CABU Solutions Update

Agenda

- CCAP Strategy
- CMTS/QAM Updates
  - uBR10K
  - Hudson release
  - RFGW-10
- Access Solutions Update
  - Optical Transport
  - Optical Nodes
  - RF Amplifiers
  - Management of OSP

Cisco CCAP Strategy

A Phased Approach to Meet Today's Challenges with Scale and Convergence

Reduce OPEX

Phase 1

Scaling DOCSIS downstream capacity and converging into a high density UEQAM

Maximize ROI

Phase 2

Maximizing and scaling downstream capacity with the existing platform

Unprecedented Scale

Phase 3

Optimizing OPEX savings with a high density, next generation cable access platform, beyond 1Gbps/SG

Cisco CCAP Strategy Key Take-aways

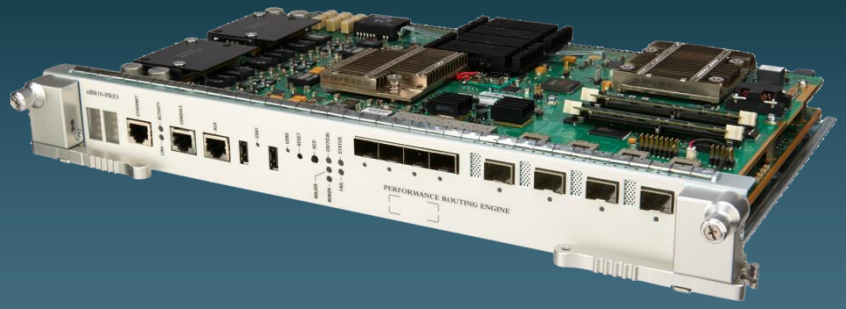
Migration	Migration to CCAP is more than an equipment upgrade
Convergence	Multi-service convergence for DOCSIS and video networks requires significant operational preparation and readiness
Modular CCAP	Cisco's modular CCAP solution, uBR10012 and RFGW-10 offers an incremental deployment approach and meets key CCAP objectives today
Integrated CCAP	Cisco's integrated CCAP solution dramatically reduces the footprint and provides the scalability needed to support the next decade of growth in IP services

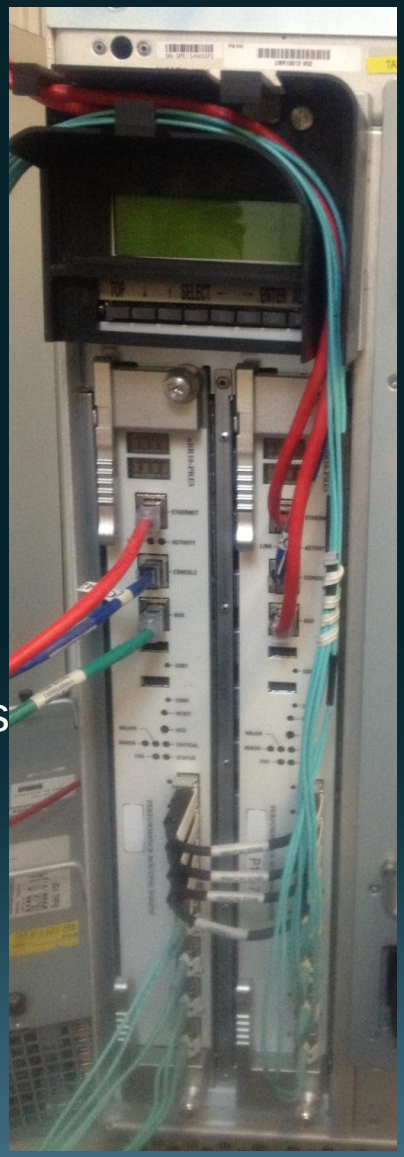
Platform Updates

uBR10K

Routing Engine Enhancements
PRE5 Overview

- ***PRE5 enables up to 40 Gbps of WAN backhaul***
  - 4x10GE WAN backhaul ports
  - 10Mpps for both IPv4 and IPv6 with commonly used features
- ***WAN backhaul ports on PRE5 free up SPA slots***
  - 8 x 3G60 + 8 x 3G-SPA in single chassis
  - Increases capacity of uBR10K upto 1152 DOCSIS DS channels
  - Enables deploying 16-24+ DOCSIS channels per SG at scale





