

The State of Multicast 2007

Marshall Eubanks

tme@multicasttech.com

Bahrain

April 3, 2007

MENOG 2007

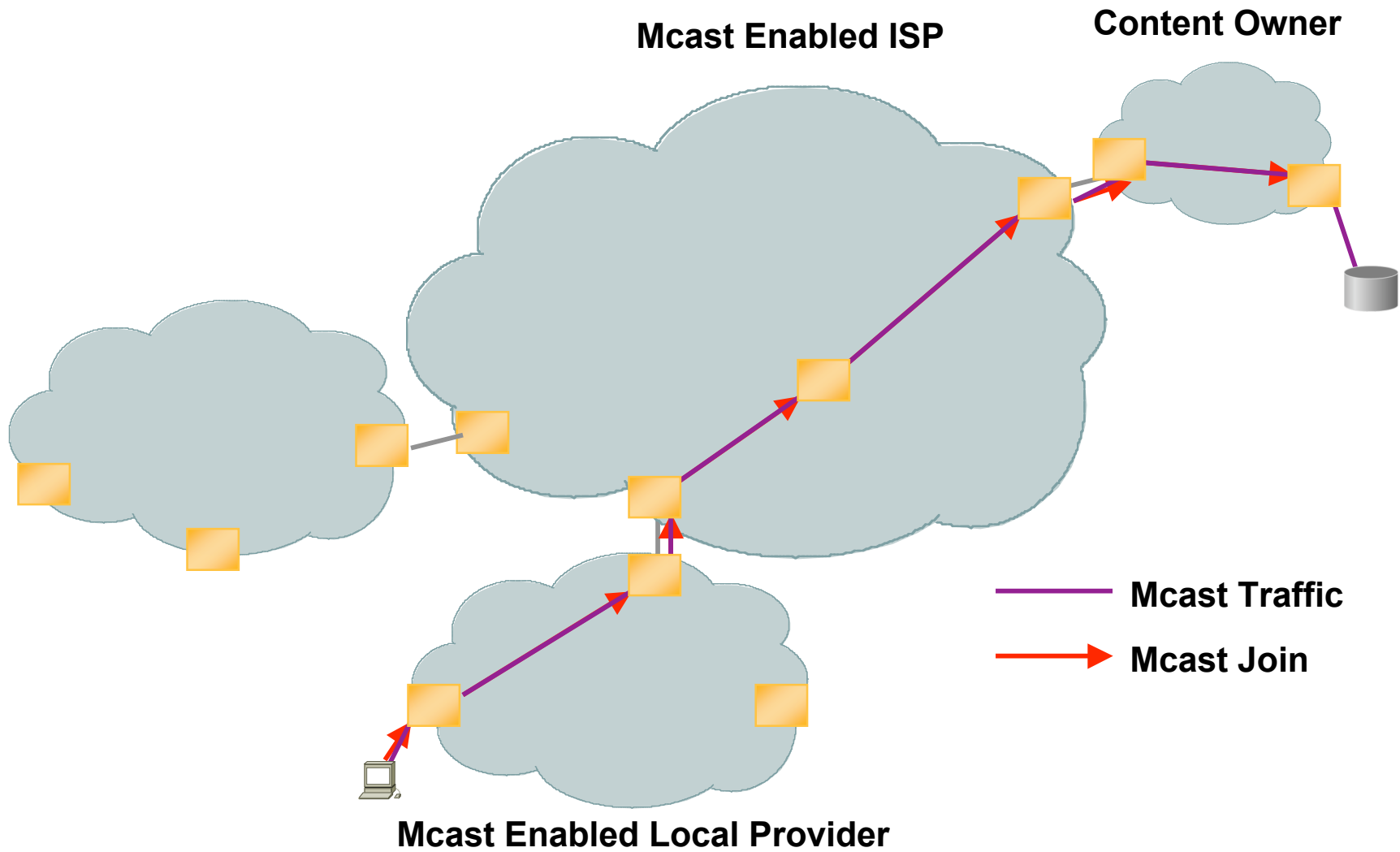
The Basic Idea of Multicast

Multicast is the Internet's means of doing one to many data transfer efficiently. Unicast is like a letter in the mail; multicast is more like a TV broadcast.

