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Radio   **Baseband**   **LMP**   **HCI**   **L2CAP**   **RFCOMM**   **SDP**   **Profiles**

Bluetooth Tutorial - Specifications

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● What is **Bluetooth** ? Well you can get lots of different definitions, but essentially Bluetooth is the term used to describe the protocol of a **short range** (10 meter) frequency-hopping **radio link** between devices. These devices are then termed Bluetooth - enabled. Documentation on Bluetooth is split into two sections, the Bluetooth Specification and Bluetooth Profiles.

● The **Specification** describes **how the technology works** (i.e the Bluetooth protocol architecture),
● The **Profiles** describe **how the technology is used** (i.e how different parts of the specification can be used to fulfil a desired function for a Bluetooth device)

The **Specification** is examined first, then the **Profiles**.

Bluetooth Specification Protocol Stack:

**What Is
Bluetooth?**

Click on a section of the diagram* above, for a tutorial of its functions

Have you visited our WAP Games section yet?
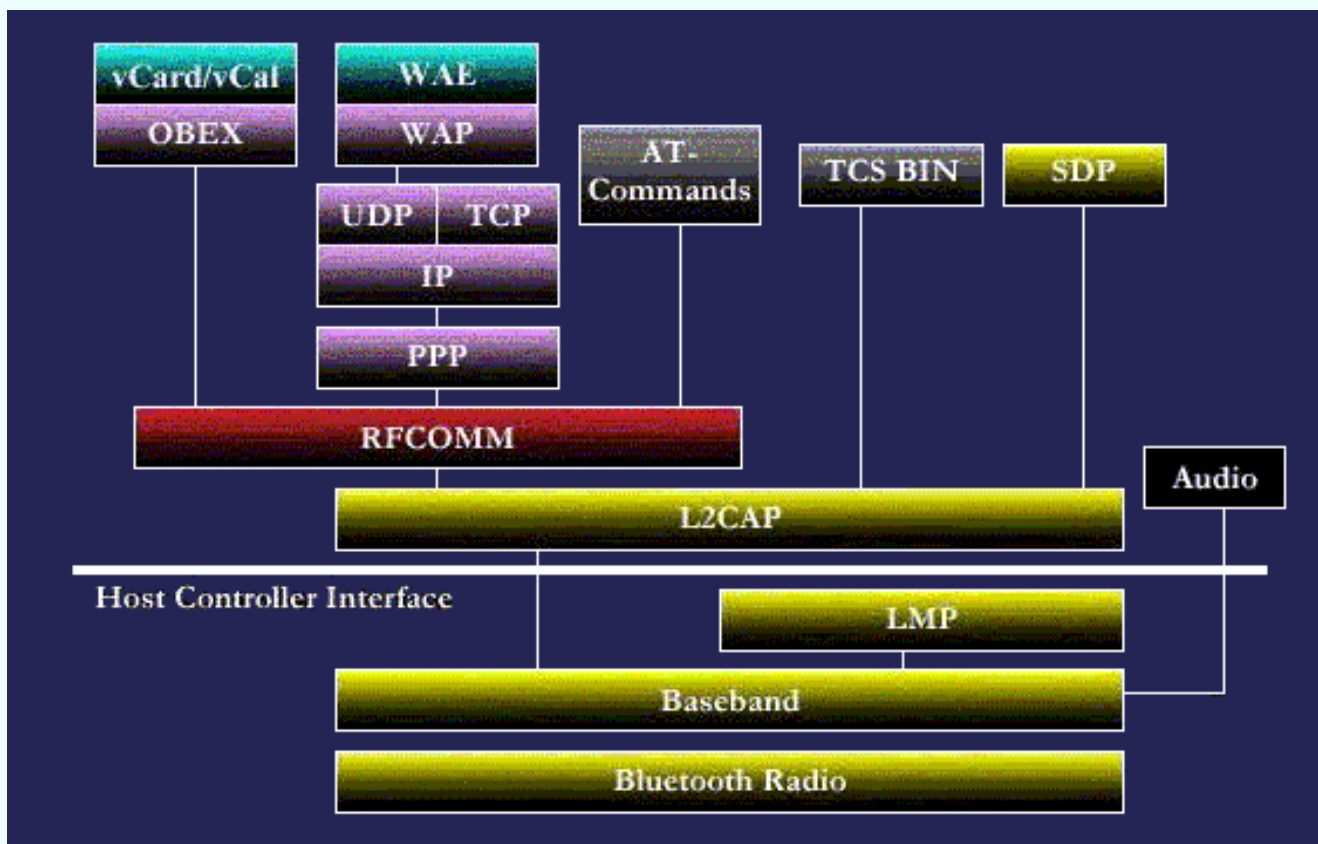
   In more detail: **Bluetooth** is the name given to a new technology using short-range radio links, intended to replace the cable(s) connecting portable and/or fixed electronic devices. It is envisaged that it will allow for the replacement of the many propriety cables that connect one device to another with one universal radio link. Its key features are robustness, low complexity, low power and low cost. Designed to operate in noisy frequency environments, the Bluetooth radio uses a fast acknowledgement and frequency hopping scheme to make the link robust. Bluetooth radio modules operate in the unlicensed ISM band at 2.4GHz, and avoid interference from other signals by hopping to a new frequency after transmitting or receiving a packet. Compared with other systems in the same frequency band, the Bluetooth radio hops faster and uses shorter packets. The following pages give more detail about different sections of the protocol, note this tutorial is completely up to date with the latest version of the bluetooth Specification (ver 1.1)

