DOCSIS3.0 Migration

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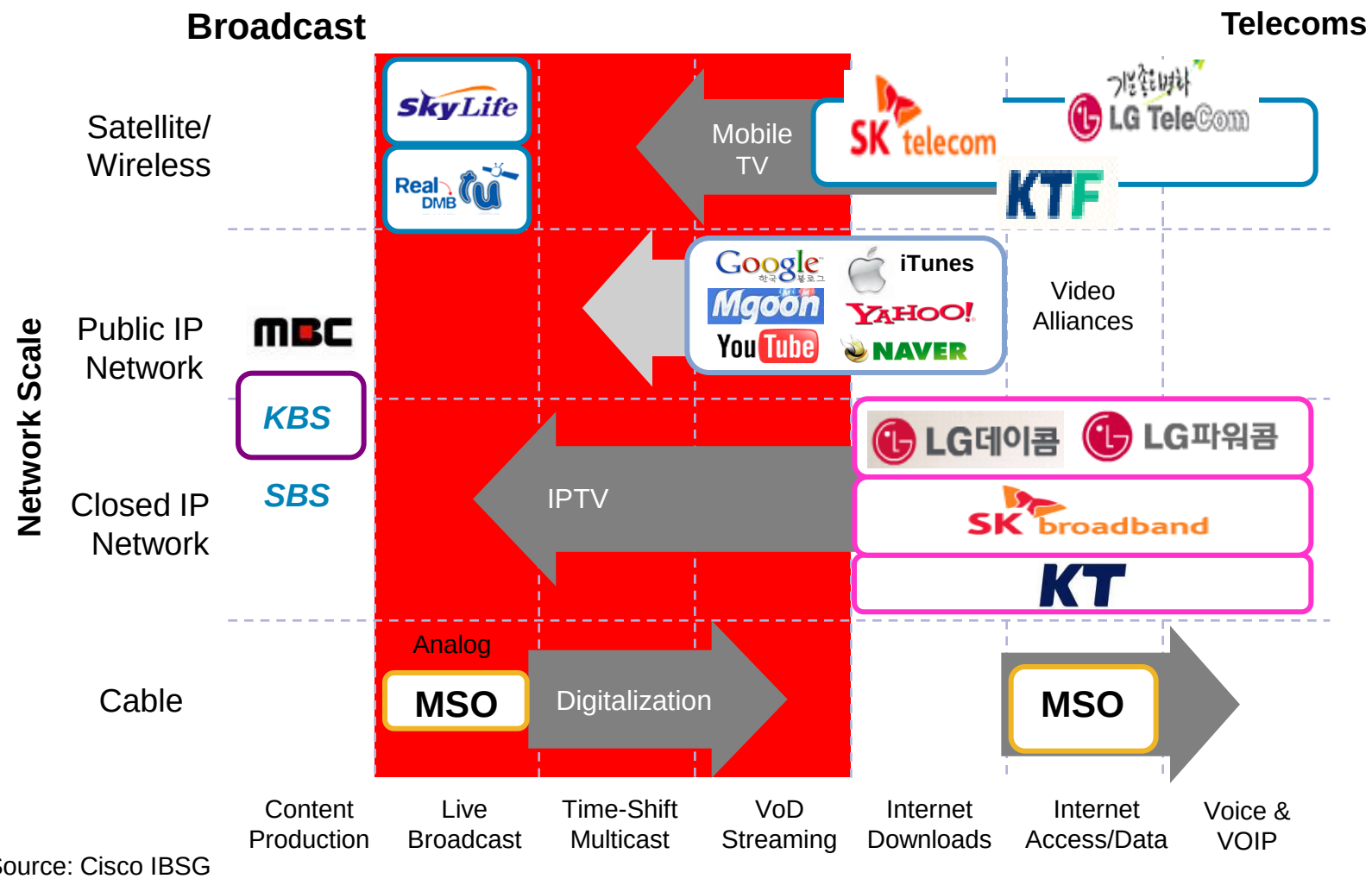
The Cable Landscape

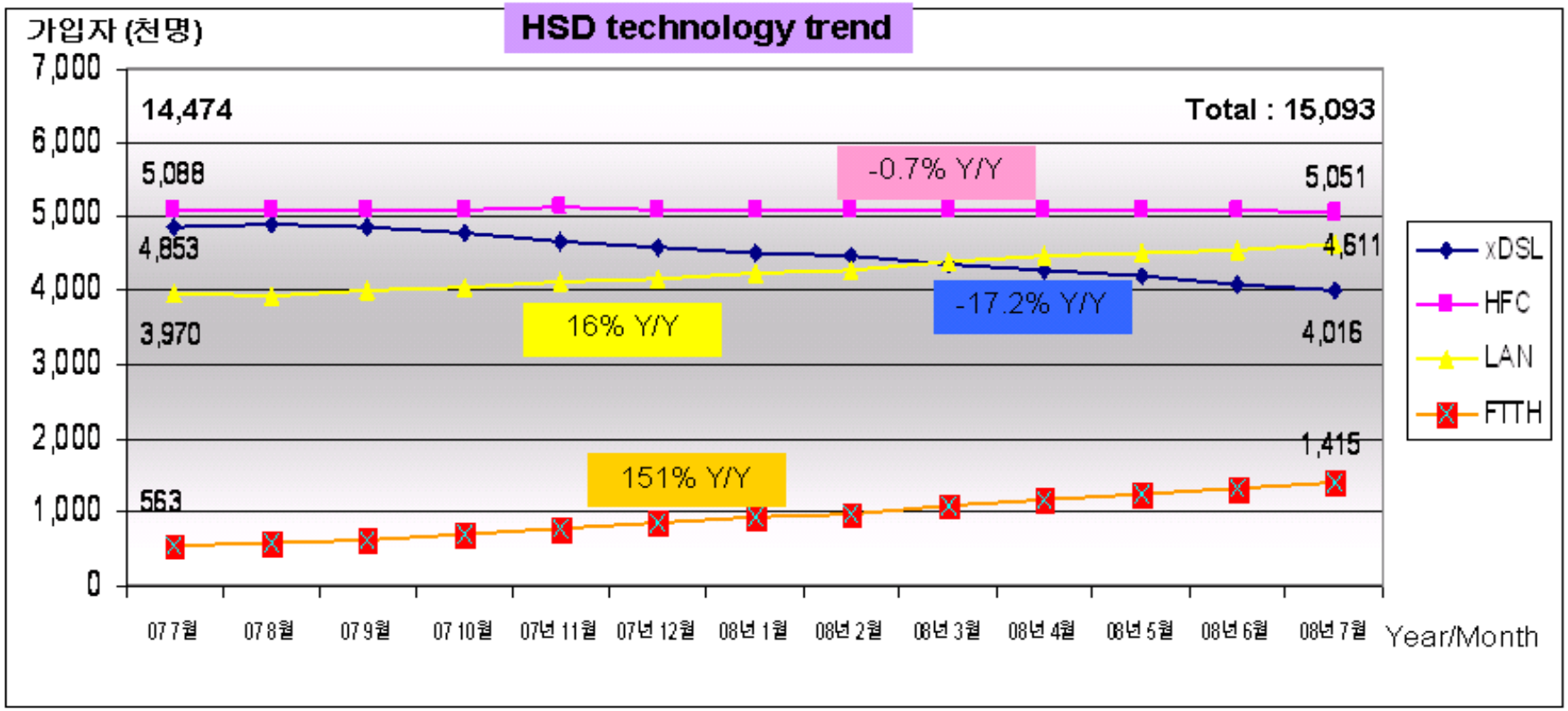
Competitive Landscape

Changing Competitive Landscape In Korea



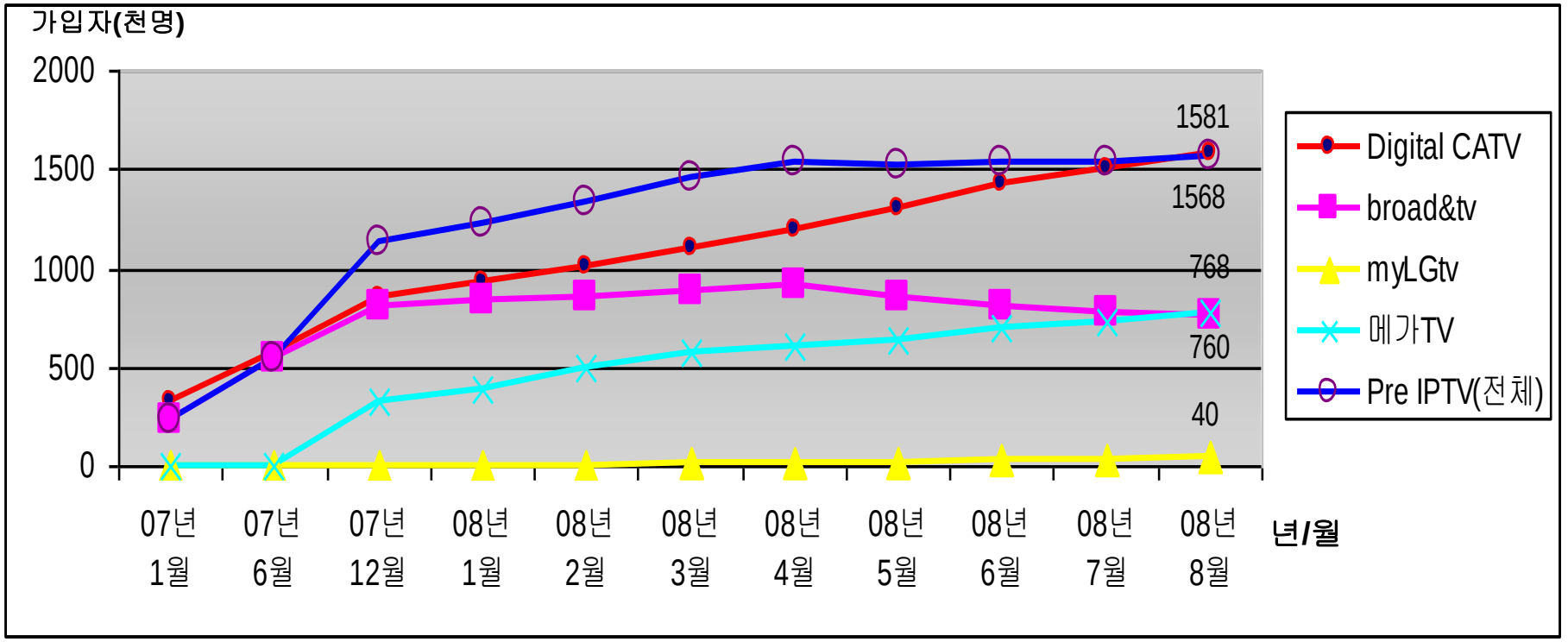
Source: Cisco IBSG

HSD 기술별 가입자 현황

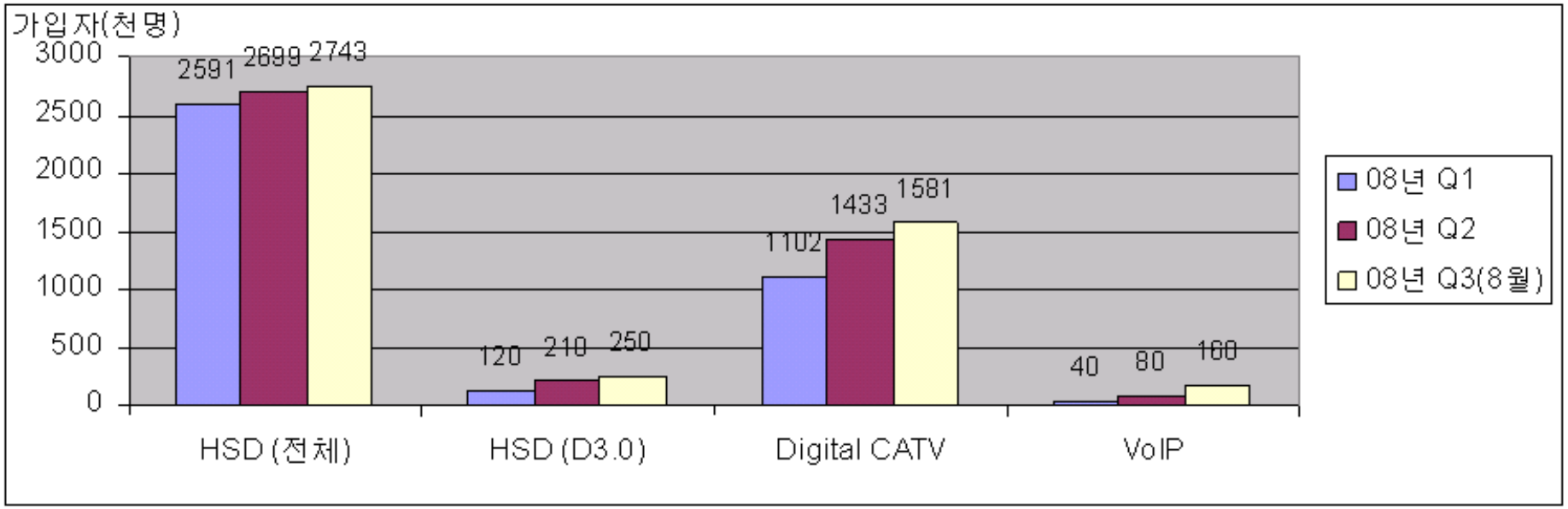


- **HSD Growth (Year over Year) : + 4.3%**
- 가구수 기준 **HSD** 보급율 **(**가구수 **1800**만 가정**) : 84%**
- 기술별 점유율 **(2008**년 **7**월 현재**)**
  HFC : 33.5 %
  XDSL : 26.6%
  LAN : 30.5 %
  FTTH : 9.4%
- **100M**급 **HSD** 비율 **: 34% → 45%**

(Pre)IPTV vs Digital CATV 가입자 현황 (2008년 8월)



케이블TV업계 TPS서비스 현황



[결합 상품]

1. Basic CATV+ 인터넷 결합상품 **: Basic CATV** 가입자 대비 **20%**

2. Digital CATV + HSD

3. 방송 **+** 인터넷 **+** 음성

[CATV 가입자 대비 **TPS** 서비스 보급율 **]**

1. HSD : 20%

2. Digital CATV : 11%

3. VoIP : 1.1%

Cable's Bandwidth Potential

Case Study:

- **100K HHP HFC plant with 500 HHP per Fiber Node**
- **Service Group (SG) is the # of FN with the same service offering**

Service	Channels		Digital BW	# SG	Capacity	
Analog	79	60%	x 3.75 Mbps	x 1 SG =	0.3 Gbps	3%
Digital	43	33%	x 38 Mbps	x 1 SG =	1.7 Gbps	15%
VOD	8	6%	x 38 Mbps	x 50 SG =	15 Gbps	72%
DOCSIS	9	7%	x 38 Mbps	x 50 SG =	2 Gbps	10%
Total	131				19 Gbps	