3G SPA Overview

- Doubles the downstream capacity of uBR10K
- 3G-SPA has functional parity with current Wideband SPA
  - 54 downstream channels hosted by 3 controllers (Annex A)
  - 72 downstream channels hosted by 3 controllers (Annex B)
  - 4 x 3G-SPA per SIP-600 card (Jacket card)
  - Cable modems can use the DS channels from 3G-SPA and US channels from 3G60
- Hardware features
  - 2 SFP+ ports & 1 SFP port on front panel; SFP+ ports can be used as SFP port
  - 2 SFP+ ports can be configured for 1+1 redundancy

HUDSON release

Hudson (12.2SCH) Features

Feature	uBR10K	uBR72xx/VXR
PRE5	Y	N/A
3GSPA	Y	N/A
3G60: 3G60 bonding groups across controllers (on the same card)	Y	N/A
LB: Independent US/DS throughput rules	Y	Y
LB: Configurable min-threshold of utilization method	Y	Y
LB: Static LB based on primary channel load for bonded modems	Y	Y
LB: Operational enhancements • Auto-generate DOCSIS 2.0 General LB Group (GLBG) • Display status information of modem-list in a LB group • Default settings for D3.0/D2.0 GLBG • Cable tags extension • Exclude cable modems from LB	Y	Y
VDOC enhancements: Channel change performance PRE4 & PRE5	Y	Y
CM: 24x8 CM interoperability support with SPA, 3G60 and 20x20	Y	Y
DOCSIS: Classification enhancement (MAC address + layer 3 classifier support)	Y	Y
DOCSIS: UCD TLV for ranging hold-off (TLV 19)	Y	Y
DOCSIS: Increase # of service class names*	Y	Y

*pre-EC

Hardware Support List in Hudson

- Supported hardware
  - uBR10K
    - **PRE5**
    - PRE4
    - **3GSPA**
    - RFSW
    - 20x20V
    - 3G60
    - DTCC
    - 3300W PS's (AC and DC)
    - Legacy PS's (AC and DC)
    - D30 SPA
    - NGRFSW
  - uBR7200
  - uBR7246 VXR
    - MC28U
    - MC88V
    - NPE-G2
  - uBR7225 (Pizza Box)
    - MC28U
    - MC88V
    - NPE-G2

- **Unsupported hardware**
  - **uBR10K**
    - **PRE2**
    - **520H**
    - **Saratoga**
      - **520S**
      - **520U**
      - **OC12 POS/SRP**
      - **OC48**
      - **PRE1**
      - **Full Height GigE**
      - **TCC+**
  - **uBR7100 Series**
  - **uBR7200**
    - **NPE-400 (or lower)**
    - **MC28C/16C/16S/16U/16X/28X**
    - **E-16U**
    - **NPE-G1**

Platform Updates

RFGW-10

RFGW-10

- Carrier Class High Availability Architecture
  - Redundant Power, WAN, Timing, GE Switching and N+1 EQAM LC
- 13RU Chassis (22.75”H X 22.25”D)
  - NEBS Compliant
  - Front to Rear airflow
  - Front Panel LCD Display and Push Button Navigation Module
- 10 Universal RF Line Card Slots
  - >20Gbps midplane connectivity / slot
  - >300 watt capacity / slot
  - 12 RF midplane connectors / slot
- 2 Supervisor Engines
  - 848 Gbps line rate switching performance
  - DOCSIS and Video Control Plane processing
  - 2 x 10GE, 2 x GE Uplinks
  - IOS-XE 3.2SQ
  - GUI, CLI, SNMP

DS384 Line Card

Video Release 1 Status / Spec Overview (FCS July 31st)

*Video release 1 spec, DS384 Card Spec:

- 768 (Annex A) QAMs per LC
  - 288 (384) Unique QAMs
  - 480 (640) RF Spanned QAMs

- **288*** QAMs per Line Card
  - Unique or spanned QAMs!!!
- 8 Ports per Card
- 1x, 2x, 4x, 8x, 12x …up to 96 QAMs per port-stacking per Card
- **Single QAM Spectrum Assignment**

- Line Card Inputs:
  - N=2 10/1 GBE SFP+'s
  - N=2 1 GBE SFP's
- Licensing for DS Channel Capacity
- New Licenses
  - RF Spanning (Capacity License)
  - PowerKEY Encryption (Feature)

