



MI Streamnet

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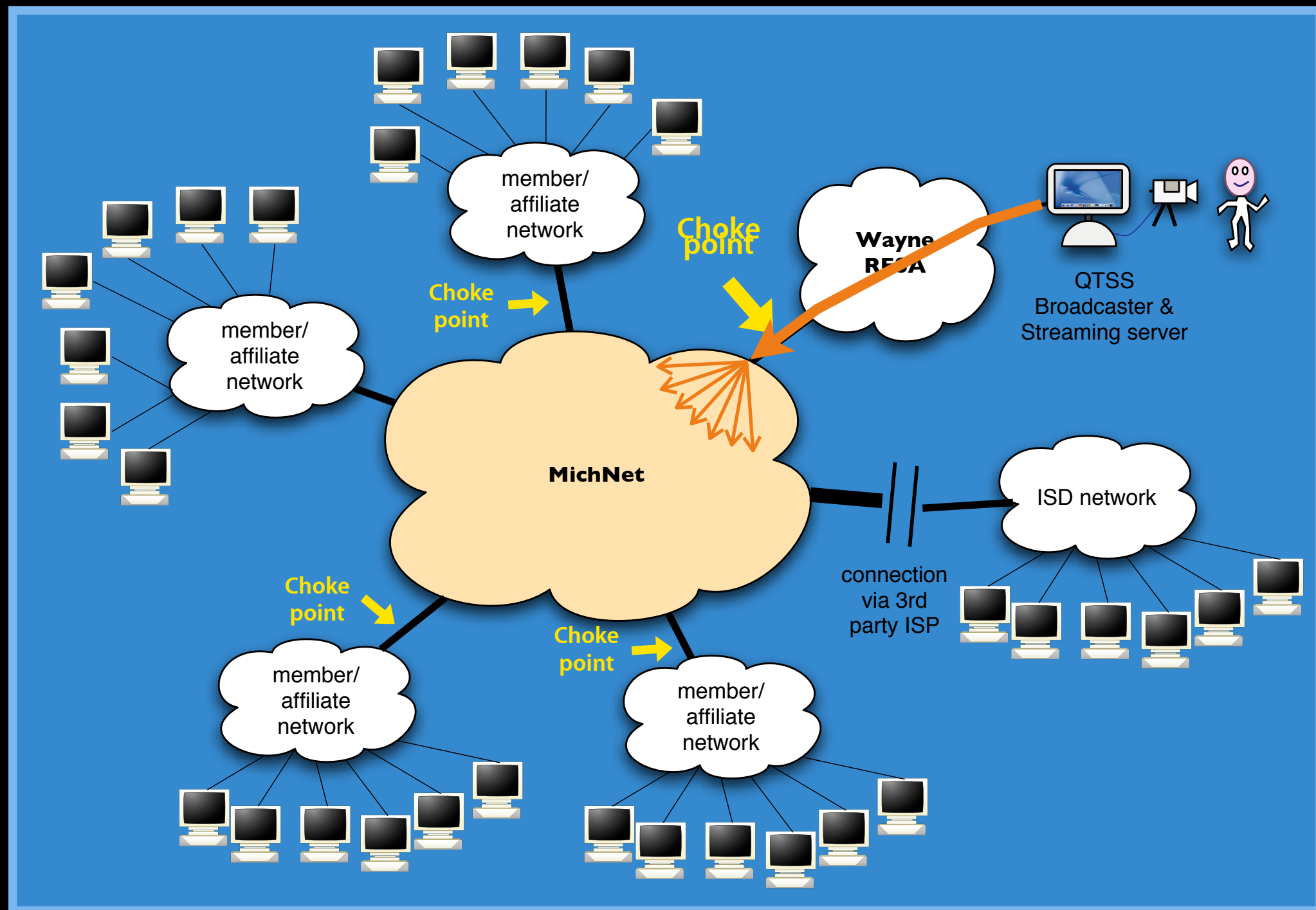
cook5@apple.com