Bandwidth Used Today

÷

Total available Bandwidth

Capacity	131	x 38Mbps	x 200 SG =	1000 Gbps

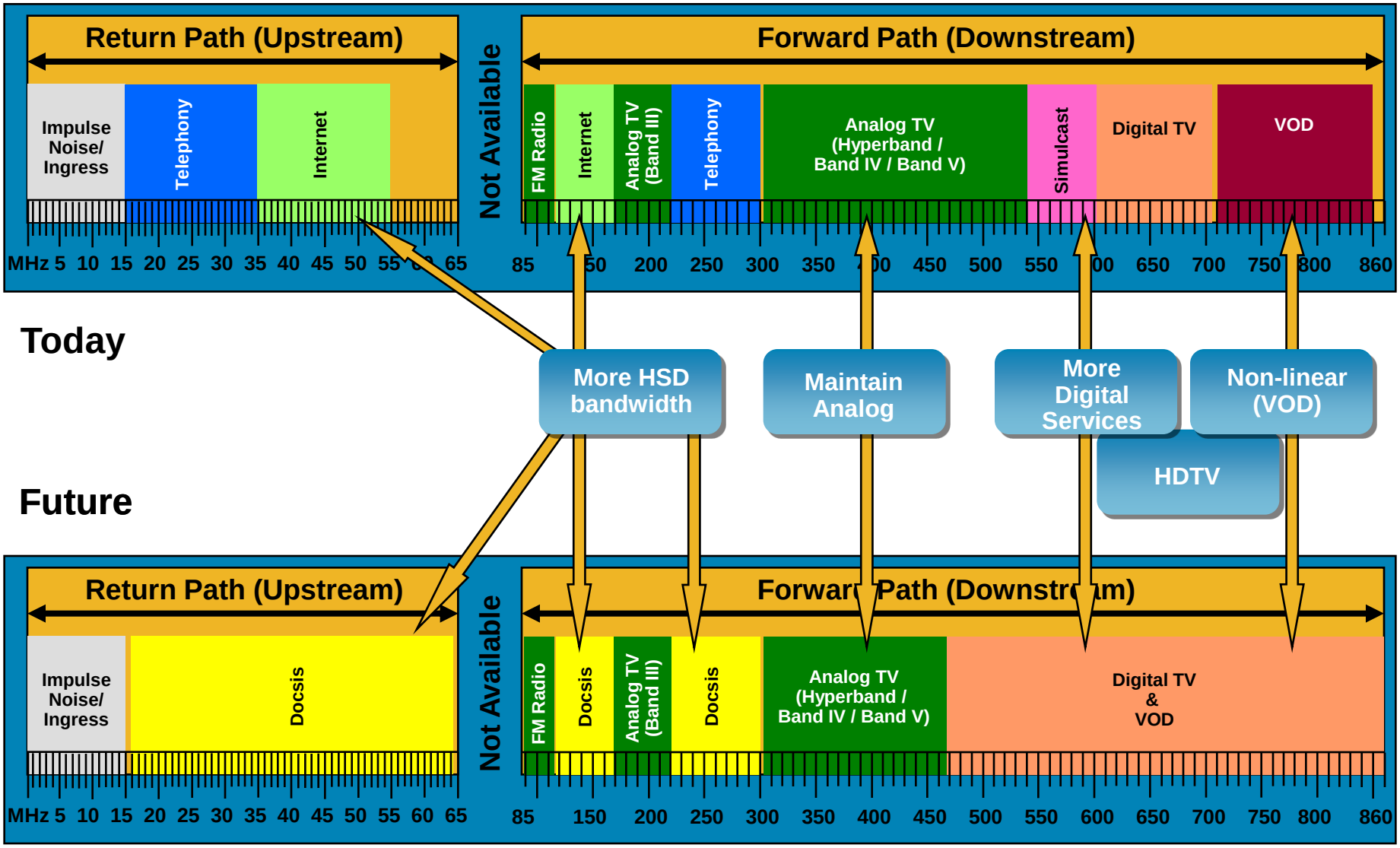
Efficiency 1.9%

✗ Change the Plant Infrastructure

✓ Re-organizing the bits on the plant

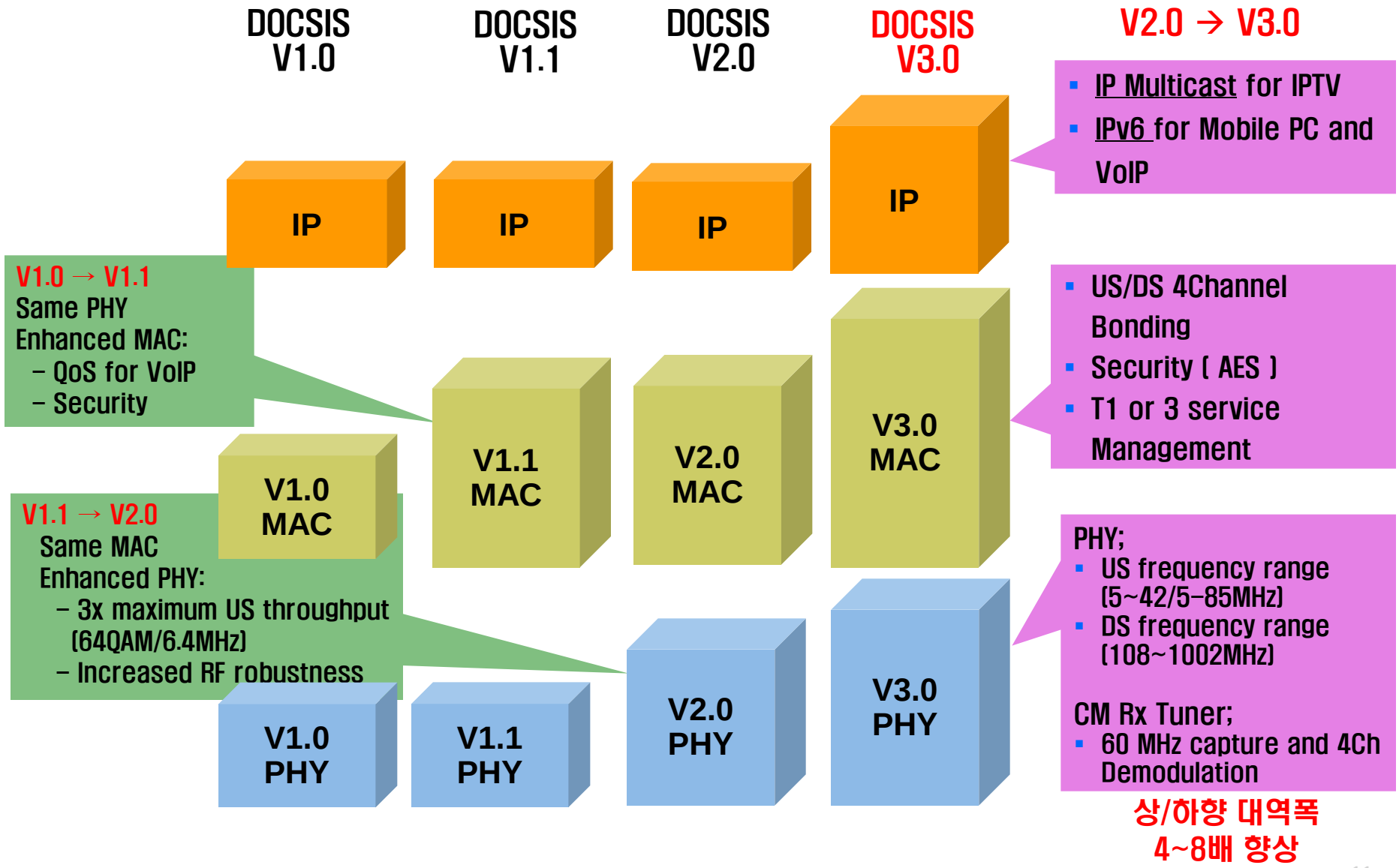
The HFC Plant is migrating from Broadcast (analog and digital TV) to unicast (DOCSIS, VOD, SDV). Currently it is about 10% unicast.

Cable Landscape
Case Example: HFC Utilization

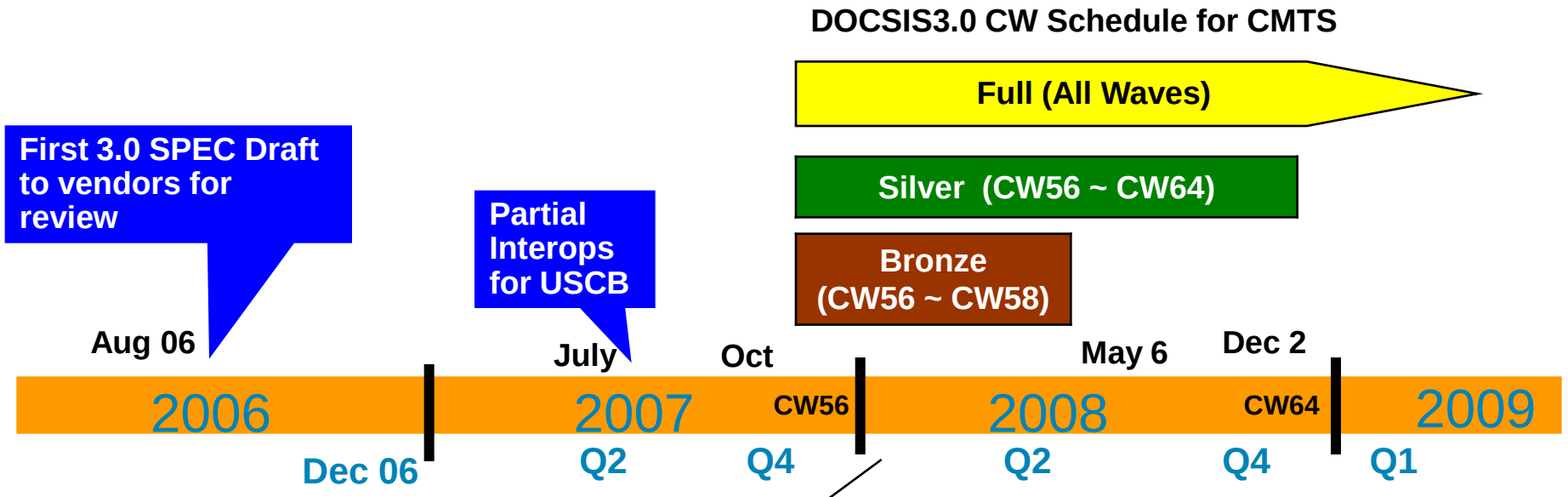


DOCSIS3.0 Update

DOCSIS 기술 비교



CableLabs DOCSIS 3.0 status



Cisco status

- CMTS
  Cisco uBR10K – Bronze (CW56)
- CM
  DPC3000 - Full (CW58)

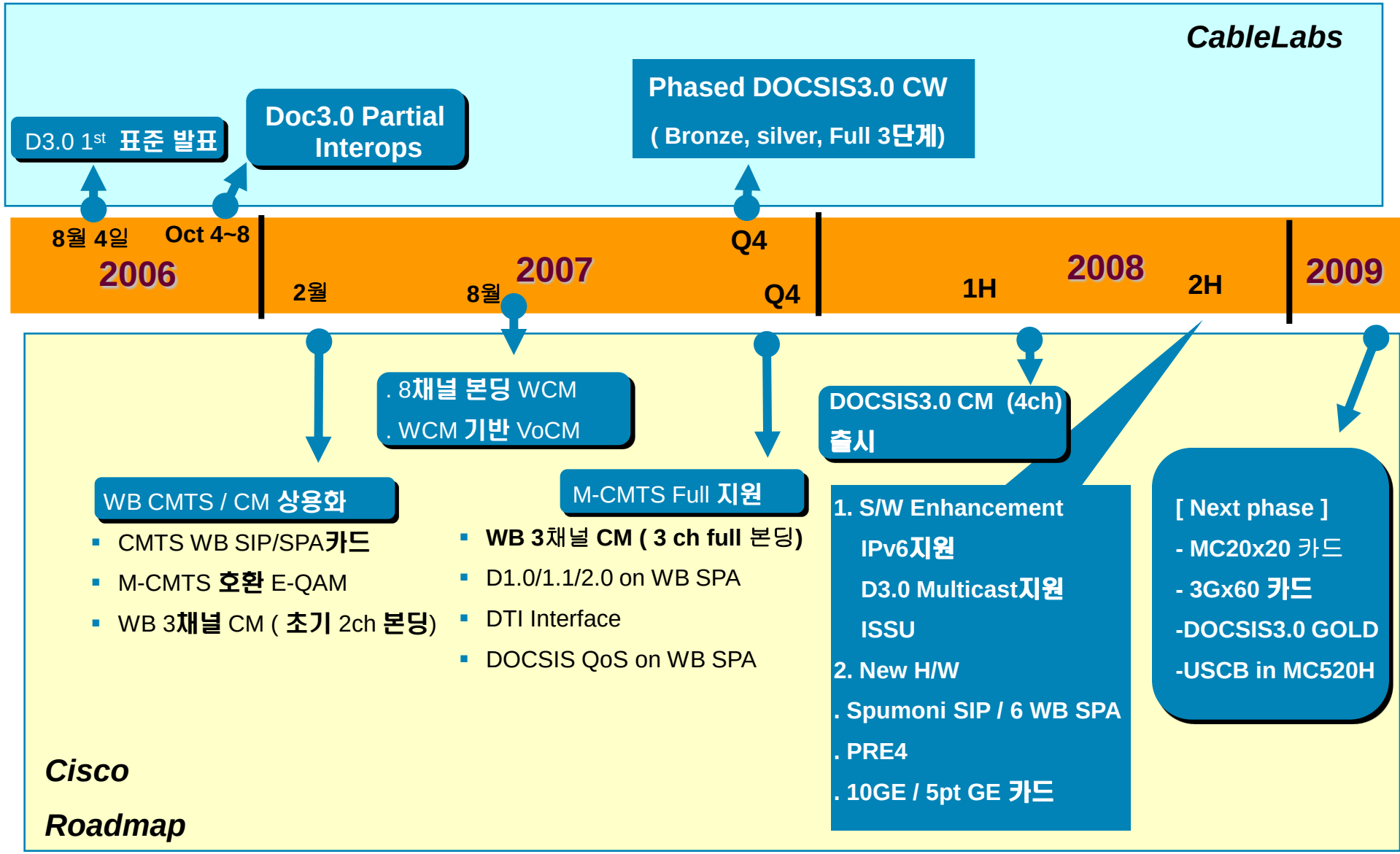
Feature requirement in 3 CMTS qualification Level

Bronze - DS Cannel Bonding, IPv6 for CM

Silver - US Channel Bonding, AES, Multicast QoS, IPv6 for CPE

Full – All DOCSIS3.0 functionality

Cisco Pre D3.0 지원 현황 및 향후 계획



Cisco D3.0 CM Evolution

DPC2505 / EPC2505

- 모델명 : **DPC2505 / EPC2505**
  - **Broadcom's 3381 3-ch/tuner**
  - **Annex A & Annex B 지원**
  - **DOCSIS 3.0 compatible**
  - **Production units : Now**

DOCSIS 3.0 Qualified

DPC3000 / EPC3000

- 모델명 : **DPC3000 / EPC3000**
  - **TI Puma5 3.0 based**
  - **4-ch US & DS bonding, 60 MHz passband**
  - **Annex A & Annex B 지원**
  - **Production units : Now**

NEW

DPC3010 / EPC3010

- 모델명 : **DPC3010 / EPC3010**
  - **~320 Mbps DOCSIS / ~400 Mbps EuroDOCSIS (8)DS X (4)US**
  - **(2) 1 GHz block tuners, 32 MHz capture range each**
  - **Highly reliable hardened design**
  - **Resists damage due to power line surges and lightning**
  - **Production : Soon**

DOCSIS 3.0 서비스 확대
- 주요 기술적 고려사항

HFC 망 고도화

- **DOCSIS 3.0** 서비스 하향채널 본딩을 위한 주파수 확보
- 향후 **DOCSIS 3.0** 서비스 상향채널 본딩을 위한 주파수 확보
- **HFC** 품질 개선을 통한 **High Modulation** 적용
- **Decrease Node Size : 예) 1000 → 500** 이하
- **DOCSIS 3.0 Spec** 확장 적용
  - **DS: 108MHz ~ 1002MHz**
  - **US: 5~42/65/85MHz**

IPv6 준비

- **IPv6 IP Address** 체계 준비
  - 향후 Home Networking, Mobile PC and IP Phone 지원.
- **Network Backbone/ CMTS/CM/DHCP Server/Others IPv6** 지원 여부 및 구성 방안

