SEBA Operations and FCAPS

Session 3: 1:30pm - 3pm
In this session

- How are operator workflows implemented in XOS, and what are its internal models and services?
- How is SEBA doing monitoring, telemetry and FCAPS with ELK stack, Prometheus and Grafana?
- How do we troubleshoot the system?
- How is the lifecycle of the pod managed?
SEBA

SDN Enabled Broadband Access

OLT
ONU

VOLTHA

ONAP
Op X OSS/BSS

SDN Controller - ONOS

Network Edge Mediator (NEM)

Trellis apps
VOLTHA apps

Abstract OLT

SEBA POD

Docker K8s Helm

External BNG

(Embedded BNG)
NEM Orchestration & SEBA Workflows

Different operators == Different workflows

Authentication is a workflow option
- 802.1x based
- PPPoE based
- DHCP based

Subscriber services are workflow options
- HSIA
- Voice
- IPTV
- Business services
- Technology profiles
- Speed profiles

BNG is a workflow option
- External physical BNG
- vBNG in compute
- BNG in Agg switches
- BNG in OLT boxes

NEM
- XOS GUI
- XOS Core
- Chameleon
- Synchronizers
- Tosca
- Database

ONOS Cluster
- vOLT
- dhcp
- mcast
- SR
- FPM
- T3

SEBA POD
- VOLTHA
- Redfish
- OF

OLT
- UNI
- NNI

ONU

AGG Switch

Compute

Chameleon

Synchronizers

Tosca

Database

XOS GUI

XOS Core

Redfish

OF

Redfish

OF
Why do we need a WorkflowDriver?

Most services are common to many use-cases.

The business logic is different operator by operator.

The workflow driver lets us re-use the same components to achieve different solutions.
ATTWorkflowDriver Modeling

- **White List**
  - Specifies which ONUs are allowed, and on which PONs

- **WorkflowDriverServiceInstance**
  - Identifies ONU
  - Identifies Subscriber
  - Contains dynamic state, typically learned from events
    - administrative
    - authentication
    - dhcp
Workflow kickoff

ONU DISCOVER -> Workflow Driver

Workflow ServiceInstance -> ONU validation (whitelist)

RCORD Service

VOLT Service

Fabric XC Service

RCORD Subscriber

OSS
Sample effects on the Service Chain

- AUTH SUCCESS
- Workflow Driver
  - Workflow ServiceInstance

Update subscriber status

- RCORD Service
- VOLT Service
- Fabric XC Service

- RCORD Subscriber
- VOLT ServiceInstance
- Fabric XC ServiceInstance

- add subscriber call in ONOS
- create x-connect in ONOS
NEM Monitoring
Infrastructure

- **Operator OSS**
- **Alarms, events & stats**
- **Logs**

Key Components:
- VOLTHA
- ONOS
- XOS
- GRAFANA
- KIBANA
- PROMETHEUS
- ELK STACK
- KAFKA
- NEM Monitoring
- Compute

Graphical Connections:
- RG → UNI → ONU → OLT → AGG → NNI
- XOS to ONOS
- ONOS to VOLTHA
- VOLTHA to ONOS
- ONOS to KAFKA
- KAFKA to ELK STACK
- ELK STACK to PROMETHEUS
- PROMETHEUS to ONOS
- ONOS to GRAFANA
- GRAFANA to KIBANA

Integration Points:
- Operator OSS
- Alarms, events & stats
- Logs
Data flow for Monitoring and Logging

- **XOS Core & Synchronizers**
  - KafkaLogHandler

- **VOLTHA**
  - KafkaLogHandler
  - event_bus

- **ONOS**
  - Filebeat sidecar
  - kafka-onos app

- **Other Components/Services**
  - Kafka Producer

- **Kafka**
  - xos.log.* topic
  - voltha.log topic
  - onos.log topic
  - voltha.kpis topic
  - onos.kpis topic

- **Kafka Topic Exporter**

- **Logstash**

- **Elasticsearch**

- **Kibana**

- **Prometheus**

- **Grafana**

- **Other Processors**

- **Other Storage**

- **Other Consumers**
Kafka Topics within SEBA

Kafka allows many components to publish and subscribe to messages, and has topics for:

- *.log* - log messages
- *.kpis* - key performance indicators
- *.events* - events created by ONOS or VOLTHA

Current convention is to encode messages as JSON, in the future Protobuf may be used.
## NEM Dashboards: XOS GUI

