Delivering Mobile Video Services

BRKMWI-2008

Eric Hamel

Cisco Networkers 2007

HOUSEKEEPING

- We value your feedback, don't forget to complete your online session evaluations after each session and complete the Overall Conference Evaluation which will be available online from Friday.
- Visit the World of Solutions on Level -01!
- Please remember this is a 'No Smoking' venue!
- Please switch off your mobile phones!
- Please remember to wear your badge at all times including the Party!
- Do you have a question? Feel free to ask them during the Q&A section or write your question on the Question form given to you and hand it to the Room Monitor when you see them holding up the Q&A sign.

Agenda

- Mobile Video: What for ?
- Mobile TV Market Overview
- Mobile TV Delivery Technologies
  - Unicast (streaming of live or stored content)
  - Multicast (3GPP MBMS / 3GPP2 BCMCS)
  - Broadcast (DVB-H, MediaFLO, S- and T-DMB)
- Summary and Conclusions

Delivering The Connected Life

VoIP	Custom Ring Tones/ MP3 Player	High-Speed Internet/VPN	Text/Instant Messaging
Push-to-Talk/ Intercom	Video Conferencing	IPTV/ VOD	PDA/ Email

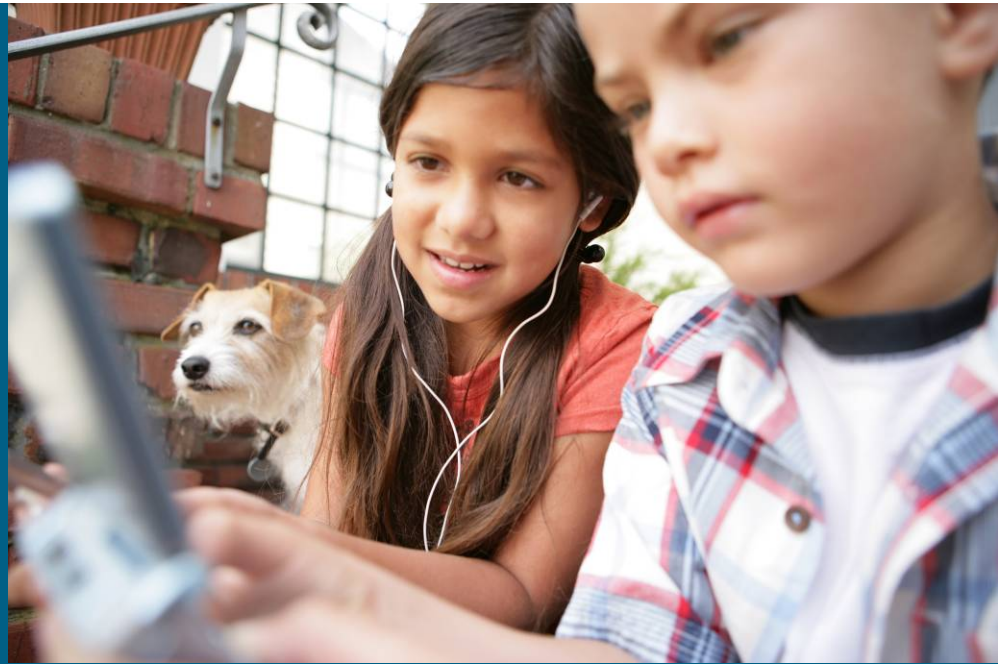
Data

Voice

Video

At Work, at Home, on the Move

Mobile Video: What for ?



Mobile Video Defined

- Mobile video is video delivered to the mobile handset of a connected user for the following applications:
  - Entertainment – Music, TV, Internet video, games
  - Commerce – Advertising, online transactions, mobile Internet applications
  - Communication – Social community, P2P, video conferencing
- These application categories will blend to create new service paradigms, built upon the principles of interactivity, personalization and user empowerment
- Mobile handset will serve as a new outlet for digital media content but also a tool for content creation
- Mobile handset will be linked with home entertainment system as well as enterprise video applications
- Mobile video drives large BW and complex service requirements; it will accelerate IPNGN transformation

Portable Devices and Video

Mobile phone is strategically positioned

Video iPOD, Portable DVD, PC, Game

- Broadcast TV/ Streaming Video
- Video on Demand/ Network PVR
- Pre-downloaded Videos
- Place Shifting
- Video Calling/MMS

Limited by memory size

When connected (Wi-Fi, Internet)

Mobile Access to Multiple Content

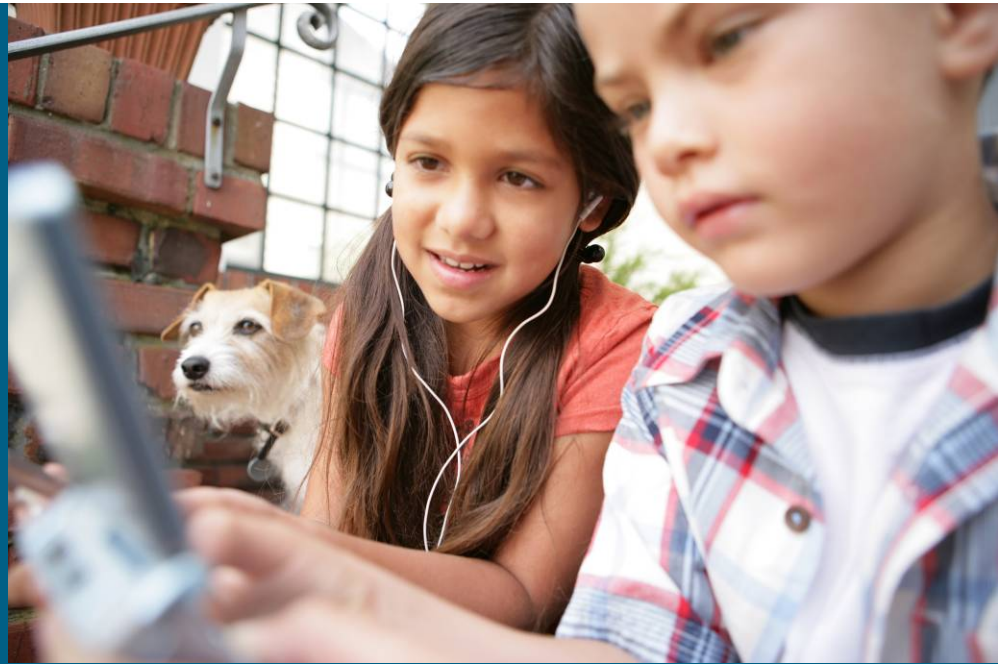
Traditional Content (Cinema and TV, Games, Music)

User Controlled Content (User Generated, Place/Time shifted)

More than video, it is about any content

- 3UK announced its X-Series services (Nov 2006)
  - Basic services include unlimited Skype calls, MSN and Yahoo IM's, and Internet search and browsing
  - Gold package adds Slingbox and Orb
- VzW and YouTube's exclusive deal (Nov 2006)
  - VzW subscribers have access to a sampling of YouTube videos
- VzW and Revver's one-year exclusive deal (Nov 2006)
  - VzW subscribers have access to Revver, site known as the marketplace for viral videos
- Yahoo launched "Mixd" mobile social networking site (Nov 06)
  - Targeting 18-25 age group for coordination of social outings
- Vodafone actively negotiating with social networking services (Nov 06)
  - General consensus is MySpace is the primary party in negotiation

Mobile TV Market Overview



Mobile TV is all the rage …. for now

- More than 100 mobile operators have mobile TV offerings
  - Mobile TV can be live or video clips tailored for mobile use
  - All are centrally deployed, not distributed (inherent to mobile data network architecture which is centralised today)
  - Most offerings include around 15-20 live channels
  - Additional video repository of thousands hours of VoD
  - User-generated video and/or Internet video are beginning to be offered
- While Europe and APAC enjoyed early service momentum, North America is catching up
  - ABI Research estimated there are under 20 million mobile TV users worldwide
  - Telephia reported by Q1 2006, over 2.0 million (~ 1.4% of the U.S. wireless sub base) subscribed to a mobile video plan.
- Nascent stage of industry development means content, service portfolio, pricing and delivery are all subject to change

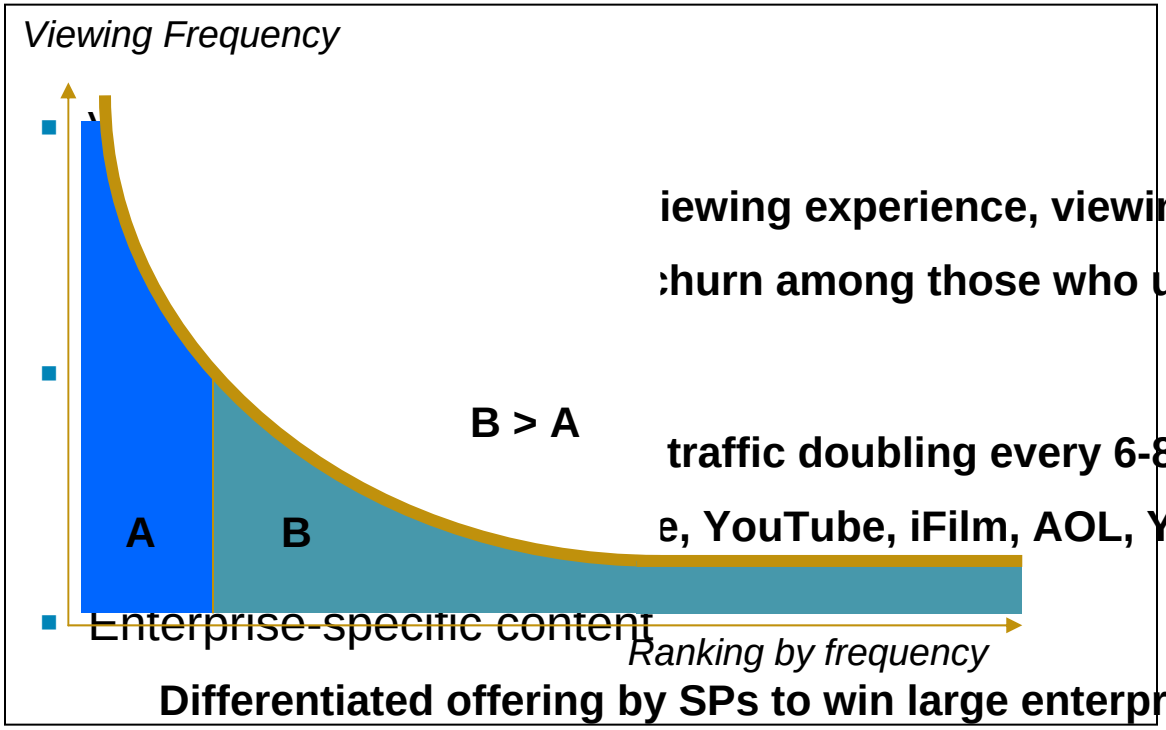
Mobile TV is not your traditional TV

Mobile TV format	• Live feed or re-purposed (condensed) TV - Some offer frequently refreshed TV clips for downloads • Made-for-mobile TV content (e.g., 2-3 min mobi-sodes of TV shows) • Special events (e.g. World Cup 2006, Olympics) • User-generated video (e.g. SeeMeeTV, YouTube)
Viewing Device	• Mobile handset: small screen size with (initially) 3-15 frames/sec resolution – needing larger memory and longer battery life • Mobile handset most popular due to volume & convenience factors (but TV is available on other PDAs and thru Wi-Fi) • Viewing interruptible by phone calls
Consumption Characteristics	• "TV Snacking" - Viewing session 2-3 minutes for video clips or 10-20+ minutes for live TV - Most viewing while in queue or in transit, but also in-home and in-office • ~US$10-15 monthly charge for 5 to 25 channels (vary by region) • Location independent, always-on, and customizable
Main Attraction	• Nascent stage of service development - "Live" mobile TV is new. In future, look to user generated content, personalization, social community, mobile Web 2.0… • TV to trigger mass interest but user videos and mobile Internet apps to offer new monetizing opportunities • Interaction will become key

Relevant trends for Unicast

Long-tail content to generate more revenue

- **Unicast better suited for on-demand and personalised content**
- **Broadcast/Multicast better suited for popular content**



iewing experience, viewing time goes up

:hurn among those who use VoD

traffic doubling every 6-8 months

e, YouTube, iFilm, AOL, Yahoo, MSN, others

Differentiated offering by SPs to win large enterprise deals

Pricing for mobile TV

Flat rate subscription

- More popular in the US, but adopted in selected EMEA markets
- General consensus in customer willingness to pay US$10-$20 per month
- Premium channels additional

Verizon	$15/month $3/day
Cingular	$9.9/month
TIM Maxi Mobile	5€/month
VF UK	2@ £5, 1@£3

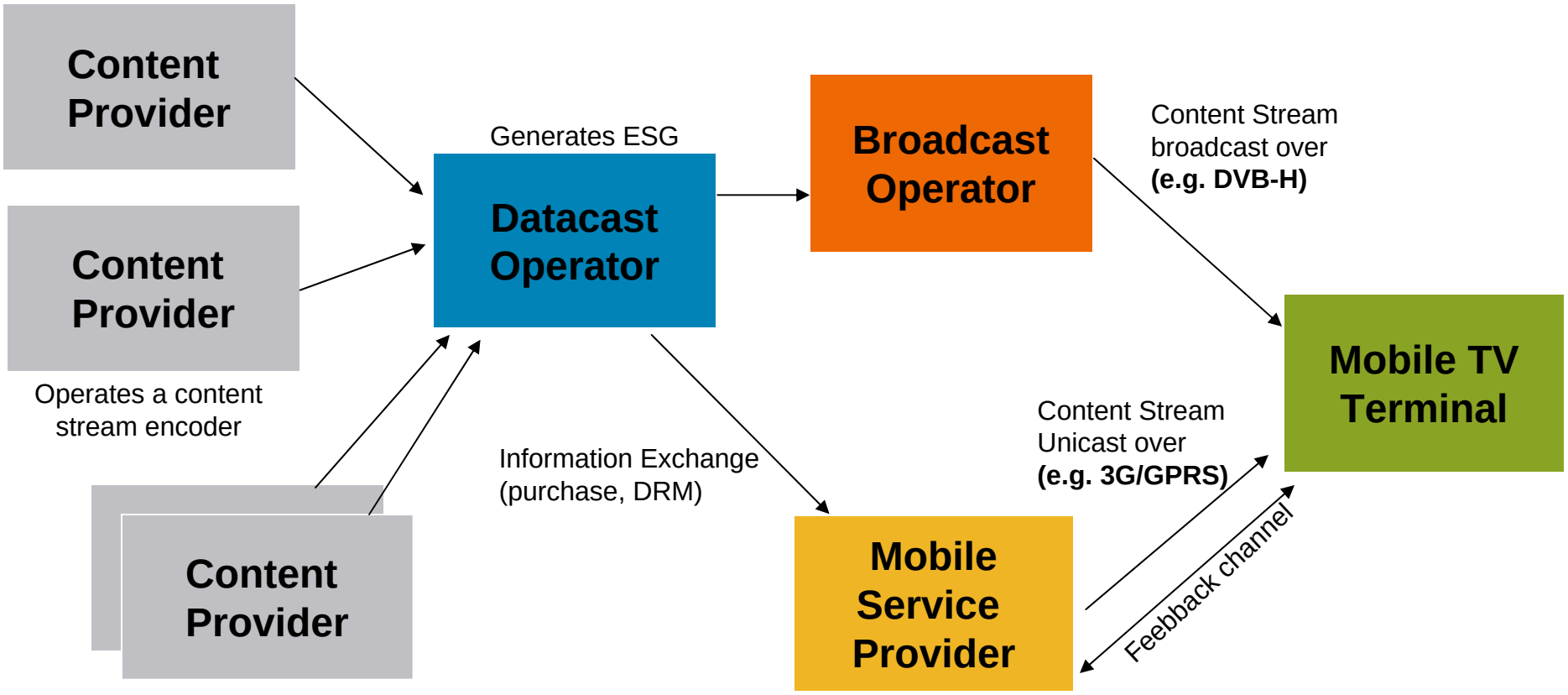
Pay-per-use

- Generally adopted in Europe
- Well aligned for VoD type content
- Easier for customer to try it out but can't be a long term solution

