ONAP VoLTE

Blueprint Overview

ONAP Voice over LTE Improves Agility and Slashes Costs for Communication Service Providers

“By using ONAP to support the VoLTE Blueprint, we expect core network services to be delivered in a more agile fashion, as VNFs can be onboarded on demand and combined in distinct ways to create customized services for users in different verticals.”

–China Mobile

OVERVIEW:

- VoLTE is being adopted by operators in order to improve voice quality and network efficiency
- Traditionally uses physical appliances
- Current operations and management use manual processes

CURRENT CHALLENGES:

- Lack of agility
- High capital expenditures
- High operating expenditures
- Reduced infrastructure utilization

SOLUTION:

- ONAP along with
- Commercial vEPC, vIMS VNFs
- Commercial SDN controllers
- Commercial cloud software

Overview

As Communication Service Providers (CSPs) move to data-only networks with LTE and 5G, a mobile core network technology called VoLTE allows voice to be unified onto IP networks.

For a consumer, VoLTE provides better voice quality and faster call setup. For example, going from a traditional 8 kbps codec to a 13 kbps codec with improved compression can result in a high-definition sound experience with higher clarity. VoLTE can also be twice as fast as voice technologies in terms of initial call setup.

VoLTE enables a CSP to offer value-added services such as video chat associated with the same phone number. The CSP can cut cost by unifying all services onto IP and increasing the efficiency of the network. VoLTE also promises additional benefits such as lower power consumption as compared to over-the-top VoIP applications, seamless handoff between VoLTE and voice-over-WiFi and improved device interoperability across networks. For these reasons, VoLTE is gaining broad adoption.

VoLTE includes two key underlying services: Evolved Packet Core (EPC) and IP Multimedia Subsystem (IMS). EPC provides data connectivity from the radio (eNodeB/RAN) on one side to the external internet on the other side. IMS is an architectural framework that, amongst other things, provides VoIP calling capability. When combined, the two services provide end-to-end VoLTE capability.

Problem Statement

Currently, CSPs use dedicated appliances (also called physical network functions or PNFs) along with manual planning to implement their core network services such as VoLTE. This approach has several shortcomings:

Lack of Agility:

Since features and capacity are planned manually, it is impractical to adjust network services to new needs dynamically.

High Capital Expenditure (CAPEX):

Physical network functions are relatively expensive contributing to a high CAPEX.

High Operating Expenditure (OPEX):

Since the maintenance and upgrade of physical network functions is manual, the OPEX is high. Furthermore, the sprawl of types of hardware platforms, management dashboards and monitoring methodologies, also contributes to a high OPEX due to the complexity of troubleshooting and overall MTTR.

Poor Efficiency:

Network designers generally attempt to handle peak traffic. When coupled with the fact that PNFs are dedicated to one service and cannot be shared across services, the result is low hardware utilization (increasing the effective cost of the service).

Solution

The Open Network Automation Platform (ONAP) project orchestrates VoLTE using software defined networking (SDN) and network functions virtualization (NFV) to improve efficiency and network agility.

ONAP is an open source project that provides a common platform for telecommunications, cable and cloud operators and their solution providers to rapidly design, implement and manage differentiated services. ONAP provides orchestration, automation and end-to-end lifecycle management of network services. It includes all the Management and Orchestration (MANO) layer functionality specified by the ETSI NFV architecture; additionally, it provides a network service design framework and FCAPS (fault, configuration, accounting, performance, security) functionality.