Video Release 1 Feature Overview

(IOS-XE 3.3 SQ – IOSd 15.0(2)SQB)

Video Features

- Embedded PowerKEY Encryption for VOD
- SDV (Pre-Encrypted)
- Table Based VOD (Un-Encrypted or Pre-Encrypted)
- Pre-Encrypted Broadcast
- GQI 2.0
- ERMI – I and II

Other Features

- RF Spanning (QAM Replication - Licensing)

Video Configuration and Management

- CLI is the Primary Configuration Method
- Embeddd GUI Supports Status and Configuration of Video QAMs
- RPU-10 Supports Mass Configuration of SDV and VOD QAMs
- Cisco Prime Network and Prime Analytics support the RFGW-10 in the Summer Release
- TACACS recommended for Roll-Based Configuration
  - Must choose an owner for the PHY

RF Spanning Overview

RF Spanning Overview

- RF Spanning is replication of QAMs Across Ports on the same DS384 Line Card
- Any QAM Type Can be Replicated
  - Narrowcast / Broadcast
  - Unicast / Multicast
  - DOCSIS / MPEG Video
- RF Spanning Applications
  - DOCSIS / Video Service Group Alignment
  - MPEG Broadcast Video
  - DOCSIS RF Spanning
  - VDOC Static Multicast (VDOC Broadcast)
- RF Spanning Enables
  - Service Group per Port Architecture
  - More Service Groups per Chassis = Fewer Chassis / Less Power
  - Increased Service Deployment Velocity
  - Reduced OPEX

SG Combining – Today's Approach

Converged QAM Network

RFGW	
DS384/1-1	48 Broad
DS384/1-2	18 DOCS
DS384/1-3	24 Narr
DS384/1-4	18 DOC
DS384/1-5	18 DOC
DS384/1-6	24 Narrow
DS384/1-7	18 DOCS
DS384/1-8	

DOCSIS and Digital Video Downstream Channels

Broadcast Channels Split/Combined Across All Service Groups

NC DOCSISQAMs Unique per Service Groups

NC Video QAMs Split/Combined Across DOCSIS Service Groups

External RF Combining Network

- **SG1** (1) — 18 DOCSIS QAMs, 24 NC VIDEO QAMs, 48 BC VIDEO QAMs
- **SG10** (10) — 18 DOCSIS QAMs, 24 NC VIDEO QAMs, 48 BC VIDEO QAMs
- **SG19** (19) — 18 DOCSIS QAMs, 24 NC VIDEO QAMs, 48 BC VIDEO QAMs
- **SG28** (28) — 18 DOCSIS QAMs

In this Example

- External RF Splitting / Combining Used
- Scaling is Port Limited
- 200 QAMs Utilized per DS384
- 1 RFGW-10 Serves 36 SG's with Redundancy

SG Combining Using RF Spanning

Converged QAM Network

BC Video

NC Video

NC DOCSIS

RFGW-10

DS384/1-1	48BC, 24NC Video, 18 DOCSIS,
DS384/1-2	48BC, 24NC Video, 18 DOCSIS
DS384/1-3	48BC, 24NC Video, 18 DOCSIS
DS384/1-4	48BC, 24NC Video, 18 DOCSIS
DS384/1-5	48BC, 24NC Video, 18 DOCSIS
DS384/1-6	48BC, 24NC Video, 18 DOCSIS
DS384/1-7	48BC, 24NC Video, 18 DOCSIS
DS384/1-8	48BC, 24NC Video, 18

SG1 1 2 9

SG10 10 18

SG19 19 27

SG28 28 36

SG37 37 45

SG46 46 54

SG55 55 63 72

RFGW-10
Universal EQAM

DOCSIS and Digital Video
Downstream Channels

RF Spanning Enables:

- Service Group per Port Architecture
- Elimination of External Combining
- Higher Service Group Density per Chassis
  - Up to 72 SG's per Chassis (redundant)
- Fewer Chassis (Lower Power / Footprint)
- Service Groups can be Wired Once and Future Changes Accomplished via Config

Platform Updates *Optical Transport, Nodes, Amps & Accessories*

Optical Transport Solutions…

Prisma II/XD Systems Overview

Chassis

Prisma II
Front Access

Prisma II
Rear Access

Prisma XD

Tx

1310 nm

1310 nm
or
MW Tx

Single
HD

Tx 1550 nm

NC, SQ or
SQ FS Tx

New

New

Single
HD or 1 slot

LRMW or
FTTP Tx

New

LR MW (E)

