Public AMT Relay Between Internet2 and Commodity Internet

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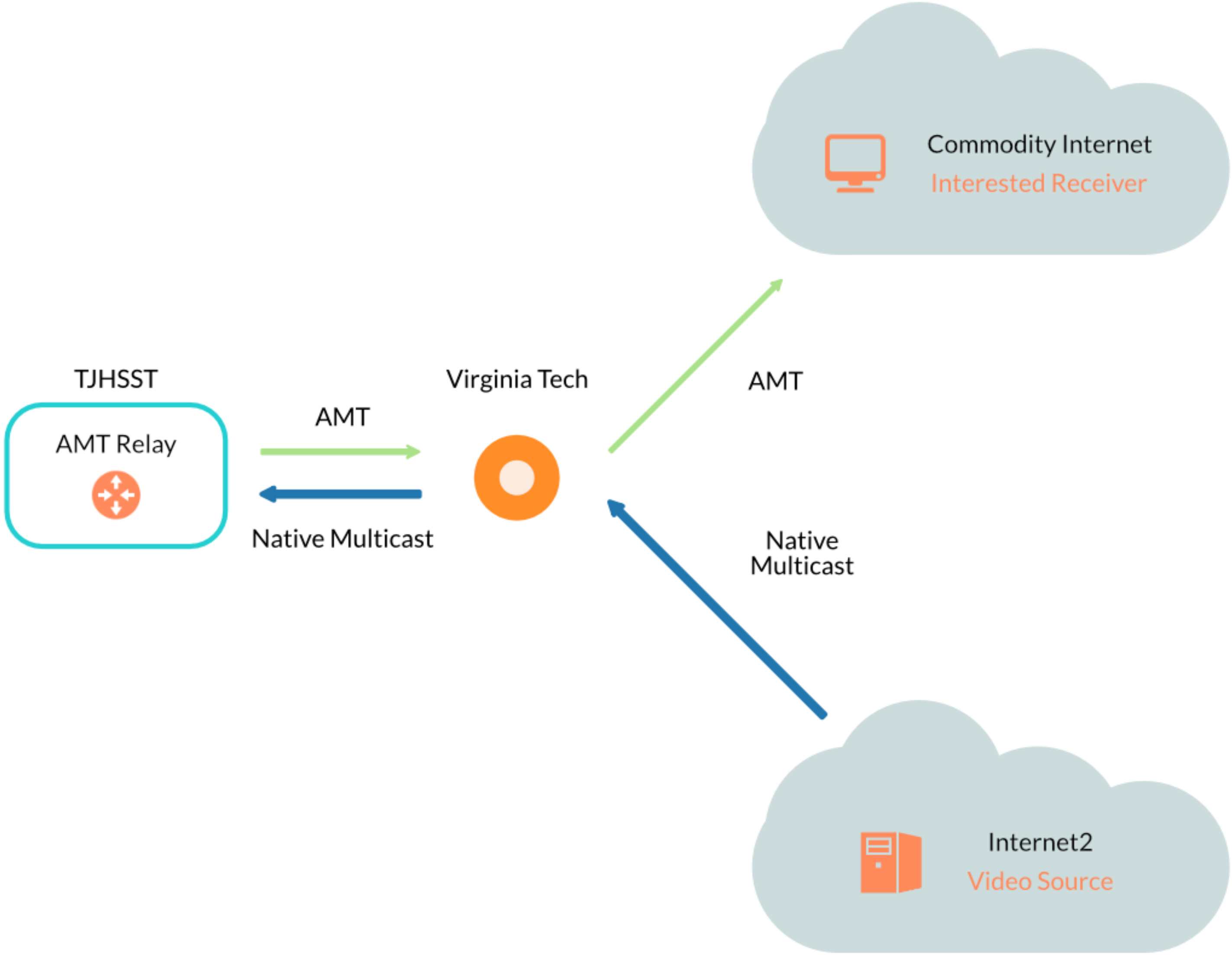
Project

- Deploy Juniper MX80 as public AMT Relay
- Support of Mr. Peter Morasca and Lenny Giuliano
- Catalog and curate existing content on MBONE
- Provide simple way for Internet end-users to view multicast content
  - Survey existing end-host AMT Gateway implementations
  - Provide simple guidance to content owners to encourage more multicast content