MI Streamnet Project Case Study

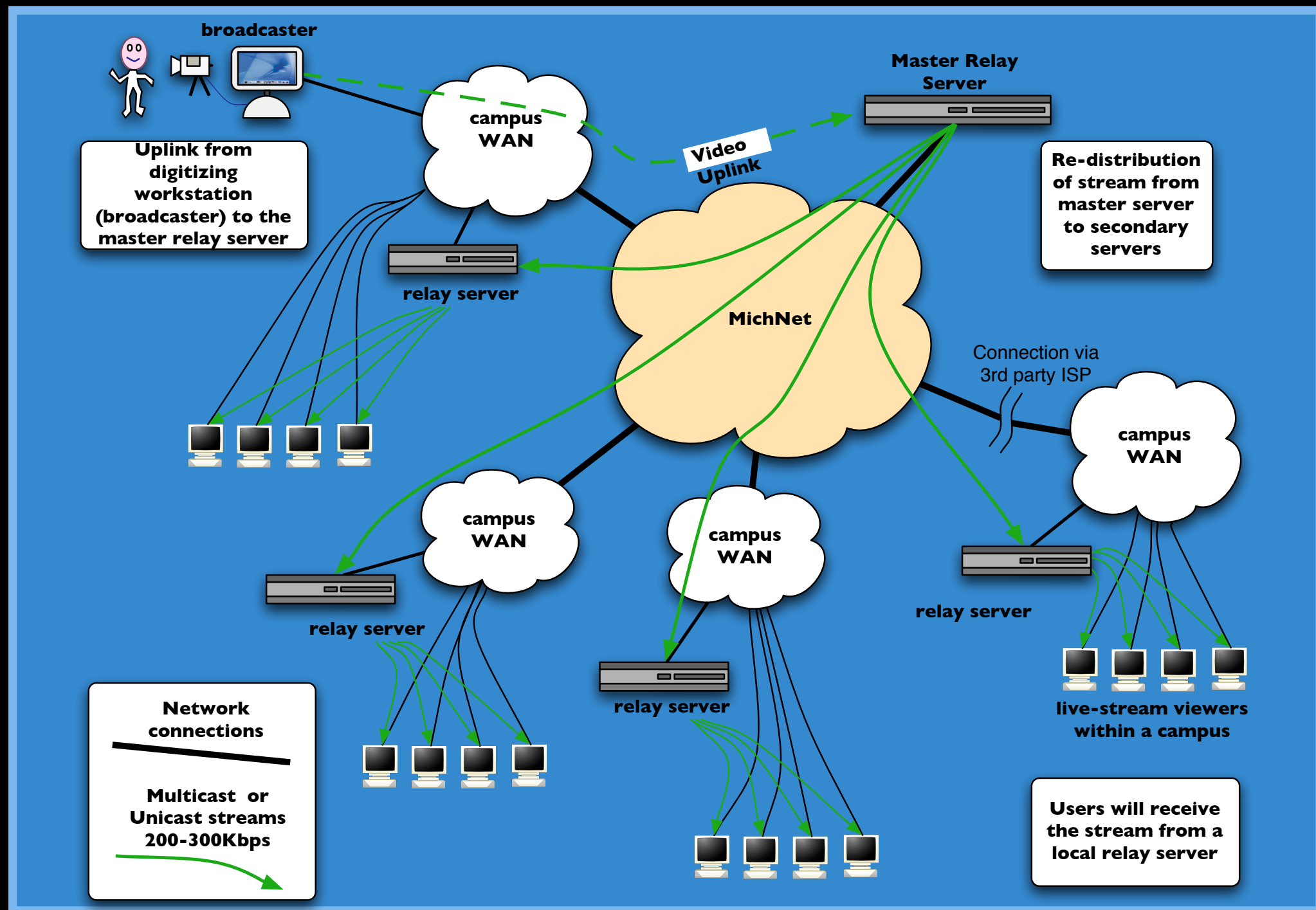
- Project objectives
 - Provide infrastructure for statewide live webcasting
 - Provide infrastructure for video on demand
 - Minimize bandwidth impact on Internet connections
- Project stakeholders
 - Regional Education Media Center (REMC)
 - Participating Michigan RESA's/ISD's
 - Merit Network, Inc.
 - Apple



