# The AT&T Developer Program: Webcast Series

## Guidelines for Delivering Streaming Services on AT&T's Wireless Network

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# Introduction - The AT&T Developer Program

**Commitment to Data Developers – support for each step of the wireless application development process**

- **Access to the latest information on building solutions for the AT&T wireless network**
  - Detailed Device & Modem Specifications
  - APIs, Toolkits, and Sample Code
  - Developer Gateways
- **Technical support and educational opportunities**
  - Webcasts
  - Developer Forums
  - Documentation and FAQs
- **Subsidized wireless devices & discounted data service plans***
- **For additional video streaming support, using Content Delivery Networks (CDN) allows large scalability without the need of extensive build out.**
  - In addition to better QoS delivery you also get reduced latency that can be key, especially in live event scenarios.
  - AT&T ICDS is optimized for delivery of HTTP Adaptive Streaming

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# To view all AT&T's Newly Released Devices

- **http://developer.att.com/devicedetails**
- **Filter tool to search for device features easily**

Answer the question at the end of the webcast and win an AT&T Phone!


**Samsung Jack**


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**LG Arena**


**BlackBerry® Bold 9700**


**Samsung Strive**

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# Wireless Streaming Services

- AT&T encourages video streaming when done efficiently and appropriately.
- AT&T does not guarantee available bandwidth for sustained streaming sessions or persistent video or audio quality.
- AT&T reserves the right to address bandwidth utilization, congestion, or quality. AT&T also reserves the right to specify performance characteristics.
- AT&T wireless-data services may not be used in connection with high-bandwidth applications that disproportionately contribute to network congestion and function in a manner that is inconsistent with AT&T wireless data services optimization requirements.

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# Wireless Streaming: Technology and Guidelines



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# Streaming Guidelines Agenda

- Key Considerations
- Media Delivery Background
- AT&T Key Recommendations for Media Delivery
- Additional AT&T Guidelines
- Streaming in the Future
- Conclusion
- Q&A

# Introduction

- Content of this Webcast is presented in more detail in accompanying white paper.
- Audio/video streaming can work well over wireless networks but needs special considerations and optimization.
- AT&T network and devices offered by AT&T have extensive streaming support.
- Wireless connections can include 2G, 3G, and Wi-Fi.

# Key Considerations – Content Type

- Content is either audio or video.
- Varies by type of content and complexity .
- Varying level of detail, activity, and fidelity needs.

- Video content has to be shaped based on:
  - > Content type
  - > Device screen size
  - > Resolution
  - > Network throughput

# Key Considerations – Content Delivery

- Communications method for delivering media information.
- Includes rate adaptation, protocols, and delivery options such as real-time streaming versus progressive downloads.
- Devices offered by AT&T support 3GPP Packet Streaming Service (PSS) as well as HTTP delivery.
- Most handheld devices support mobile-specific protocols (e.g. PSS).
- Higher-end devices (e.g., smartphones, netbooks) may use same protocols as other computing systems.

# Key Considerations – Containers, Encoding

Containers:

- File formats and other means of storing media information.
- Feature phones use mobile-specific containers (e.g., 3GP).
- Higher-end devices may use same containers as other computing systems (e.g. WMV).

Encoding:

- Algorithms for compressing and decompressing content.
- Many available codecs are available for audio and video (software- and hardware-based).
- Mobile devices use same codecs as other computing systems.
- Advanced codecs such as H.264 are well suited for wireless.

# Key Considerations – Device, Network

Device:

- Various devices: lower-end handsets, smartphones, netbooks, notebooks.
- Capabilities vary across device types.
- Processing speed, resolution, and supported codecs.

Network:

- 2G, 3G, Wi-Fi
- Wireless networks have different characteristics than wireline.
- Varying speeds and transmission quality.
- Mobility characteristics such as handover and roaming.

# Content Delivery and Protocols

Downloads:

- Simplest approach (e.g., podcast, full-track song).
- Often accomplished via HTTP.
- Play cannot begin until download completes.
- Digital Rights Management (DRM) considerations.

