

Webcasting and Technological Features

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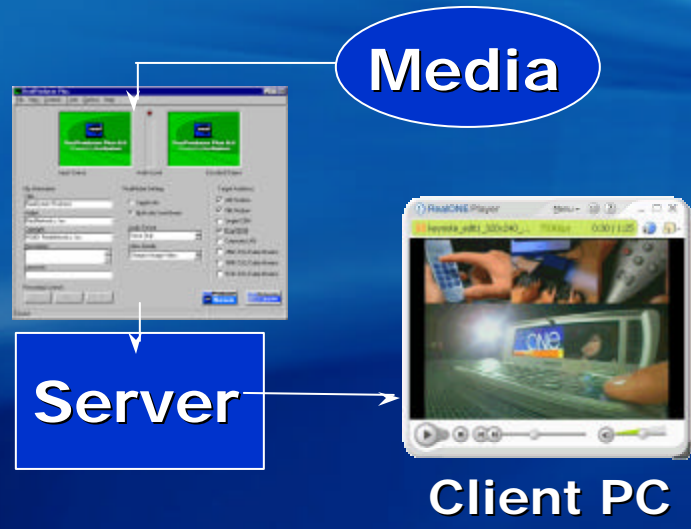
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**June 23, 2003 presentation to WIPO
SCCR 9**

→ **What is "Streaming"?**

- ♣ The real-time transmission of audio and/or video from a source (server) via a computer network to many, or point-to-point, for immediate performance.

→ **What is Streaming Media?**



→ **Streaming is Different from:**

♣ **Delivery of Web Pages**

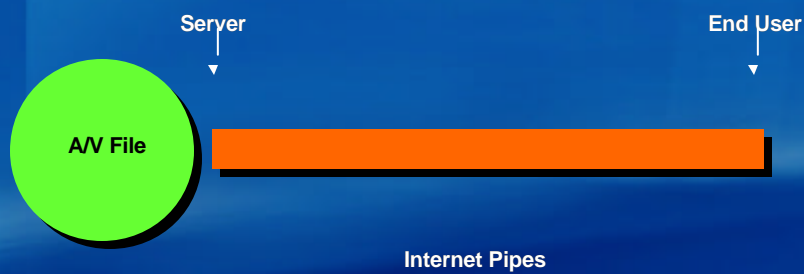
- Different types of data
- Technical "protocols" for transmission are different
- Readily distinguished by receiving PC

→ Streaming is Different from:

♣ Downloading

- Downloads deliver entire files for local long-term storage
- Streaming transmits packets of data, not entire files
- Streamed data are discarded immediately after performance

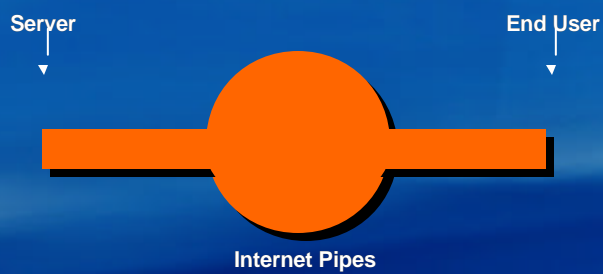
→ The Process of Downloading A/V Files...



→ An Entire File from the Server...



→ is sent, all at once, across the network.



- ♣ Network breaks file into packets transparently for transfer across the network.

→ **Exact copy of file is stored locally on client machine for playback**



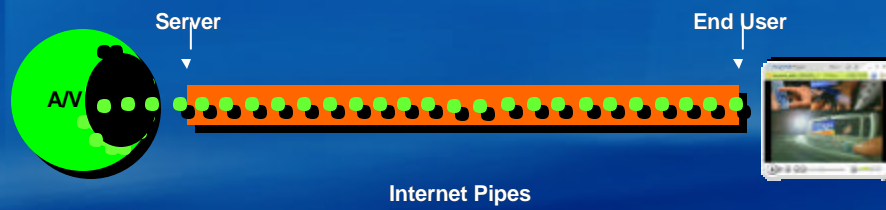
→ **Streaming Media**
Breaks file into Small Data Packets...



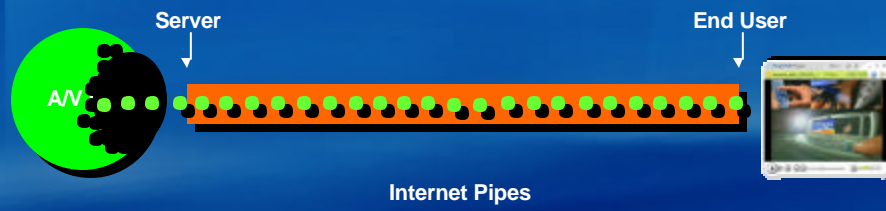
→ Stream Across the Internet...