TIM Italy	€0.20 per minute
3 Italy	€0.90 per five minutes
SFR in France	€0-0.25 per minute
Amena in Spain	€3 per MB

Source: Ovum, Informa, Pyramid Research, Company information

Multiple Roles in Delivering Mobile TV

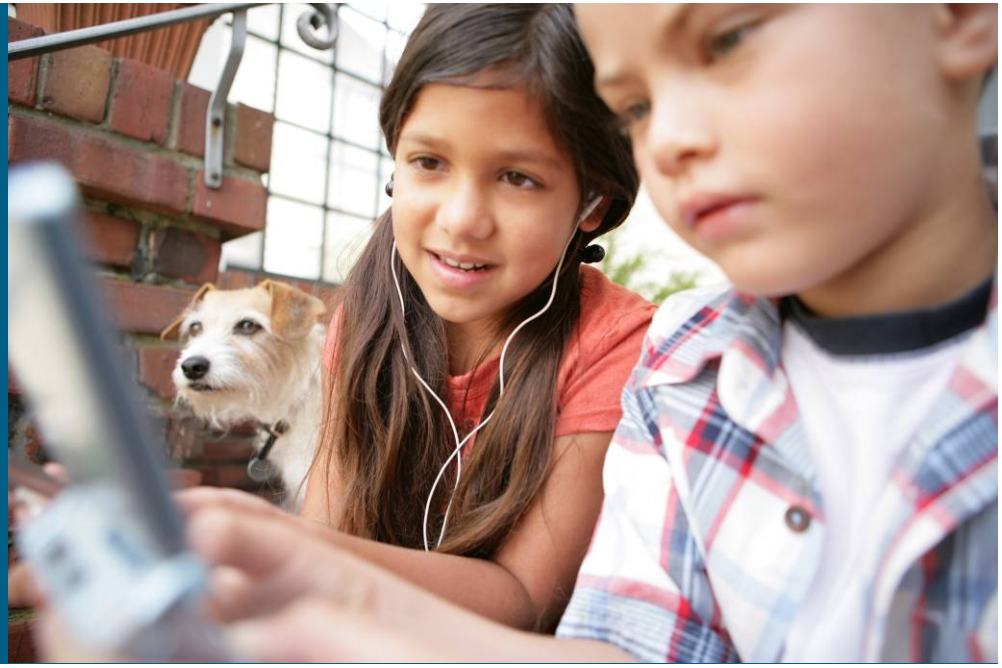


- Responsibilities shared between different actors

  Content Providers, Broadcasters, Mobile Service Providers

- No single model exists today

Delivering Mobile TV over Unicast



Unicast Delivery

- For initial LiveTV deployment, On-demand content or Surveillance/Local Information
- Available today on most mobile networks with increasing adoption

  Orange France example:

  - Content: 50 live channels and more than 2500 VoDs
  - High Definition: MPEG4 at 250 kbit/s for 320x240 screens
  - Users: 420.000 on 2G/3G (end of 2006)
- Client based streaming technology based on standard protocols

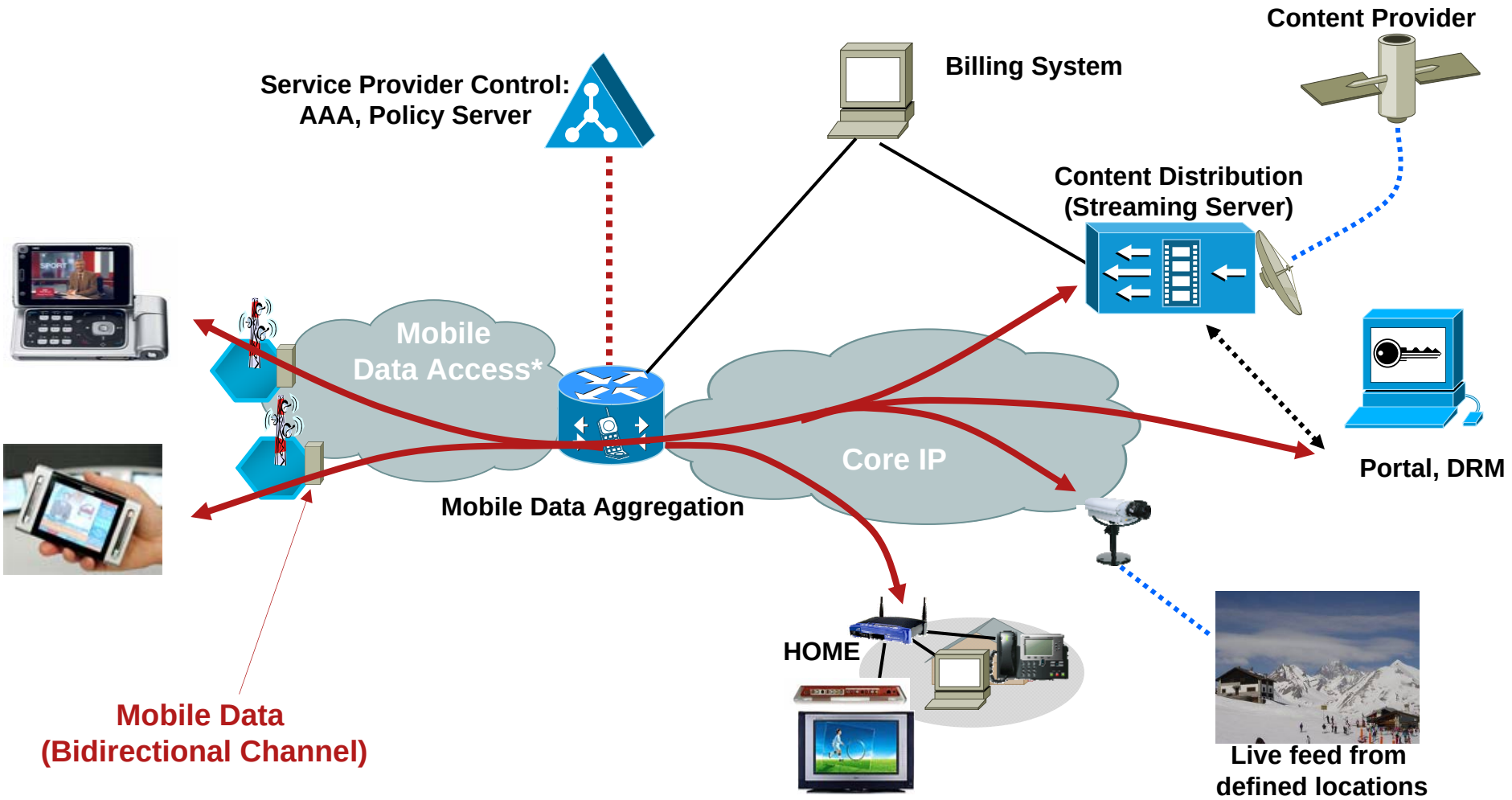
  HTTP, RTSP
- Dependency on access network

  Quality of Service not an issue as long as adoption remains low

  Wider adoption to raise concern on resource required at the access network

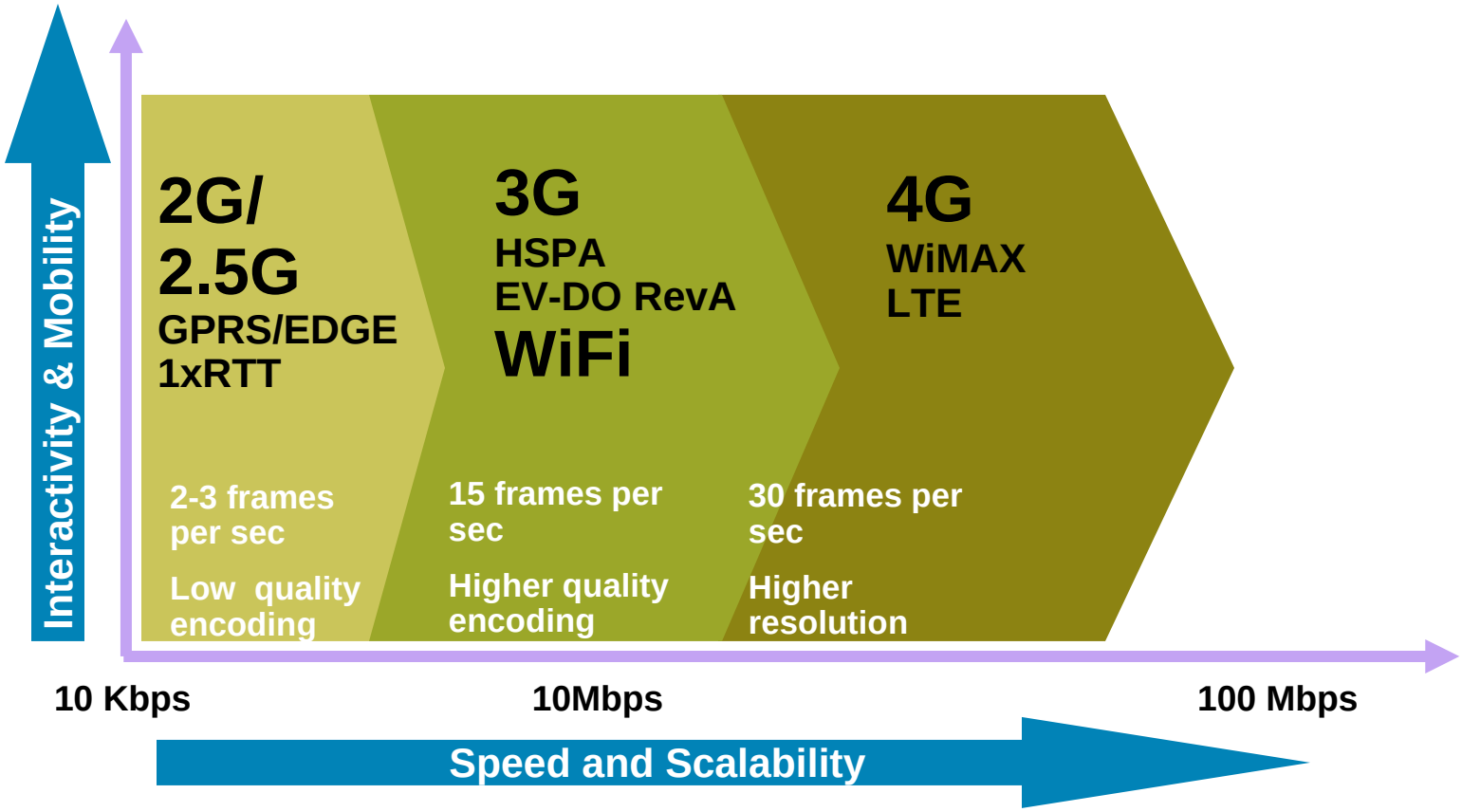
  - More bandwidth (3G and EVDO)
  - Tighter QoS control (prioritisation of applications, etc.)

