Bluetooth
-
An Adequate Solution for Local Ad-Hoc Networking?

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What’s it all about...

Bluetooth™

- Industry Standard to replace ubiquitous cabling
- ISM 2.4 GHz cellular technology, ~10 m cell size
- Aggregate BW 1 Mbit/s
- Single chip for under $5
- Support for different communication profiles (13)
Connectivity Scenarios

- Voice/Data Access Points
- Cable Replacement
- Personal Ad-Hoc Networks
- Synchronization of PDA, Business Cards, etc.
- Conferencing
- Home Automatisation

- The Network is the Appliance (actually an old slogan...)

- First Connectivity Trials flunked! (CeBIT 2001)
Bluetooth Spec

- Master/Slave Connectivity with max. 7 Slaves
- Master/Slave Switch
- Frequency Hopping Scheme controlled by Master
- Adaptive Transmit Power

- Synchronous and Asynchronous Channels
- Service and Network Discovery
Bluetooth Spec cont’d.

- Modular Protocol Stack
- Generic Command based Host Controller Interface
- Radio, Baseband and Link Manager Functions encapsulated
- Standard Interfaces to Applications and IF: UART, USB, PCM-Audio
- Security Features
Bluetooth Network Topology

• No centralized Master
• Dynamic Network Topology
## Power Consumption

<table>
<thead>
<tr>
<th>Vendor</th>
<th>Device</th>
<th>Description</th>
<th>Standby</th>
<th>TX</th>
<th>RX</th>
<th>INQ</th>
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<tbody>
<tr>
<td>Ericsson</td>
<td>ROK101007</td>
<td>Module, BT1.0b</td>
<td>3.3V/5.95mA*</td>
<td>3.3V/26mA*</td>
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<td>Reselec</td>
<td>Bluefrog</td>
<td>Module on SiWave, BT1.1</td>
<td>3.1-4.7V/50µA*</td>
<td>27-50-65mA*</td>
<td>27-50-65mA*</td>
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<td>Ericsson</td>
<td>GSM R520m</td>
<td>GSM Prototype, BT 1.0b</td>
<td>&lt;0.3mA*</td>
<td>8-30mA Voice* 0.3-30mA Data*</td>
<td>8-30mA Voice* 0.3-30mA Data*</td>
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<td>MTC-60110</td>
<td>Single Chip</td>
<td>2.7V/60µA*</td>
<td>2.7V/60mA*</td>
<td>2.7V/60mA*</td>
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</tr>
</tbody>
</table>

* Datasheet Value only

- Many Power Modes still not Operable
- Protocol not Designed for Saving Power
Bluetooth Power Consumption Chart
Flavours of Devices

Chip Set attached to Host System

Single Chip Standalone System

IP Block on Host System

Source: Alcatel

Jan Beutel, Bluetooth Ad-Hoc?
Compared to other Wireless Systems

- Bluetooth is truly Digital for the OEM (HCI Interface)
- FM Radio Modules on ISM Bands (400 MHz - 2.4GHz)
- DECT
- Metricom Telephone Pole Access
- HomeRF (mix of 802.11 and DECT for Multimedia)
- IEEE 802.11 (WaveLan, Apple Airport, Orinoco, Aironet)
- IEEE 802.15 (emerging Standard for all kinds of wireless comm)
Status of Bluetooth in Q1/2001

• Standards Proposal from 1999, revised to spec 1.1
• First Silicon available in Q2/2000
• Sample quantities slowly available, with varying features, i.e. no USB, no Audio, no multipoint
• Qualification process running up slowly
• First commercial products appear in shops now

• RF-on-a-chip and many profiles are the key issues
• IP and Software are the big deal for industry

A lot of hype is getting down to earth a little bit lately.
Visions...

- Revised Radio Frontend, Human Interface Device, Multimedia
- Even more Profiles
  - Car
  - PAN
  - Printing
  - Still Image
  - Extended Service Discovery
  - Local Positioning
- Interaction with IEEE 802.15 working group
- Lower power devices
- Diversity in Devices and Applications