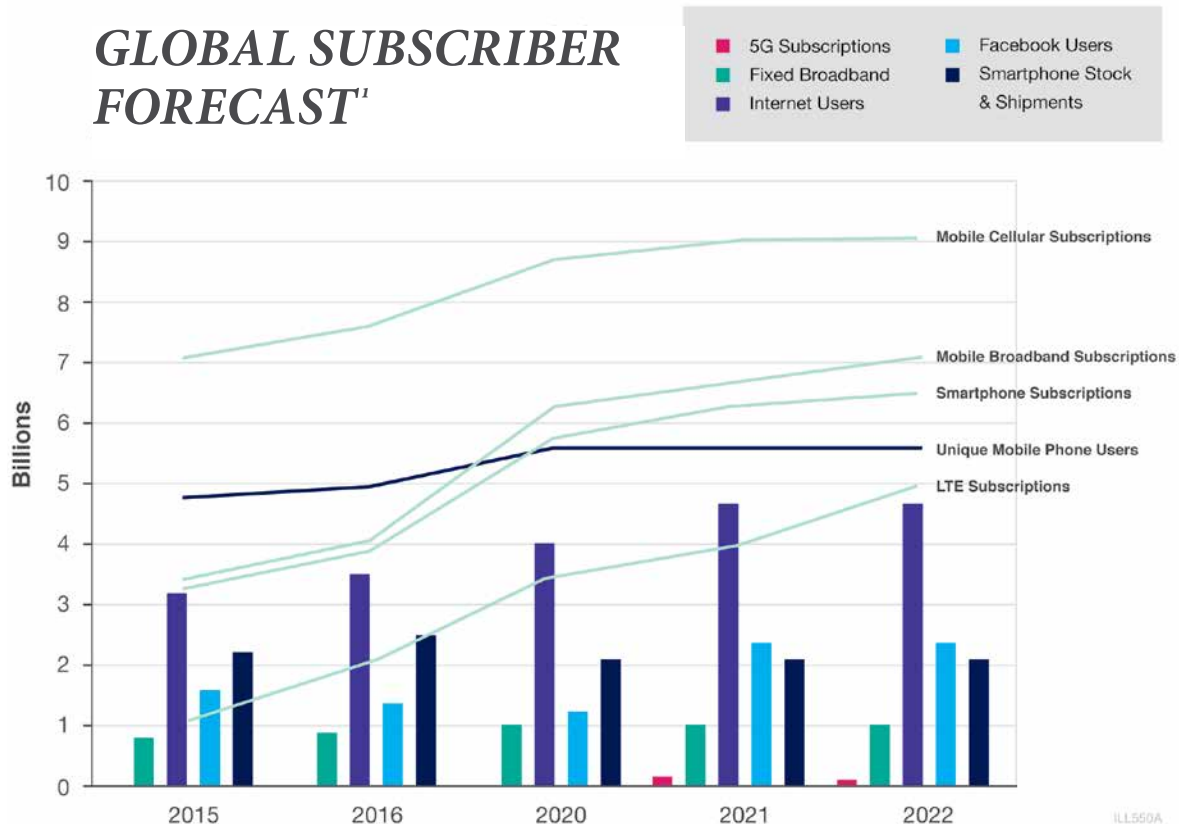
## TOP 10 PEAK PERIOD APPLICATIONS

	Upstream		Downstream		Aggregate	
Rank	Application	Share	Application	Share	Application	Share
1	Facebook	19.09%	Youtube	20.78%	YouTube	19.59%
2	SSL - OTHER	11.40%	Facebook	15.96%	Facebook	16.35%
3	Google Cloud	10.46%	HTTP	10.75%	HTTP	10.69%
4	HTTP	10.33%	SSL - OTHER	7.29%	SSL - OTHER	7.81%
5	YouTube	5.50%	MPEG - OTHER	4.54%	Google	4.33%
6	BitTorrent	3.25%	Snapchat	4.33%	Snapchat	4.11%
7	Snapchat	2.75%	Pandora Radio	4.30%	MPEG - OTHER	4.09%
8	Instagram	2.25%	Instagram	4.02%	Pandora Radio	3.95%
9	Pandora Radio	1.54%	Netflix	3.44%	Instagram	3.79%
10	Skype	1.03%	Google	3.33%	Netflix	3.22%
		<b>67.60%</b>		<b>78.72%</b>		<b>77.94%</b>

Regardless of which application is consuming the most bandwidth, the point is that there is more demand for bandwidth than ever, driven by end-user applications in the cloud. Demand for bandwidth is likely to increase incessantly – and the communications industry needs more flexible and programmable access systems to accommodate faster upgrades and more flexible access bandwidth to deliver new services.