Specification Table Of Contents:

1 Radio v1.1

The **Radio** layer defines the requirements for a Bluetooth transceiver operating in the 2.4 GHz ISM band.

2 Baseband v1.1

The **Baseband** layer describes the specification of the Bluetooth Link Controller (LC) which carries out the baseband protocols and other low-level link routines.

3 LMP v1.1

The **Link Manager Protocol (LMP)** is used by the Link Managers (on either side) for link set-up and control.

4 HCI v1.1

The **Host Controller Interface (HCI)** provides a command interface to the Baseband Link Controller and Link Manager, and access to hardware status and control registers.

5 L2CAP v1.1

Logical Link Control and Adaptation Protocol (L2CAP) supports higher level protocol multiplexing, packet segmentation and reassembly, and the conveying of quality of service information.

6 RFCOMM v1.1

The **RFCOMM** protocol provides emulation of serial ports over the L2CAP protocol. The protocol is based on the ETSI standard TS 07.10.

7 SDP v1.1

The **Service Discovery Protocol (SDP)** provides a means for applications to discover which services are provided by or available through a Bluetooth device. It also allows applications to determine the characteristics of those available services.

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- See our **Wireless Market Research** section for currently-featured reports.

- **Wireless Events, Conferences, Trade Shows** - What's coming soon!

October 2003

- We've added a new section for **EDGE (Enhanced Data for Global Evolution) resources**.

September 2003

- *** We've moved servers. Some teething problems have

occurred during the upgrade, including frequent restarts of the site. Sorry for any inconvenience.

- We've updated our WAP Resource Center. Many expired links have been removed from our WAP Download, WAP Portal and WAP Search Engine pages.

- We've tidied up our WAP Game, MMS Game and Java, J2ME Game pages.

- We've updated our Bookshop, Bluetooth, Infotooth, HomeRF and IrDA sections.

- We've created an IrDA News Archive section for older infrared news items. (** Premium Membership required).

- Palowireless Wireless Update September 2003 Events, Location-Based Services (LBS), Market Research, From The Wireless Bookshop, Advertising and Sponsorship, Premium Membership, Recent Site News...

August 2003

- We no longer accept Free Event Submissions. As of August 2003 Paid (or Premium) Event Submissions are required to add a conference or trade show to our listings.

- We've added a new section on Wireless Local Loops (WLL) networks **
   ** Premium Membership required.

July 2003

- We've added a new bookshop section for Space-Time Coding and related publications.

June 2003

- We've updated our [news headlines feed]. You'll find brief news headlines in the right side of our [news pages] and other selected sections.

- Can't find a past edition of our newsletter? Members can find recent editions in the [Newsletter Subscriptions] page.

May 2003

- We've added a new [Radar Resource Center] covering RAdio Detection And Ranging topics.

- Our [UWB Resource Center] has been updated with recent UWB news, new books and market research reports.

- We've added a new section to the Wireless Bookshop for [Wideband and Ultra-Wideband] titles.

See our [What's New Archive] for older details of additions and changes.

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Click here to see the list of sites included in the **Whole Site** search.

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What's New

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Short-range radio.

BREW
Binary Runtime Environment for Wireless.

CDMA
Code Division Multiple Access.

GPRS
General Packet Radio Service.

GPS
Global Positioning System.

