End to End Content Delivery using UPnP and WiFi

Axel Fuchs and Hanford Choy
Media Format is Changing FAST....

- We now live in a world of digital media
  - 60 million people in the U.S. have downloaded digital music
  - 59% of those Americans who’ve downloaded music are older than 34
  - 60% of all U.S. households profess an interest in subscribing to a service that allowed them to create their own playlists and have their music in a format most suitable to their lifestyle.
Broadband and Wireless LAN Penetration... at Mass Market Levels

- 46% of U.S. households will have broadband access in 2007
- 25% of online households will have a PC-based network in 2006

Source: Jupiter Home Networking Model 4/02 (US only)
Wireless Networking in U.S. Homes… Experiencing EXPLOSIVE growth!

- **Growth Attributed To:**
  - Growing Use Of Laptops
  - Falling Prices Of Wi-Fi Equipment
  - Growing Desire For Mobile Connectivity
- Nearly 2 Million Households Added Wireless Connectivity Between Late 2001 And Early 2003
- Nearly 10 Million Households With Data Networks
  - 1/2 Have Wi-Fi Solutions
- Nearly 30 Million Households With Data Networks By End Of 2007
- Wireless Networks Account For 60% Of All Networks By End Of 2007

**Source:** Parks Associates ‘03
Digital Media Access Through WLAN Hotspot is the Future

- The Worldwide Fee-based Hotspot Market - - From 28,000 Locations In 2003 To 145,417 Locations Worldwide In 2007
- Worldwide Revenues - - From $70.5 Million In 2002 To $500+ Million By 2007
- Tremendous Growth This Year
  - North America - 4.7 Million Users
  - Asia-Pacific - 2.7 Million Users
  - Europe - 1.7 Million Users
- Building the Momentum By Key Players in the Market
  - Verizon : Free Hotspot Access In NYC
  - T-Mobile : Hotspot Service Option With Cellular Plan
  - Intel : Centrino Mobile Technology

Source: In-Stat/MDR Aug. ‘03
Moving Digital Content to the Auto: Burning CDs is NOT an Elegant Solution!

Creating-Burning CDs for car:
- 1 CD = 20 minutes to burn
- 200 CDs = 65 hours
- Any changes = start over

Download → Rip/Mix → Burn → Carry

NOT convenient, NOT flexible, NOT efficient
Digital Media Access & Distribution through Home WLAN Network

- HUGE improvement in convenience
- Infrastructure in Place
  - 30 million broadband homes
  - 5 million with WLAN and DOUBLES every year
- Economics
  - Zero marginal cost per bit delivered
- Availability
  - Cars spend a lot of time at home
SimpleDevices Automotive Connectivity & Content Delivery Options

- Portable Hard Disk, USB or Compact Flash – PC Connected
- Wireless via Home PC via WLAN Access Point
- Wireless at Hot Spot’s – Service Provider Managed

Home PC

Connected PC Storage

Hot Spot

W-LAN hub

Connect & Carry

W-LAN hub

THE INTERNET  ISP

Connected through Home PC, PC Storage, and Hot Spot.
Performance Drivers for In-Vehicle Audio Systems

- **Playlist Management**
  - Content Navigation and Display
  - In-Vehicle Playlist Creation — No Playlist Flexibility for Changer

- **Interaction Speed**
  - Next Track Transition
  - Within Disk Track Transitions
  - Disk to Disk Transitions

- **Size and Weight**
  - Affects Placement in Vehicle

- **Reliability**
  - Life Span
  - Shock and Vibration Performance during Playback in Auto

- **In-Vehicle Content Access**
  - Mechanical Change of Media
  - Large Number of Available Songs

- **Content Portability**
  - Works with Home PC, Entertainment Center and Portables
  - Users can Aggregate Media Collections for Access Anywhere
In-Auto Content Access and Management

**Content Access:**
- 10-20 Hours
- 100 Hours
- 400 Hours

**Playlist Management:**
- No Database/Cross Reference
- Metadata
- No Look Ahead
- Single Level

**Shuffle and Random Play:**
- Slow due to Disk Transition Speeds

**Dimension:**
- 101/8"W x 3¾"H x 6¾"
- 9 7/8" x 3 ¾" x 6 ¾"
- 7 ½" x 2" x 5 1/2"

40% smaller
Requirements for Embedded Software

- **Rich media player software**
  - Support all rich media formats – audio, photos, video
  - Support (1) hard disk, (2) flash, and (3) network media databases
  - Support development of customizable, branded GUIs

