

# Multicast and the “Triple Play” : The Business Case

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SANOG 7 Meeting 2006

# Thanks

- Thanks to
  - The Internet 2 Multicast Workshop team and the I2 Multicast Working Group
  - Gurvinder Singh, Cisco Systems
  - Toerless Eckert, Cisco Systems
  - Leonard Giuliano, Juniper Networks
  - Michael Luby, Digital Fountain
  - John Kristoff and Tim Ward, Northwestern U.
  - Dave Schroeder and David Devereaux-Weber, U. Wisconsin - Madison
  - Brandon Butterworth, BBC.

# Multicast Applications

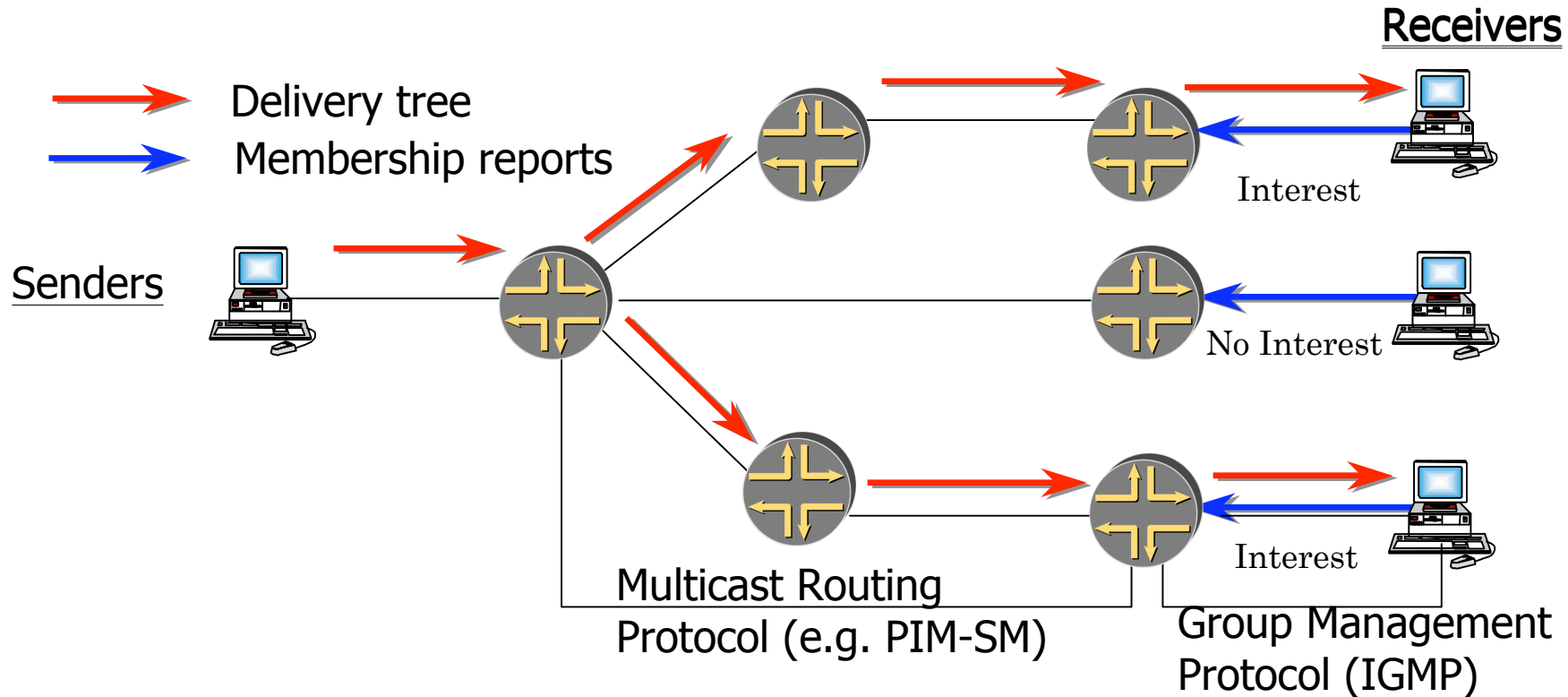
- Multicasting is how the Internet broadcasts
  - Multicast delivers packets from one or more sources to one or more receivers without unnecessary duplication.
- Multicast is slowly becoming ubiquitous “behind the scenes” in network applications
- Multicast applications are focused around the
  - Timely distribution of data
  - Distribution from unknown sources
  - Distribution to large numbers (such as video)
- Multicast is becoming a crucial component of the “Triple Play” of VOIP, Data and Video.

# The Basic Idea

Rather than sending a separate copy of the data for each recipient, the source sends the data only once, and routers along the way to the destinations make copies as needed.

In Unicast, you worry about where the packet is going to, in Multicast, where it came from.

# The Essence of IP Multicast



- Sources send data, receivers express interest, the network (routers) get the data from the source to the receiver
  - And, equally important, the network keeps data from those that don't want it
- The Data flow along one unique path from the source (or a Rendezvous Point) to each receiver, with no loops - the **Multicast Tree**.

# Multicast Grows Up

- Since 2000, the building blocks for a multicast-enabled Internet have been put into place.
  - Protocol Independent Multicast – Sparse Mode (PIM-SM) was developed and deployed.
  - Multiprotocol BGP (MBGP) multicast peering was developed and deployed.
  - The service model was split into:
    - a many-to-many part (e.g., for videoconferencing): Any-Source Multicast (ASM), and
    - a one-to-many (or “broadcast”) part: Source-Specific Multicast (SSM).
- By 2006, with the use of Multicast accelerating, “Triple Play” became the buzzword of the moment - Voice, data and (Multicast) video, all on the same network.