MI Streamnet History



MI Streamnet Topology



MI Streamnet Nodes

Statewide streaming for education in Michigan



MI Streamnet Architecture

- Broadcasts can be initiated from any Internet node
- Parent Node at Merit Data Center (Ann Arbor, MI)
 - “Push” relays to participating RESAs and ISDs
 - Content replication via rsync
 - Apache CGI redirection script
- Child nodes in RESAs/ISDs across the state
 - Establish .sdp files to relayed streams from Parent Node
 - Replicated content from Parent Node
 - Locally hosted video on demand content
- Catch all Server “Shunt”
 - Up to 50 non REMC users



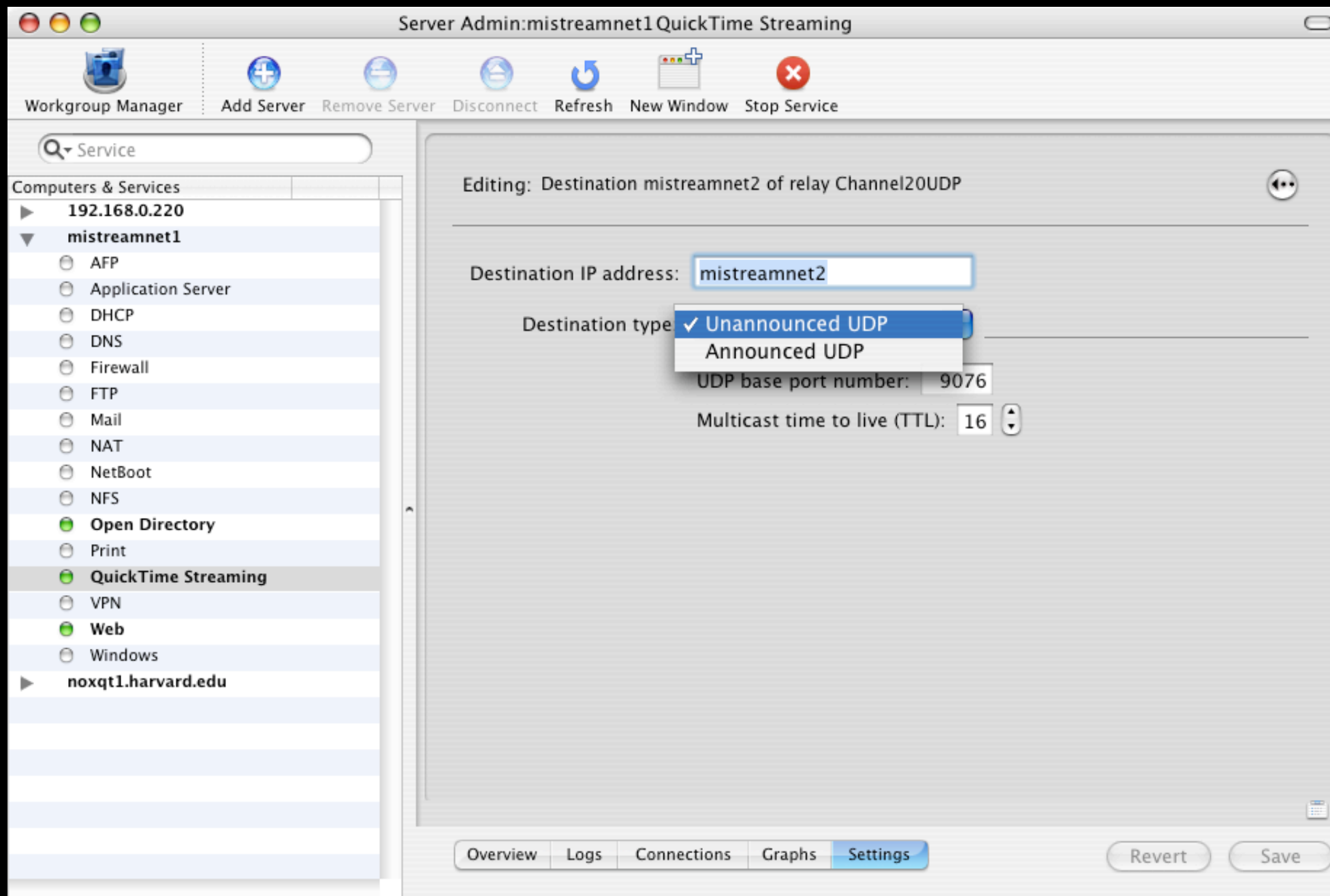
Webcasting Implementation

Unannounced destinations

- Announce Live Stream from encoder
 - QuickTime Broadcaster “Automatic Unicast”
- Announced .sdp file is the Relay Source on the Parent node
- Each Child Node destination configured as Unannounced UDP
 - Copy the sdp file created by Broadcaster
 - Edit the file to match relay destination settings
 - Distribute the file to all Child Nodes



Unannounced Relay



MI Streamnet Relays

What we learned