D3.0 Multicast QoS
QoS for VoIP

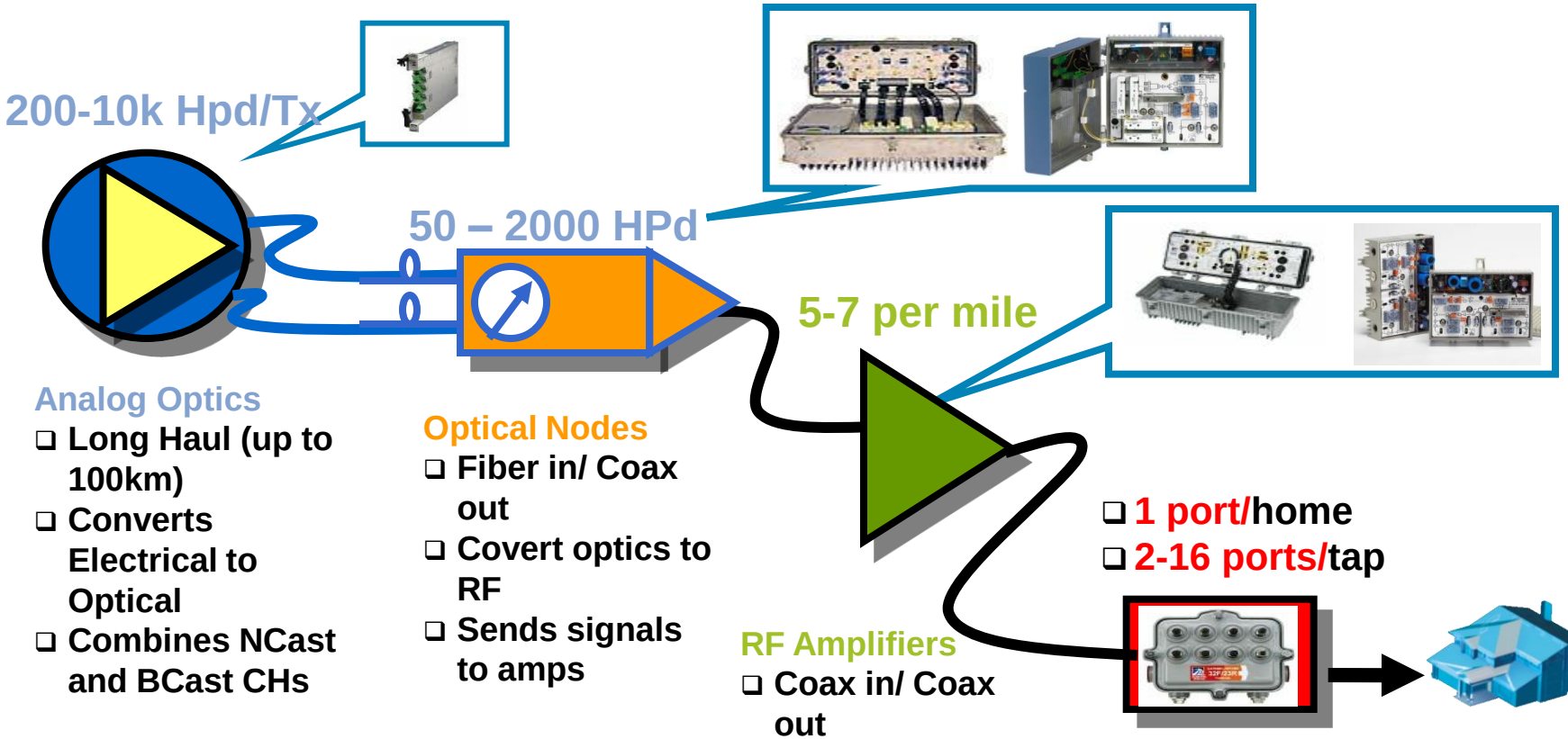
- **IPTV over HFC** 서비스 검토
- **DOCSIS 3.0 Bonded Multicast & Multicast QoS** 지원
- **VoIP** 서비스 확대를 위한 **QoS** 방안

DOCSIS 3.0 BG별 수용 가입자

- 하향 채널 본딩을 통한 **100M** 서비스 시 적정 가입자 수
- 현재 집선비 **100 ~ 120:1** 적용

HFC migration

CATV Access Components



Analog Optics
- Long Haul (up to 100km)
- Converts Electrical to Optical
- Combines NCast and BCast CHs

Optical Nodes
- Fiber in/ Coax out
- Covert optics to RF
- Sends signals to amps

RF Amplifiers
- Coax in/ Coax out
- Increases signal strength
- Sends signals to taps

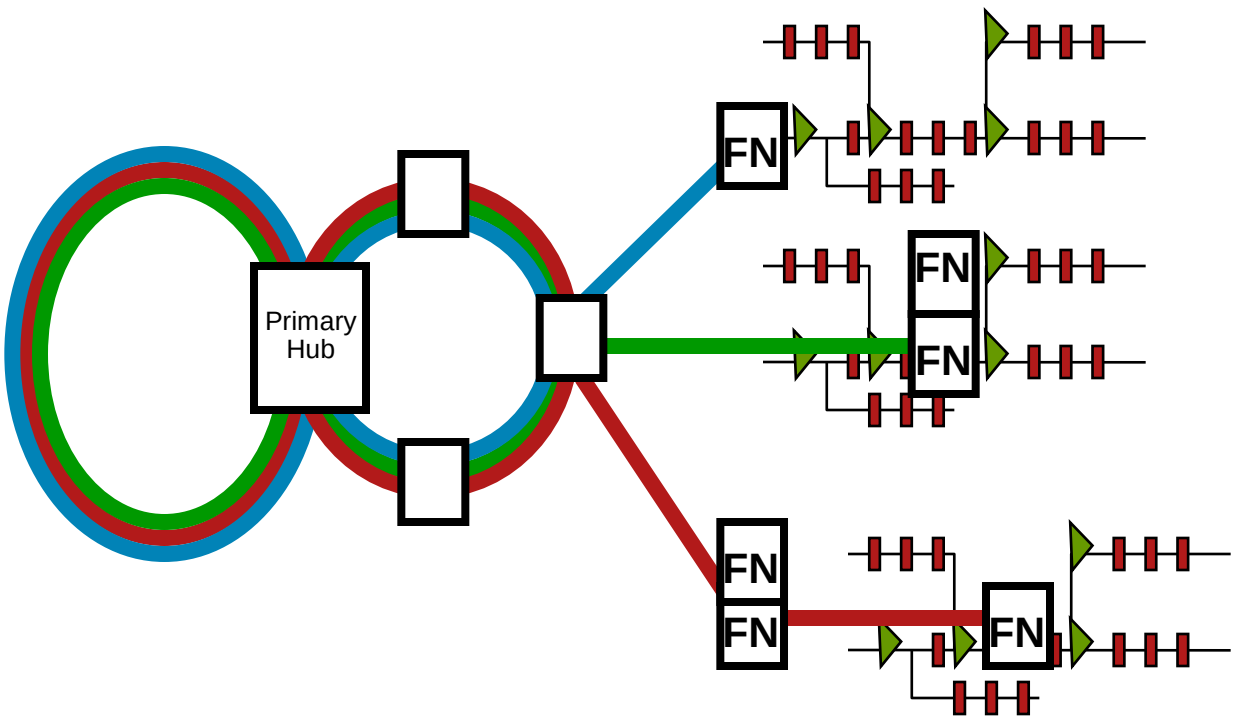
- 1 port/home
- 2-16 ports/tap

Taps and Passives
- Coax in/ Coax out
- Conditions signals for home or STB
- Sends signals to TV/STB

Global Product Lines To Fit Each Theaters Product Needs

Node Service Group Reduction

- MSOs are taking steps to reduce the number of subscribers supported per node group
- 3 Options:

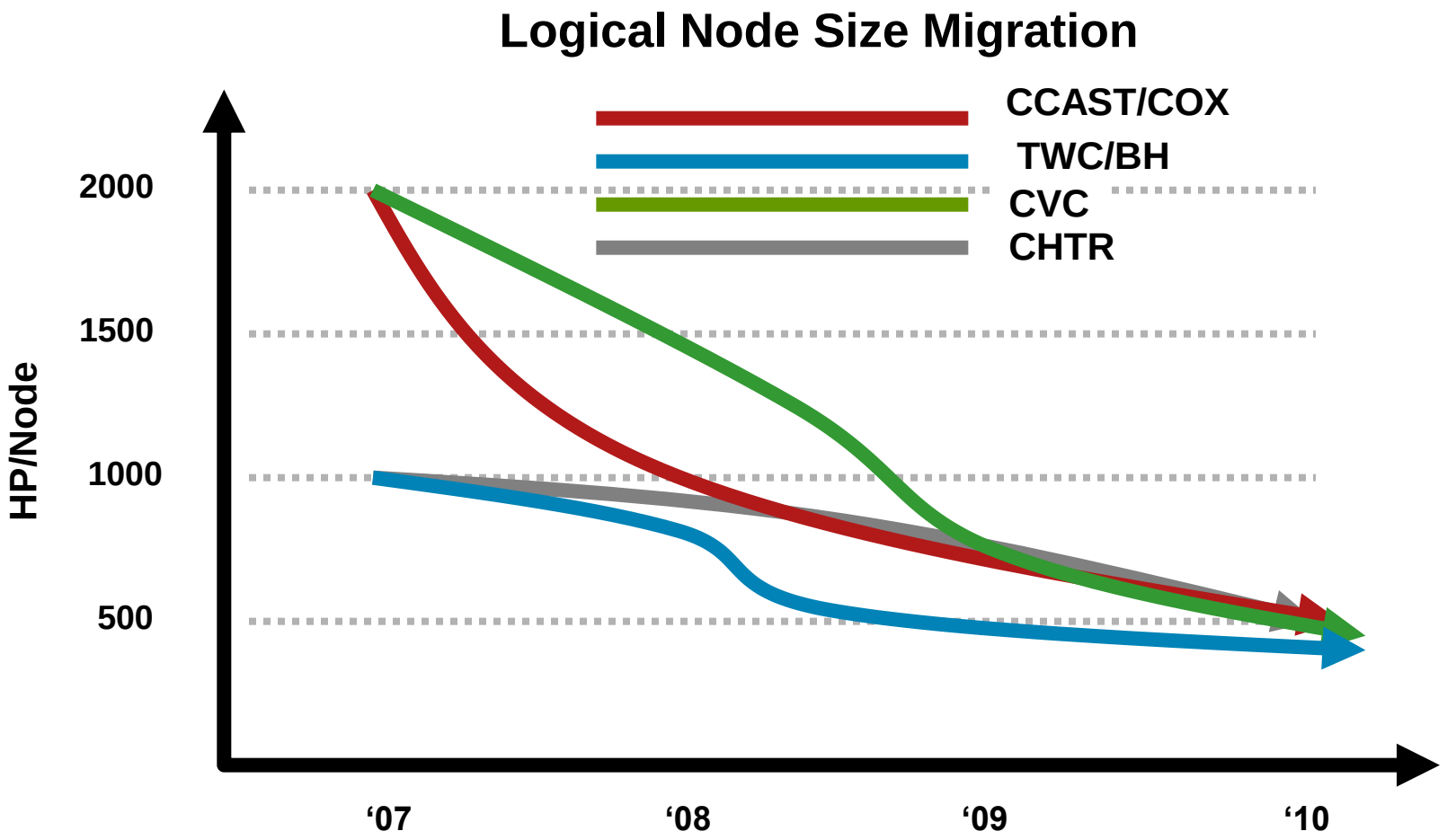


Logical Splits
1:1 Tx/Node Ratio
Add DOCSIS CHS
Increased Txs

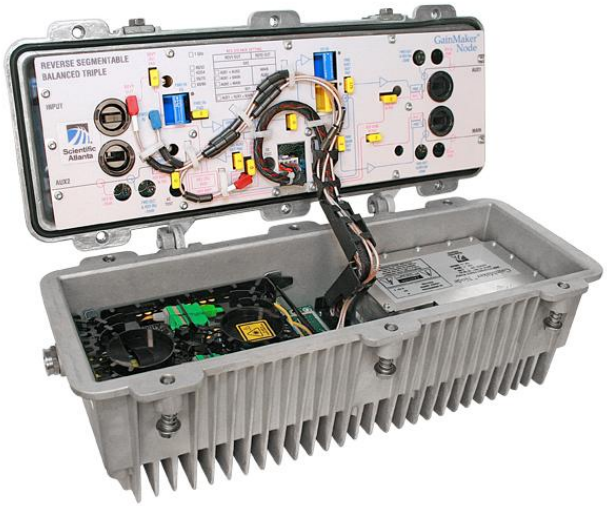
Modular Splits
Co-Locate Nodes
Segment Nodes
Increased Txs/Rxs

Physical Splits
Drive fiber deeper
Add nodes/Upgrade amps
Increased Txs/Rxs & Nodes

Node Service Group Reduction Sizing

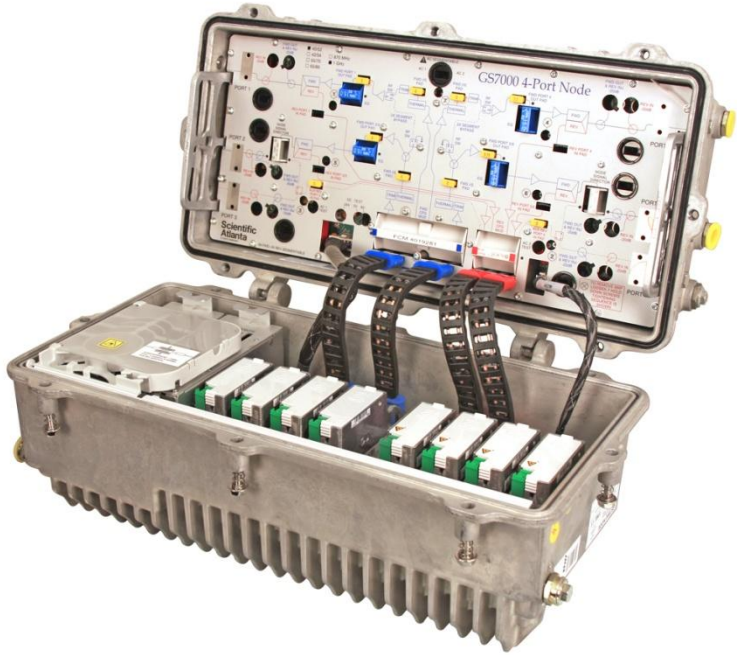


New 1 GHz Nodes



GainMaker and also Gain Maker Reverse Scalable Node

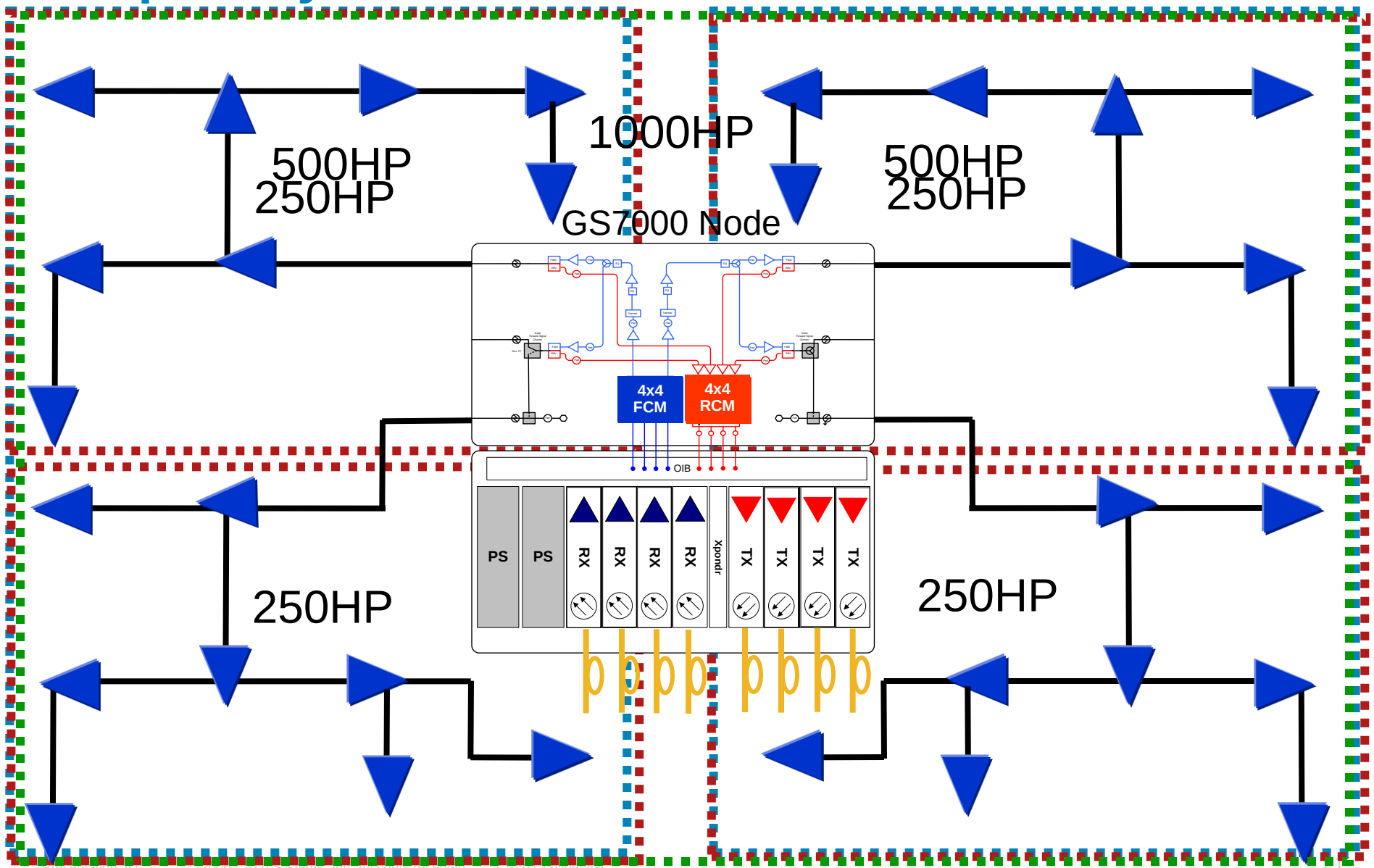
•2-3 Ports
•1Rx, 2Tx
•Option for RF backup
•1310 FP/DFB, 1550 CWDM TX and NEW 2:1 BDR



