IPTV and Beyond

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Outline

What is IPTV?

Market Drivers

Triple Play/IPTV Architecture

Technology Enablers

Challenges

Bell Labs Project

Conclusion

IPTV Dimensions

Network Type

- **Managed**
  - **Service provider controls core, access network, set-top box**
  - **E.g., Cable TV service today**
- **Unmanaged**
  - **Over "someone else's" broadband network or, Internet**

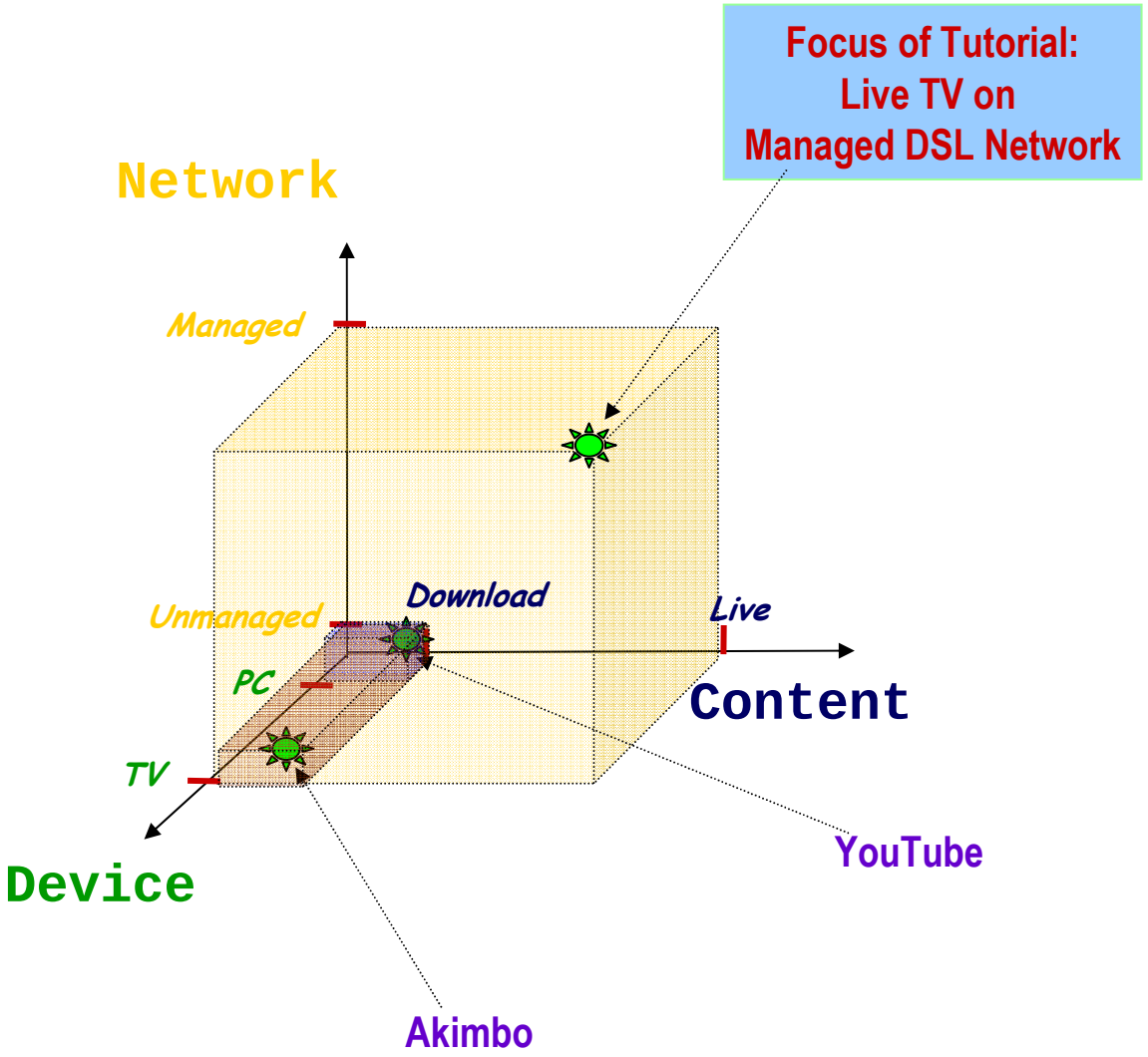
Content

- **Live**
  - **TV channels, as in home**
- **Download-n-Play**
  - **Movies, videos, canned content**

Device

- **TV**
  - **Ye Ole idiot tube**
- **PC/Laptop**

IPTV Dimensions



Managed IPTV

The IPTV buzz is really around Managed IPTV

- TV service from Telcos (or, Cable Cos)

Service over "managed" access network

- Service provider controls access equipment outside or, even, inside the home
- Multiple access technologies --- DSL, Cable, FTTx

Service, quality guarantees from provider

TV on PC may also be offered

- e.g., Time Warner, UPC Netherlands

Focus of talk on Managed IPTV

IPTV Market Drivers

VoIP Attack → Declining Voice Business

Voice revenues are the Telco cash cow

- However, steady erosion from VoIP and wireless

Cable MSOs and independent VoIP providers *(e.g. Vonage)* offering residential/enterprise voice services

Declining Voice Revenues (Yankee Gr, 2004)

Year	Consumer ($ B)	Business ($ B)
2003	74.4	62.2
2004	69.8	59.9
2005	65.4	57.9
…		
2007	57.2	54.0

VoIP Subscriber Growth (Yankee Group, 2005)

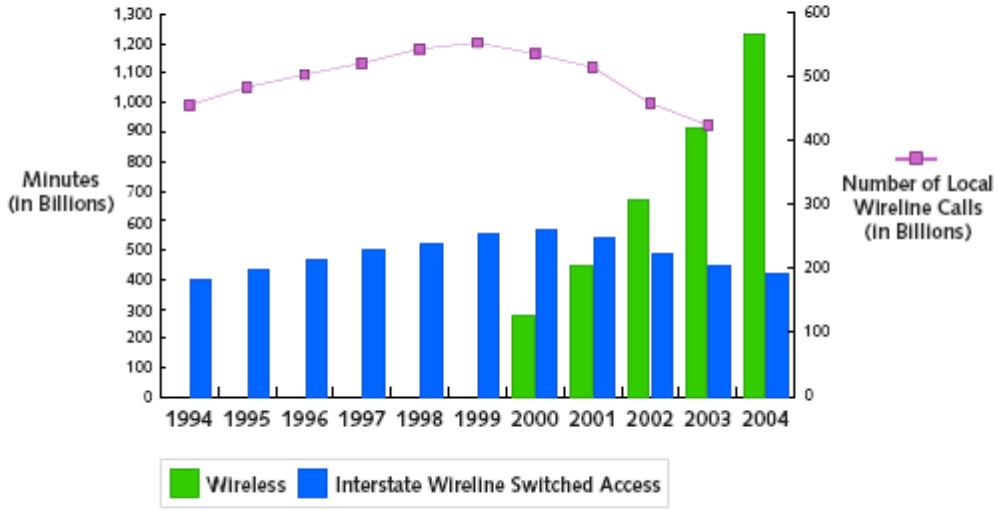
Year	US (Millions)	Global (Millions)
2005	2.9	16.5
2006	5.2	22.6
….		
2009	15.9	51.2

Wireless Churn

Exhibit 1.

Wireless Grows with the Decline of Wireline

Source: FCC Trends in Telephone Service Report, June 2005, and Yankee Group 2005 North America Wireless/Mobile Carrier Tracker



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Migration to Cellular/VoIP also triggered by FCC mandated landline-cellular number portability

Higher ARPU in Video Business

Customers also willing to pay more for video

Surveys show compared to voice spending alone (~$50/month), ARPU for:

- Voice + Data: 2x Voice
- Voice + Data + TV/Video: 4x Voice

By offering Pay-per-view and Video-on-Demand, TV providers also expecting to grab share of the video rental market (e.g., Blockbuster, Netflix)

Bundling: Triple Play – Voice, Video & Data

- Bundling of services → lower package price
  - Higher ARPU by selling multiple services
- Lowers customer churn
  - *Cox Communications* reported *50%* reduction in customer churn (Instat/MDR 2003)
- Operational efficiencies from integrated OSS