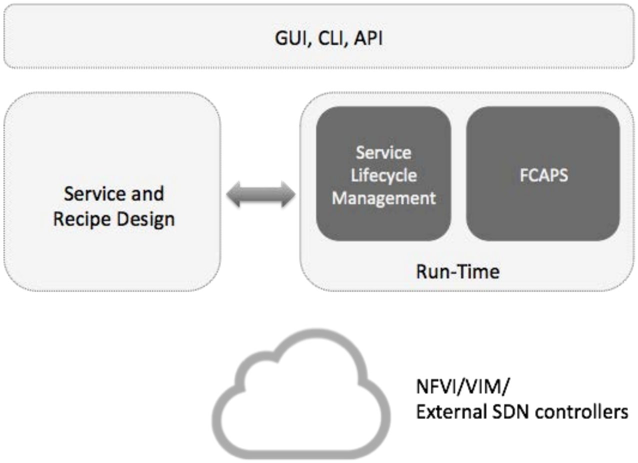

Figure 1: ONAP Functionality

ONAP includes a VoLTE blueprint for two purposes:

- Show how ONAP can used by CSPs to implement VoLTE consistently and cost-effectively
- Provide a tangible use case to the ONAP developer community to help them prioritize features and platform optimizations

The ONAP VoLTE blueprint incorporates commercial virtualized network functions (VNFs, see below for list) to create and manage the underlying vEPC and vIMS services (virtualized versions of the EPC and IMS services respectively), via collaboration with commercial software from VNF vendors, VIM vendors and SDN device vendors. More specifically, in VoLTE blueprint , ONAP interworks with vendor-specific VNF managers (VNFMs), element management systems (EMSs)), Virtual Infrastructure Manager (VIMs) and SDN controllers across two datacenters -- edge and core. The use of commercial software offers CSPs a path to production.

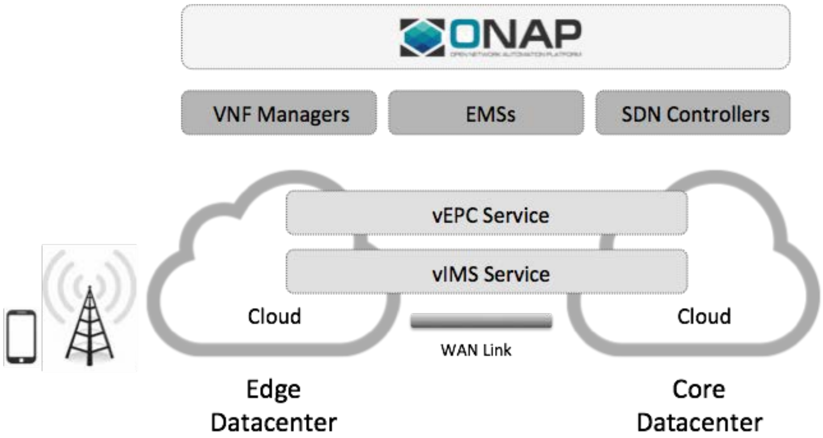

Figure 2: ONAP VoLTE Blueprint

Implementation Details

Specifically, the ONAP VoLTE blueprint utilizes the following components in addition to ONAP:

- Virtualized Infrastructure Manager (VIM): VMware Integrated OpenStack (VIO) and Wind River Titanium Cloud Platform
- vEPC: VNFs from Huawei and ZTE along with associated VNFM and EMS
- vIMS: VNFs from Huawei and Nokia along with associated VNFM and EMS
- SDN controllers: Huawei and ZTE

The blueprint involved 7 initial design steps:

1. VNF onboarding: During this step, vendor-provided VNFs, VNFMs and EMSs are imported into the ONAP platform. All of this vendor-provided software (VSP) has to follow strict ONAP packaging and documentation guidelines to promote standardization and reuse of components. Once the software has been imported correctly, it is tested and stored in a catalog for designers to use.
2. vEPC network service design: In this step, a designer takes onboarded VNFs and connects them together to form a vEPC service. Custom workflows are also designed at this point.
3. vIMS network service design: Similarly, a designer utilizes onboarded VNFs to form a vIMS service. Like vEPC, custom workflows are also designed at this point.
4. Underlay network service design: The underlay network configuration is captured in a design template. This service is responsible for configuring all physical switches, routers, and gateways. The underlay network service also configures the PE routers adjacent to the edge and core datacenters to create the L3 VPN tunnel that ensures the quality of service of the WAN connection.
5. Overlay network service design: The overlay network that connects all VNFs to each other (datapath and control-path) and to ONAP (management) uses VxLAN and is configured using this network service design template[1].
6. VoLTE service design: An end-to-end VoLTE service is constructed next by using the vEPC, vIMS, underlay network and overlay network services.
7. Closed loop automation design: Finally for service assurance purposes, a closed loop automation recipe is created. The flow of this initial recipe is relatively simple: if a VM goes down, two alarms are triggered for the same event — one from the VIM and another from the EMS. Alarm correlation analysis concludes that the root cause of both alarms is the VM going down. The recipe makes sure that a self-healing workflow is generated. The recipe itself contains three components: A) data collectors, B) alarm correlation rules, and C) a policy to trigger the self healing workflow.