# What capabilities does IP Multicast provide ?

- **Timely** distribution of data
- **Robust** distribution of data
- **Cost-efficient** distribution of data

“Data” here could be

- Files
- Streamed Audio or Video

# Cost Efficient Data Distribution

- This is the core of the streaming case.
  - Unicast streaming to millions is just too expensive.
  - This is true either on the commodity Internet or on the Intranet.
  - Multicast is especially compelling for video.
- At \$ 100 Mbps / month, a 2 Mbps unicast video channel would cost \$ 200 per month per user for IP transit.
  - At a CPM of \$ 25 (USA Superbowl), advertising could bring in \$ 60 to \$ 120 per viewer per month.
    - Not counting cost of content, cost of acquiring ads, etc.
- Multicasting is needed to make Internet video make economic sense.



# Commerical Multicast Video Distribution

- Multicast is becoming the preferred means of distribution for video (TV) to Set Top Boxes (STB) over IP Networks (i.e. IPTV).
- Why ?
  - It saves money.
  - It uses the IP Infrastructure
- The Buzzword of the day is “Triple Play” - Data, VOIP, and Video on the same network
  - And this requires Multicast Video

# Multicast Video Today

I will cover 3 test cases :

– Northwestern University (NUTV)

<http://www.i2-multicast.northwestern.edu/>

– University of Wisconsin (DATN)

<http://datn.wisc.edu/about/>

– Hong Kong Broadband Networks (HKBN)

[http://www.cisco.com/application/pdf/en/us/guest/netsol/ns610/c647/cdecont\\_0900aecd80375b69.pdf](http://www.cisco.com/application/pdf/en/us/guest/netsol/ns610/c647/cdecont_0900aecd80375b69.pdf)

# Northwestern's Experience

- Effectively, Northwestern University is running a medium sized “cable” company, except entirely through IP Multicast.
- Northwestern uses video broadcast solutions from Video Furnace, Inc.
  - <http://www.videofurnace.com/>
    - “The Video Furnace solution handles all the heavy tasks of capturing and encoding live video to standards based MPEG streams with quality from VHS to full D1 broadcast, while seamlessly managing the distribution of client viewers to your Windows, Mac and Linux users.”
- NUTV estimates they saved about \$ 3 million USD from not having to do a Coaxial cable install.
  - The Triple Play ideal - only one network to install and maintain



# What Has Been Deployed?

- 20 channels of entertainment television
  - Combination of off-air and CATV channels
- Multicast to all undergraduate dormitories (4350 unique locations)
- MPEG2 encoding, 29.97 FPS, ~2Mbps per stream (128Kbps mono audio)