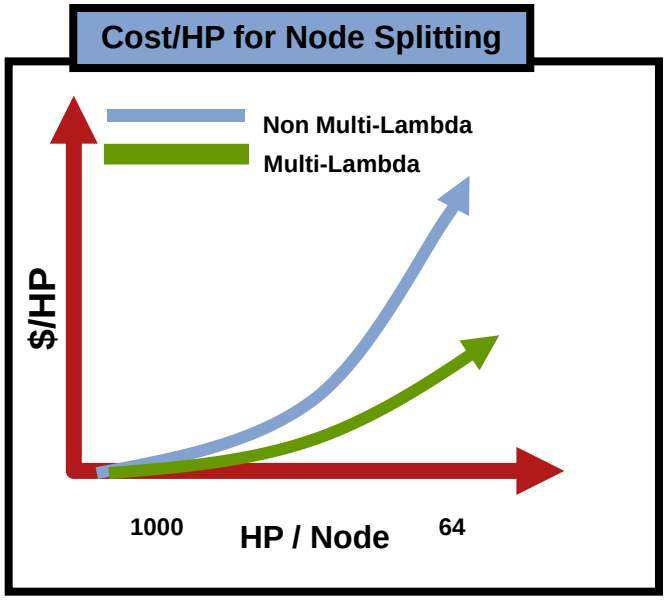
GS-7000 4x4 Scalable Node

•4-6 Ports
•4Rx, 4Tx
•4x Fwd Scalable
•4x Rev Scalable
•Redundant Rx, Tx, P-S
•1310DFB, 1550 CWDM Txs
•2:1, 4:1 BDR

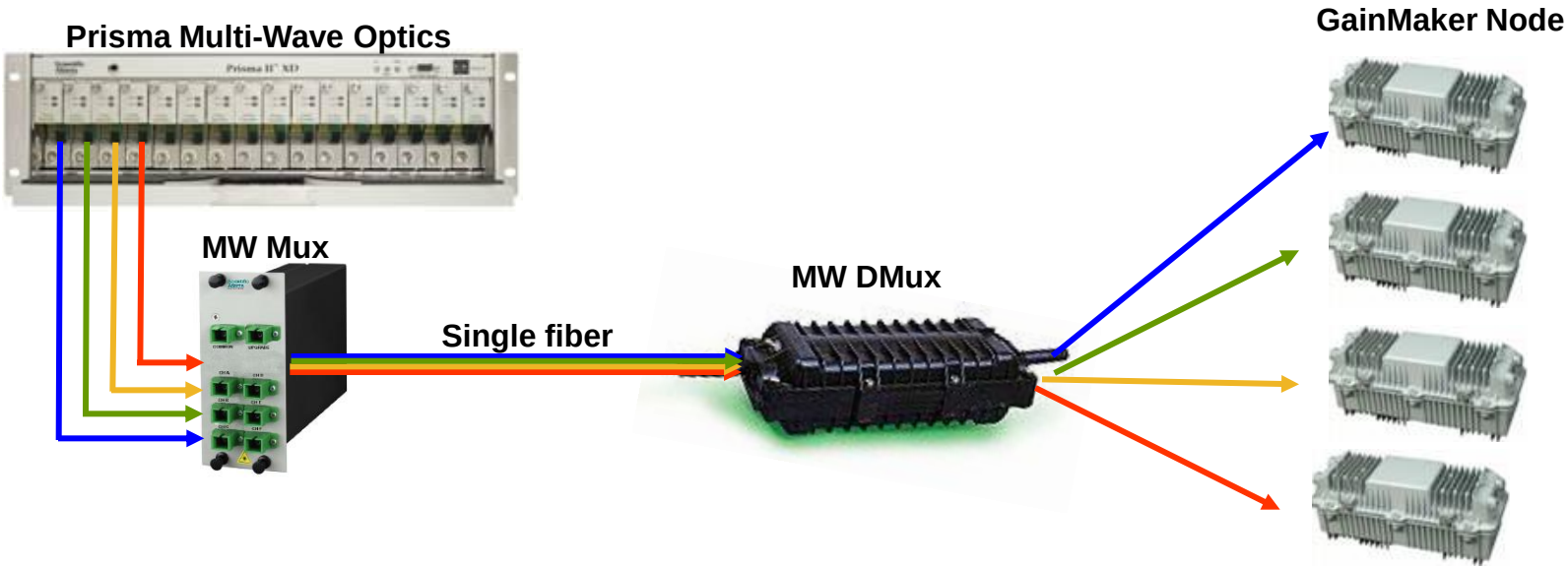
New GS7000 4x Forward / Return Segmentation Capability



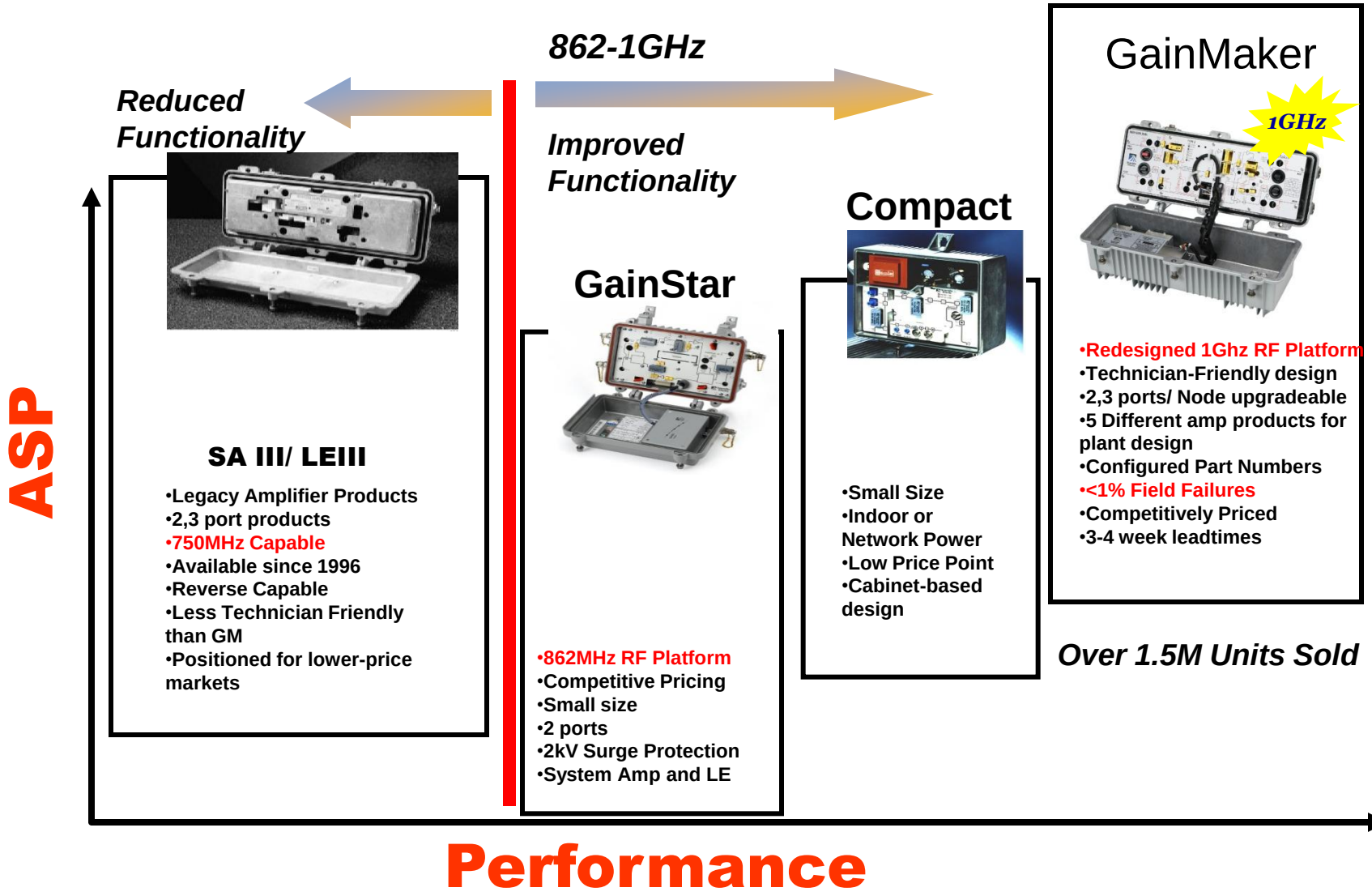
Multi-wavelength Transmission System



- **What is it?**
  - Forward transmitters capable of co-propagating multiple wavelengths in a single fiber with full RF loading on each
- **Why do it?**
  - Push to add new and/or expanded customer services
    > More VOD, VoIP, increased HSD rates
  - Node splitting is often THE solution to reduce service group sizes
  - **As service groups are reduced, more fiber construction is a costly solution**



S-A RF Amplifier:



1 GHz Upgrade

- **Network Impact**
  - <= 750 MHz of BW may not be enough
  - Node splitting & SDV alone do not solve HFC BW problem
  - 1 GHz BW upgrade required

- **1GHz Network Benefits**

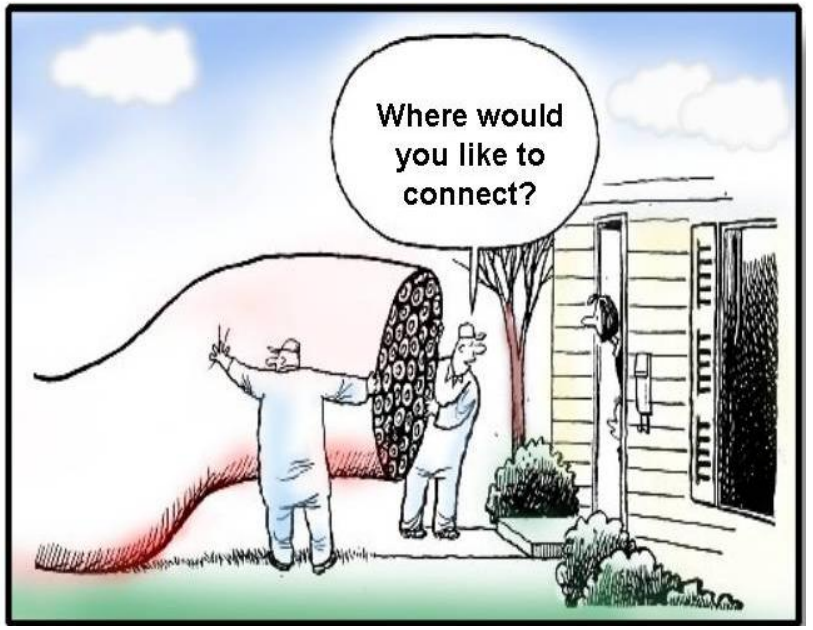
. Low-Cost Bandwidth Freedom

- Headroom for new service offerings
- Without the capital cost of an “upgrade”
- Ability to migrate to higher reverse split

. Improves Current Offerings

- Provides ample room to serve more HDTV, streaming video, commercial services, HSD, etc.

1GHz Bandwidth Enhancement & Segmentation



1 GHz is a cost-effective tool to increase broadcast and narrowcast BW

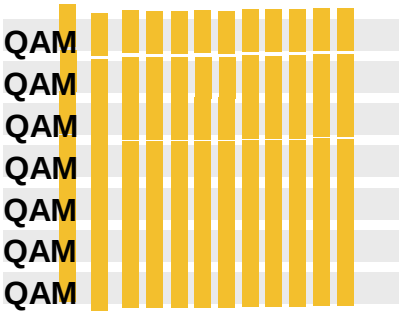
Bandwidth Optimization

- Switched digital video
  - –SDV sends programs to subscribers only in areas where programs are being requested in real-time
  - –Reclaim some RF bandwidth for repurposing to DOCSIS 3.0
- Analog reclamation
  - –Example: Ten analog channels > one digital channel, frees up nine 6 MHz channel slots
  - –Potential cons: Programmer contracts, franchise agreement, must-carry, need for digital STBs
- Migrate to all-digital
  - –Frees up substantial spectrum, but requires digital STBs for most subscribers

Cable IPTV Solution

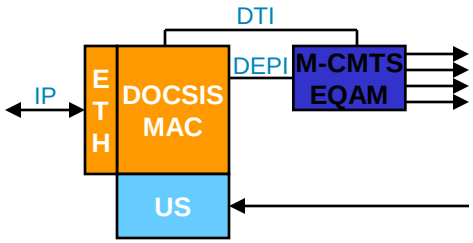
Video over DOCSIS 3.0 – truly converged network

