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Agenda

- **Trends from the mobile consumer market**
  1. Portable Media Players
  2. Portable Navigation Devices
  3. Cell Phones
- **Cell phone / mobile consumer devices are driving consumer electronics**
- **Trends in automotive infotainment**
- **Implications for in-car multimedia systems**

Portable Media Player Trends

- **More storage capacity at the same cost**
  - NAND cost/GB dropping from $22.70 in 2006 to $5.60 in 2008
- **Increased multimedia capability**
  - Audio to photos to TV quality video
- **Connectivity**
  - Wi-Fi, Bluetooth, FM and digital radio
- **Media portals**
  - iTunes and more – Zune Marketplace, YouTube, media providers

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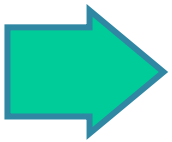
Portable Navigation Device Trends

- **Divergence into:**
  1. Low-cost, single-use devices (<100 Euros)
  2. Converged, high-featured devices
- **PND suppliers seeking differentiation:**
  - Services such as HD Traffic Info
  - Features like 3D map support
- **Data pipe needed for services**
  - GPRS in Europe
  - Digital radio in US ?

Cell Phone Technology Complexity Increase

Features	2001	2007	2011
Camera	VGA	3 Mpix	8 Mpix
Display colors	4k	16M	24M
Memory	8 MB	4 GB	160 GB
Baseband	180 nm	65 nm	32 nm
Data rates	12 kbps	3.6 Mbps	100 Mbps
Phone thickness	24 mm	10 mm	< 5 mm
RF bands	3	7	14
Code size	360 k lines	3 M lines	8 M lines
CPU	100 MHz	> 600 MHz	> 1-3 GHz



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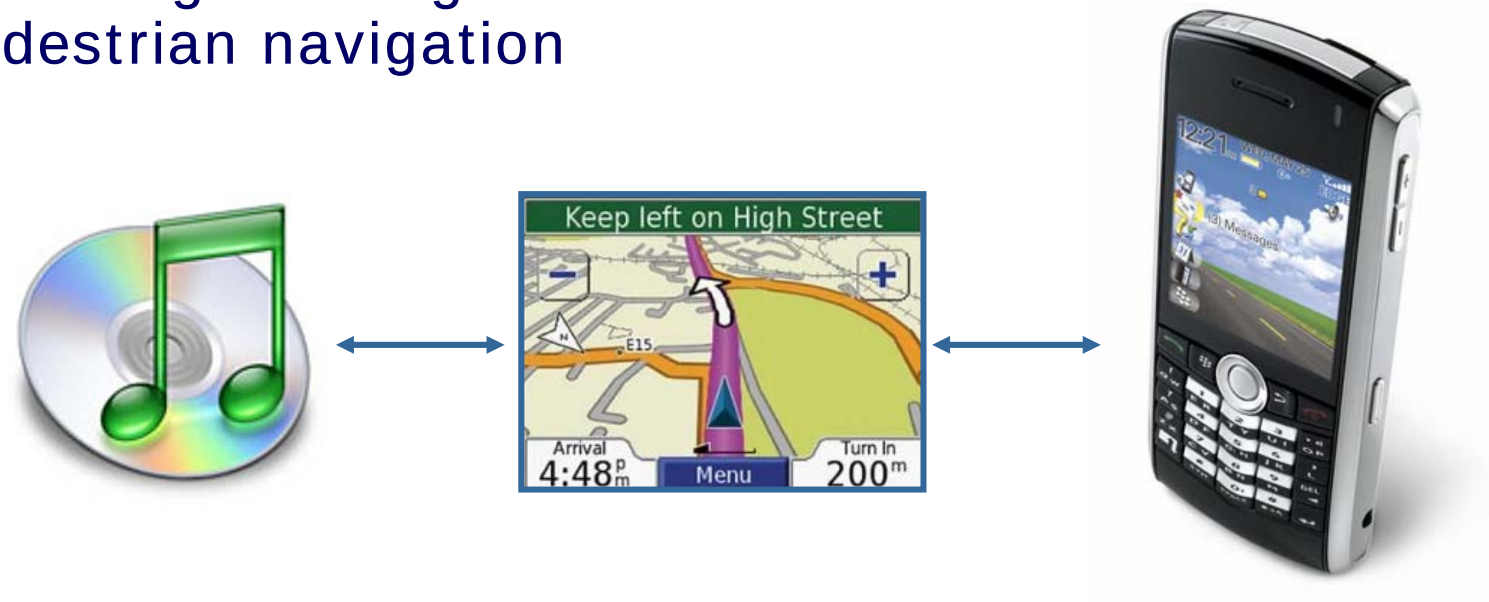
Cell Phone Trends

- **Most cell phones will support music playback via Bluetooth or USB**
  - 1B music phones estimated to ship in 2010
- **Navigation rolling out to cell phones**
  - Still a big learning curve for services and for pedestrian navigation



Portable Device Trends (general)

- **Becoming PC-free?**
  - PC is used today to obtain & manage content
  - Playback is done on the portable device
  - Uptake of Wi-Fi & 3G allow portable devices to obtain content direct from the web
    - E.g. Amazon eBook does not use a PC
  - Intuitive User Interfaces eliminate need for PC to organise content
- **Lossless audio formats coming**
  - Purchased content must have higher quality

Trends & Implications for Car Infotainment

- **Infotainment system should be geared around accessing content on portable devices not duplicating content**

  - Streaming music from PMPs or music phones
    - USB and Bluetooth co-exist

  - **Navigation connectivity to a PND or cell phone**
    - Simple audio connection (TTS & Voice Req)
    - Turn-by-turn pictograms
    - Map display
    - Handoff of route from car navigation system to portable device

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Trends & Implications for Car Infotainment (contd.)

- **Infotainment system should use provide voice activation of portable devices**
  - Search for and play music
  - Navigation destination entry
  - Hands-free phone calls and name dialling
- **"iPhone-like" graphical user interfaces will impact the car**
  - Must be combined with voice activation to reduce distraction
  - Passengers will want to view album art

Trends & Implications for Car Infotainment (contd.)

- **Need flexible infotainment architecture**
  - E.g. Apple decodes audio in the portable device, Microsoft PlaysFromDevice decodes audio in the car
  - Support features not possible in portable device e.g. 5.1 audio playback
  - Balance MIPS & memory bandwidth for speech/audio/graphics
  - Speech recognition stresses MIPS/memory bandwidth, not DSP
- **Costs must be contained to avoid huge price disparities vs. consumer world**

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