Worldwide Developers Conference

Emerging Internet Standards

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Internet 2

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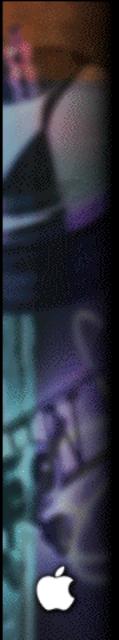# What Is Internet 2?

The next generation Internet

- Sponsored by the U.S. research community
  - Over 100 universities
  - Ten affiliates (non-profit)
  - Partners (ANS, CISCO, Fore and IBM so far)
- Assisted by the U.S. government
  - Funding—Next Generation Internet (NGI)
  - Federal Agencies (NASA, DoE, CDC, etc.)

Technical Details

Infrastructure, applications, management

- **Overall plan**
  - GigaPoPs; Connectivity
- **Phased approach**
  - July '98: end-to-end using vBNS (155Mbps)
- **First deliverables**
  - Common bearer service = IPv6
  - Quality of Service (QoS) operational
  - Cost and Price Management

Why is Internet 2 Important ?

… setting stanards for the next decades

- **Qualitatively Different Network**
- **Catalyst for New Applications for Research and Teaching**
  - music instruction, medical monitoring and diagnosis, atmospheric and astronomical supercomputing, networked learning environment, nano-manipulation, digital libraries, virtual laboratories, visualization, tele-immersion, media integration, and publishing innovations.

What Are the Challenges?

Where should Apple products play?

- Speed: Desktop architecture to support > 100 Mbps sustained throughput
- Middleware and Security: Rapid response
- New Client Tools: Collaboration
- Metadata Services: like MCF?
- Component Software and Compound Document Support
- Network-wide Utilization Metrics

Information and Opportunities

- PowerPC + Rhapsody = i2 Workstation?
- Work with universities or partners
  - 100+ universities
  - 4 partners

  http://www.internet2.edu

Streaming Protocols

Dave Singer

Apple Interactive Media Group

What's Streaming?

- Real-time media sent over network at media rates
- No download-and-play
- Can be one-to-many
- May be unreliable delivery

What Protocols?

- **RTP—Real Time Transport Protocol**
  - Time-stamp, sequence, payload identification
- **IP Multicast**
  - One-to-many at the IP level
  - Supported in OpenTransport
- **RTP+IP Multicast+Public Internet = MBone (roughly)**

What Protocols? *(cont.)*

- **RTCP—Real Time Control Protocol**
  - Part of RTP
  - Source, sink, receiver, traffic info, etc.
- **RTSP—Real Time Streaming Protocol**
  - Control protocol for streaming; start/stop, etc.
  - Can be used as delivery channel also
- **SDR/SDP—Session Description Protocol**
  - Multicast or put in files
  - Like a basic program guide

The New Media Channel

You are a TV station or a video library

- **Video-on-demand finds the Internet**
  - "Closed" trials now closing, but the Internet is open…
- **IP Multicast takes server load away**
  - Network does the replication
  - Clients all see the same material
  - "Digital TV"

Who Wants Internet TV?

It's kinda small and jerky and sounds bad

- 28.8 is about 3600 bytes a second
- Faster processors
- Faster access networks
  - 56K, xDSL, cable modems
- Better compression
- Controlled networks (intranet)

Current Tools

- **UNIX 'reference' tools**
  - VIC/VAT/SDR, used on the MBone
- **Macintosh demonstration tools**
  - QuickTime TV, currently given away
- **Windows tools**
  - Variety of free and for sale software (e.g., Precept)

Specification and Deployment Status

- RTP, IP Multicast, SD
  - RTP is RFC 1889 (and 1890)
  - Stable, widely used, interoperable
- RTSP
  - Currently a working draft at IETF (MMusic)

Macintosh Tools

Developed in research and advanced development

- QuickTime TV
  - RTP/SD support (receiver only)
  - Unicast support, send and receive Non-RTP, has reflector
- QTTV team is now part of QuickTime engineering

Developer Opportunity

- **Streaming is currently an end-to-end problem**
  - One company does authoring, serving, protocol, client
- **Standard protocols will open the field**
  - Just as in HTML, get specialists in each area

Developer Opportunity *(cont.)*

- **For live or near-live multimedia**
  - Internet is the only channel
  - (Unless you can afford to buy cable time)
- **Many "halo" opportunities as well as core**
  - Firewalls, gateways, monitoring, etc.

You, Apple and the Opportunities

- QuickTime is the place to stand
- QTTV was a "vertical" testbed
  - QuickTime is a horizontal layer
- QTTV was on QuickTime Conferencing
  - …
- Developers are independent partners
  - Author, serve, monitor, display, encode, leverage…

Summary

- A Mac is a good place to be
  - A/V, networking, IP multicast
  - QuickTime
- TV for the rest of us
  - Internet TV is coming
- Standards are consolidating
  - Market grows faster
  - Specialization improves both:
    - Developer opportunity
    - Quality of the experience

References

- **MBone, RTP etc.**
  - http://ds.internic.net/
  - http://www.mbone.com/
- **RTSP**
  - http://www.prognet.com/rtsp
- **QuickTime TV**
  - http://qttv.quicktime.apple.com