DOCSIS Evolution



DOCSIS 3.0

- Bonded Channel
- Enhanced Multicast



DOCSIS M-CMTS

- Universal QAM
- Lower QAM cost

New Functionality

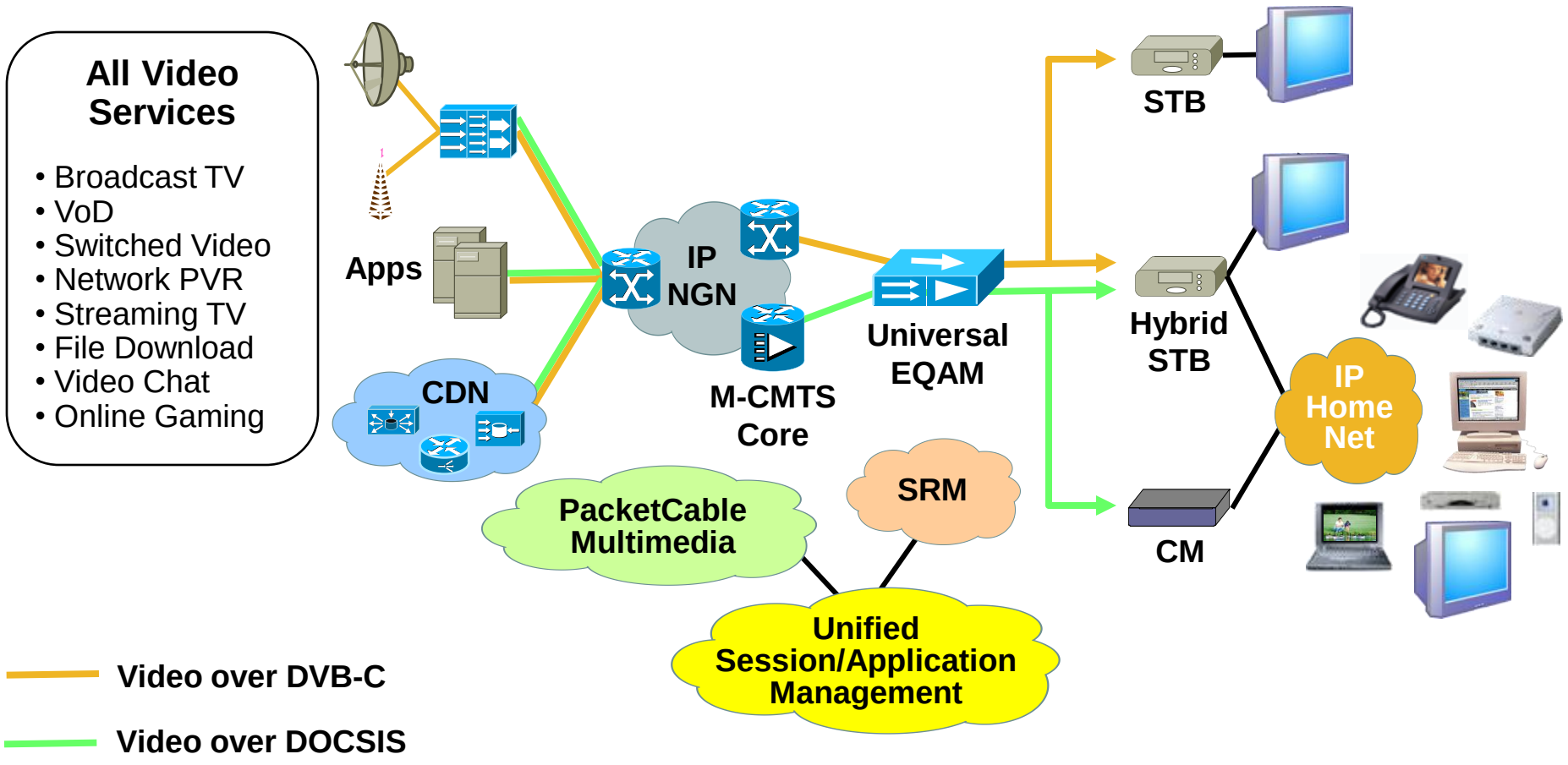
Ubiquitous IP Video Device

Video Mosaic

Fast Channel Change

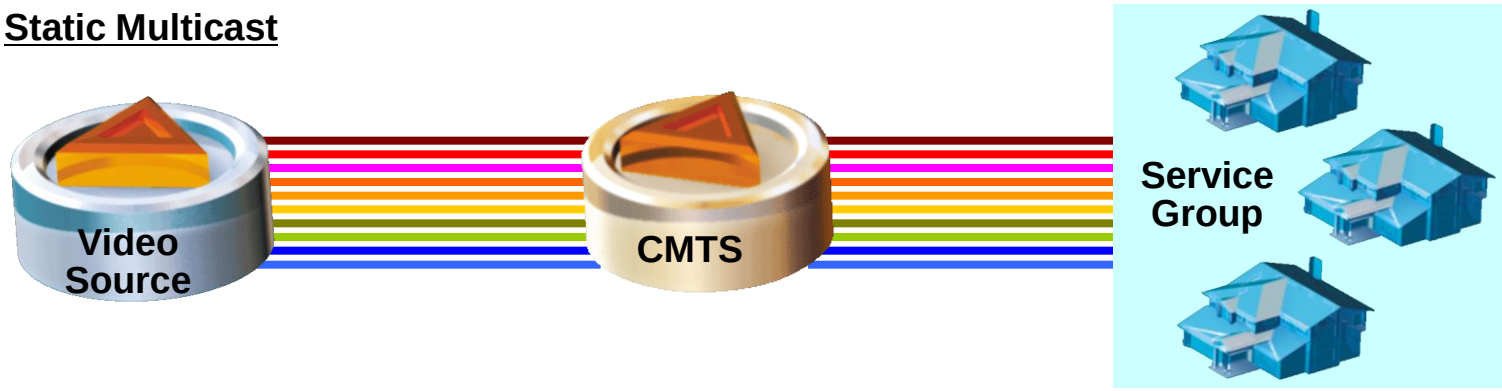
Connected home

Integrated Platform for Cable (IP)TV



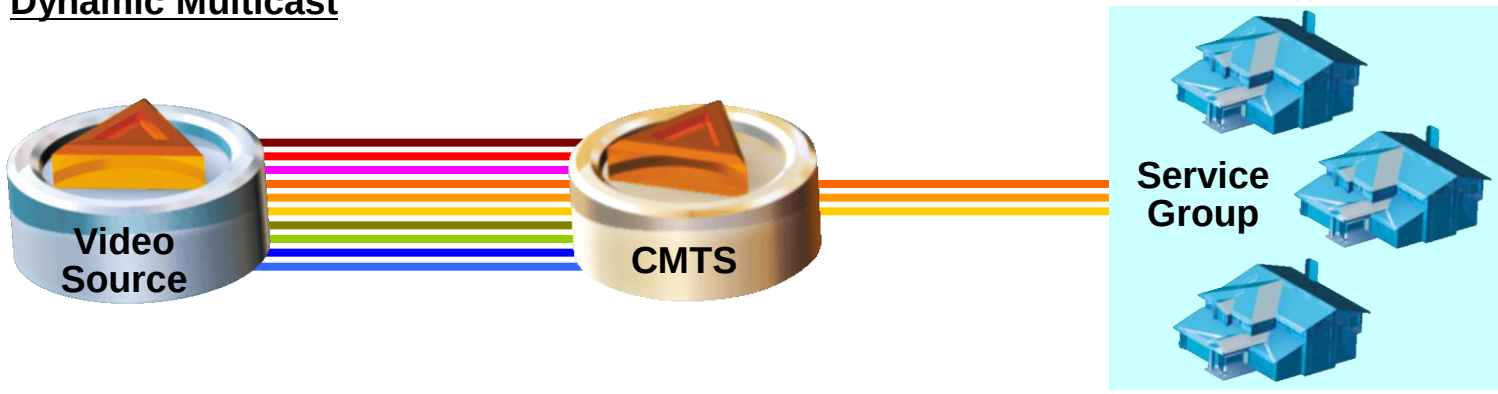
Switching in IPTV over DOCSIS

Static Multicast



- Limited number of channels, especially for 4x4 CM
- RF spanning may provide some cost benefits

Dynamic Multicast

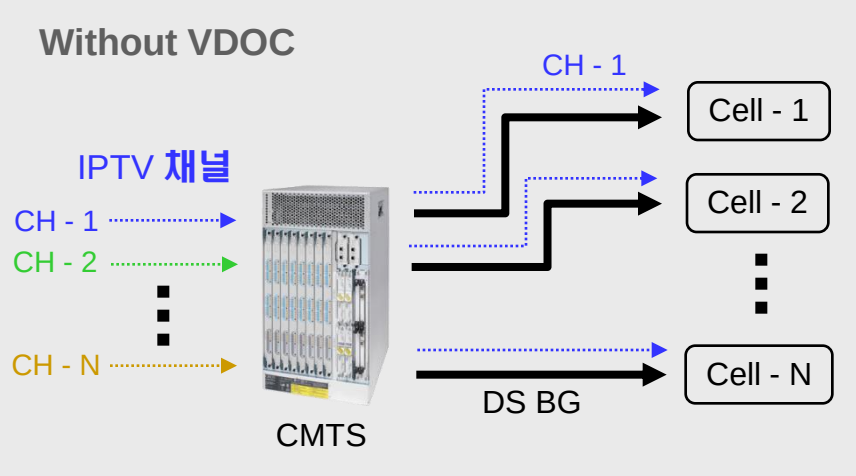


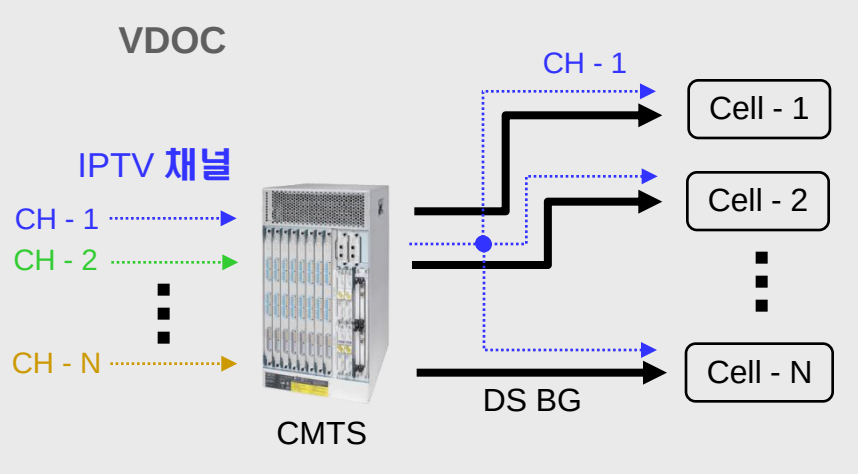
- Bandwidth efficient
- Need smaller service group to really benefit

Caveat: uBR10k supports dynamic multicast with Amazon release

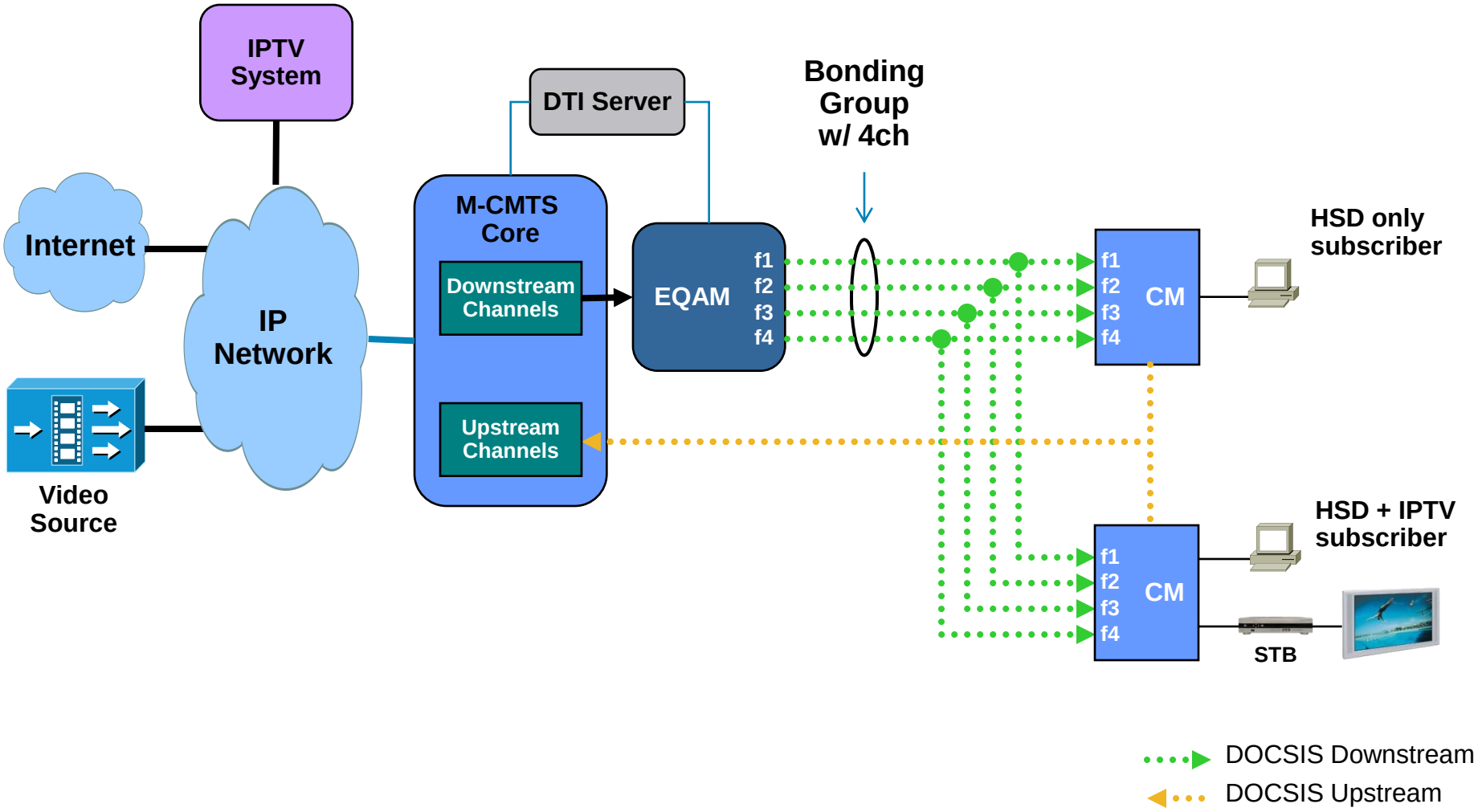
Cisco Cable IPTV Solution

- VDOC (Video over DOCSIS),
  - –Cisco DOCSIS 3.0 DBC (Dynamic Bonding Change) based IPTV video solutions for HFC
  - –Enable efficient and cost-effective delivery of cable TV programming to PCs and other IP-enabled devices.
  - –Provide flexibility and control needed to deliver IP video services with the quality of experience subscribers expect