Video over Unicast Architecture



Note: GPRS, 3G, CDMA, WiMAX, WiFi, etc.*

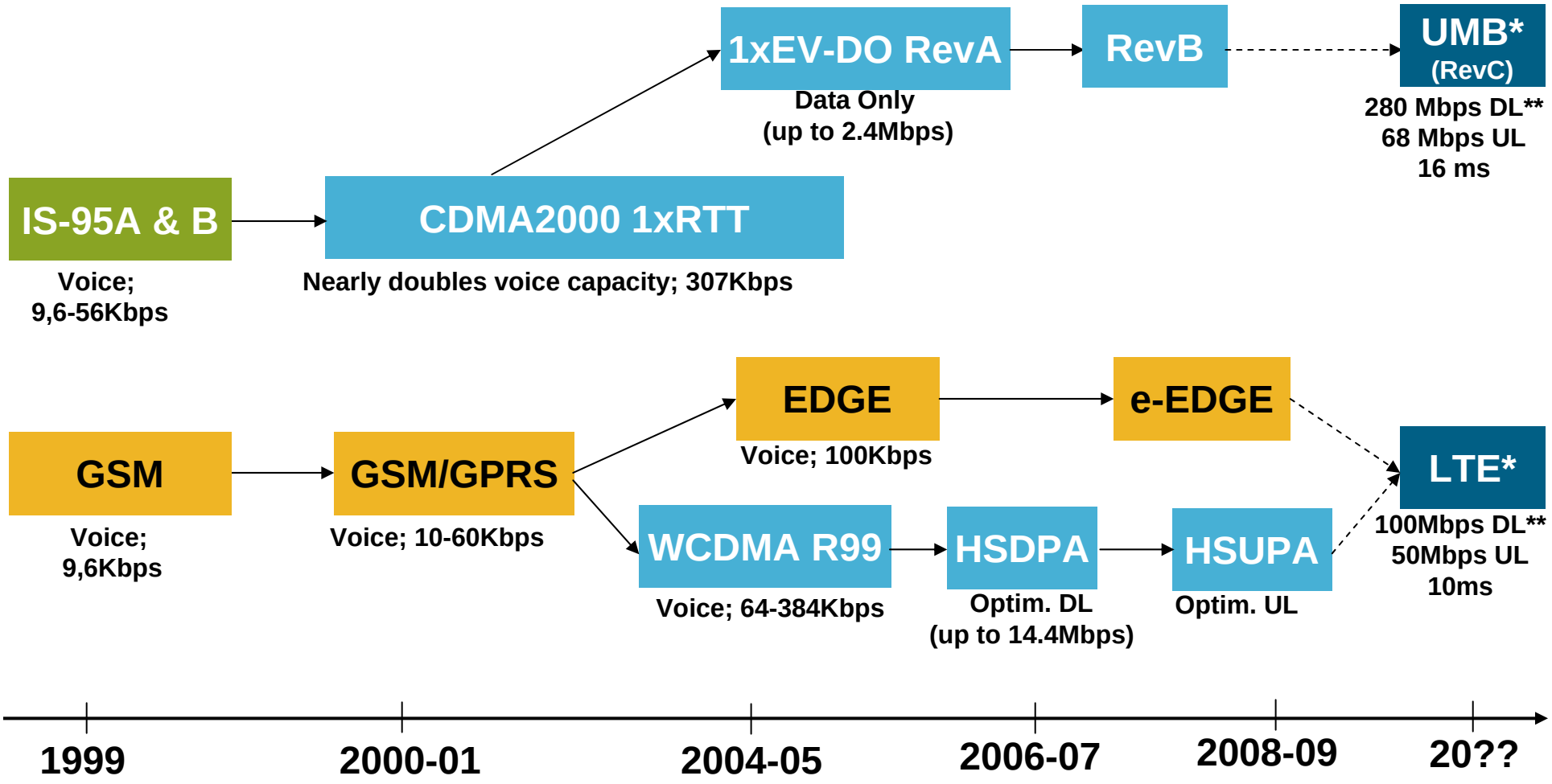
Evolution of Mobile Data Networks



Source: Informa, Cisco analysis

Broadcast network provides the relief BW en route to 4G

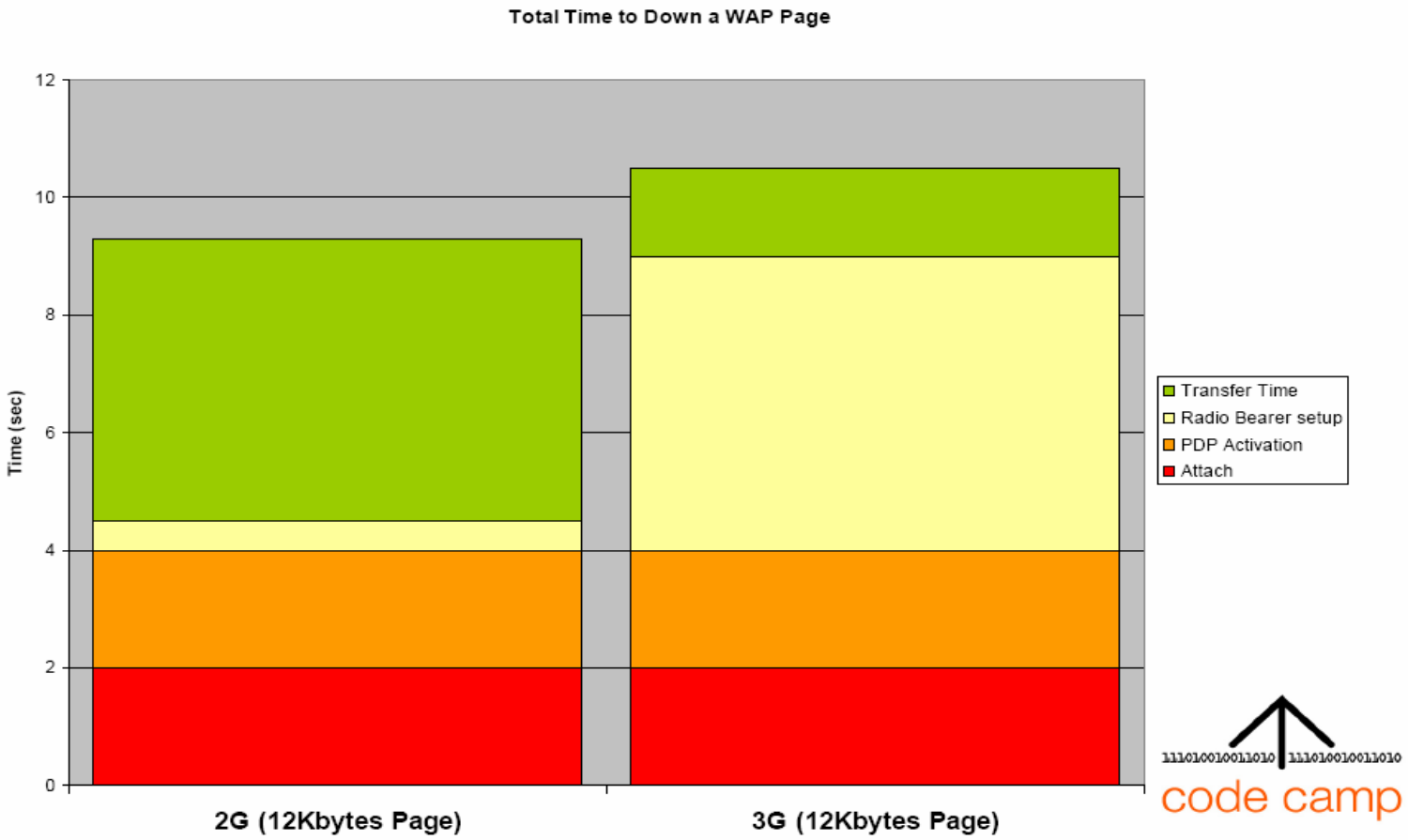
Mobile Radio Access Evolution Timeline



Notes: **standards currently under definition*
*** expected values*

3GPP Release 99 – Latency Impacts

UMTS performance

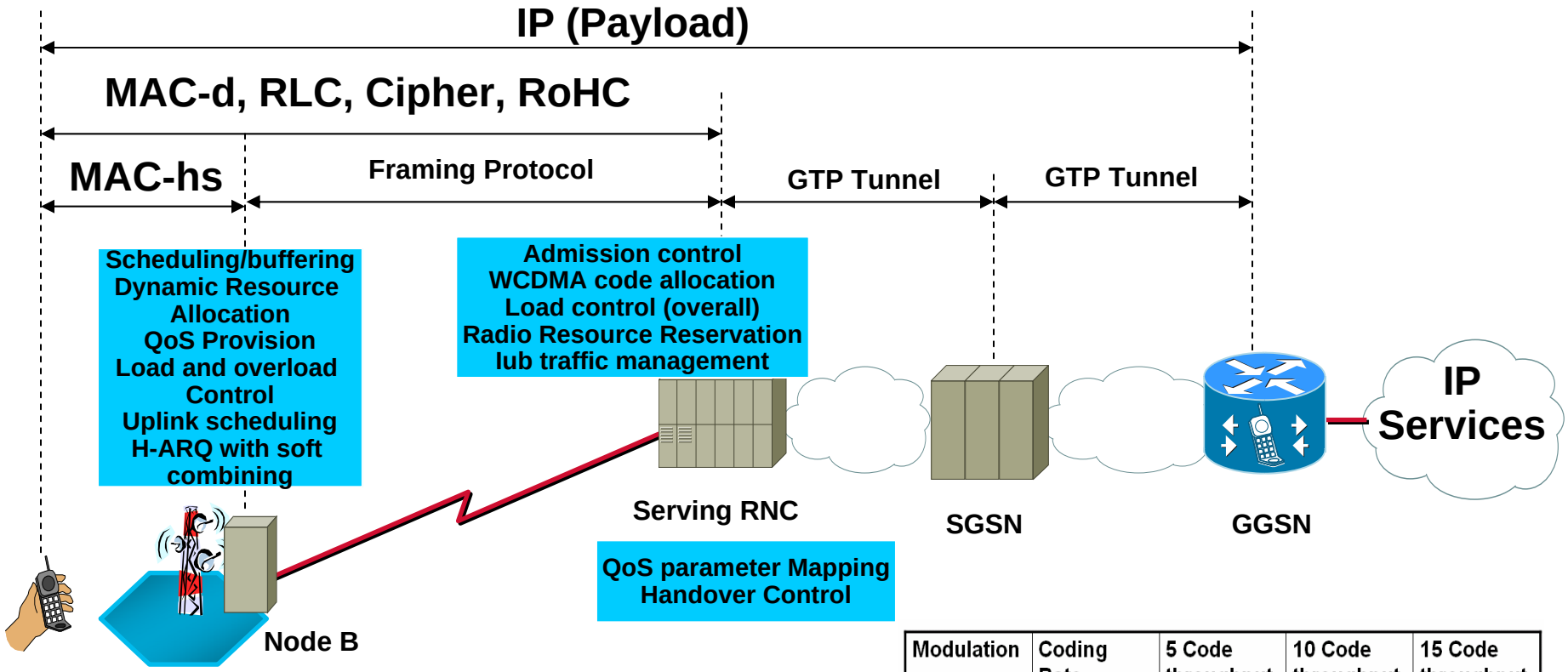


code camp

Evolution of 3G Radio AccessHigh Speed Packet Access

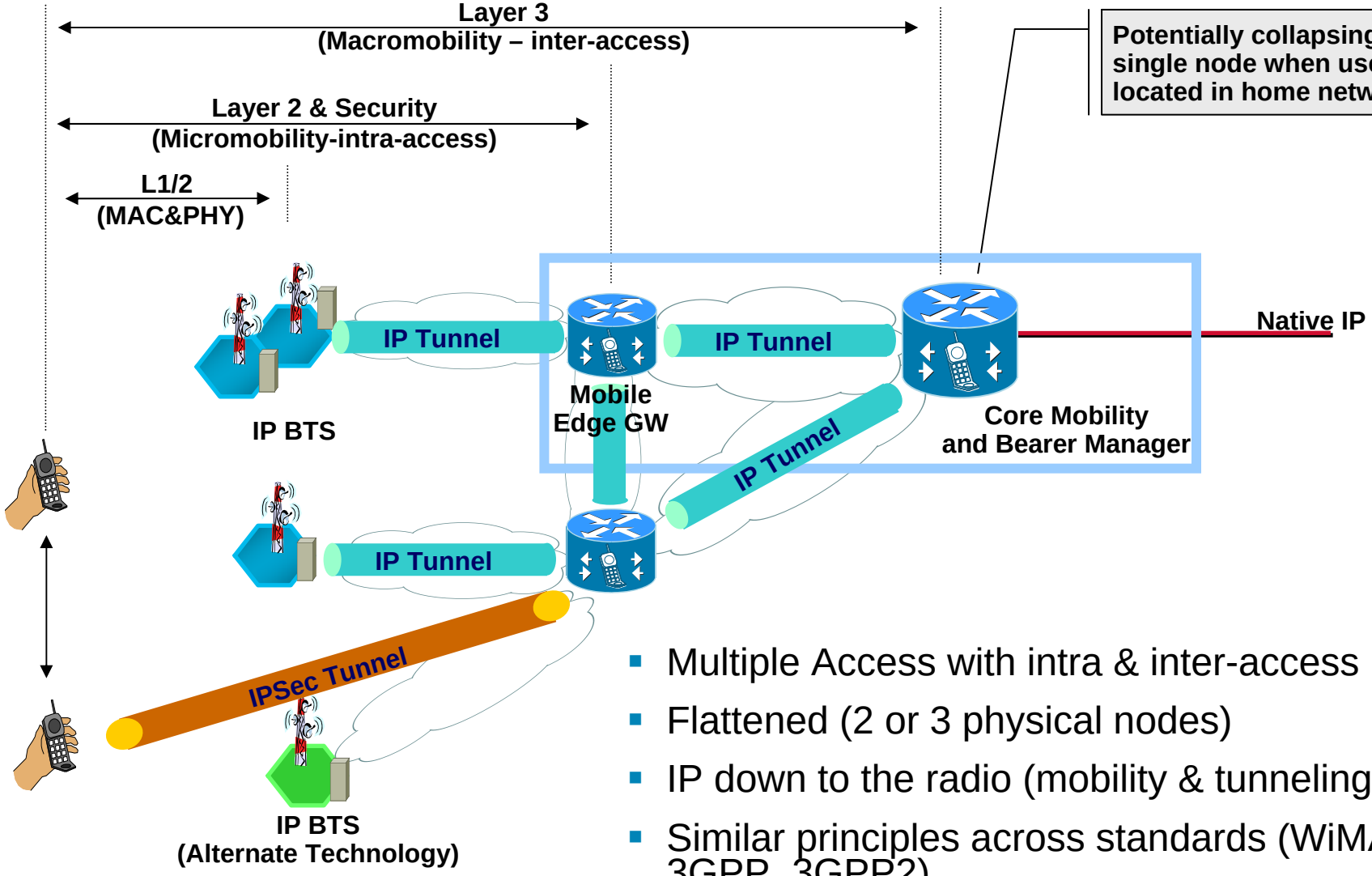
- Introduction of HSPA (High Speed Access)
  - HSDPA introducing “3G DSL” in 3GPP R5 (asymetrical throughput)
  - HSUPA (counterpart for Uplink) defined as part of 3GPP R6
  - Optimal use of traffic and signalling channels
  - Latency improvement
- HSPA is required to support symetrical real-time data applications (e.g. multimedia over IP)
- Long Term Evolution (LTE)
  - LTE project aims to ensure the continued competitiveness of the 3GPP technologies for the longer term (10 years and beyond)
  - Increased Peak Rates (100/50MbpsDL/UL in a 20MHz spectrum) – 3-4/2-3x improved efficiency compared to HSPA
  - Optimized latency – EUTRAN latency 10ms in an
  - OFDM technology chosen on the radio

Release 6 - HSPA



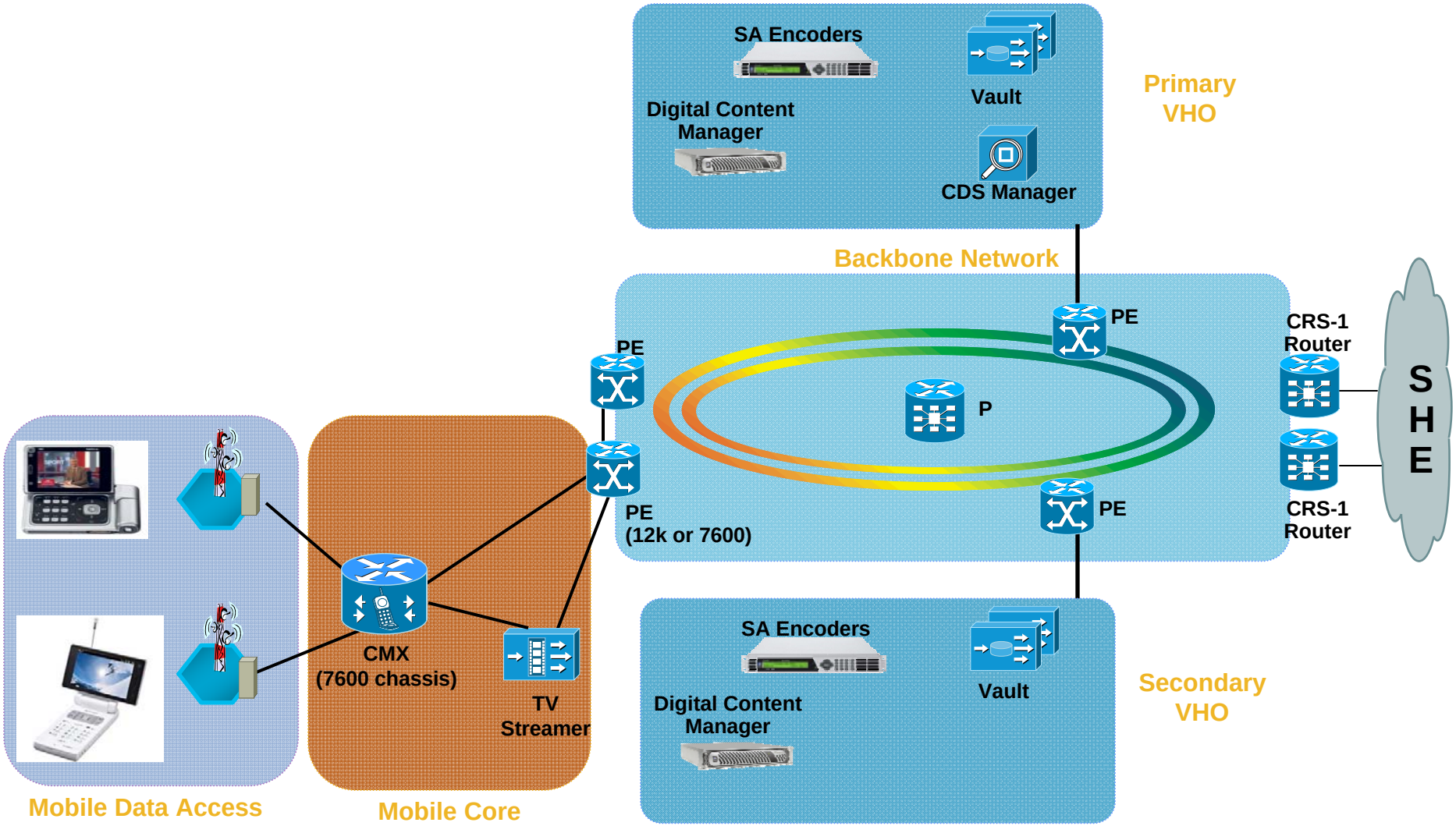
Modulation	Coding Rate	5 Code throughput	10 Code throughput	15 Code throughput
QPSK	1/4	600 kbps	1.2 Mbps	1.8 Mbps
	2/4	1.2 Mbps	2.4 Mbps	3.6 Mbps
	3/4	1.8 Mbps	3.6 Mbps	5.4 Mbps
16QAM	2/4	2.4 Mbps	4.8 Mbps	7.2 Mbps
	3/4	3.6 Mbps	7.2 Mbps	10.7 Mbps
	4/4	4.8 Mbps	9.6 Mbps	14.4 Mbps

Mobile Architecture Evolution



- Multiple Access with intra & inter-access mobility
- Flattened (2 or 3 physical nodes)
- IP down to the radio (mobility & tunneling)
- Similar principles across standards (WiMAX, 3GPP, 3GPP2)

Mobile Unicast Video Network



Cisco Content Delivery System Vision

Enables any content, any device, any location from a single, open delivery platform.