Of course, bandwidth to the consumer must be in place to enable the use of applications. This is where service providers play such an important role. High-bandwidth technologies have enabled these applications. The success of digital media and social apps is a source of great consternation for service providers, who are constantly pressured to keep up by maintaining expensive “plumbing.” If they don’t increase the scale of this plumbing and decrease the costs; they will fail.

## GLOBAL SUBSCRIBER FORECAST<sup>1</sup>



With the pace of innovation and bandwidth-consuming apps ever increasing, bandwidth deployment will be stretched to keep up. The next generation of technologies is coming, which promises more growth in digital applications and its related business effect. The speed and capacity of passive optical networks continue to increase steadily, helping promote quality of experience (QoE) for new services and applications (see graph above).

Access networks will need to grow to accommodate this demand. Of course, there is a wide range of technologies coming. The graph above, based on information from the ITU provides a summary of many broadband technologies and applications and how they will accompany the growth of Internet applications.

To support the growth of advanced broadband technologies and services the access network must be adapted to be more open and flexible. This will also enable increased service velocity and programmability. Gone are the days when we could manually build out a network for each new broadband service – the network needs to be future-proofed so that it can be upgraded and programmed on demand.

<sup>1</sup> Source: <http://broadbandcommission.org/Documents/reports/bb-annualreport2016.pdf>; pg 22

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## From Pipelines to Platforms: Engineering for Success

As new access technologies and digital applications proliferate, service providers are moving to cloud architectures to respond. This represents a major shift in decades of thinking, where services were rolled out in discrete silos. These technology silos are a result of decades of evolution of the “pipeline” model, where service providers introduced one service at a time. Here’s a voice network! Here’s a cable network! Here’s 3G mobile!

Then the cloud explosion came. With digital services growing daily and access network bandwidth demand scaling proportionately, service providers have realized they cannot keep up – and that the pipeline model no longer scales. One of the largest barriers to supporting growth is hardware in the access network, which often requires manual configuration or installation.

The best way to think of this is that service providers want to build a software platform that gives the user more power to access bandwidth, resources, and digital services faster. They want to move from the pipeline model to the platform model.

The dilemma of pipelines vs. platforms has been described by authors Marshall W. Van Alstyne, Geoffrey G. Parker, and Sangeet Paul Choudary in the book, “Platform Revolution,” as well as in a recent article in the Harvard Business Review (HBR), titled, “Pipelines, Platforms, and the New Rules of Strategy.”

How did all of the new social media and digital media businesses succeed so fast? Robust platforms have been the strategic weapon of new technology services taking market share. The article describes how platforms can be used to rapidly connect participants into a marketplace of apps, generating value for the community.

“Apple (along with Google’s competing Android system) overran the incumbents by exploiting the power of platforms and leveraging the new rules of strategy they give rise to,” says the HBR article by Van Alstyne, Parker, and Choudary. “Platform businesses bring together producers and consumers in high-value exchanges.”<sup>2</sup>