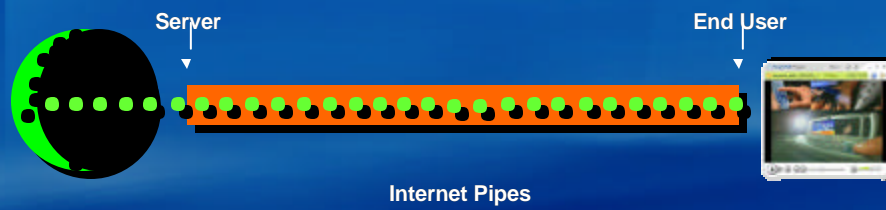
→ Uncompress and Play...

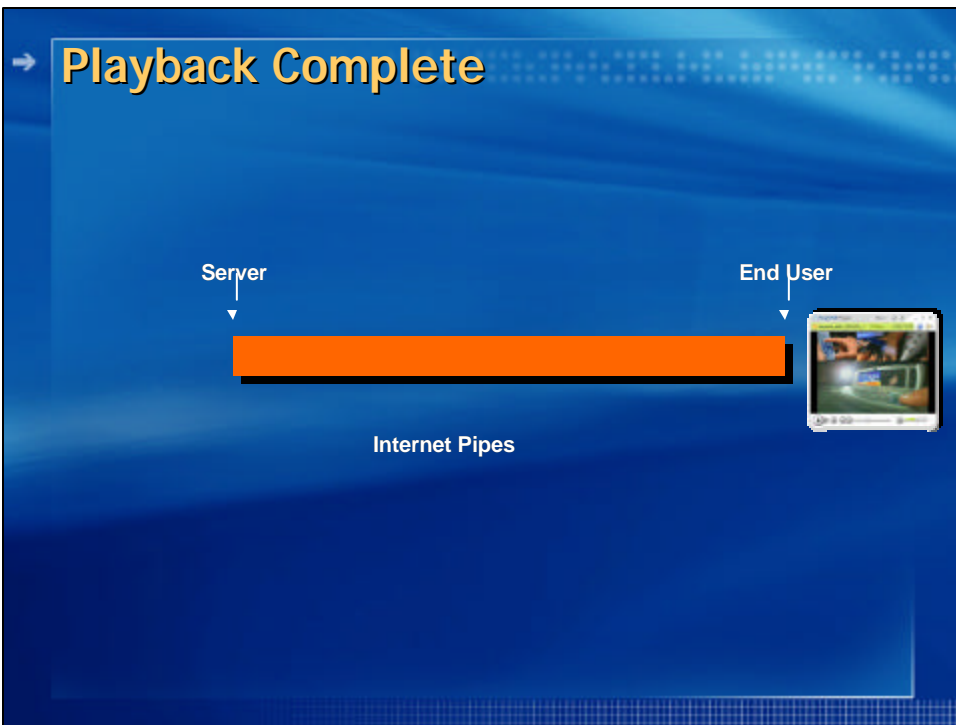
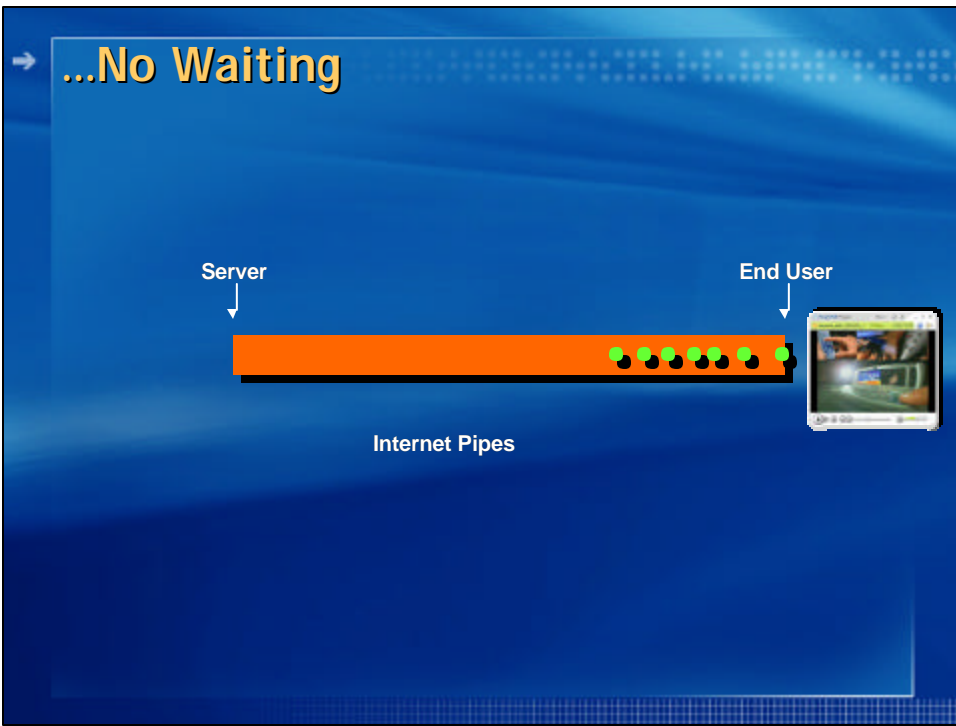


→ Watch/Listen as New Data Arrives...