GSM
Global System for Mobiles.

HiperLAN
Wireless LAN technology.

HomeRF
Wireless Home Networking.

imode
Mobile Internet Technology.

IEEE 802.11
Wireless LAN technology.

IEEE 802.15
Wireless Personal Area Networking (PAN) technology.

IEEE 802.16
Wireless Metropolitan Area Networking (MAN) technology.

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Coming Soon:

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20 Nov 2003
Paris, France

Short Range Wireless
14 Jan 2004
London, UK

Asia-Pacific

AFR Telecom Summit
27 Nov 2003
Sydney, Australia

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2 Dec 2003
Beijing, China

Pages Served:

2003: 3.6 million

2002: 3.27 million

2001: 2.15 million

[IrDA](#)
Infrared Data Association standard.

[Java](#)
Wireless Java and J2ME.

[LBS](#)
Location Based Services and Location-Enabled Business.

[OFDM](#)
Orthogonal Frequency Division Multiplexing.

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Radio Detection And Ranging.

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Communications, TV, Remote sensing and other related topics.

[SMS, EMS, MMS](#)
Short, Enhanced & Multimedia Messaging Services.

[SyncML](#)
Data synchronization standard.

[UMTS/3G](#)
Universal Mobile Telephony System and Third Generation Mobile.

[UWB](#)
Ultra Wide Band radio.

[VoiceXML](#)
Voice eXtensible Markup Language.

[WAP](#)
Wireless Application Protocol.

[WLL](#) **
Wireless Local Loop.

[ZigBee](#)
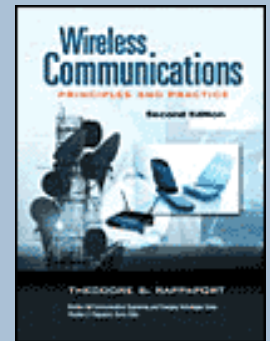Specification for untethered devices.

General Wireless Resources

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General wireless events, news and info.

[Antennas](#)
Aerials, Antennae. Also see [Bluetooth](#).

[Bookshop](#)
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Specialist consulting organisations.

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Wireless development tools, SDKs, software, hardware, kits and more.

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Off-the-shelf wireless domain names.

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Conferences, trade shows, exhibitions, seminars.

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Phones, gizmos, PDAs and other wireless devices.

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Useful resources on initial public offerings.

[Jobs](#)
Wireless Employment pages and resources for [freelancers](#).

Library
Useful links and information resources.

Market Research
Wireless market reports, research and other publications.

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m-Commerce news, tools and applications, wireless Banking.

Medical **
Wireless medical news, products and applications.

News
Latest news from the wireless world.

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Search our extensive on-line knowledge base of web pages, books, publications and research.

Security **
Wireless security news, products, tips, and techniques.
WLAN Security,
WAP Security,
Java Security.

Spectrum **
Radio spectrum resources, regulations and useful sites.

Technology
Miscellaneous wireless technologies.

Telematics **
Wireless automotive telematics.

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Wireless tendering and procurement resources.

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Test tools, organisations and equipment.

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Wireless training courses.

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WLLs

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● In this section:

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- Resources
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- Wireless Top 10

Specialist Titles:

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Essential Guide to RF and Wireless, Second Edition

Complete Wireless Design with CD ROM

Mathematics Calendar 2004

Piloting Palm: The inside Story...

Smart Mobs: The Next Social Revolution

ARRL Antenna Book with CD-ROM

802.11 Wireless Networks: The Definitive Guide

XHTML Recommended

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Medical & Radiology
The latest mobile medical applications, radiology and related topics.

ARRL
Books on American Radio Relay League topics.

Games
Game Design and Implementation.

GSM
Global System for Mobiles publications.

LBS
Location-Based Services and Location-Enabled Business books and publications.

.NET
The latest books and references guides on the .NET framework.

Bluetooth
Books on Bluetooth Short Range Radio.

GPRS
General Packet Radio Service publications.

i-mode
The best i-mode and cHTML books and publications.

mCommerce
The latest mobile commerce titles.

OFDM
The latest OFDM books and other publications.

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Wireless Nation: The Frenzied Launch of the Cellular Revolution in America

Dilbert and the Way of the Weasel

Essential Guide to Wireless Communications Applications

Bluetooth for Java

Bluetooth 1.1: Connect Without Cables, Second Edition

OFDM Wireless LANs: A Theoretical and Practical Guide

Wireless Messaging Demystified: SMS,EMS, MMS and Others

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Books on satellites, comms, TV, encryption and related topics.