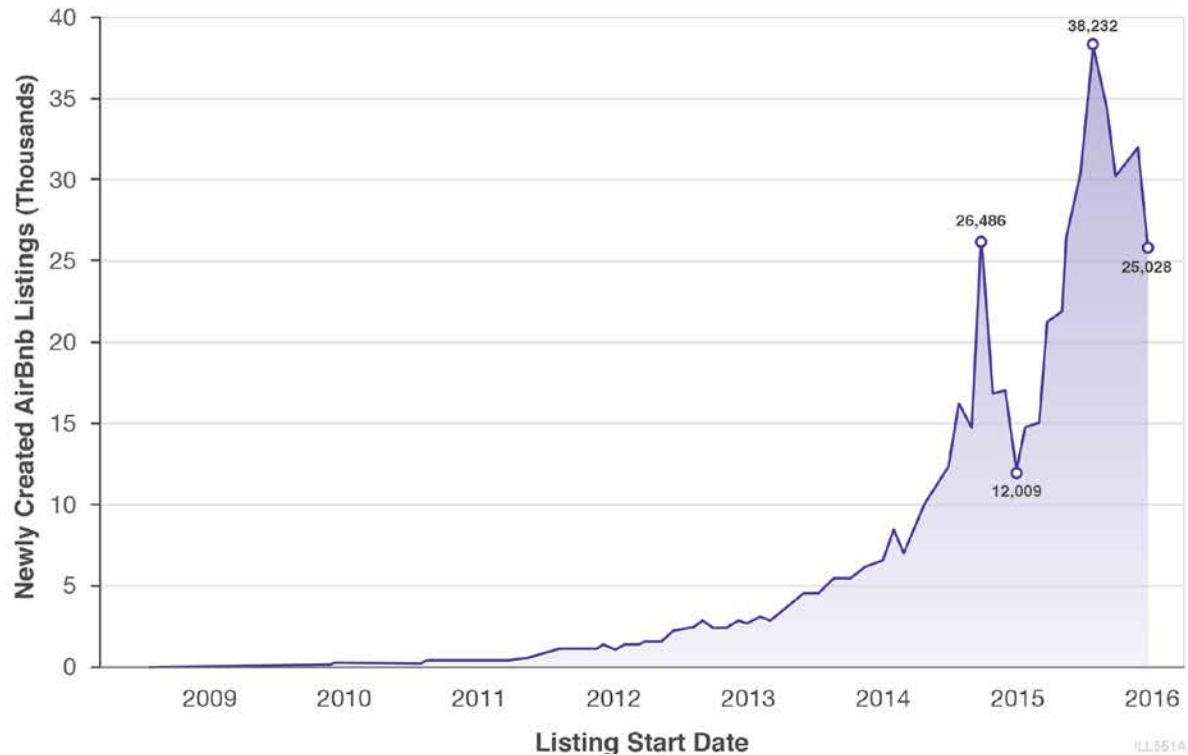
How disruptive are these platforms? Let’s just look at ways platforms have crushed incumbents in respective markets and created trillions of dollars of value in just a few years.

## PLATFORM DISRUPTION

Industry	Example of Insurgent Platform	Incumbents	Value of the platform
Digital Entertainment	Netflix	Cable TV	Instant selection and wider range of choice
Hotel industry	Airbnb	Hotel companies	Instant access to excess housing capacity worldwide
Transportation	Uber, Lyft	Taxi companies	Instant dispatching and simpler payment model
Music	iTunes and Spotify	Record companies	Consumer gets direct digital access to multiple catalogs
IT Services	Amazon	Hardware “box” companies	Ease of use, fast access to new technology, and economy of scale

<sup>2</sup> Source: <http://https://hbr.org/2016/04/pipelines-platforms-and-the-new-rules-of-strategy>

## AIRBNB GROWTH<sup>3</sup>



If you look at the most successful services today, whether it's an iPhone, Netflix, or Airbnb; they are platform models founded on rich ecosystems which are aligned with consumers' interests – robust development ecosystems, better products, and services delivered as fast as possible. The platform gives the consumer a tool to get access to what they want whenever they want it.

When you give end users access to a platform that enables them to connect to more resources, the growth can be phenomenal, as seen in the chart above which demonstrates the growth of Airbnb, a classic platform play.

Airbnb uncovered immense latent demand for spare housing capacity – by building a software platform that could be accessed via mobile phone. Airbnb created a

platform that not only provided the benefit of connecting producers and consumers, but provided a platform from which these same consumers of rooms could become producers of rooms. This is a great example of how a platform opens a broader ecosystem to create customer value.

If this is so, what is the platform model for service providers? They need to create a platform for bandwidth access, just as Android and Apple have done. This requires building a flexible operating system with software-defined control and a broad ecosystem of interoperability. Just as Airbnb connected users with newfound resources, service providers can find the spare resources to deliver to their customer base.

<sup>3</sup> Source: AirDNA (<http://blog.airdna.co/wp-content/uploads/2016/01/listing-growth.jpg>)

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## Requirements for the SD-Access Platform

To handle the scale and velocity of service that is required in the new digital world, service providers will need to build a dynamic and open SD-Access platform. In the cloud, Amazon, and Google took modular commodity hardware parts, and connected them with smart software that could automate and orchestrate dynamic connectivity to resources.

