Plug-and-Play Configuration of Cisco Devices

Session NCM-102

Agenda

• Network Deployments Today
• Industry Initiatives
• Case Study
Congratulations!
You’ve Just Been Promoted to Deploy and Manage the Entire Network for the Western Region...

Network X

Management Layer

- ISP
- GWY
- POP/CO
- Aggregator
- Call Control Layer
- Switch
- Unified Messaging Server
- Announcement Server
- PSTN Gateway

Requirement
Customer needs to deploy 25,000+ gateways in next two years
Targeted customers—small and medium business (SMB)
Configuration Process Today

- Order
  - CSR
  - E-mail
  - Web
- Manufacturing
- Shipping
  - Warehouse
  - Subscriber
- Configuration
  - Provisioning/staging
  - Testing
  - Repacking
  - Shipping
  - Installation

Deployment Today

Existing Provisioning Process

Subscriber ➔ Process ➔ Technician Delivers and Installs

Sell Line Installation and Provisioning Install Router

Asset Management Inventory Control Unpack

Asset Management Configuration Creation Load into Router Asset Tag Archive Information Repack Reship

- Costly
- Labor and time intensive
Solutions Offered by Equipment Vendors

- Order
  - CSR
  - Email
  - Web
- Manufacturing
  - Custom CPE
  - Testing
  - Documentation
- Shipping
  - Subscriber

Customized Configuration

- Internet Operations Configuration Express
  - Network Engineer Creates IOS S/W Configuration Template via Web, Order
  - Entry Personnel Initiate and Process Customer Orders via Cisco Ordering
    Tool or ICS GUI Applications
  - Sell
  - Line Installation and Provisioning
  - Asset Management
  - Network Parameters
  - Configuration Template Management
  - Information for Archive
  - Cisco
- Install Router
  - Streamlines deployment
  - Reduces complexity
  - Lowers cost
Limitations of Custom Configuration

- Additional cost incurred by network equipment vendor
- Equipment vendors require a solution where custom configuration of CPE devices is not required
- Need to re-configure CPE if customer discontinues subscription before installation
- Service delay, if CPE is shipped to an incorrect address
- Need to re-configure in case of CPE failure
- Customer specific information may not be available ahead of shipping
- Cannot maintain inventory

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Technology

**Business Challenges**
- Time to market
- High rollout cost
- Customer retention
- Provisioning services
- Hiring skilled technicians

**Operational Challenges**
- “Hands free” deployment
- Long wait time
- Multiple truck rolls
- Trouble resolution
- Circuit + packet world

Cable Network Architecture

**Internet**

**IP Addr**

**Config**

**CPE**

**CMTS**

**CNR DNS**

**CNR “Spoofing” DNS**

**CNR TFTP**

**CNR DHCP**

**LDAP**

**3rd Party Billing System**

**Call Agent**

**Web**

**Default**

**Gold**
DOCSIS SOLUTION

Data Over Cable Service Interface Specifications (DOCSIS)

• International standards-based (802, ITU-J83, J112, IETF) system for operating data/voice/video modem over HFC cable plants
• Ensure interoperability and security between cable modem and Cable Modem Terminating Systems (CMTS)
• Multi-vendor CMTS and Cable modem support
• Specifies file format and parameters for configuring cable modems
• Current version 1.1 extends specifications to include VoIP features and QoS between cable modem and CMTS
• TFTP server to generate DOCSIS configuration file

DOCSIS Cable Modem Boot Process

• Ranging—Find an up/down stream frequency for initial configuration
• DHCP—Obtain IP address, gateway, subnet mask and location for configuration file
• TFTP—Obtain essential modem configuration info
• S/W update—Option to download to new software image using TFTP
• Registration—Register cable modem with CMTS
• Privacy—Authenticate the baseline privacy key pair
Cable Network Architecture

1. Customer call CSR
2. Cable modem request IP address
3. DHCP provides IP address
4. Cable modem request config file
5. TFTP server provides config file
6. Cable modem reboots
7. CPE (PC) request IP address
8. DHCP provides IP address
9. Customer ready to surf

DSL Subscriber Provisioning
Open DSL Solution

- OpenDSL comprises collaboration of DSL network equipment vendors, chip manufacturers, system integrators and service providers; features and benefits include
  - Open standards
  - Auto-configurable CPE
  - Pre-certification testing
  - OpenDSL equipment and application certification
- Proxy element support from DSLAM or aggregation router
- Software image download
- SNMPv3 over AAL5 for transport
- MMI uses VPI/VCI of 0/16 between CPE and proxy element
DSL Subscriber Provisioning

