

Streaming Media Concepts and Trends

Douglas Dixon
Manifest Technology® LLC



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www.manifest-tech.com



Overview

- **Streaming Context**
 - Architecture: Download, Progressive
- **Issues**
 - Real-Time, Bandwidth
 - Solutions
- **Technology**
 - Video Formats: DTV, PC, Web
 - Codec Improvements
- **Trends**
 - Technology & Business
 - Scalability, System



Streaming Media Context

- **Internet Media Delivery**
 - Access: Real-Time
 - Broadcast: Live Events
 - On-Demand: Programming
 - Content protection: Digital Rights Management (DRM)
- **Entertainment, Education**
 - Corporate: Communications, Intranet
 - Consumer: Dial-up to broadband, Computer to set-top
 - Handheld: Mobile phones and PDAs



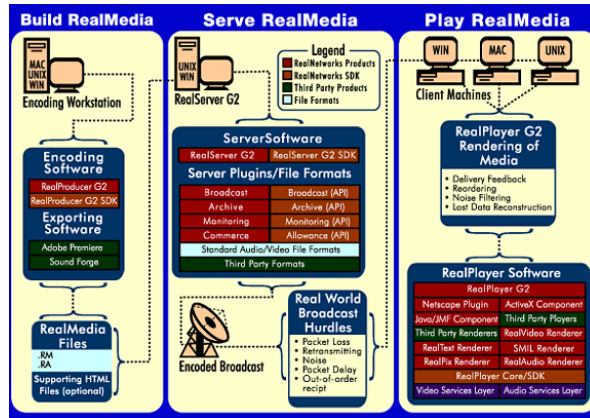
“Streaming”

- **Download**
 - Simple, Just like any other file, HTTP server
 - Have local copy, No contention, replay, share
 - Cannot preview, Must wait for full download
- **Progressive Download**
 - Start playing while file download completes
 - Smarter player client: QuickTime; Standard server
 - Short form - Movie trailers - Higher quality
- **Streaming**
 - Live broadcasts, Skip & search in stream
 - Special streaming server, and client player
 - Adapt to current connection, bandwidth



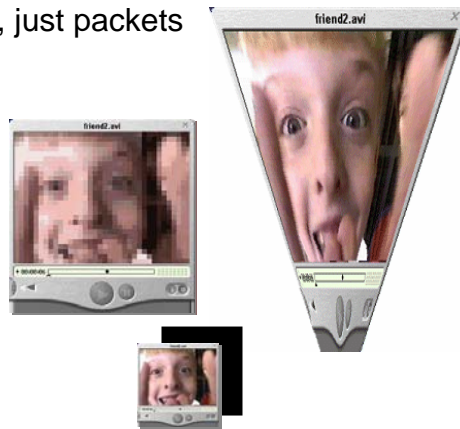
Streaming Media Architecture

Creation (Encoding) → Server (Storage) → Player (Decoding)



Streaming Media Issues

- **Internet Not Designed for Real-Time Streaming**
 - Not a dedicated channel, unknown path
 - No guaranteed delivery, just packets
- **Issues**
 - Bandwidth constraints
 - Transmission latency
 - Noise
 - Packet loss
 - Retransmission
 - Out of order delivery



Streaming Bandwidth Range

Wide Range of Data Rates

- **Dial-Up**
 - Modem 28 - 56 Kbps
 - ISDN 64 - 128 Kbps
- **Broadband**
 - DSL / Cable 200 - 400 - 650 Kbps - 2 Mbps
- **Backbone**
 - T1 1.5 Mbps
- **LAN**
 - Ethernet 10/100 10 / 100 Mbps
- **PC Interfaces**
 - USB 1.x 12 Mbps
 - USB 2.0 480 Mbps (Hi-speed)
 - FireWire/1394 100 - 400 Mbps
 - FireWire 800/1394b 800 Mbps (to 1.6, 3.2 Gbps)



Streaming Solutions

- **Shooting & Editing for Streaming**
 - Cannot just repurpose existing content
 - Close-up: More than TV
 - Limit camera movement, good lighting
 - Simple background, reduce detail
 - Simple editing: Avoid fancy transitions
- **Compressing for Streaming**
 - Select codec and options for specific use
 - Video: Talking head vs. motion / Audio: Voice, Background, Music
 - Trade-offs: Resolution vs. Frame Rate (Slide Show)
 - Variable bit rate, two-pass encoding, inverse telecine, interlace
- **Server Support for Streaming**
 - Adjust to bandwidth: Multi-rate, dynamic
 - Optimize path: End to end system
 - Content protection



