Agenda

- Cloud CMTS
- DAA + Automation & Orchestration
- Single Pane of Glass Management
Evolution of Cable to Webscale Architecture

Cloud CMTS
- Virtualized CCAP Core
- Flexible MAC

DAA
- Physical Core
- RPHY
- CIN network

Automation
- RPD, CCAP core and CIN onboarding
- SW Upgrade, Change Management

SPOG Cloud & DAA Mgmt
- DC, DAA and CCAP Health Management
- Analytics and Cross Domain Orchestration
Cloud CMTS
Cloud Native Broadband Router (cnBR)
### Cisco Cloud Native Broadband Router

A containerized, cloud native, CCAP, unifying multivendor solutions into a single, secure, standards-based architecture

<table>
<thead>
<tr>
<th>Cloud native</th>
<th>Operational Simplicity</th>
<th>Automation &amp; API Driven</th>
</tr>
</thead>
<tbody>
<tr>
<td>NFV done right. Containerized software architecture that is elastic, resilient and composable simplifying the transition to CI/CD.</td>
<td>Microservices architectural pattern for high portability, scalability, and elasticity. Moving from SNMP and CLI to API and dashboard driven architecture.</td>
<td>APIs enabling Intent driven networking. Transform network operations with closed-loop automation.</td>
</tr>
</tbody>
</table>
cnBR Architecture

Operations Hub (OpsHub)
- Health Monitoring
- Automation
- Provisioning

cnBR Cluster
- DOCSIS APP Services
- DOCSIS CP Services
- DOCSIS Real Time
- DOCSIS DP Services

Common Cloud Native Stack for vEPC, Cloud CMTS and vBNG

High-Perf Container networking
- vSwitch, FD.io, Ligato.io, etc

Cloud Native Infra: K8s, Docker, etc

Host OS

Server HW / FW (Bare metal or VM)
cnBR Enables Convergence At The Edge for 5G

End2End Automation Integration

- cnBR for Cable
- vEPC for Mobility
- Telco vBNG

Common Cloud Native Stack

Kubernetes Cluster

Host OS
Server HW

Compute
Storage
Network

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cnBR Managed from a Single Pane of Glass

Data & Messaging Infra: KAFKA, etcd, …

DOCSIS APP Services
- CM Load Balancing
- Packetable / PCMM
- RPHY Manager
- App upgrader
- DSG
- IPDR...

DOCSIS Real Time
- US Scheduler
- Ranging

DOCSIS CP Services
- DOCSIS core protocol
- PTP
- BPI
- OFDM

DOCSIS DP Services
- VPP vSwitch
- VPP DP
- DHCP Relay Agent

vSwitch (FD.io (VPP), Ligato.io)

Internet

Data Center Fabric

CN

Operations Hub
- Health Monitoring
- Analytics
- Cross Domain Orchestration
- Optimization
- Cloud CMTS LifeCycle Mgmt

OpsHub

cnBR

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Operational Efficiency
Feature, Test and validation lifecycle efficiency

Legacy operations

Cloud Native operations

Design Provision Monitor

New Functions Design Test Provision Deploy Monitor

JAN MAR SEP OCT NOV

6+ Months

Every 2 weeks
cnBR Supported Services

- DOCSIS 3.0
- DOCSIS 3.1
- Voice
- DSG
- BSOD
- RPHY
- Health Visualization
- Infrastructure Resiliency
- Service Resiliency
Highly Scalable System

**Base system:** 3-node cluster, 2 active and one standby, running cnBR and Cloud Native Software Infrastructure

<table>
<thead>
<tr>
<th>Features</th>
<th>Base cnBR System</th>
<th>Expansion Server (Server 3+)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Throughput</td>
<td>100G</td>
<td>100G (Server 3+)</td>
</tr>
<tr>
<td>CMs</td>
<td>20000</td>
<td>20000</td>
</tr>
<tr>
<td>Service Group</td>
<td>160</td>
<td>160</td>
</tr>
</tbody>
</table>
DAA + Automation and Orchestration
**SP Automation Framework**