JUNIPER NETWORKS

Public AMT Relay Goals

- Deliver multicast content on MBONE (I2) to unicast-only receivers on the rest of the Internet
  - Unicast-only AD to Multicast-enabled AD model
  - RFC8313, Sect 3.4
- Gain experience, prove viability and develop best practices for running a public AMT relay

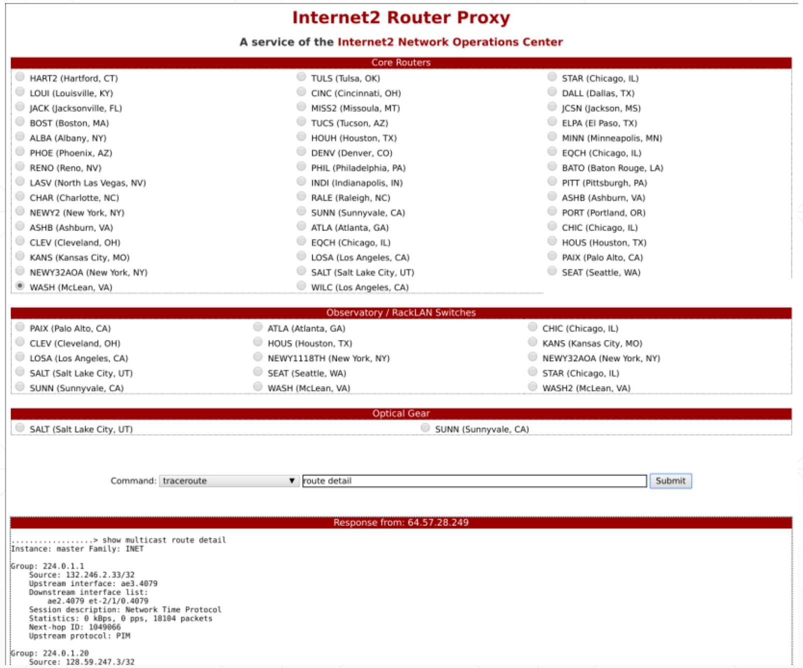


Public AMT Relay Deployment

- 10Gig P2P link to Virginia Tech
- MBONE connectivity via Virginia Tech Internet2 access
- I2 contains majority of MBONE
- 1Gig link to commodity Internet
- MX80 configured as AMT relay
- Potentially first public AMT relay on I2/MBONE

MBONE Multicast Content Curation

- Without content, no point in AMT
- Internet2 Looking Glass
  - Run commands on I2 routers
  - Interested in `show multicast route detail`
  - Too many routers to do by hand
- Python script
  - Reverse-engineered request endpoint and params
  - Parse response from endpoint and reformat
  - https://github.com/willzhang05/senior-research/blob/master/find_src_i2.py



Internet2 Router Proxy

A service of the Internet2 Network Operations Center

Core Routers

○ HART2 (Hartford, CT)
○ LOUI (Louisville, KY)
○ JACK (Jacksonville, FL)
○ BOST (Boston, MA)
○ ALBA (Albany, NY)
○ PHOE (Phoenix, AZ)
○ RENO (Reno, NV)
○ LASV (North Las Vegas, NV)
○ CHAR (Charlotte, NC)
○ NEWY2 (New York, NY)
○ ASHB (Ashburn, VA)
○ CLEV (Cleveland, OH)
○ KANS (Kansas City, MO)
○ NEWY32AOA (New York, NY)
● WASH (McLean, VA)
○ TULS (Tulsa, OK)
○ CINC (Cincinnati, OH)
○ MISS2 (Missoula, MT)
○ TUCS (Tucson, AZ)
○ HOUH (Houston, TX)
○ DENV (Denver, CO)
○ PHIL (Philadelphia, PA)
○ INDI (Indianapolis, IN)
○ RALE (Raleigh, NC)
○ SUNN (Sunnyvale, CA)
○ ATLA (Atlanta, GA)
○ EQCH (Chicago, IL)
○ LOSA (Los Angeles, CA)
○ SALT (Salt Lake City, UT)
○ WILC (Los Angeles, CA)
○ STAR (Chicago, IL)
○ DALL (Dallas, TX)
○ JCSN (Jackson, MS)
○ ELPA (El Paso, TX)
○ MINN (Minneapolis, MN)
○ EQCH (Chicago, IL)
○ BATO (Baton Rouge, LA)
○ PITT (Pittsburgh, PA)
○ ASHB (Ashburn, VA)
○ PORT (Portland, OR)
○ CHIC (Chicago, IL)
○ HOUS (Houston, TX)
○ PAIX (Palo Alto, CA)
○ SEAT (Seattle, WA)

