Enhancing Network Security: an SDN (Software Defined Networking) Method

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Abstract: Today's IT infrastructure, featuring a mobile workforce, IoT apps, digital business transitions and the cloud, is developing at a rate that exceeds traditional technology approaches capabilities. Network security has proven insufficient and lacks the visibility, control and intelligence necessary to meet changing needs. SDN became a subject of interest for academia and industry to discuss the network on-demand relevant aspects of applying real-time network policy. The article is an assessment of the security situation and what to do to strengthen it. In this paper we introduced SDN-based approach functionality not available in traditional approaches to security. This show how the proposed security architecture can be used to fortify the overall protection of today's network.

Keywords: Control Plane, Data Plane, Open-flow, SDN

I. INTRODUCTION

With the number of devices growing, ICT infrastructures are constantlyexpanding. At the same time, IoT systems, mobile employees, digital work place transformation, and cloud changes all over the place increase the size and complexity of IT infrastructures and their related attack surfaces. More on-site and cloud apps, devices, users and network traffic are that the surface of the attack, making it harder to avoid, track and respond to security incidents. As a result, the security of the network becomes more complex each year. The perimeter defence framework established the old enterprise security model. What it takes today to protect your data is more than just a legacy firewall and antivirus software.

The new, innovative security solution needs to be looked at designed to address an environment where a fixed perimeter paradigm is vanishing as the cloud becomes more omnipresent. Software defined networking is an emerging technology that can provide security defence solutions because it can detect attacks and act in a faster fashion than traditional networks.

Section II discusses issues in the conventional security model, and what needs improvement. We implemented the SDN and Open flows in section III. In section IV, we present proposed company security model focused on SDN and current related work in section V. Section VI completes the study by summing up and considering future work.

II. CONVENTIONAL NETWORK SECURITY AND PROBLEMS

Cloud computing and increasing number of computers, network security and network management are becoming more complicated each year with the rise in IT infrastructures. Organizations today face a world of ever-evolving security threats and there's a little option but to rely on a mix of complex, centralized, and scope-limited security solutions. If a function in the network is breached, vulnerabilities can be identified by an attacker and sensitive network information such as topology, key server location, etc.

Fig.1 Conventional Network

Figures 1 and 2 show the conventional network architecture in which protection was developed at the edge, companies and their networks were exposed to a risky world in which persistent cyber attacks were able to circumvent outdated security mechanisms. The SDN architecture for network security was implemented in Figure 3 and in Figure 3 we compared how the architecture differs from Figure 2.

Fig.2. Conventional Network Security Model

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III. NETWORK SUPPORT AND APPLICATE

Combating the alluded to above complexities of the conventional SDN network infrastructure is a new paradigm that separates Command and Data Plane features of the network. The network devices are manage and configured using SDN data plane and a centralized controller. The portion of the network feature management was removed from the SDN data plane, and a centralized controller is used to track and configure network devices.

Figure 3 demonstrates how SDN divides power and data plane. For clarity, definition of SDN as base for Open Network (ONF) is described in this article: “Command and Route data planes are decoupled in the SDN architecture state are logically centralised, and the applications are abstracted from the underlying network infrastructure”. SDN focuses on four key features:

- Command plane isolation from data Plane.
- Open interfaces between controlplane devices (controllers) and data plane devices.
- Network programming through global technologies.
- Better protection and stability with full view and monitoring of the network.

IV. SDN BASED PROPOSIT MODEL SECURITY

The strategic centralization of intelligent networks and the full networking view in SDN offers exciting challenges and opportunities to enhance network security, including new ways of preventing, monitoring, and reacting to attacks, as well as creative security services and SDN centric applications. Packet filtering can be performed at various network rates and most should be able to test the packet headers up to the transport layer. OpenFlow will allow the filtering of traffic above layer 4 by inspecting the controller side packets if all incoming packets are sent with Packet-In messages.
To present and clarify the tools and components needed to validate the proposal for research and the related information. Mininet is emulator for the SDN network. On a single Linux kernel it operates a collection of end-hosts, switches, routers, and links. A single system looks like a complete network using Lightweight virtualization, running the same kernel, applications and usercode. A Mininet host operates just like a real computer; if you start sshd and link the network to your server, you can ssh it in and run arbitrary programs. The programs you run will send packets, with the speed and delay of a given link, through what appears to be a real Ethernet interface. Packets are handled by what appears to be a real Ethernet switch, modem, or middle box, with some queue. If two programs communicate via Mininet.