Suppose you have one stream of data to send to many people.

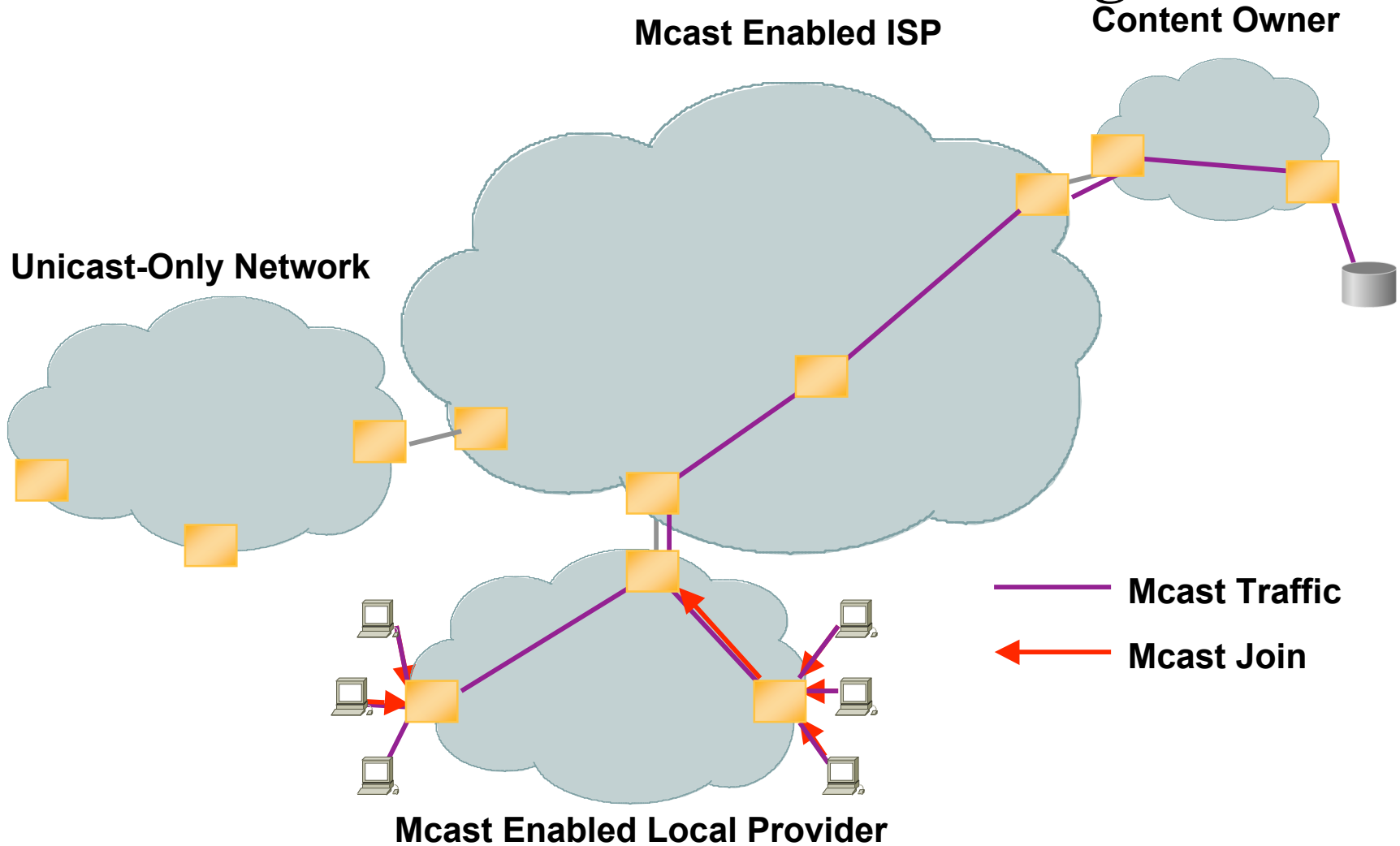
Rather than sending a separate copy of the data to each recipient, the multicast **source** sends the data only once, routers along the way to the destinations make copies as needed, and multicast **receivers** just have to request data to receive it.