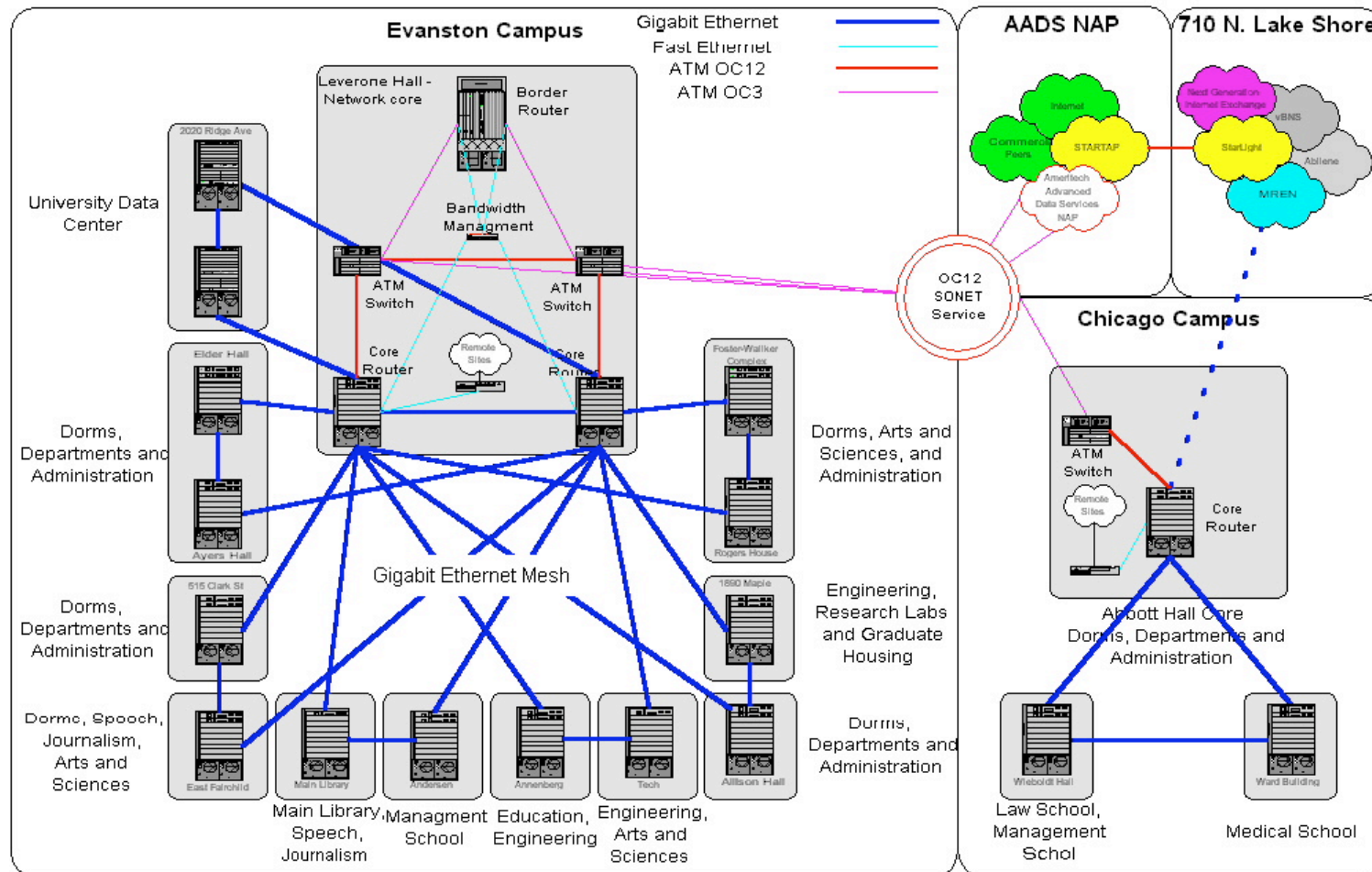


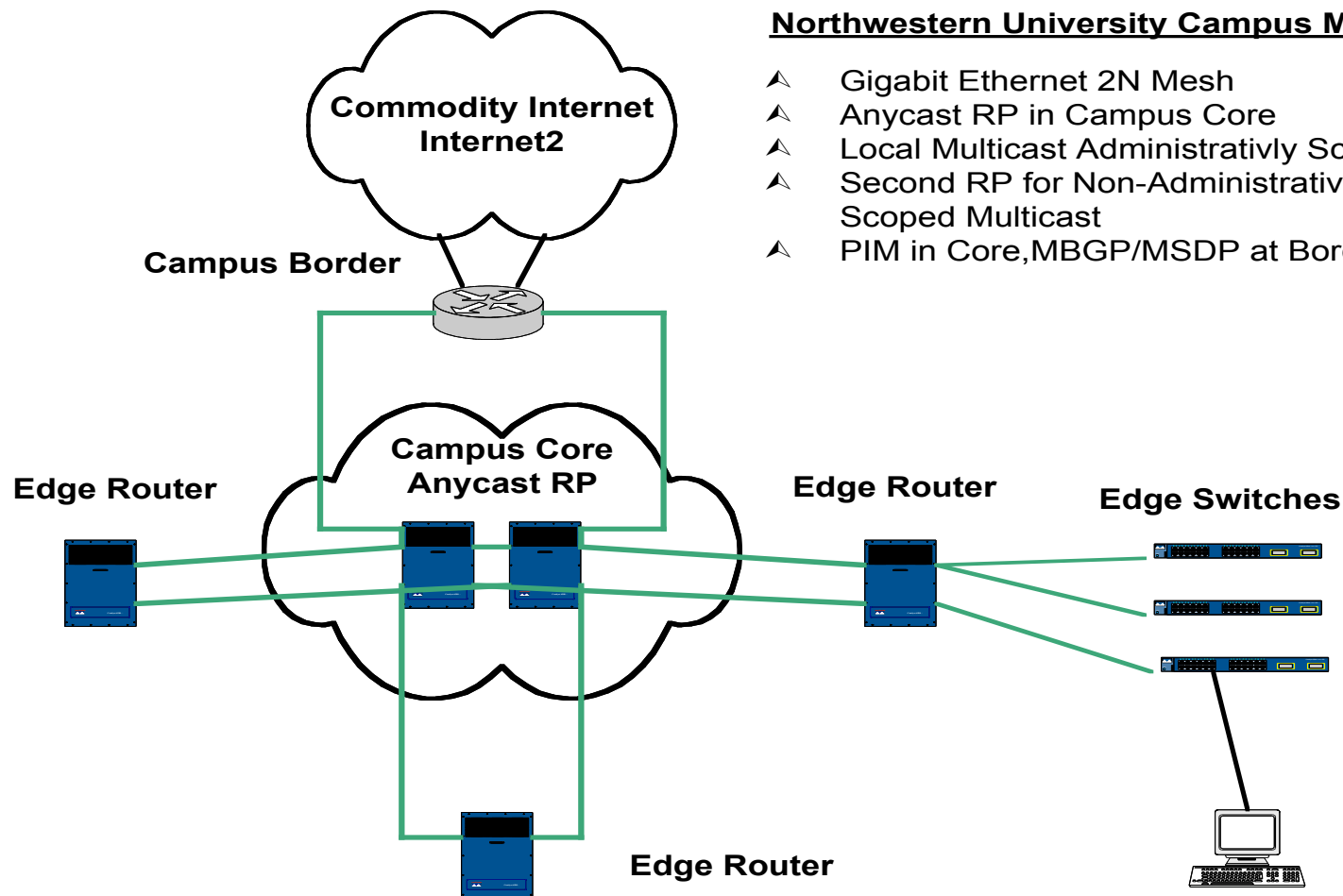
## Why Deploy This Type of System?

- No CATV in student dormitory rooms
  - Only in common areas/lounges
- Over 60 residence halls
  - Cost to wire with coax very high (\$2-\$5 Million)
  - Estimated time of completion: ~4 years
- CATV major issue for the student population



