Streaming Media Formats

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Streaming Media Formats

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

MPEG Standards – Summary

- **Motion Picture Experts Group (MPEG)**
  - CD to Broadcast to Multimedia
  - MPEG-4 Industry Forum (M4IF)
  - Internet Streaming Media Alliance (ISMA)
  - Wireless Multimedia Forum (WMF)

- **MPEG-1 (1991) - CD, 352 x 240, 1 - 2 Mbps**
  - MP3 (level 3) audio (64 - 192 Kbps)
- **MPEG-2 (1994) - Broadcast, DVD, ~ 4 - 9+ Mbps**
- **MPEG-4 (1999) - Interactive multimedia**
  - Error resilience for networks
  - Esp. for medium bitrates (384 to 768 Kbps)
- **MPEG-4 H.264 / AVC (2003) - Advanced Video Coding**
  - Joint Video Team (JVT)
- **AAC audio - High efficiency**
  - Stereo CD at 48 Kbps

MPEG Standards

- **Moving Picture Experts Group**
  - Profiles (tools) @ Levels (complexity)
- **MPEG-1 - 1991 - CD**
  - Designed for CD-ROM rates, quarter-screen TV
  - 352 x 240 (SIF), 30 frames/sec (NTSC), 1.5 Mbps
- **MPEG-2 - 1994 - Broadcast / DVD -> HD**
  - Designed for digital TV broadcasting, scalability, 4 - 9 Mbps
  - NTSC to 15 Mbps / HDTV to 80 Mbps
- **MPEG-4 - 1999 - Interactive Media**
  - Designed for interactive multimedia across networks
  - Video, plus audio, interactivity, objects, error resilience
  - Clear improvement for medium rates (384 to 768 Kbps)
- **MPEG-4 H.264 / AVC - 2003**
  - Joint Video Team (JVT)
  - ITU H.264 / MPEG-4 part 10 - Advanced Video Coding (AVC)
  - Substantially higher video quality – 20% improvement
- **MPEG-7 - Metadata**
- **MPEG-21 – Digital rights management**

MPEG-1 and MPEG-2

- **MPEG-1 - 1991**
  - Designed for CD-ROM rates, quarter-screen TV
  - 352 x 240 (SIF), 30 frames/sec (NTSC)
  - Bit rate optimized around 1.5 Mbps

- **MPEG-2 - 1994**
  - Designed for digital TV broadcasting, scalability
  - Target bit-rate between 4 and 9 Mbps
  - Main Profile, Main Level (MP@ML) 720 x 480 at bit rates up to 15 Mbps for NTSC video
  - HDTV resolution of 1920 x 1080 pixels at 30 frame/sec at bit rates of up to 80 Mbps

MPEG-4 Summary

- **MPEG-4 - 1999**
  - Designed for interactive multimedia across networks
  - More than just video: Includes audio, video, interactivity
  - Video similar to H.263, file format based on QuickTime
  - Error resilience features
  - Clear improvement for medium bit rate coding (384 to 768 Kbps)

- **MPEG-4 H.264 / AVC - 2003**
  - Joint Video Team (JVT)
  - ITU H.264 / MPEG-4 part 10 Advanced Video Coding (AVC)
  - Substantially higher video quality, higher complexity

MPEG-4 Scope

- **Broad Applicability**
  - Content production, distribution and access
  - Interactive multimedia: Web
  - Digital television
  - Interactive graphics applications: Synthetic content
- **Scalable**
  - Wireless handhelds, PDAs, mobile phones
  - Dial-up / Broadband streaming
  - Broadcast / High definition
- **Issues**
  - Licensing, DRM, AVC complexity
  - Compatibility of bitstreams, profiles, file formats

Apple QuickTime – Summary

- **Cross-platform, Open standards**
  - CD to Progressive to Streaming to MPEG-4
- **QuickTime 1 (1991)**
- **QuickTime 2 (1994) - Music, MIDI, MPEG**
  - 1995-96 - QuickTime VR, Animation, Windows
- **QuickTime 3 (1998) - Open architecture,**
  - 50 formats, effects, AVI, DV, HTTP streaming
- **QuickTime 4 (1999) – 200 formats, Streaming Server**
- **QuickTime 5 (3/01) - MPEG-1,2, Sorenson 3, Flash 4**
- **QuickTime 6 (7/02) - Mainstream MPEG-4**
  - AAC audio, JPEG 2000, Flash 5
  - Open source streaming servers; Broadcaster

