Live streaming with H.264
Digital Academic Television Network (DATN)
University of Wisconsin—Madison

Dave Schroeder
Systems Engineer
University of Wisconsin—Madison
das@doit.wisc.edu
What is H.264?

• Part of the MPEG (Motion Picture Experts Group) family of standards
  − ISO: MPEG-4 Part 10, MPEG AVC
  − ITU-T: H.264
• Includes all of the capabilities of MPEG-2
• Supports HD at 6-8 Mbps, SD at 1.5-2 Mbps, DVD quality video at under 1 Mbps
• Scales from 3G handheld devices to HD
• Included in QuickTime 7 and supported by QuickTime Streaming Server and QuickTime Broadcaster 1.5
• For more information, see:

Live streaming with H.264

- Live streaming with H.264 is very processor intensive
  - Requires about twice the processing power of MPEG-4
  - Delivers about twice the image quality at same datarate
- Standard definition TV quality streams are possible in under 1.5 Mbps
- Improvements in QuickTime Broadcaster 1.5 and QuickTime 7 also make much higher quality streams possible
  - Formerly, QuickTime Broadcaster discarded half of the vertical frames of DV input
  - 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
Requirements for H.264 live streaming

• Ideal streaming configuration
  – Dual G5 system (Power Mac G5, Xserve G5)
  – Mac OS X Server 10.4.x
  – QuickTime 7.x
  – QuickTime Broadcaster 1.5.x
  – DV or suitable capture card source

• This configuration can handle...
  – 720 x 480 (640 x 480)
  – 30 (29.97) fps
  – “Best” quality
  – 1-2 Mbps

• ...and consumes about 65% CPU on dual 2.0 GHz Xserve G5
Requirements for H.264 playback

• For standard definition content (1-2 Mbps)

• Mac OS
  – Mac OS X 10.3.x or 10.4.x
  – QuickTime 7.x
  – 1 GHz G4

• Windows
  – Windows 2000 or XP
  – QuickTime 7.x
  – 1 GHz PIII
IP Multicast

- Critical to deployment of services such as large scale live video delivery
- Allows for one or more hosts to “listen” to a stream, with no impact on the server or network beyond the initial stream; whether one client or one thousand is watching CNN, the impact on the overall network is the same
- Delivery scope can be inherently managed by the topology of the network
- For more information, see http://multicast.internet2.edu
Why QuickTime?

• Open standards
  – MPEG-4, H.264
• Flexible content delivery
  – Using open standards allows us to reach widest range of clients and devices
• Cost
  – Hardware
    – Xserve less expensive than dedicated products
    – Multiple streams possible with single server
  – Software
    – QuickTime Player: Free for Mac OS and Windows - key!
    – QuickTime Broadcaster: Free
    – QuickTime Streaming Server: Included with Mac OS X Server
Sample live streaming setup

• Xserve boots, and automatically logs in as the broadcasting user

• In the event of an anomaly, the machine will automatically reboot itself via watchdog. The machine can also monitored by Server Monitor and other tools.

• QuickTime Broadcaster is started via AppleScript upon login with the appropriate settings:

```plaintext
tell first document of application "QuickTime Broadcaster"
start
end tell
```
Sample live streaming setup (Cont.)

- Entry in `crontab` spawns Broadcaster monitor

```
* * * * * /usr/local/sbin/qtbmon
```

- Script relaunches Broadcaster if not running

```
#!/bin/sh

/bin/ps auxwww | /usr/bin/grep Broadcaster | /usr/bin/grep -v
grep > /dev/null 2>&1

if [[ $? = 1 ]]; then
    open -a /Applications/"QuickTime Broadcaster Start.app"
    echo `date` >> /Users/datn/Library/Logs/qtbmon.log
fi
```
Typical streaming node (DATN)

- Head node
- Streaming node
- Xserve Cluster Node
- Optional Miglia AlchemyTV PCI TV tuner card
- Canopus ADVC--100
- TextGrabber closed captioning decoder
- Blonder Tongue ZDM Series TV tuner

Connections:
- Coax
- FireWire
- Video
- Audio
- Serial
- Network
Interesting H.264 applications with iChat

- iChat in Tiger uses H.264 codec configuration optimized for lower datarates
- Use iChatUSBCam with iChat to allow other video sources
- iChat conferences can be combined with live sources (internal content, closed circuit video, television, other DV source, etc.)
- Other video such as television channels, satellite events, or live camera sources can be “invited” to multiperson conferences to support, e.g., collaboration during a Research Channel event, discussion of satellite imagery, etc.
For More Information

http://datn.wisc.edu/