Arroyo (Cable TV & IPTV)

Cisco (Internet Video)

TV

Mobile

PC

Cisco CDS

Linear

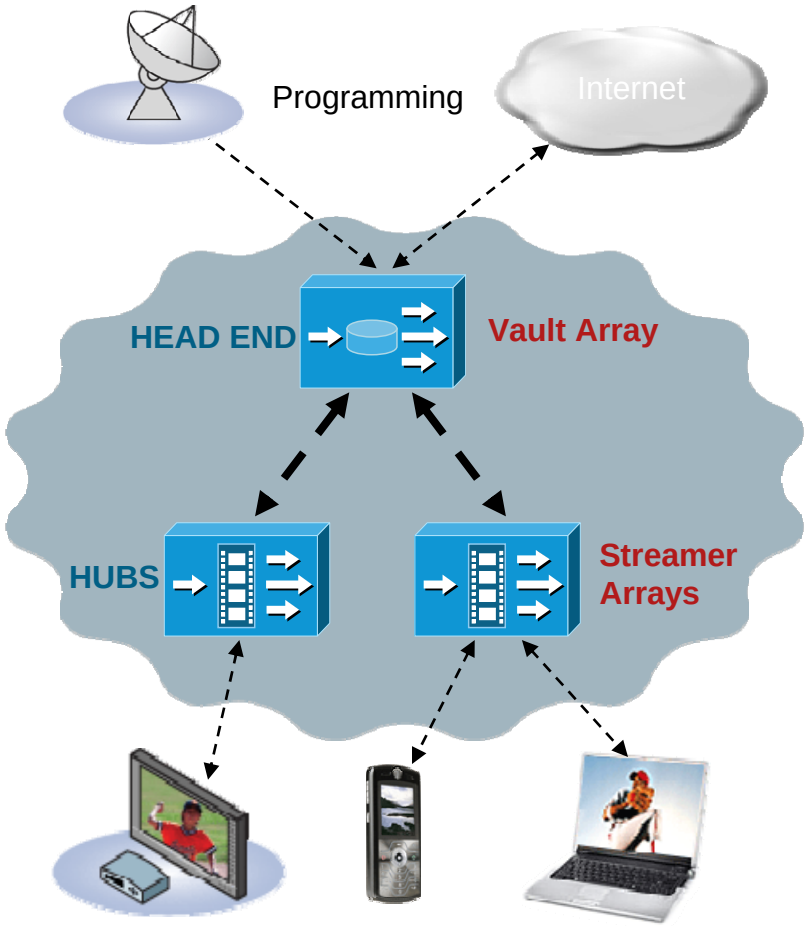
On Demand

Time Shifted

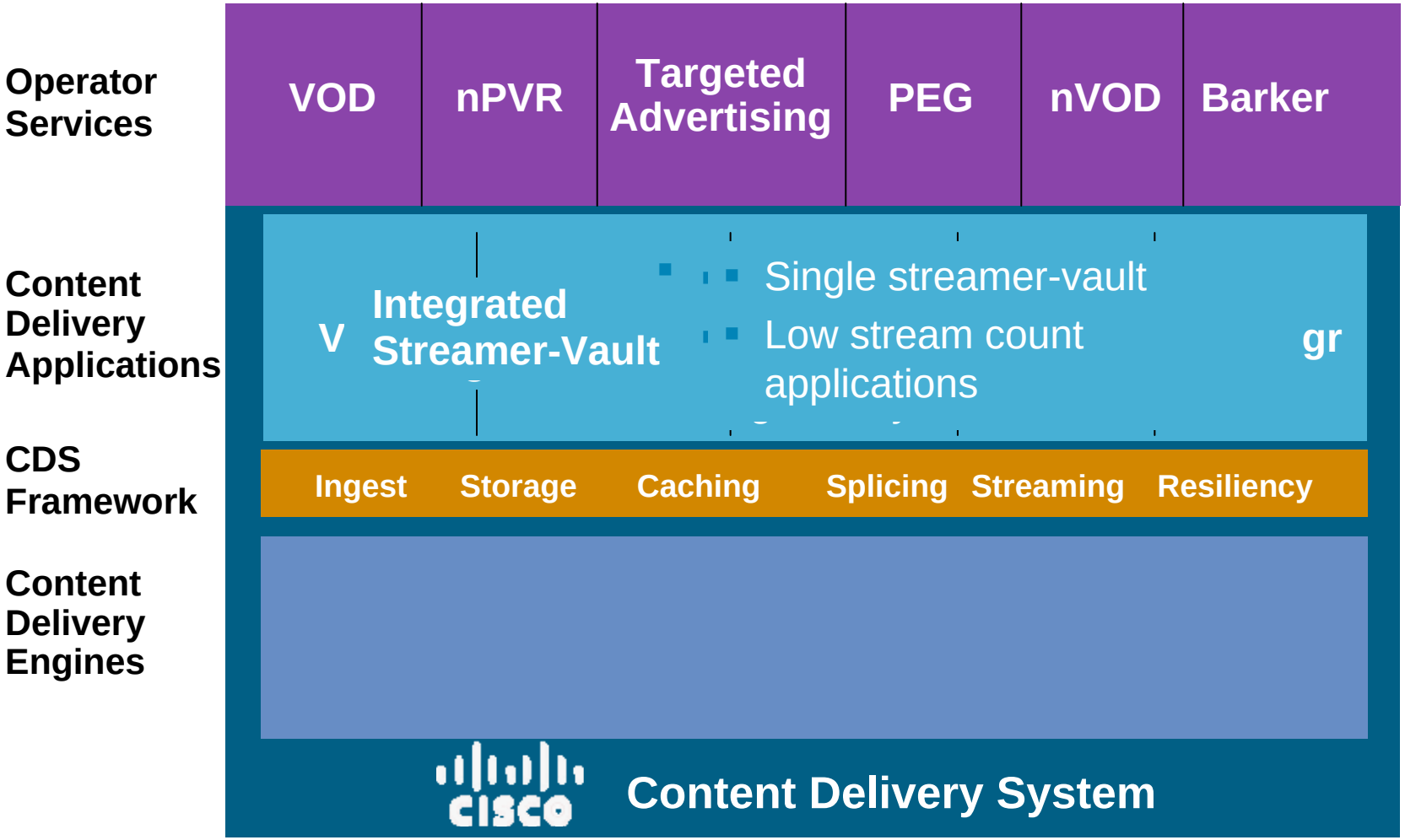
Personalized

Cisco Content Delivery System
The Network is the Platform

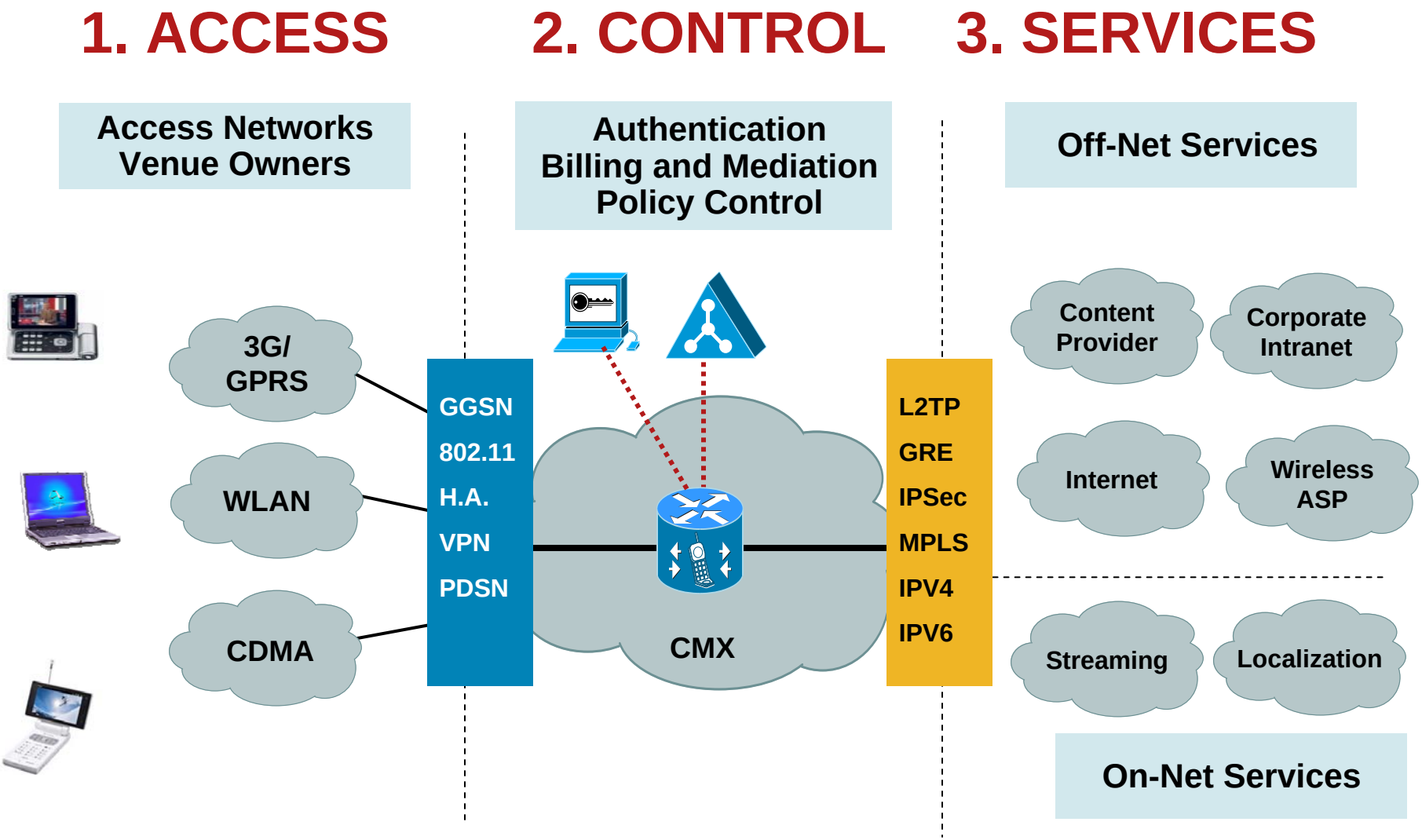
- Network-centric architecture
  - Intelligent distributed architecture
  - Networked Content Delivery Engines work as one virtual system
    - Centralized, shared ingest and reliable content storage (Vaults)
    - Personalization and streaming at the network edge (Streamers)
- Technology base
  - Unique caching protocol eliminates need to predict viewer behavior or pre-position content – only 300ms from ingest to play out
  - Resilient design with autofailover
  - Multi-format, multi-device
- Optimized for real-time media services
  - Enables converged live and on demand applications
    - Switched video & time-shift TV
    - Personalized content & advertising



Content Delivery System Architecture



Cisco Mobile Exchange



CMX Role for Unicast Mobile TV

- User Awareness (Authentication and Autorisation)
- L2 Mobile Radio Access Termination point
  - GGSN for 2G and UMTS networks
  - Access Gateway for WLAN
  - ASN GW for WiMAX (upcoming)
- Deep Packet Inspection (L7 for RTSP and HTTP)
  - Per Stream autorisation enabling Parental Control
  - Content billing (Online and Offline charging model)
- QoS assurance
  - Traffic prioritisation (DiffServ)
  - Dynamic Policy Control: Network resources only reserved based on actual application requirmeents

Policy Control

- Policy Control becoming a hot topic for SP market in general (cable, wireline and mobile)
- Policy Control is key to retain control on the user access to network and application
- In details, looking at policy control to:

  - Manage and guarantee end-to-end QoS (essential as radio access is a shared medium)

    QoS enforcement and Call Admission Control

  - Dynamically control bearer charging architecture

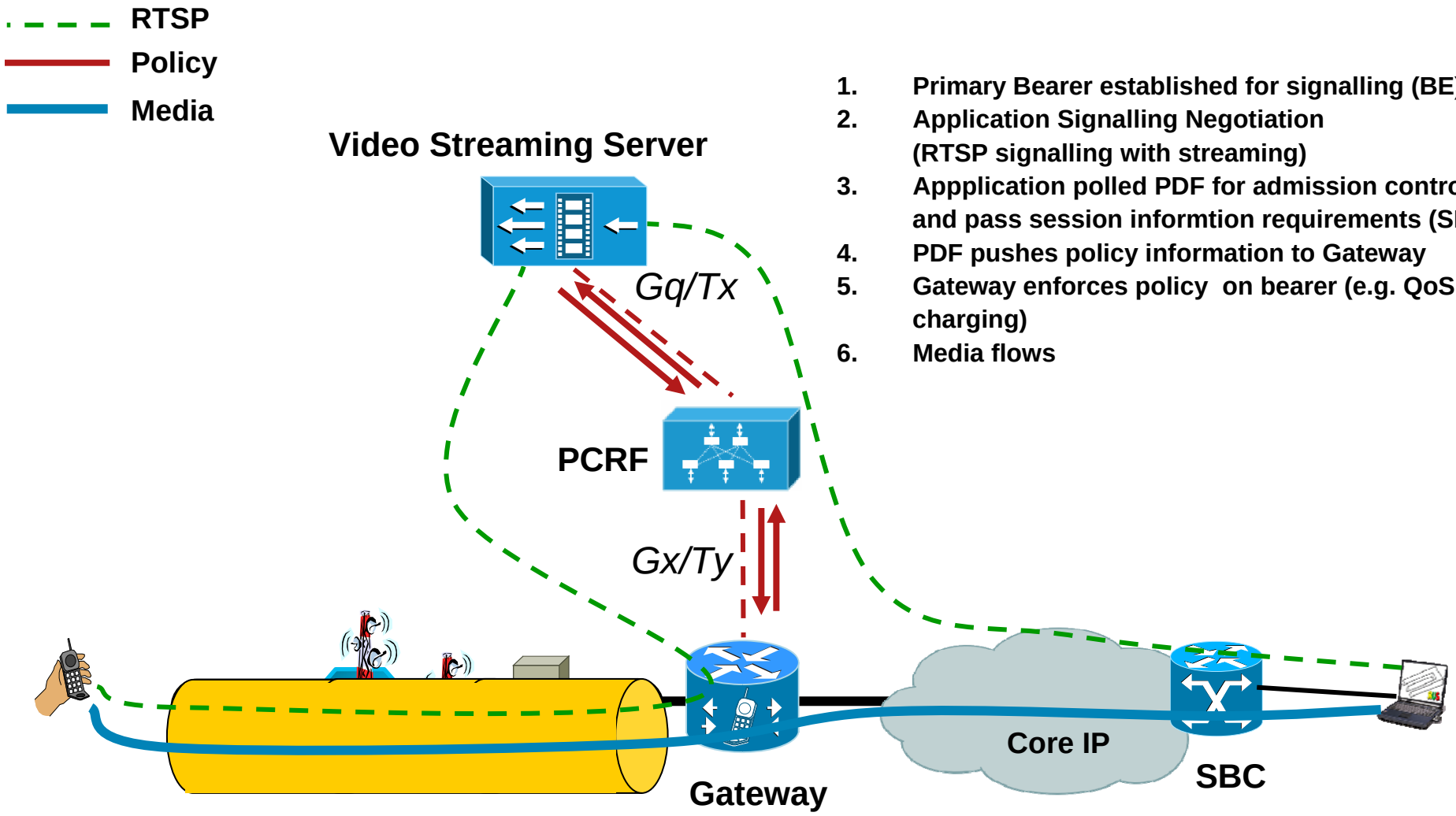
  - Extend to other capabilities (security, firewalling, NAT, etc.)