- Unannounced relays require more setup
 - Editing and distribution of sdp file
 - The same sdp file can be used on all Child Nodes
- Unannounced relays are more robust
 - If connectivity with a Child Node is lost, the parent continues to relay to all destinations
 - When a connectivity to a child node is restored, clients will automatically reconnect



MI Streamnet Parent Relay

List of relays

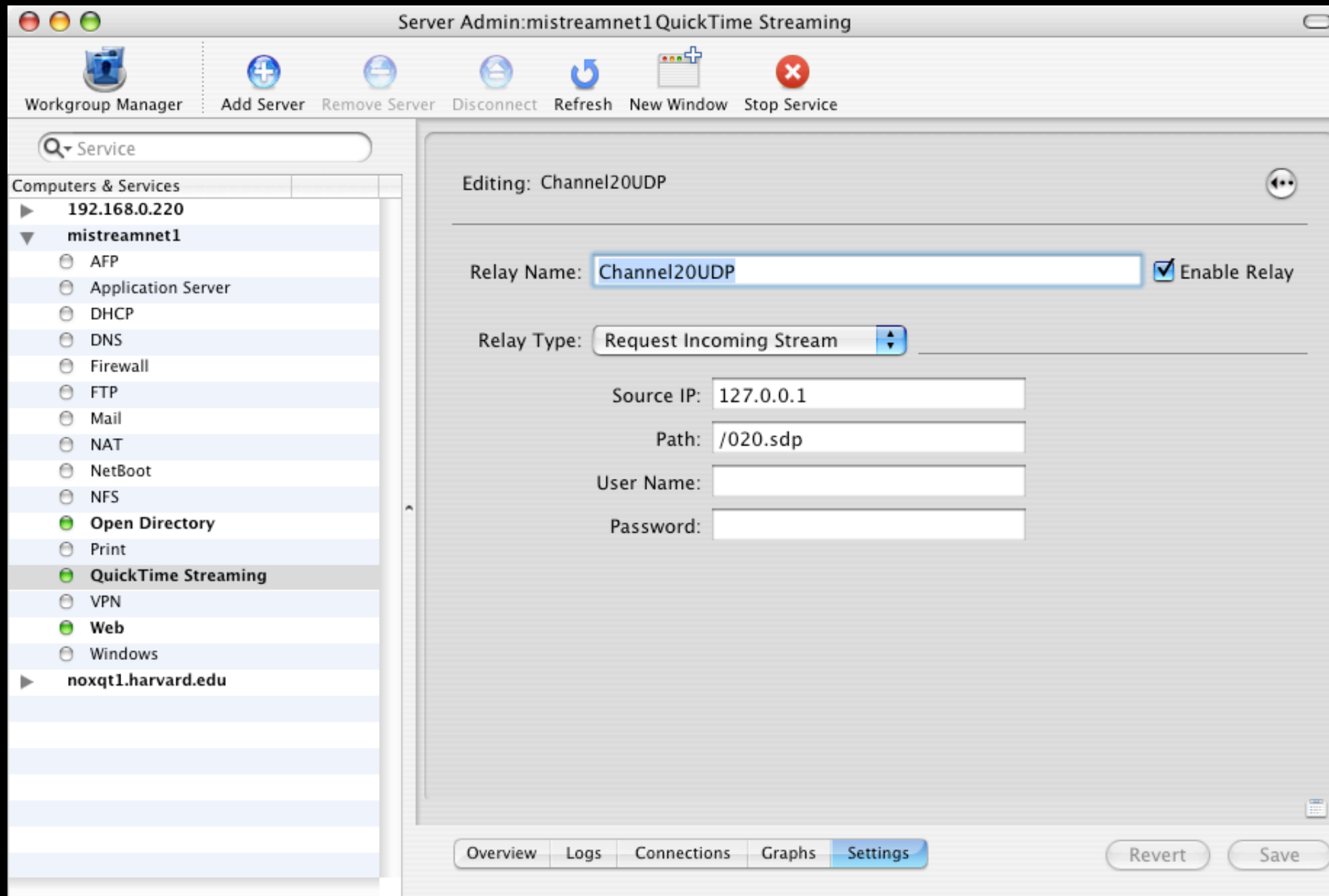
The screenshot shows the 'Server Admin: mistreamnet1 QuickTime Streaming' window. The 'Relays' tab is selected, displaying a list of relays. The left sidebar shows the 'Computers & Services' tree with 'mistreamnet1' expanded and 'QuickTime Streaming' selected. The main pane shows a table of relays with columns 'Enabled', 'Relay Name', 'Destination Address', and 'Destination Type'. The table lists 18 relays, all enabled, with names from Channel02UDP to Channel17UDP. The destination addresses are various domain names, and the destination type is 'Unannounced UDP' for all. At the bottom, there are buttons for '+', '-', and a pencil icon, and a 'Settings' button is highlighted in the bottom bar.

