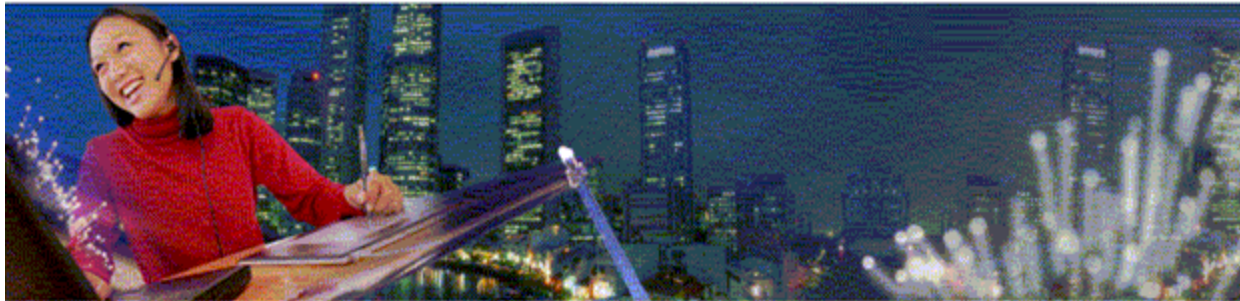


IPTV Technologies and Deployment Challenges



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Outline

What is IPTV?

Market Drivers

Triple Play/IPTV – A Quick Introduction

Technology Enablers

Network Transport Architectures

Challenges

Competitive Threat

IPTV Vendors and Service Provider Strategies

Conclusion

Triple Play/IPTV—A Quick Introduction

Basics

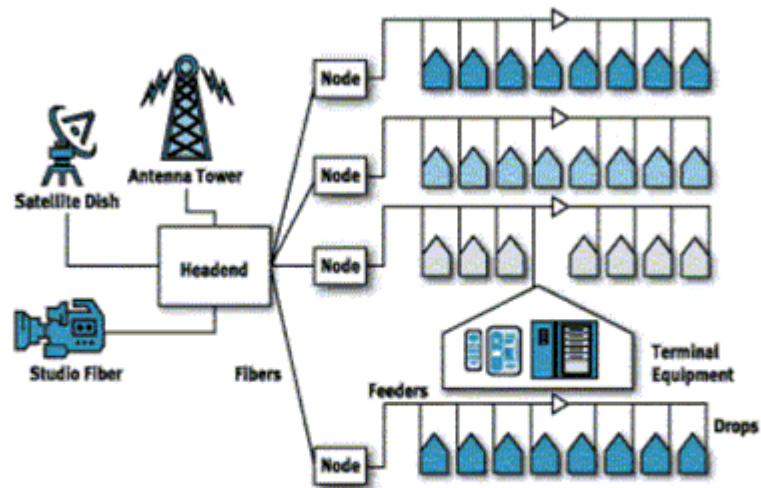
Triple-play refers to delivery of voice, video and data over a single pipe

–*Quadruple-Play*: T-play + Wireless offer

IPTV is digitally encoded video switched and delivered over managed IP infrastructure

Access network could be *xDSL*, Fiber-to-the-Home (*FTTH*), Fiber-to-the-Node (*FTTN*), Fiber-to-the-curb (*FTTC*)

