

A Framework for Network Intelligence

June 5, 2018

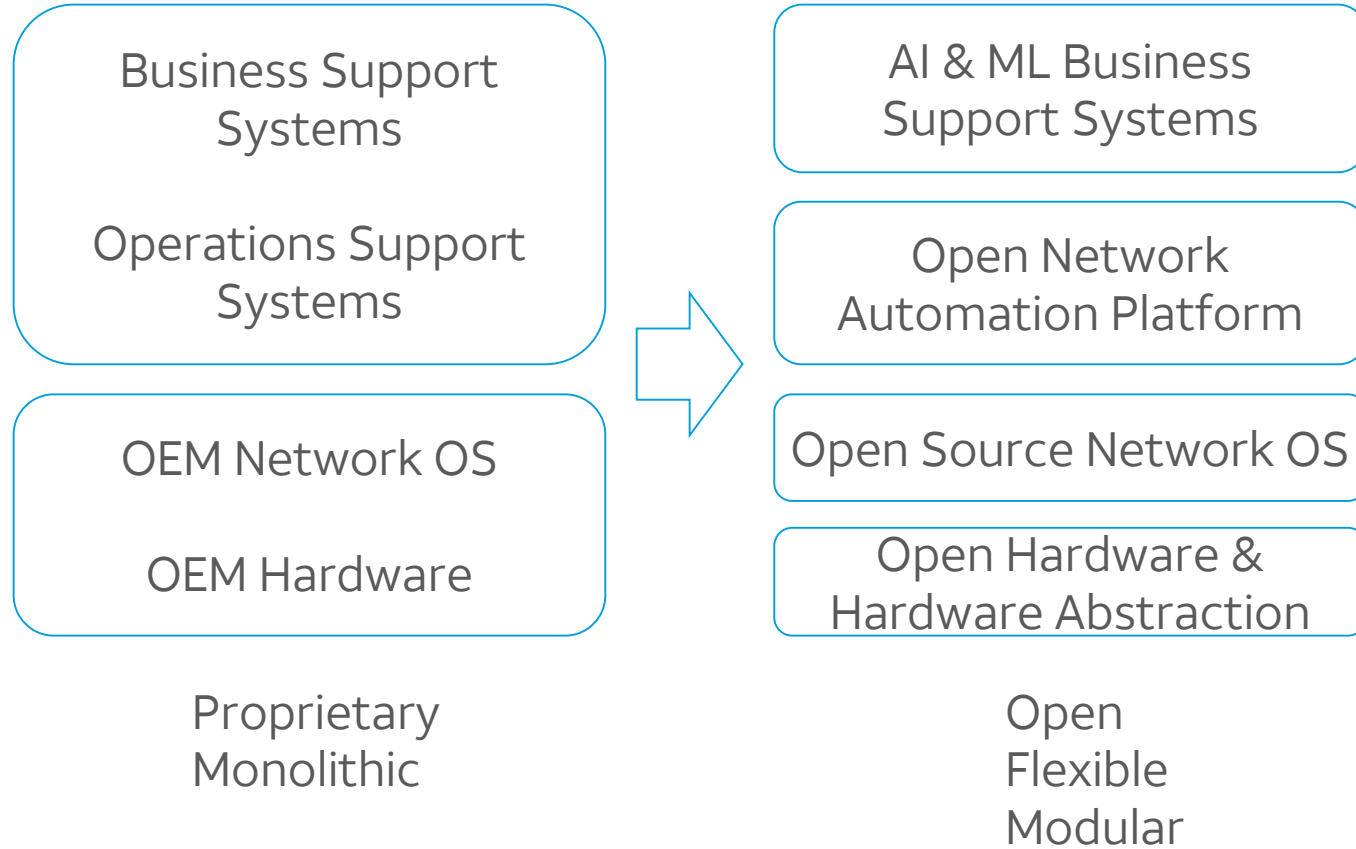
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Motivation for Intelligent Networks