## Northwestern University Network



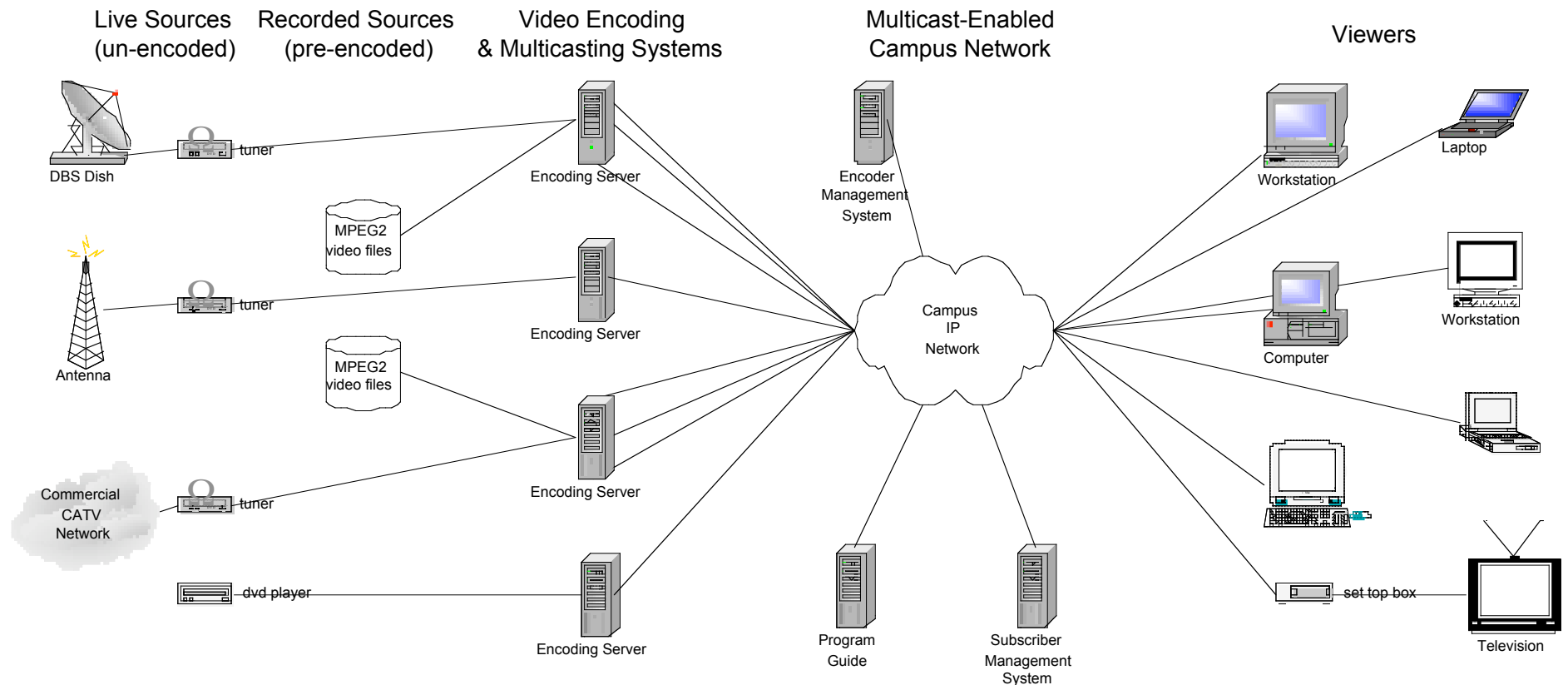


## Northwestern University Campus Multicast

- ▲ Gigabit Ethernet 2N Mesh
- ▲ Anycast RP in Campus Core
- ▲ Local Multicast Administratively Scoped
- ▲ Second RP for Non-Administratively Scoped Multicast
- ▲ PIM in Core, MBGP/MSDP at Border