Enabled	Relay Name	Destination Address	Destination Type
<input checked="" type="checkbox"/>	Channel20UDP	mistreamnet2	Unannounced UDP
<input checked="" type="checkbox"/>	Channel02UDP	monroeisd	Unannounced UDP
<input checked="" type="checkbox"/>	Channel03UDP	coppercountryisd	Unannounced UDP
<input checked="" type="checkbox"/>	Channel04UDP	wexford-missaukeeisd	Unannounced UDP
<input checked="" type="checkbox"/>	Channel05UDP	muskegonisd	Unannounced UDP
<input checked="" type="checkbox"/>	Channel06UDP	gratiot-isabellaresd	Unannounced UDP
<input checked="" type="checkbox"/>	Channel07UDP	bay-arenacisd	Unannounced UDP
<input checked="" type="checkbox"/>	Channel08UDP	ottawaisd	Unannounced UDP
<input checked="" type="checkbox"/>	Channel09UDP	vanburenisd	Unannounced UDP
<input checked="" type="checkbox"/>	Channel10UDP	kalamazooresd	Unannounced UDP
<input checked="" type="checkbox"/>	Channel11UDP	geneseeisd	Unannounced UDP
<input checked="" type="checkbox"/>	Channel12UDP	jacksonisd	Unannounced UDP
<input checked="" type="checkbox"/>	Channel13UDP	washtenawisd	Unannounced UDP
<input checked="" type="checkbox"/>	Channel14UDP	macombisd	Unannounced UDP
<input checked="" type="checkbox"/>	Channel15UDP	stclairisd	Unannounced UDP
<input checked="" type="checkbox"/>	Channel16UDP	wayneresa	Unannounced UDP
<input checked="" type="checkbox"/>	Channel17UDP	noxqt1.harvard.edu	Unannounced UDP