Network Platform Evolution



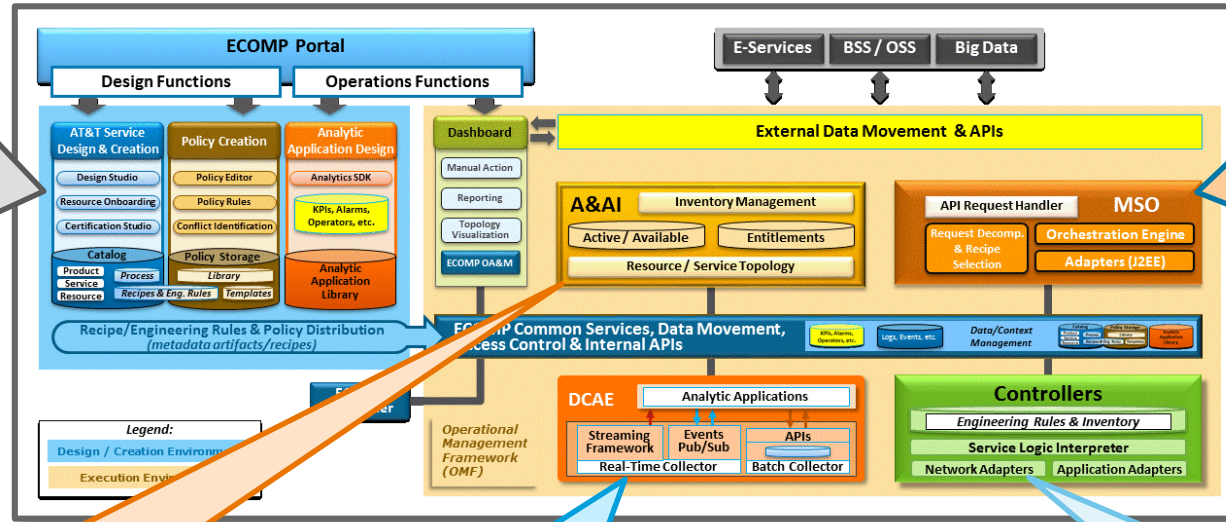
Drivers

- Agility
- Cycle time
- Interoperability
- Optimization
- Cost
- Ecosystem
- Innovation



ONAP Architecture

ONAP project brings together over 50 of the largest network and cloud operators and technology providers from around the globe—representing more than 60% of the world’s mobile subscribers



Design Platform

- **Service Design:** Rich catalog-driven environment to construct and maintain service and resource definitions, constraints and management processes & policies (recipes)
- **Policy Creation:** Associate anomalous and actionable conditions with automated remedy actions
- **Analytic App Design:** Design capabilities for creation of analytic applications

Master Service Orchestrator (MSO)

- Orchestrates and manages the delivery, modification or removal of networks & services
- Provides cross domain orchestration to optimize the utilization of resources or take broad corrective action
- Interacts with various applications to collect data to determine network facing parameters

Active & Available Inventory (A&AI)

- Real-time topology map with context views of virtual networks, services and applications
- Relationship context between components and the network fabric & infrastructure in which they operate
- Uses the network resources as the database of record due to their dynamic nature
- Provides a registration method used to discover and maintain services and resources

Data Collection, Analytics & Events (DCAE)

- Collects Data & Events necessary to manage and evolve D2.0 networks and services
- Makes collected data available to real-time apps
- Provides framework for analytics apps to identify patterns/anomalies and publish events to drive closed-loop control
- Provides these functions at all layers in the architecture

Controllers

- **Network:** Instantiates, configures & manages the lifecycle of Transport VNFs, infrastructure networking (e.g. leaf, spine & virtual switches) & WANs
- **Service/App:** Instantiates, configures & manages the lifecycle of Service VFs
- **Infrastructure:** Instantiates, configures & manages the lifecycle of infrastructure (compute, storage, etc.)