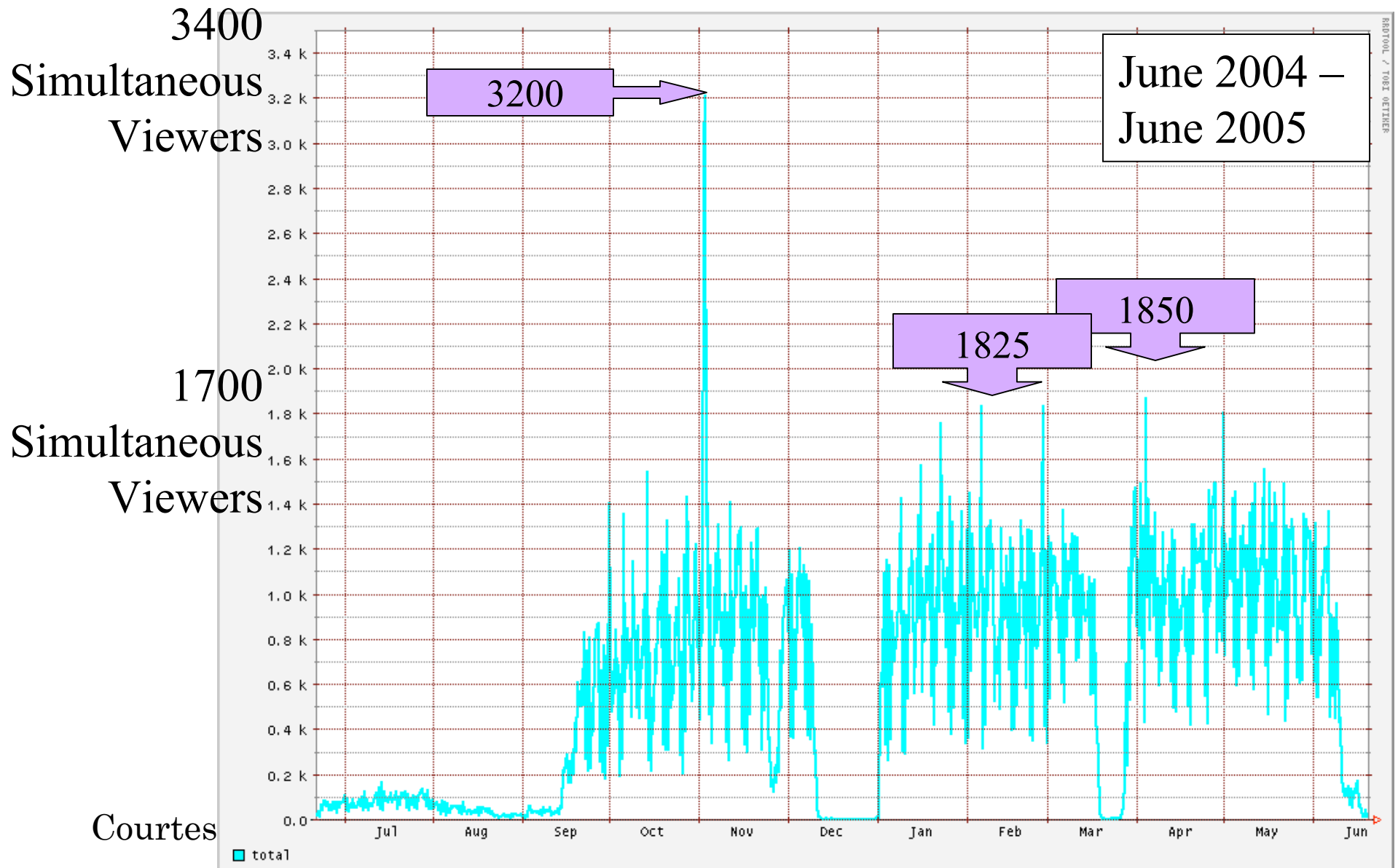
# System Components



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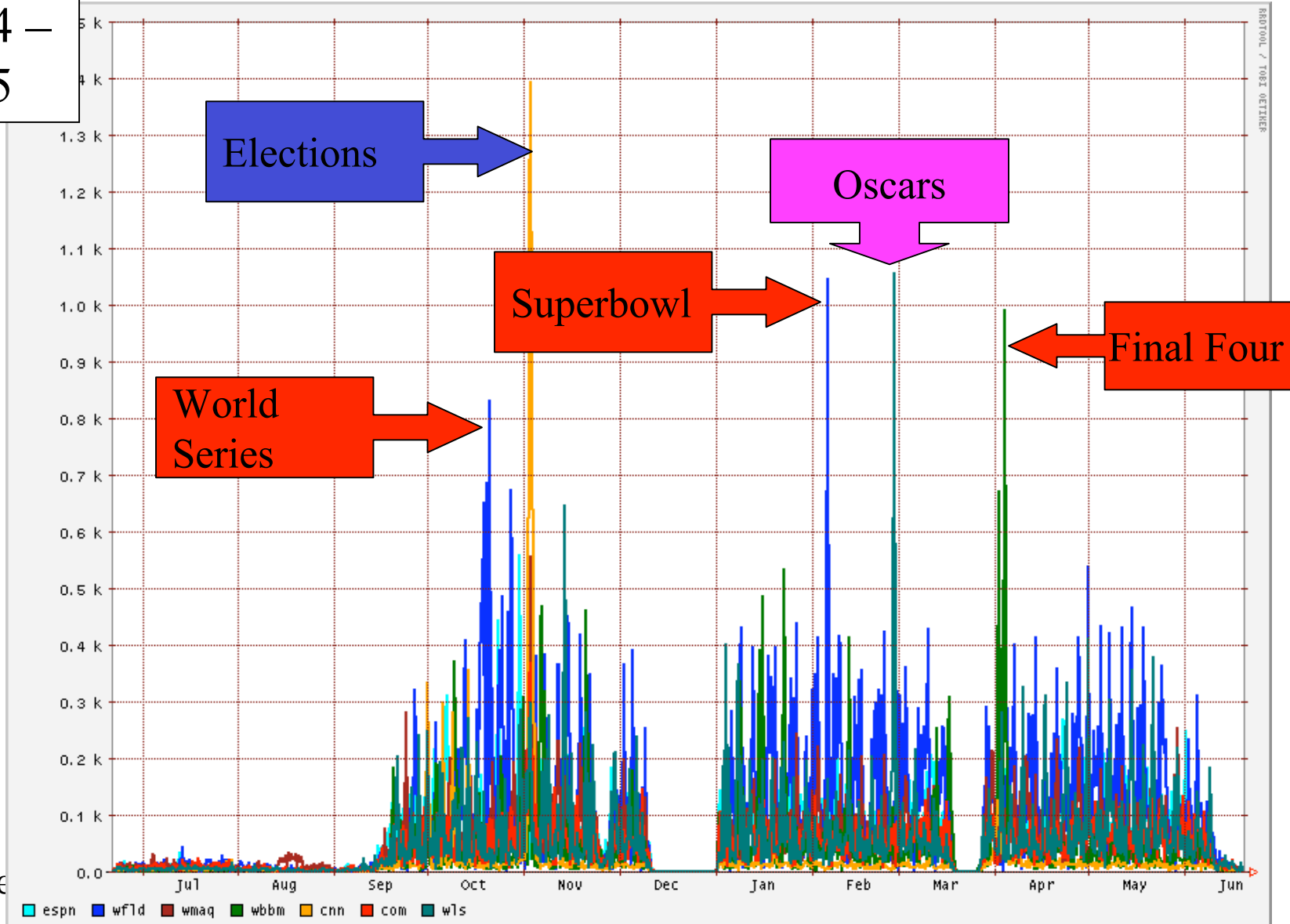
Courtesy Northwestern University







