SDN and FTTH

Software defined networking for ultrafast broadband networking

A technology to simplify management of FTTH networks

What is SDN

Software Defined Networking (SDN) revolutionizes service deployment and service activation in today's telecom networks

SDN with Open Flow is acclaimed as the best solution for data center provisioning

SDN reduces operators costs for virtual servers and data centers

How does SDN work?

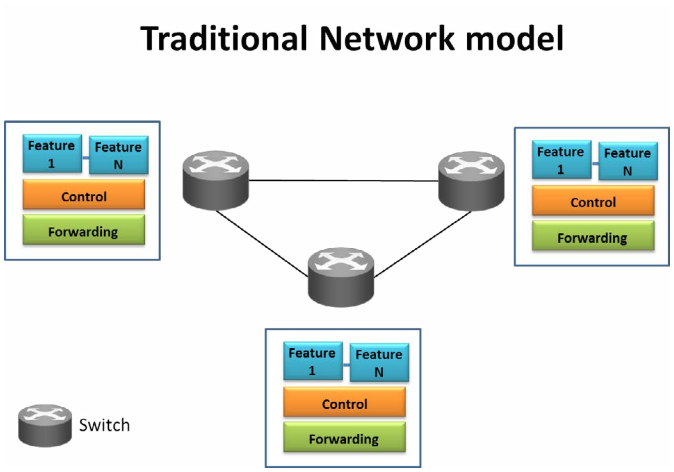
At its most simple, the SDN method centralizes control of the network so that software at a central location can make function calls to network elements and control how they operate. In so doing, a programmatic network is achieved that can be simply and quickly reconfigured to meet new customer and service demands.

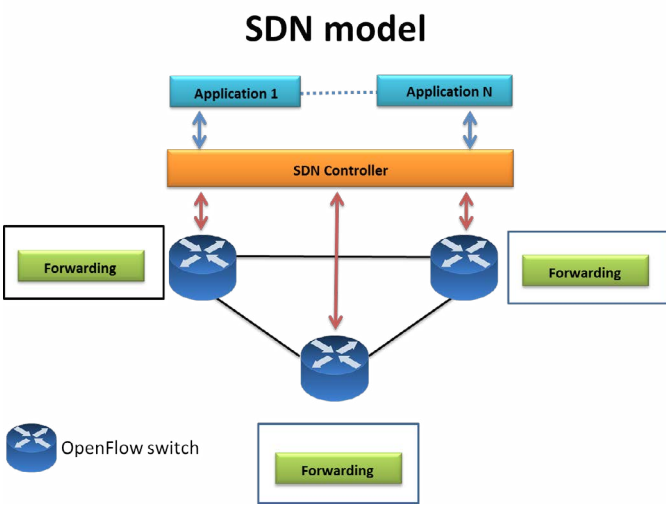
SDN means that creating a new service is just a matter of implementing the software to configure the network and then integrate this software in the service delivery chain within the support systems of the operator.

Rather than using configuration controllers on the network devices, the configuration control for deploying services in the network are kept in a central software repository.

Highly-automated and centralized control of how each device in the network operates gives a number of benefits:

- faster and more agile service provisioning
- better network flexibility and bird's eye view
- better, more granular security
- better efficiency and lower operating expenses
- lower capital expenditure with virtual network services





What does SDN mean to FTTH networks

Software-defined networking will simplify network control and service provisioning in FTTH networks

Benefits for FTTH

By moving control of the network to the SDN controller, operators get a common, centralized point where all actions related to the network are managed. The SDN controller is vendor-agnostic and uses standardized APIs to communicate with all sorts of network devices.

From operator point of view, this achieves better control and enable functionality such as:

- **Automated provisioning**
  The SDN Controller receives requests to activate or deactivate services in the network and can send function calls to enable or disable services functions in the network, thus eliminating errorprone manual configuration and shortening delivery time from order to activation.
- **Managed Network Services**
  Enterprise- and carrier network managed services (MNS) are services for geographically distributed networks. The SDN Controller can manage these complex operations using global definitions
- **Security**
  By periodically collecting network statistics from the forwarding plane of the network in a standardized fashion and using classification algorithms, any anomalies can easily be detected. The SDN controller can then reprogram the data plane to correct the problem or prevent the threat

In FTTH networks, the challenge is to manage any thousands of residential customers with frequent updates to service subscriptions and relatively low revenue. The cost of changing or updating a service for an individual customer may very well exceed many months of revenue from that same customer.