- Stop-gap triple-play offer: Phone companies reselling TV via Satellite

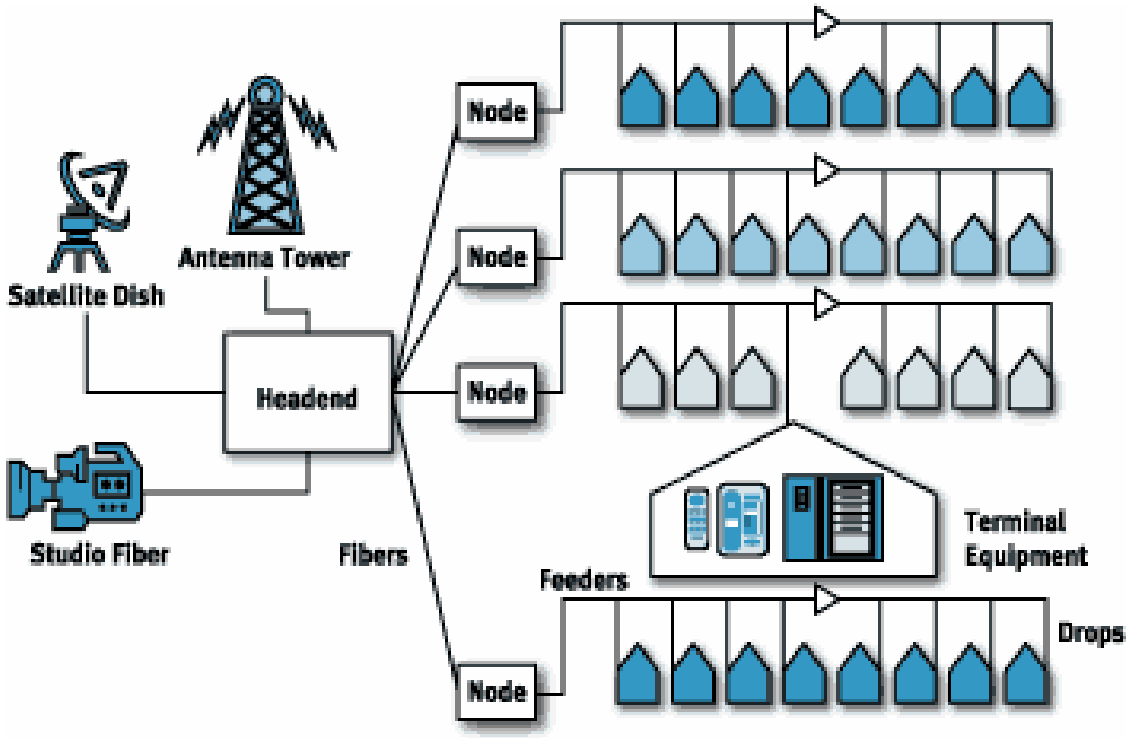
So, Why Now?

- Telcos have to defend their territory
  - Survival, no longer a matter *choice*
- FCC's unbundling relief to ILECs for Fiber to the curb deployments
  - Goal to encourage fiber deployment by RBOCs
- DSL advances *(ADSL, ADSL2+, VDSL)*
  - Higher bit rate, better reach
- Mature video standards *(MPEG-4 H.264)*
  - Halved bandwidth requirements

Technology Advances Making IPTV a Reality!

Triple Play/IPTV—A Quick Introduction

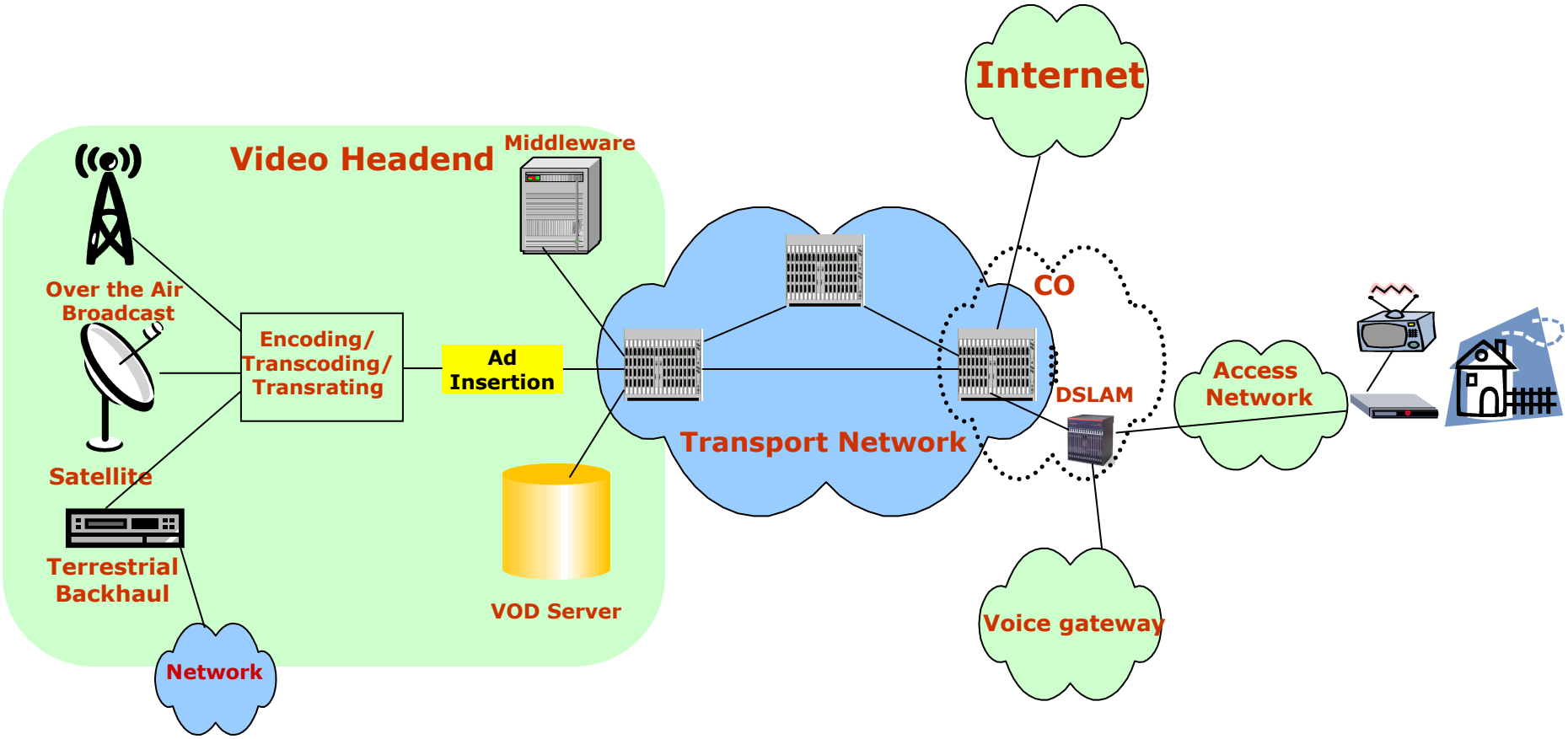
The Cable Plant Architecture



Today, most plants are HFC – Hybrid-Fiber Coax

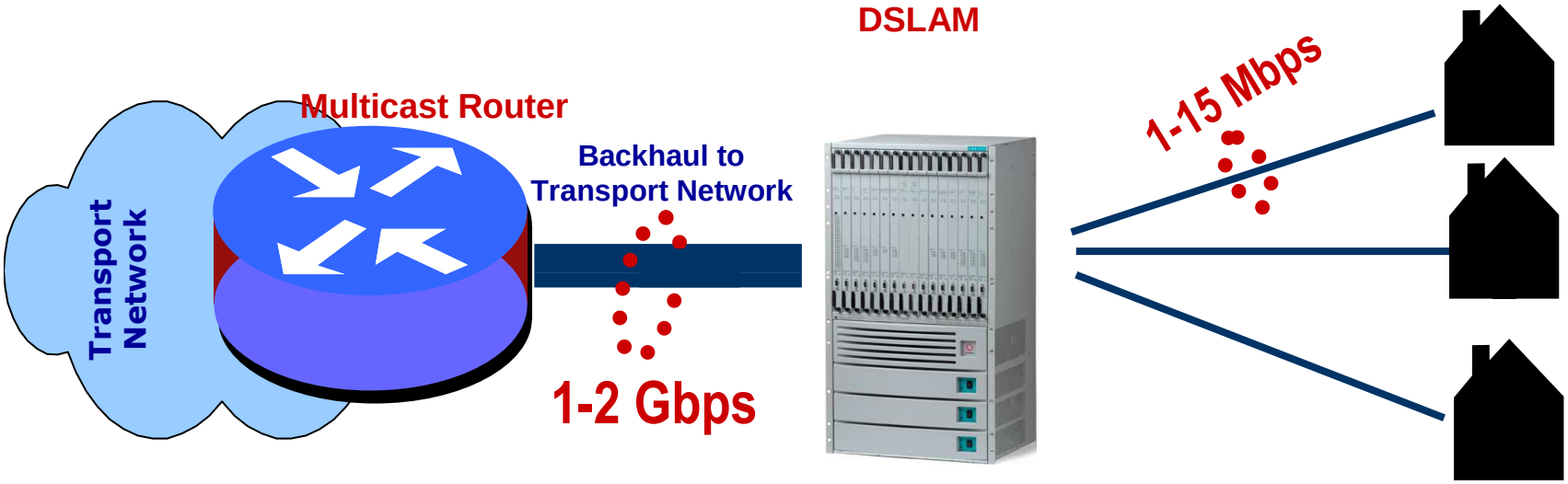
- Fewer amplifications
- Two-way communication

