Whitepaper | Openmul

An Introduction to OpenMUL SDN Suite

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The networking industry at a crossroads

The network is more critical than ever before. The significant shortcomings of closed and proprietary traditional networking architectures have started to manifest. Different networking technologies operate as islands each with disparate features and functionality, different management interfaces, and distinct policy definitions. As a consequence, network configuration today is a highly manual process; each device must be configured on a device-by-device basis. And, because these devices are vertically integrated and do not expose robust programmatic interfaces, they can't be programmed or automated to respond to network events at the required scale. Ultimately, the network is unable to meet the business needs and response time requirements of the customers using the network.

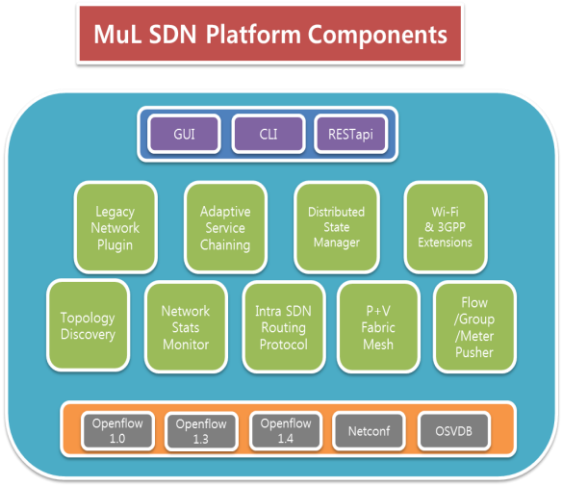
The software defined network's prime motive is to provide "centralized management and control of networking devices from multiple vendors". One of the key challenges confronting potential users of software-defined networking is discerning the specific value of SDN controllers. Controller SDN software suite, after all, play critical role as the key arbiter between network applications and network infrastructure.

Introducing MUL SDN Suite

MUL is an advanced global network control platform suite that bridges the gap between virtualized resources and the physical network. MUL combines network orchestration, control and full network management in a simple, easy-to-use and easily extensible software platform. It ties together compute (virtual and physical) and network resources tightly under a single management umbrella.

Engineered around a highly optimized and scalable core-engine, it has been consistently rated as one of the top-performing controllers in several research publications. It is implemented using `C` programming language and designed for high performance and reliability which is the need of the hour for deployment in mission-critical networks.

MUL provides multi-level and multi-language APIs to support different application needs. The `C` language bindings can be used for performance and latency sensitive apps while RESTful APIs can be used by web apps. It can control network devices supporting Openflow, OVSDB as well as Netconf.



Unified control with industry standard protocols

MUL provides a unified network control plane offering centralized programmability to deploy dynamic services across the network. MUL leverages industry standard protocols, such as Openflow, N to abstract the network data plane from the control plane, and to centralize network control logic and intelligence into an easy to program interface. This enables administrators and applications to directly access and control elements of the network, such as the global topology, switch and host states, and other statistical information. Such unified control has never before been available in traditional systems or multivendor environments.

Modular and Distributed Services/Core-Applications

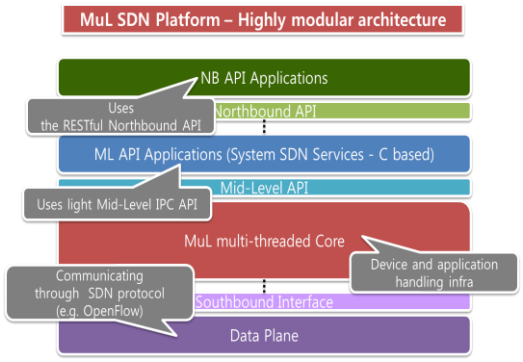
One of the key features of the controller is the ability to host a huge set of standalone and high performance services as well as applications. Unlike many other controllers' where base network services and core applications reside in the same address space; MUL's service reside as standalone entities and has a distributed architecture. These services expose MLAPIs which can be used by any application as per need.

Various services available in MUL SDN Stack today:

Service (Core-Application) Name	Service Description
Topology manager	Automatic topology discovery
Routing manager	Node-to-Node Path-finding service
L2/L3 Host Tracker	Host tracking service using IP+MAC combination
NAT	Network address translation service
ConX	Flow connectivity manager across any set of nodes
REST API	Provides RESTful API
CLI manager	Provides CLI access to end-user

Flexible and High Performance Platform

For the various application needs, MUL provides three kinds of APIs that enable network applications to be deployed on top of the network abstraction. The `C` language bindings can be used for performance and latency sensitive apps. Python bindings can be utilized for fast app development while RESTful APIs can be used by web apps.



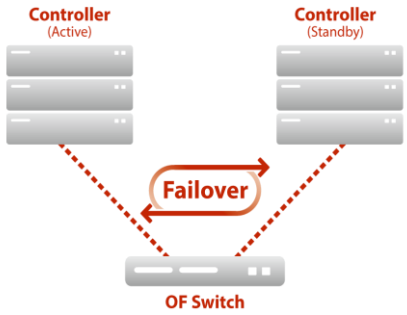
Closer to iron

Unlike most of the other SDN controllers, MUL is implemented in C programming language, hence, closer to iron and able to squeeze more out of the same hardware. MUL is able to deliver best in class performance in terms of throughput and latency of flow download rates.