Progressive Downloads:

- Extension of download approach, though the experience is similar to streaming.
- Content begins to play shortly after download begins.

Streaming:

- Continuous audio/video.
- Player presents content almost immediately.
- Can adapt bit rates in response to network conditions.

# Streaming Approaches

3GPP Based Packet-Switched Streaming Service

- Content is delivered primarily using Real Time Streaming Protocol (RTSP) and Real Time Transfer Protocol (RTP).
- Built-in mechanism to adjust to network conditions.
- Audio and video encoded at various bit rates.

Streaming over HTTP – Non Adaptive

- Similar to progressive download without caching of content.
- Can use an ordinary Web server.
- Content exists as single file on server.

Streaming over HTTP – Adaptive

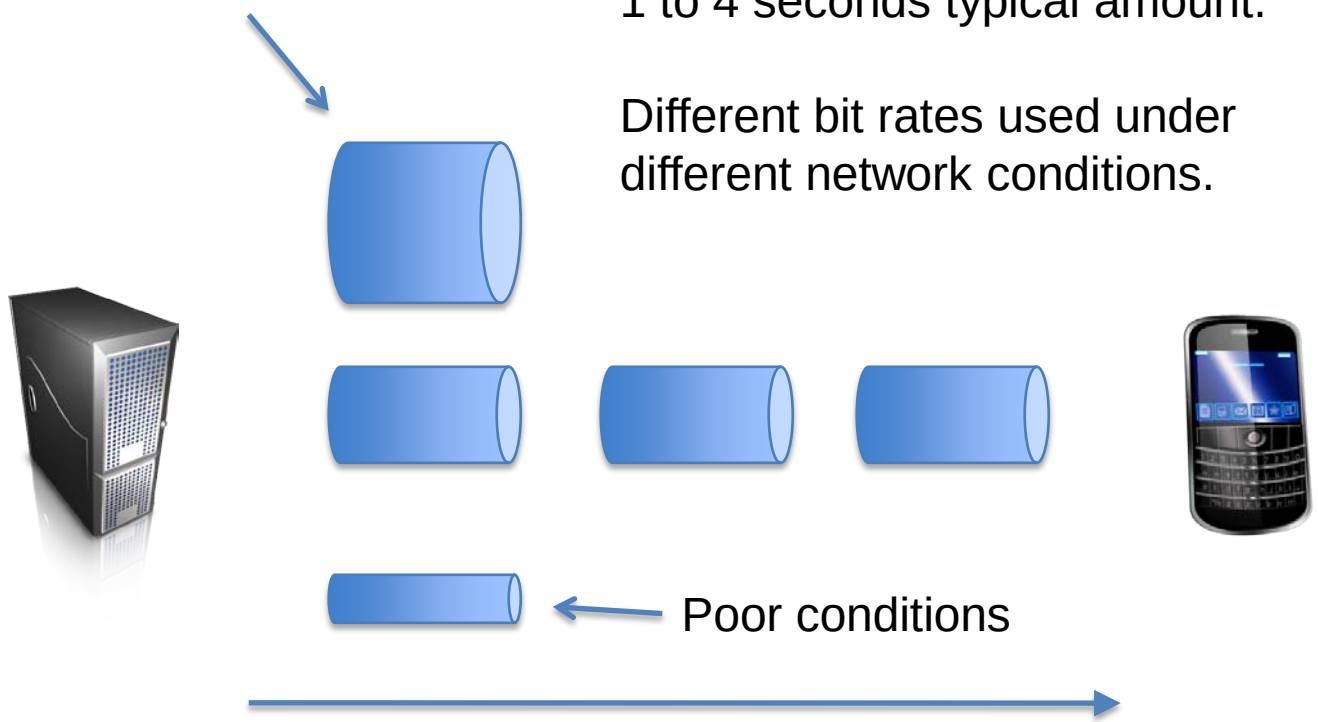
- Accommodates real-time changes in throughput rates in response to network conditions.  E.g. Apple's Live Streaming protocol. Other vendor solutions are available as well.

# HTTP Rate Adaptation

Good conditions

Media split into series of file chunks.
1 to 4 seconds typical amount.