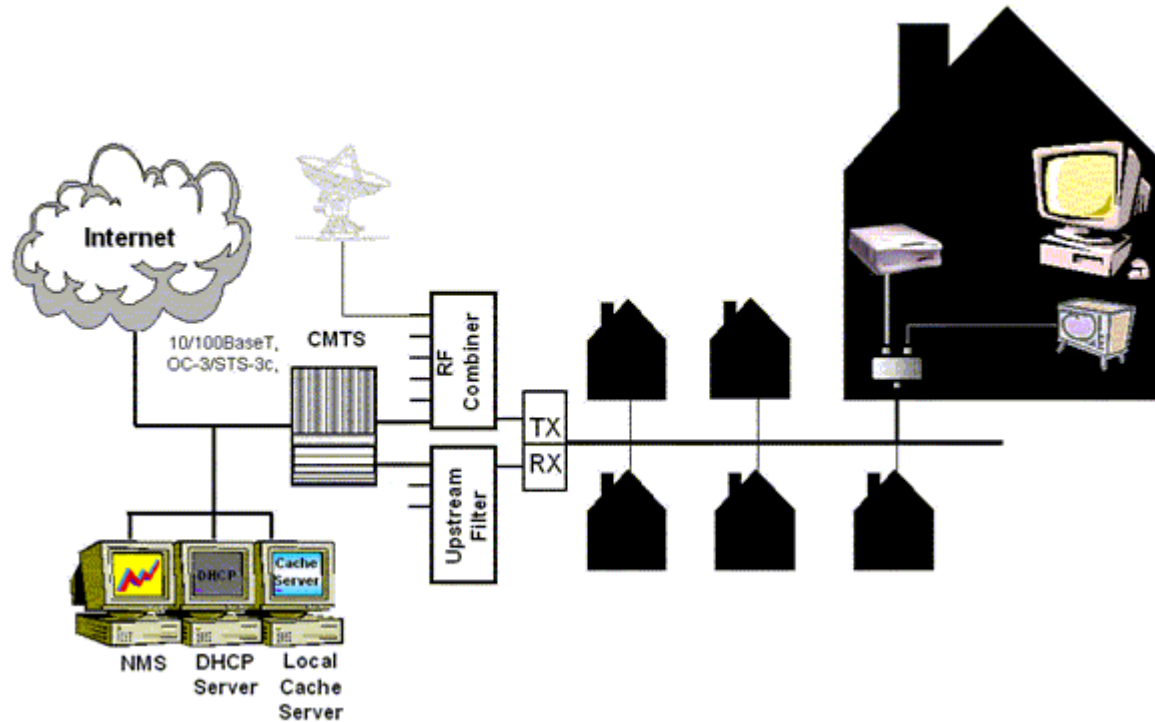
The Cable Plant Architecture



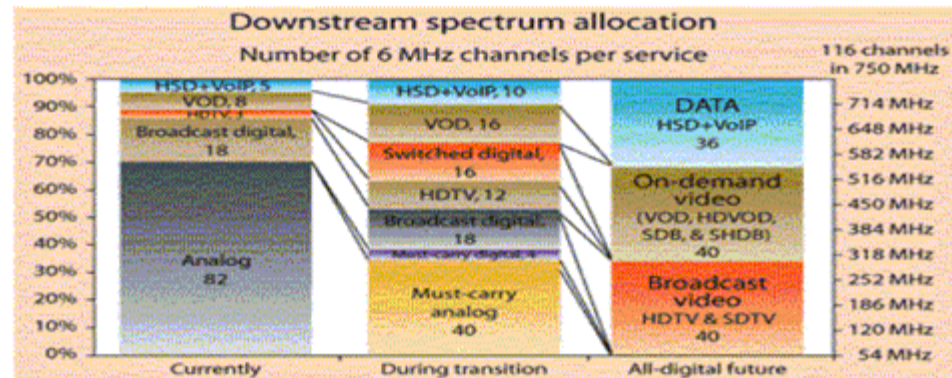
Today, most plants are HFC – Hybrid-Fiber Coax

- Fewer amplifications
- Two-way communication

Cable Modem/Data Architecture



Cable Spectrum



Downstream bandwidth is shared among all users in the loop (typically, ~ 500-700 households)

➤ About 4.5 Gbps total bandwidth

– 40 mbps per 6Mhz channel

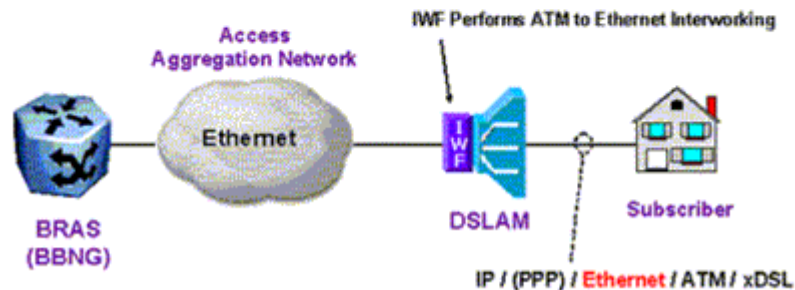
Data+Voice bandwidth to rise from 5% (today) to third of total