IPTV Reference Architecture



DSLAM: Digital Subscriber Loop Access Multiplexer

DSL Bandwidth Limitations



DSL pipe to customer is dedicated

- Not shared like CATV

However, today, DSL copper loop and the DSLAM backhaul have lower bandwidth

- Key to different approaches in IPTV and CATV

Implications of Lower Bandwidth

DSLAM Backhaul

Determines "size" of channel lineup

- Video + Voice + Data carried over backhaul
- Assuming 60% of 1Gbps = 600 Mbps for video
  - @ 6Mbps per channel ≅ 100 channels simultaneously per DSLAM

DSL Line Bandwidth

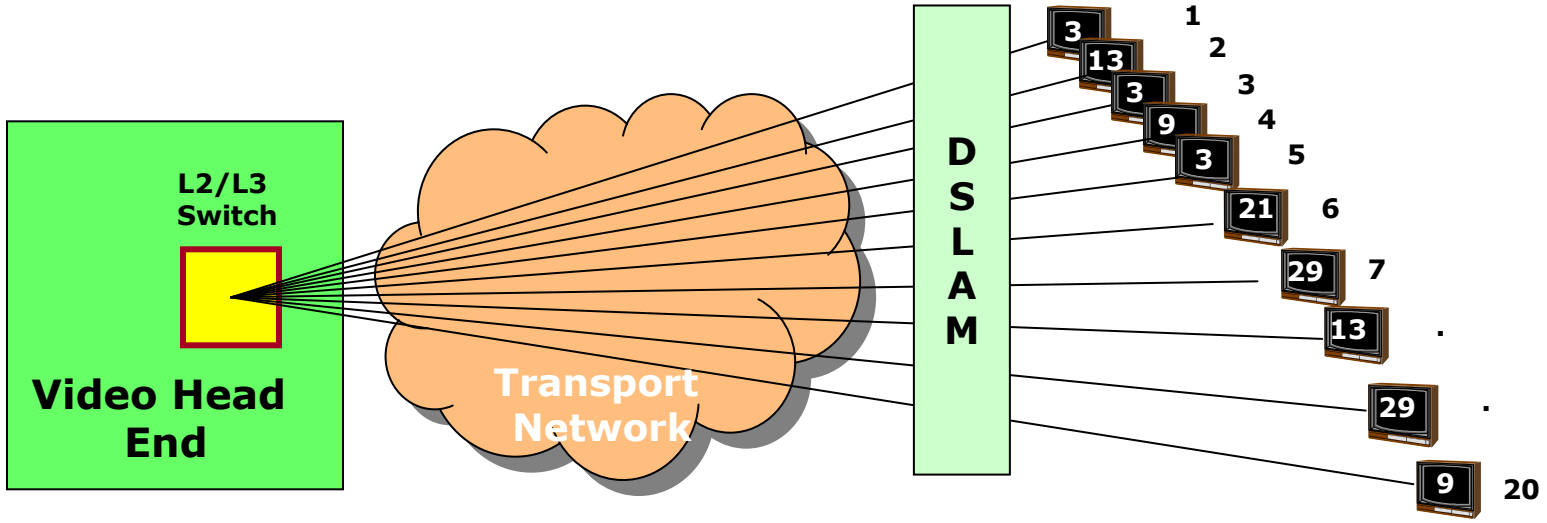
Determines the number of "simultaneous" channels one can watch

- Determines how many TVs in the home can get service
  - 20 Mbps downstream @ 6Mbps per channel → 3 channels/TVs

This is the primary driver for switched video

⇨ No longer a "broadcast" TV model

Unicast TV Delivery



Assume: 5 channels (3, 9, 13, 21, 29)

Potential bottlenecks:

- Transport network
- DSLAM backhaul

Transport B/W needs to scale with subscribers

IPTV and Multicast

For IPTV deployments with switched video:

- Every channel maps to a multicast address
  - Core technology driving IPTV. First large-scale commercial use

Flipping to a new channel implies “joining” the multicast group corresponding to the channel

Channel #	Multicast Address
1	239.192.1.1:1234
2	239.192.1.2:1234
…….	
48	239.192.1.69:1234

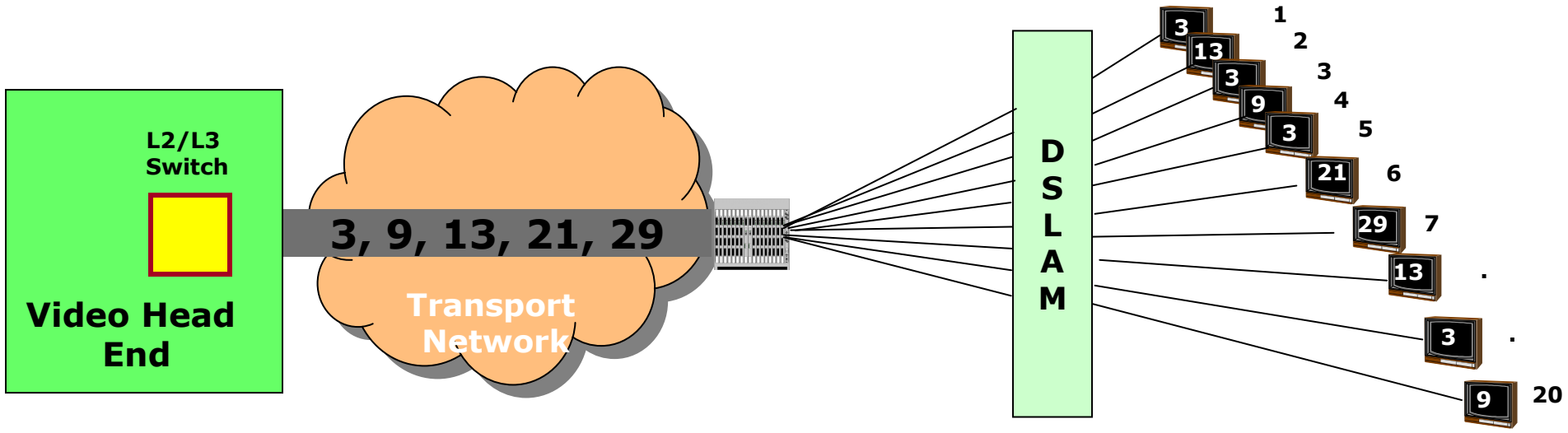
Multicast IGMP

IGMP: Internet Group Management Protocol

Multicast protocol between hosts (set-top box) and router

- How hosts inform routers about group membership
  - IGMP “join”
  - IGMP “leave”
- Router solicits group memberships from directly connected hosts
  - IGMP membership “query”

Router-based Multicast



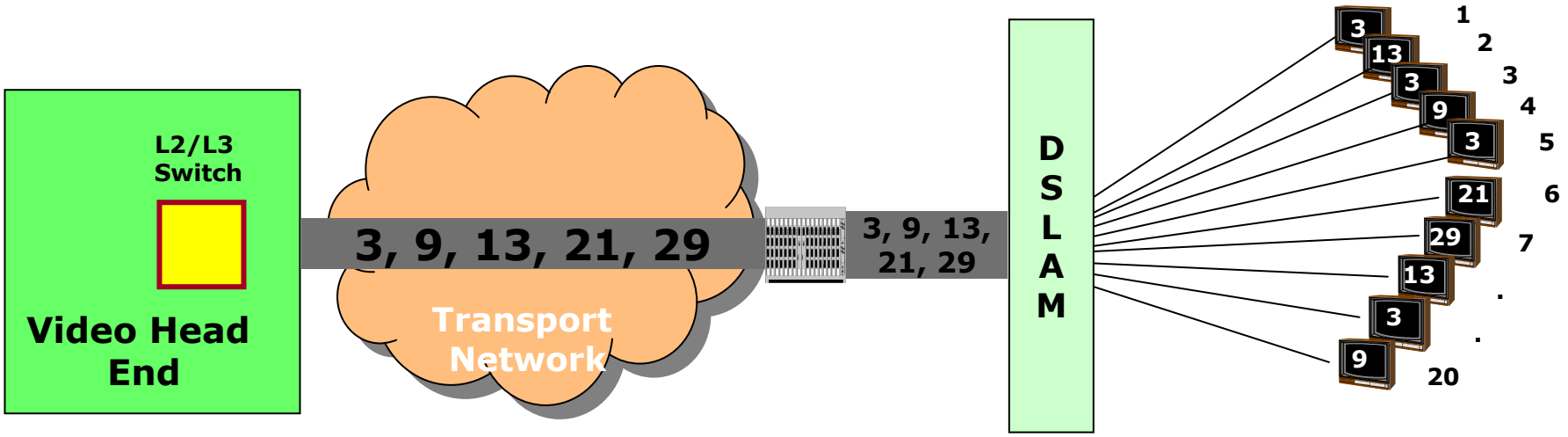
Assume: 5 channels (3, 9, 13, 21, 29)

Potential bottlenecks:

- DSLAM backhaul

Lower Transport B/W, DSLAM bottleneck remains!

