LET’S BUILD TOMORROW TODAY
The Changing Mobility Business in the Age of Virtualization

Ben Bleichman, Product Manager
Greg Horlacher, Product Manager
Policy Management, Service Provider Mobility
BRKSPM-2022
Flexible and Service Oriented Networks with Cisco Policy Suite

• In the face of stagnant revenues, rising costs and increased competition, service providers are increasingly demanding networks that are highly flexible and service oriented. This means defining new operating models and rolling out next generation policy platforms to support the demand. Cisco Policy Suite is leading the industry shift to more agile and simplified service deployment models by employing a more modular, flexible, and platform-based approach. This session will take a detailed look into how key emerging technology enablers such as policy virtualization and service chaining are changing SP operating models. At the same time, we will provide an update on real-world use cases and business benefits provided by next-generation policy.
Agenda

• Introduction
• Cisco Dynamic Policy
  • NFV/Dynamic Orchestration
• Business Opportunities
• Conclusion
Global Mobile Data Traffic Drivers

By 2019:

- More Mobile Users
  - 2014: 4.3 Billion
  - 2019: 5.2 Billion

- More Mobile Connections
  - 2014: 7.4 Billion
  - 2019: 11.5 Billion

- Faster Mobile Speeds
  - 2014: 1.7 Mbps
  - 2019: 4.0 Mbps

- More Mobile Video
  - 2014: 4.3 Billion
  - 2019: 5.2 Billion

Source: Cisco VNI Global Mobile Data Traffic Forecast, 2014–2019
Global Mobile Device Growth by Type
By 2019, M2M Devices will grow to 28% of devices, up from 7%

*Figures (n) refer to 2014, 2019 device share
Source: Cisco VNI Global Mobile Data Traffic Forecast, 2014–2019
Cisco Policy Delivers Value to Service Providers

**Wireless ARPU**

- **CAGR**
  - AP: 0.8%
  - NA: 4.4%
  - Europe: 6.6%
  - Emerg.: 3.9%

- **Stabilize and increase ARPU**s through new consumer and vertical segment offers
- **Reduce churn** through self-service selection, subscriber-determined policies and a high degree of personalization
- **Reduce the cost, complexity and time to market** for delivering new services
- **Monetize** via flexible, innovative billing models, market segmentation.

Source: BofA Merrill Lynch, UBS, Company Data, Corporate Strategy Analysis
How Operators Capitalize on Mobile Growth

Individual Services
• Turbo boost
• Freemium
• Location-specific information
• Parental control

Vertical Markets
• Automotive
• Internet of Everything
• Healthcare

Policy Opportunities

New Business Models
• Enterprises/MVNOs
• VoLTE/VoWi-Fi
• Sponsored data
Vertically Targeted Services Enable Operators to Grow the Pie

Today: Operator business mostly focused on the saturated consumer market

Future: Vertically targeted services will accelerate operator business growth
Cisco Policy ready for vertical take off

- Next-Gen Architecture
- Modular Platform
- Open environment
Comparison: Music and Telco Virtualization markets

Innovation in music industry over time

- < Audio Quality
- > Usability

Innovation in network (policy) virtualization over time

- > Dynamic
- > Complex
- > Utility
- < Cost

New consumption models
- Any audio quality
- New value chains

Value is derived by opportunity to serve new markets in new ways

New consumption models
- New value chains

AAA
Policy v1
Virtual machines for machine to machine

Monolithic PCRF

Virtual PCRF

X86 hardware
Virtual Policy – Why it helps new sectors..

Data sovereignty
Global architectures

Separation of interests
Departments / companies

Functionality
Release cadence

Access selection
Device Entitlements

Device

SELECT WiFi?

Right SLA
per customer

SLA's

Right model
per customer

Redundancy

Payment

Bill for machines

Security

Industry sectors
Different demands

Features

Security
Redundancy
SLA's
Payment
Device
Geo
Ops

Global
architectures

Select Wi-Fi?
Next-Generation PCRF is at the heart of SDN

PCRF’s Strategic Network Position:

- Maintains subscriber and session visibility
- Abstracts data from network sources (DPI, Probes, SON)
- Makes decisions based on network information
- Conveys policy decision to SDN controller

Fulfilling SDN Requires Next-Gen Capabilities:

- Supports multiple 3GPP and non-3GPP end points
- Ability to program a service chain based on context (profile, event, network condition, time)
- Dynamically select user forwarding path to enhance subscriber services
Policy Creates New Business Opportunities

- Policy enables service innovation and velocity
- New policy architecture with virtualization will create agility and scale
- New business models and verticals enable operators to grow revenues

www.cisco.com/go/mobilepolicy
Cisco Dynamic Policy
3 Generations of Policy

Gen 3.0
- Virtualization of PCRF
- Launch pad for new services enabled by enterprises utilizing north-bound API's
- Sponsored data
- New verticals emerging for policy

Gen 2.0
- Personalization of data services

Gen 1.0
- Control and utilization of assets
- Network centirc policies
Dynamic Policy: Your Service Innovation Center

- Build and launch new services in days or weeks
- Manage experience throughout entire subscriber lifecycle
- Promote monetization by dynamically matching services to user, context and NW conditions
- Deliver a personalized experience at network scale
- Facilitate OTT partnerships and vertical services
Cisco Policy Suite: Delivering Dynamic Services

- **User**
  - Profile
  - Services
  - Segment
  - Device
  - Etc.

- **Session**
  - Subscriber Id
  - Access Type
  - Location

- **Network**
  - Load

- **SON**
  - Existing services
  - OTT providers
  - New services

- **Cisco Policy Suite**
  - Delivery optimization

- **Services**
  - QoS
  - Time
  - Etc.

- **Analytics**
Cisco Policy Suite High-Level Network Integration
Cisco Policy Suite

**Quota Module (Balance)**
Defines the times, rates, and balances (quota) that are used as part of CPS; recurring and one-time balances, shared quota, threshold triggers.

**Policy Module (PCRF)**
Provides real-time management of subscribers, applications, and network resources based on service provider-configured business rules.

**Policy Builder**
Web-based GUI “Service Creation Workbench” for quickly authoring policies, creating new use-case blueprints, and extending solutions with different enforcement points and databases.

**Charging Module (OCS)**
Real-time rating rules; easily deployed prepaid charging, including integration with external intelligent network (IN) systems.

**Access Policy Module (ANDSF)**
Enables personalized, network-aware access selection policies that run in real-time on the device.

**Subscriber Management Module**
Standalone or fully integrated, centralized, highly scalable subscriber data management coupled with a virtualized bridge to federate existing subscriber databases into a unified access layer.
Cisco Policy Suite

Common Service Orchestration

3GPP PCRF/OCS

SP Wi-Fi

BNG

Access Selection Policy
(ANDSF, HS2.0)

Personalization Rules

Transaction Processing

Session Management

Cisco® Policy Suite

Common Infrastructure Orchestration

Using the platform to enable complementary technologies.
Cisco Policy Platform Extensibility

- **Prepackaged Plug-ins**
  - Diameter
  - Quota Mgmt
  - Notification Center
  - Vendor APIs
  - Vendor APIs

- **SP Specific Plug-ins**
  - Custom Plug-in
  - Custom Plug-in
  - Custom Plug-in
  - Custom Plug-in

- **Plug-in Binding Rules**
  Define how and when to call plug-in

- **Core Rules Engine**
  - Stimuli ➤ Decision ➤ Action(s)
  - Logging, diagnostics, statistics, monitoring, session management
Cisco Virtualized Platform Architecture

Orchestration (Provisioning, Elasticity, Monitoring, HA/Failover)

OpenStack/KVM/VMware

- OSS/BSS
- P-CSCF
- OCS
- ANDSF
- ANDSF Client

Policy Director

PCEF

Gx/Gy/Sd RADIUS

USuM/SPR

PCRF

OCS

ANSDF

Profiles

Sessions

Balances

Distributed SDM/SPR

SOAP/XML

S14

Gx/Gy/Sd RADIUS

PCEF

PCRF

OCS

ANSDF

Policy Director

Policy Director

Gx/Gy/Sd RADIUS

S14

S14
Orchestration simplifies and accelerates service delivery.

(orchestration = automation)
Introduction to Orchestration

**Functional Building Blocks**

**Upper Stratum of Orchestration – Domain Service**
Has connotations of business process, it also deals with the bigger picture across the entirety of the network and addresses the questions: what is the service and how does it fit in.

**Middle Stratum of Orchestration – Network and Service (Paas)**
Has a connotation of engineering process. This layer is responsible for deploying VNFs based on deployment policies and manage VNF lifecycles including healing and scaling.