The Big Picture



MENOG 2007

The Multicast Advantage



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 2007, “Triple Play” has become the buzzword of the moment - Voice, data and video, all on the same network.
 - IP Multicast is an essential part of the Triple Play.

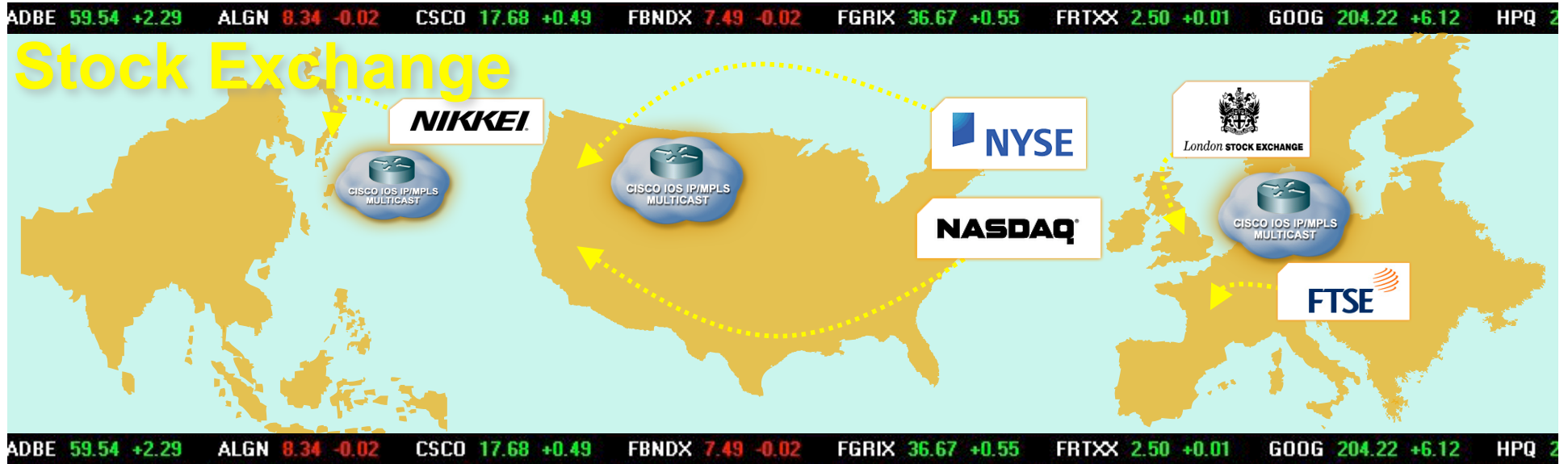
Multicast Applications

- The classic Multicast application is the distribution of financial information.
 - NASDAQ, NYSE, FTSE, NIKKEI, Mumbai Stock Exchanges all use multicast to get financial information to analysts on a timely basis.
- Multicast is used to distribute files from one server to many nodes
 - Norton “Ghost” can do software updates
- Multicast is used for audio and video broadcasting
 - IPTV

The First Multicast “Killer App” : Distribution of Financial Data

- Many stock exchanges use multicast to “push” financial information and stock quotes to traders and analysts
 - Very tight requirements on simultaneity of data delivery
 - Absolutely mission critical application
 - Common to use middleware to obtain reliable multicast
 - Tibco / Talarian PGM is common
- Exchanges include
 - Nasdaq
 - New York Stock Exchange
 - Nikkei
 - FTSE
 - Bombay Stock Exchange (using DVMRP)

Finance Demands Timely Data Delivery



Trading Floor



With IPTV, Multicast is suddenly “hot” (again)