MI Streamnet Parent Relay

“Channel 20” Source



MI Streamnet Parent Relay

List of relays

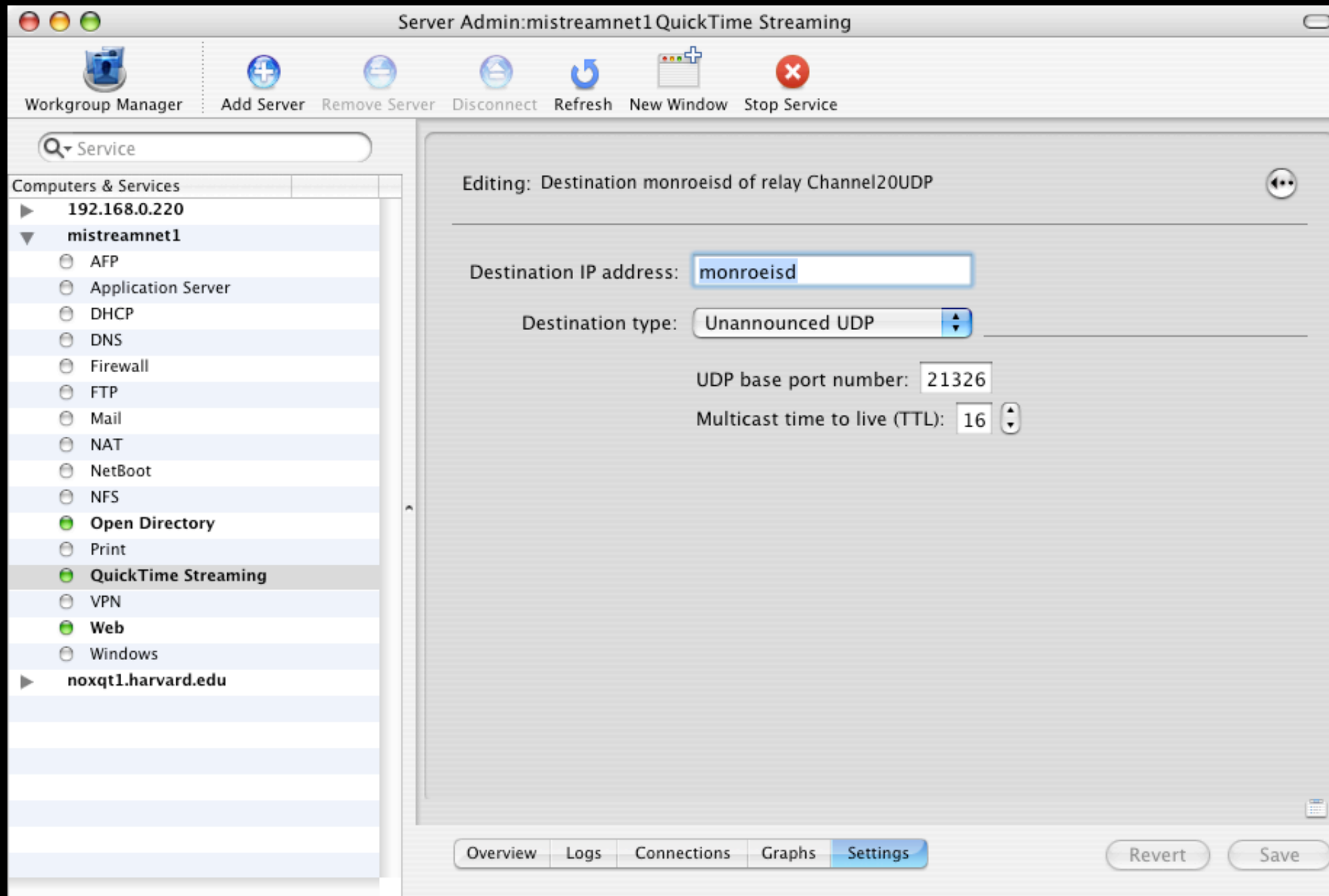
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Enabled	Relay Name	Destination Address	Destination Type
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<input checked="" type="checkbox"/>	Channel06UDP	gratiot-isabellaresd	Unannounced UDP
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<input checked="" type="checkbox"/>	Channel15UDP	stclairisd	Unannounced UDP
<input checked="" type="checkbox"/>	Channel16UDP	wayneresa	Unannounced UDP
<input checked="" type="checkbox"/>	Channel17UDP	noxqt1.harvard.edu	Unannounced UDP



MI Streamnet Parent Relay

“Channel 20” Destination



Child Node .sdp File

```
v=0  
o=ctnadmin 3289090834 3289090834 IN IP4 205.39.0.242  
s=/020.sdp  
c=IN IP4 127.0.0.1  
t=0 0  
a=control:*  
m=audio 21326 RTP/AVP 96  
a=rtpmap:96 x-Purevoice/11025/1  
a=control:trackID=1  
m=video 21328 RTP/AVP 97  
a=rtpmap:97 X-QT  
a=cliprect:0,0,240,320  
a=control:trackID=2
```