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The latest reference books and guides to space-time techniques.

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The latest reference books and guides for VoiceXML.

[Wideband and Ultra-Wideband](#)

Our new section for wideband and related topics.

[Wireless Application Protocol (WAP)](#)

The best WAP reference books and programmer's guides.

[Wireless LANs](#)

The latest WLAN books and other publications.

[Wireless Local Loops](#)

The latest WLL books and related publications.

[XHTML](#)

Books on eXtensible HyperText Markup Language (XHTML) and related topics.

[Books For Dummies](#)

Ok, admit it - we've all bought one of these sometime...

Recommended:

[IEEE 802.11 Handbook: A Designer's Companion](#)

[Wireless LANs: Implementing High Performance IEEE 802.11 Networks](#)

[RF Power Amplifiers](#)

[Wireless Spectrum Finder](#)

[Building a Cisco Wireless LAN](#)

[Wireless Java Programming with J2ME](#)

[Creating Location Services for the Wireless Web](#)

[GPRS from A-Z](#)

[Smart Antennas for Wireless Communications](#)

⭐ **[Wireless Top 10](#)**
The current Top 10 Wireless Bestsellers from barnesandnoble.

⭐ **[2002 Book Of The Year](#)**
Our Wireless Book Of The Year (WBOTY) for 2002.

⭐ 2003 Book Of The Year
The 2003 Palowireless WBOTY will be announced in December - stay tuned!

⭐ **[Recommended Reading](#)** *
Some of the best reference books around on wireless topics.

 * **[Membership](#)** is required for some sections.

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[Internetworking with TCP/IP Vol.1 : Principles, Protocols, and Architecture](#)

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Other Goodies:

[Dilbert](#)
You don't have to be an engineer - these are for people in cubicles everywhere!

2004 Desk Calendars

Got yours yet? Check out our favorites.

⭐ Featured Section

Have you visited our featured section for this month?

The **palowireless.com / barnesandnoble.com Wireless Top 10**

November 2003

- This months best-selling wireless titles from the Barnes and Noble catalogue.

- All prices are in US$, unless otherwise stated.

This Month	Last Month	Title
1	1	**802.11 Wireless Networks: The Definitive Guide** *As a network administrator, architect, or security professional, you need to understand the capabilities, limitations, and risks associated with*

integrating wireless LAN technology into your current infrastructure. 802.11 Wireless Networks: The Definitive Guide *provides all the information necessary to analyze and deploy wireless networks with confidence.*

Matthew S. Gast, Mike Loukides
Format: Paperback, 464pp.
Publisher: O'Reilly & Associates
Published: May 2002

| 2 | 4 | **The Essential Guide to RF and Wireless, Second Edition** |
| | | |

The Essential Guide to RF and Wireless, Second Edition

There's a wireless revolution underway! With The Essential Guide to RF and Wireless, Second Edition, you can help drive that revolution, even if you don't have a technical background. This clear, concise, easy-to-understand briefing cuts through the jargon to explain how today's wireless systems really work. Fully updated to

		reflect the hottest technologies: wireless LANs, broadband fixed wireless, new GPS systems, smart antennas, and much more. Carl J. Weisman Format: Paperback, 2nd ed., 332pp. Publisher: Pearson Education Pubished: January 2002
3 WIRELESS HACKS *100 Industrial-Strength Tips & Tools* O'REILLY *Rob Flickenger*	-	**Wireless Hacks: 100 Industrial-Strength Tips and Techniques** *Wireless Hacks offers 100 industrial-strength tips about wireless networking, contributed by experts who apply what they know in the real world every day. Each hack can be read in just a few minutes, but can save you hours of research. Written for the intermediate to advanced wireless user, Wireless Hacks is full of practical, ingenious solutions to real-world networking situations*

		and problems. Whether your wireless network needs to extend to the edge of your office or to the other end of town, this collection of nonobvious, "from the field" techniques will show you how to get the job done. Rob Flickenger, Dale Dougherty Format: Paperback, 304pp Publisher: O'Reilly & Associates Published: September 2003
4	5	**How Wireless Works** *How Wireless Works continues in the How It Works series tradition by explaining every aspect of wireless communications, from the remote control on your coffee table to the most sophisticated wireless Internet networks. As wireless technology proliferates, readers will need to understand how wireless technologies*

work in order to make educated buying and business decisions related to wireless technologies. This book will provide readers with a basic technical background on wireless technologies, including infrared, radio-frequency, power line, and PNA (wireless home networking.)