Apple QuickTime Background

- **Wide Distribution (10/02)**
  - End-to-end, open-standards streaming solution
    - 25 Million downloads QuickTime 6 in 100 days
    - 200K downloads QuickTime & Darwin Streaming Servers
- **QuickTime History**
  - 1991 - QuickTime 1 first released
  - 1994 – QuickTime 2 - Music, MIDI and MPEG
    - 1995 - QuickTime VR interactivity, Animation tracks
    - 1996 - QuickTime 2.5 - Windows, images, M-JPEG
  - 1998 - QuickTime 3 - Open architecture
    - 50 formats, special-effects architecture
    - MOV, AVI, DV, stills, audio, animation, MIDI, M-JPEG
    - HTTP streaming, select connection speed

Apple QuickTime Releases

- **QuickTime 4 (1999)**
  - Over 200 digital media formats
    - Video, audio, image, animation
    - Sorenson Video 2, QDesign Music 2, MP3
    - Flash, MIDI, text, VR, SMIL, JavaScript, AppleScript
  - QuickTime Streaming Server: HTTP, RTP, RTSP
- **QuickTime 5 (3/01)**
  - QuickTime 5 Player
    - MPEG-1, -2, Sorenson Video 3, Enhanced DV Codec
    - Flash 4, Cubic VR 360°
  - QuickTime Streaming Server 3
    - Skip Protection
    - RTP and RTSP protocols

Apple QuickTime 6 & 7

- **QuickTime 6 (7/02)**
  - Mainstream MPEG-4, AAC audio
  - MPEG-2 playback separate component
  - JPEG 2000, Flash 5
- **QuickTime and Darwin (enterprise) Streaming Servers**
  - Free and open source, Instant-On streaming
- **QuickTime Broadcaster for live streaming**
- **QuickTime 7 (4/05)**
  - MPEG-4 H.264 (AVC) video – 3G to iChat AV to HD
  - Multi-channel playback, up to 24 channels
  - Zero configuration streaming – auto connection speed, auto reconnect

RealNetworks RealVideo

- **Streaming focus, to Subscription**
  - Cross-platform, All major media types
  - RealPlayer on 90% of home PCs; 285 million registered users
    - More than 85% of Web pages with streaming media (6/02)
- **First RealPlayer (1995)**
- **RealJukebox supports Windows Media Audio**
- **RealVideo 7 (12/99) - VBR, two-pass encoding**
- **RealVideo 8 (5/00) – QT, 40 formats, MP3, Flash 4**
- **RealVideo 9 & RealAudio Surround (4/02) – Helix architecture**
  - Mobile devices, Open source
- **Real 10 Platform (1/04)**
  - RealPlayer 10: Real, WM, QT, MPEG-4, MP3; Music Store
  - RealVideo 10: 30% better, DVD 1 Mb, HD 5 Mb; Helix DRM
  - RealAudio 10: AAC, MultiChannel, Lossless

RealNetworks Background

- **Usage (6/02)**
  - RealPlayer on 90% of home PCs
  - Over 285 million registered RealPlayer users
  - More than 85% of Web pages with streaming media
  - 2500 live streaming radio stations
  - 800 companies have products using Real technology
- **Corporate History**
  - 1994 - Rob Glaser founded as Progressive Networks
  - 1995 - First RealPlayer
  - RealJukebox license Windows Media Audio
  - 2000 - RealServer 8 supports Apple QuickTime
  - 2002 - RealVideo 9 and RealAudio Surround

RealNetworks Releases

- **RealSystem G2**
  - SureStream, Intel Scalable Video Technology, Up to 1 Mbps, 30 fps
  - RealPlayer G2: frame rate upsampling, Win & Mac (Unix 5)
  - RealServer G2: RTSP and SMIL, WinNT & Unix
- **RealVideo 7 (12/99)**
  - Variable bit rate, two-pass encoding, inverse telecine
- **RealVideo 8 (5/00)**
  - Intel, DCT, temporal motion, interframe coding
  - RealSystem 8 - 40 media formats, MP3, Flash 4

RealVideo 9

- **RealVideo 9 & RealAudio Surround (4/02)**
  - 30% savings over RealVideo 8
  - Two full-length movies on a CD, Fifteen on a DVD
- **Helix Universal Server, Helix Universal Gateway**
  - All major media types: RealAudio/RealVideo, Apple QuickTime, MPEG-4, Windows Media
- **Helix Producer production tool**
  - Live broadcast, on-demand delivery, and download
- **Helix DNA client**
  - Mobile devices: Palm, phones
- **Open source: Client 10/02, Producer 12/02, Server 1/03**
  - Commercial and non-commercial public licenses