EDFA's

EDFA

GF EDFA

EDFA
(RFO)

BC / NC GF
HD, 1 or 2
1 GHz
1-24 output
Up to
33dBm

New

HD BC or
GF NC
EDFA

HEDA's

Fw / Rev
1 slot
1 GHz

Optical Switch

New

(HD) Optical
Switch

Single
HD or 1
slot
< 50 ms

New

Dual
EDRx

Dual
(LN) RvRx

FW Rx's

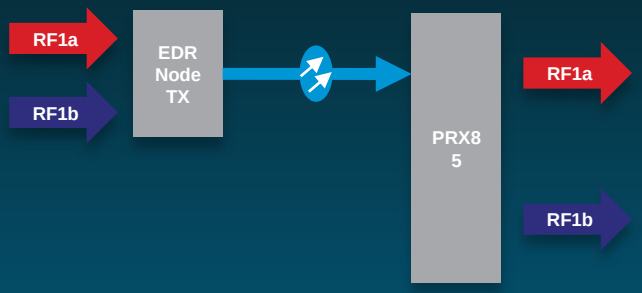
Single /Dual
HD or 1 slot

1 GHz (Fw)
85 MHz (Rv)

PII HD Dual Ch. Enhanced Digital Reverse

Combined with A9020x EDR Reverse Tx

PRX85



- Prisma II HD Reverse Rx
  - Prisma II XD chassis
  - Prisma II chassis using host module
- Single HD Rx module
  - Simplified inventory management
  - Multiple configurations
  - Supports all reverse splits - 5 to 40, 42, 65 and 85 MHz – no change to Rx module
  - 10 dB adjustable link gain 0.5 dB steps
- Small form factor OPM
  - Standard range (21 dB link)
  - Extended range (28 dB link)
    - SR RX Sensitivity @5Gbps = -8 to -18 dBm
    - EX RX Sensitivity @5Gbps = -8 to -25 dBm

Prisma II Pluggable Tx

PII HD Dual Tx w. OPM
(SCTE 2012 sample)

PII HD Tx

- Utilize high density “host module” for Prisma II and Prisma II XD
- **Double the density,** two transmitters in the space of one *(10.66 Tx per RU)*
- **Half the power consumed**, less than 3 W per module *(50 to 80% savings)*
- Modules in a XD host module can potentially be **re-used on NG CMTS**
- This truly represents **Cisco’s commitment to developing Green products**

Compact Optical Nodes

Fiber Deep & Segmentable Nodes

1 GHz
2 Output
AGC
114 dBuV

A90098

Compact Forward Fiber Deep Node

1 GHz
2 Output
EGC
AGC
117 dBuV
CWDM

A90100/A90300

EGC Compact Fiber Deep Node

870 MHz
2 Output
AGC
112 dBuV
CWDM

A90075

1x2 870 MHz Compact Node

*Incl. new DOCSIS Xponder Option**

New

1 GHz
3 Output
EGC
AGC
117 dBuV
C/DWDM
EDR

A90200/A90201

2x2 EGC 1GHz Compact Segmentable Nodes

New By Q1 CY13 DOCSIS Xponder option will be available on all Compact Nodes

A90201 Compact EGC Segmentable Node

Highest Output at Lowest OPEX

- GaN **based 1 GHz** design
- Up to **2 x 117 dBµV** RF output level
- Forward /Reverse **2 x 2 Segmentable**
- Integrated automatic redundancy switching for forward path
- **Dual Active / Triple Output**
- Wide **+2 to -7 dBm optical input** with optical AGC, added full **Electronic Gain Control**
- FP, DFB, CWDM as well as **DWDM* reverse lasers**
- **EDR reverse** option for **true Plug & Play** with **integrated backhaul of node status information**
- Plug-in Transponder and **Control/Status module** with 7 segment display
- **Dynamic Power Save** mode
- **IP67** housing with built-in fiber/splice organiser
- Multiple powering options (65, 90, 115 or 230 VAC)