Preston Gralla
Format: Paperback, 232pp.
Publisher: Que
Published: November 2001

5	6	**Wi-Fi Handbook: Building 802.11b Wireless Networks**

Wi-Fi Handbook: Building 802.11b Wireless Networks

The Wi-Fi Handbook covers the technology, design, and implementation of Wireless Fidelity in a variety of unique business applications. This guide provides an abundance of experience to the reader in an organized and easy-to-read format. If you want to address the

complexities of building 802.11b wireless networks in your own world, this is the book for you.

Franklin D. Ohrtman, Konrad Roeder
Format: Paperback, 363pp
Publisher: McGraw-Hill Companies
Published: April 2003

| 6 | 3 | **Smart Mobs: The Next Social Revolution**

How the convergence of mobile communications and computing is driving the next social revolution-transforming the ways in which people meet, mate, work, buy, sell, govern, and create.

Howard Rheingold
Format: Hardcover, 288pp.
Publisher: Perseus Publishing
Published: September 2002 |

7	2	**Passport to World Band Radio (2003)**
		This is a consumer's guide to radio receivers plus a directory to shortwave radio broadcasting around the world. . . . The buyer's guide to world-band radio section rates receivers and lists them in various categories (portables, tabletop, and special categories, including a section on antennas). . .
		Lawrence Magne, Tony Jones Format: Paperback, 592pp. Publisher: International Broadcasting Services, Ltd. Published: December 2002
8	9	**Introduction to Space-Time Wireless Communications**
		"The authors present the basics of space-time wireless propagation, the space-time channel,

diversity and capacity performance, space-time coding, space-time receivers, interference cancellation for single carrier modulation, and extensions of OFDM and DS-spread spectrum modulation. They also cover space-time multi-user communications and system design tradeoffs." This book is an introduction to this rapidly growing field for graduate students in wireless communications and for wireless designers in industry. Homework problems and other supporting material are available on a companion website.

Arogyaswami Paulraj, Dhananjay Gore, Rohit Nabar
Format: Hardcover, 308pp
Publisher: Cambridge University Press
Published: May 2003
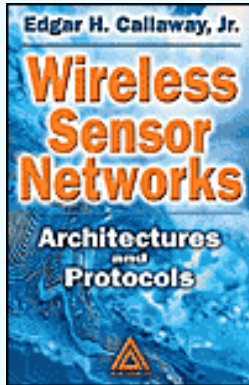
9	-	**Wireless Sensor Networks: Architectures and Protocols**

Because they provide practical machine-to-machine communication at a very low cost, the popularity of wireless sensor networks is expected to skyrocket in the next few years, duplicating the recent explosion of wireless LANs. Wireless Sensor Networks: Architectures and Protocols *describes how to build these networks, from the layers of the communication protocol through the design of network nodes. This overview summarizes the multiple applications of wireless sensor networks, then discusses network device design and the requirements that foster the successful performance of these applications...*

Edgar H. Callaway
Format: Hardcover, 360pp
Publisher: CRC

		Press Published: September 2003
10	-	**Real 802.11 Security: Wi-Fi Protected Access and 802.11i** *Real 802.11 Security addresses the theory, implementations, and reality concerning Wi-Fi Security. The first two sections introduce you to security issues in general, and how security works in Wi-Fi networks, delving into the various security protocols. In the third section of the book, practical real world issues and examples of attack tools are discussed. Written by two experts in wireless security, Jon Edney and William Arbaugh, this book describes new approaches to wireless LAN security, showing you how these approaches work and how they give maximum effect.* Jon Edney, William A. Arbaugh

		Format: Paperback, 451pp Publisher: Addison-Wesley Published: August 2003

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The Webmaster's Favorites

- Quick searches of the MindBranch catalog for technologies and markets covered by this site:

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  - EMS
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  - GPS
  - GSM
  - HDML
  - HiperLAN
  - HomeRF
  - i-mode
  - IEEE 802.11
  - IEEE 802.15
  - IEEE 802.16

  - LBS
  - MExE
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  - UWB
  - VoiceXML
  - WAP
  - WiFi
  - WLANs
  - WML

What's Hot:

2003 Wireless Markets

Wireless Infrastructure Market Strategies

Wireless Java 2002

Business Benefits of VoiceXML

The Complete Guide to UMTS Licences Worldwide

Phones Get Smarter

Multimedia Messaging Services

Optimising Revenues from Mobile Messaging

Western European GPRS and UMTS

International Satellite Directory

- IrDA
- J2ME
- Java
- Jini

- WPANs
- XHTML
- ZigBee

Location, Location, ...