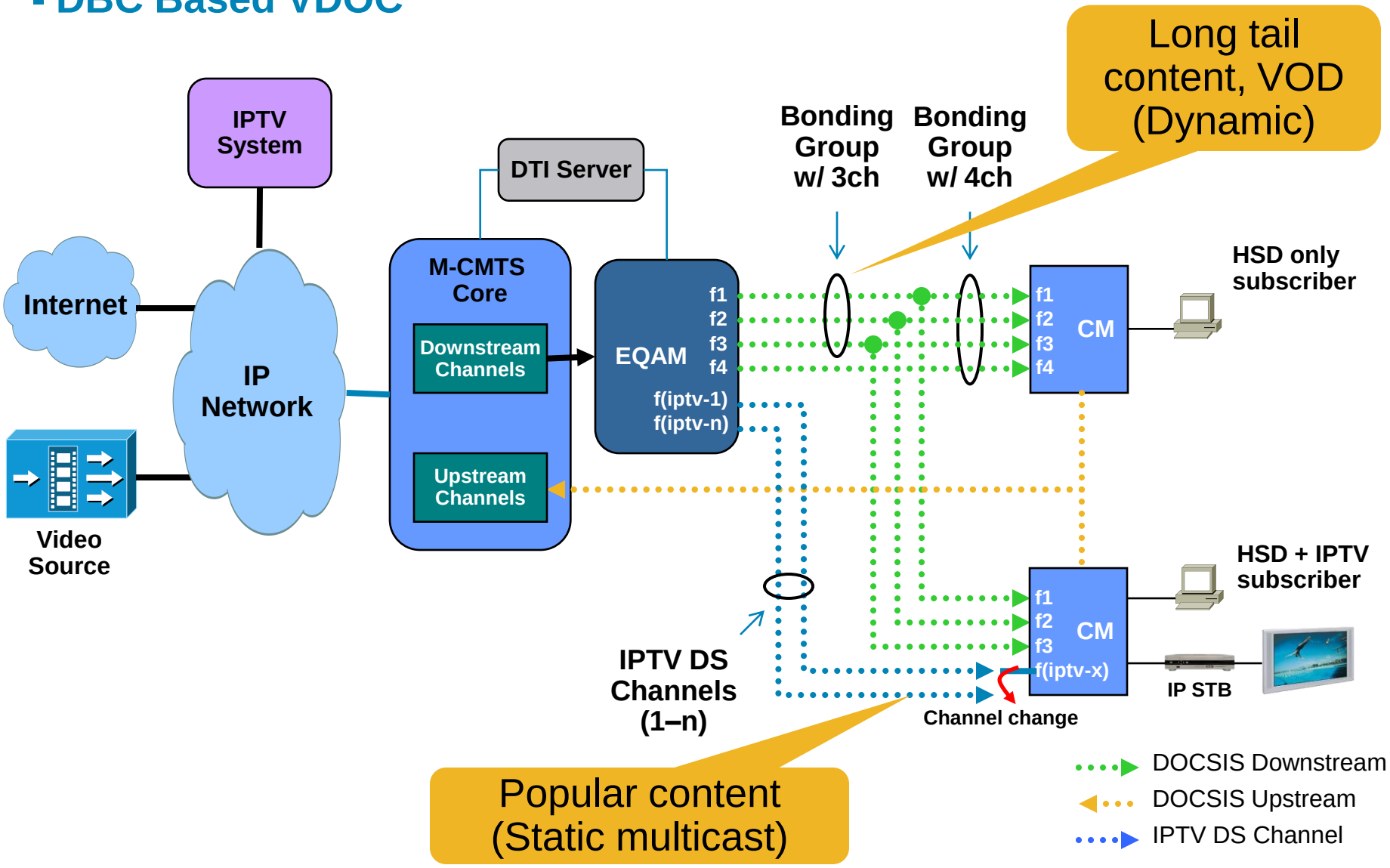




Cable IPTV Solution – Option 1



Cable IPTV Solution (Option 2)
- DBC Based VDOC



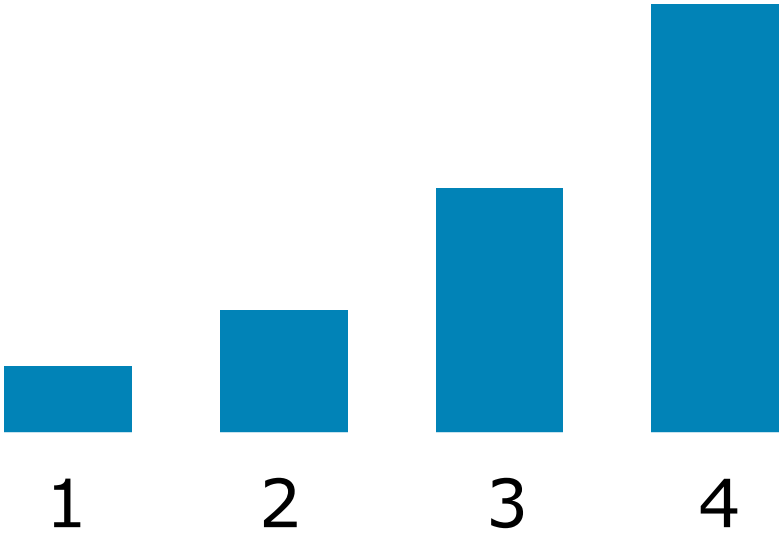
Benefits of Cisco Cable IPTV

- Enables video services to multiple devices
  - –STB, PC, mobile device
- Single transport – multiple services
- Efficient use of DOCSIS network capacity and HFC spectrum
  - –Deliver bonded high-speed data, VoIP, VoD and “long-tail” TV content on shared bonding group
  - –Dynamic bandwidth sharing by multiple services maximizes utilization of CMTS DS capacity and HFC spectrum
- Industry-standard, end-to-end IP networking solution
  - –Fully compatible with DOCSIS 3.0 specifications such as D3.0 multicast and DBC (Dynamic Bonding Change)
  - –Works with off-the-shelf cable modem software

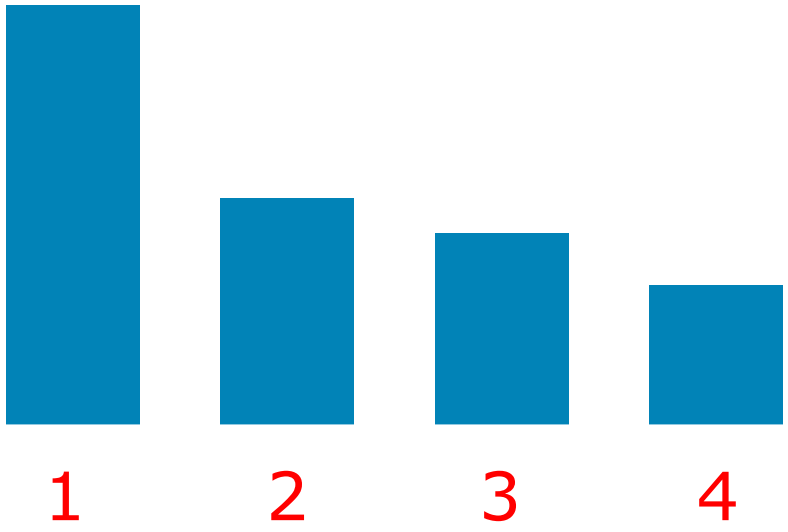
Multi Service over HFC

The Power of the Complete Bundle

$ Average Rev. Per User



% Churn



Voice Advantage in Bundled Triple Play Services

Willingness to Switch SPs if Single Provider Offered "Triple Play"

Voice is a Key Triple Play Component in Reducing Churn

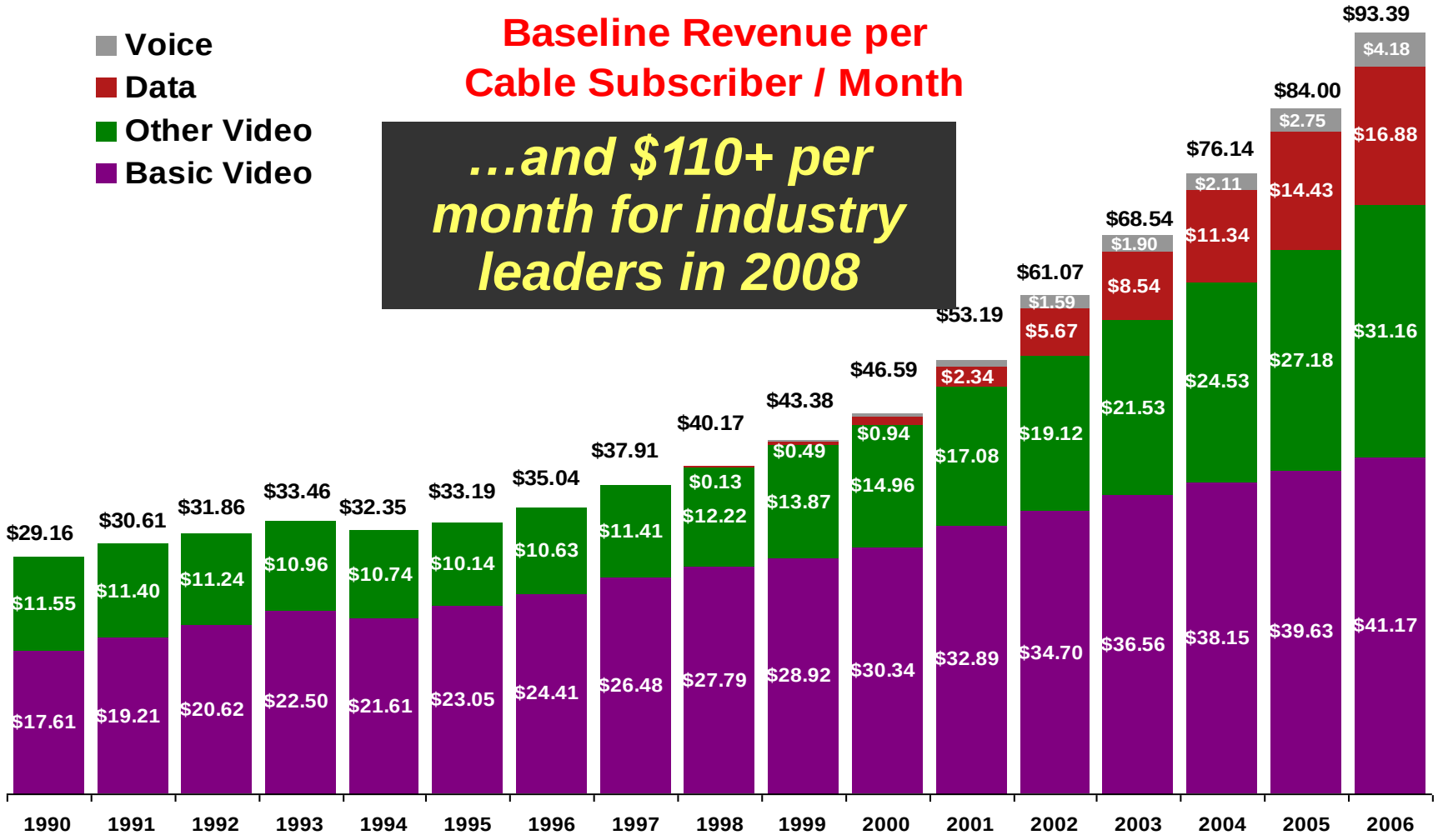
	Monthly Churn
CATV Only	2.5%
CATV & HSD	2.2%
CATV, HSD, & Voice	1.1%

Source: Kagan

77% of broadband households interested in VoIP services would switch to a triple play service provider for only a $10 Monthly Savings

Source: Parks Associates, "Residential Voice-over-IP: Analysis & Forecasts", Jan. 2004

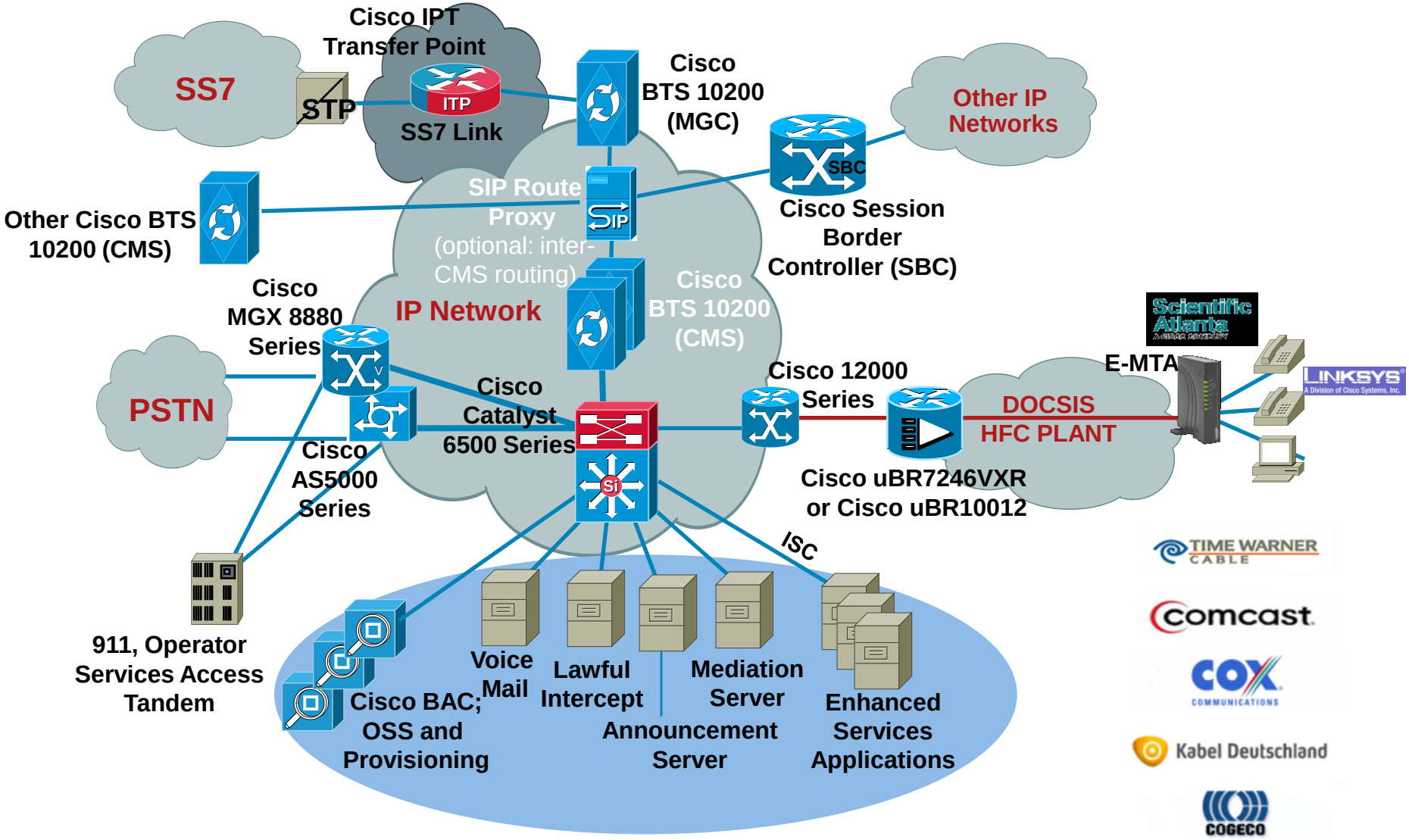
Results: Triple-Play Driving Revenue Growth



Source: Kagan Cable Financial Factbook, Kagan Cable Futurecast
Note: Data for 2006 are Kagan projections

Cisco Cable Voice Solution

Market Leadership and Proven Success



케이블 가입자 망에서 VoIP에 대한 QoS 고려사항

- **VoIP 최소 품질 기준 (2004년 10월 정통부에서 발표한 시행 계획 참조)**

품질지표	품질기준	
통화품질	R값	70 이상
	단 대 단 지연	150msec 이하
접속품질	호 성공율	95% 이상

- **Cable Access 망에서의 QoS**
  1. CODEC 방식 : G.711 CODEC방식을 기본으로 채택하여 높은 통화품질 확보
  2. eMTA를 채택한 경우 Dynamic QoS 또는 PQoS기술 적용
  3. QoS 파라미터 : 하향 CIR, 상향 UGS-AD 권고
  4. HFC망에서 상향 SNR 25dB이상 및 상향 uncorrectable FEC 에러율 최소화

Static QoS적용시 수용 가능한 VoIP 가입자 수

1. CMTS 상향 포트 기준 (Static, UGS-AD 적용 시)

Modulation	CH Width	Sampling (msec)	Actual US rate (kbps)	상향 포트 별 실제 수용 가능한 VoIP가입자 수 (명)
QPSK	1.6Mhz	20	108.8	13 (local 시험 결과는 12명)
QPSK	3.2Mhz	20	108.8	33
16QAM	1.6Mhz	20	115.2	34
16QAM	3.2Mhz	20	115.2	72

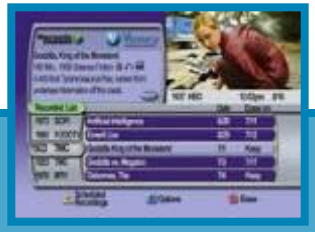
2. CMTS 하향 포트 기준 (Static, CIR 적용 시)

Modulation	CH Width	하향 포트 별 실제 수용 가능한 VoIP가입자 수 (명)
64QAM	6Mhz	269
256QAM	6Mhz	388