Limitations of the Solutions

- Industry initiatives address only subscriber provisioning for Cable and DSL space
- Other technology space that needs attention include
  - VoIP
  - Managed services
  - VPN
  - Frame Relay, ISDN services
  - Network core provisioning
- Solution to deploy and manage converged Circuit + Packet network; number of devices expected to grow from 1000 to 100,000 to millions
Managing Large Networks

- Network equipment vendors should design and build their devices intelligent than totally relying on OSS
- Network intelligence distributed across and closer to the network rather than centralized architecture
- Shift in network management paradigm by moving away from polling the network elements
- Network level management rather than device level
- Focus on communicating to multiple devices than to individual devices using Telnet, Telnet, Telnet, Telnet…

Intelligence into the Network

- Centralized (or) Distributed Directory
- Event Bus with Location Services
- EMS/NMS
- Appliance eMgmt
- OSS
- Partner Applications
- NOC Data Center Co-Location
- LAN
- HTTP/XML SSL/Encryption
- Telnet/SSH
- Pop or Region
- Large Pop or Region
- Small Pops or Regions
XML for the CLI

XML DTD for Configuration Data

```xml
<!ELEMENT config-data (config-id, error-info?, cli*)>
<!ELEMENT error-info (line-number?, error-message)>
<!ELEMENT config-id (#PCDATA)>
<!ELEMENT error-message (#PCDATA)>
<!ELEMENT line-number (#PCDATA)>
<!ELEMENT cli (#PCDATA)>
```

```xml
<config-data>
  <config-id> Router1-123abc </config-id>
  <cli> interface FastEthernet 1 </cli>
  <cli> ip address 10.10.10.1 </cli>
</config-data>
```

Config XML Formats (Examples)

```xml
<config>
  <cli> Hostname router </cli>
  <cli> enable password XYZ </cli>
</config>
```

Payload of IOS Configuration From CNS Configuration Server

```xml
<config-failure>
  <identifier> OSIRIS-030500-1330 </identifier>
  <config-id> Router1-030500 </config-id>
  <error-info>
    <line-number> 1 </line-number>
    <error-message> Incomplete command </error-message>
  </error-info>
</config-failure>
```

IOS Device Sends Event Notifying of Configuration Failure

```xml
<config-server config-action="read", no-syntax-check="FALSE">
  <identifier> OSIRIS-030500-1330 </identifier>
  <server-info>
    <ip-address> 1.2.3.4 </ip-address>
    <web-page> osiris/config.asp </web-page>
  </server-info>
</config-server>
```

Configuration Server Sends Event to IOS Device Commanding It to Http Get Configuration From IP Address 1.2.3.4
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Case Study 1

- Greenfield next generation communication provider offering data/voice/video services; the operational challenge is to deploy 25,000+ Gateways to their SMB customers
- Key customer requirements are
  - CPE should be shipped directly from the manufacturer to their customer
  - CPE should not carry any device specific information
  - Power up, CPE should resolve its identity, download device specific information and self-configure
  - When truck roll is necessary, it should not require a highly skilled technician to install
Customer Network

Management Layer

ISP

GWY

POP/CO (Boston)
Aggregator
Appliance

POP/CO (Miami)
Aggregator
Appliance

Fast Ethernet

Gig Ethernet

Switch

Unified Messaging

PSTN Gateway

• 1 Customer places order
• 2 SP orders router from Cisco
• 3 Provision network
• 4 Aggregator IP+1 becomes customer's unique ID
• 5 Build customer config file
• 6 Config Express ships router with stock-standard config
• 7 Customer connects the cable and powers up the Gwy
• 8 Using SLARP or PPP Gwy learns IP address of interface terminating in aggregator
• 9 IP address+1 becomes Gwy's unique ID
• 10 Gwy identifies uniquely to the Appliance
• 11 Request config file using HTTP
• 12 Config file transported using XML
• 13 Outcome is notified as an event

Mass Re-Configuration

1. Network engineer changes service policy or configuration parameter
2. Lightweight event broadcast to all affected devices
   Devices pull new configuration from local configuration server—change deployed!
3. Optional synchronized commit via second event
Summary

- Complexities in large scale network deployment
- Business and operational challenges
- Industry initiatives for Cable subscriber provisioning
- Industry initiatives for DSL subscriber provisioning
- XML-based programmatic interface
- Publish/subscribe technology to communicate to multiple network devices
- Scaling to deploy and manage large scale networks
- Case study
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Please Complete Your Evaluation Form

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