Have you visited our Bookshop yet?

Featured Report

Our recommended reading for this month is:

★ **Emerging Mobile Wireless Technologies - Road to a Wireless World**

The global Wireless Market has undergone immense expansion in the last 25 years. While several factors are collectively responsible for this growth, the convergence between the "wired' and the 'wireless' is arguably the most significant of them all. The progress that has been seen in wireless and portable computing owes hugely to the blurring of boundaries between the wireless, wireline and the Internet service providers. 'Mobile wireless' thus is the latest buzzword that has caught the attention of all concerned participants in the market.

Published: September 2003
Published By: RNCOS
Page Count: 50

Recommended Reading

★ **E-Stats**

Are you seeking a source for reliable, statistically verifiable statistics about the cellular and PCS industries? E-Stats is an updated collection of key industry indicators derived from the proprietary Shosteck database. This database includes over 150 tables and figures detailing nearly every aspect of the cellular/PCS industry. It's now available to your firm, through any web browser, 24 hours a day, for a single annual licensing fee.

Published: Quarterly
Published By: The Shosteck Group

* * * *

★ **Beyond CE/PC Convergence:** Emerging Opportunities in the Home Connectivity Markey in 2003

The PC and consumer electronics convergence market for home networking has gotten most of the attention in 2003. However, In-Stat/MDR believes that this is not the only segment to pay attention to in 2003, as the move to pervasive connectivity in the home is beginning to open up other opportunities.

This report looks at some of the key demographic and technology trends that are resulting in new product opportunities, and then looks at some

specific opportunities in the home office and remote monitoring spaces.

Published: July 2003
Published By: In-Stat/MDR
Pages: 26

 * * * *

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Palowireless Consulting Services

- **Need some help on an upcoming project?**
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The experts behind the palowireless web site can provide consulting services in a number of areas. Every day, thousands of wireless industry professionals come to us for information, tips and advice. Why not try us at your place?

- **Our Services** - Areas we work in.
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  - Marketing Services
  - Management Services

- **Our People** - A bit about our experts.

- **Contact Us** - for a quotation.

About Palowireless Pty Ltd

Palowireless Pty Ltd was established in 2000 by a group of experienced IT&T professionals to service the

wireless and mobile technology market. The company is new, but our people have many years of experience in technology and business.

Palowireless company activities include:

- Provision of professional services to our corporate and government clients.

- Operation of the palowireless.com web site.

- Publishing and sales of market research for the wireless marketplace.

- Publication of newsletters on Bluetooth, WAP, WLANs and other topics.

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Wireless Database

● Our detailed news and summary profiles for key wireless products, applications, manufacturers and vendors.

● To access these pages you require Premium Membership.

● For a free preview click here or here.

● This section is constantly being updated and expanded. If you would like to suggest a topic click here.

Contents

- **Our A - Z of selected wireless vendors**
  News, products and summaries for key wireless companies from Agere to Zeevo.

- **Summaries and reviews by application category**
  - **Bluetooth Antennas**
    Our detailed roundup of news, products and vendors of antennas for Bluetooth applications.

  - **Bluetooth Chipsets**
    Our April 2002 roundup of selected Bluetooth chipset suppliers.

❍ [Bluetooth Modules](#)
   Our April 2002 roundup of selected
   Bluetooth module suppliers.

❍ [Bluetooth Development Kits](#)
   Our April 2002 roundup of selected
   Bluetooth development kit suppliers.

❍ [Headsets](#)
   A quick tour of the state-of-the-art for
   Bluetooth headsets and related
   components.

❍ [Batteries](#)
   Our new (and still growing) roundup of
   batteries for mobile applications.

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Bluetooth Resource Center

What's new?

The original and definitive internet guide to Bluetooth* technology. If you're a Bluetooth professional, please bookmark this page **now**!