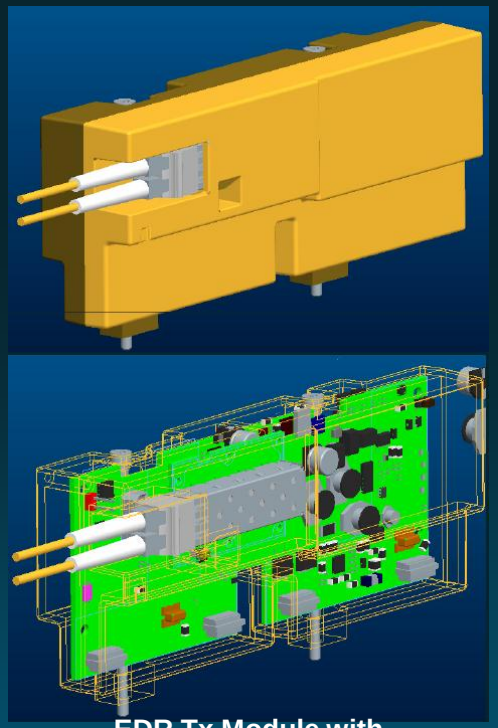
***Applicable to EDR reverse configuration only**

Modular 2 ch. Enhanced Digital Reverse

For A90200 and A90201 EGC Segmentable Nodes

- **Main Characteristics:**
  - **Dual channel**
  - **Compatible with both A90200 as well as A90201**
  - **Supports 40, 42, 55, 65 and 85 MHz reverse bandwidth**
  - **Plug-able optics for lowest TCO (min. sparing, min, down time,…)**
    - **CWDM (18 ch.)**
    - **DWDM (+40 ch.)**
  - **Link budgets**
    - **Standard range (21 dB link)**
    - **Extended range (28 dB link)**

Plug-able Optics



EDR Tx Module with OPM

Modular 2 ch. Enhanced Digital Reverse

Scenario's that favour Digital Reverse

While Analog Reverse stays the optimum solution for shorter, single channel per fiber set ups, Enhanced Digital Reverse clearly stands out in the following scenario's:

- Longer fiber links *(approaching or surpassing the budget as can be covered with analog reverse)*
- Segmented reverse paths *(small CAPEX premium for EDR, offset by lower fiber count and easier reverse path alignment)*
- Single fiber reverse backhaul *(EDR is lowest CAPEX/OPEX compared to analog reverse combined with higher count e.g. CWDM passives)*
- ***DWDM*** *(analog reverse only features CWDM, making EDR the only option)*
- Minimal OPEX *(With a much larger dynamic range, EDR is easier to set and eliminates the potential requirement for future/periodic realignments)*

Compact EGC (Mini)-Amplifiers

Introduction

1 GHz
1 Output
EGC
38 dB
112 dBuV
A93230

1 GHz
1 Output
EGC
38 dB
112 dBuV
Xponder
A93240

A93230/A93240

Single Output EGC Mini Amplifier

1 GHz
2 Output
EGC
AGC
40 dB
112 dBuV
Xponder

A93280

Dual Output Single Active EGC Amplifier with optional AGC

1 GHz
2 Output
EGC
40 dB
112 dBuV
Xponder

A93250/A93451

Dual Output Single Active EGC Amplifier

1 GHz
3 Output
EGC
AGC
40 dB
112 dBuV
Xponder

A93270

Dual Output Dual Active EGC Amplifier with optional AGC

New **By Q1 CY13 DOCSIS Xponder option will be available on all Compact Amps** (excl. A93230)

Compact (Euro) DOCSIS Transponder

Main Features

General

- HMS compatible transponder that uses DOCSIS PHY & MAC (instead of HMS PHY & MAC)
- Same feature set as current HMS transponders added DOCSIS features
- USB port and Embedded Web server for local access and configuration

Main advantage

- Avoids use of HMS PHY & MAC that requires an HMTS (Phoenix)
- Simpler RF wiring in the HE as only CMTS needs to be connected
- Coexistence with potential use of upstream filters
- Much better frequency agility due to DOCSIS PHY

