I2 Multicast: Not WIDE-scale Deployment FULL-scale Deployment

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The Power of Multicast

- Solves bottlenecks, etc. etc.
 - ? ...the obvious scalability issues
- Enables new applications
 - ? and new paradigms for communication

12's Responsibility

- I2 is the right place to work on multicast
 - ? after all, that's our mission
 - ? I2 is a great testbed
- Multicast as a worthwhile topic:
 - ? a next evolution of IP
 - ? beyond the protocols there is the challenge of deployment and new applications

The Creeping Fog

Multicast is already well on its way in I2

- Proof is in the deployment statistics:
 - ? 11 peer networks
 - ? 35 connectors
 - ? 110 participants
- See also http://imj.ucsb.edu/mantra/

Multicast connections: participants: 110

Abilene Network Operations Center

www.abilene.iu.edu/images/ab-mcast.pdf

Indiana University



The Abilene Network
Multicast deployment
includes MBGP, MSDP, and PIM-sparse protocols full-mesh on backbone connectors: 35 peer networks: 11 REUNA NREN DREN CERN Maine SURFnet Pacific/Northwest MontanaSU UNH. CAnet3 U Montana VBNS Ι Seattle NotreDame U Idaho APAN/Transpac Cornell STARTAP MREN Boston U U Wisconsin-Madison Renater U Wisconsin-Milwaukee U Washington U Illinois-Chicago UHawaii Argonne NorduNet DREN (NOX) Columbia Northwestern (PennSD) NyserNet* UCAR S.DakotaMines&Tech U Illinois-Urbana CMD NREN N.DakotaSD **OregonS** Advanced Dante NCSA U N.Dakota Pitt NGIX-Ames U Oregon UMN Oregon ESNET MIX MERIT* EROS DataCtr (Colorado-Bo PSC New York City U Nebraska Northern NorduNet MichiganSU Sunnyvale UMichigan Lights* SURFnet Utah S Cleveland WayneSU FrontRange U Kansas Utah Sacramento HighwayD MAX GreatPlains U Arkansas-LR MichTechU OARnet Calren VirginiaTech Denver CSU Stanford Kent SU U Virginia Hayward U Penn UC San Francisco **U** Arizona OhioSU Kansas City Indianapolis C Santa Cruz ArizonaSU MAGPI NCSA Access Memphis Indiana OneNet UC Davis Vanderbilt Washinaton OldDominion Oklahoma Indiana U UC Berkeley OklahomaSD Purdue U NCSUUNC-CH U Del Los Angeles Duke NCNI NGIX-UMD Calren Atlanta WakeForest EastCarolina SDSC UC Riverside VBNS GSFC

U Kentucky UC San Diego UC Los Angeles U Tennessee-K UC Irvine UC Santa Barbara Florida SU **UT-Austin** CalTech SOY Clemson San Diego SD JPD U Cent.Florida Cal Poly Pomona U S.Carolina USC-ISI U Georgia CSU San Bernardino U Florida MedU S.Car USC Georgia Tech U Alabama-H CSU West Ed Houston U So.Florida Georgia SU U Alabama-T Texas Emory U Alabama-B 23 February 2001 Auburp TexasTech Florida International BaylorCMed

TexasA&M

multihomed connector

Atlanta Abilene Core Node

Texas > Abilene Connector FSU Transparent Laver-2

Indiana UD Abilene Participant

BNS Peer Network

Kev:

NSF

OC3 POS/ATM

The Challenge

 Achieving deployment in the stubborn networks

How do we do this? Tell a good story

- So here's the story:
 - ? Multicast is already widely deployed
 - ? Multicast is mostly straightforward to deploy
 - ? Multicast content is Mmmm, good

The Goals

- Raise awareness among the masses (instead of in the choir)
 - ? dispel the myths
 - ? create demand
 - ? create a minimally resistive path
- So, let's get started....

Multicast Myths

- Multicast is only good for streaming audio/video
 - ? Research to develop other applications
- Multicast is UDP and UDP is dangerous
 - ? Research to solve the problems
- Multicast is not widely deployed
 - ? It is in Internet2

Create Demand

- Some streaming A/V content:
 - ? UofO (http://videolab.uoregon.edu/)
 - ? GRID (http://www-fp.mcs.anl.gov/fl/accessgrid/)
 - ? ICAIR CSPAN (http://cspan.icair.org/)
 - ? On-the-I (http://www.on-the-i.com/)
 - ? Yahoo (http://www.broadcast.com/broadband/)
 - ? NASA (http://www.nasa.gov/ntv/ntvweb.html)
 - ? UCSB (http://imj.gatech.edu/)
 - ? All the commodity traffic (sdr)

So Why is Deployment Only at 50%?

- Infrastructure
 - ? Some networks need help
 - ? Some organizations need help
- Fear
 - ? Too many myths...

Multicast is a boat leaving the dock...
not something to put only one foot into

Creating a Minimally Resistive Path: Getting Started

- I2 Multicast WWW page
 - ? http://www.internet2.edu/multicast/
- I2 Multicast mailing list
 - ? send email to listproc@internet2.edu w/
 "subscribe wg-multicast John Doe" in the body
- Abilene NOC WWW pages
 - ? http://www.abilene.iu.edu/index.cgi?page=multicast
- Attend the Joint Techs Meetings

Creating a Minimally Resistive Path: Deployment Help

- Abilene NOC
- WG mailing list
- Joint Techs
- Debugging Site
 - ? http://imj.ucsb.edu/mantra/
- NCNE
 - ? http://www.ncne.nlanr.net/faq/mcast_eng_faq.html
- WG WWW site



Internet2 Engineering Update

Lincoln Guy Almes <almes@internet2.edu>

Short- and Long-term Issues

Short-term Issues

- ? Encouraging deployment and applications
- Pressing router/software vendors for specific needed improvements
- ? Improving the set of tools for network management

Long(er)-term Issues

- ? Scalability (what happens if it *does* catch on?)
- ? Exploring the role of Source-Specific Multicast

Could SSM be Enough?

'Classic' Multicast

- ? Group <g> has global significance
- ? A user creates, joins, sends to g
- ? Others can join, then send to and/or listen to g
- MBGP, PIM-SM, MSDP triad

Source Specific Multicast

- ? Group <g> has local significance
- ? A user s creates, sends to <s,g>
- ? Others can subscribe to, then list to <s,g>
- ? No need for MSDP (or allocation of <g> values)