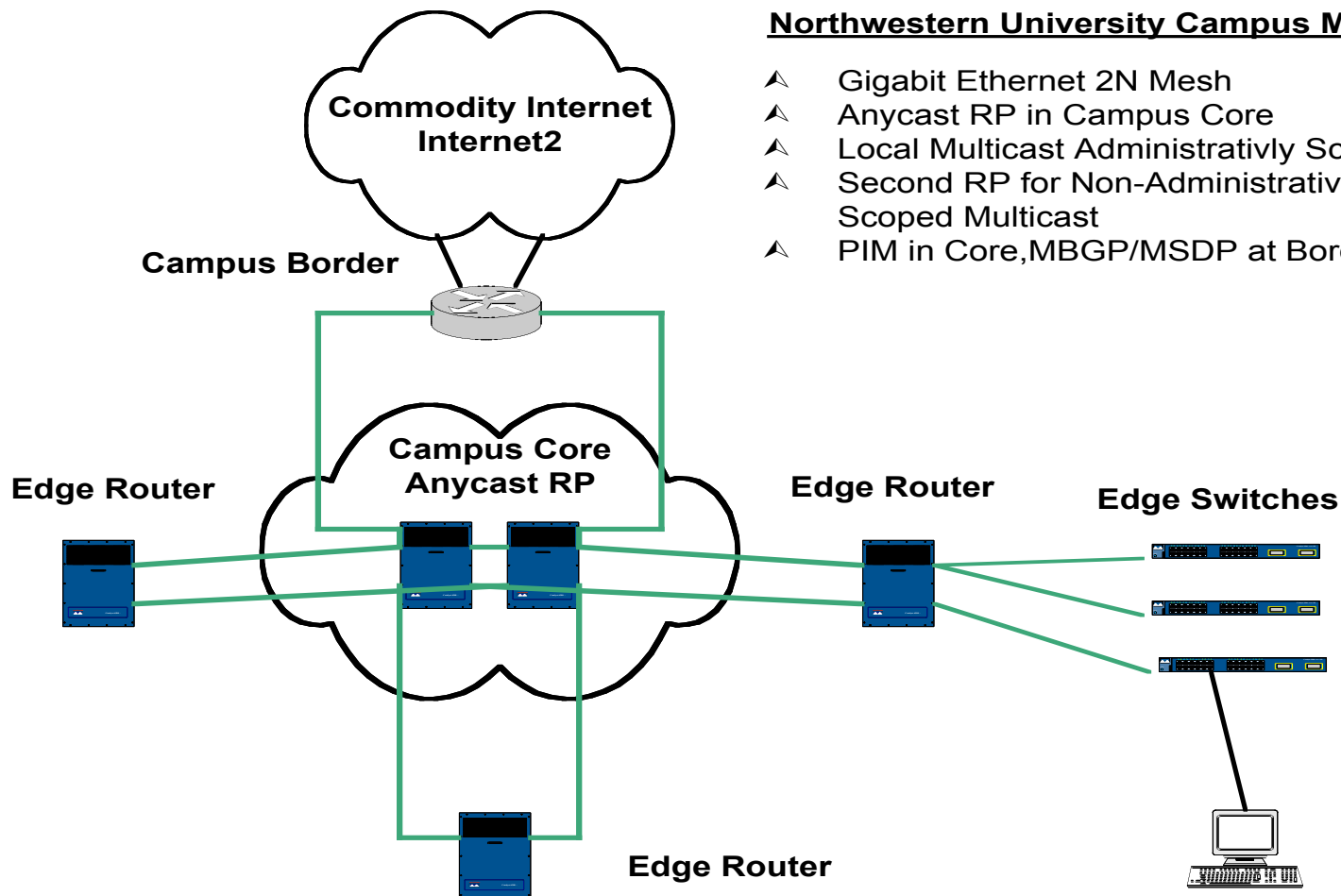
- By 2006, with the use of Multicast accelerating, “Triple Play” became the buzzword of the moment - Voice, data and (Multicast) video, all on the same network.
 - 16,700 hits for “Triple Play” this morning on Google™ News
 - 1800 hits for “IPTV” this morning on Google™ News
- Multicast is BCP for Triple Play / IPTV video
 - Generally ASM with IGMPv2
- 3G Wireless has adopted IP Multicast in the 3GPP MBMS and 3GPP2 BCMCS services
 - This includes multicast at the RF link layer.
 - 1130 hits for “3G Video this morning on Google™ News
- L3VPN Multicast is a hot topic in the IETF
 - Used for carrier video transport for enterprises...

