Whitebox and Autonomous Networks

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Domain 2.0 Architecture & Design
Challenge: Current hardware-centric path is unsustainable

- Projected backbone traffic growth by 2020: 10X
- HW centric network design and build: Linear scale
- SW centric network design and build: Hyper scale
Changes in consumer behavior are impacting data consumption

1GB

4MB ~250X

350KB ~10X

20KB ~10 to 20X

1 minute virtual reality experience

1GB ~10X

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Elements of an SDN Transformation

Real-time, Agile customer enablement

Speed and Flexibility -- Improved efficiency, reduced cycle times, innovative services & apps, faster

NFV
ONAP
SDN

Network Cloud - Integrated Cloud – Shared, Common, Homogeneous

Skills Pivot - Internal Transformation – People, Process, Culture
Near term benefits:
• Near Real-time predictive control
• Optimized user experiences
• Greater operational automation

Future capabilities:
• Machine learning & artificial intelligence
• Hyper-automation

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Whitebox Opportunity

Not Custom Built
Open Platform/Interfaces
Off-the-Shelf Technology
Multi-Vendor Sourced
Network ASIC Data Plane

Open Network Environment
Software Defined Data Center Networking Solution

Orchestration Control & Network Mgmt

openstack

API

NOS
Universal OS Installer
Firmware

Bare Metal Switch

White Box
Whitebox: Shift to Open & Flexible

Proprietary
- Fixed
- Siloed

Open - Standard
- Flexible
- Modular

Software Control

Open Interfaces

Hardware

Software

Hardware

Hardware

Hardware
Whitebox Benefits

- Modular with Open Interfaces
- Lower CAPEX and OPEX for the new solution
- Using original design manufacturers (ODMs) for hardware configurations
- Built on Merchant Silicon
- Better visibility and input into silicon roadmap
- A growing, open hardware ecosystem in communities like the Open Compute Project (OCP)
Whitebox: New Ownership Options

Option 1:
Service provider can, essentially own or control the integration, delivery and support for the entire solution.

Option 2:
Service provider can control the design and specification of hardware and software modules and use third party integrators for manufacturing, break-fix, integration, and maintenance services.

Option 3:
Service provider to specify exactly what elements are to be used and what features are desired, and buy the complete solution from a single entity, specifying which elements and features you want.
Whitebox: Disaggregation of Network Elements

**Traditional Technologies**

Proprietary Hardware & Software From OEM

**New Whitebox Ecosystem**

- **Software 2 Layer**
  - N/W O.S. and Protocols (including data models)
  - Network Function Reference Design [OCP, ODMs]
  - Silicon Interfaces [Driver to Chip, DPDK, P4]
  - Merchant Silicon [Many Choices]

- **Hardware 2 Layer**
  - Standard

- **Software 1 Layer**
  - Swappnable Standard

- **Hardware 1 Layer**
  - Merchant Silicon
AT&T Whitebox NOS Open Architecture

- **Net Mgmt**
- **Feature & Service Mgmt**
- **Routing Controls**
- **OAM Counters**
- **Packet Processing Pipeline Cfg**
- **ACLs, Traffic Mgmt. Cfg**
- **RIBs, RPLs, FIBs**

**Common Infrastructure Data**

**Forwarding Hardware Abstraction**

- **SDKs & Drivers**
- **Base-OS (Linux-distribution)**

**Controller CPU & BMC**

**Forwarder**

NPU ASIC and/or x86 CPU
Whitebox: Common Infrastructure Data
Macro-level Topology and Placement of Whitebox elements
Autonomous Network

Machine Learning (ML)

The ability for networks to become data-powered predictive systems

Artificial Intelligence (AI)

The ability for networks to learn and acquire information from data and to continuously optimize policies and actions over time

Autonomous Network = ML/AI + SDN + BIG DATA
Hyper-automation Drives an Autonomous Network

Hyper Scaling

Collect

Predict

Machine Learning

Predict

Optimize

Artificial Intelligence

Predict

Optimize

Optimize

Optimize

Act
Virtual Machine Life Cycle Management

Collect

Historical counters, KPI, and VNF alarms, network events

Predict

Machine Learning

Optimize

Artificial Intelligence

Optimize

Learn & update policies

Act

Dynamic Learning of corrected actions

Migrate traffic, reboot VM and then health check

Time correlation and predict signatures

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APPLICATION: DRONES MEET VIDEO AI

Goals

Automate inspecting and resolving cell tower faults by drones
  • Reduce the cost of maintenance and time to repair
  • Improve technician safety

Status

  • Acquired over 500GB of cell tower images and videos
  • Deep Learning identifies hardware components

Features

  • Hours-long videos summarized so technicians can focus on key areas
  • Image-based search allows technicians to zero in on specific components
  • Supervised Learning identifies trouble spots for exploration

Platform Microservices Involved:

- Video Segmentation
- Image Classify
- Image Search
- Image Storyboard
- Summarization
- Event Detection

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Application: Automated Visual Cell Tower Inspection

- Current state is human inspection – live / videos
- Using drones to capture videos instead of dispatching technicians
- Ultimate goal is full automation using drones for capture and visual inspection by machines