Video Formats: DTV, PC, Web

- **Consumer Digital Video**

- “Full-quality” video for display on consumer televisions
- DV, DVD / MPEG-2
- 720 x 480 video, 30 fps, Stereo / surround audio
- DV fixed 25 Mb/s; DVD MPEG-2 typically 4.5 Mbps, max 10



- **Desktop Video**

- Presentation video for PC playback or CD-ROM productions
- Microsoft AVI, Apple QuickTime, MPEG-2, MPEG-4
- Typically 640x480 -> 320x240, 30 / 24 / 15 fps
- CD-ROM 1X - 150 KBps (1.2 Mbps)



- **Streaming Video**

- Bandwidth reduces resolution, frame rate, quality
- MS Win Media, Apple QuickTime, RealNetworks, MPEG-4, Flash
- Typically 320x240 -> 160x120, 15 / 10 / 5 fps
- Modem 28-56 Kbps, ISDN 64-128, Broadband 200+

Codec Improvements

- **Video Codecs**

- Wireless 10 Kbps (160 x 120)
- Half-screen 56 Kbps (Dial up)
- Near-VHS 800 -> 160 Kbps (Broadband)
- Near-DVD 1 Mbps -> 500 Kbps -> surround
- SD DVD / DV 2 -> 1 Mbps (MPEG-2 ~6, DV 25 Mbps)
- HDTV 5 Mbps

- **Audio Codecs**

- Low rate 20 Kbps (voice and music)
- CD / stereo 128 -> 64 -> 48 Kbps (1/2 – 1/3 MP3)
- 6-channel 192 - 256 Kbps

Streaming Trends: Technology

- **Codec Improvements**
 - Movies over broadband; HD, surround sound
 - Mass storage: Two movies on a CD, 15 on a DVD
 - 133 hours on 60 GB drive vs 5 hours of DV
- **Cooperation and Competition**
 - Partners / Open source; Hardware decoders
- **Scalability**
 - Wireless, dial-up, broadband, broadcast, high-def
 - Mono, stereo, multi-channel surround
- **Container**
 - Video, audio, graphics, synthetic, animation
 - Scenes, objects, interactivity; SMIL, MPEG-4

Streaming Trends: Business

- **Open Architecture / Open Source**
 - Multiple formats: DV, MP3, MIDI, Flash; APIs
 - Servers, Players, Codecs -- MPEG-4: M4IF, ISMA
- **System Approach**
 - Content production, distribution and access
 - Codecs, Servers / broadcast, Players, APIs
 - Architecture: DRM; Instant start, glitch tolerance
- **Wider Applications**
 - PC, Film, Broadcast, Subscription services
 - Consumer Electronics Devices
 - Portable players, stereos, DVDs, PDAs, wireless
- **Patents: MPEG-4, Acacia Research**

Not Just “Streaming”

- **Architecture**
 - From Codecs and Tools to Systems
 - From Proprietary to Multiple / Open Formats
- **Applications**
 - From Internet and PC to Wireless to High Definition
 - From Networked to Consumer Devices
- **Content**
 - From Video to Media Objects
 - From Streaming Playback to Interactive Experience

Streaming Media: Key Trends

- **Stability in players and formats**
 - QuickTime, RealNetworks, Windows Media, MPEG-4, Flash
- **Scalable: Handheld to High-Def**
 - Major codec improvements: Broadband movies, surround sound
- **Full system architecture**
 - Content production, distribution and access; DRM
 - Codecs, tools, servers, players
- **Cooperation and competition**
 - From proprietary to multiple / open formats
- **Content to container: Media objects**
 - Video, audio, graphics, synthetic, animation, scenes, objects
 - From Streaming playback to Interactive experience
- **Patent Issues**
 - MPEG-4 licenses; Acacia Research claims Web streaming media

Streaming Media Formats

- MPEG-4 Standards
- Apple QuickTime
- RealNetworks RealMedia
- Microsoft Windows Media
- Macromedia Flash MX - Spark



For More Information



The Manifest Technology site by Douglas Dixon contains over 150 articles and technical references on multimedia technology, especially digital video editing and DVD authoring.