Commercial 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 goal is to put everything - Data, VOIP, and Video - on the same network
 - And this requires Multicast Video

Video Bandwidths are Increasing Rapidly

- Video Bandwidths are in general increasing rapidly
 - Streaming is breaking the 1 Mbps barrier
 - IPTV is typically 3 Mbps for SD, 6 to 10+ Mbps for HD
 - Virtual Telepresence (Cisco, HP, Iformata) requires 5 to 10 Mbps in HD
 - The number of channels is growing rapidly
 - The amount of unicast transit is ballooning.
- Network provisioners : You have been warned !

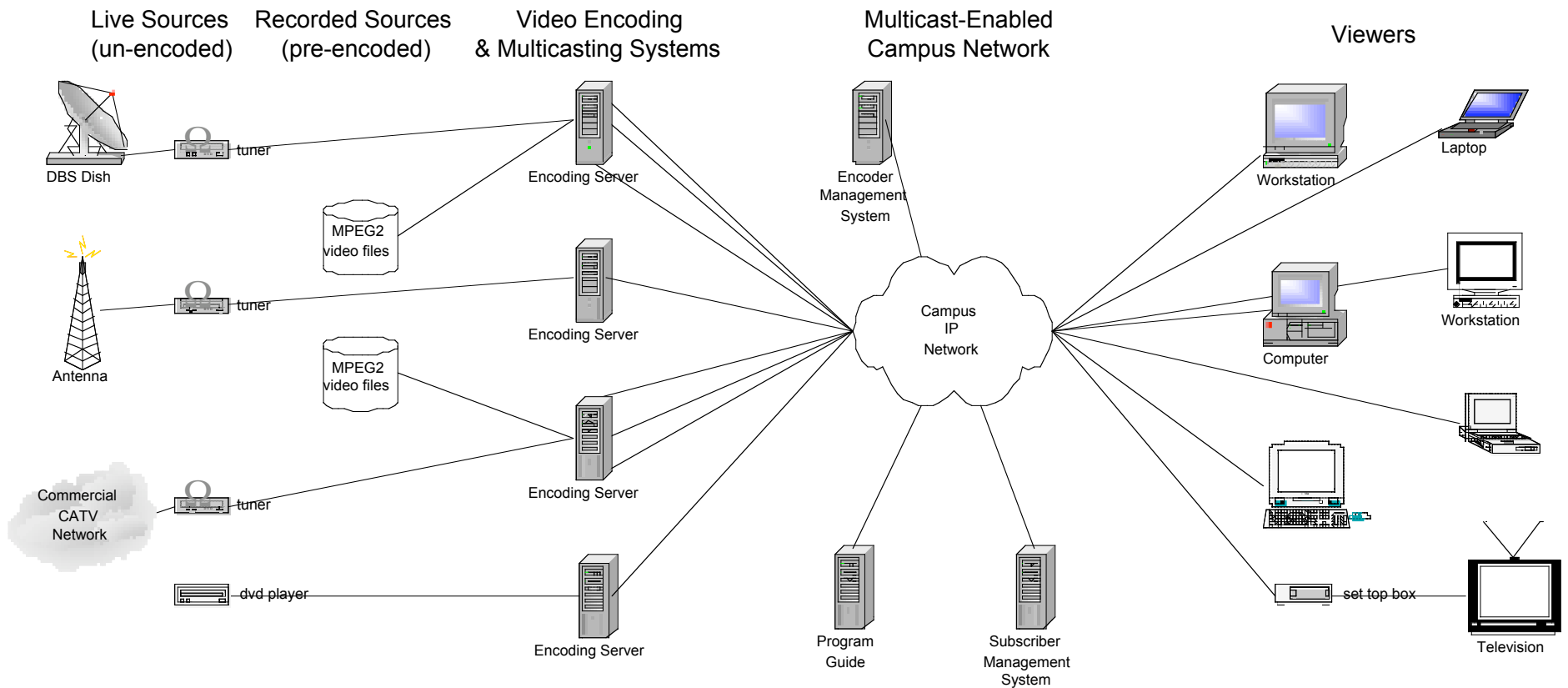


Northwestern University Campus Multicast

- ▲ 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



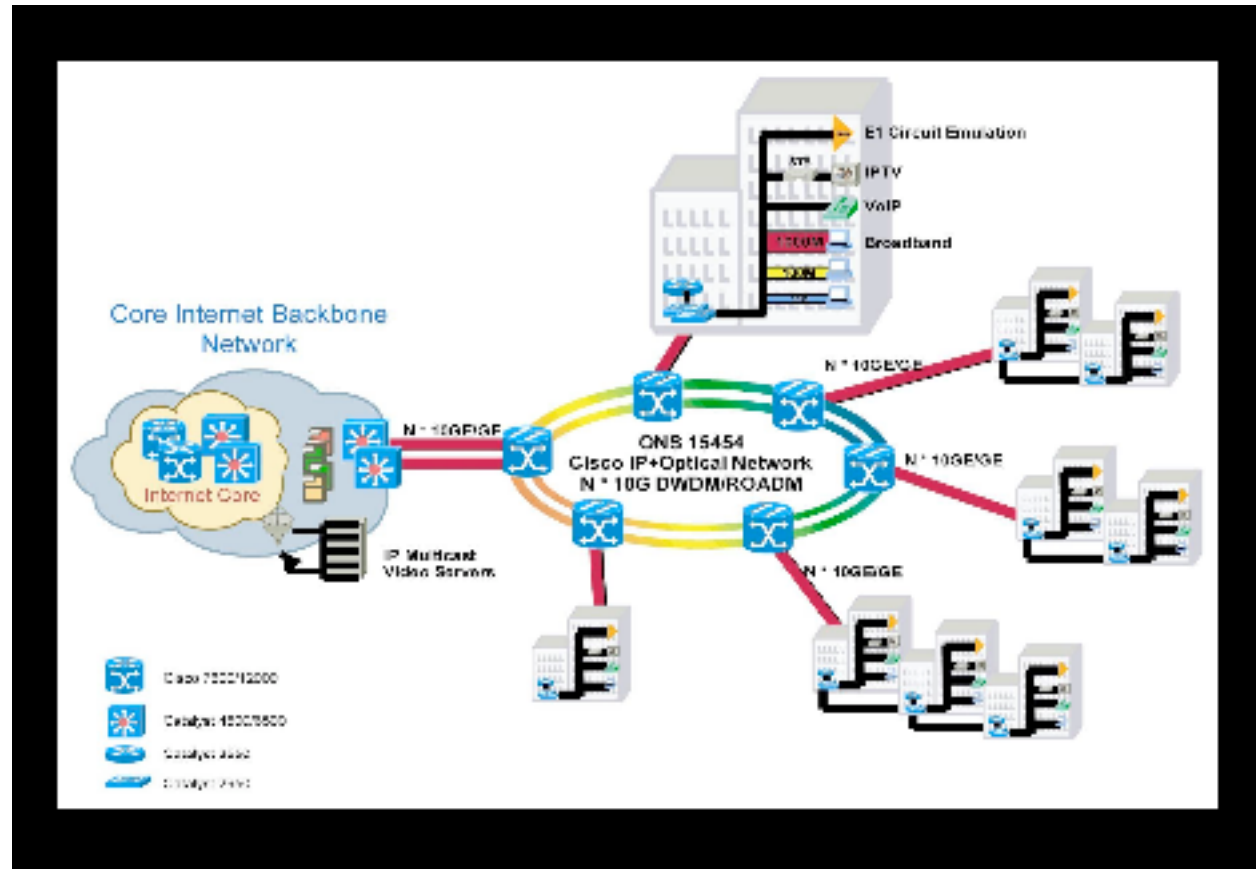
System Components



MENOG 2007

HKBN Network Topology

A Commercial IPTV Deployment in Hong Kong



MENOG 2007

Multicast Streaming :

Walled Garden or Global Utility

- Most current plans for multicast streaming is entirely behind the scenes.
 - The “walled garden” approach.
 - Video packets and user packets never touch
- The real question is whether the walls will stand.
 - Statistical models predict 10,000’s of channels in the USA alone.
 - 100,000 plus globally.
 - It’s hard to see how the walled garden can be extended to encompass this
 - 100,000 channels is thousands of servers
 - The content providers should buy these, not the ISP.
 - Contractual issues alone will make this impossible to support with the current *business* model.