Different bit rates used under different network conditions.



# Containers and Codecs

| Container | Video Codecs |
|---|---|
| 3GP | H.263, H.264, MPEG4 Part 2 |
| FLV (Flash) | H.264, On2 VP6, Sorenson Spark |
| F4V (Flash) | H.264 |
| Ogg (Open Format) | Theora |
| MP4 | H.263, H.264, Dirac, VC-1, MPEG4 Part 2 ASP |
| MKV | Sorenson, Cinepak, Real Video, Theora, H.263, H.264, Dirac |
| WMV | VC-1 |

# Device Categories and Capabilities

| Type of Device | Media Capabilities |
|---|---|
| Lower-end handsets (e.g., closed-OS feature phones) | Common audio and video codecs (e.g., H.264) but restricted selection.<br><br>Mobile-specific containers (e.g. 3GP).<br><br>Mobile-specific delivery protocols (e.g., 3GPP PSS). |
| Higher-end handsets (e.g., most feature-rich phones and most open-OS smart phones) | Common audio and video codecs. Wider choice.<br><br>Mobile-specific and common containers. Varies by platform.<br><br>Mobile-specific and common delivery protocols. Wider choice than lower-end handsets. |
| Netbooks/notebooks | Greatest choice of built-in and installable players and support of codecs, containers, and delivery protocols. |

# Network Type and Mobility

| Technology | Typical Download Speed |
|---|---|
| 2G (EDGE) | Range from 70 to 135 kbps |
| 3G (UMTS/HSPA) | Range from 200 kbps to 3 Mbps<br>Note: (AT&T's low-end typical 3G speed is significantly faster) |

Throughputs depend on multiple factors such as radio-signal quality, network loading, and devices.

Hotspot speeds can vary by backhaul bandwidth and congestion.

Seamless handover from network perspective for intra-system handover and handover between 2G and 3G.

Today, there is no handover to Wi-Fi. Device either maintains two connections or must establish a new connection.

# Key Recommendation – Wi-Fi

- **Where feasible, use Wi-Fi for multimedia streaming.**

- Wi-Fi hotspots are part of AT&T's wireless offering.
- More and more devices support Wi-Fi.
- Many devices will automatically connect to AT&T Wi-Fi hotspots.
- Application should use Wi-Fi as a default option.
- Wi-Fi network selection can be done either under application control or user control.
- Wi-Fi traffic is not routed through the AT&T WAP Gateway; developers will not be able to rely on WAP headers on WiFi.

# APIs for Network Connection Control

| Platform | API |
|---|---|
| Android | Use android.net. ConnectivityManager class to query and control the active connection. |
| BlackBerry | Use standard javax packages such as javax.microedition.io. Connector and URL option of 'interface.' |
| iPhone | Use Objective C, the Reachability API, and the Sockets API to check for connection types and open connections. |
| Symbian | With C++, use the Connection Manager API, such as instance RConnectionManager.<br><br>With Java ME, use interfaces in javax.microedition.io. |
| Windows | With .NET Development, use the OpenNETCF.net package in the Smart Device Framework.<br><br>With C++, use the Connection Manager API in connmgr.h. |
| Windows Mobile 7 | Use the new Mobile Broadband API. COM based API declared in mbnapi.h.<br><br>Old APIs from Windows Mobile 5/6 are still available. |

# Key Recommendation – Codecs

- **Where possible, content should be encoded in H.264 “Baseline Profile.”**
- AT&T is working to ensure that more and more wireless devices support H.264 for video.
- Most devices offered by AT&T support H.264 “Baseline Profile” up to Level 1.2.
- A small number of low-end 3G devices only support level 1.0 and 1.1.
- Some of high-end devices support levels 2.2 and 3.0.
- Some devices support additional video codecs.
- For details on codec support per device, please refer to http://developer.att.com/developer/device_home.jsp

# Developer Site Example: HTC Pure

Video Player Details:

- Screen Height: 800 pixels
- Screen Width: 480 pixels
- Video Delivery: Streaming and Download
- Video Format: MP4, H.263+AMR, MPEG4, WMV, H.264, 3GP
- Video Protocols: UDP, RTSP, RTP, TCP
- Total Video Storage Capacity: Up to available memory
- Max Number Of Videos: Up to available memory


Comparable information available for every AT&T device.