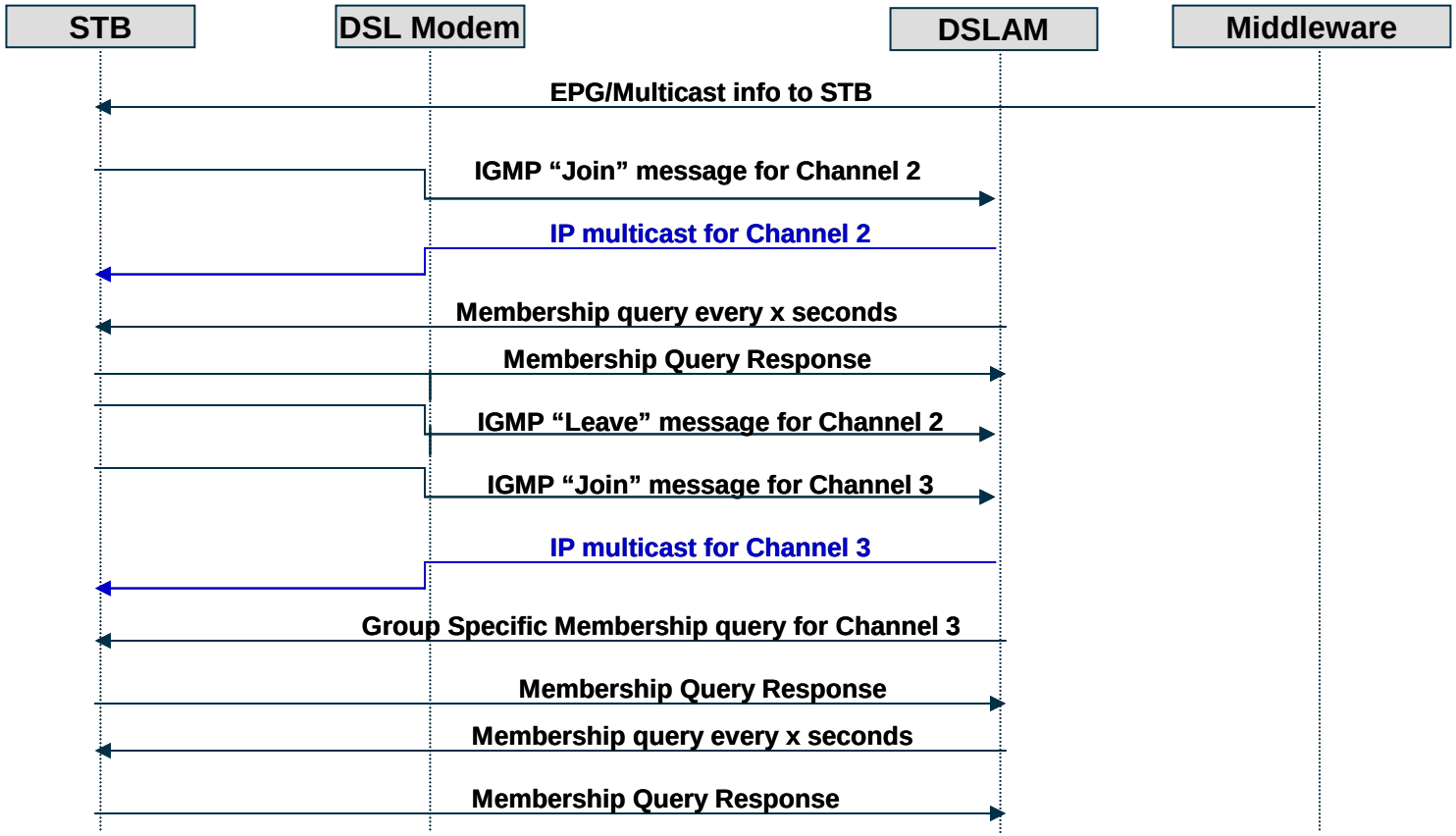
DSLAM-based Multicast



Assume: 5 channels (3, 9, 13, 21, 29)

Most Efficient! Requires DSLAM Multicast Support!

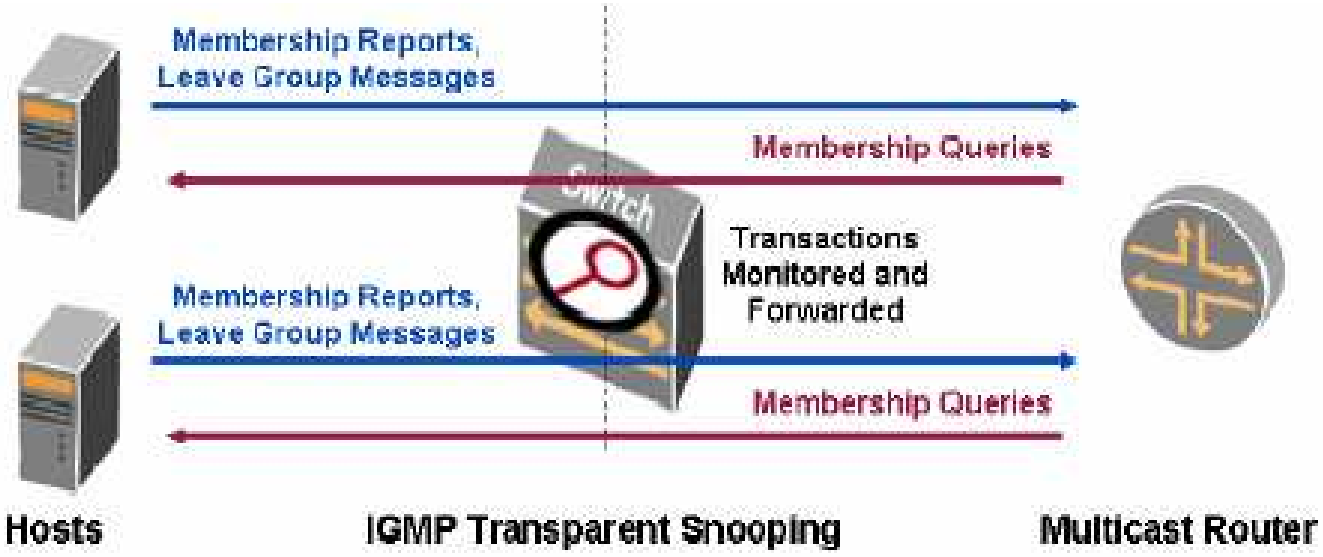
IPTV Channel Flip Mechanism



STB: Set-top Box

DSLAM Multicast Options:
IGMP Snooping

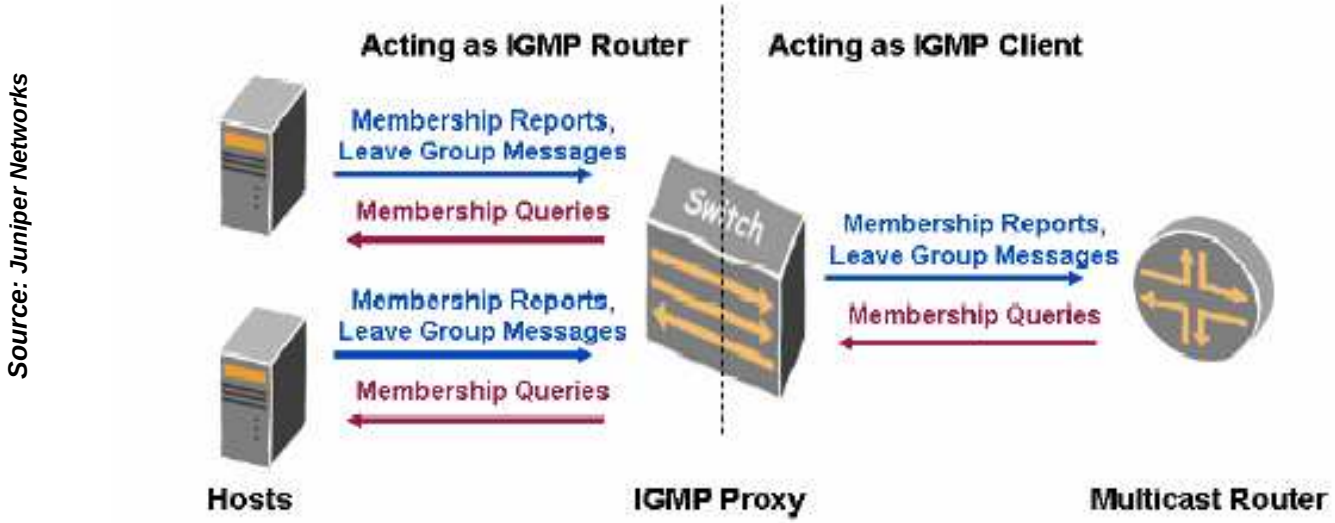
- DSLAM is transparent in the IGMP control path between STB and router
- It monitors IGMP joins/leaves and replicates to appropriate DSLAM port