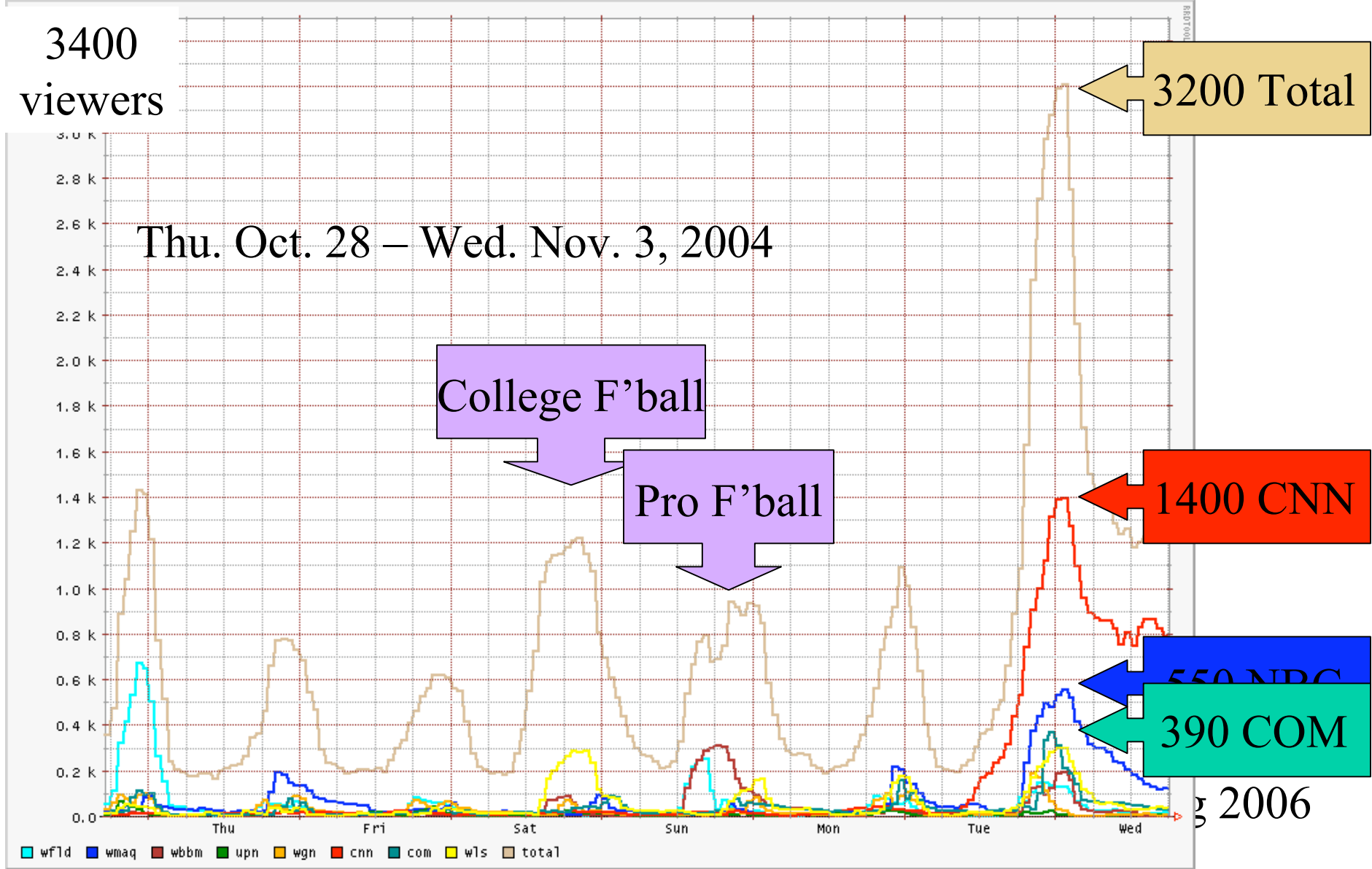
June 2004 – June 2005



Courte



3400 viewers



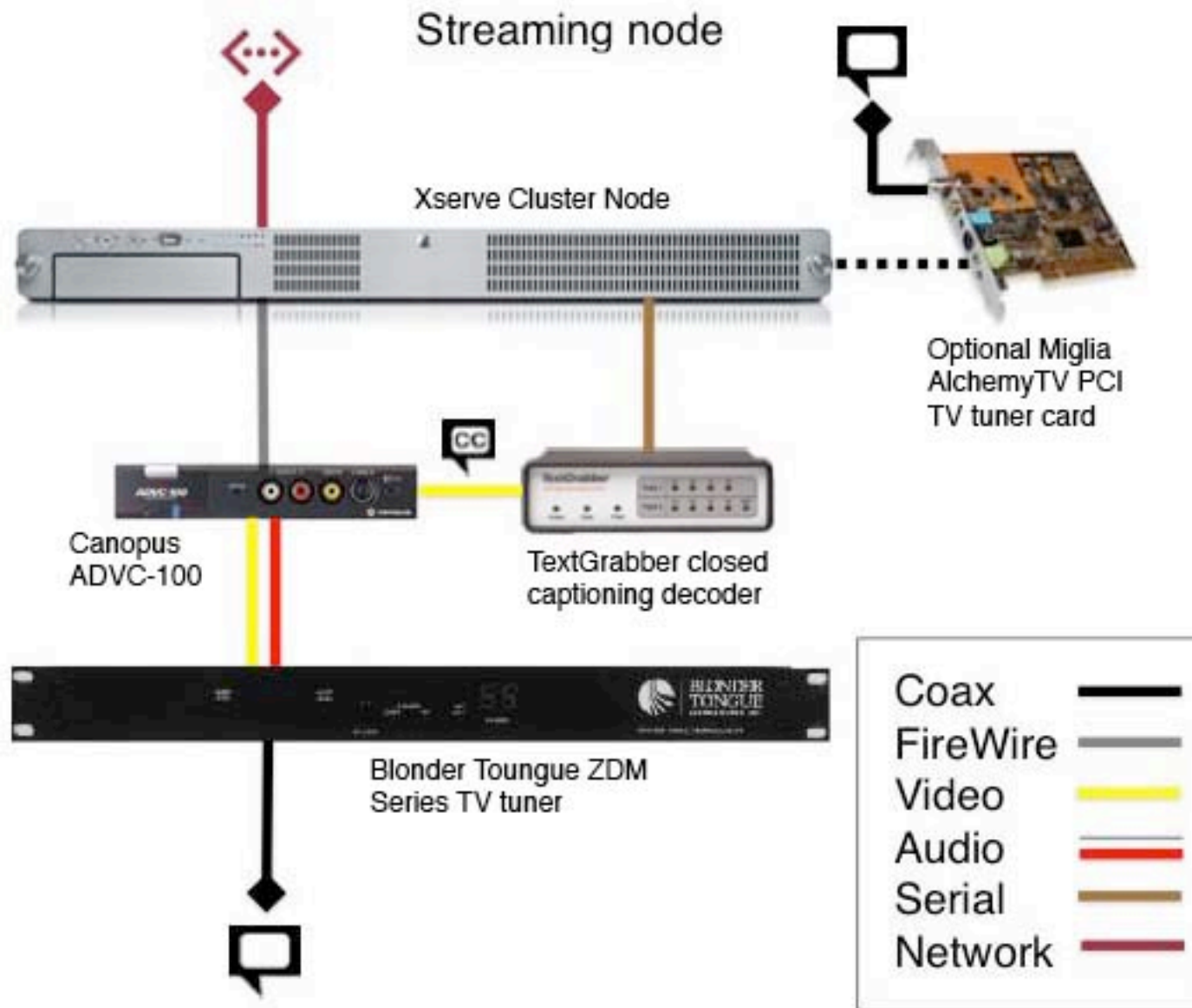
# Wisconsin DATN

- Wisconsin has chosen a more open system.
  - Digital Academic Television Network or DATN
  - At University of Wisconsin - Madison
  - Based on Apple Quicktime
    - Quicktime 7 or VLC is the player
    - Server is Apple Xserve (1 per channel)
      - Mac OS X Server
      - QuickTime Broadcaster
      - QuickTime Streaming Server
      - Apache
      - Tongue ZDM Series (TV tuner)•
      - TextGrabber GP500 closed captioning decoder•
      - Canopus ADVC-100 analog to FireWire AV converter



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# DATN Channel Architecture



2006

# DATN Video

- DATN
  - Streams 78 channels of live local television
  - via multicast over a 10-GigE backbone network
  - to a 65000-person research campus.
  - No DRM (Digital Rights Management)
    - They don't want it
  - No EPG (Electronic Program Guide)
    - This is an issue with Multicast Video
    - A standard is needed

# DATN Video : Why Quicktime

- Why did DATN pick Apple Quicktime and QTB and QTSS ?
  - Support of open standards
    - MPEG-4 and H.264 (MPEG-4 version 10)
  - Support of common OS's
  - Cost
    - Quicktime is free
    - Quicktime Streaming Server is free
    - Quicktime Broadcaster is free



# DATN Video : More about why QT

- QuickTime capabilities :
  - QuickTime Text Track allows DATN to stream closed captioning content independent of video
  - QuickTime Skins allows DATN to use flexible approaches for the display of video on the client end