DSLAM

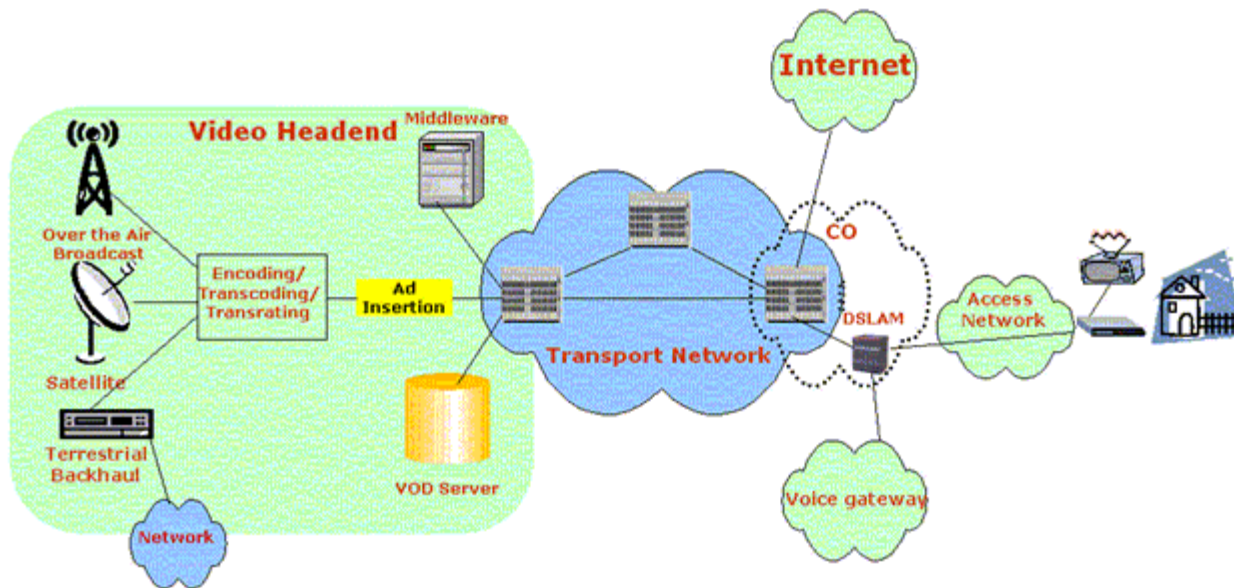
Digital Subscriber Loop Access Multiplexer key element of the DSL access network

Interfaces between DSL line on customer side and the transport network

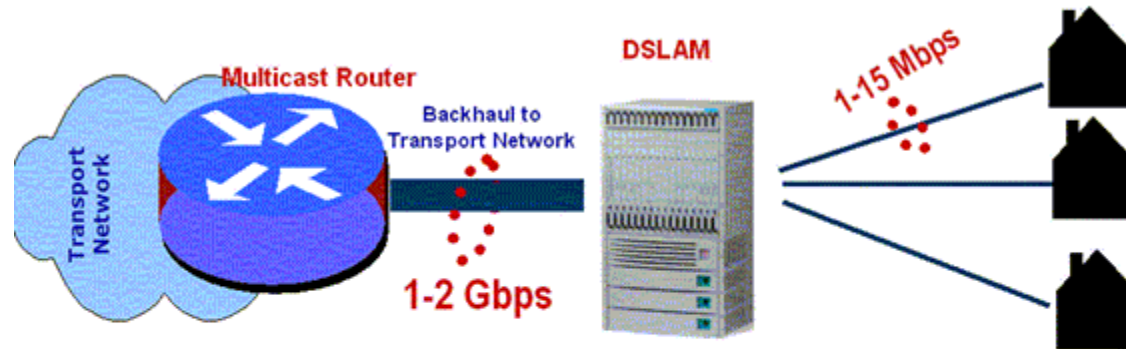
DSLAMs migrating from ATM-based to IP/Ethernet-based backhaul



IPTV Reference Architecture



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 \cong 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 \rightarrow 3 channels/TVs

This is the primary driver for switched video

\Rightarrow No longer a “broadcast” TV model

So What, For End-User?