Source: Juniper Networks

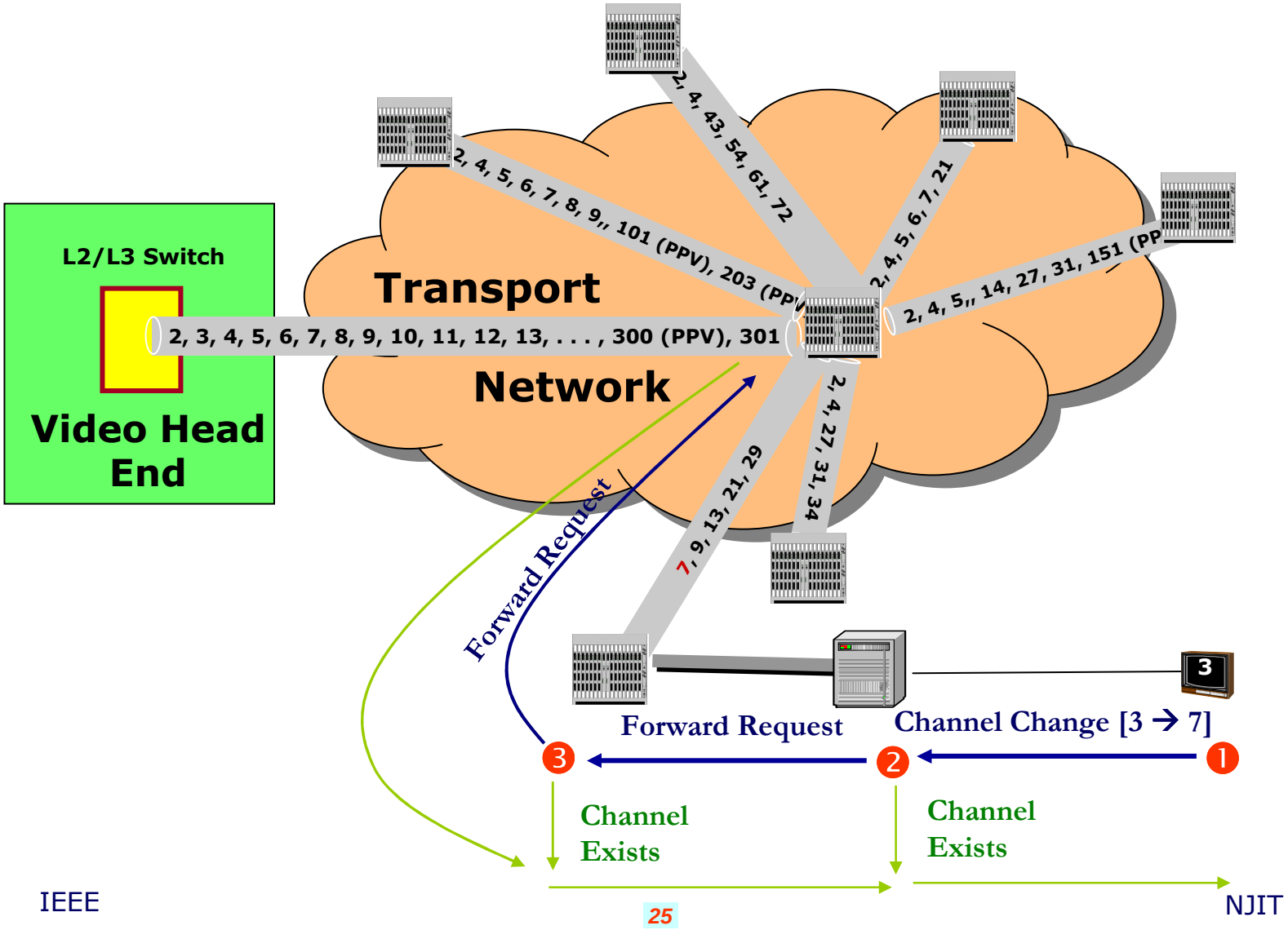
DSLAM Multicast Options: IGMP Proxy

- DSLAM acts as an IGMP server to STBs and as an IGMP client to upstream routers
- DSLAM "hides" individual join/leave messages from STBs and forwards only first (join) and last (leave)



IGMP Proxy vs. Snooping: DSLAM Complexity vs. Latency tradeoff !

Multi-level Multicast and Network Implications of Channel Flipping



So What, For End-User?

For the user, a few differences from Cable TV:

1. Need for a Set-top Box
   - TVs designed for analog broadcast, not needed for basic Cable
2. User experience differences – channel flipping
   - Time, Scalability
3. Program recording
   - DVR, Network PVR

Novel IPTV Services

TV Caller ID with TV "Pause" Feature

Screen shows Caller ID, program pauses. Consumer controls voice call w/ remote.

Blended Web and TV

While watching TV, consumer experiences personalized, interactive communications: Browse Web,Vote, Shop, Phone access, IM or Email.

iLocator for Family Finder™ Applications

Consumers locate family and friends from their TV, via loved ones cell phone.