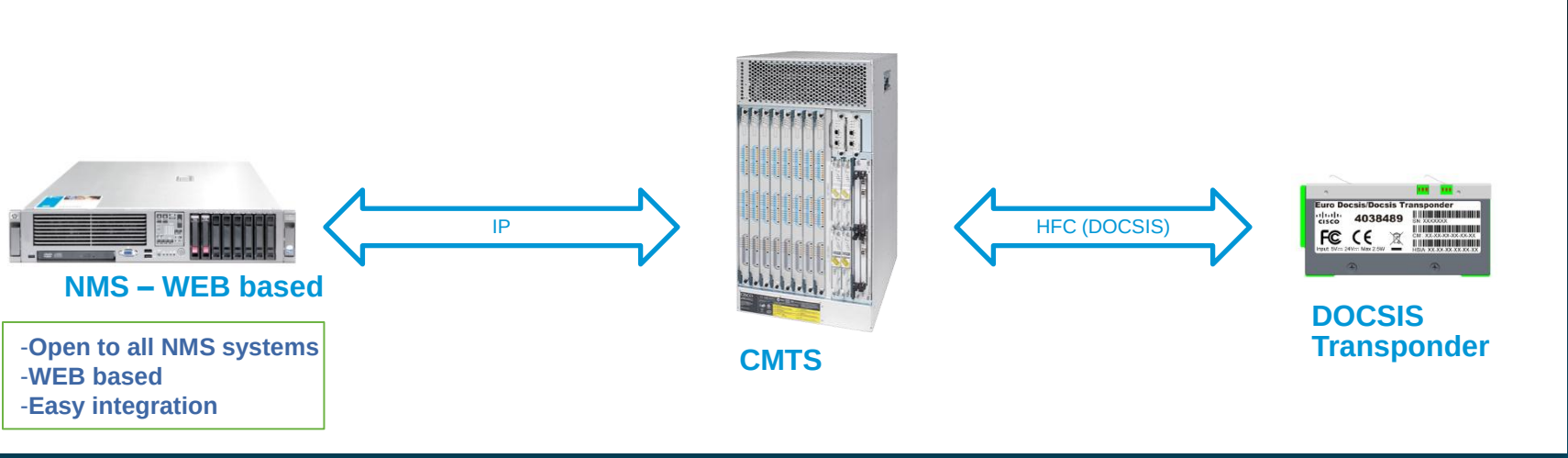
Compact Nodes & EGC Amplifiers

- Standard (A90075), EGC Fiber Deep (A90100), EGC Segmentable (A90200 & A90201)
- EGC Mini (A93240) EGC (A93250) , EGC with optional AGC (A93270 & A93280)