<table>
<thead>
<tr>
<th>Business &amp; Operations</th>
<th>Service Automation</th>
<th>Application Automation</th>
<th>Data &amp; Analytics</th>
<th>Data Platform</th>
</tr>
</thead>
<tbody>
<tr>
<td>Processes &amp; Systems</td>
<td>Design &amp; Modeling</td>
<td>CI/CD Toolchain</td>
<td>Performance</td>
<td>Visualization &amp; Reporting</td>
</tr>
<tr>
<td></td>
<td>Simulation &amp; Staging</td>
<td>API Management</td>
<td>Availability &amp; Continuity</td>
<td>Distribution &amp; Streaming</td>
</tr>
<tr>
<td>Data Protection &amp; Availability</td>
<td>Service Catalog</td>
<td>Definition &amp; Development</td>
<td>Revenue Assurance</td>
<td>Transformation</td>
</tr>
<tr>
<td>Identity Management</td>
<td>Service Lifecycle</td>
<td>Scheduling &amp; Orchestration</td>
<td>Event Management</td>
<td>Collection &amp; Storage</td>
</tr>
<tr>
<td>Access Control</td>
<td>Service Orchestration</td>
<td>Coordination &amp; Discovery</td>
<td>KPI Management</td>
<td>Indexing &amp; Search</td>
</tr>
<tr>
<td>Certificate Management</td>
<td>Service Assurance</td>
<td>Application Assurance</td>
<td>Diagnostics &amp; RCA</td>
<td>Telemetry Collection</td>
</tr>
<tr>
<td>Fraud Management</td>
<td>Naming &amp; Discovery</td>
<td>Performance &amp; Scaling</td>
<td>Correlation</td>
<td>Logging &amp; Tracing</td>
</tr>
<tr>
<td>Risk Management</td>
<td></td>
<td></td>
<td>Prediction, Insight</td>
<td>*Cisco SP CTO</td>
</tr>
<tr>
<td>Intrusion Detection &amp; Prevention</td>
<td></td>
<td></td>
<td>Machine Reasoning</td>
<td></td>
</tr>
<tr>
<td>Distributed Firewall</td>
<td></td>
<td></td>
<td>Machine Learning</td>
<td></td>
</tr>
<tr>
<td>Policy &amp; Rules Mgmt</td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>Lawful Intercept</td>
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<tr>
<td>Regulatory &amp; Compliance</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

- **Security & Policy**
  - Data Protection & Availability
  - Identity Management
  - Access Control
  - Certificate Management
  - Fraud Management
  - Risk Management
  - Intrusion Detection & Prevention
  - Distributed Firewall
  - Policy & Rules Mgmt
  - Lawful Intercept
  - Regulatory & Compliance

- **Infrastructure Automation**
  - Network Design
  - Capacity Planning
  - Element Modeling
  - Network Optimization
  - Workflow Management
  - Change Management
  - Configuration Mgmt

- **Application Automation**
  - Capacity Management
  - Resource Catalog
  - Dynamic Inventory
  - Service Discovery
  - Element Lifecycle
  - Software Lifecycle
  - Resource Lifecycle

- **Service Automation**
  - Product Catalog
  - Order Management
  - Mobile Device Mgmt
  - Workflow Management
  - Provisioning & Activation
  - SLA Management
  - Charging & Billing
  - User Experience
  - CRM

- **Data Platform**
  - Cluster & Host Management
  - Virtual Networks
  - Network Control
  - Event-based Compute
  - Licensing
  - Resource Configuration
  - Resource Monitoring
  - Remediation
  - Simulation & Staging
  - Resource Test & Probes
  - Addressing
  - Licensing

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Cross Domain Orchestration
Evolution to Intent based Automation

Operations catalog
- Upgrade/Downgrade MCP
- Golden Config
- cBR8 to cnBR offload
- Service Group onboarding
- Resource Validation
- Device Onboarding & activation
- Pre & Post Checks
- Device Migration

Service Design Platform
- Modelling
- Template editor
- Simulation

Service instantiation Platform
- Configuration Management
- Inventory Management
- Image Management
- Policy Management

Service Assurance Platform
- Collector
- Event correlation
- Health monitor
- Expert system

Recommendation Engine Platform
- AI/ML

Domains
- PTP controller
- CIN controller
- CCAP controller
- RPD controller
- Router controller
- cnBR controller
- Fabric controller
- Node controller
- MPEG Video controller
- Cable Modem controller

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DAA Management Architecture
DAA Automation Service Offer

End-to-End Solution to Onboard and Activate elements of a Remote-PHY Network.

5 Use Cases that leverage Smart-PHY, BPA, and NSO
DAA Automation Service Offer

Service request, configuration and fulfillment Portal

User interface:
- Workflow manager
- Automation and orchestration

Backend system:
- Team Coordination
- Configuration Standardization
- Deployment at Speed and Scale

Platforms:
- Service Readiness
- Deployment Status
- Golden Config Templates

Processes:
- CIN O&A
- cBR8 / RPD O&A
- OS Upgrades
## DAA-A 1.0 Offer

<table>
<thead>
<tr>
<th>Use Case</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>✔️ Automated RPD Onboarding and Activation</td>
<td>RPD can be onboarded via GUI or REST API call from 3rd party application</td>
</tr>
<tr>
<td>✔️ Automated CIN Onboarding and Activation</td>
<td>Onboarding (BPA and NSO) of existing CIN Devices via Zero Touch Provisioning</td>
</tr>
<tr>
<td>✔️ Automated cBR-8 Onboarding and Activation</td>
<td>Onboarding of existing cBR-8 devices into BPA and NSO</td>
</tr>
<tr>
<td>✔️ OS Upgrade</td>
<td>Upgrade of CIN and cBR-8 devices. Defined process template leveraged from workflows.</td>
</tr>
<tr>
<td>✔️ Configuration Compliance (aka Golden Config Templates)</td>
<td>Predefined configurations that allows to maintain consistent configuration on devices.</td>
</tr>
</tbody>
</table>
DAA Automation Evolution
Support Multi-vendor Environments