- In terms of standards, Policy Control is specified byy all main standards organisation (TISPAN, 3GPP/3GPP2, Packet Cable) and one of the key aspects of IMS

  ➔ Policy Control has commonalities across access

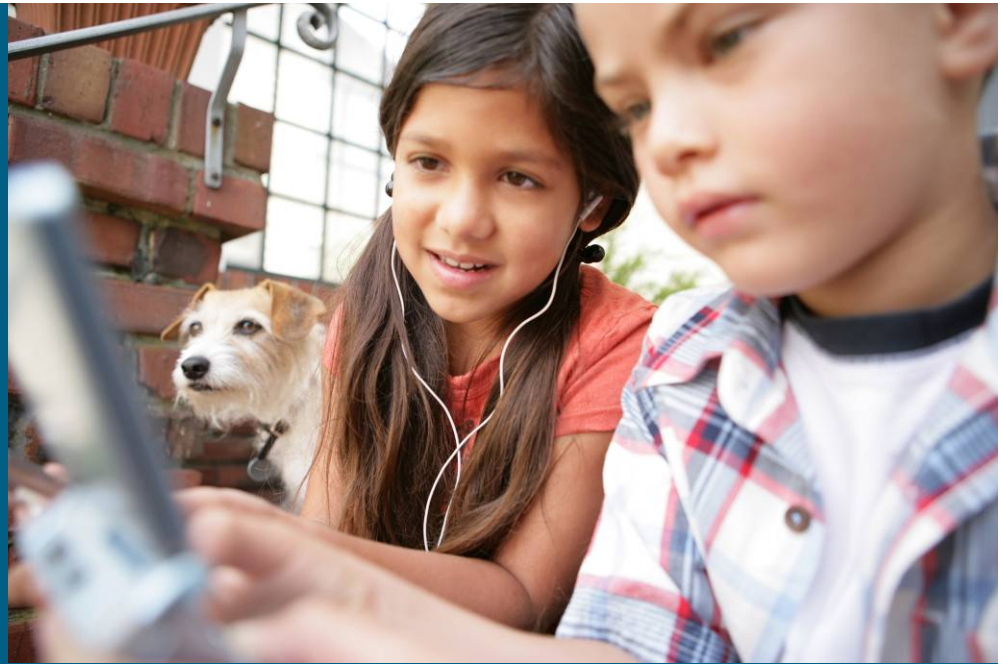
- Also applicable to non-IMS applications

Mobile Access Policy Control
PUSH Model (Video application example)



1. Primary Bearer established for signalling (BE)
2. Application Signalling Negotiation (RTSP signalling with streaming)
3. Appplication polled PDF for admission control and pass session informtion requirements (SDP)
4. PDF pushes policy information to Gateway
5. Gateway enforces policy on bearer (e.g. QoS & charging)
6. Media flows

Delivering Mobile TV over Multicast



Multicast and Broadcast in Mobile

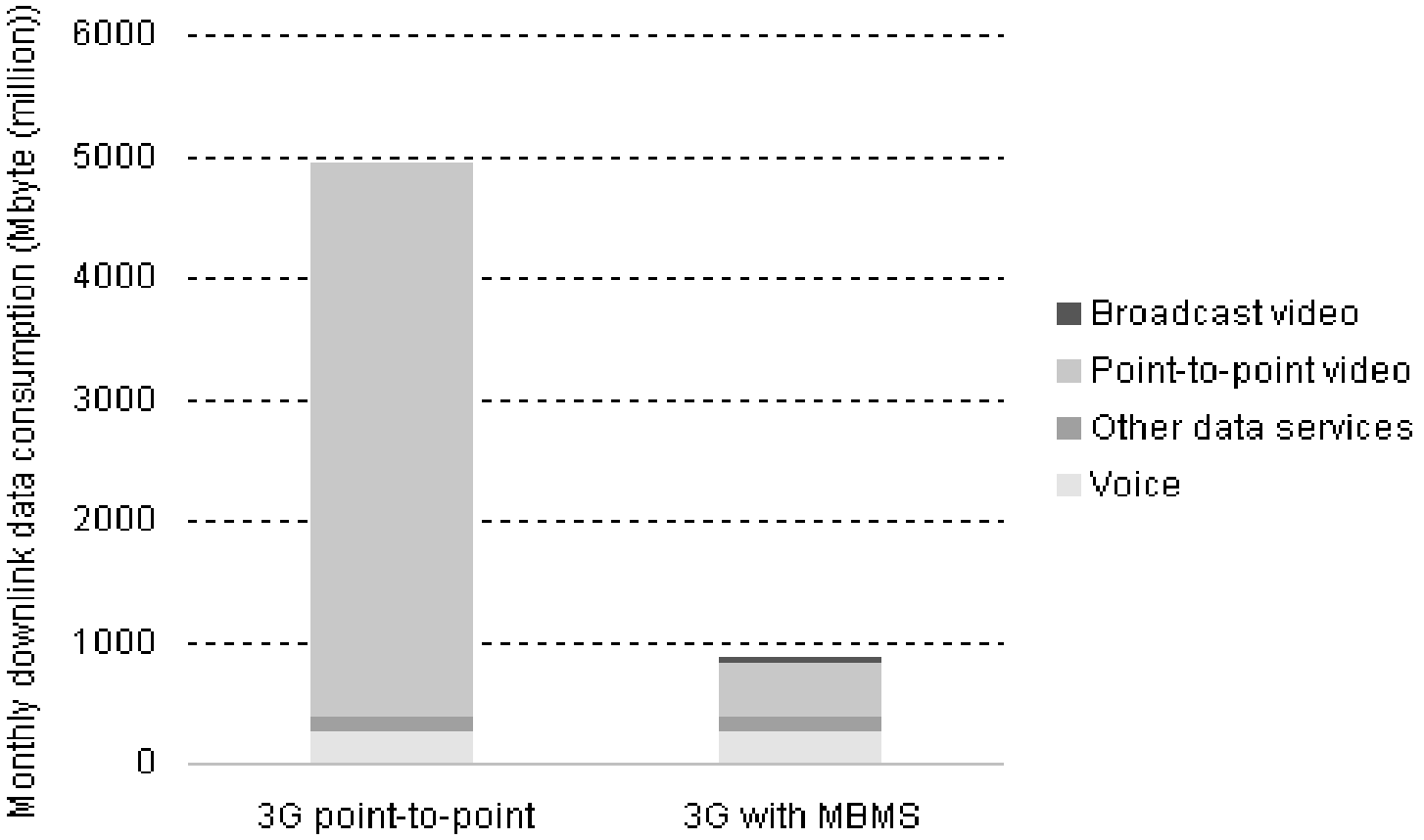
- A possible way to overcome capacity issues of Unicast
- Of interest for popular contents and live events
- Standardised mechanism

  MBMS in 3GPP (3G TS 23.246) and BCMCS in 3GPP2 networks
- Principle

  MBMS optimises the radio resources to transmit the same multimedia content simultaneously to a (large) group of user

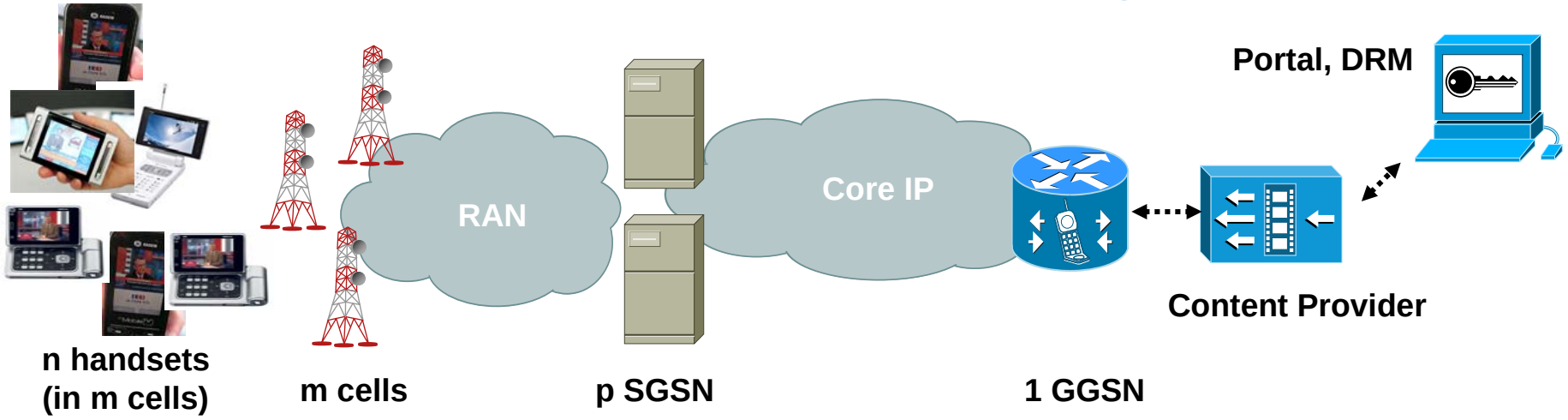
  Interworks with Multicast technology as defined by IETF (i.e. for group management and routing)
- First Trial expected in 2007 with commercial architecture in 2008 (corresponds to mass handsets availability)
- Model favouring the mobile service providers (over broadcasters)

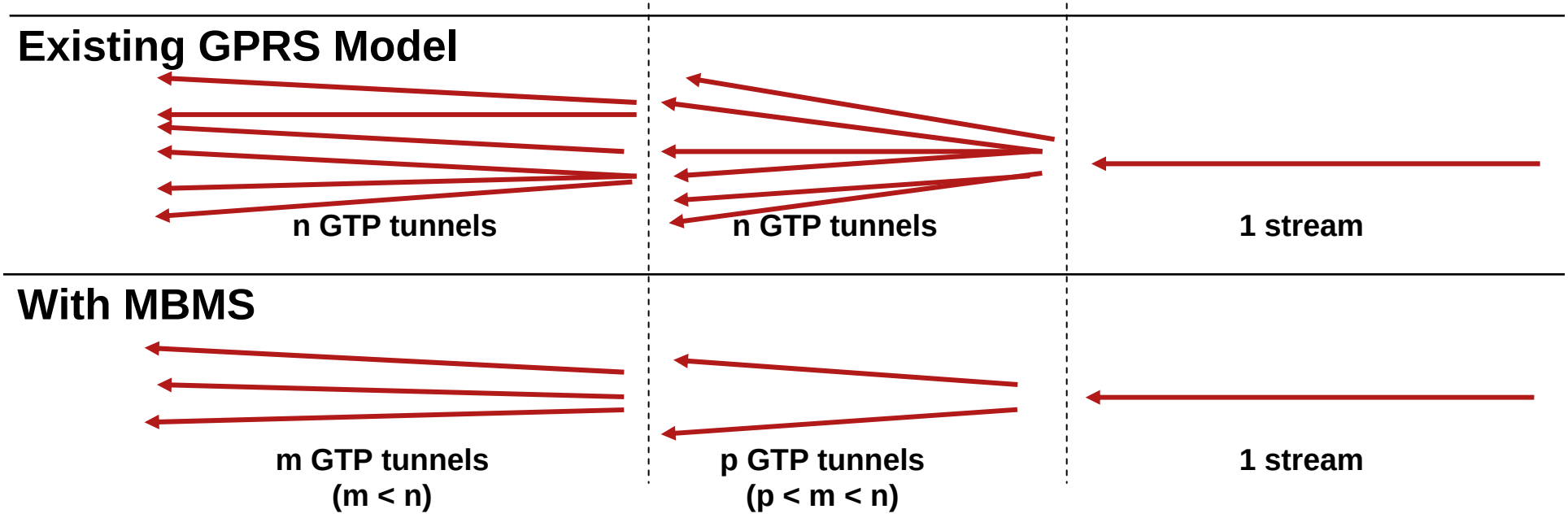
MBMS Benefits



The scenario assumes 75% penetration of mobileTV and video services in the 3G user base and average daily video usage of 20 minutes per service user
(Source: Analysys Research, 2005)

MBMS
Architecture & Principle (Optimising bandwidth)





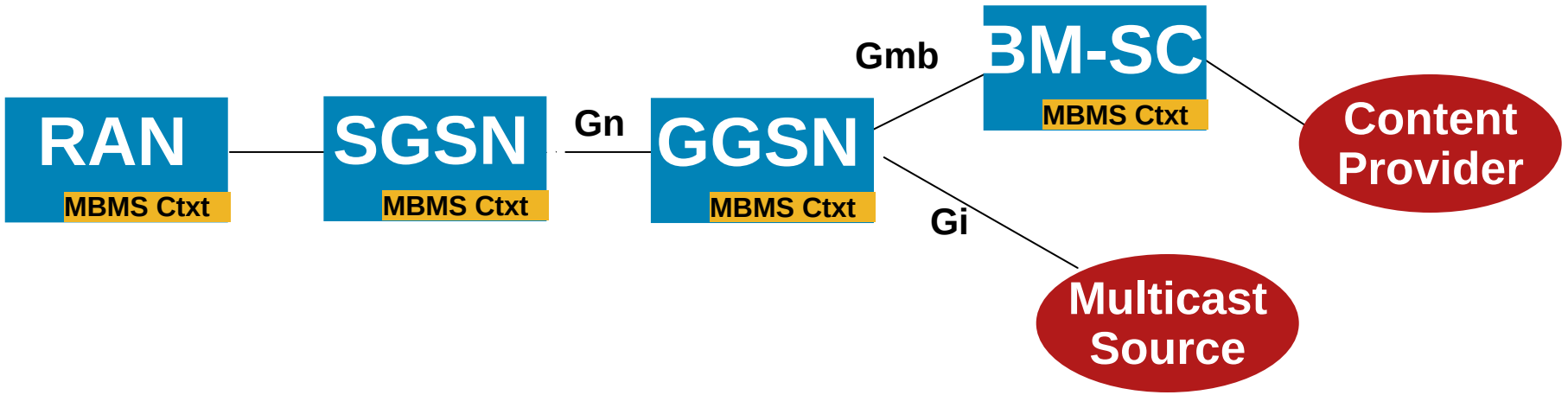
MBMS Architecture

- New element: Broadcast Multicast Service Center (BM-SC)
- A new type on context is defined, MBMS bearer context:

  An MBMS Bearer Context is created in the SGSN and GGSN when the first MBMS UE Context is created in the node or when a downstream node requests it.

  GGSN can trigger the MBMS UE context based on IGMP/MLD join

  The MBMS Bearer Context is statically configured in the BM-SC



MBMS requirement on GGSN

- Enhanced GTP support: MBMS context
- Gmb Diameter interface support (optional)

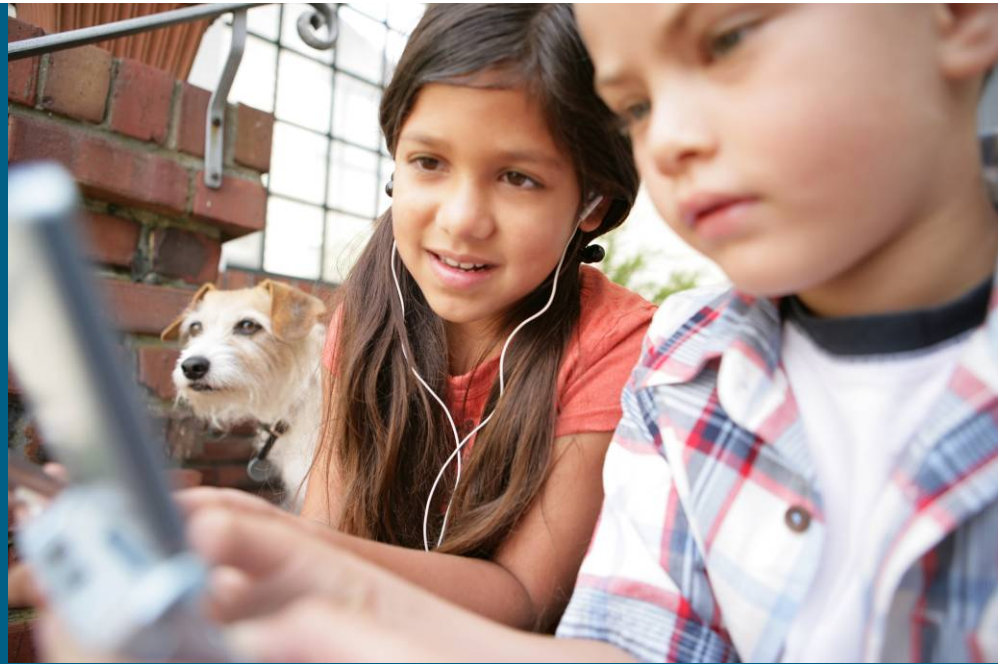
  Request authorisation/deactivation of a user for an MBMS service,

  Register/de-register the GGSN for receiving the MBMS service.