**Lower Stratum of Orchestration – Infrastructure (IaaS)**
Is down at the physical management of data center server and storage resources and their virtualization.
Integrated End-to-End Orchestration

**NFVO**

- Network Domain Controllers:
  - WAN WAE
  - DC VTS, ODL, APIC
  - CPE Meraki

- EMS

**Physical Devices**

- VNF MANAGER(S)
  - ESC, CTCM

**Virtual Devices**

- Virtualized Infrastructure Manager(s)
  - OpenStack

**VNF / VM Lifecycle**

- Service Agility / Activation

**Physical**

**Virtual**

- NFV INFRASTRUCTURE (Compute, Storage, Network)
VNF Manager

**General**

- **VNF Manager**
- **VIM (Virtualized Infrastructure Manager)**: OpenStack, VMware, vCloud
- **Vnfm**: To/From VNF-M
- **NFV-O (NFV Orchestrator)**: NSO
- **VNFM Integration**
  - Nfvo-Vnfm: To/From NFV-O

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**Lifecycle Management of VNF Instances**

- **VNF Provisioning**
  - (Instantiation / Software Update & Upgrade / Scaling / Healing / Termination)
- **VNF Bootstrap (Day-0) Configuration**
- **VNF Monitoring**
- **VM Provisioning / Bootstrap Configuration / Monitoring**

**Cloud APIs**
- OpenStack, VMware vCloud

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**VNF**

- **Service**
  - Operating System
  - VM

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**NF-Vi**: To/From VNF-M
CPS Platform Architecture Revisited

Cisco Policy Suite (vPCRF)

VM Policy Director

VM Policy Server

VM Distributed SDM/SPR

Control Center

Virtualization / Abstraction Layer

Vmware
OpenStack
KVM

COTS Hardware

CPU Resources
Memory Resources
Storage Capacity
Network Access
CPS NFV Evolution

Virtualized Deployment

- Policy Director Layer
- Application Layer
- Persistence Layer
- Policy Director
- Policy Server
- USUM
- OAM
- CPS Cluster Manager
- Installer

Network and Compute

VMware

• Current vPCRF
• REST API for Policy Provisioning

NFV Deployment

- Orchestration
- NSO (Tail-f)
- CTCM (VNFM)
- OpenStack (VIM)

- ETSI NFV MANO Compliance
- NSO NETCONF/YANG Interface (or REST)
- CTCM VNFM integration (or AIC VNFM)
- Openstack/KVM support

Network and Compute

- CPS vPCRF
- CPS PCRF VNF

CPS Cluster Manager

Element Management System

CPS NFV Evolution

End of Document
Cisco Policy Suite NFV Deployment

1. The NFV-O receives a message from the OSS/BSS to instantiate a CPS and VPC, e.g., small, medium, large instances of each.
2. NFV-O provisions a VNFM for CPS and VPC (uses OpenStack to create the VM and attaches to the network).
3. NFV-O calls an API on the CPS and VPC VNFMs to instantiate the CPS + VPC, e.g., “medium” as well as the external networks that need to be reachable.
4. VNFM uses OpenStack to create the CPS + VPC VMs and attach to the various network VLANs.
5. NFV-O pushes the service configuration to the VNFM for diameter peers, policy rules, etc.
6. VNFM applies this configuration to the various VNFs.
7. CPS + VPC instances ready for service.

Deploy CPS and VPC Instances in Hours vs. Weeks
NFV: Cloud-Enabled Cisco Policy Suite

Yesterday

Virtualized Cisco Policy Suite

- Virtualized Solution - no bare metal deployments
- Use VMware toolkit with manual installation
- Use orchestration tools - Puppet and SVN today to automate the provisioning of VMs
- VMware Hypervisor

Today

Cloud-Enabled Cisco Policy Suite

- Dynamic Orchestration
- Automating installation
- Real-time elasticity
- Health Publisher and Algorithm
- VMware and KVM/OpenStack Hypervisor support
Policy Builder
Service Velocity for New Revenue Streams

Sample Use Cases
- Multi-device, Multi-access shared quota policies
- Fair usage throttling policies
- Nights and weekends time-based policies
- Parental and usage control policies
- Video optimization policies
- Tethering control policies
- Wi-Fi offload policies
- RAN congestion policies
- VoLTE policies
- Bill shock policies
- Tiered service policies
- Web application policies
- Sponsored access policies
- Subscriber personalization policies