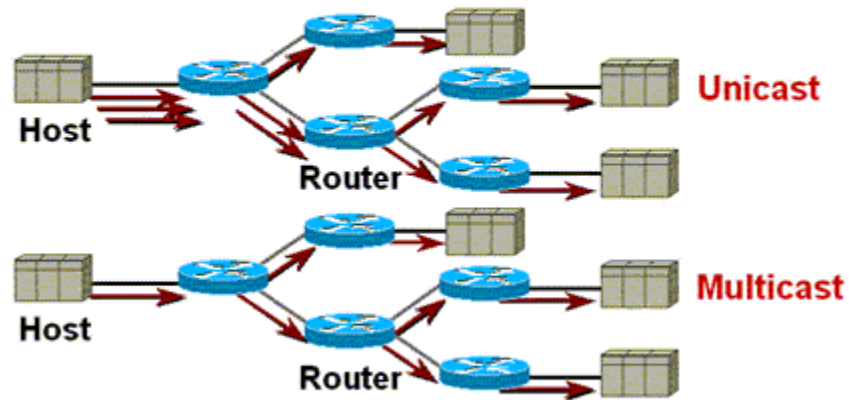
For the user, a few differences from Cable TV:

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

Multicast

Core technology driving IPTV

First large-scale commercial use



Key requirement: Packet "replication" at appropriate routers

IPTV and Multicast

For IPTV deployments with switched video:

➤ Every channel maps to a multicast address

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

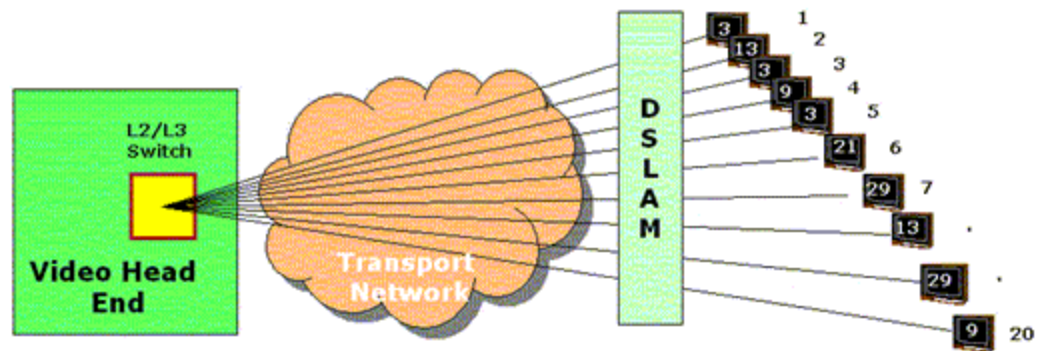
Multicast IGMP

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”

Unicast TV Delivery

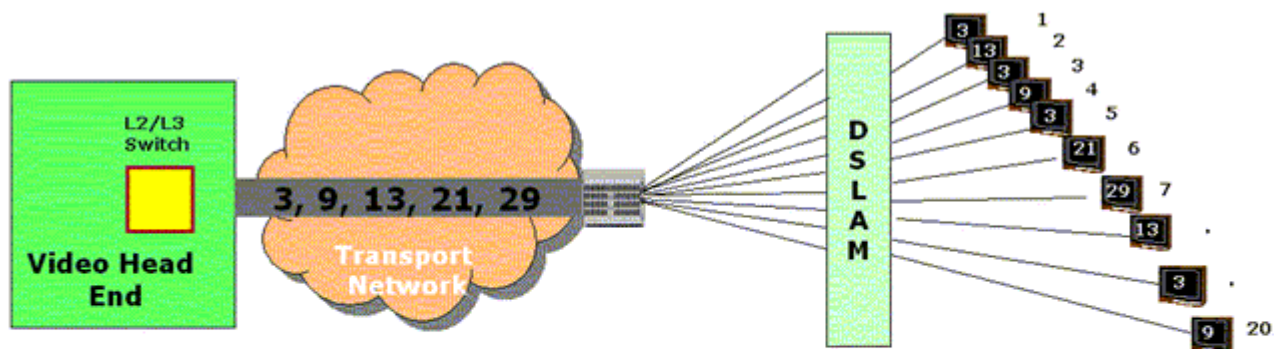


Assume: 5 channels
(3, 9, 13, 21, 29)

Potential bottlenecks:

- Transport network
- DSLAM backhaul

Router-based Multicast



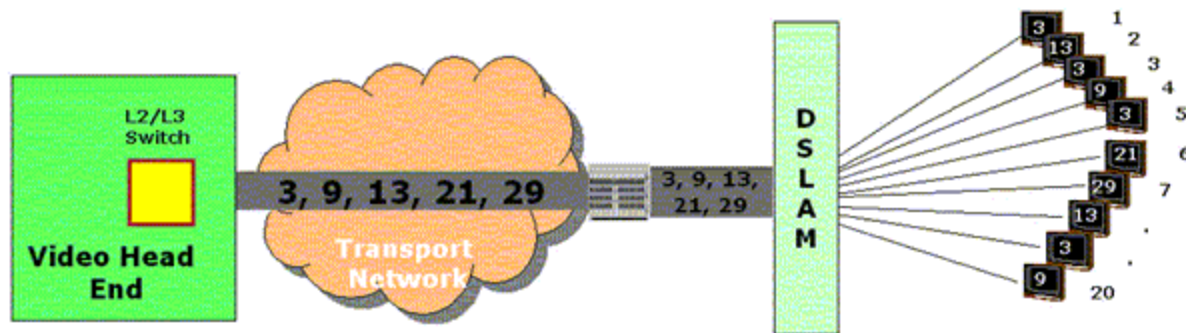
Potential bottlenecks:

- DSLAM backhaul

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

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

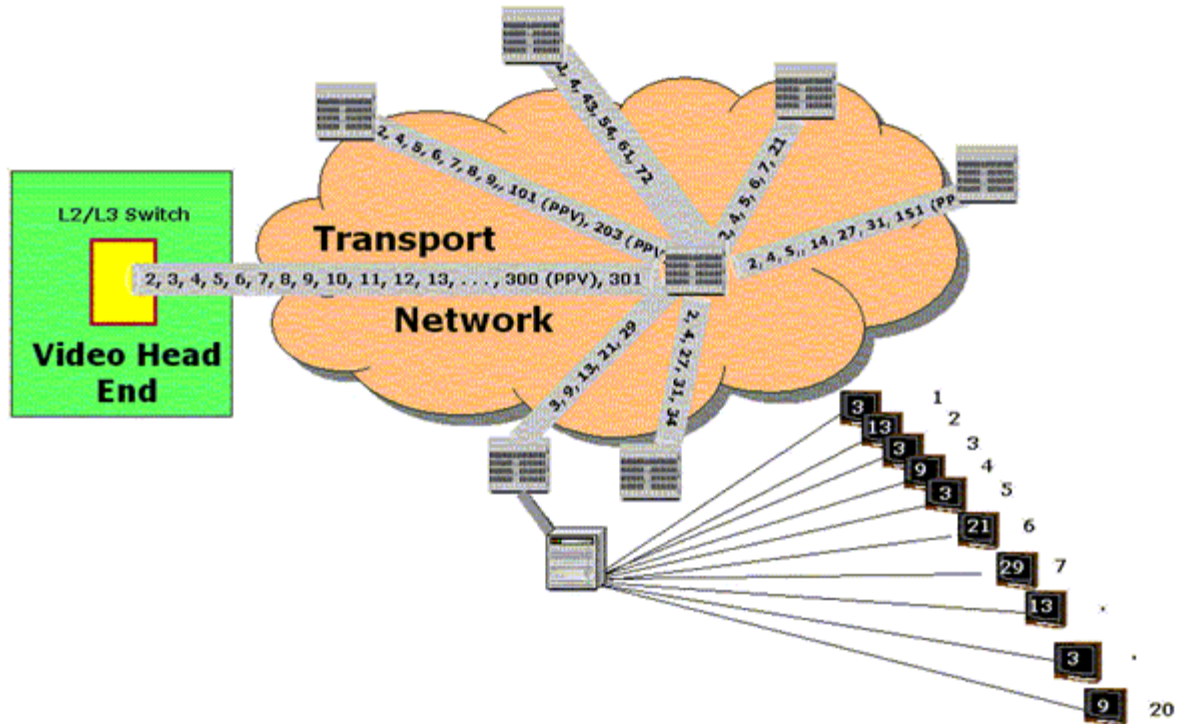


DSLAM Multicast Options: IGMP Proxy

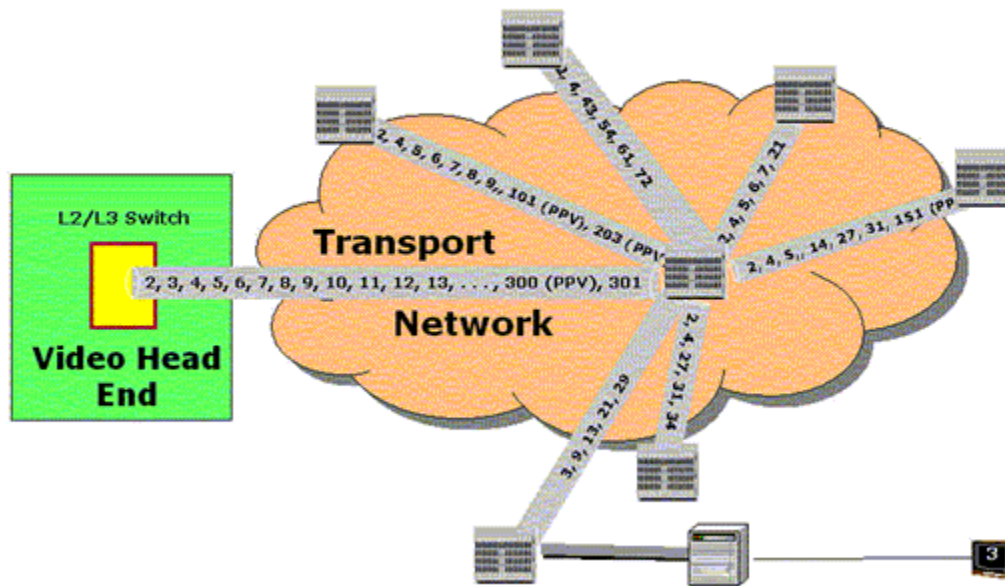
- DSLAM acts as an IGMP server to STBs and as an IGMP client to upstream routers
- DSLAM “hides” individual join/leave messages from STBs and forwards only first (join) and last (leave)



Multi-Level Multicast



Network Implications of Channel Flipping



Channel Flipping Impact

Latency key factor driving quality of user experience

- Minimizing flip latency critical

Other factors besides network determine latency

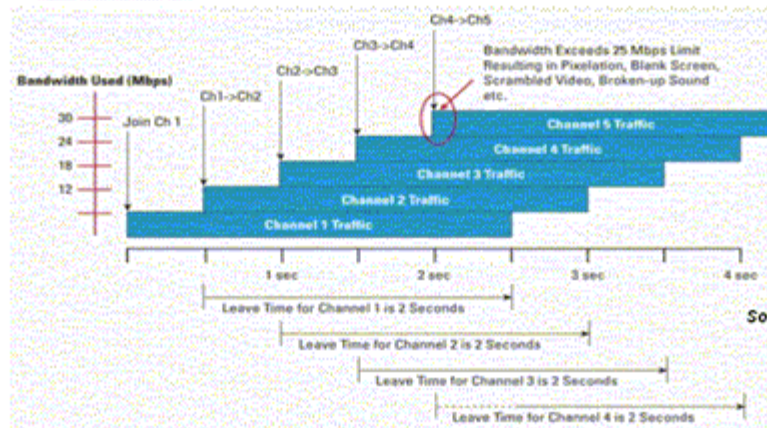
- More later in tutorial

More importantly for the operator, will the network scale?

Poor designed network can “freeze” at critical moments

- Overloaded DSLAM/Routers can lose IGMP messages
- Network has to be sized for worst-case scenarios
 - After popular TV programs end (e.g., Superbowl, Season finale of *Friends* series)

IGMP Leaves



Let's assume:

25 Mbps bandwidth, MPEG-2 stream of 6 Mbps, user switching channels every 0.5 seconds, join latency 0.5 sec, leave latency 2sec

If Latency (join) < Latency (leave), system will glitch!

Novel IPTV Services

TV Caller ID with TV "Pause" Feature

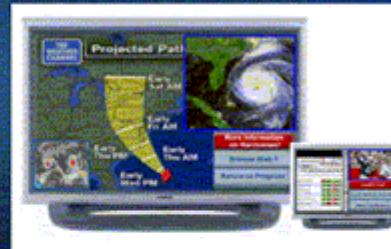
Screen shows Caller ID, program pauses.
Consumer controls voice call w/ remote.



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.



Source: Lucent Technologies

Mobile Multimedia

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