CCAP Core Vendor

CIN Vendor

RPD Vendor

CCAP Vendor 2

CIN Vendor 2

RPD Vendor 2

CCAP Vendor 3

CIN Vendor 3

RPD Vendor 3

Current Offer
In Production
TBD

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Single Pane of Glass
Operations Hub
Operations Hub Business Drivers

Simplification

- Provide common tools and framework for DAA deployments
- Deliver single pane of glass & core functionality to manage, automate and simplify DAA deployments
- Provide a common interface and tooling for CBR-8 and cnBR environments
- Ease integration into existing back-office

Ease Migration to Cloud

- Simplify deployment of cnBR
- Single pane of glass to ease migration to cloud
- Provide core management and configuration capability for cnBR
- Create an ecosystem for new applications innovation by operators and partners
Operations Hub (OpsHub)

01 Ecosystem Health Monitoring

02 Automation

03 Performance

04 Security & accounting

A Cloud Native Applications Ecosystem to Manage, Operate and Optimize DAA + Cloud Deployments

40% Health management

20% Performance Management

30% Configuration and Automation

10% Security & Accounting

API First, Insight Based, Telemetry Driven and Analytics Focused
# Operations Hub Functional Components

## OpsHub Applications

<table>
<thead>
<tr>
<th>Health Monitoring</th>
<th>Configuration</th>
<th>Accounting</th>
<th>Performance</th>
<th>Controllers</th>
<th>Security</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service Health</td>
<td>cnBR Deployer</td>
<td>Inventory</td>
<td>D3.1 Profile</td>
<td>GCPP Core</td>
<td>Authentication</td>
</tr>
<tr>
<td>Network Health</td>
<td>RPD Configuration</td>
<td>Usage metrics</td>
<td>Optimization</td>
<td>GCP Redirect</td>
<td>Infra security</td>
</tr>
<tr>
<td>System Health</td>
<td>CIN Configuration</td>
<td>Fault metrics</td>
<td>RF Optimization</td>
<td>Aux Core</td>
<td>Application security</td>
</tr>
<tr>
<td>CCAP health</td>
<td>iNode Manager</td>
<td>Audit metrics</td>
<td>Capacity Planning</td>
<td>Cross Domain Orchestration (SmartPHY 3.0)</td>
<td></td>
</tr>
<tr>
<td>CIN Health</td>
<td>RPD Move</td>
<td>Analytics</td>
<td>CIN optimization</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RPD Health</td>
<td>SmartPHY</td>
<td></td>
<td>End to End optimization</td>
<td></td>
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<tr>
<td></td>
<td>Image Management</td>
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<td></td>
<td>Software Upgrade</td>
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<tr>
<td></td>
<td>Ops Automation</td>
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</tbody>
</table>

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A Single Pane of Glass Management for Current and future DAA Deployments

Operations Hub
- Health Monitoring
- Analytics
- Automation
- Cross Domain Orchestration
- Optimization
- Cloud CMTS LifeCycle Mgmt

Other OSS/BSS
- IPDR Collector
- Topology Mgmt
- AIOps
- HFC Health Insight

Mini-Data-Center 1 (cnBR Cluster 1)
- cnBR Ins A
  - Server N
  - Server 2
  - Server 1
- 100s - 1,000s RPDs & SGs

cnBR Clusters
- Mini-Data-Center 2 (cnBR Cluster 2)
  - CNBR Inst B
    - Server N
    - Server 2
    - Server 1
  - 100s - 1,000s RPDs & SGs

- Mini-Data-Center M (cnBR Cluster M)

- CNBR Inst Y
  - Server N
  - Server 2
  - Server 1

- CNBR Inst X
  - Server N
  - Server 2
  - Server 1

- 100s - 1,000s RPDs & SGs
Customer Deployment Model Examples

Our Vision

**On-Premise**
- SMI Deployed Operations Hub Infrastructure
- Individual Applications with Helm charts
- Support Both Basic and Advanced Features

**Hybrid**
- Local On-Prem Data lake
- Application in the cloud

**SaaS**
- Option for some applications
cnBR Management

- OpsHub
- CX Cross Domain Orchestration Offer*

*Under Development
Cloud CMTS Mgmt Architecture
Cisco Cable Cloud Base Stack

- Cable Software Package
  - Instantiation of Cisco cnBR Core Infra
  - Deployment of Cisco cnBR CNF
  - Lifecycle Management of cnBR Core
  - Telemetry from cnBR Core
  - Config API Representation

- Base-stack
  - Hypervisor
  - Host OS
  - Compute / Storage
  - Switch Fabric
Full-stack: Cross-Domain Orchestration and Base-Stack

- **Top-stack**
  - Instantiation of cnBR Core Infra
  - Deployment of cnBR Core NF
  - Lifecycle Management of cnBR
  - Service Assurance of cnBR Core
  - cnBR Core Function Pack (NSO)

- **Base-stack**
  - VMware or Baremetal
  - Cisco UCS
  - Cisco Switch Fabric (ACI / Nexus)
Summary

Cable’s Evolution to Webscale has started but to get to cloud scale, you need to...

• Deploy DAA – RPHY + CIN
• Automate your operations
• Implement cross domain orchestration
• Simplify management with a Single Pane of Glass