→ Real-Time Experience...





→ First Step: Content on Server

- ♣ Generally, files stored on a server by the webcaster
- ♣ Streams sent to server for transmission
 - Example: Live station or live remote webcast
 - Sends live streams via telephone line or computer network to Streaming Transmitter
- ♣ Files sent to server for delayed transmission

→ First Step: Content on Server

- ♣ Popular streaming formats
 - Real
 - Windows Media
 - QuickTime (Apple)
 - MP3
- ♣ Some player applications play all formats

→ Encoding Content on Server

- ♣ Data is written as “packets”
- ♣ A Packet is a small, individually decodable blob of data.
 - May be part of a single video frame

→ Transmission from Server

- ♣ User requests stream
- ♣ Server sends the data at a rate suitable for that user
 - Based on connection speed
- ♣ Server can adjust data rate, up or down, during streaming

→ Unicast or Multicast

♣ "Unicast" -- One to One

- Source serves one stream for each user
- NOT just point to point -- multiple one-to-one streams equals One to Many

♣ "Multicast" -- One to Many

- Source serves stream to local servers
- Local server streams to multiple users
- More efficient use of Internet backbone
- Increases reach to audience

→ Unicast



Webcaster
Server

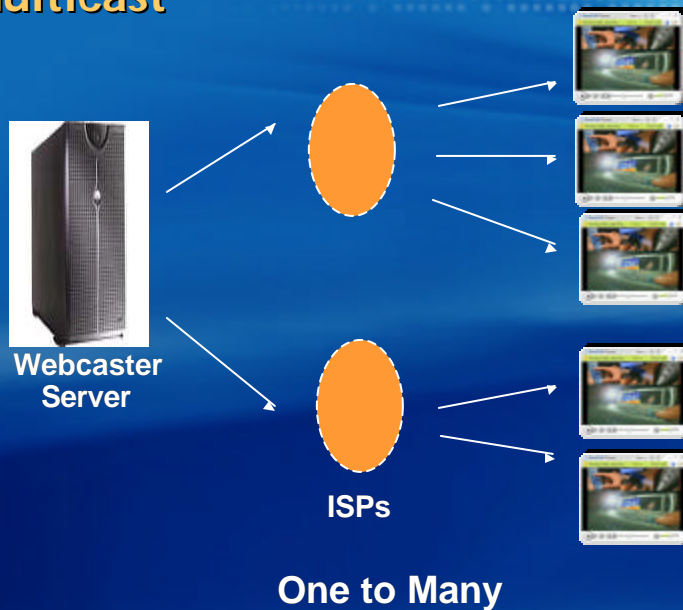


ISP



One-to-One

→ Multicast



→ Internet transport

- ✿ Data passes through network devices (routers/gateways/bridges)
 - These devices temporarily store small amounts of data to account for any difference in the receive rate vs. the send rate
 - These devices have no understanding of the data they transport
 - Do not store the webcast content

→ Receipt of stream by User

- ♣ Received packets are read from network into memory "buffer"
- ♣ Data in buffer is ordered and decoded
- ♣ Player software renders data
- ♣ Data is deleted after it is rendered

→ Buffering in the client

- ♣ Packets are stored for a few seconds ("buffered"), until they are performed by the player application
- ♣ Player on PC buffers packets to account for 'jitter'
- ♣ Software identifies an amount of data that must be buffered before playback can begin
- ♣ Amount of buffer can be increased or decreased

→ Buffering in the client

- ♣ Buffers are not written on the hard disk drive by the player application
- ♣ Buffers are not kept contiguously in memory
- ♣ It is impossible to playback media from buffers “captured” from memory

→ Content Control

- ♣ Data is streamed only to authorized users
- ♣ Copy controls can prevent direct recording
- ♣ Software that circumvents these protections is unlawful under Digital Millennium Copyright Act
 - *RealNetworks, Inc. v. Streambox*, 2000 U.S. Dist. LEXIS 1889 (W.D. Wash. 2000).

→ Piracy of Webcasts

- ♣ Unauthorized taking of streams from the server, and retransmitting them through the pirate's website
- ♣ Hacking into the webcaster's servers and stealing hidden content files
- ♣ Technological measures are temporary fixes against piracy

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