Some Multicast Problems

- Problem 1 : Multicast is not globally deployed
 - Multicast requires end to end deployment to work.
 - In a walled garden, that is possible.
 - Deployment is not there across the Internet
- Problem 2 : Multicast is Complicated
 - Multicast deployments can have obscure issues

Problem 3 : IPTV is Deploying Old Technology

- At the beginning of this century, a broadcast “profile” for multicast was finalized.
 - Source Specific Multicast (SSM)
 - Minimal Impact, Maximum robustness
 - This requires version 3 of the Internet Group Management Protocol (IGMPv3)
 - Unfortunately, most IPTV deployments only support IGMP v2
- This will cause problems moving forward.
 - It will make it hard to bring in Multicast feeds across the Internet
 - Hard to use Internet transport from content providers
 - Hard to break the Walled Garden
 - Will not lead to global deployment.

Problem 4 : Multicast Lacks QOS

- In the walled garden, providers can apply Diffserve or some other QOS mechanism
 - Protects against congestion loss, but not against all packet losses.
- Even this is not generally possible on the wide Internet.

The IETF and Multicast

- The Internet Engineering Task Force (IETF) is the standards body for the Internet.
 - www.ietf.org
- Within the IETF, there are Multicast related Working Groups that deal with the problems I just mentioned
 - Multicast backbone deployment (Mboned)
 - <http://www.ietf.org/html.charters/mboned-charter.html>
 - Reliable Multicast Transport (RMT)
 - <http://www.ietf.org/html.charters/rmt-charter.html>
 - Forward Error Correction Framework (FECFrame)
 - <http://www.ietf.org/html.charters/fecframe-charter.html>
- These are open groups - *everyone* is welcome to join and participate.

Efforts to deal with the 4 problems

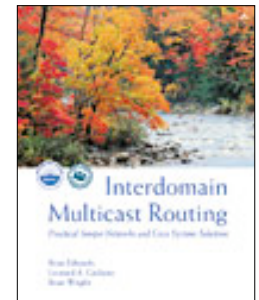
- Problem 1 (Deployment) : MBONED is working on AMT, a protocol to allow efficient multicast failover to unicast in cases where deployment isn't global.
- Problem 2 (Complexity) : MBONED is working on Best Current Practice Guides for IPv4 and IPv6, tools for multicast debugging, etc.
- Problem 3 (IGMPv2 vs v3) : This is an open issue right now.
- Problem 4 (QOS) : RMT and FECFRAME are working on Raptor and SMPTE codes for Forward Error Correction (FEC) at the application (RMT) and the IP transport layer (FECFRAME), so that redundancy can be applied to recover from losses.

Conclusions

- I have tried to give some flavor of the solutions in place today using Multicast
 - People do make money from Multicast
 - Multicast is becoming widely used behind the scenes
 - Deployment is increasing
 - There are mechanisms to deal with current issues.

Information Online

- <http://www.multicasttech.com/faq/>
- <http://www.sprint.net/multicast/faq.html>
- <ftp://ftpeng.cisco.com/ipmulticast.html>
- Multicast hardening :
http://www.juniper.net/solutions/literature/app_note/350051.pdf
- tutorial-style paper at:
<http://multicast.internet2.edu/almeroth.pdf>
- Status Of Inter-domain deployment : <http://www.multicasttech.com/status>
- Books: See <http://www.multicasttech.com/faq/index.html#Books>
 - “Interdomain Multicast Routing”,
Edwards, Giuliano, Wright (Addison-Wesley)
 - “Interdomain Multicast Solutions Guide”,
Beau Williamson (Cisco Press)



MENOG 2007