  Receive indication of session start and session stop messages, which shall cause the GGSN, SGSN and RAN to set up/tear down the appropriate resources for the service
- IPv4 multicast support (Ipv6 later) on Gi (PIM)

  Support of IGMP/MLD
- Billing interface to be enhanced as well to bill per multicast group

Delivering Mobile TV over Broadcast



Introduction to Broadcast

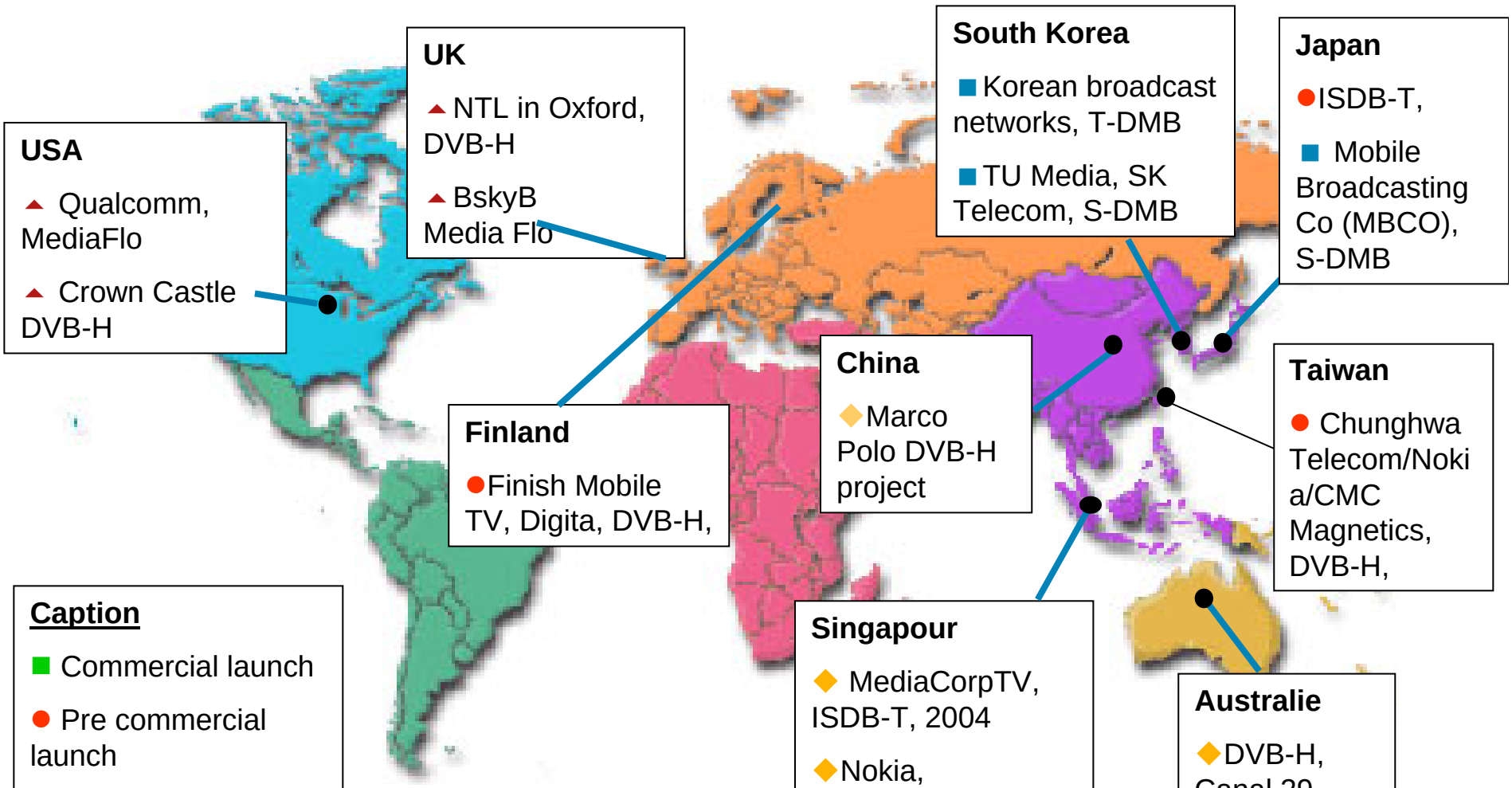
- A parallel network used to transmit liveTV channels or offloading most popular contents
- Principles
  - Alternative spectrum
  - Digital content
- Multiple standards
  - DVB-H (close to DVB-T)
  - MediaFLO (mostly for CDMA networks)
  - S- or T-DMB (South Korea)
  - ISDB-T (Japan)
- No built-in feedback, require mobile data network for reurtn path
- Different deployment models

Mobile TV Broadcast Standards

Standards	DVB-H	MediaFLO	DMB-T	ISDB-T
Origin/Status	Evolved from DVB-T; Adopted by ETSI in 2004	Qualcomm proprietary	Evolved from DAB standards	Developed in Japan to support HDTV
Channels per transmitter*	9 channels for 6 MHz ~ 300kpbs each	20 channels for 6 MHz ~ 300kbps each	3 channels for 1.5 MHz ~ 250kbps each	13 channels for 6 MHz ~ 230kbps each
Operating frequency	470–862 MHz (EU) /1670–1675 MHz (US)	700 MHz (US)	200 MHz (Korea)/ L-Band (1452 –1467.5 MHz)	2600 MHz
Deployment regions	US, **Europe**, Asia	**US**, South Korea	**South Korea**, Europe (limited)	**Japan**
Handset	Available	Available	Available	Available
Major backers	Nokia, IT, Modeo, 3 Italy, and many more	Qualcomm, VzW	SK Telecom, Samsung, Korea gov't	TI, Nippon TV, TV Asahi, Fuji TV, etc
Assessment	Leading standard; Dependencies on spectrum	More capacity; CDMA or UMTS; no other backer	Regionalized	Regionalized

Note: comparison done with equal link margin*

Example of pilots around the World



Case Studies: 3 Italy and TIM

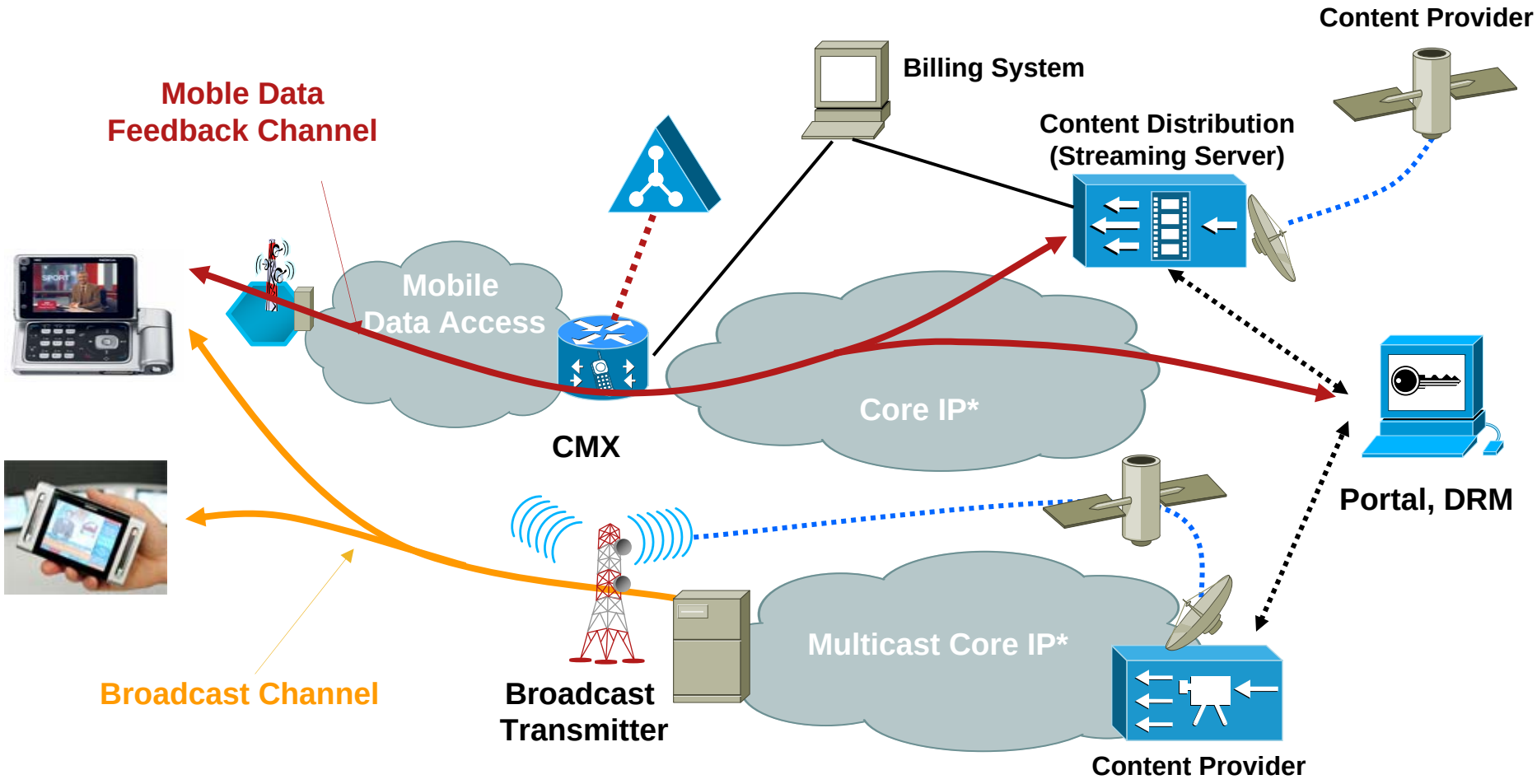
- 3 Italy bought an Italian TV channel, Canale 7, in Nov 2005
- €220m investment in DVB-H service development
- Signed deal with Mediaset to get DVB-H rights for football
- Commercial (www.latv.it)

- Mobile Service Provider Model (full ownership)
- Potential financial challenge to support the service

- Signed deal with Mediaset to define DVB-H offer
- Completed with streaming over GPRS/3G
- Commercially available

- Shared model with Broadcaster
- Potential issue for service differentiation

Video over Broadcast Generic Architecture



Note*: Depending on the deployment model, these two IP Core could be a common network

Broadcast Network CAPEX

- Overlay broadcast network

  Modeo: $500M

  MediaFLO: $800M committed ($400M for network buildout)

  Mediaset spent approximately €250 million building its DVB-H network in Italy in the VHF spectrum

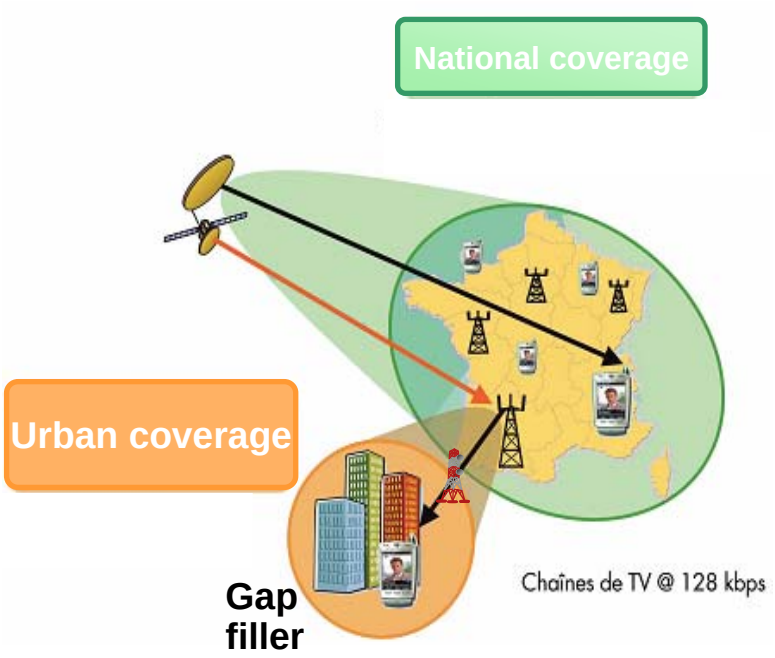
- Ovum DVB-H business case:

  Network build-out cost in UK and France

  - €140M in the UK (for 2300 broadcast sites)

  - €310M in France (for 5500 broadcast sites)

Source: Ovum, 2006



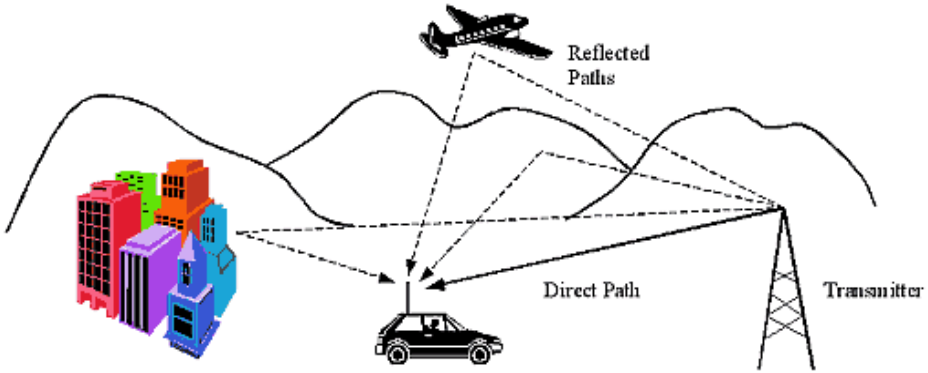
Building out a broadcast TV network is a major a investment!