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Bluetooth
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Articles
Asia-Pacific
Audio
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Consultants
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Dev Tools
Downloads
Events
FAQ
Forums
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Featured Market Research Report:

★ **Emerging Mobile Wireless Technologies - Road to a Wireless World**

The global Wireless Market has undergone immense expansion in the last 25 years. While several factors are collectively responsible for this growth, the convergence between the "wired" and the 'wireless' is arguably the most significant of them all. The progress that has been seen in wireless and portable computing owes hugely to the blurring of boundaries between the wireless, wireline and the Internet service providers. 'Mobile wireless' thus is the latest buzzword that has caught the attention of all concerned participants in the market.

Published: September 2003
Published By: RNCOS
Page Count: 50

Also Recommended:

★ **Bluetooth 2003: Are PMGs Another Driver?**

The Bluetooth semiconductor market has made solid progress in spite of the economic ups and downs. Final 2002 worldwide chipset shipments were 35.8 million units, resulting in 245% growth over 2001. As this market's size grows and matures, the growth rates will naturally decrease. Bluetooth chipset units will swell from 35.8 million to 575 million from 2002 to 2007, for a five-year Compound Annual Growth Rate (CAGR) of 74%. Meanwhile, silicon revenue will rise to $1.7 billion in 2007. The vast majority of chipset shipments in 2002 were up to the HCI (Host Controller Interface) only; however, that will migrate slowly to more that include all of the embedded upper stack elements.

Published: July 2003
Published By: In-Stat/MDR
Pages: 79

* * * *

See our Market Research section for more.

From the Wireless Bookshop

See our Bluetooth Books section for all the latest titles.
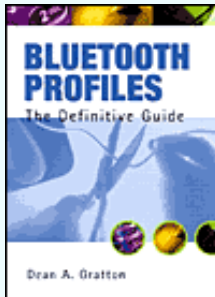
Bluetooth Profiles: The Definitive Guide

Bluetooth Profiles are the key to delivering interoperable products that work reliably, "right out of the box." Now, leading Bluetooth expert Dean Anthony Gratton brings the Bluetooth Profiles to life, showing you exactly how to use them to build winning user-centered products. Gratton takes you "under the hood" of every significant Bluetooth Profile, from Bluetooth's essential Foundation Profiles to powerful emerging profiles for personal area networking, automotive applications and imaging. Drawing on his extensive experience with Bluetooth development, Gratton also offers practical guidance for creating innovative new profiles of your own.

Dean A. Gratton
Format: Hardcover, 569pp
Publisher: Pearson Education
Published: December 2002

Getting Started with Bluetooth

As the world continues to become more mobile and business is conducted in the blink of an eye, a new system is taking communication one step further. Bluetooth technology unites computing with telecommunication. This innovative breakthrough eliminates the need for cables by using short-range radio links. Equipped with features such as robustness, low complexity, low power and low cost, this technology incorporates any digital device, including PDAs and printers, into the Bluetooth system. Getting Started with Bluetooth *teaches you concepts about Bluetooth specifications, devices, and architecture, giving you the knowledge to gain a competitive edge!*

Madhushee Gangali
Format: Paperback, 416pp.
Publisher: Premier Press
Published: September 2002

* Bluetooth is a trademark owned by Bluetooth SIG, Inc.

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Database

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Antennas
Articles
Asia-Pacific
Audio
Books
Cathal's Corner
Consultants
Design Tools
Dev Tools
Downloads
Events
FAQ
Forums
Glossary
InfoTooth
News
Products
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[Also see: **Bluetooth Dev Tools**   **Bluetooth Products**   **Books on Antennas**]

Bluetooth Antennas (Antennae & Aerials)

- Specialist manufacturers and vendors of Bluetooth antennas and related components.

- **Blue2Net** (Sweden)

  ○ Directional high-gain antenna omni-directional low-gain antenna.

- **Centurion**

  ○ Bluetooth Antenna Products Internal and chip antennas.

- **Ethertronics** (USA)

  ○ A variety of embedded antennas for cellphone manufacturers and short range wireless Bluetooth and 802.11b antennas.

- **Fractal Antenna Systems** (USA)

  ○ Low-profile ComCyl antenna for the Bluetooth (2.4-GHz) and wireless local-area network (WLAN).

- **GigaAnt** (Sweden)

  ○ 2.4 GHz antennas for the Bluetooth wireless technology - ready for delivery.
  ○ Swivel, snap-in and SMD antennas.

- **Halon Tech Co., Ltd**
  Manufacturers of Bluetooth antennas, GPS antenna, WLAN antenna, 3G filter,...

