


A close-up photograph of a hand in a dark suit jacket, with the index finger pointing upwards. The tip of the finger is touching a bright, glowing blue point of light that creates a starburst effect. The background is a soft, out-of-focus teal color.

the VIRTUAL
NETWORK

More than Fast Internet: Network Virtualization and Software Defined Networking Make New Applications Possible

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Incumbents beware: Municipalities are discovering that the next generation gigabit network enables an explosion of compelling new services and benefits.

Broadband access is not a business for the faint of heart. The access network has thousands of miles of facilities that radiate from head-ends and hubs and terminate in nearly every home and building in the serving area.

It has specialized outside plant electronics deployed in cabinets, underground vaults and mounted to utility poles. Adding to the challenges are onerous federal, state and local regulations that hinder flexibility. Plus, there are real operational challenges, including lightning, floods, backhoe fades and squirrel chews.

Adding to "access network realities" is the cost and complexity incumbents face. They have decades-old access infrastructures and limited CAPEX budgets. Upgrading to gigabit networks is an expensive undertaking. At the same time, people across the country read about Google Fiber and gigabit broadband communities. No one wants to be on the wrong side of the "digital divide", which gigabit cities will make even wider.

All is not lost. Today, incumbents have the opportunity to re-make themselves. According to Aman Segal of Virtual Gateway Labs, "By taking advantage of proven software defined networks as well as virtualization and open source solutions, incumbents can build the right network for the next 20 years." "If they continue the five- to seven-year upgrade cycle many ILECs will get left behind. They will face competition from gigabit community networks that will severely limit their options and perhaps put them out of business."

The founding member of Virtual Gateway Labs and developer of the world's first SDN-capable Virtual Broadband Gateway enabling multi-tenancy for service providers, Sehgal's disruptive business model upends the status quo. "Open access networks will give the people choices for all of their services. Today, some have the choice to switch from a telco triple play to a cable triple play. These are closed access networks. You may have a choice but the choice is between triple play bundles. Switching between providers can be done with the frequency of their contract duration of one or two years," Segal continues. "With open access, consumers have a choice for every service. You would go to a portal and see a menu. You can select a data service (bits/\$) from a number of ISPs. Similarly, you can select a video service from numerous providers and you could select a voice service the same way. The service experience can be described as "Internet-Like" meaning that end users can select and change services instantly. The provisioning is automated so the service is available immediately."

"Why Software is Eating The World" - Marc Andreesson, 2011

"We are at the dawn of a new era: Software Defined Infrastructure . . . a starting point of a very deep revolution that will reshape our global computing infrastructure." That, according to a February, 2016 National Science Foundation Workshop Report. That's a bold statement given the global transformation that has occurred over the past 30 years; a transformation that was driven by computers, smart phones, and communications networks

and has altered every sector of the global economy.

Just as we saw with the Internet revolution, the implications of the transformative shift to network virtualization and a software centric communications network well beyond our ability to predict.

According to Jeff Christensen, President of Entry Point Networks, "By shifting to software-centric networks, innovation will move at the speed of software development rather than at the speed of hardware development. That is a shift from months to hours."

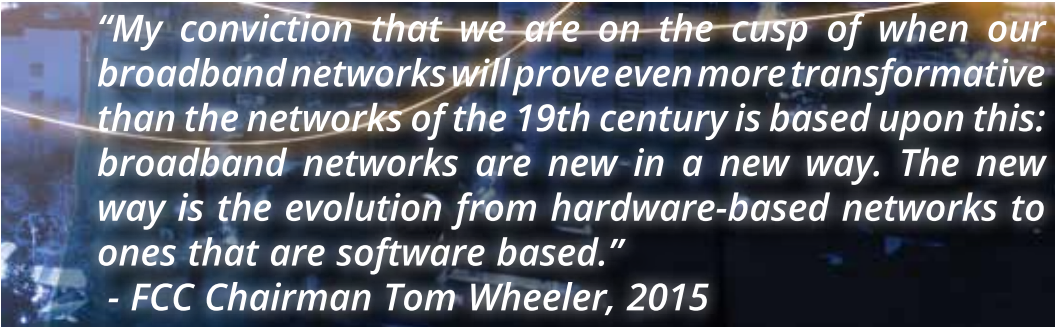
"The impact won't just speed up innovation, software control will also give more flexibility and control to users through automation and easy-to-use interfaces," Christensen continues. "Young children will be able to provision a network slice for a short term need (perhaps to play a game over the network) and then they will dismantle the network when they are done. Historically that kind of provisioning was expensive and required that a network technician come to your house - sometime between 9:00 a.m. and 1:00 p.m."

