OSM#9 Ecosystem Day
Delivering Closed Loop Operations
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Let us simplify the network!

“The definition of genius is taking the complex and making it simple.

- Albert Einstein
Autonomous Network Vision

Network with a brain, that -

Self Learns
continuously learn from past anomalies and predict and prevent future failures

Self Protects
constantly look for security attacks and shield the system before any harm is caused

Self Optimize
constantly adapt to the network dynamics to provide a superior end user experience
Journey to Autonomous Network

- People Driven
- KPI & Rules Driven
- Predictive
- Prescriptive
- Reactsive Automation
- Open Loop Automation
- Closed Loop Automation
- Autonomous Network

Degree of Automation vs. Business Impact & Productivity

- Human Machine Interface
- Proactive Automation

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What is Closed Loop Automation?

Closed-loop automation powers autonomous networks.

1. Observe
Collect network metrics through streaming telemetry interfaces.

2. Decide
Processes collected metrics to determine the network status, and decides action to be taken based on network policies. This phase is not responsible for executing the action.

3. Act
Acts upon orchestrated object and implements given lifecycle action.
Use Cases of Closed Loop Automation

- **Autonomous Network Planning**: Intelligent radio & fiber optics network planning
- **Autonomous Service Rollout**: Zero touch service or network rollout
- **Autonomous Network Operation**: Automated root cause analytics (RCA) & guided diagnostics
- **Autonomous Network Security**: DDoS attack and BotNets prevention
- **Predictive Maintenance**: Prevent complex faults & performance issues
What Is Needed to Build a Robust CLA?

1. Sense
   - Realtime Network Data

2. Predict
   - Trained Models
   - Realtime & Forecasted Network Anomalies

3. Prescribe
   - Action Scoring Secondary Feedback Loop
   - Calculate Reward
   - Get Previous Action's Outcome

4. Act
   - SDN Controller NFV MANO
   - Network Intents

**Secondary Feedback Loop**

1A. Append to Historical Dataset
1B. Validate ML Models
1C. Update Scorecard

**Primary Feedback Loop**

2. Act
3. Act
4. Act

Business Intents

Model Training Secondary Feedback Loop

Train ML Models
Mapping with OSM Service Assurance Components

1A. SNMP Exporter
1B. Train ML Models
1C. Test ML Models
2. MON
3A. Calculate Reward
3B. Update Scorecard
3. POL
4. LCM

Primary Feedback Loop
- Resource Request
- Act
- Act
- Act
- Sense
- Prescribe
- Action Scoring
- Secondary Feedback Loop
- Get Previous Action’s Outcome
- Prescribe New Action

Secondary Feedback Loop
- Update Scorecard
- Realtime & Forecasted Network Anomalies
- Train ML Models
- Test ML Models

Business Intents

Keras
TensorFlow

MON
Trained Models
Network Data

Test ML Models
Trained Models
MON

Network Data
Prescribe New Action
Resource Request
Primary Feedback Loop
Action Scoring
Secondary Feedback Loop
Get Previous Action’s Outcome
Prescribe New Action

RO

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First step is already there !!

Auto Scaling

• Auto scaling allows to automatically scale VNFs with a VDU granularity and based on any available metric.

• Scaling descriptors can be included and be tied to automatic reaction to VIM/VNF metric thresholds.

• Supported metrics are both VIM and VNF metrics.

Alarms

• An internal alarm manager has been added to MON through the 'mon-evaluator' module, so that both VIM and VNF metrics can also trigger threshold-violation alarms and scaling actions.
What is available today?

- MON - Covers the basic monitoring, with a solid architecture to expand them easily.
- POL - Designed around basic auto scaling & alerting
- Static thresholds for alerting policies
- No correlation of metrics

What is required?

- Advance streaming telemetry like gRPC
- Long term storage of data
- Replace threshold based alerts with ML based advanced anomaly detections.
- ML based predictive alerting
- Recommendation engine
- Continuous improvement with feedback loop