DANOS Open Source Network OS Architecture

Linux/DevOps friendly

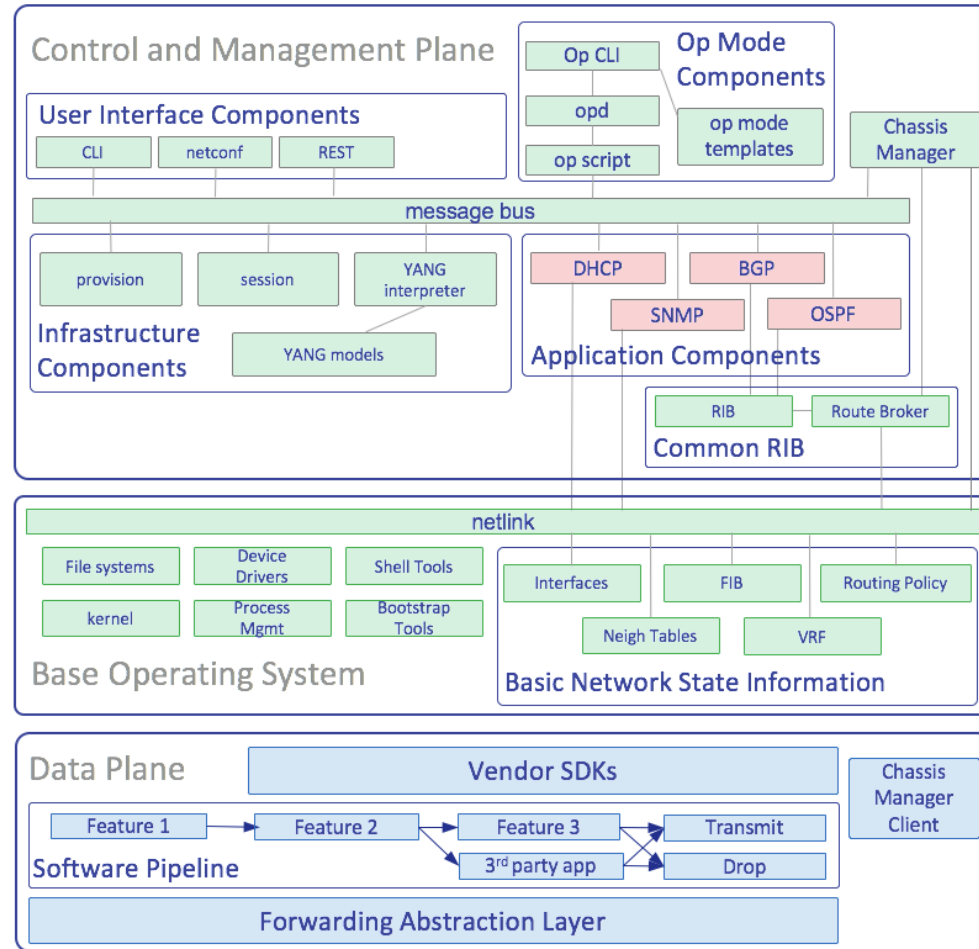
- Easy integration for existing applications
- Supports native Linux networking APIs, daemons, shells and tools
- DevOps ready, scripting API support

Network engineer friendly

- Familiar router interface and ops model
- Multiple simultaneously installed images
- Image rollback, global config file, etc

Completely Modular

- Package level modularity for application vendors
- Customizable to your specific use case
- Lightweight control plane infrastructure API
- Modular vector based software forwarding pipeline
- Modular hardware abstraction interface



Distributed forwarding abstraction layer

- Physical separation between control plane and data plane(s)
- Manage multiple distributed software and hardware data planes, including P4

Fully featured software data plane

- Forwarding/Firewall/NAT/QoS/VPN
- Programmable vector based pipeline

Hardware data plane abstraction layer

- Multi-vendor merchant silicon support

Virtualization ready

- Bare-metal and VNF, private/public clouds
- Host OS support for VNFs in VMs and containers
- High speed L2/L3/stateful services between VNFs