Real 10 Platform

- **Real 10 Platform (1/04)**
  - HD, Digital cinema: RealVideo 10 + RealAudio Multichannel
  - DVD at 1 Mbps, HD at 5 Mbps; 50 portable music devices
- **RealPlayer 10**
  - Real, Windows Media, QuickTime, MPEG-4, MP3
  - Music store: 400K songs, 99¢ track, $9.99 album
- **RealAudio 10**
  - RealAudio 10: Low to mid bit rate (< 128 Kbps), freq. bands
  - AAC for high fidelity, consumer music (> 128 Kbps)
  - RealAudio Lossless: Professional and archiving (1/2 size)
  - RealAudio Multichannel
- **RealVideo 10**
  - 30% improvement over RealVideo 9 (Encoder; same decoder)
- **RealProducer10 - encode media; Helix DRM 10**

Microsoft Windows Media

- **End to End Solution, PC to Consumer Electronics**
  - Full solution: Codecs, Servers, Players, DRM
  - Used by more than 70 companies (1/03)
    - PC software, hardware, Film, Broadcast, DVD / set-top chips Certified Web hosting, Subscription services, Content providers
  - More than 500 consumer electronics devices (1/04)
    - DVD players, digital audio receivers, car stereos, portable music devices, Pocket PCs, wireless phones
- **Windows 3.0 (1991) - AVI video**
- **Windows 95 & NetShow streaming**
- **Windows 98 & Windows Media Technologies 4.0**
- **Windows Player Media 7 (7/00) - Jukebox, Web media**
- **Windows Media 8 (12/00) - DRM, Mac, Pocket PC, portable players**
- **Windows Media 9 (9/02, 1/03) - System**
  - High-definition video, 5.1-channel surround sound

Windows Media Background

- **Broad Scope (1/03)**
  - Used by more than 70 companies
    - PC software, hardware, Film, Broadcast, DVD / set-top chips Certified Web hosting, Subscription services, Content providers
  - More than 200 consumer electronics devices
    - DVD players , digital audio receivers, car stereos, portable music devices, Pocket PCs, wireless phones
- **Windows Media History**
  - 91-92 - Windows 3.0 - AVI video
  - 92-95 - Windows 95 & NetShow streaming
  - 97-98 - Win 98 & Windows Media Technologies 4.0
  - 2000 - Windows 2000, Player 7, Windows Media 8
  - 2002-3 - Windows Media 9 on Windows XP

Windows Media Releases

- **WM Player 7 - Personality / skins (7/00)**
  - CD Jukebox: Rip, catalog, burn, portable devices
  - Organize: Web Media guide, Library
  - Web media: Video, Internet radio tuner
  - WM Player 6.3 for Mac and Solaris
- **Windows Media 8 - 30% better (12/00)**
  - Near-DVD video 500 Kbps, near-CD audio 48 Kbps
  - Digital rights management
  - Mac, Pocket PC, portable players

Windows Media 9 Series

- **Windows Media 9 (9/02, 1/03)**
  - High-definition video, 5.1-channel surround sound
  - Video 15 – 50% better than WMV 8
    - 3X MPEG-2, 2X MPEG-4
  - Audio 20% better than WMA 8
    Perceptually lossless at 5:1
- **Windows Media Player 9**
- **Windows Media Services 9**
  - Windows .NET Server doubles server capacity
  - 20,000 20 Kbps streams per server
  - Fast streaming, Instant-on, Always-on
- **Windows Media Encoder 9, 9 Series SDK**
- **Hardware decoders: WMA, WMV**

Windows Media 10

- **Windows Media Player 10 (end 2004)**
  - Windows Media Services, Encoder, SDK
  - Hardware decoders: WMA, WMV
  - Advanced Profile codec - 2004
    - Interlaced, broadcast and wireless
- **SMPTE Standardization (VC-1)**
  - Adopted by next-gen DVD formats
- **Windows Media in Products**
  - CE Devices – Sigma Design processors
  - Networked DVD Media Players
  - Digital media receivers
  - Internet Protocol television (IPTV) set-top boxes

MPEG References

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  - www.microsoft.com/windows/windowsmedia
- **Macromedia Flash**
  - www.macromedia.com/software/flash

For More Information

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