Multimedia Transport Over Wireless LANs

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Market Need

Tutorial on Multimedia Transmission
> **Characteristics**
> **Requirements**

Technical Feasibility

Introduction - Goals for Presentation

- **Discuss the market dynamics for multimedia home networks**

- **Introduce the technical issues surrounding transport of multimedia streams over wireless networks.**

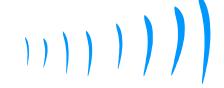- **Encourage the creation of a PAR**

Market Needs

Key benefits

Market drivers

Analyst View

Consumer Interest
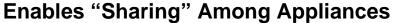
Consumer Benefits of Multimedia Networks

Lets Users Consume Content in Preferred Locations
- Allows access from any room
- Provides for both stationary and mobile appliances

Reduces the Cost of Appliances
- Leverages compute power & peripherals of "media server"
- Central upgrade point mitigates obsolescence

Enables "Sharing" Among Appliances
- Content sharing
- Peripheral sharing
- Connection sharing

Content Use Is More Enjoyable, Convenient and Affordable

Home Multimedia Drivers/Trends

- **Broadband is a Key Driver for Multimedia Content**
  - 45 million homes with broadband (cable & dsl)access by 2002
  - Multimedia apps key driver of broadband demand
    - ~ 63% cited downloads of audio, video & games files
    - ~ 54% would increase consumption of streaming

- **Streaming Media Trends**
  - 65 million downloads of RealPlayer
  - 2000 radio and TV stations broadcasting on the internet
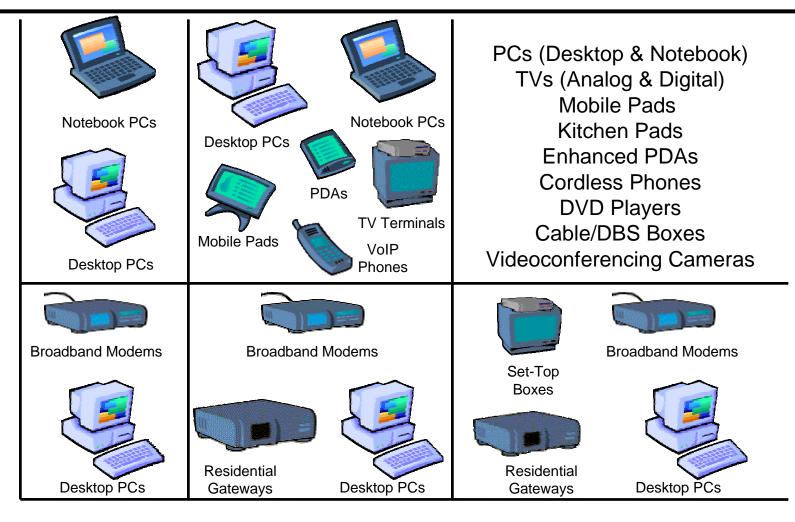 - Many major service providers looking at remote applications

- **Stored Media Trends**
  - 14 million DVRs (e.g., TiVO, Replay) by 2004
  - Digital audio now a industry phenomena
    - ~ 180 million MP3 files downloaded on a weekly basis
    - ~ 30M portable MP3 players (e.g., Rio) by 2003
    - ~ MP3 will be > $1 billion business by 2003
  - Digital cameras & v-conferencing > $1 billion by 2003
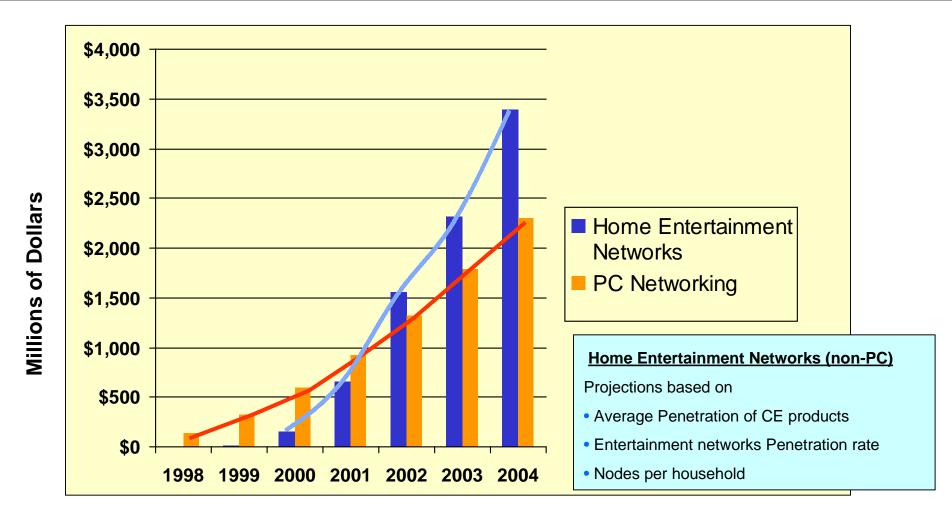
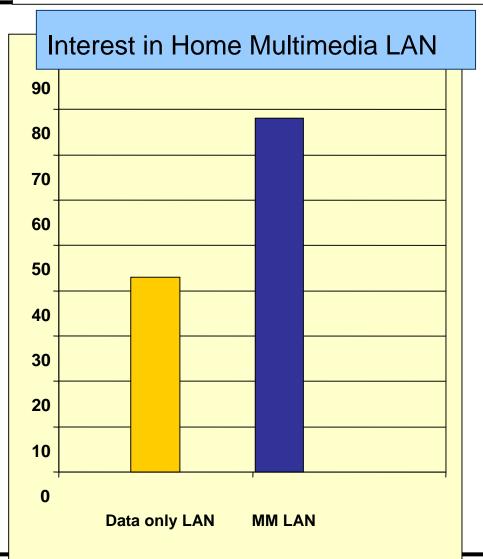# Market Evolution of Multimedia Network Devices