- **Automatic, Time and Content specific synchronization engine**
  - Periodically and automatically synchronize updated local LAN and internet service based media databases & playlists
  - Automatically synchronize preferred daily content services from leading on-line providers like Wall Street Journal, CBS and others.
UPnP as the new standard for Media Delivery

- UPnP is backed by more than 636 companies in UPnP forum (www.upnp.org)
- UPnP defines how distributed devices can share media through ad-hoc network connectivity
  - Based on Internet standards (TCP/IP, HTTP, XML, SOAP,…)
  - Supports multiple physical connections (USB, IEEE802.11, 802.3,…)
  - Devices can automatically join network
    - obtain IP address with AutoIP
    - convey own capabilities, discover services at remote devices with SSDP)
  - Devices can control remote devices (UPnP control point)
  - Devices can share media (Media Server)
  - Devices can play media (Media Renderer)
  - Devices can browse and search a Content Directory
- UPnP can run in Java, Java OSGi, and C environments
- UPnP can run on a variety of OS and HW platforms
Requirements for supporting media synchronization with a limited power UPnP LAN Connected device:

**Timing**
User defined and pre-defined wake up times (eg. Once per day)

**Power Management**
Automatic software algorithms to monitor and manage synchronization cycle and process against available battery power

**User Controlled Sync**
On demand from remote key-fob, home PC, and on-device

**Sync Interruption Recovery**
Database Corruption Protection during sync interrupts

**Content Prioritization System**
Synchronize most important content first
UPnP Enhancements: Navigation of Content in Car

- **Fast database navigation**
  - Supports category jump buttons – e.g. Home, Artist, Album, Genre
  - Supports playlist jump buttons – item, page, 10% up/down
  - Browse by alphabet
  - Caches media databases in RAM for fast navigation

- **Disc jockey**
  - Supports creation of favorites playlist on the fly
  - Supports presets on local and network databases
  - Supports repeat/shuffle
  - Rip and Play – automatically record content from CD to storage while playing
Content Transfer Requirements

- **Content Security Options**
  - DRM (digital rights management) ensures media is protected
  - End-to-end protection from content provider to PC to device

- **Firmware upgrade**
  - New features
  - New codecs
  - New DRM updates

- **Compatible with third-party UPnP media servers**
  - SimpleCenter
  - Real Listen Rhapsody
  - MusicMatch
  - Microsoft Media Server
Customizing Devices With UPnP components

GUI Display Code → User Input Code →

<table>
<thead>
<tr>
<th>GUI Abstraction</th>
<th>Input Abstraction</th>
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<tbody>
<tr>
<td>UPnP Control Point</td>
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<tr>
<td>UPnP Media Renderer</td>
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</tbody>
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Common UPnP Library

Plug-In Decoder Framework

MPEG-1, MPEG-4, JPEG, MP3, AAC
Complete Software Integration

- LCD Display Software
- GUI Code
- Input Code
- Input Software
- Input Abstraction
- GUI Abstraction
- UPnP Control Point
- UPnP Media Renderer
- Common UPnP Library
- Plug-In Decoder Framework
- MPEG-1
- MPEG-2
- MPEG-4
- JPEG
- WMA
- MP3
- AAC

Drivers

RTOS

Hardware

- Provided by automobile device OEM
- Provided by SimpleDevices
- Provided by RTOS vendor
- New development
Rich Media Management Software for the PC

- Includes UPnP Media Server, Media Renderer, and Control Point
- Supports all rich media formats – audio, photos, video
- Intuitive media management application
- Seamlessly integrates Internet services
- Records (Rips) media from CDs
- Metadata editing and cleaning
- CD ripping with Cddb
- Manages UPnP devices
- Customizable branded GUI for OEM
SimpleWare Automotive Digital Media Software Products

- **SimpleDevice™ Embedded Software**
  - Rich media player software – audio, photos, video
  - Browse local and network directories
  - Portable to any RTOS

- **SimpleCenter™ Software**
  - PC and Macintosh multimedia jukebox software
  - Media and services aggregation and organization
  - Media server – delivers rich media to devices
  - Fast, scalable media database

- **SimpleSync™ USB Software**
  - Software to copy rich media to USB media
  - Fast distribution of media to USB hard discs and flash cards

- **SimpleSync™ Wireless Software**
  - Software to distribute rich media to network devices
  - Automatic distribution of new media
  - Automotive WLAN connectivity and content distribution