The same thing needs to happen in the access world to enable the dynamic bandwidth that will be required in the future. In the SDN and NFV model, hardware platforms will be designed to be more open and programmable so that they can be quickly provisioned with software to deliver new services. They will also be geared toward a cloud-based model – in other words, they will be able to dynamically interact with other networking systems and software in the cloud, gathering information, analytics, and other data to adjust dynamically to changing network conditions.

The requirements for this new SD-Access network include the following:

- Open hardware with programmable Application Program Interfaces (APIs)
- A programmable operating system (OS)
- Software-defined control from the cloud
- Built-in network management and visibility tools
- Customer-based provisioning

The appeal of a software-defined model is obvious: just like on a digital consumer platform, the customer can control the technology and update software and services on demand. Updates and services can be pushed out through the cloud. This can speed service agility and customer satisfaction.

## COMPARING NETWORK OPERATIONS TASKS

Requirement	Legacy Access Network	Open SD-Access
Provisioning	Requires manual provisioning	Can be customer provisioned
Upgrades	Requires manual equipment upgrades and/or truck rolls	Can be automated and network-based
Software updates	Customer-driven "pull"	Automated service-driven "push"
Operating System	Proprietary	Open with APIs
Management	Proprietary and monolithic	Open and distributed
Orchestration	Manual and hardware-based	Automated and software-based
Assurance & Visibility	Requires software add-ons	Built in
Underlay/Overlay	Proprietary Underlay	Underlay integrated with open standards and APIs
Applications	Built by the provider	Built by provider and/or third parties



If these new technologies are adopted, here's what an open SD-Access platform can deliver:

- **Service Agility and Flexibility in Service Deployment:** Services and provisioning features can be updated and pushed out with software, rather than requiring hardware replacement.
- **Network Automation:** By programming the network, carriers can build a more dynamic system that monitors conditions and can make prescribed changes automatically.
- **Reduced capital expenses (CAPEX)**
- **Reduced OPEX:** Automated software updates and dynamic control software mean less human OPEX (involvement in managing the network).

- **Open Development Platform:** By building access networks that leverage open standards, service providers can create a more dynamic service creation environment.

How exactly will this be attained? The key will be the development of open standards that can be applied to connect the access network and telecommunications cloud infrastructure.

The growth of these new open standards and the use of open-source and cooperation with open-source foundations is a relatively new trend in the service provider community. But there is no doubt that the movement is gaining momentum, as many large global service providers shift their development focus to technologies that leverage open-source and open standards.

## KEY OPEN NETWORKING ENTITIES

Key Standard(s)	Role	Organization(s)
Netconf/YANG	Automated device configuration	IETF
Topology and Orchestration Specification for Cloud Applications (TOSCA)	Configuration and templating for cloud applications	OASIS
Open Daylight (ODL)	Open-source SDN controller	Linux Foundation
Open Network Operating System (ONOS)	An open-source OS designed for implementing SDN control for service providers	Linux Foundation, ON.LAB
OpenFlow	Open-source networking protocol that enables network flows to be programmed in devices from the cloud.	Linux Foundation
Central Office Re-architected as a Data Center (CORD)	A reference implementation for open, industry-standard hardware in telecommunications networks	Linux Foundation, ON.LAB
Docker, Kubernetes, Linux	Standards for building applications with a distributed microservices architecture	Docker, Google, Linux Foundation
ECOMP	Open architecture for OSS	Founded by AT&T, moving to Linux Foundation

## How to Find ROI for SD-Access

How exactly will service providers get a return on their investments in SD-Access? The primary goals of communications service providers (CSPs) are to increase service agility while at the same time reducing CAPEX and OPEX. The key gains will come in the ability to reduce truck rolls, enable automated hardware configuration and customer provisioning, and dynamic software updates. Think of an access network that is more self-sufficient by taking care of itself.

The second area of gains will come in economies of scale, as service providers consolidate services platforms and use cloud data centers to deliver the same services – rather than building siloed, pipeline services.