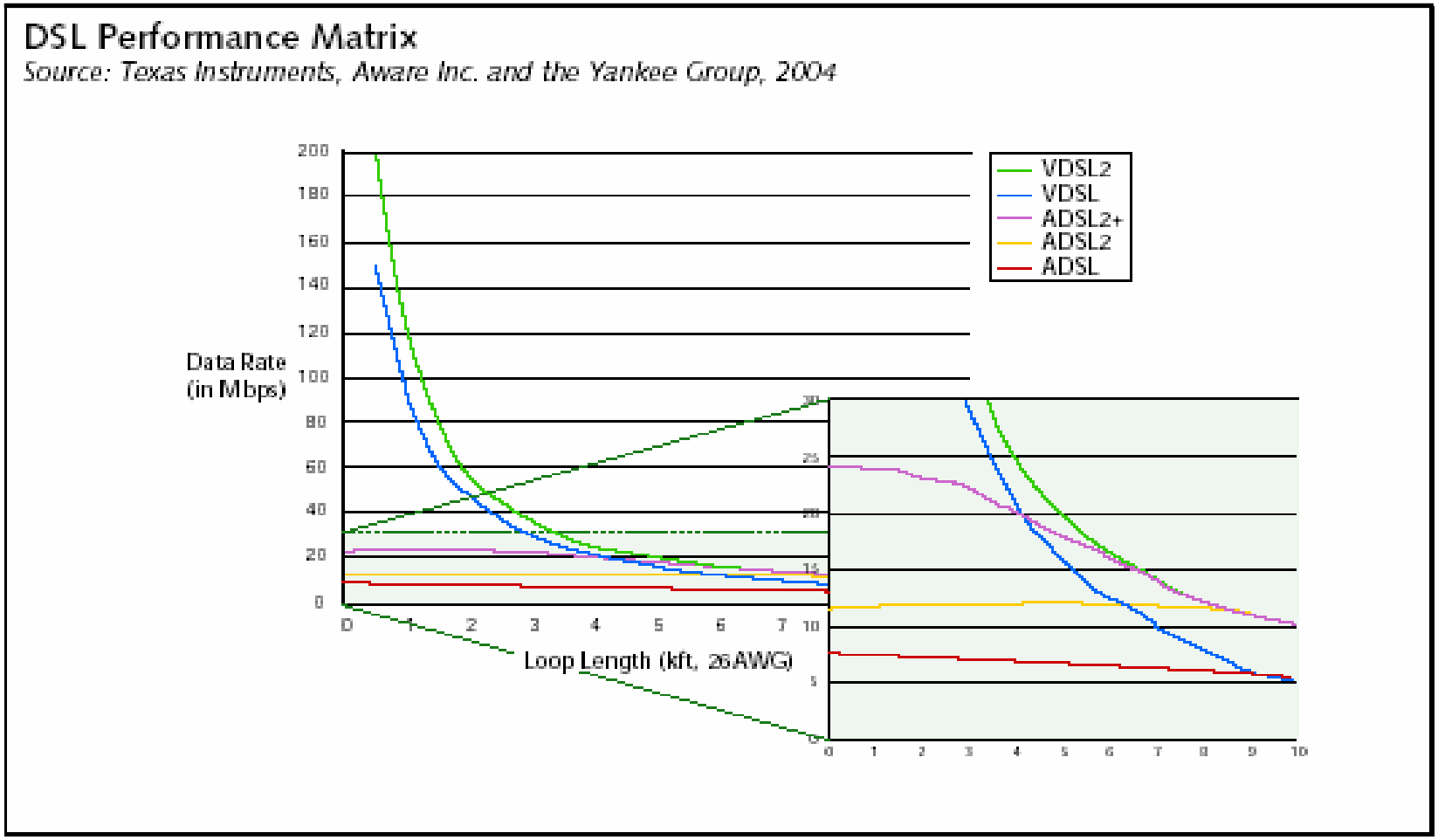
Mobile Multimedia

TV service is forwarded to any location, on any device, with same look and feel as at home.

Source: *Lucent Technologies*

Technology Enablers

DSL Rate Reach Comparison



MPEG Compression

MPEG 2

DTV Standard	Pixel Resolution	Data Rate
Standard Definition DVD Quality	640 x 480	4 Mbps
EDTV	704 x 480	7 Mbps
HDTV	1280 x 720	7 Mbps
HDTV	1920 x 1080	15 Mbps

MPEG4-H.264

DTV Standard	Data Rate
SDTV	< 2 Mbps
HDTV	6-8 Mbps

H.264 most advanced codec in MPEG-4 standard.

- Substantially improves over MPEG-2 performance

HDTV sales in US low but expected to grow

- FCC forcing broadcasters to migrate to digital television

IPTV CPE

DSL modem to terminate DSL signal

Set Top Box (STB)

- Not optional (unlike cable TV).
- Can run a middleware client software to render the EPG data or, a browser to obtain program guide data from server (thick vs. thin client)
- Support for MPEG2, MPEG4 decoding, DRM
- High-end box can run an operating system (Win CE) and off-loads some middleware tasks from Middleware Server
- DSL Modem may be integrated in STB. Obviates the need of an additional box
- Support for 802.11 becoming popular. Simplifying the home networking

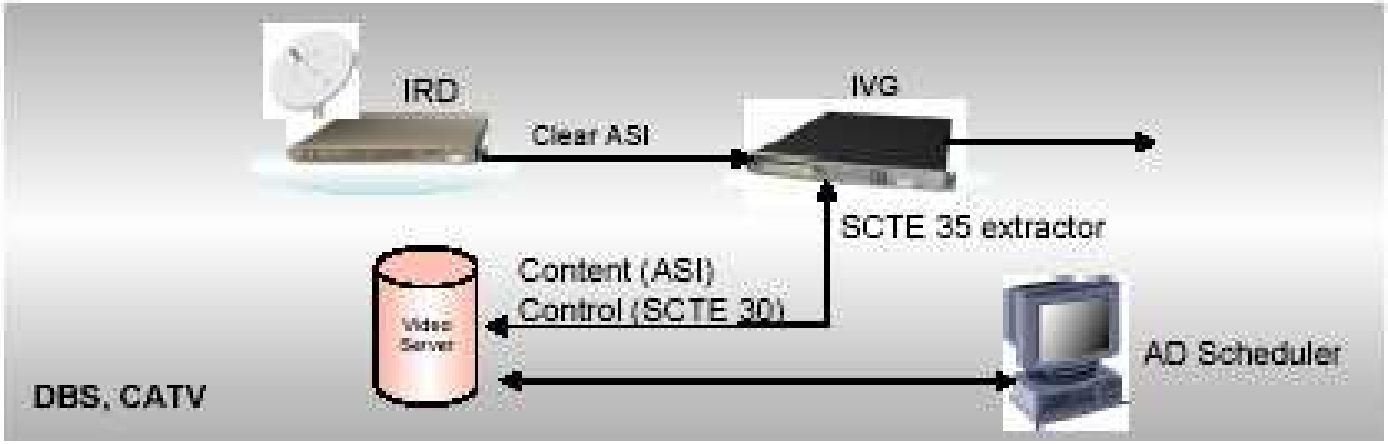
Digital Ad Insertion

Requires ad insertion markers in the transport stream, as *SI tables* (SCTE 35 standard)

Special encoders enable creation of the Ad insertion markers in the transport stream during the contribution process.

At headend, splicer detects the insertion markers and triggers video server to insert relevant ads.

- Communication between the Splicer and the video server is based on the SCTE 30 protocol.



Source: Scopus Network Technologies

Challenges

Content Acquisition

Content acquisition not a familiar territory for service providers

1. Acquiring rights
2. Transport of the content

Extensive channel lineup important for a competitive offering

Content Provider Type	Content	Transport
Direct	✓	X
Co-op (e.g. NCTC)	✓	X
Aggregator (AT&T HITS)	X	✓
Wholesaler	✓	✓

How much bandwidth is enough?

Number of TV sets per household *2-3 (Avg: 2.7, source: Yankee Group)*

HSIA, online gaming bandwidth requirements

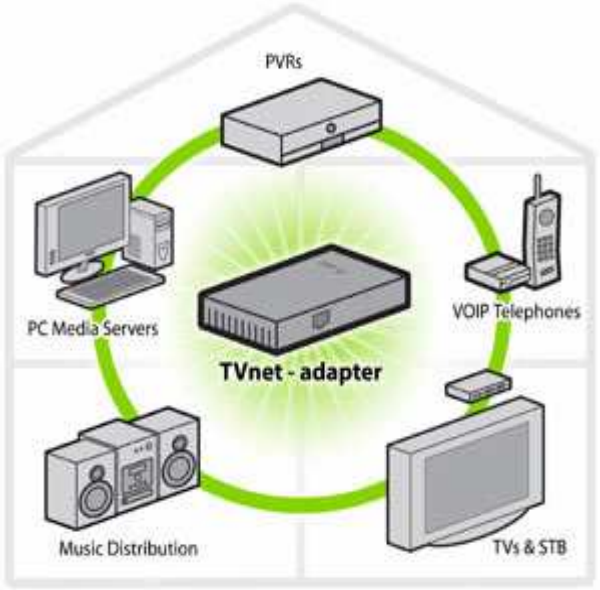
Type of Service	Bandwidth Needed
3 HDTV channels	3 x 6Mbps = 18
HSIA (download, online gaming,VoIP, video telephony)	3-5Mbps
	21-23Mbps

Demonstrates the need for at least ***ADSL2+*** and ***MPEG4-AVC*** compression for a comprehensive offering

Home Networking

DSL terminates at the master STB

- How to deliver content to multiple TVs?