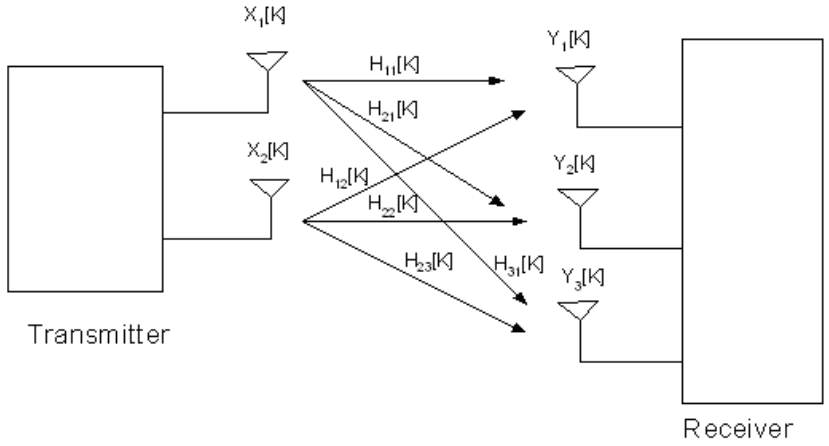
Yet, it is significantly smaller than a mobile data network

A deeper look at DVB-H

- DVB-H: Digital Broadcast Services to Handheld Devices
- Standard approved by ETSI in 2004: ETSI EN 302 304
  - Specifications available at the following url (http://www.dvb-h-online.org/)
- Main characteristics
  - OFDM Radio Modulation
  - Time slicing (key to save power on devices)
  - Forward Error Correction (FEC)
  - MPEG-4 (H.264) and AMR-WB media encoding
- Key proponents: Nokia
- Large trial carried out throughout Europe

DVB-H Radio technology





- Orthogonal Frequency Division Multiplex (OFDM)

  Carrier for each channel are made orthogonal to one to minimise interference

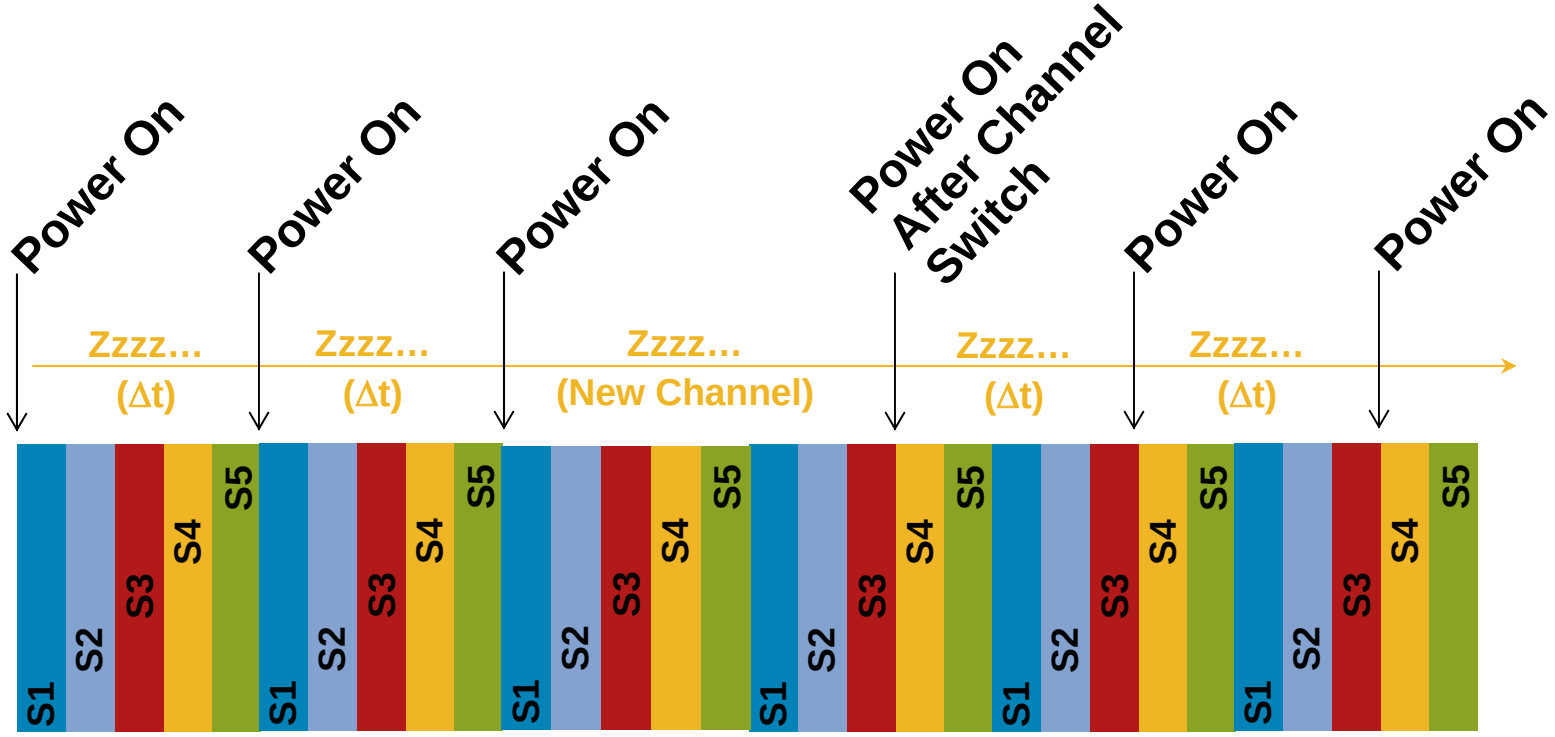
  ➔ Better multipath propagation handling through signal recombination

- High Spectrum efficiency

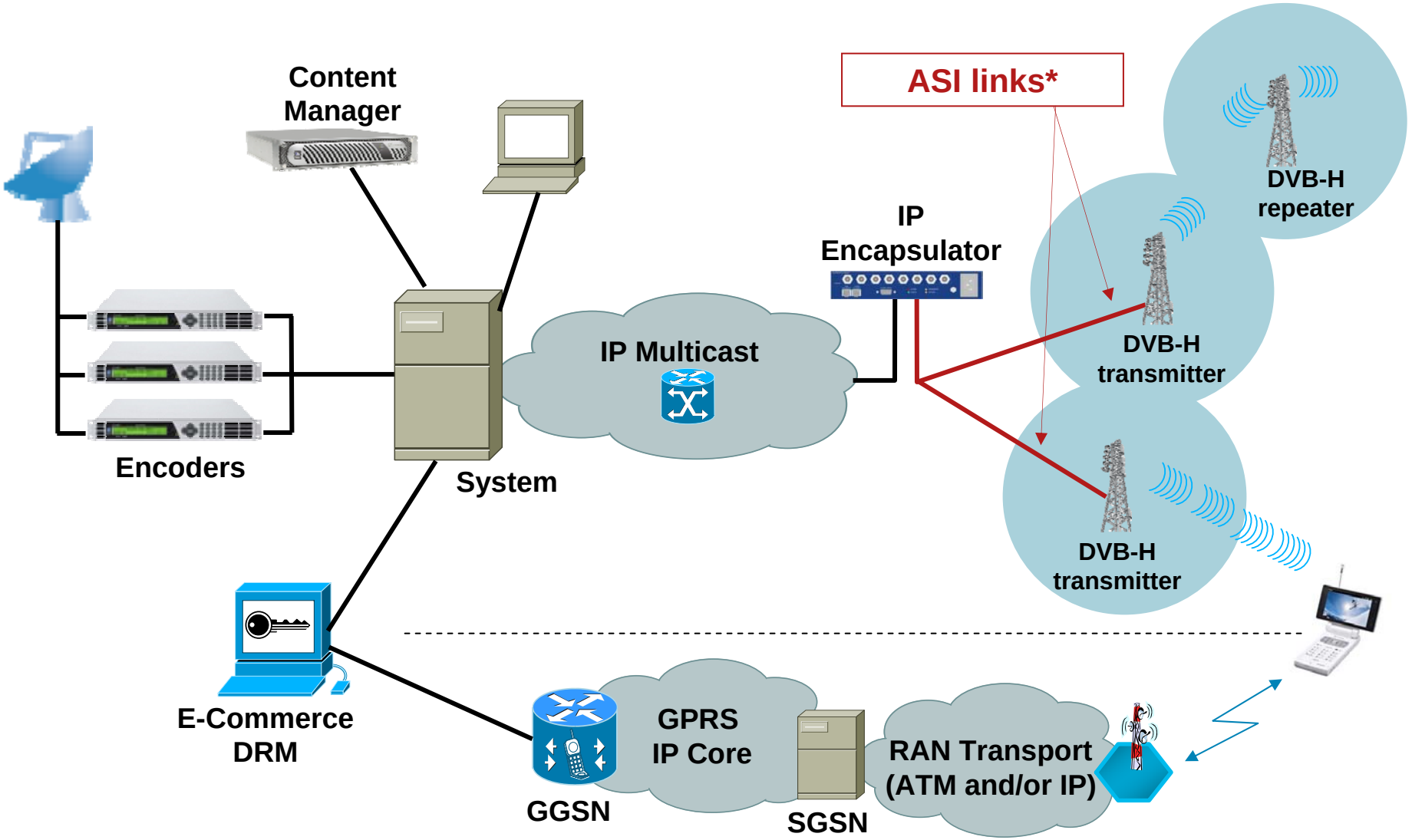
  Same technology chosen across standards (3GPP LTE, WiMAX, etc.)

TimeSlicing

- Power Saving mechanism
- Terminal is off up to 80-90% of the time
- Ease handover and Channel Switch