EntryPoint's vision is that Fiber Optic networks can provide much more value - beyond just delivering fast internet. New technologies including Software Defined Networking, Network Virtualization, and Network Automation make it possible to deliver new applications that make a difference in people's lives in open, secure, cloud-like ecosystems. The same tools that enable automated Open Access also provide a platform for Smart Cities and

the Internet of Things.

"We are quickly reaching a point in many cities across the country where the existing infrastructure is not sufficient for the bandwidth demands. Fiber optic infrastructure provides both bandwidth and speed advantages and the ability for data to travel greater distances. In many situations, fiber may be more expensive to install but will likely prove less expensive to manage over the long run," Christensen says.

If the actual cost to move from 100 Mbps to 1,000 Mbps with fiber optic infrastructure is relatively inexpensive, why do Internet Service Providers and Network Operators treat bandwidth like a scarce resource? Partially because they have a tight grip on yesterday's business models and their current control allows them to keep bandwidth scarce - even in cases where they are upgrading infrastructure to fiber optics.



"My conviction that we are on the cusp of when our broadband networks will prove even more transformative than the networks of the 19th century is based upon this: broadband networks are new in a new way. The new way is the evolution from hardware-based networks to ones that are software based."
- FCC Chairman Tom Wheeler, 2015

EntryPoint and many others are advocating for a dismantling of this model by separating the network infrastructure and network services and then opening up the network. The incumbent operator could continue as an operator or as a service provider but should not exclusively perform both roles. The model that is most favorable for all stakeholders is to have a local municipality install software defined fiber optic infrastructure and manage it as a public utility and then make broadband services available in a cloud ecosystem where the private sector has an opportunity to innovate and compete.

The proposed model is analogous to life before/after the app store on Smart Phones. The app store gave innovators both a technology and business platform from which they could deliver new services. This will lead to evolvable, dynamic networks that foster change.

EntryPoint is focused on Dynamic Open Access. The difference between historical Open Access and Dynamic Open Access

is that we have combined the capabilities of software defined infrastructure, SDN orchestration, network functions virtualization with cloud-like functionality (automation, programmability, virtualization, multi-tenancy, anytime-anywhere access, on-demand self-service, rapid provisioning, easy-to-use interfaces, and management efficiencies) in an open access environment.

The changes will be tangible for every user connected to the network. The results will be real competition for broadband services, a groundswell of innovation in new services, and much more flexibility, control, and utility for users. We can't anticipate the new ideas and solutions that will come from open networks and open API's but we believe the impact will be broad and will drive innovation in telemedicine, smart grid, distance learning, emergency communications, smart homes, entertainment, transportation, private clouds, Internet of Things, and Smart City applications.

In time, software controlled fiber optic networks will be essential to attract new businesses, improve city services, and reduce the costs of running a city. Small cities, which are the most underserved communities in America, will be the first to adopt these technologies. Ironically, for a time, communities with 10,000 residents will have much more powerful networks than large urban centers. As the technologies are validated and innovation accelerates, adoption will move to larger cities. There are many cities that are not even thinking about deploying a fiber optic network today. Three years from now they will start to realize that they run the risk of putting themselves at an economic development disadvantage and they will need to pay attention to this issue to stay vibrant.

Scott Raynovich of SDX Central notes, "The cloud model is only just getting started in communications and it's likely to follow the path that enterprise software has followed. I think this change is coming in telecom. The new buzzwords

in the telecom industry are about provisioning and orchestration. Just like in cloud services, the ideal is that a customer goes online, signs up, and provisions a service how they want it and when they want it."

The 'Softwareization of the Network'

Always on, ubiquitous access has been around for many years. What's new here is the move to high-bandwidth access networks: gigabit networks. While few consumers and small businesses actually need a full gigabit per second speed, the move to gigabit networks eliminates bandwidth as a constraint.

High-bandwidth applications such as Netflix, will run better with more bandwidth. More bandwidth will drive the global innovation engine to create new applications we haven't even thought of. This occurred when we moved from 56 Kbps voice band modems to the few megabits of broadband. The same also occurred when the few meg's jumped to a few 10's of meg.

In addition to the raw speed, gigabit networks also offer very low latency. This too will stimulate applications we haven't thought of yet. Gigabit low-latency networks eliminate distance as a concern. To grasp the implications of this, the distance between a CPE and Memory could be miles apart, not millimeters.

The 'Softwareization of the Network' will mean lower costs for services, choices for all services, new services and better services. Software Defined Infrastructure will greatly simplify the ongoing operations and maintenance of the access network, driving down costs and reducing the burden on rate payers. It will also enable new services and business models.

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