  - Because of the granularity of the system, other uses of the content can be explored
    - Closed captioning search database
    - Video archival
    - Custom players and other applications
    - Computer “set top box” configurations
    - See [http://datn.wisc.edu/about/DATN\\_WWDC\\_2005.pdf](http://datn.wisc.edu/about/DATN_WWDC_2005.pdf) for more details

# DATN Video : Future Plans

- QuickTime 7!
  - H.264
    - Requires about twice the processing power of MPEG-4
    - Delivers about twice the image quality at same data rate
    - Standard-definition TV quality streams are possible in under 1.5 Mbps
  - QuickTime Broadcaster 1.5 with QuickTime 7 now supports full frame (720 x 480) DV
  - QuickTime Broadcaster 1.5 with QuickTime 7 now supports full frame (640 x 480) from Miglia AlchemyTV card

# What DATN Looks Like :



- DATN Developed its own player skin

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# Other Educational Multicast Video

- Northwestern University and UW-Madison are hardly alone
  - Many schools are running trials or initial deployments of multicast video
  - Dartmouth announced it will use Video Furnace equipment on May 18th, 2005
    - 62 channels and wireless. -
  - Cornell University is rolling out service “soon.”
  - AHECTA - American Higher Education Cable TV Association - is interested
- Then there is also the Open Student Television Network (OSTN.tv)
  - Focused on student produced content

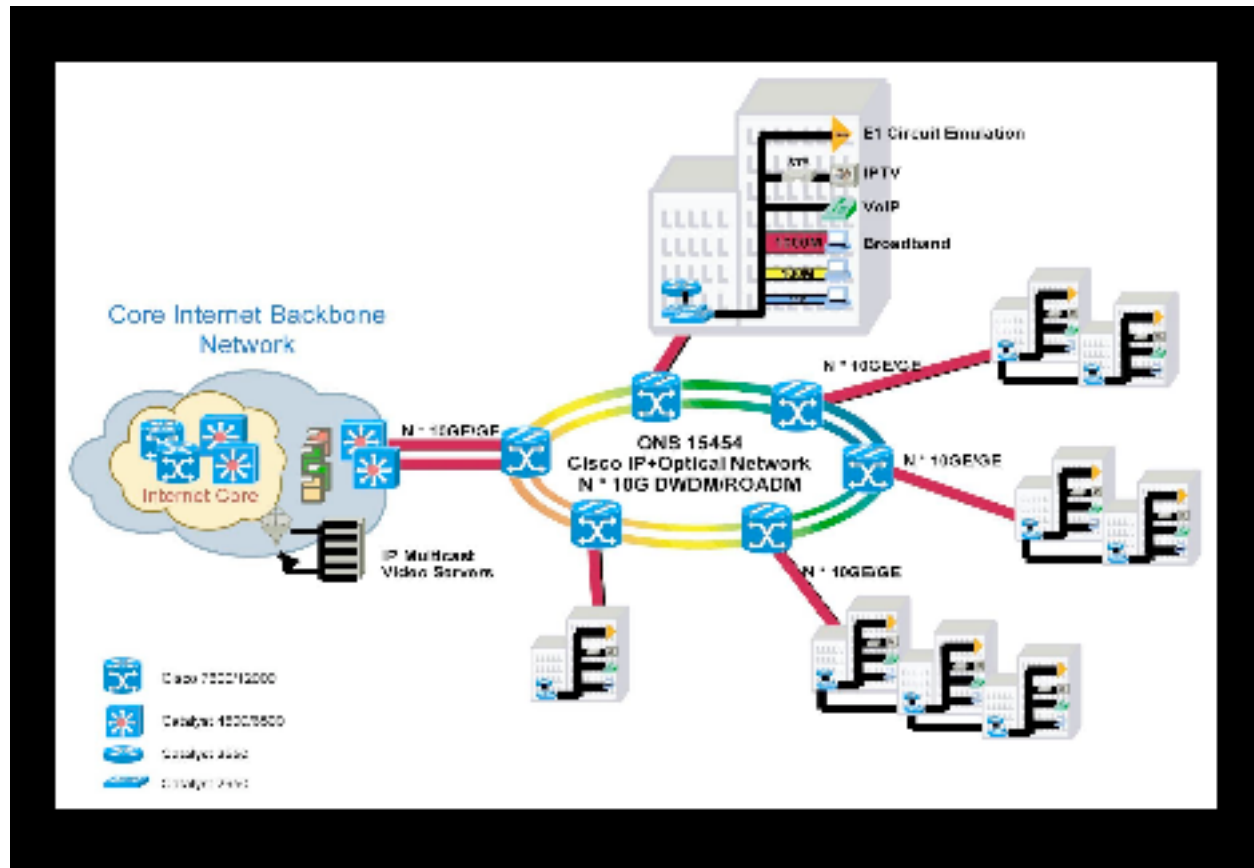
## Hong Kong Broadband Networks LTD.