[1] The overlay network is also responsible for configuring the gateways at the edge of each datacenter (using EVPN and VxLAN) to logically isolate VoLTE data traffic. This is currently performed manually and is anticipated to be automated in the Beijing release.

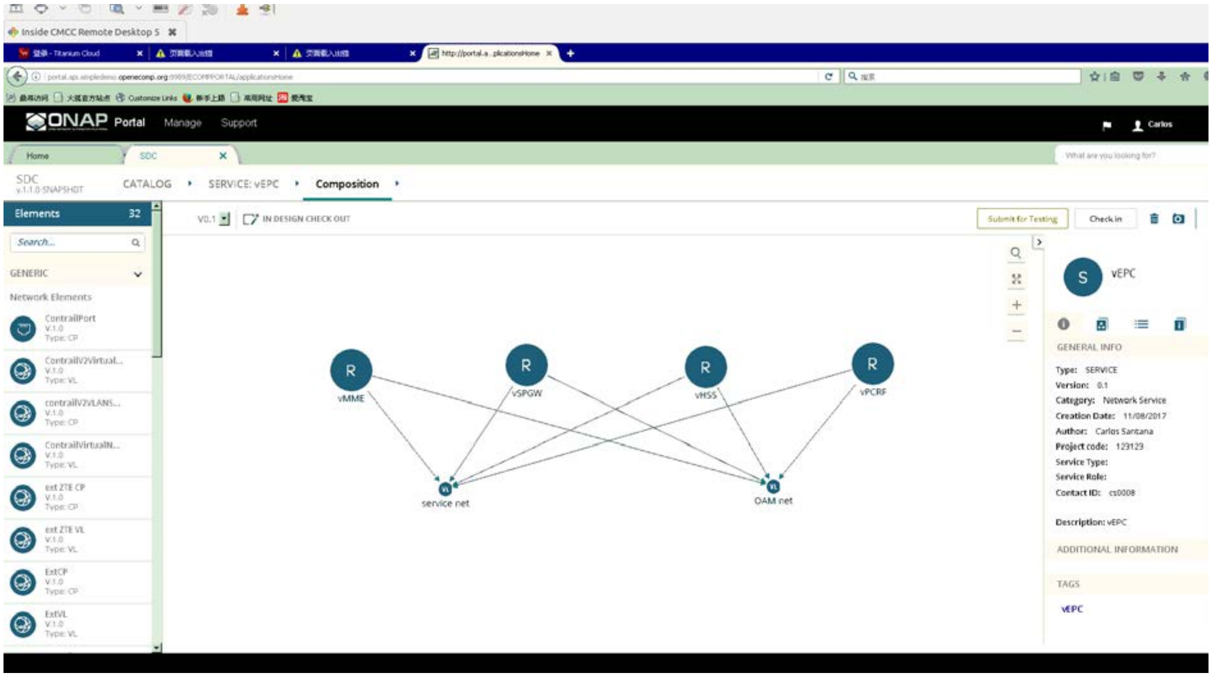

Figure 3: ONAP Service Design and Creation (SDC) Portal Screenshot

Once the design phase is complete, the various artifacts are automatically distributed to the right run-time component of ONAP, and the user does not have to take any special steps. ONAP uses a sophisticated set of algorithms, independent of the VoLTE blueprint, to distribute the right artifact to the right run-time software component:

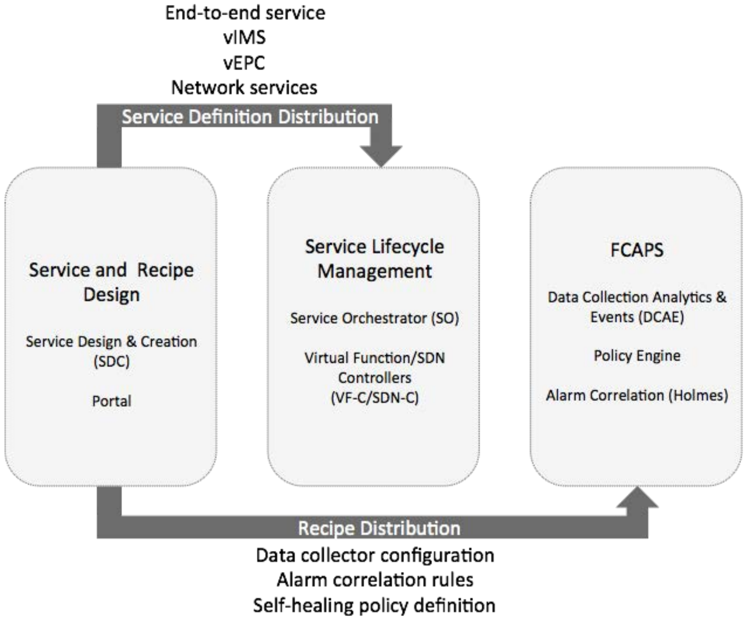

Figure 4: Distribution of VoLTE artifacts from design to run-time

After the artifacts have been distributed to the right component, run-time processes take over. Run-time deployment is triggered via a special ONAP Portal application called the Use Case UI (UUI). The service orchestrator (SO) and its virtual function and SDN controllers (VF-C, SDN-C) jointly complete initial deployment and subsequent lifecycle management. The end-to-end VoLTE service is broken down into the four respective services described above. Each of these services are orchestrated, and subsequently the end-to-end VoLTE service is orchestrated. Run-time lifecycle management for all these services is provided by UUI. Many of the 29 projects in the Amsterdam release of ONAP and 3rd party software components interact with the VoLTE blueprint (a full discussion is outside the scope of this document). In fact, VF-C and SDN-C depend on third-party VNFMs/SDN controllers for deployment and lifecycle management of specific VNFs and DCI (DC interconnection) network connections, and third-party EMSs for VNF configuration and monitoring.

Once the service deployment is complete, the Data Collection Analytics and Events (DCAE) software configures data collectors for monitoring. In the VoLTE blueprint, both the VIM and VNFs are monitored. Events are sent by DCAE to the alarm correlation engine — Holmes. If Holmes detects two concurrent failure alarms as described above, it generates an event that then triggers a policy to execute the self-healing workflow. The self-healing workflow calls VF-C (which in turn calls external VNFMs) to create additional VNF instances as appropriate.

Users can also manually trigger VNF scale-out/scale-in operation through the UUI. Manually triggered scaling is useful to schedule capacity in anticipation of events such as holiday shopping. The actual scaling operation is carried out by VF-C in conjunction with external VNFMs.

Results

As we have seen, ONAP is used to design, deploy, monitor and manage the lifecycle of a complex end-to-end VoLTE service. The VoLTE blueprint uses commercial production-ready VNFs and VIM software.

The results are promising: service deployment times are slashed from months to hours or minutes. Similarly, service assurance can be addressed in real time instead of minutes or hours. Hardware efficiency goes up, since ONAP is multi-tenant and services can be scaled up and down as needed. Finally, the operations and management burden is reduced through automation, helping CSPs move from a break-fix mentality to a plan-build process.

Summary

ONAP helps fulfill the promise of automation for the VoLTE blueprint. By using ONAP to manage the complete lifecycle of the VoLTE use case brings increased agility, CAPEX and OPEX reductions and increased infrastructure efficiency to CSPs.

Resources

VoLTE blueprint video on YouTube and Youku
VoLTE blueprint wiki page