AI Driven Orchestration, Challenges & Opportunities

Openstack Summit 2018
Sana Tariq (Ph.D.) – TELUS Communication
Agenda

- Service Orchestration Journey
- Service Orchestration Operational Challenges
- Closed Loop Orchestration and Dynamic Policy
- AI/ML Driven Orchestration
NFV and Orchestration Journey…

- **2016**: PNs
- **2017**: Building NFV Cloud
- **2018**: Applications Onboarding
- **2019**: Automated Assurance
- **2020**: AI driven/managed operations, capacity and applications
- **2021**: AI driven/managed services (advanced)
- **2022**: 5G IoT customers defined services through customized user portals

**IoT and OTT Services/ User-defined Services/International customers**

- **Increased Maturity OSS/BSS interlock, evolution of customer Portals, inventory compliance**
- **Increased Maturity of Catalogs/Templates/Blueprints to deliver software defined services**
NFV Telco Cloud - is different ...

- APIs
- Reliability
- Self serve
- Automation
- Scalability
- Standards based
- Secure
- Cost efficient
- 24x7 availability
- Fast and agile
- High Throughput Low Latency
- High Throughput Low Latency
NFV and Orchestration Journey...

- Building robust cloud infrastructure
- Virtualizing Applications
  - Provisioning workflows
  - Assurance
  - Automated scaling
- Traffic steered through SDN network
- Monitoring through holistic service assurance
- Integration with OSS/BSS
- E2E Service Orchestration plays are major “orchestration” role
Orchestration: Commercial or Open Source

Commercial
- Vendor lock-in/proprietary plugins
- Higher licensing cost
- Trusted support model
- R&D driven roadmaps
- Depends on Company size

Opensource
- Vendor agnostic/shared community plugins
- Significantly lower costs
- Self/Community support
- Community driver roadmaps
- Depends on community participation

Opensource SI Vendors

Commercial Vendors

Vendor lock-in/proprietary plugins
Higher licensing cost
Trusted support model
R&D driven roadmaps
Depends on Company size
Orchestration Functional Elements

- Service Design and Creation
- Redundancy
- Template Validation
- VNF/Services Testing
- Life Cycle Management
- DevOps Model Enterprise License
- Analytics & Policy
- Automated Install
- Resource Orchestration
- Adaptors/Plug-ins

Orchestration Evaluation
Cloud
Robust Cloud supporting automation features, APIs, elasticity etc.

SDN Network
Complete softwarization of DC and WAN for on-demand creation of services

Analytics
Robust analytics cross-functional domains for scaling, healing & optimization for cloud and services

DevOps
Effective DevOps culture and support for short time-to-market and efficiency targets

Data Models
Homogeneity across stacks for consistent data models for seamless integration, reusability and abstraction
Chaos of Multi-Vendor Multi-Domain...

Customer facing services

NaaS/OTT  Voice OTT  5G IoT  VoD

SD-WAN

NFV Cloud

E2E Service Orchestration
Software Defined Service Operational Challenges...

1. Service Design
2. Orchestration (testing in a sandbox)
3. Package and distribution
4. Orchestration (runtime)
5. Assurance
6. Troubleshooting

Debug
Launch
Offline in lab
Services Operation in real-time

Service failure
Closed Loop Orchestration Static...
AI/ML Orchestration

**WHY?**
- Data Surge: 5G Services/ IoT increase in traffic volume and patterns
- Static Policies: Reactive decisions, False Spikes, Too many policies & conflicts
- Dynamic Policy: Strategy to develop dynamic policies and testing
- Analytics Model: Robust Analytics framework for feeding AI/ML systems

**WHAT?**
- Customer Experience: Closer to the edge, Service Healing, Service optimization, Differentiated QoS
- Cloud Optimization: Energy optimization, Capacity optimization, Faults prediction & healing, Fast troubleshooting
- Network Optimization: Traffic optimization SDN controller, QoS based routing
- Security: Proactive/predictive threat identification, Closed loop decisions to attacks mitigation

**HOW?**
Building an AI Application

**STEP 1**
Problem definition

**STEP 2**
Gather real, sizeable training data

**STEP 3**
Prepping the data: cleansing, normalization, feature engineering

**STEP 4**
Training phase: robust training environment

**STEP 5**
Testing phase: Experiment with Models, Pick best Models and create feedback Loop

**STEP 6**
Evaluation, predictor improvement and re-training

RESULT
AI is becoming easier...

Raw AI/ML
- Data Scientists needed, higher complexity

ML Libraries
- Python libraries – lower complexity
  ONAP leverages
  SPARK, Mlib,
  MALLET, WEKA etc.

AI Projects
- H2O, TensorFlow

Acumos
- Predictors & Models developed by shared community effort + data

Accessible Data
- Better Analytics Engines,
  Better data organization
- Large volumes of managed Data

Computing Power
- Low Cost
- High Power
- GPU, NPU availability
ONAP Intelligent Closed Loop Architecture...

**Design Time**
- CLAMP (Closed Loop Automation and Management Platform) GUI that generates TOSCA
- SDC (Service Design Creation)

**Run-time**
- DCAE
  - AI/ML (Python Library)
  - Policy Execution
  - Synthetic Data (Extension)
  - Hadoop
  - Ceilometer collector
- DMAAP
  - POLICY EXECUTION ENGINE
  - POLICY EXECUTION ENGINE
  - SDN-Controller
  - APP-C (GVNFM)
  - Service Orchestration

**Condition**
- Cloud Region 1
- CPU Utilization
- Alert
- Action
- Shift VNF / workloads from Cloud Region 1 to Cloud Region 2

**TOSCA Policy 1**
- Cloud Region 1
- VNF 1
- VNF 2

**Cloud Region 2**
- Cloud Region 1
- VNF 1
- VNF 2

**Ceilometer**
ONAP Policy Execution Flow...
AI/ML Orchestration Industry Verticals

- Study of VNFs performance requirements (MME, S/P-GW, vSBCs etc.)
- NSD and VNFD Package description to associate color tags for VNF types to support these use-cases
- DCAE: Dynamic Policy and Cloud optimization use-cases
- Acumos: Develop ML Models for cloud optimization use-cases
- BigData/Hadoop/Analytics
- Policy Rules:
  - Initial Placement
  - Cloud Optimization related actions
  - Customer QoS related actions

Enhance ceilometer & support cloud optimization configurations
Sana Tariq (Ph. D.)
Sana.tariq@telus.com