Operators face two major challenges; to reduce costs for OPEX, and costs for service provisioning.

- Network device configuration, often as much as 45% of the total cost of ownership, is the greatest contributor to operating expenditure. Today, this requires a small army of technicians.
- Creating and activating of new services to generate more revenue requires re-configuration of large numbers of network devices that may take weeks, or even months, to complete

The common challenge for both these tasks in FTTH networks is the that the physical network devices use proprietary control and management operating systems. Configuration using CLI scripts is the dominant method used in networks today. This approach to the rollout of new configuration and services is both expensive and time consuming.

SDN accelerated networks

FTTH networks offer not only greater speed but also greater complexity because customers can consume an ever increasing number of services. To be able to provision these service and still maintain a flawless performance, network configuration must become more efficient and more centralized. Properly implemented, SDN can simplify network configuration and service provisioning, and thereby boost the performance of the entire network.

Full adaptation to SDN is a disruptive process and it will take network owners years to complete. However, SDN has exposed the shortcomings of the traditional approach to network management and there is now a demand for SDN solutions that work with the existing physical network.

In the short term, FTTH networks need a means of dramatically reducing OPEX and accelerating service provisioning that can be adapted today and that delivers SDN advantages to the existing network while also preparing the way for full SDN.

SDN is not only OpenFlow

Is Open Flow the holy grail for SDN?

OpenFlow is the first attempt to define an open standard to separate the forwarding and control planes. The forwarding plane stays in the network device while the control plane moves to the Open Flow controller. The Open Flow controller makes routing decisions that it then tells the forwarding plane to act on. Open Flow makes a switch 'programmable'.

OpenFlow is used to program 'flows'. Flows can match packets on fields like IP address, input ports and others. Actions include:

- sending packets to specific ports
- assigning Quality-of-Service parameters
- sending packets to the controller via the controller's interface to the switch.

In this way, the controller becomes aware of new flows and take decisions on what to do with them.

Indeed, OpenFlow provides an effective means to control flows of packets that are handled on a very basic forwarding level but the main limiting factors for scalability is the speed at which OpenFlow can recognize new flows, decide how to program the network element, and then deploy that programming to the actual device.

In a limited environment like a data center, the distance and latency between the OpenFlow controller and the network device is short and the number of network devices are few. In a large, geographcially distributed network with hundreds of thousands of ports and billions of flows, the latency and complexity of controlling forwarding becomes overwhelming.

OpenFlow, to its nature, is reactive - it reacts to a new packet flow appearing in the network, allowingthe controller to determine what to do, and where to forward the flows. Open Flow fails to make use of advanced functionality for traffic management and Quality-of-Service found in most switches today. The distributed logic already existing in network elements is not used.

Because OpenFlow is device agnostic, it does not take advantage of vendor specific hardware capabilities.

These control functions require a vendor specific API.

The complete removal of control and management intelligence from network devices is often the most touted aspects of SDN. To reduce CAPEX by using a central controller to manage cheap switches that only do flow forwarding is a tempting proposition. But, on a nationwide or even city wide scale, this centralization meets new challenges in scalability that will increase CAPEX and OPEX. More powerful servers for the complex operations of SDN Controllers will be required because OpenFlow does not control rate-limiting and other essential functions needed for telecommunications services.

Today's distributed control plane in network devices are capable of "self-healing". If there is any failure with the link or neighbor device, the switch finds alternative ways, automatically and quickly (Fast Convergence). A switch can pre-compute the alternative way and prepare the forwarding plane before the failure happens (Fast Re-route).

Today's network with distributed control planes has become resilient, closing the milisecond gap between the start of the failure and the traffic forwarding.

In order to benefit from SDN and provide reliable, secure, and cost effective services, Open Flow is not the solution.

For FTTH networks, a different solution than Open Flow is needed. FTTH networks need to make use of the distributed intelligence and fast convergence capabilities for its services.

FTTH needs smart SDN boxes

FTTH network switches are not just boxes, they also need to be intelligent

NetConf — an industry standard

NetConf is a standard protocol (RFC4741) for reading and writing network configurations that is transaction basedand relies on a data modelling language to describe a network devices.

The data modelling language means a standardized way to explain what the device can do, what configuration settings that are possible to make and what information that can be read from the device.

The transaction capability means that the network device can verify that an intended configuration can be applied before it is actually applied. This allows multiple network devices to be challenged – can they all be successfully configured for a new service – before actual configuration activation takes place. As a result, the network never enters an unknown state with some devices configured and some not done because of an unforeseen error occurring.