Modern scalable distributed build and test environment

- Automated, differential product builds from module manifests and packages



Framework for Intelligent Networks

Framework Implementation

Acumos AI & ML¹

ONAP²

DANOS³

Whitebox & Hardware
Abstraction⁴

Framework

- Whitebox as the base
- Acumos AI & ML at the top
- DANOS & ONAP tie Acumos & Whitebox together
- Open Source
- Provides unprecedented ecosystem opportunity for zero touch automation

¹ www.acumos.org

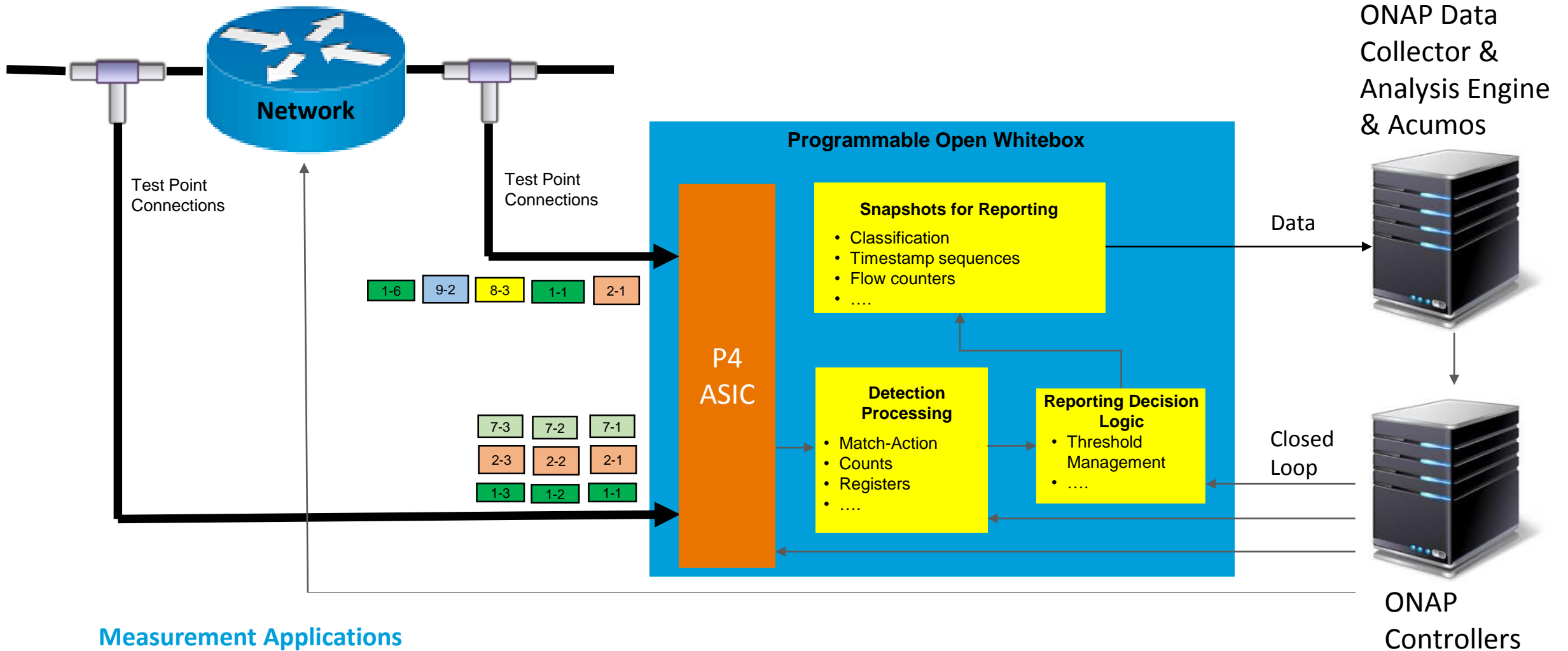
² www.onap.org

³ about.att.com/story/dnos_software_framework_into_open_source.html

⁴ www.opencompute.org; www.p4.org



P4 Based Measurement Toolkit/Framework



Measurement Applications

- Anomaly Detection & Traffic Classification (Microbursts, Ingress/Egress Anomalies)
- Statistical Traffic Modeling
- Traffic Matrix Characterization



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