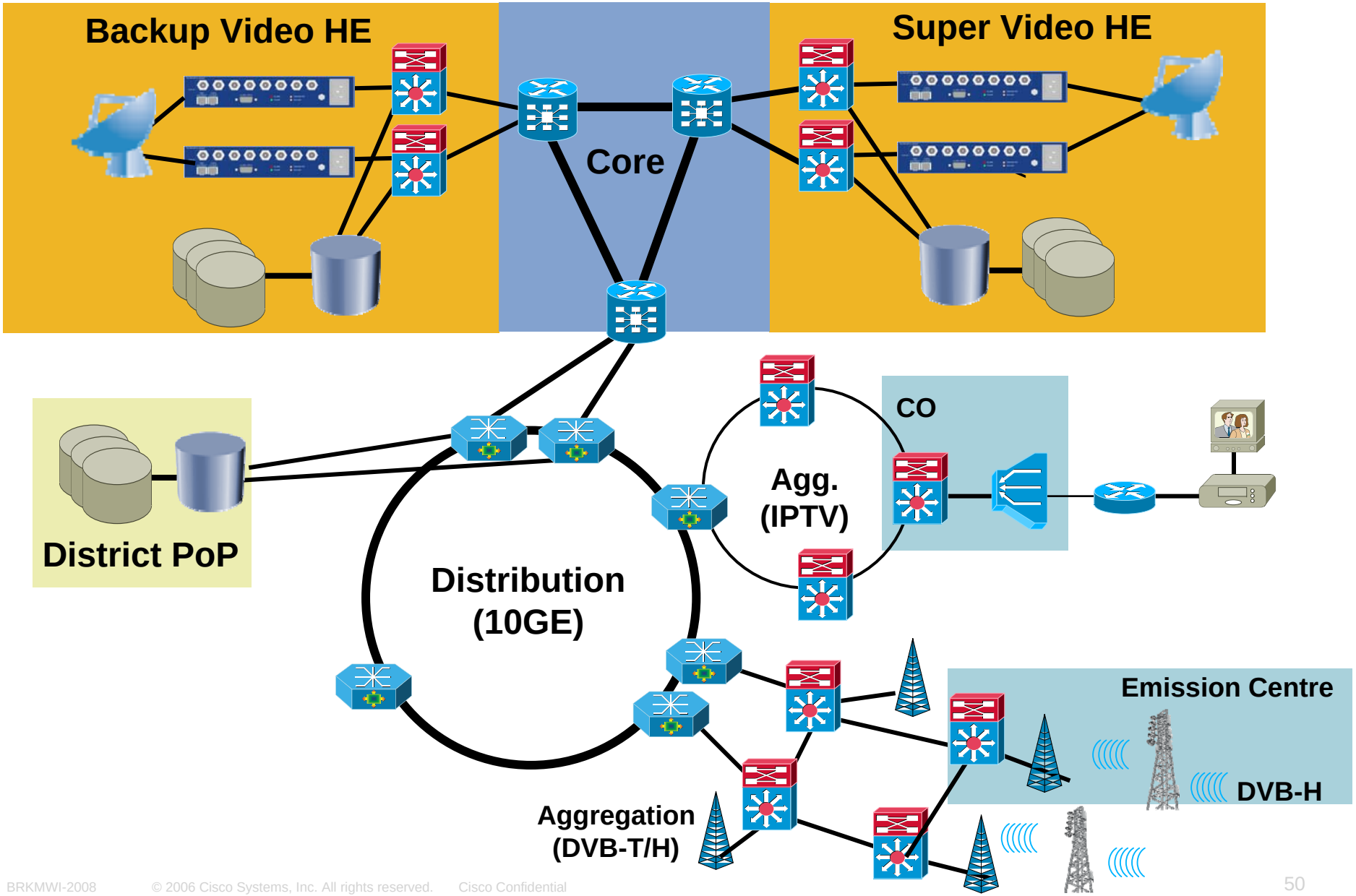


DVB-H Architecture



Note: can be mapped onto IP or ATM transport technologies*

Video Transport Network Example

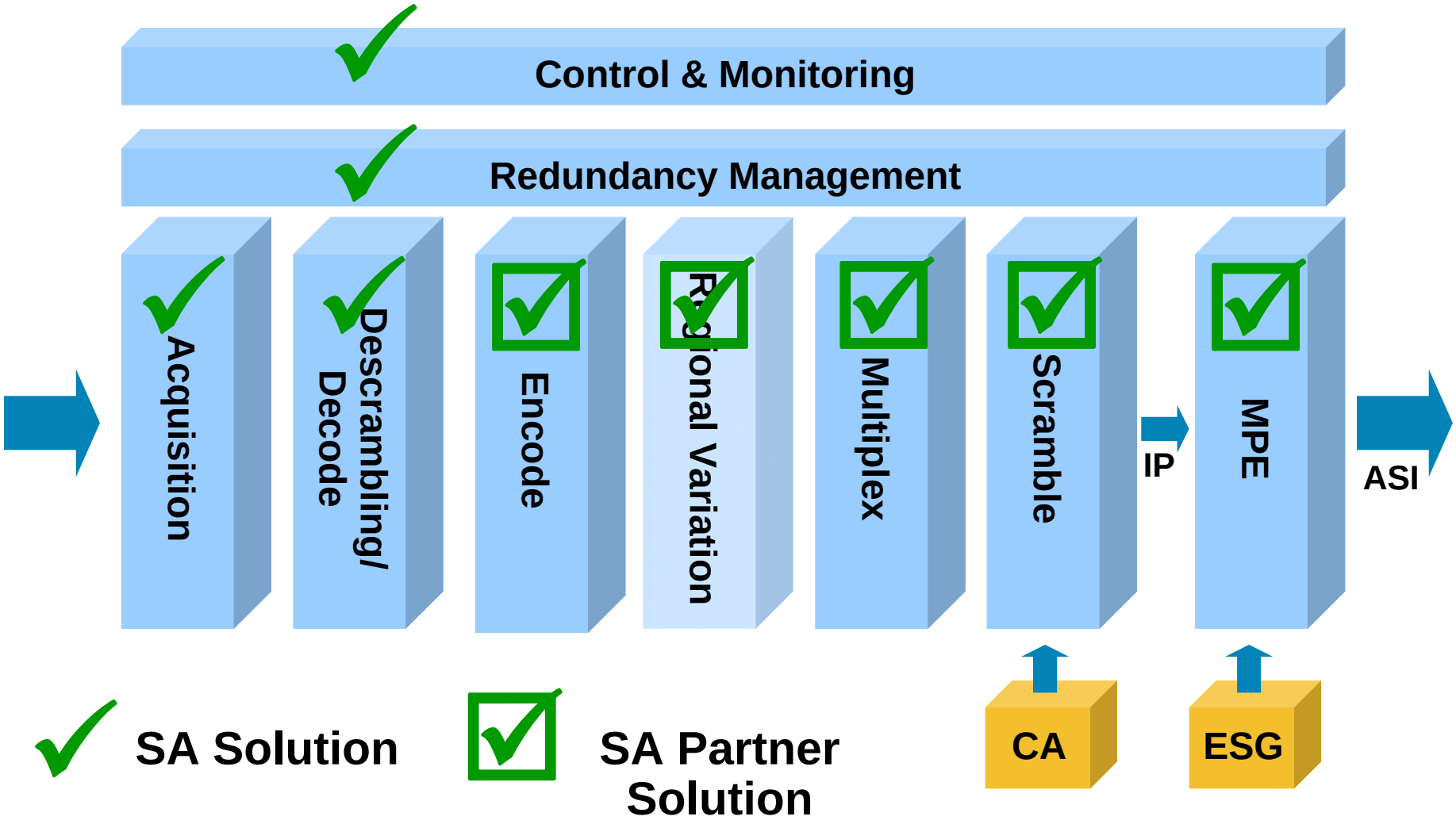


Scientific Atlanta
Mobile TV Broadcast Solution

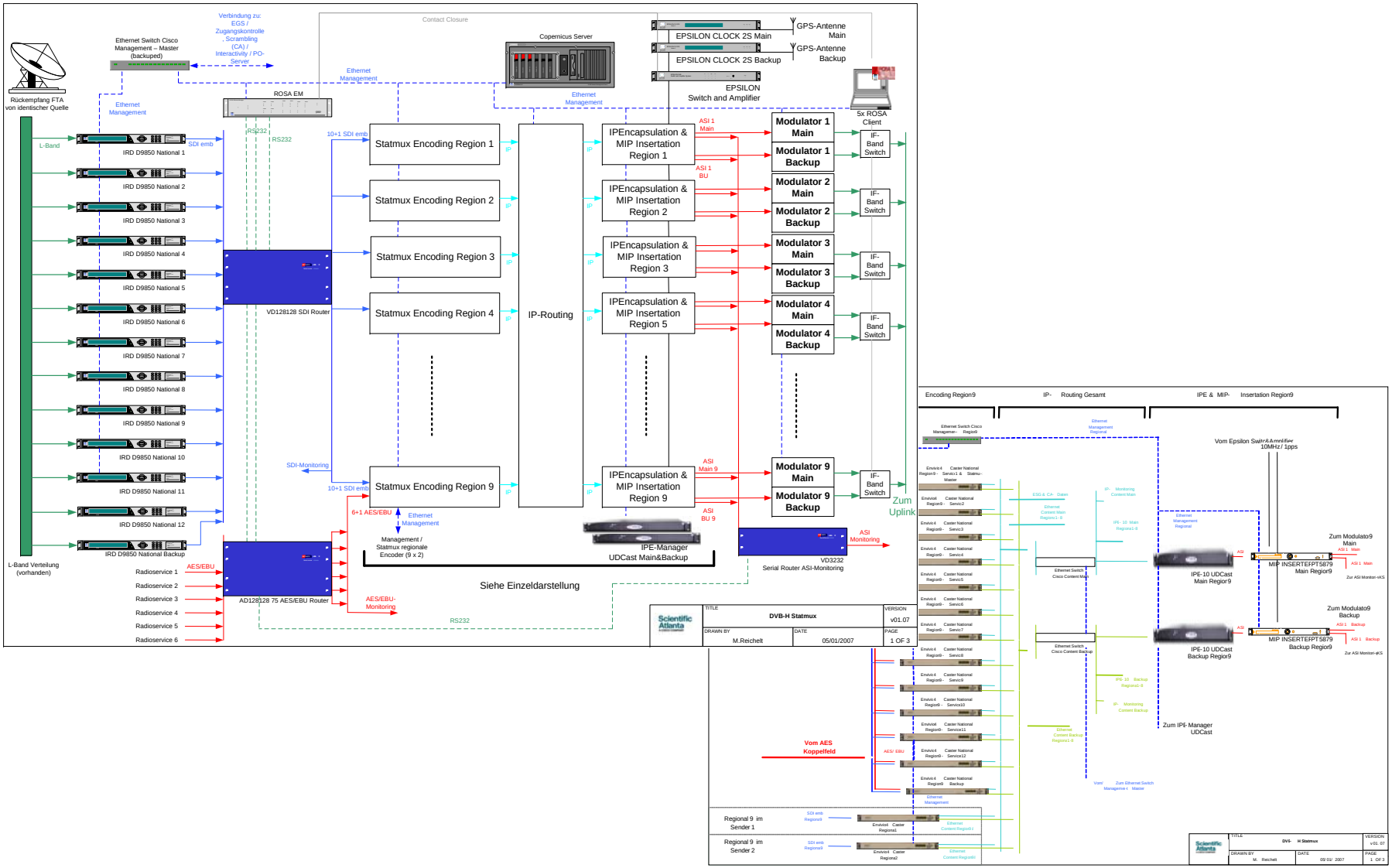
- Targeting DVB-H
- 3 Types of Solutions:
  - Contribution / Acquisition of TV channels
  - DVB-H video encoding head-end
  - Distribution over IP or Satellite
- Providing Design, Installation, Integration and Support
- Products within the solution are from

Scientific Atlanta	Contribution, Acquisition, Distribution, Monitoring
Envivio	DVB-H Encoding
UDcast	DVB-H IPE (MPE)
Other 3rd Parties	ESG, CA

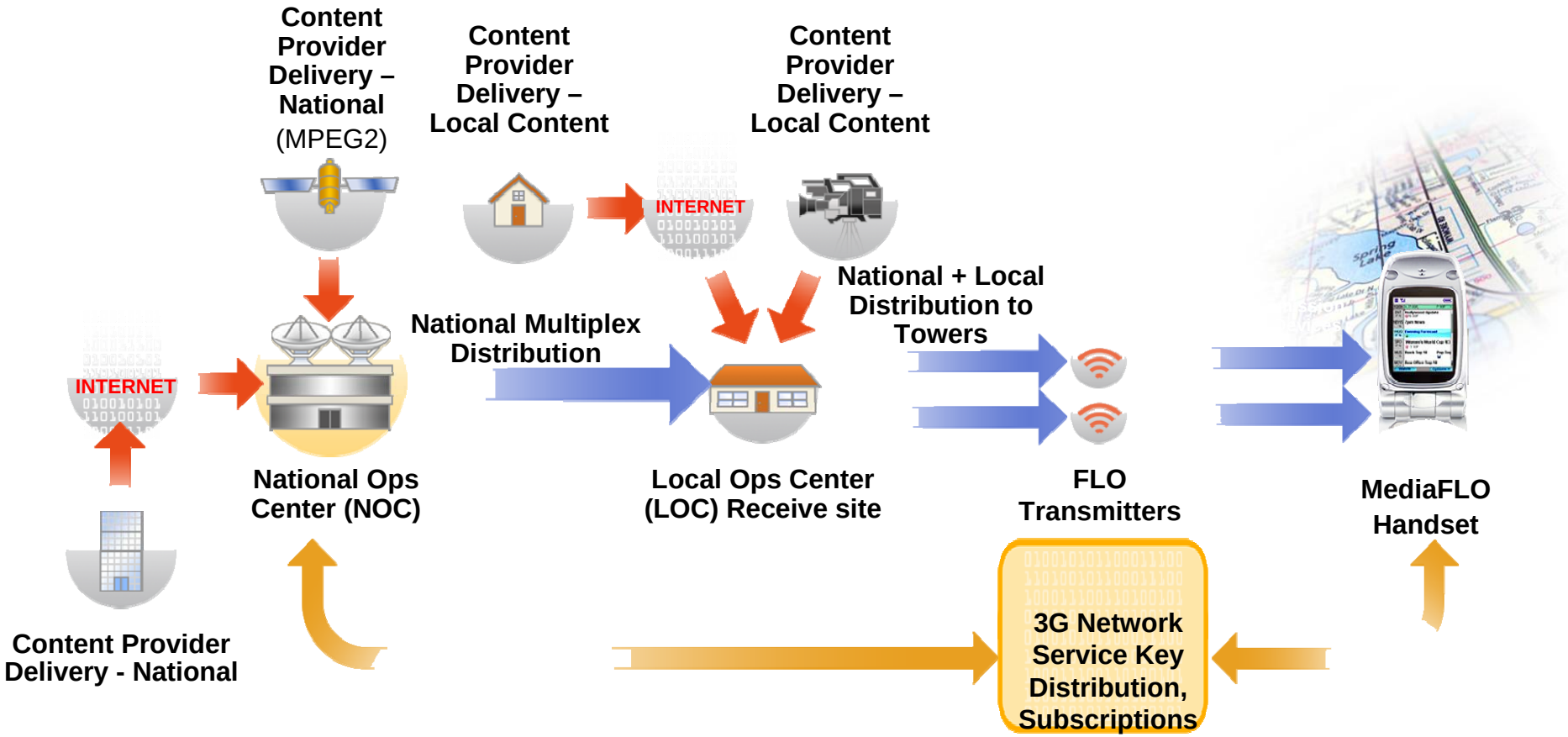
Scientific Atlanta
DVB-H Head-End - Simplified Architecture



Scientific Atlanta
Example DVB-H Head-end Design



Qualcomm MediaFLO Architecture



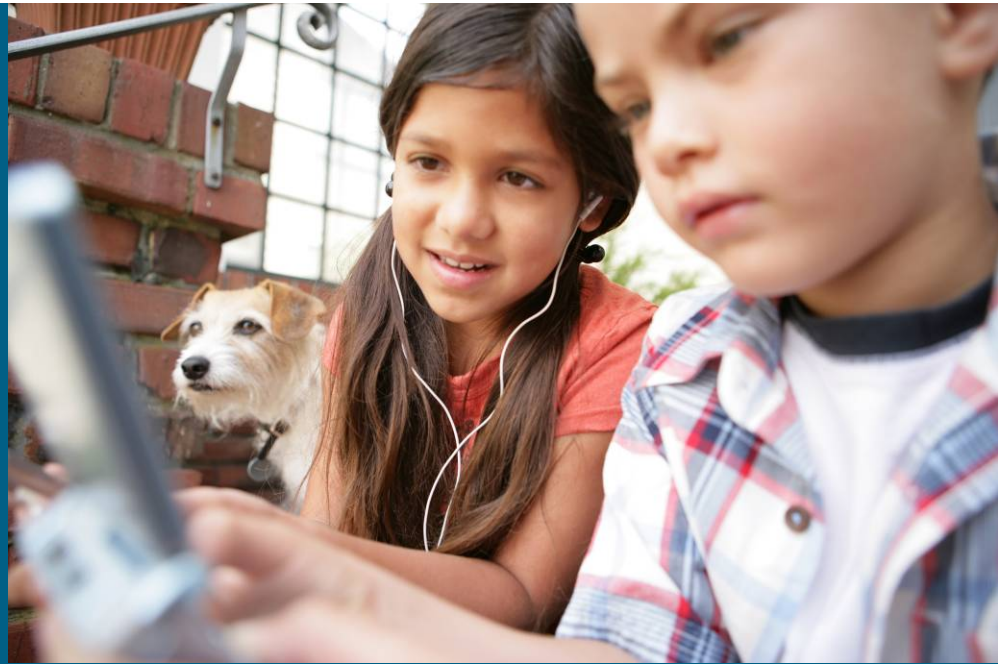
Synergies with other Networks

- Mobile Data Network for feedback channel
  - User or client interaction (e.g. DRM)
  - Authorization and billing
- Mobile Data Transport
  - Data transport (IP Multicast then ATM) down to transmission site
  - Synergies with RAN transport architecture to ensure full coverage
    - (Refer to Networkers RAN transport session)
- Possible integration with DVB-T networks
  - Re-use of frequency
  - Re-broadcast received DVB-T feed into DVB-H network

Major Challenges to Broadcast Mobile TV

- Lack of available broadcast TV spectrum
  - In Europe, will take until 2012 to release all analog spectrum
  - Purchasing spectrum may be expensive
- Deployment Model
  - Broadcasters vs Mobile Service Providers vs vendors
- Market fragmentation
  - Four competing broadcast TV standards
  - Handset price – need volume to fall
- Digital Rights Management
  - Flexibility from content owners and media producers
  - Software for DRM
- Navigation, search and channel switching - key to customer experience and successful service (“content discovery” issue)
- In-building coverage – adding to the cost (due to 20-25% of in-door and at home viewing observed in trials and commercial deployments)

Summary and Conclusions



Video delivery: two technology to co-exist

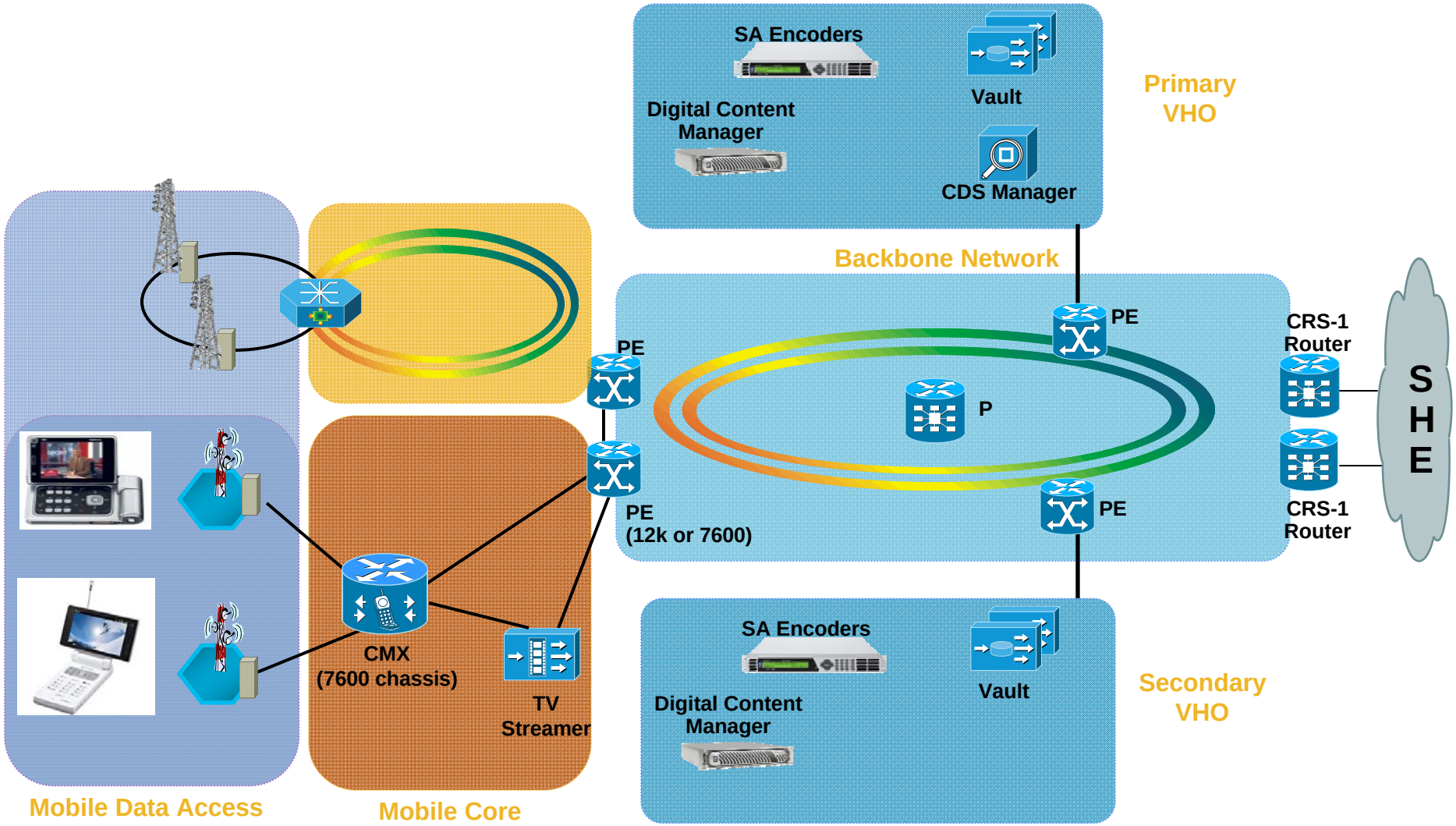
Broadcast

- Mass content to all users
- Live TV and clipcast
- DVB-H and MediaFLO
- Starting 2H2007 (trials done or underway)
- **Cisco/SciAtl solutions**
  - **Scientific Atlanta for Head-End**
  - **Cisco multicast (HE to encapsulator)**
  - **CMX for Admission, charging control**
  - **RAN for video transport over ATM**

Unicast

- Unique content to specific users
- Web, longtail VoD, replays, specials, niche live TV
- CDMA EVDO and UMTS
- Already available
- **Cisco/SciAtl solutions**
  - **Scientific Atlanta for Head-End**
  - **Cisco CDS**
  - **Cisco CMX for QoS and billing**
  - **Cisco CMX for Mobile Data Access**
  - **Cisco routing**

Mobile Video Network Architecture



Cisco Mobile Video Solutions

	Unicast Network	Broadcast network	Ad Insertion	Connected Home
Broadcast HE		x		
IPTV Infrastructure	x			
CDS transcoding	x			
CDS content caching/distribution	x		x	
Video Data Center	x		x	
CMX – CAC	x			
CMX – CSG video billing	x	x		
CMX – CSG Parental control	x	x		
KISS - Timeshift				x
KISS + Mobile				x

Meet the Experts
Mobility

- Eric Hamel
  Consulting Systems Engineer

- Gaétan Feige
  Consulting Systems Engineer

- Marco Centemeri
  Distinguished Systems Engineer

Recommended Reading

BRKMWI - 2008

- Continue your Networkers learning experience with further reading from Cisco Press.
- Visit the on-site Cisco company store, where the full range of Cisco Press books is available for you to browse.