A. Plan for Implementation of System Solution:
We used POX in mininet as a SDN checker which is a component-based programming system for Software Defined Networks, allowing you to program applications using multiple protocols. In the SDN environment, we test HUB's behavior and use python code to convert the hub to OpenFlow support switch.

B. Secure Infrastructure Proposed Network Description:
The figure shows the architecture of the network proposed for the setup. We used an OpenFlow switch s1 attached to IP address 10.0.0.2, 10.0.0.3 and 10.0.0.4 with three host h2, h3 and h4. The switch is attached to controller C0, with loopback address 127.0.0.1 in port 6633.

The Simulator System consists of the following elements:
- VirtualBox Remote Console: Links to OpenFlow image. You created this one to start the VM.
- SSH: Logs into OpenFlow Tutorial.
- OpenFlow checker: Lies over OpenFlow controller. The OpenFlow reference implementation contains a controller, which combines to serve as an Ethernet learning switch with an OpenFlow switch. You will then On top of NOX or Beacon write our own controller in the next section.
• OpenFlow Switch: is located under the OpenFlow gui. The reference distribution for OpenFlow includes a switch for the space consumer program. Open vSwitch is another software but a kernel-based ed switch, while a range of hardware switches are a viable from Broadcom, HP, NEC, and others.

• Ovs/ofctl: command line utility that sends short OpenFlow messages. Can be used to show port switches and flow information, or to manually insert flow inputs.

• iperf: general command line utility to check a single TCP connection speed.

• Mininet: Architecture for emulation of networks. Mininet establishes a virtual OpenFlow network on a single real or virtual computer-controllers, switches, hosts, and connections.

• Cbench: Tool for testing OpenFlow controller flow setup rates.

V. RESULT

New Features Provided by SDN SDN/OpenFlow provides programmability, dynamicity, flexibility, and intelligence to current network architectures, and its benefits can be delivered from four main features: (i) dynamic flow control, (ii) network-wide visibility with centralized control, (iii) network programmability, and (iv) simplified data plane.

Dynamic Flow Control: Based on SDN’s basic characteristics (i.e., ask the control plane if the data plane does not have a flow rule to handle a network flow), a network application can control network flows dynamically. This feature is highlighted with network applications for flow control, such as dynamic load balancing and network management application. Network-Wide Visibility with Centralized Control: In SDN, all data planes are connected to a centralized control plane to receive control messages (e.g., flow rule insertion and data plane configuration). In addition, the control plane collects network status information from each data plane by sending a statistics query message. Therefore, a network application running on the control plane naturally has a view of all connected data planes, and it can control all data planes in a centralized way.

Several network-wide monitoring applications with SDN are good examples that benefit from this feature. Network Programmability: Since all data planes in an SDN network can be controlled by a network application program, SDN provides a strong capability to program enable new network functions. This is similar to programming a smartphone (e.g., Android) app to enable unlimited creativity of functionalities. To empower this feature, several network programming languages have been proposed so far, and they help us program network functions easily. Simplified Data Plane: Basically, the SDN architecture separates the data plane from the control plane, and thus the data plane only has relatively simple logic. This simplified data plane gives us chances of adding some new features NetFPGA, DevoFlow are good examples of the simplified data plane and its modification.

VI. CONCLUSION

At the heart of the proposed security architecture lies the challenge of implementing a security strategy based on the SDN OpenFlow model. The method, now connected to the SDN / OpenFlow network control mechanism, not only helps to identify treads in a creative manner but also help to respond to threats in a controlled manner.
This design requires a single switch and 3 host, and it is possible to implement and check a more complicated version of this architecture with more than one switch with load balancing and malicious traffic filtering as future work.

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