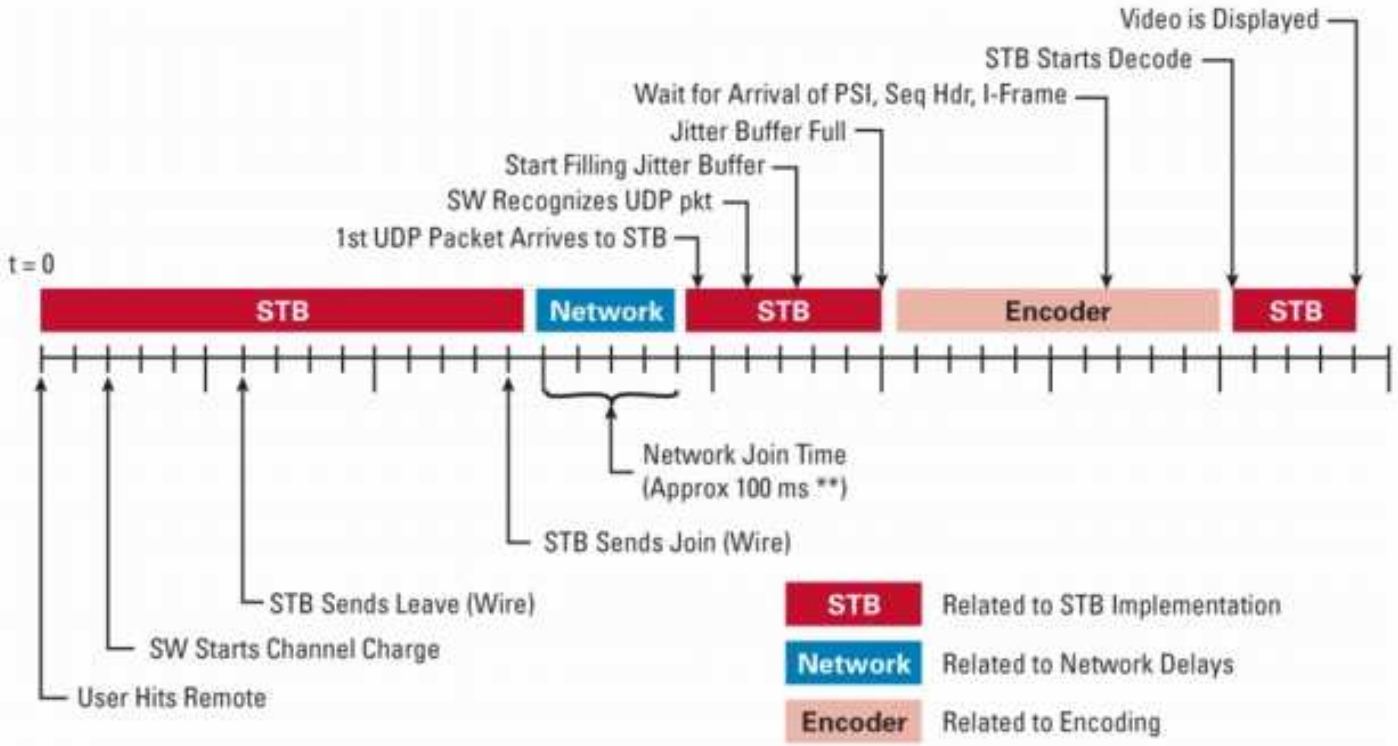
Source: Coaxsys systems

Technology	Pros	Cons
Home Phone Networking Alliance(HPNA V3)	100+Mbps	Must co-exist with DSL
100 Base-T Ethernet	100Mbps, in-expensive	Rare Ethernet wiring inside homes
HomePlug(AV) Power Alliance	250+Mbps	Still in development
Multimedia over Coax Alliance (MoCA)	High bandwidth, 250+Mbps, pervasive	Still in development

Channel Switching Issues

Small channel change latency key to user experience. Three main contributors to channel change timing

- MPEG coding structure (GOP size)
- IGMP join/leave time (network dependent)
- Buffering delays



Alcatel·Lucent

Bell Labs OmniVu Project

Anywhere, Anytime TV

What is Omnivu?

Traditionally TV subscription is tied to the "home"

- No access to subscribed content if not on "roaming" TV lineup

Omnivu provided a *paradigm shift for the TV industry*

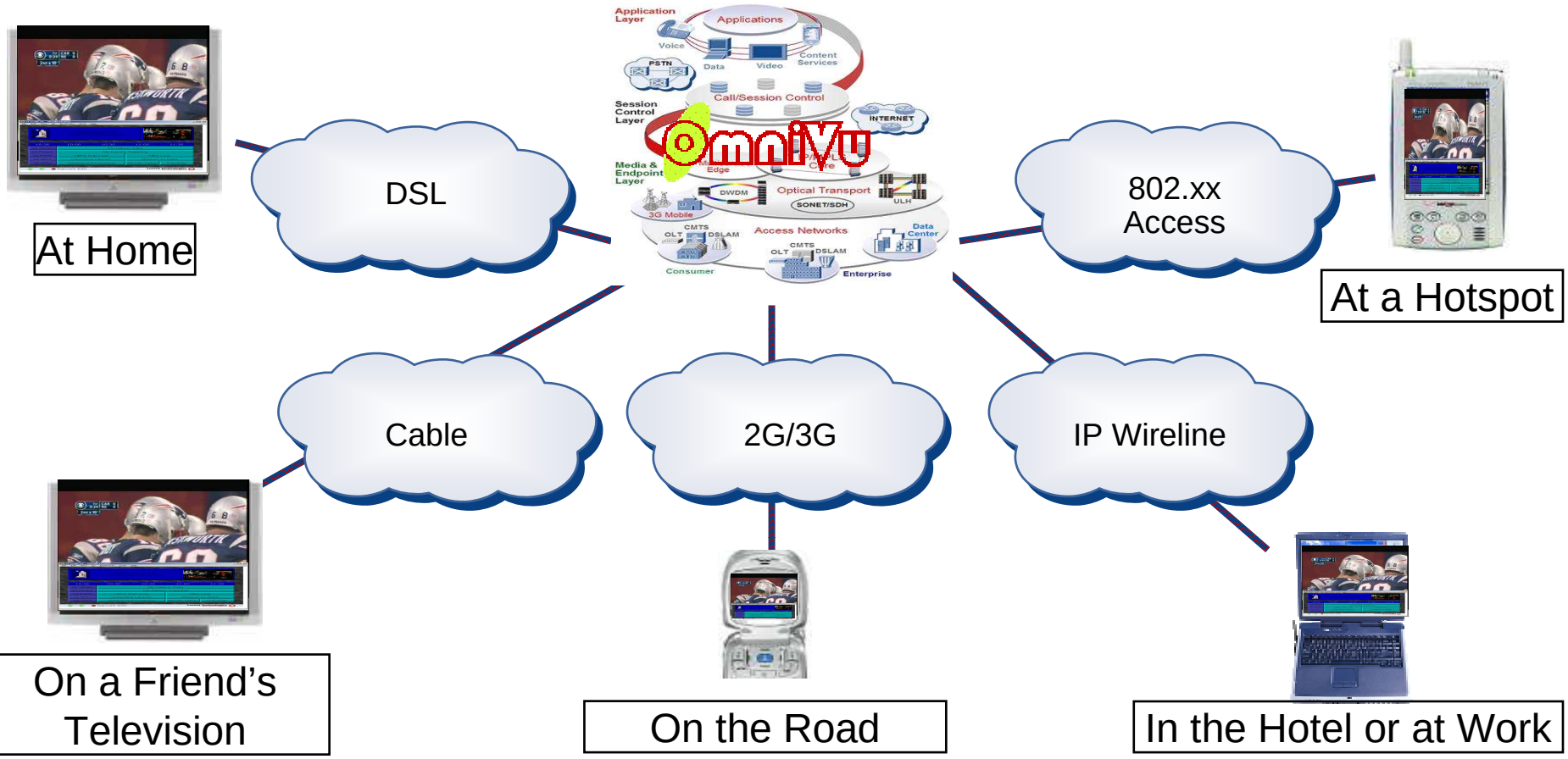
- Launched in Feb 2005

All-in-one Network-based solution for seamless TV "roaming" across:

- Any network: Wireline, Wi-Fi, 3G
- Any location: Home, Hotel, Bus, Train, Friend's Home
- Any device: TV (HD, SD), Laptop, Handheld

Making your TV "follow" you wherever you go!

OmniVu Schematic



OmniVu Is The Only "Three Screens" Solution In The Market Today

Roaming Demo

Demo Scenario:

- Charlie is watching NFL football
- Visitor Swarup interested in viewing soccer (UEFA Cup)
- Charlie does not subscribe to soccer channel (but Swarup does)
- Using OmniVu, Swarup enables his roaming subscription
- The look and feel of the program guide now reflects Swarup's preferences
- Channels from both users are available in this setup (Football -Ch 2, Soccer -Ch 3)
- Swarup disables roaming on the way out and the TV returns to Charlie's lineup

Value Proposition for Service Providers

Service differentiation is essential

- IPTV needs to offer compelling applications to take significant market share or retain share in increasingly competitive world

Anytime, anywhere access to high quality TV content provides new revenue stream with the delivery of different content

- New advertising revenue/promotional opportunities for Service and Content Providers + Advertisers
- More revenue from subscribers (enhanced service offering) and more stickiness/less churn
- Key advantage for providers who offer both wireline IPTV and wireless: e.g. *Family tracker channel*

Service is Low Cost to SP = Large $$ Return on Minimal (additional) CAPEX/OPEX Investment

Technical Challenges

Support from set-top box, DSLAM

- To initiate roaming and overriding the subscription policies contained in STB and DSLAM

Content forwarding, Transcoding, Transrating

- Content needs to be adapted to fit the target device (e.g Laptop, PDA) and routed from source headend to destination

OmniVu as a standalone system requires interfacing with the various middlewares

Interfacing with Hotel or other networks may also be required

Popular Press Coverage

(MiViTV:Bell Labs code name, MiViewTV: Original Bell Labs Name

BBC: Among six "coolest" gadgets of CeBIT 2006

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Cebit 2006: Gadget round-up

By Mark Ward
Technology Correspondent, BBC News website, in Hanover

The Cebit technology fair is taking place in Hanover. Here are some of the coolest gadgets on display:

SAMSUNG VP-X210WL

Although digital camcorders are shrinking all the time you still have to hold them to shoot pictures even when it would be safer to have both hands free.