# Key Recommendation – Bit Rates

- Higher rate is not always better; can adversely affect user experience based on network conditions and device.
- All content should be encoded at multiple rates to allow optimum starting experience depending on the network type, as well as capabilities and resolution of the device.
- **As a general guideline, the following rate ranges are recommended:**
  - **2G: 44 to 64 kbps helps prevent excessive buffering.**
  - **3G: 85 to 200 kbps can provide a good user experience.**
- WiFi can support higher rates.
- Content delivery should support adaptive delivery mechanisms wherever possible.

# Key Recommendation – Delivery Method

- **Use the 3GPP Packet-Switched Streaming Service Protocol for delivering the content in a continuous form of streaming.**
- Most of the AT&T handheld device portfolio supports 3GPP Rel 6 PSS protocol.
- 3GPP Rel 6 Rate adaptation recommended to dynamically adjust the content bit rate.
- Other HTTP adaptive streaming protocols can be used if supported by the device and the application.
- For Simple HTTP Delivery (as for Progressive Downloads), use efficient mechanisms to minimize needed bandwidth. E.g. Limit play-ahead time and maintain 10-20 seconds of content before playback.

# Guidelines – Audio Encoding

- Codec of choice is HE-AACv2, if supported by the range of targeted handsets.
- Also known as aacPlus v2.
- Format is backward compatible with AAC-LC, universally supported by 3GPP video-capable handsets.
- Following general guidance applies for various content types using HE-AACv2 encoding:
  - Low-quality mono (e.g., news, weather) – sampling rate 22 kHz, bit rate 24 kbps. (Note: lower sampling rates may be acceptable for this type of content.)
  - Medium-quality stereo (e.g., for sporting events and movies) – sampling rate 32 kHz, bit rate 32 kbps.
  - High-quality stereo (e.g., music, movies) – sampling rate 44.1 kHz, bit rate 64 kbps.

# Guidelines – Video Frame Rate

- Consider resolution of target devices.
- Encode separately for each desired resolution and aspect ratio.
- Maintain aspect ratio of source content.
- Majority devices support 15 frames per second. Newer devices support 30 fps.
- Consider 15 fps for 2G/3G, 24-30 fps for Wi-Fi.
- Higher encoding rates do not necessarily translate to better customer experience.

# Guidelines – User Feedback

- Some users may be on usage-based plans.

- Where appropriate, consider providing users information about amount of data content may consume.