Nodes

Notebook PCs

Desktop PCs

Desktop PCs

Notebook PCs

PDAs

Mobile Pads

TV Terminals

VoIP Phones

PCs (Desktop & Notebook)
TVs (Analog & Digital)
Mobile Pads
Kitchen Pads
Enhanced PDAs
Cordless Phones
DVD Players
Cable/DBS Boxes
Videoconferencing Cameras

Hosts

Broadband Modems

Desktop PCs

Broadband Modems

Residential Gateways

Desktop PCs

Set-Top Boxes

Broadband Modems

Residential Gateways
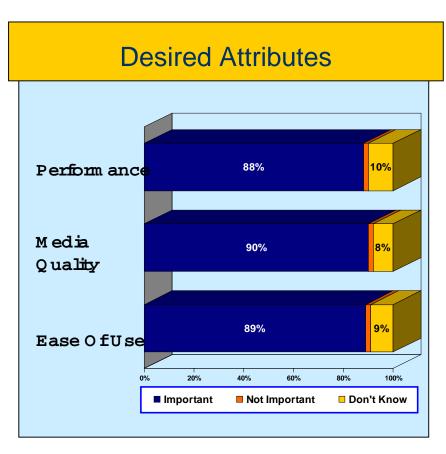
Desktop PCs

1999   **2000**   **2001+**

Multimedia Network Adoption

Source: Parks Associates Connections'99 Workshop.

Consumer Interest in Multimedia Networking

Interest in Home Multimedia LAN

Bar chart with y-axis from 0 to 90. Two bars: "Data only LAN" at approximately 48, "MM LAN" at approximately 84.

Desired Attributes

Attribute	Important	Don't Know
Performance	88%	10%
Media Quality	90%	8%
Ease Of Use	89%	9%

Legend: ■ Important ■ Not Important ■ Don't Know

* 279 US Households Survey

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Tutorial: Transporting Multimedia Over 802.11b Wireless LANs

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Asynchronous data v/s multimedia (MM) Streams

Asynchronous Data

- Little or no latency restrictions
- Real-time delivery not an issue
- All data frames are treated equally

Multimedia streams

- Need security due to copyright restrictions
- Sensitive to latency in delivery
- Network throughput is an issue as it controls how many MM streams can be efficiently supported at a given time
- All MM frames can NOT be treated equally
- Hence need stream support at the MAC level
- Further needs dynamic management of the network resources

What is a stream?

- A stream is a set of frames requiring specific services and a specific range of parameter values for the required services. Some of the examples of the services are;

  - Latency: How often the stream frames are transmitted independent of the network traffic conditions.

  - Bandwidth: How many stream frames are transmitted per second independent of the network traffic conditions.

  - Priority: How important is this stream compared to other traffic on the network

  - Channel protection: How much error correction or retransmission is carried out on the frames of the stream.

- Streams are virtual connections over the basic MAC/PHY services of transmission and reception of frames.

What is needed for Multimedia data transport (1)?

The requirements of transporting multimedia streams over LANs are grouped into three broad categories. They are; Latency, Bandwidth Management, and Channel Throughput

- Latency
  - Streams from interactive applications demand tighter latency in delivery. While voice streams require the latency to be less than 10ms, a video stream can tolerate latencies up to 100ms (or about 3 frames).
  - For streams from non-interactive real-time applications, latency jitter increases the buffer size required at the receivers.
  - Hence the LAN should support a stream to be transmitted at pre-negotiated intervals of time.

What is needed for Multimedia data transport (2)?

- Bandwidth Management
  - MM stream support needs a mechanism for an STA to negotiate and obtain the required bandwidth
  - Since the start and end of a stream or the content of the stream is unpredictable at the MAC level, there is a need for a simple mechanism to negotiate/re-negotiate the bandwidth required by each STA.
  - Since different MM streams could have different priorities, priority management is needed to transport the most important streams with appropriate quality (guaranteed service)
  - Due to the limited number of PHY channels, efficient bandwidth management across coordinators is essential.

What is needed for Multimedia data transport (3)?

- Channel Throughput
  - Collision free operation increases the channel throughput and reduces latency of delivery
  - Without error detection/correction, one bit error could mean
    – for voice stream, loss of up to 10ms worth of data
    – for video stream, in the worst case scenario, corrupted data frame could mean the entire video frame or even all the remaining picture frames in the current group of frames being dumped
  - Channel errors reduce the channel throughput with no error correction
    – 25% PER is typical in the home environment
  - With error correction, the channel throughput required for the multimedia streams can be sustained
  - Extreme interference in the channel means finding a better channel to support the throughput required by the multimedia streams

What else is needed or not needed?

- Isochronous support over lossy medium is a difficult task. **However, simple-but-clever multimedia coordination can achieve the same goals**
- MM stream support does not necessarily need different mechanisms for authentication/ de-authentication / association/ re-association/ disassociation
- Improved ease-of-use desirable for installation, authentication, security and channel selection
- Encryption is required in order to preserve the copyright restrictions on multimedia data along with the privacy of the user
- Backward compatibility should not be ignored

Is a solution possible?

A solution should be possible that…
- Meets the market's needs
- Requires no changes to current STA
- Enhances 802.11 to encompass applications beyond data
- Is technically feasible and low cost