Policy Builder provides an easy-to-use “Service Creation Workbench” coupled with Service Orchestration APIs for quickly authoring policies, creating new use case blueprints, and extending solutions with different enforcement points and databases.
Service Velocity Lets You Seize Your Opportunities

- The market’s most rapid service innovation engine
- Extensive library of use cases for instant rollout
- Policy Builder/Service Orchestration APIs: configure new use cases without new code
- Table-driven policy evaluation: easily manage decision logic
- Feature-based platform easily extensible for complex cases

New Service Time-to-Market

<table>
<thead>
<tr>
<th>Cisco Policy Suite</th>
<th>Legacy Policy</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-30 Days</td>
<td>3-6 Months</td>
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Cisco Policy Suite Meets Evolving Policy Requirements

**Gen 1.0 Policy (2009-11)**
- 1-10,000 TPS in an average network
- Dozens of policy controlled apps (for example, fair use and bill shock)
- Policy may only be applied to 10% of subs
- One or two policy triggers per service. Interface to a single network or IT element
- Develop new policy-driven services in months
- “Single” policy server deployed on dedicated hardware

**Gen 2.0 evolving to 3.0 (2012 and later)**
- 100,000+ TPS in an average network
- Hundreds of policy controlled services, including VoLTE, OTT apps, M2M, Verticals
- Policy applied to 100% of subs
- 10 to 100 policy triggers per service. Interface to multiple network or IT elements, including OTT domains
- Configure new policy-driven services in weeks
- NFV policy deployments with dynamic orchestration and multiple policy server instances

**Defensive strategies to protect network**

**Dynamic, application-centric monetization**
Investment-Protected with Unmatched Scalability and Reliability

- By far the industry’s top-performing policy solution
- Ready for the most demanding LTE use cases
- Manages policy for entire subscriber base, not a subset
- Manages hundreds of policy-directed services concurrently
- Applies policies in real time, based on a wide range of triggers and criteria

Independently verified in 2013 by EANTC

- 250K Transactions per Second
- 75M Concurrent Sessions
- 14ms Average Latency
- 50K Session Set-ups per Second

Cisco live!
Cisco Policy Suite Delivers

- Exceptional carrier-grade scalability and reliability
- Fully virtualized software architecture
- Cost-effective systems integration
- Accelerated service velocity and reduced operating expenditures
- Multi-application subscriber experience control platform
- Multi-access converged platform - 3G, LTE, Wi-Fi, DSL, cable

Designed for Lower TCO, Better Agility, Performance, and Linear Scale-Out
Business Opportunities Enabled by Cisco Policy Suite
FCC Net Neutrality 2015

*FCC is reclassifying broadband as a telecommunications service under Title II of the Telecommunications Act, instead of a lightly-regulated information service, a move that carriers and ISPs have said will stifle innovation.*

**No Blocking:** broadband providers may not block access to legal content, applications, services, or non-harmful devices.

**No Throttling:** broadband providers may not impair or degrade lawful Internet traffic on the basis of content, applications, services, or non-harmful devices.

**No Paid Prioritization:** broadband providers may not favor some lawful Internet traffic over other lawful traffic in exchange for consideration – in other words, no “fast lanes.” This rule also bans ISPs from prioritizing content and services of their affiliates.

**Sponsored Data (Zero-rating):** sponsored data is not banned but is “on watch” to ensure fair competition.

**Reasonable Network Management:** For the purposes of the rules, other than paid prioritization, an ISP may engage in reasonable network management. This recognizes the need of broadband providers to manage the technical and engineering aspects of their networks.
Congestion-Aware Content Delivery

**Challenge**

- Ensure that the subscriber experience meets service expectations and entitlements
- Truly monetize QoS (for example, turbo boost, bandwidth on demand)
- Monetize exclusive and premium content (for example, NFL, Champions League, etc.)
Schedule-based RAN Congestion

Description:
 Alleviate user plane network congestion
 Provide all users a fair access to network bandwidth
 Potential evolution to SON/Probe-based solution
 Fair use policies
   P2P BW Limits
   Video Optimization
   Heavy User Bandwidth Throttling

Benefits:
 Improved User Experience
 Prevent revenue erosion from subscribers experience churn
 CAPEX savings from deferred capacity growth
Sponsored Data Offers