3. 요약

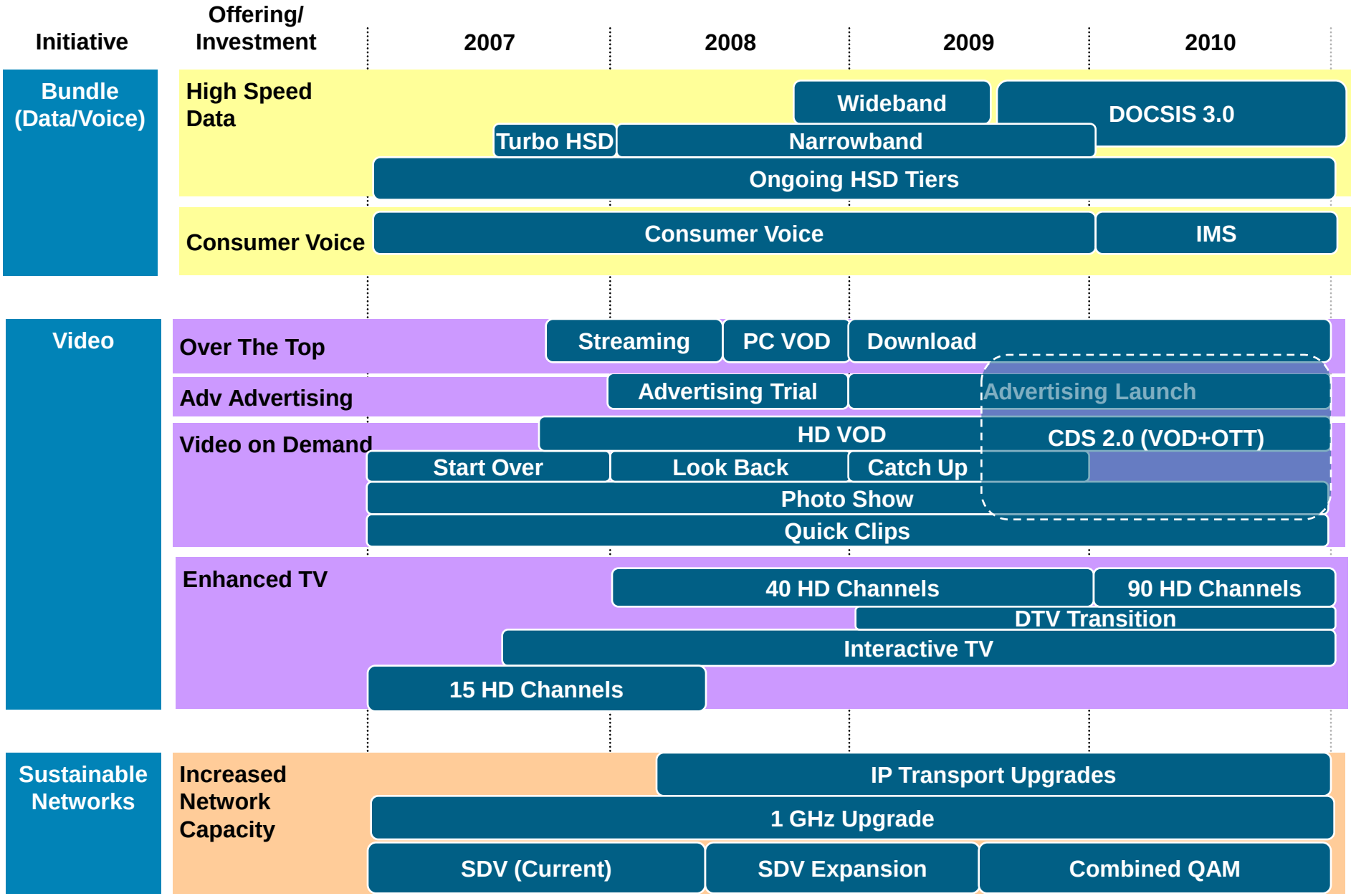
1) 하향 CIR 및 상향 UGS-AD 모두 Oversubscription은 불가 함
2) Modulation & 채널 대역폭에 따라 가입자 online 수 제한
3) **DQoS 또는 PQoS 기능이 지원되지 않는 단말인 경우**
   Option 1) 상기 범위내에서 **Static QoS** 설정 운용 **(VoIP 가입자용 단말에만 Static QoS 적용)**
   Option 2) **PCMM**을 이용한 Dynamic QoS 적용
   Option 3) **상향 모듈레이션 또는 채널 대역폭의 개선**
   Option 4) 상향에 RTPS QoS 적용

We Believe the Bundle will Evolve to a More Integrated Offering of "*Buy More, Get More*"

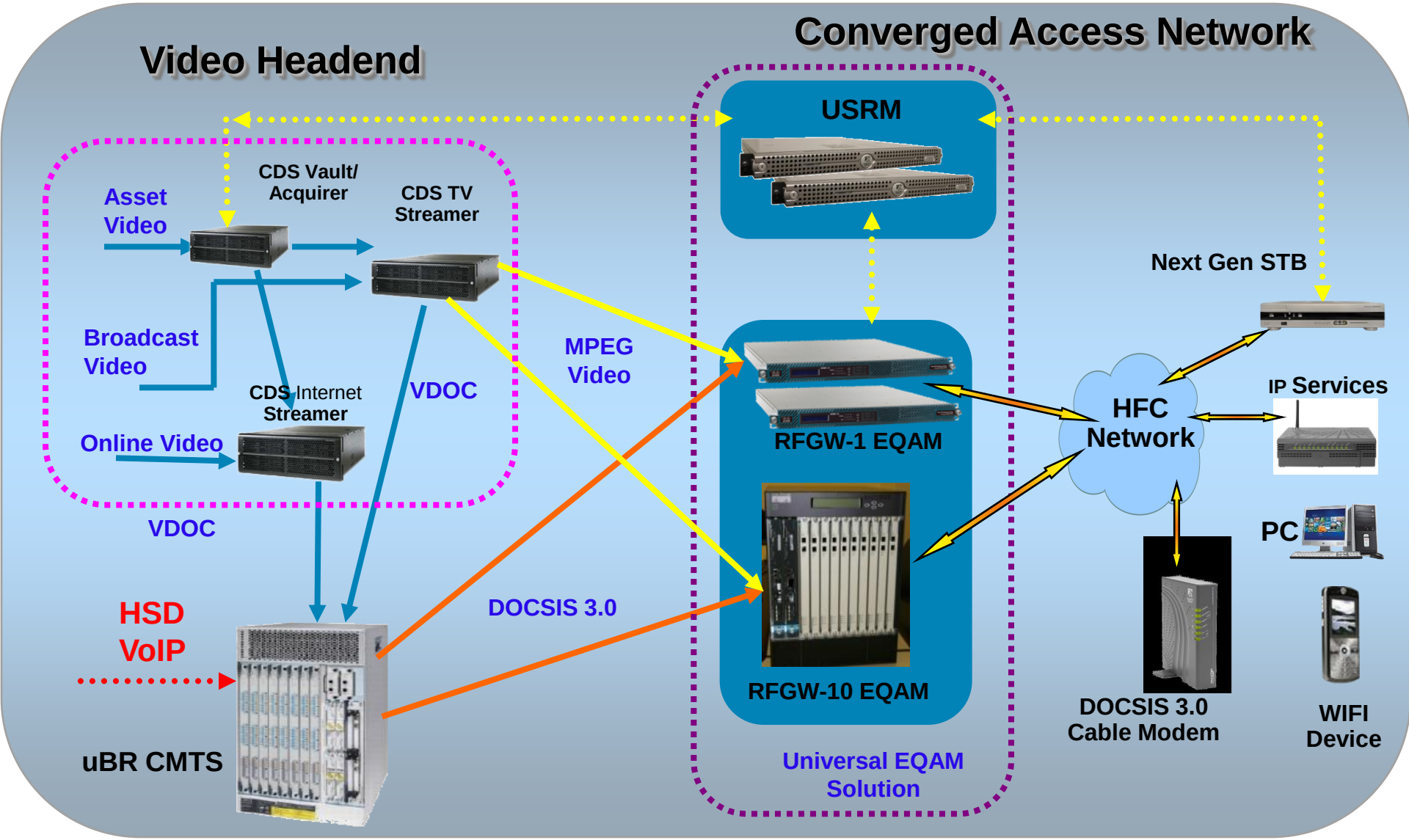


	Video Services	Data / Web-Based Services	Voice-Based Services
TV	▪ Video on demand ▪ DVR ▪ Enhanced navigation ▪ *Integrated search across storage media*	▪ Personalized content on your TV ▪ Internet video ▪ Music on demand	▪ *Caller ID on TV* ▪ Unified comms on your TV ▪ Synchronized with cell and PC
Mobile Phone	▪ Control recording on DVR remotely ▪ Receive video clips from your DVR ▪ *Send photos or video clips to DVR*	▪ Control what to get on cell phone ▪ Personalized content on your cell phone… music and photos	▪ Unified comms on your cell phone ▪ Receive voice messages from DVR ▪ Synchronized with cell and PC
PCs	▪ Manage content on DVR ▪ Video to PC ▪ Integrated services portal	▪ Manage service preferences at home or at office	▪ Unified comms on your PC ▪ Synchronized with cell and DVR

MSO strategy – Case example



Cisco's Converged Service Delivery Platform

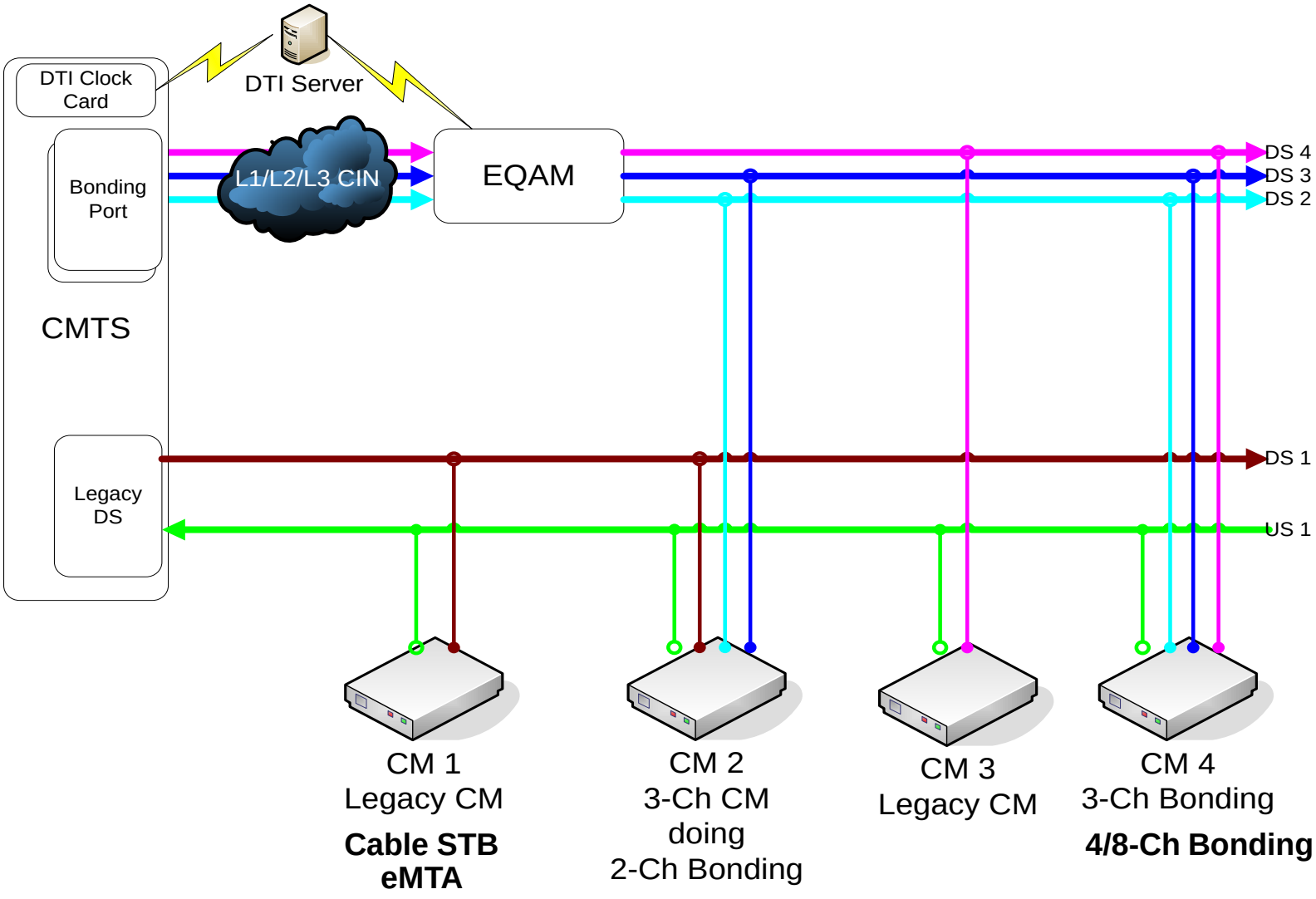


- DOCSIS 3.0 Converged Video, Data, Multimedia and Voice delivery to any device

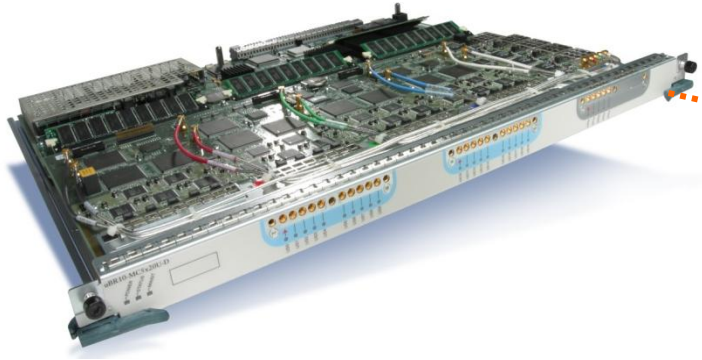
DOCSIS3.0 Migration

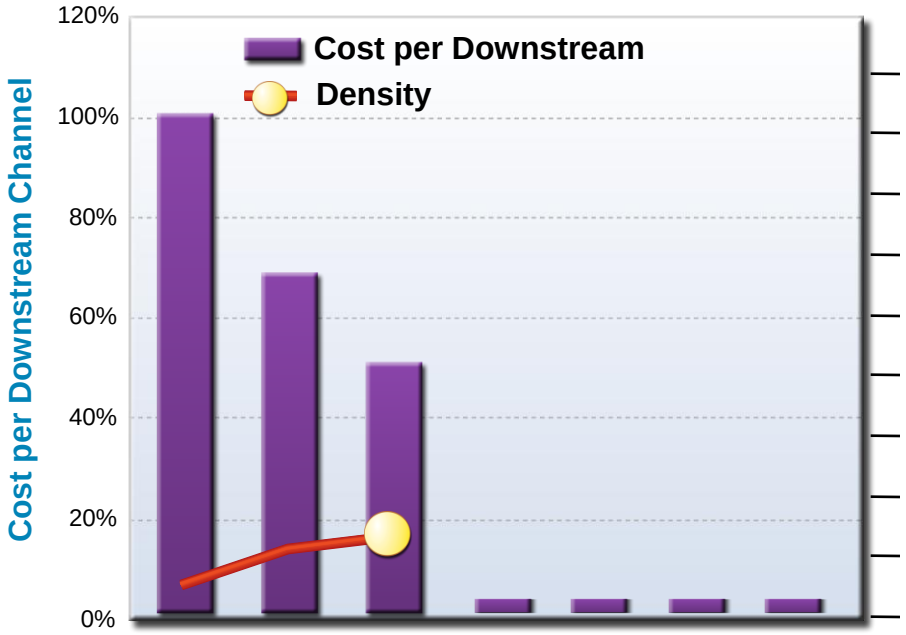
“ The Cisco way”