Runtime service instantiation, Inventory, Workflow status

### AttWorkflowDriver Service Instances

<table>
<thead>
<tr>
<th>Actions</th>
<th>Authentication state</th>
<th>Backend state</th>
<th>Dhcp state</th>
<th>Id</th>
<th>Ip address</th>
<th>Mac address</th>
<th>Name</th>
<th>Of dpid</th>
<th>Onu state</th>
<th>Owner id</th>
<th>Policy status</th>
<th>Serial number</th>
<th>Status message</th>
<th>Uni port id</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q  X</td>
<td>AWAITING</td>
<td>AWAITING</td>
<td></td>
<td>56</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q  X</td>
<td>APPROVED</td>
<td>DHCPACK</td>
<td></td>
<td>57</td>
<td>10.11.1.107</td>
<td>90.E2:BA:6E:70:64</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q  X</td>
<td>APPROVED</td>
<td>DHCPACK</td>
<td></td>
<td>59</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q  X</td>
<td>APPROVED</td>
<td>DHCPACK</td>
<td></td>
<td>60</td>
<td>10.44.1.101</td>
<td>90.E2:BA:6E:70:67</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q  X</td>
<td>APPROVED</td>
<td>DHCPACK</td>
<td></td>
<td>61</td>
<td>10.22.1.101</td>
<td>90.E2:BA:6E:70:66</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
NEM Dashboards: Grafana

Statistics (FCAPS)
NEM Dashboards: Kibana

Logs (FCAPS)


<table>
<thead>
<tr>
<th>Time</th>
<th>kafka_topic</th>
<th>levelname</th>
<th>message</th>
</tr>
</thead>
<tbody>
<tr>
<td>September 9th, 2019, 11:25:58.056</td>
<td>onos.log</td>
<td>INFO</td>
<td>Sending DHCP packet to client at ef:0000d0d3e158fede/128</td>
</tr>
<tr>
<td>September 9th, 2019, 11:25:58.042</td>
<td>onos.log</td>
<td>INFO</td>
<td>Received DHCP Packet of type DHCPREQUEST from ef:0000d0d3e158fede/128</td>
</tr>
<tr>
<td>September 9th, 2019, 11:25:57.911</td>
<td>onos.log</td>
<td>INFO</td>
<td>Sending DHCP packet to client at ef:0000d0d3e158fede/128</td>
</tr>
<tr>
<td>September 9th, 2019, 11:25:54.927</td>
<td>onos.log</td>
<td>WARN</td>
<td>getMacVlanNextObjectiveId query - groupHandler for device ef:0000d0d3e158fede/128 not found</td>
</tr>
<tr>
<td>September 9th, 2019, 11:25:54.925</td>
<td>onos.log</td>
<td>WARN</td>
<td>Untagged host 46:E3:2:F5:21:8B/None is not allowed on ef:0000d0d3e158fede/128 without untagged or nativevlan config</td>
</tr>
<tr>
<td>September 9th, 2019, 11:25:54.924</td>
<td>onos.log</td>
<td>INFO</td>
<td>Host 46:E3:2:F5:21:8B/None is added at ef:0000d0d3e158fede/128</td>
</tr>
<tr>
<td>September 9th, 2019, 11:25:54.924</td>
<td>onos.log</td>
<td>INFO</td>
<td>Populating bridging entry for host 46:E3:2:F5:21:8B/None at ef:0000d0d3e158fede/128</td>
</tr>
<tr>
<td>September 9th, 2019, 11:25:54.882</td>
<td>onos.log</td>
<td>INFO</td>
<td>Received DHCP Packet of type DHCPDISCOVER from ef:0000d0d3e158fede/128</td>
</tr>
</tbody>
</table>
Backup

The NEM database (Postgres) can be backed up and restored using the `cordctl` CLI tool, or via gRPC API.

Logging/monitoring services can be configured to use persistent storage within the pod, and have API's for export/storage.
SEBA Lifecycle and Upgrades

In-service software upgrade (ISSU) is supported within NEM

- XOS
- 3rd party components (monitoring/logging/storage)

Other components (ONOS, VOLTHA) don't have persistent state and are configured by XOS, so can be upgraded or restarted with minimal service interruption.
Troubleshooting a SEBA deployment

- Check the cabling
- Check that traffic is flowing
  - Packet counters are aggregated in Prometheus and Grafana
  - tcpdump and similar
- Check for errors in the logs
  - Logs are aggregated across components in ELK Stack
- Follow the troubleshooting guide
  - https://guide.opencord.org/profiles/seba/
Most common issues

● Configuration differs from physical setup
  ○ How to spot: port state (up/down) in ONOS and XOS
  ○ Errors in the ONOS log

● Serial Numbers mismatch
  ○ How to spot: AttWorkflowDriver, sadis command in ONOS
Most common issues

● OLT Agent incompatible version
  ○ How to spot: Device is not active in VOLTHA, or no ONUs are discovered

● BNG or Radius configuration
  ○ How to spot: EAPOL, DHCP or Ping not working, ONOS/AttWorkflowDriver logs
Q & A?