Samsung has gone some way

LUCENT MIVIEWTV

Soon you will be able to take your own personalised TV channel with you wherever you go.

US firm Lucent is showing off at Cebit a concept for the days when we get our TV piped via the net rather than through the old-fashioned airwaves.

MiViewTV aims to operate in a similar way to webmail services

Called MiViewTV, the idea aims to let people watch the TV channels and programmes to which they have subscribed no matter where they are.

Lucent spokesman Eric Kamp said it aimed to operate just like webmail services such as Hotmail and Gmail which let users read their messages no matter which computer they use.

Similarly, by the use of a login, the MiViewTV idea aims to let people sit down in front of any IP-enabled TV system and watch as if they were at home

BBC NEWS: VIDEO AND AUDIO
Watch special coverage of the Cebit fair in Hanover
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CEBIT 2006

LATEST NEWS
- Cebit rings mobile phone changes
- Fuel cells to change laptop use
- Radio tag study revealed
- Handheld PC dominates

FEATURES

IEEE

FT (London) article on TV "Roaming"

FINANCIAL TIMES
TUESDAY NOVEMBER 8 2005

MEDIA TECHNOLOGY

The roaming revolution that will be televised

Subscribers to premium channels may soon be able to watch television programmes anywhere outside their homes, writes Thomas Clark

Last week, the heads of four big US cable companies, among them Comcast and Warner Cable, as well as the head of one of the country's biggest mobile phone operators, Sprint-Nextel, hosted a press lunch in a posh hotel in New York's Upper East Side.

The five CEOs announced a joint venture to develop a series of "converged" services that would allow people to watch clips from their favourite cable television programmes on a mobile device. And some audience members were invited to indulge in a "live" demonstration on their own mobiles.

Swarup Acharya might have reacted to this glimpse of the future with a yawn – just as the e-mail services offered by Yahoo or MSN allow one to check e-mail from any internet terminal. Mr Acharya's colleague logs out Paul at his home television and enters the pay-TV services with Frank's identification details. Suddenly, the sports channel that was blocked is activated and available to watch.

"Today a premium television service is not really linked to a person," he says. "It is linked to a location. Once you are outside your living room, it doesn't help you that you have subscribed to a premium television service because you simply can't access it."

In his showroom this issue has already been solved. To show how a pay-TV service can be accessed from various locations, the research team has set up a makeshift wall between two ordinary television sets with a makeshift wall between them. One of the television sets, Mr Acharya explains, resides in the home of a subscriber he calls Frank. The other television set is in the virtual home of Frank's friend Paul.

'Once you are outside your living room, it does not help that you have a premium service because you cannot access it'

Spain by Telefónica. Moreover, he says, it will have a breakthrough in the US at the beginning of 2006, when the two biggest telecoms operators in the country, Verizon and SBC, start using their beefed-up telecommunication lines to offer hundreds of television channels via IP-TV.

Yet why should any of these operators, let alone the content creators and rights owners, allow such universal access? One danger, for example, is that customers simply hand out their passwords to friends, reducing the number of actual or potential subscribers to a premium television service.

According to Mr Acharya the solution to the problem lies in "roaming", a term from the mobile phone industry that describes the

INDUSTRY INSIDER: TECH & TELECOM

Bell Labs aims for next step in Internet television

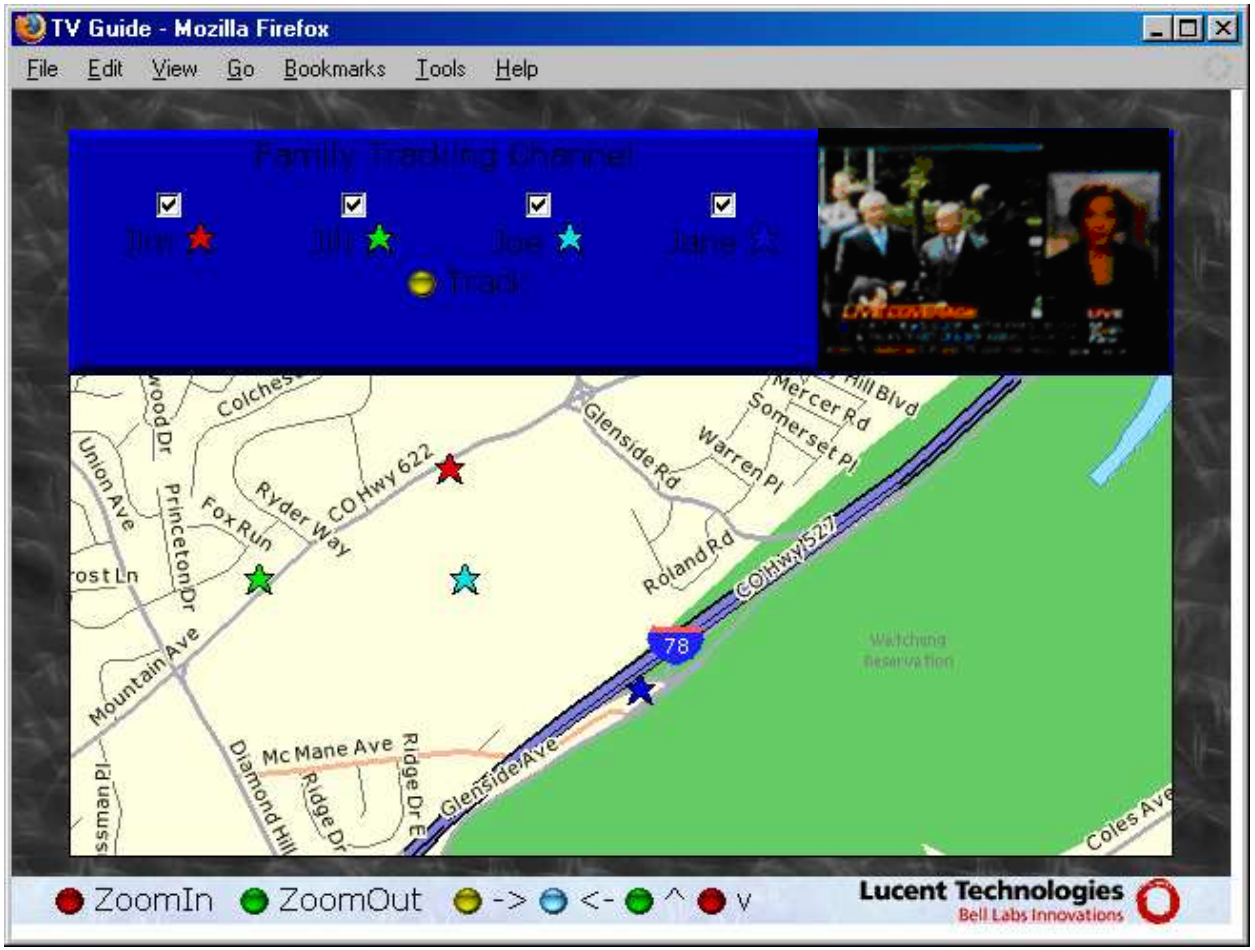
FINANCIAL TIMES DEUTSCHLAND

Pay-TV zum Mitnehmen

von Thomas Clark, New Jersey

Es hat ein bisschen gedauert, aber nun sind die Zahlen beeindruckend. Der Markt für Pay-TV und vor allem für den Abruf eigener Wunschprogramme zu beliebiger Zeit hebt in den USA ab.

Personalized Content – Family Tracker Channel



An Unique application which spans both wireline and wireless technologies

– Demonstrates the value proposition for IMS infrastructure in enabling converged applications

Conclusion

ADSL/VDSL has provided the highly anticipated "*big pipe"* to consumers home

- Transport cost $$/bit is constantly declining

Advancements in video compression, reliability of IP transport enabling digital-quality video transmission

Regulatory and franchisee issues seem to be working in favor of service providers

Telcos have the know-how in operating large scale IP networks

- Content acquisition, Video head-end design, and monitoring are the key field deployment challenges

Service differentiation is critical to compete with cable MSOs

- Telcos need to offer *cool applications* leveraging their wireline/wireless presence

Conclusion(contd.)

OmniVu like systems offer the opportunity for service providers to differentiate their offering

- Generate additional revenue stream

Applications such as *Family tracker channel* give Telcos with wireless presence (e.g. Verizon) an unique competitive advantage

- An offering cable operators can not match without wireless partnership

Telcos should leverage the unique advantage with wireline/wireless business to offer such differentiating IPTV applications

Thank You

Questions??