M-CMTS Network Topology



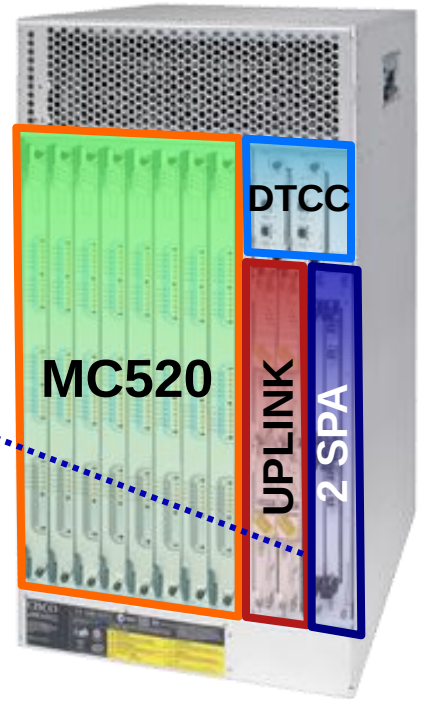
2006 – MC520 Line Card

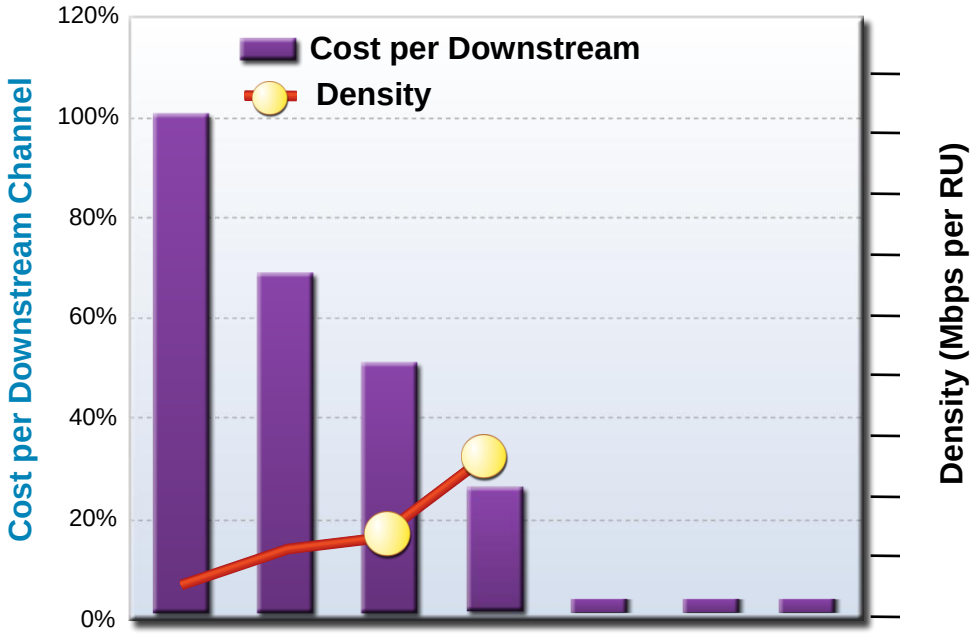




- DS : 40
- US : 160
- DOCSIS : 1.x, 2.0
- 4~10M급 8,000~12,000명 수용
  (집선비 50~60: 1)
- DSG STB 30,000 이상 수용 가능
- Uplink : HH-GE

2007 – 2 x D3.0 DS SPA

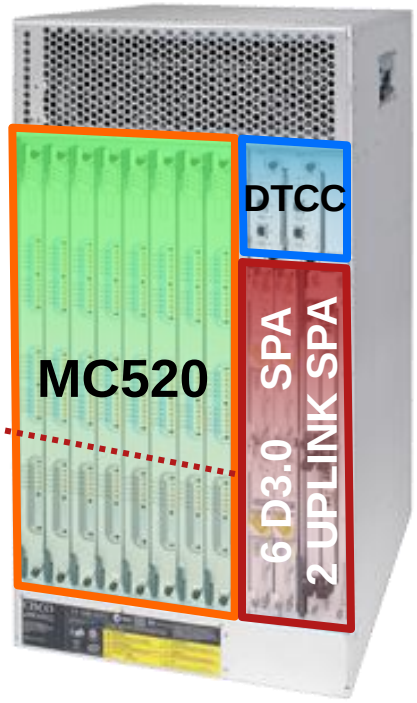


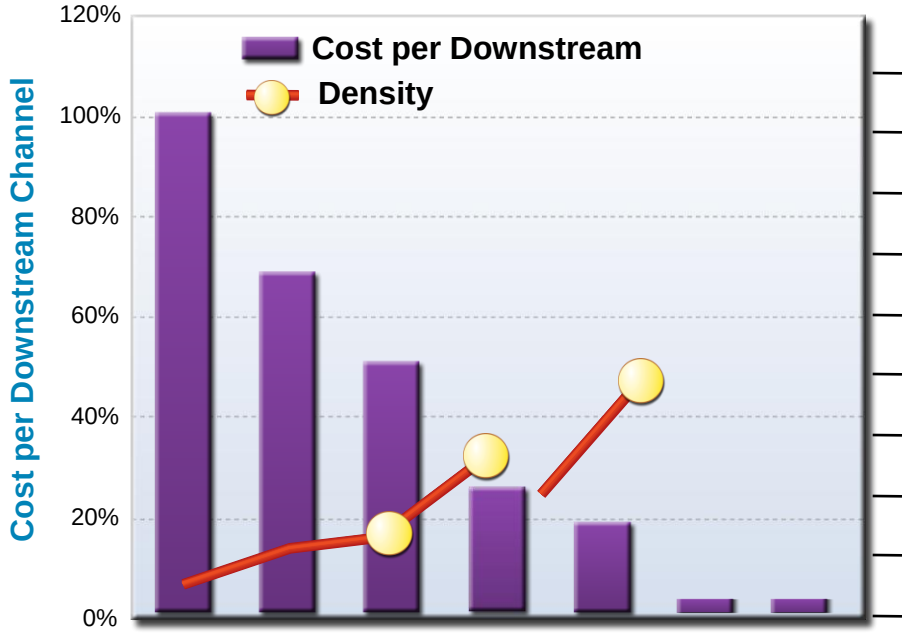


- DS : 40→88
- US : 160
- DOCSIS : 1.x, 2.0, 3.0 BRONZE
- I-CMTS & M-CMTS

- 최대 BG 수 (6/8/8 모드) : 24BG
- 100M급 가입자 : 2400명(집선비 100:1)
- D1.x/2.0 Load Balancing
- NO RF Re-Cabling – Lo OPEX
- Uplink : HH-GE

2008 – 6 x D3.0 DS SPA
(4xSPA : PRE2, 6xSPA : PRE4 권고)



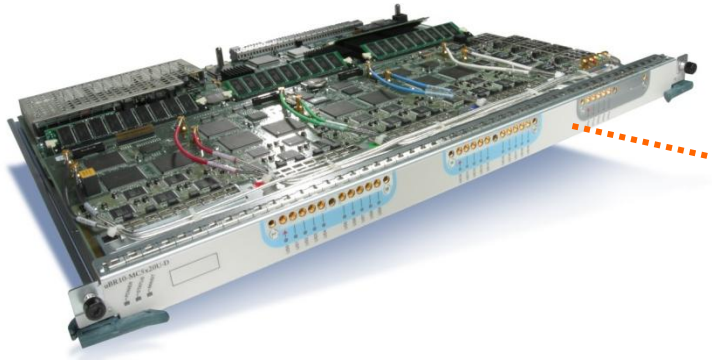


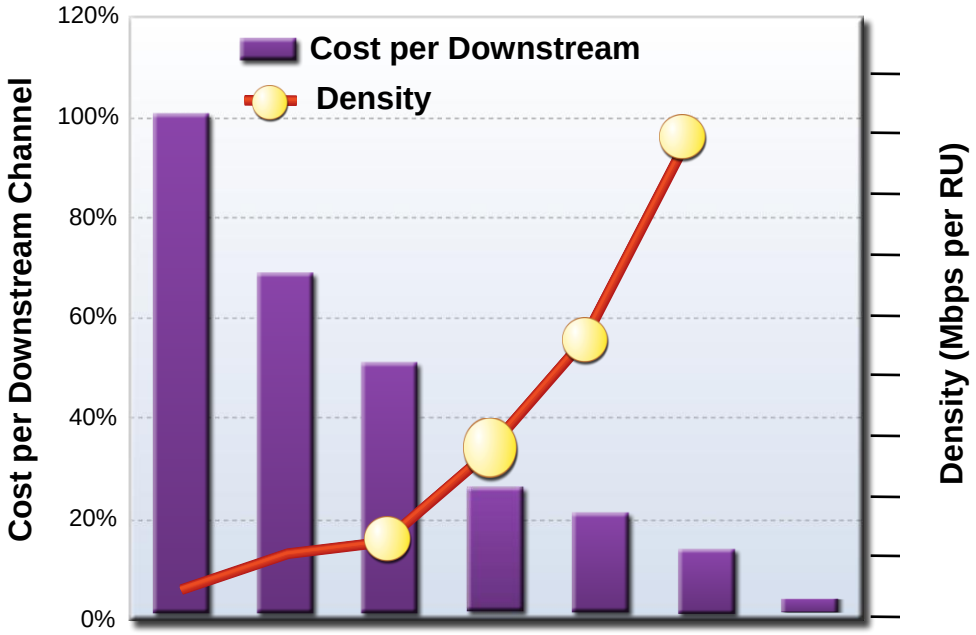
- DS : 40→88→184 (>4x)
- US : 160
- DOCSIS : 1.x, 2.0, 3.0 BRONZE

- 최대 BG 수 (6xSPA, PRE4 적용시)
  1) 6/8/8 모드 : 72BG
  2) 6/8/8/8 모드 : 48BG
- 100M급 가입자 : 7200명 (집선비 100:1)

- Uplink option
  - 10GE, 5pt GE , HH-GE

2009 – MC2020 Line Card

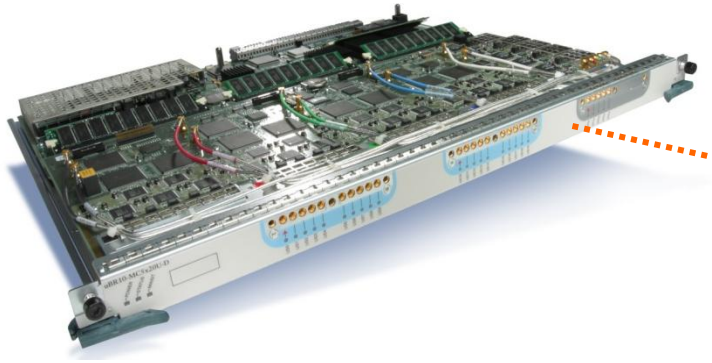


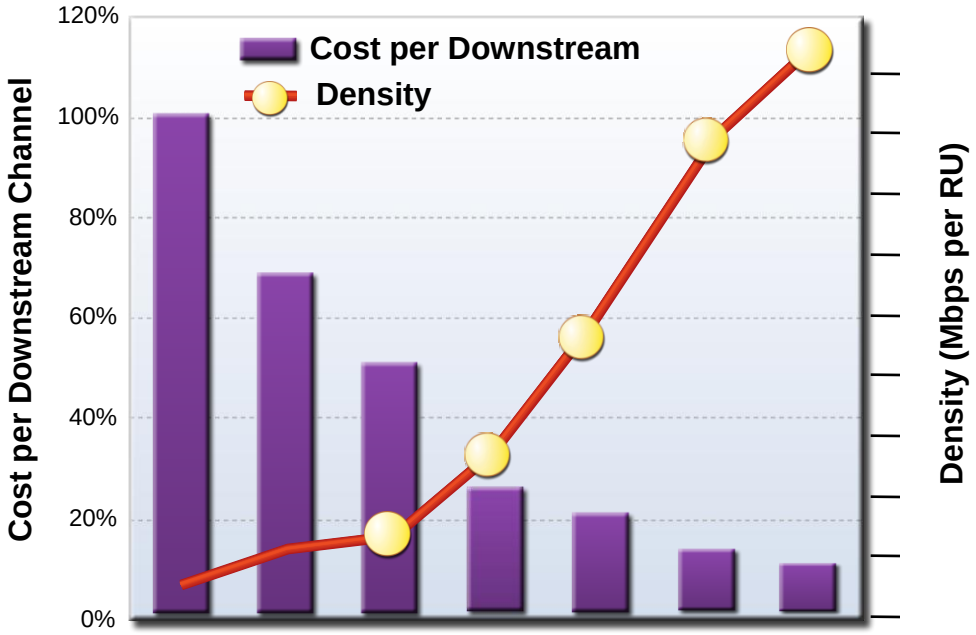


- DS : 40→88 →184→304
- US : 160
- DOCSIS : 1.x, 2.0, 3.0 GOLD
- I-CMTS & M-CMTS

- >7x DS Capacity
- Large Scale, HA & USCB
- D1.x/2.0 LB and D3.0 Bonding
- NO RF Re-Cabling – Lo OPEX

2009 – MC3G60 Line Card





- DS : 40→88 →184→304→512
- US : 160→480
- DOCSIS : 1.x, 2.0, 3.0 GOLD
- M-CMTS

- >12x DS Capacity
- 3x US Capacity

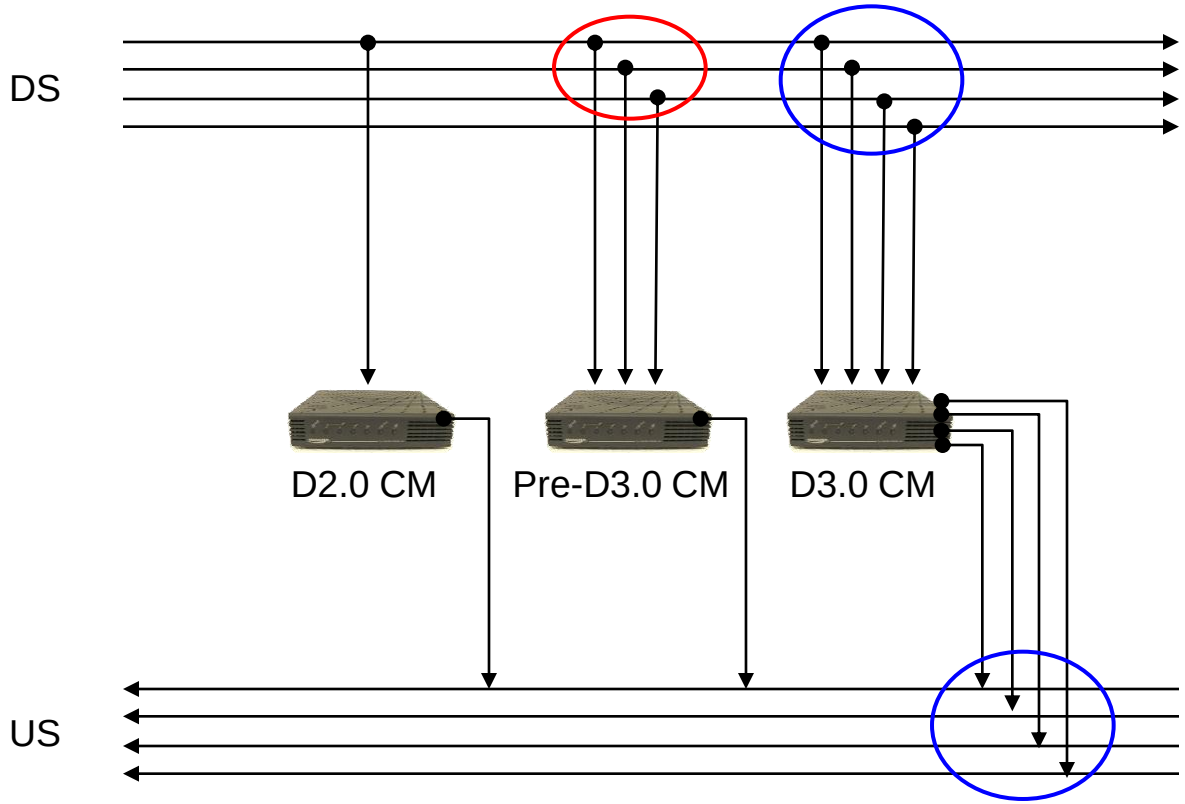
- Massive Scale

HFC 상/하향 주파수 준비

- DS : 100Mbps
- US : 4Mbps

- DS : 100Mbps
- US : 30Mbps

- DS : 100Mbps
- US : 60Mbps



6MHz x 4CH = **24MHZ**

6.4MHz x 4CH = **25.6MHZ**

Q and A