Observatory / RackLAN Switches

○ PAIX (Palo Alto, CA)
○ CLEV (Cleveland, OH)
○ LOSA (Los Angeles, CA)
○ SALT (Salt Lake City, UT)
○ SUNN (Sunnyvale, CA)
○ ATLA (Atlanta, GA)
○ HOUS (Houston, TX)
○ NEWY1118TH (New York, NY)
○ SEAT (Seattle, WA)
○ WASH (McLean, VA)
○ CHIC (Chicago, IL)
○ KANS (Kansas City, MO)
○ NEWY32AOA (New York, NY)
○ STAR (Chicago, IL)
○ WASH2 (McLean, VA)

Optical Gear

○ SALT (Salt Lake City, UT)
○ SUNN (Sunnyvale, CA)

Command: traceroute ▼ route detail Submit

Response from: 64.57.28.249

```
..................> show multicast route detail
Instance: master Family: INET

Group: 224.0.1.1
    Source: 132.246.2.33/32
    Upstream interface: ae3.4079
    Downstream interface list:
        ae2.4079 et-2/1/0.4079
    Session description: Network Time Protocol
    Statistics: 0 kBps, 0 pps, 18104 packets
    Next-hop ID: 1049066
    Upstream protocol: PIM

Group: 224.0.1.20
    Source: 128.59.247.3/32
```

Data Collection

- Filtered out any sources with < 5 pps
  - Identify interesting content
  - Video / audio have high pps
- Output at any given time is not representative
  - Changes with activity
  - Without any interested receivers, a source won't necessarily show up
- Parse and write logs every 2hr as cronjob for over a month
- Wrote Python script to sort unique and find operators of sources: https://github.com/willzhang05/senior-research/blob/master/logs/whois_log.py

Data Collection Results

- Parsed data: https://github.com/willzhang05/senior-research/blob/master/logs/raw.txt
- Whois included: https://github.com/willzhang05/senior-research/blob/master/logs/results.txt
- 119 unique Multicast sources and 40 unique Multicast groups
- Source: 129.174.131.51 Group: 233.44.15.9 PPS: 1167
  GEORGE-MASON-UNIV - George Mason University, US
  - Source: 130.206.3.133 Group: 224.4.0.10 PPS: 990
    REDIRIS RedIRIS Autonomous System, ES
  - Source: 193.17.9.3 Group: 232.223.222.2 PPS: 3762
    EUMETSAT-OPS, DE

AMT Gateway Implementations

- UT Dallas VLC AMT gateway (http://www.utdallas.edu/~ksarac/amt/)
  - Works but outdated
  - Windows-only
- Upipe Native Client Demo (http://upipe.org/player_chrome/)
  - SSM-only
  - Apparently works, but only on certain systems
  - Uses NaCl, which is Chrome-specific and no longer supported
- Concordia / UT Dallas reference implementation (amtgwd)
  - Compiles and runs
  - Has broken / outdated IGMPv3 proxy implementation (gproxy)

AMT Gateway Implementations cont.

- GregB’s Java SDK for Multicast Services (https://github.com/willzhang05/js4ms)
  - Missing documentation
  - Self-signed cert prohibits running of .jnlp
- Jake Holland's reference implementation fork (https://github.com/willzhang05/amt)
  - Needed a few changes to compile and run
  - Also needs IGMPv3 proxy, but uses actively-developed mcproxy
- Cisco SSMAMTTools (https://github.com/cisco/SSMAMTtools)
  - Only available embedded AMT library
  - Good documentation

Further Work

- VLC integration
  - Widely supported
  - Cross-platform
- WebAssembly implementation
  - Very new technology
  - In-browser, similar to Upipe NaCl demo
  - Supported by all major browsers

Try out the AMT relay!

- http://utdallas.edu/~kxs028100/amt/archive/vlc-0.9.0-svn-01-22-08.zip
- At the menu, choose [Media]-[Open Network]. Mark the [Show More Options] box and type the following command to the [Customize] box.
- URI: udp://129.174.131.51@233.44.15.9:50001:amt=198.38.23.145/2
- The VLC will wait for the native multicast until the timeout is expired. If it doesn't receive any data after that, the AMT protocol will be initiated and receive the data via AMT relay.