# Future – Radio-Technology Advances

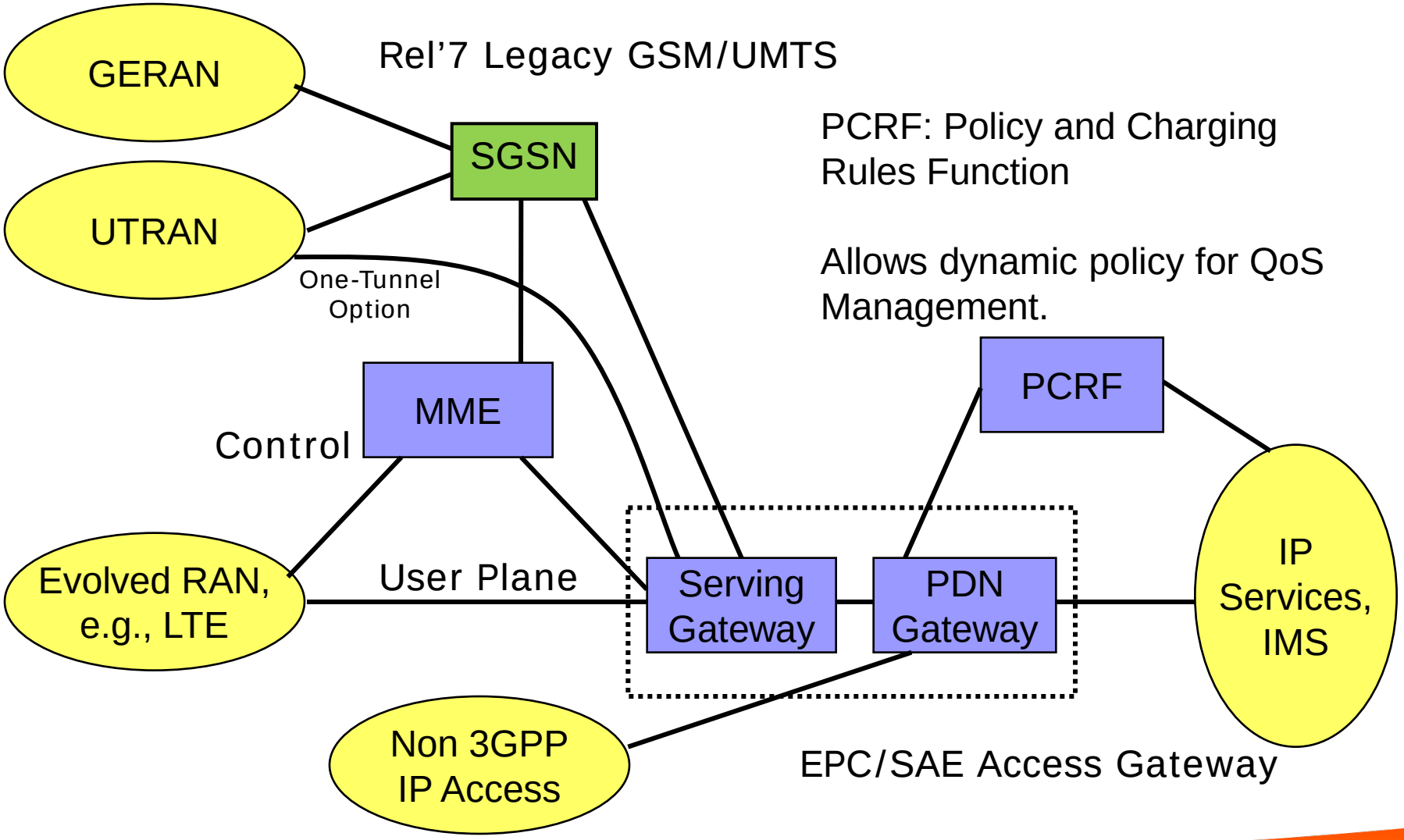
HSPA:

- Faster radio links as technology matures.
- Expanding backhaul capability.
- AT&T has deployed HSPA 7.2 technology across its 3G cell sites.
- As the standards for HSPA continue to develop, AT&T continues to evaluate and consider the technology and performance enhancements.

LTE:

- Beginning in 2011, AT&T is planning to deploy Long Term Evolution (LTE) technology.
- A scalable IP network with “always-on” capabilities to support a wide range of IP-based multimedia services and applications.

# Future – QoS-Enabled Networks



# Future – HTML 5

- Implements audio and video using <audio> and <video> tags.
- Separate media player (usually plugin) not required.
- Only mobile browser supporting HTML 5 is iPhone Safari.
- HTML 5 object model will allow full control via JavaScript; potentially enables advanced features such as adaptive streaming.
- Hold great promise, but not yet final, implementations are immature.

# Conclusion and Call to Action

- The AT&T wireless networks and devices support streaming.

- Special considerations at multiple levels:
  - Content creation
  - Delivery protocols (adaptive best)
  - Efficient codecs
  - Device capabilities
  - Network capabilities

- Download our white paper at: http://developer.att.com/videostreaming

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# CONTEST

Question: Most devices offered by AT&T support H.264 Baseline Profile up to what level?

A: Level 1.0
B: Level 1.1
C: Level 1.2
D: Level 2.2
E: Level 3.0

Send answers to:
developer.program@att.com
Winners will be selected randomly from correct responses



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# Streaming over Wireless Networks

## QUESTION & ANSWERS

Webcast slides will be posted shortly on
http://developer.att.com/webcasts