NetConf uses a programmatic API in the form of Extensible Markup Language (XML) to communicate with the switches and routers. XML is well known to system developers.

NetConf does not in itself provide the mechanisms to control individual flows or determine how traffic should run through the network, but it exposes whatever means each network device already have to do so to a programmatic interface and thereby allows complete programmatic control of the functionality of the device.

If the device supports per flow classification and control it can be set by NetConf. Where the device allows rate-limiting or reprioritization of traffic, NetConf can handle it. Should certain packet filtering be needed or the port be assigned to a different VLAN than normal, NetConf can deploy that configuration. In summary NetConf can be used to completely control all features and functions of a managed device. There are no limitations set by NetConf in this regard – only what limitations the vendor of the device impose, what features that are exposed for control by NetConf.

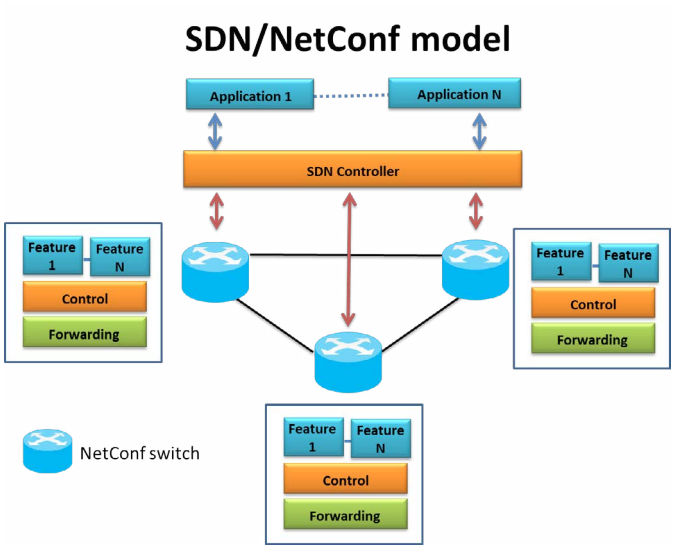
A software developer can make use of all distributed and advanced features in the network and can therefore adapt services without the scalability issues of Open Flow.

SDN and Netconf

Retaining use of the distributed intelligence and advanced functionality present in todays network devices is the smart move. The benefits of SDN with programmatic control can be achieved with NetConf, but more importantly NetConf also allows full use of the features and functions resulting from over 25 years of network industry development. Yes, Open Flow provides a very crisp and fine-granular control of traffic, but at great risk with its scalability and reliability uncertainties.

Using NetConf that fine-granular control is determined by what capabilities the switch vendor offer. If your network needs granular control, then the solution is to use vendor equipment that provides a sufficient level.

NetConf is transaction-based and based on open



standards based, and it provides significant advantages and very few drawbacks compared to OpenFlow.

NetConf delivers SDN functionality for FTTH networking that today's OpenFlow cannot.

Our SDN products for FTTH networks

Considering SDN for your network. What's the next step?

We understand programmatic networking

From the very first FTTH router, Waystream has integrated programmatic functionality in its network hardware. Many years before SDN was introduced as a model for programmatic management of networking hardware, our customers' networks were enjoying the benefits of homegrown centralized software to control, manage and provision services on our devices. Indeed, many networks are still using these products today.

As the industry matured, we have continuously introduced support for open, industry-standard protocols to simplify integration with existing network management software.

As of 2015, support for the Netconf protocol is included with iBOS 7 products ensuring a seamless integration into any standard SDN controller.

MS4000 Gigabit Ethernet L2+ FTTH Switch

ASR6000 Gigabit Ethernet Layer 3 FTTH Switch

MPC480 BNG/Core/Ethernet Aggregator chassis

To join the increasing number of successful FTTH companies using our ultrafast broadband products, contact sales@waystream.com

We fully support the industry shift towards SDN and open standards, and our unique experience in interaction between network hardware and software to deliver services is something we are eager to share.

Our new line of products include the latest standards, such as NetConf, that are necessary for providing full SDN support - even for the most complex services.

Johnny Hedlund, CEO Waystream

Waystream AB

Head office
Färögatan 33
Kista Science Tower
SE-164 51, Kista
Sweden

Contact us
info@waystream.com

Visit us
www.waystream.com

We offer world class switching and routing expertise and products to provide reliable, user-centric functionality for telecom operators and service providers that need digital infrastructure for service delivery. Our products are easy to operate, smart, and designed to maximize the end-user experience.