- A commercial video deployment
  - All Cisco based solution
- They want to compete with DSL by using Ethernet deployments
- Customer Charges :
  - 10 BaseT is “below dialup” cost
  - 100 BaseT is \$ 27 USD / month
  - 1 GigE is \$ 172 USD / month

# HKBN Business Model

- HKBN offers (to subscribers)
  - VOIP at \$ 6 / month flat rate
  - 60+ channels of IPTV
    - In 10 / 2005 :
    - HKBN has 120,000 subscribers @ \$ 16 USD / month
    - Their conventional competitor, HK Cable, has 685,000 subscribers @ \$ 39 USD / month
  - Ethernet Cost is \$ 130 USD / residence passed
    - Hong Kong is a population dense urban environment

# HKBN Network Topology



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# HKBN Network Architecture

- Multiple 10 Gig DWDM rings
  - Cisco 12000 and 7600's
- 10 GigE to the Internet and video servers
- 10 GigE to Multi Tenet Units (MTU's)
  - Catalyst 4500's switch at the "miniPOP's"
  - Catalyst 3450's at the MTU's
- Convert to Copper and put on risers
  - Catalyst 2950 switch to users at the subscribed rate.



# Other Commercial Multicast Video Deployments

- Time Warner is undergoing trials of Multicast Video in San Diego
  - Using Real Networks for back office, encoders, DRM, etc.
  - The encode rate in demonstrations was 700kbps, but is adjustable.
  - DRM is being used, but not clear if this is for multicast or unicast content.
- Comcast is in the process of converting to a multicast enabled national backbone.
- Fox Cable, with TVN Entertainment, is using multicast to pre-cache Video on Demand (VOD).
- There is my very own AmericaFree.TV
  - This is a multicast source of free content.
  - 500 Kbps H.264 encoding (multicast & unicast)
  - Soon to Launch Near Video On Demand (NVOD)

# Multicast Video :

## Walled Garden or Global Village ?

- Most current plans for multicast streaming do not accept video from outside.
- The “walled garden” approach.
  - Video packets and user packets never touch
- The real question is whether Zipf’s Law will allow the walls to stand.
  - My statistical models predict 100,000’s of channels will be supportable commercially in the USA alone.
  - It’s hard to see how the walled garden can be extended to encompass 100,000’s of channels
  - 100,000 channels is ~ 10,000 servers
    - The content provider should buy these, not the ISP.

# When the World Deploys Multicast

- A successful multicast business model makes IP profitable for content owners
  - Success brings MORE content
- Access networks of tomorrow look like provider networks of today
  - Few large circuits upstream, many small circuits downstream
- Provider revenue model gets flopped
  - Few small circuits from content networks, many large circuits down to access networks

# Conclusions and a Call to Action

- Multicast is, after a fallow period, rapidly developing.
  - It is an integral part of the triple play.
  - I would appreciate talking with conference delegates about their experiences
- What needs to happen to break out of the walled garden ?
  - SSM Deployment
  - Video Standards
    - Encoders
    - STBs
    - PVRs
  - Electronic Program Guide Standards
  - Metadata Standards
  - Ad Placement Standards
  - Auditing and Accounting
  - ...

# Information Online

- <http://multicast.internet2.edu>  
especially the tutorial-style paper at  
<http://multicast.internet2.edu/almeroth.pdf>
- <http://dast.nlanr.net/Projects/Beacon/>
- [www.multicasttech.com/faq/multicast\\_faq.html](http://www.multicasttech.com/faq/multicast_faq.html)  
and  
[www.multicasttech.com/status/](http://www.multicasttech.com/status/)
- Greg Shepherd's multicast site: [www.shepfarm.com/multicast/](http://www.shepfarm.com/multicast/)
- [http://www.cisco.com/en/US/tech/tk828/tsd\\_technology\\_support\\_protocol\\_home.html](http://www.cisco.com/en/US/tech/tk828/tsd_technology_support_protocol_home.html) and  
<ftp://ftpeng.cisco.com/ipmulticast.html>
- [www.sprint.net/multicast/faq.html](http://www.sprint.net/multicast/faq.html)
- <http://www.juniper.net/techpubs/software/junos/junos72/swconfig72-multicast/html/ip-multicast-overview.html>