An overview of Software Defined Networking

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Abstract—Software Defined Networking (SDN) is a transforming network architecture gaining interest from research communities and also tailored to meet the requirements of end users, enterprises by allowing them to gain, unprecedented programmability, automation, network control, ability to build highly scalable, flexible networks that readily adapt to changing business needs. In this paper features of SDN are highlighted which enable them to provide the facilities listed above.

Index Terms-- Software Defined Networking (SDN), Data Plane, Control Plane.

I. INTRODUCTION

Computer Networks are difficult and challenging in managing and consists of different kinds of equipment like routers, switches, firewalls, network address translators, server load balancers, intrusion detection systems .Routers and switches run software's which run at the level of protocols, networks and this reduces interoperability of networks as the complexity increases and thus poses a limitation on innovation.

Software Defined Networking (SDN) is an emerging network architecture where network control is decoupled from forwarding and is flexible in programming. Software Defined Networking (SDN) is changing the way we design and manage networks [1].Support of decoupling provides an abstracted view of underlying networks for applications.

An SDN separates the control plane (which decides how to handle the traffic) from the data plane (which forwards traffic according to decisions that the control plane makes)[1].

SDN has the following eye catching features:

• Separation of the control plane from the data plane

• A centralized controller and view of the network

• Open interfaces between the devices in the control plane (controllers) and those in the data plane

The concept behind SDN has been evolving since 1996[2].

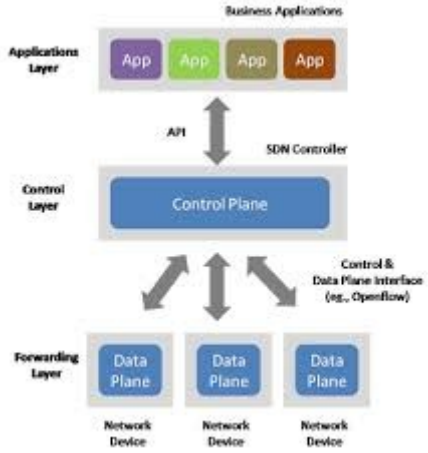

Figure 1. SDN architecture

Figure 1 depicts a logical view of SDN architecture. Network management is embodied in SDN controller and which provides a vendor independent management of the entire network for end users.

This process also simplifies the complex task of programming and understanding numerous protocols that need to be embedded into different network nodes. Instead any change to be made to the network can be done in this centralized SDN controller which over comes the disadvantage of updating the changes, done in one node, to the entire network.

In addition to abstracting the network, SDN architectures support a set of APIs that make it possible to implement common network services, including routing, multicast, security, access control, bandwidth management, traffic engineering, quality of service, processor and storage

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optimization, energy usage, and all forms of policy management, custom tailored to meet business objectives.[3].

II. BACK GROUND: WHY MOVE TO SDN?

A. TRADITINAL NETWORKS

Primary purpose of any network is to forward the data from one point (source) to another point (Destination). In this process data travels across different network elements to reach the destination and hence during this travel optimization needs to be done in the way the data is transferred.

In traditional networks the task of controlling and forwarding is combined with one another where the control plane configures the nodes and paths to be followed for the data transfer and these pre-determined paths are followed by the data plane to carry out the data transfer from source to destination.

In this traditional approach, once the flow management (forwarding policy) has been defined, the only way to make an adjustment to the policy is via changes to the configuration of the devices [2]. This task increases the complexity for network operators who wish to accommodate dynamic traffic loads.

B. SUPPORT OF SDN IN TODAYS NETWORKING

SDN has evolved over the years to accommodate the requirements of dynamic networks where the control plane is decoupled from the data plane. Control no longer exists in individual network nodes instead it is moved to a centralized controller.

Controller can manage the entire network and hence support user service requirements like bandwidth, QoS,etc.

This dynamic view of network from a central point helps in managing the changing traffic load and requirements.

III. KEY CHALLENGES

Although SDN is promising a dynamically programmable network in terms of meeting the requirements of deployed there are four challenges needs to be addressed by SDN as done by any network and they are:

i) Centralized control with performance:
ii) Security
iii) Interoperability
iv) Scalability

i) Centralized control with performance:

SDN can control any open flow enabled network device deployed from any vendor. The term performance in the present context means processing speed of the network considering the parameters throughput and latency. Performance can be achieved with hybrid networks.

ii) Security:

A security group Open Networking Foundation (ONF) has been set up to look into the security issues of SDN. Issues with respect to security will rise as more and more industries, research groups and enterprise start to adopt SDN.

SDN architecture has a basic inbuilt support for reactive security monitoring system with analysis and response. SDN supports network forensics, security policy alteration, security service insertion.

SDN also allows to define high level policy and configuration statements to support security.

iii) Interoperability:

Once the platform is set to work with SDN the next question that arises is how to standardize the current existing networks to support SDN. One solution would be to introduce components in the network which would support SDN but this solution would be impractical as it has to replace the entire existing network which incurs heavy cost. One possible solution to this is The IETF path computation element (PCE) [7] which will support gradual or partial migration to SDN. With PCE in use the path computation component is moved from the distributed component to the centralized controller and the rest of the components not

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using PCE would have the path computation existing within the devices.

Further improvisation is required where a traditional network, SDN enabled network and a hybrid network can interoperate together. IETF's Forwarding and Control Element Separation (ForCES) Working Group has been working on standardizing interfaces, mechanisms, and protocols with the goal of separating the control plane from the forwarding plane of IP routers.[2]

iv) Scalability:

As the demands on the data centers increases network must also grow to accommodate the network changes. Today's networks traffic patterns are unpredictable and dynamic and the data centers have to accommodate these changes to provide seamless service to the users.

VII. BENEFITS OF SDN

1. Centralized control: An SDN can provide centralized control in a multi-vendor environment where in the network devices can be from multiple vendors.
2. Network Reliability and Security: SDN architecture eliminates the need of individually configuring the network devices each time a new service is introduced or a policy changes.

   SDN controllers provide a complete control over the network and also its visibility which ensures access control, quality of service, security.
3. Granular level of control: Policies can be applied at granular level like session, application, user and device.
4. Enhanced User experience: Centralized control provides information at application level which makes the network to better adapt to dynamic needs that provides user a better seam less service experience.

VII. CONCLUSION

SDN has emerged over the years to improve the operability within the network and to provide a better user support. Demanding trends of mobility, virtualization and need to support rapidly changing enterprise needs place significant demands on the network. SDN promises to transform todays static networks into dynamic programmable and adaptable platforms with the built in intelligence to accommodate dynamic traffic loads, varying resource request and also to consider the QoS parameters.

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