MI Streamnet Live Redirection

Redirecting clients to Child Nodes

- To reduce bandwidth consumption, clients must connect to the correct server
- QuickTime can open URLs to CGI Scripts
- References to QuickTime Streams can be expressed in text (.qtl files, .smil files, RTSPtext files, etc.)
- MIStreamNet uses a Perl CGI for redirection
 - Based on the client's IP address
 - Returns .qtl text to redirect client to the appropriate Child Node
 - Logs connections
 - Works with .sdp, .mp4, and .mov files



Redirection Configuration File

Child Node IP Address	Client IP Address Range Start	Client IP Address Range End	Multicast on this Child Node?	Description
205.38.89.160	205.38.64.*	205.38.95.*	undef	(REMC 14) Genessee ISD



Calling the Redirection Script

Script returns .qtl text (XML):

```
curl http://mistreamnet1:8080/cgi-bin/mistreamnet.pl?020.sdp
```

```
<?xml version="1.0"?>
<?quicktime type="application/x-quicktime-media-link"?>
<embed src="rtsp://205.108.89.171/020udp.sdp" controller="true" autoplay="true" quitwhendone="false"/>
```

Embedded in the MStreamNet page:

```
<object classid="clsid:02BF25D5-8C17-4B23-BC80-D3488ABDDC6B"
  codebase="http://www.apple.com/qtactivex/qtplugin.cab#version=6,0,2,0"
  width="215" height="175" align="middle">
  <param name="src" value="click4player.jpg">
  <param name="type" value="video/quicktime">
  <param name="cache" value="false">
  <param name="target" value="QuickTimePlayer">
  <param name="href" value="http://mistreamnet1:8080/cgi-bin/mistreamnet.pl?020udp.sdp">
  <param name="autoplay" value="true">
  <embed align="middle" width="215" height="175"
    pluginspage="http://www.apple.com/quicktime/download/"
    src="click4player.jpg"
    type="video/quicktime"
    cache="false"
    target="QuickTimePlayer"
    href="http://mistreamnet1:8080/cgi-bin/mistreamnet.pl?020udp.sdp"
    autoplay="true" />
</object>
```



Testing and Configuration of MI Streamnet

- Load testing the Parent Server
 - Use StreamingLoadTool to stress test the Parent Node
 - Use a Python script to stress test the redirection script
 - Requests the redirection URL and prints success or failure
 - Testing helped isolate and resolve specific problems
 - Use StreamingLoadTool to stress test the Parent Node
- Configuring MI Streamnet Servers
 - All unnecessary services disabled
 - File copies over secure connections
 - Firewall rules limit access



StreamingLoadTool

MI Streamnet test

- /usr/bin/StreamingLoadTool binary
 - Can be copied to any Mac OS X system
- streamingloadtool.mov must be in the server's Movies directory
- streamingloadtool.conf modified:
 - Runforever yes
 - concurrentclients 50
 - url rtsp://mistreamnet1/020udp.sdp
- Ran multiple instances of StreamingLoadTool on 3 systems while monitoring the stream with QT Player and tailing the StreamingLoadTool log file



MI Streamnet Content Replication

Using rsync for content distribution

- rsync command-line utility is built into Mac OS X

```
rsync -R --verbose --stats --recursive --rsh=/usr/bin/ssh /  
Library/QuickTimeStreaming/Movies/sync/ admin@mistreamnet2:/
```

- Used to synchronize content from “Movies” directory across MI Streamnet nodes
- Synchronization occurs at specified times via the system crontab on the Parent node
- Uses ssh for secure connections
- Replicated content works with redirection script



MI Streamnet Monitoring

For local administrators

- Web CGIs use the QTSS Admin Protocol
- Report server status, current bandwidth and connected users
- Procedure for publishing locally produced content
 - QTSS Publisher
- Moodle web site to provide ongoing training and communication to local admins



QTSS Publisher

Easy to use content management and publishing

- “Child nodes” on MI Streamnet need to publish School and District specific content
- Technology coordinators need an easy graphical tool for managing local content and publishing web pages
- Need to provide access without compromising security of servers





Q&A