Compact (Euro) DOCSIS Transponder

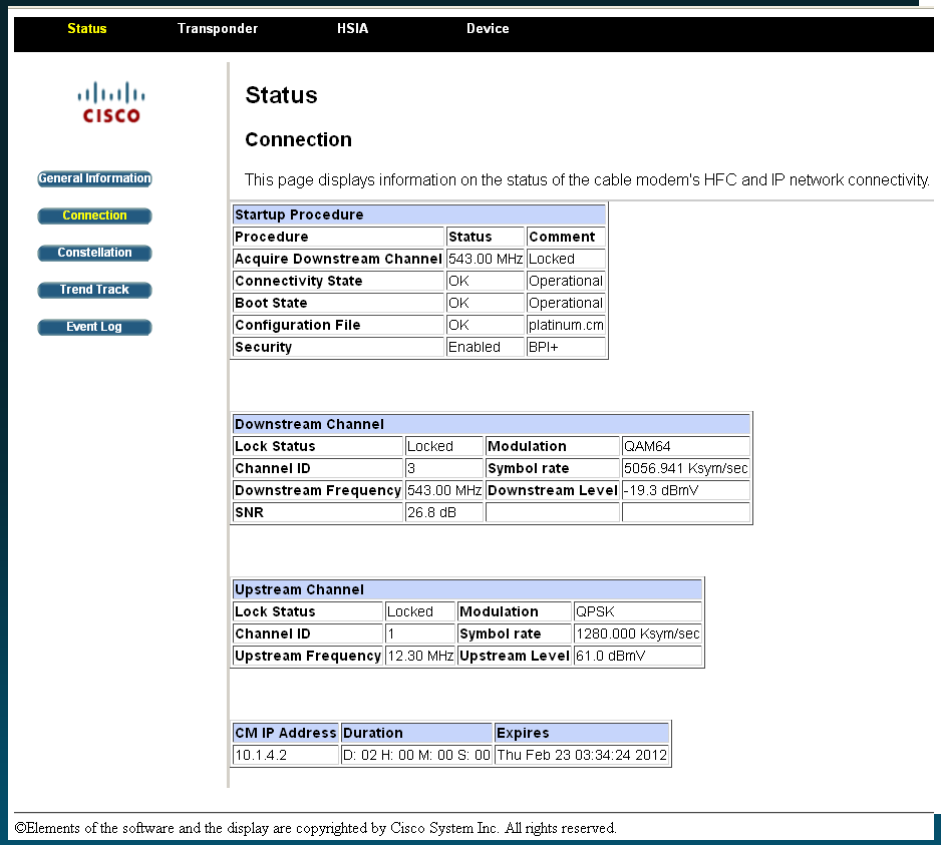
Main Advantages

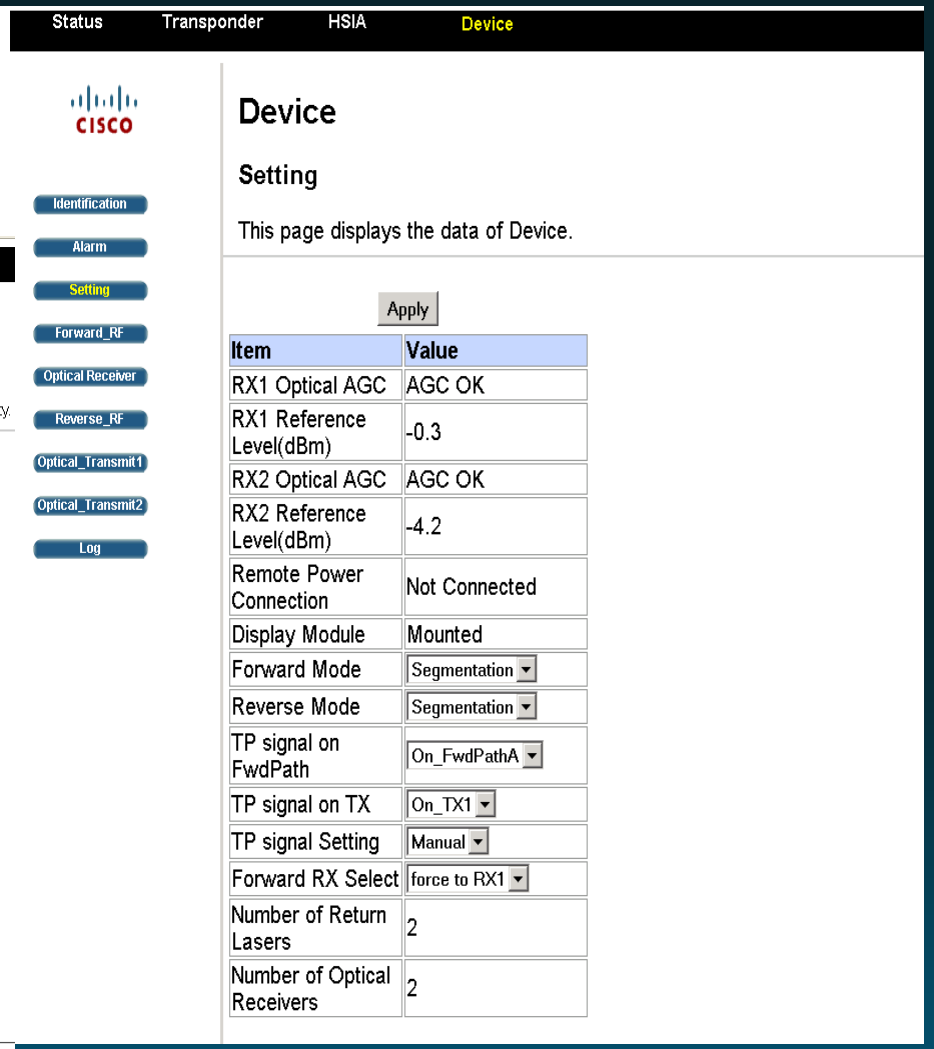
- Allows an all DOCSIS upstream
- Avoids use of HMS PHY & MAC that requires an HMTS (Phoenix)
- Simpler RF wiring in the HE
- Much better frequency agility due to DOCSIS PHY
- Adds DOCSIS points of monitoring at the HFC active elements



Compact (Euro)DOCSIS Transponder

Web Interface for Device & Docsis Parameters & Settings





Trend tracking of DS signal (new)

Trend Tracking for DS Signal

- **Tracking of :**
  - **Received signal level**
  - **MER**
  - **BER**
- **Able to send log file to server**
- **Set sampling period and log period**
- **DS Constellation Maps**

Thank you.