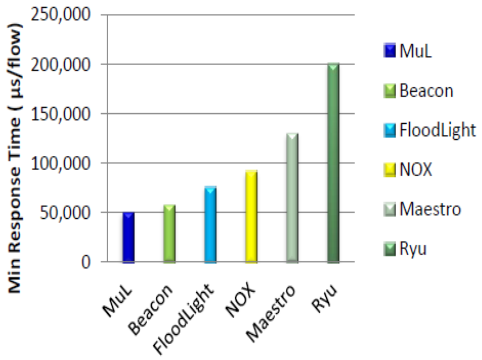
It is designed for high performance and reliability which is the need of the hour for deployment in mission-critical networks.

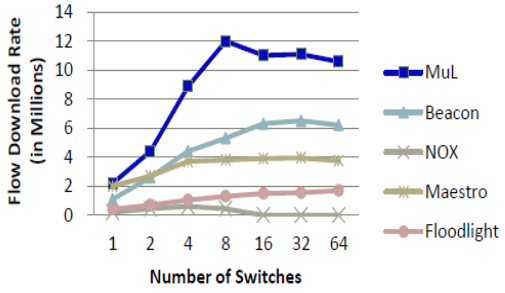
Carrier-grade Resiliency

MUL supports carrier grade resiliency as multiple controller nodes can be deployed in a hot/warm cluster configuration for high availability. Controller nodes fail over to another controller instance in the event of any system problems, hence, preserving existing configuration, re-establishing the network and provisioning new configuration seamlessly. It can be deployed in active-active, active-standby as well as cluster configuration.



Control the network with high performance





Application-Core Coherence

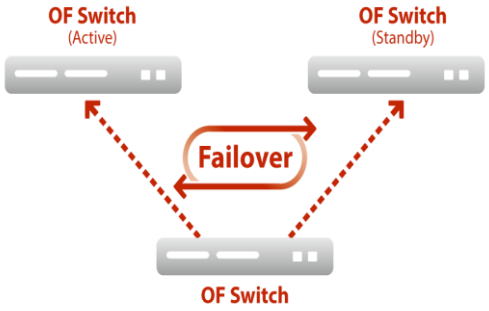
MUL controller offers two hot features: **FirmFlow** and **FlexPlug**

As network is dynamic and agile, need of network upgrade becomes prominent. If any application, during upgrade or for any reason, loses the contact with Core Engine or any other application, FirmFlow feature will ensure that flows installed by other applications or services are not affected in the Core Engine and in the data path. Moreover, the application which has undergone upgrade will also re-gain all the information back from Core Engine. In case, Core Engine undergo upgrade FirmFlow™ will re-gain all the information from Openflow switches.

FlexPlug feature, on the other hand, gives the flexibility of plugging and unplugging any application from the core engine without affecting any other application or the core engine itself. Any application can be plugged-in or plugged-out anytime.

Global Network Control

MUL offers the ease and simplicity of centralized network planning and management with the rapid response and scalability seen in decentralized control systems. Once MUL has established the network policies, it then works with the network devices to orchestrate the desired network state. Local decisions for link failure handling and forwarding are handled on each switch for scale and performance using advanced Openflow features like OF-groups. It also employs n-way ECMP and MC-LAG depending on network workloads with built-in fast failover mechanisms.



User Friendly GUI and CLI

MUL has been architected to orchestrate the network automatically and transparently. If direct management or trouble-shooting is needed, interactive command-based and graphical interfaces are available to provide visibility into the network resources. As MUL maintains a network-wide view, it can provide advanced tools including end-host location awareness with end-to-end path tracking. This greatly simplifies debugging and problem resolution compared to traditional hop-by-hop network implementations.

MUL SDN Suite's Feature Tank

Feature	Description
Southbound Protocols	Openflow 1.4, 1.3.x, 1.0, Ovsdb
Multi-Version	Supports different versions simultaneously
Flow Download Rate	10.5 Million / sec
FlexPlug™	Provides the flexibility of plugging/unplugging any application
FirmFlow™	Flow coherence across application, controller and switch restarts
SSL	Supports TLS 1.2
Learning Module	L2 learning module with IGMP snooping
Multi-Mode Openflow	Can operate in heterogeneous mix of Openflow switches
Topology Discovery	Automatic topology discovery
Path Compute	N-way ECMP (Floyd-Warshall algorithm)
APIs	Rich set of RESTful APIs, Python APIs & C APIs
P2P Networks	Multi-tenant aware loop less P2P fabric using P+V model
Statistics	Openflow provided stats collection
Hot standby HA	Controller availability to mitigate outages
Loop detection	Fast loop detection mechanism based on xSTP
Address space protection	Controller runs completely independent of all system apps
CLI Support	Supporting industry standard CLI for user management

Use Cases

MUL SDN Suite offers services for application to communicate with each other. It also provides set of North-Bound APIs and South-Bound APIs by using which applications can communicate with switches. All the applications can use features like FlexPlug™ and FirmFlow™.

SDNized Legacy Network – PRISM app

SDN is not a magic wand which can replace all the legacy equipment. Our goal is to bridge this gap for operators and users to try and deploy SDN in a step by step manner. At the same time, this should not affect the production network.

PRISM enables seamless integration with legacy networks. Acting like a gateway between SDN and legacy network islands, PRISM disguises a SDN network as a legacy node to interact with legacy routing protocols.

Cloud OS Network- Fabric app

With growing importance of data-centers, data-center networks have taken a center stage as they have traditionally been very rigid. Modern data-center networks need to dynamically adapt themselves based on work-loads, server virtualization, multiple-tenants and presence of various network services (L4-L7).

Fabric app provides loop-less & broadcast free network, "real" zero-touch capability, dynamic default gateway insertion as well as scalable multi-tenancy. It integrates with OpenStack using Neutron plugins.