Challenge: Data Quota-conscious users who ration consumption of rich-media content are using less mobile data and not upgrading to higher data plans

- Gain additional revenues from data quota savvy subscribers. Remove disincentives to engage with ads
- Increase non-access revenue sources (advertisers, sponsors)
- Create business partnerships with content providers to increase usage
Example

New York City, NY
40.773639N, -73.95992W

Device
iPad 4
Connection
LTE

CONNECTION SPEED
12.67 Mbps

DATA QUOTA BALANCE
1.95Gb

MOBILE USAGE ANALYTICS

Web:
Fashion, Lifestyle, Fitness, Film

Apps:
Yelp, Facebook, Twitter, IMDB, MyFitnessPal
MVNOs are Thriving Worldwide

- In 2019, MVNOs will account for 3.7% of global mobile subscribers
- 43% CAGR from 2014–19 in Oceania, Eastern & South-Eastern Asia
- Japan predicted to be within top 5 countries with the highest ARPU for MVNO in 2019

MVNO connection forecast by subregion, 2013-19

Case Study: K-Opticom Mineo Service

Operator Challenge

- Build a system with flexibility for subscriber services
- Be attentive to each user’s needs, providing and managing customized plans
- Ensure precise management of its many plans and services

Solution

- Cisco Policy Suite with Cisco ASR 5000

Benefit

- Can now offer a broad range of useful services to mineo customers, including rollover unused data, family plans
- Network resources available on demand
- Future plans: 1M users while being attentive to each user’s needs

“Cisco Policy Suite is providing the environment which we can serve the customer in the very best way”

- Yoshihiro Matsumoto, General Manager, Technology Planning and Development Group, K-Opticom
Service Providers are Connecting Cars

“Connected cars will create new business models and provide opportunities for current businesses to greatly improve their service offerings.”

Forbes, February 20, 2015
AT&T to Utilize Cisco Virtual Mobile Network Technology Within Its Connected Car Services

"With this new software-driven mobile Internet solution incorporated into our offerings, we can help to provide auto makers with advanced connected car services that give consumers more real-time communications services that positively impact the driving experience."

Cameron Coursey, Vice President, Product Development and Operations, Internet of Things, AT&T
Cisco Access Policy
Access Network Selection Today
A Source of Poor User Experience…and a Large Opportunity

Device Driven
Limited QOE awareness
Wifi selection and login hassles
Limited / no SP Operator controls / inputs

…thus an opportunity for SP / MSO differentiation through QOE improvement while also achieving managed cellular offload
Typical Network Selection Problems

Signal Quality
Signal quality alone does not guarantee user experience

Wi-Fi

3G/4G

Ping-Pong Effect
Mobile users constantly switching between Wi-Fi and 3G/4G
Cisco Intelligent Access Selection Solution

Network Aware Access Policy
- Personalized access policy in context of SP commercial data bundles.
- Integratable to PCRF, SPR, Analytics/OSS, SON/RAN ecosystem for full network awareness.
- Build to scale for millions of sessions
- Integration of device Analytics

Network
- Wifi / RAN Analytics
- Cisco Wifi APs
- Security RA/CA
- SON
- PCRF/SPR/DBs

Operator driven policy rules
- Bring SP controls and presence onto subscriber devices, ensuring better QOE and new service offerings

Improved User Experience
Focus on full device ecosystem / options
- Access selection based on link QoS
- Policy on the Device (e.g., Wifi Roaming service)
- Support for iOS and Android

Open HTTP/XML Interface
- OMA-DM based S14
- Flexible, optional extensions for value-added device client functions
  (GCM, APNS, device based analytics)
Access Selection Policies Overview

- Location Based Access
- Time Based Access
- Power Geo-Fence
- Wi-Fi Link Quality
- Access Prioritization
- Smart Secure Wi-Fi

- Subscriber Profiling
- Personalized seamless login
- Location Triggered Policy Pull
- Server Triggered Policy Push
- Automated subscribers on-boarding
North American MNO Adopts Cisco Policy Suite
Enabling New Applications and Monetization Models

Connected Car (IoE)

Enterprise Private Mobility

Reseller / MVNO virtualized platform

OTT App Gateway

Consumer PCRF (500M subs/1M TPS)
Cisco: Recognized Leader in Policy Management
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- Related sessions
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