There is already proof in the cloud model, where many enterprises moved their IT services. The cloud providers, who moved to open architectures first, have already demonstrated their efficacy in supporting scale. An IDC study indicates that using public cloud service such as Amazon Web Services (AWS) can generate a 560 percent ROI and 64 percent reduction in total cost of ownership (TCO). (Source: Amazon - <https://aws.amazon.com/economics/>)

Krish Prabhu, former CTO and president of AT&T Labs publicly stated that AT&T has calculated OPEX cost savings of up to 40 or 50 percent in its plan for SDN and NFV virtualization. These savings will be primarily delivered by automating the network with scripting and automatic network configuration.<sup>4</sup>

Central Office Re-architected as a Data Center (CORD) and other SDN/NFV efforts are expected to deliver many operational efficiencies to service providers. According to Verizon, as stated in its SDN/NFV reference architecture document, it plans to increase operational efficiency by automating many management functions.

Here are the goals that Verizon lists in its move to SDN/NFV architectures including those that could be extended to SD-Access:

### 1. Operational Efficiencies

- Elastic, scalable, network-wide capabilities
- Automated Operations, Administration, Maintenance & Provisioning (OAM&P); limited human touch
- Dynamic traffic steering and service chaining

### 2. Business Transformation

- Reduced time-to-market; elimination of point solutions
- Agile service creation and rapid provisioning
- Improved customer satisfaction

### 3. Expanded Ecosystem of Applications

- Open market for operator applications
- Standards for ensuring third-party interoperability of applications and software
- Creation of a platform for adding value with third-party applications

The benefits of SD-Access will be similar to the benefits of SDN and NFV in the core. Virtualization converts manual control of hardware into software-based control. This has tremendous potential for service providers to manage and provision more services via the cloud, without having to touch or manually configure hardware components.

In another data point, a survey by ACG Research found mobile operators would begin saving money on NFV deployments within the first year and realize an investment payback within three years; adopting a virtualized evolved packet core can reduce CAPEX by an average of 68 percent and OPEX by 67 percent. The study also found that deployment of virtualized network components can happen within six months, compared with an average of 15 months for traditional network hardware, resulting in a quicker time to market and return on investment.

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<sup>4</sup> Source: <https://www.sdxcentral.com/articles/news/att-cto-expects-sdn-reduce-opex-costs-40/2016/06/>

## Conclusion: Enabling a SD-Access Platform for Growth

It's never been clearer that the service provider industry is on the cusp of huge change as it develops better ways to scale its networks and deliver a wider range of services to customers faster. This is going to require a rapid shift to the cloud platform model for rolling out services and using software-defined technologies – especially for access.

Bandwidth access is the linchpin to nearly all digital services, so this is a natural place to evolve a more flexible platform. If access networks are going to keep pace with the immense growth in user demand, service providers are going to have to find a more efficient way to scale and manage their infrastructure.

Beyond being a scalable and efficient architecture to support the next generation of services, an SD-Access platform provides an ideal spot for service creation – both operational and consumer in nature – where producers and consumers of telecom applications are part of a value exchange. This exchange must be inclusive of SD-Access vendors, service providers, best-in-class third parties as well as expert users all working to create and share disruptive, high-value applications further growing the impact of the value exchange platform.

There are enough proof points in the success of social media, digital media, and cloud services giants. They all scaled by building large, dynamic platforms that unlocked value by providing wider connectivity to partners and developers. This is the future of SD-Access and it will enable service providers to escape the pipeline mindset and move to the platform future.

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# SOLUTION HIGHLIGHT

## What is ADTRAN Mosaic?

ADTRAN is enabling this model of flexible SD-Access with its Mosaic cloud access platform. Mosaic provides deep integration between access hardware, OS, and a cloud management platform to deliver management, scalability, and programmability of communications and broadband services from the cloud.

Using a programmable SD-Access system is going to be crucial for service providers who want to roll out new services with the power and speed of the Web-scale world. Mosaic provides this open SD-Access platform with a programmable modular OS, integrated control with underlying access hardware (hardware underlay), and compatibility with open standards for SDN control such as Open Daylight (ODL) and ONOS.

Mosaic has the advantage of providing a single management platform that can control the environment from the cloud. It uses a collection of management and control standards, including configuration tools such as NETCONF/YANG. This means that access devices can be configured, managed and programmed from the cloud, regardless of the specific access media being used (PON, G.fast, Ethernet, etc.). This media-agnostic view of the network means that all services can be managed and configured with a single view. Using open SDN technologies, the devices can be programmed, and changes can be automated to deploy rapidly or adjust services.<sup>5</sup>

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<sup>5</sup> Source: ADTRAN (<http://www.adtran.com/mosaic>)



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