- **Integral Technologies/Antek**

  ○ Embedded antennas for Bluetooth devices.
  The TPF-3000 is applicable to a wide variety of short-range consumer applications, such as wireless video and audio equipment, headsets, modems, mobile computers, mobile phones, and other portable handheld devices and conforms to the Bluetooth, IEEE 802.11, and HomeRF protocols.
  ○ Antek Wireless, Inc is a wholly owned subsidiary of Integral Technologies.
  ○ Series of low profile, metal mount, flat panel antennas. This line of antennas includes GPS/400Mhz, GPS/CDPD, GPS/LEO, GPS/2.4 Ghz, GPS/1.9Ghz or any combination required.

- **Intenna** (Sweden)

  ○ Bluetooth Antennas Intenna Technology develops and manufactures bluetooth antennas ready for delivery as

well as client-optimized bluetooth antennas.

- **[Matsushita Electric Industrial](#)**

  - ❍ Super-small ceramic antenna for Bluetooth.

- **[Mitsubishi Materials Corporation (MMC)](#)**

  - ❍ [SMD Antennas](#) - MMC has developed small surface mountable antennas for use in Bluetooth devices, wireless LAN, and other 2.4GHz equipment.

- **[Murata Manufacturing (USA)](#)**

  - ❍ G2 Series chip dielectric antennas for Bluetooth, which can be built into notebook PCs.

- **[Panorama Antennas](#)** (UK)

  - ❍ [Product Catalogue](#) A range of cellular and radio antennas, Panorama Antennas is also developing advanced antennas for 3G cellular and new radio based technologies including Bluetooth.

- **[Perseus Tech. International Corp.](#)** (Taiwan)
  - ❍ Bluetooth antennas provided either as antenna only or mounted on a small PCB with connector as per customer requirements.

- **[Rainsun](#)** (USA)

  - ❍ Rainsun designs and manufactures Bluetooth and 802.11 antennas with LTCC technology. These small

size antenna with peak gain ~ 3dBi can be used for single or dual-band applications.

- **RangeStar** (USA)

  - ❍ [Bluetooth Solutions](#)

- **SkyCross** (USA/Japan)
  - ❍ SkyCross provides [antennas](#) that will work in the ISM and U-NII frequency bands, for applications such as IEEE 802.11 and Bluetooth devices.

- **World Products** (USA)
  - ❍ Wireless surface mount components and external antennas for Bluetooth, 802.11a/b/g, cellular GSM/DCS/GPRS, CDAM/AMPS/PCS, GPS and other emerging wireless frequencies.

- **Yokowo** (Japan)
  - ❍ [Ceramic antennas](#) for personal communication.

Also see:

- Take a look at [books on antennas and antenna design](#) in our Wireless Bookshop

- [Presentation on Bluetooth technology & its interference with the surrounding](#) (antenna types & modulation techniques)

- [SIGnal article on Bluetooth Antennas](#)

- [GigaAnt](#) [Antenna Basics - Basic Antenna Facts](#)

- Skycross [White Papers](#)
  - ❍ Antenna Design for Improved Efficiency and Reduced

SAR
- ❍ MLA Antennas - Physically Small, Electrically Large
- ❍ Today's Wireless Antenna: More Efficient, Multiple Frequencies
- ❍ Future Telematics Applications Rely on Wireless Integration.

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Bookshop
Market Research
Search
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Consulting
Database

Bluetooth
Antennas
Articles
Asia-Pacific
Audio
Books
Cathal's Corner
Consultants
Design Tools
Dev Tools
Downloads
Events
FAQ
Forums
Glossary
InfoTooth
News
Products
Profiles
Research
Security

[Also see: **Cathal's Corner**   **Tutorial**   **Books**]

Bluetooth Articles

● Welcome to our section for Bluetooth articles, overviews and other useful documents.

● A palowireless Premium Membership is required to view articles marked **.

CATHAL'S CORNER
Articles by our resident Bluetooth columnist Cathal Mc Daid...

❍ **Future versions of Bluetooth - Bluetooth 1.2 & Bluetooth 2.0** ** The Bluetooth SIG has aimed from the start to ensure that developers and users do not concern themselves with updated version of

SoftTooth Bluetooth Overview

By Manoj Gupta and SoftTooth.

A concise introduction to Bluetooth from the Bluetooth architecture, radio and baseband to a detailed look at connection establishment. *more...* **

❍ **Introduction** ** Smart appliances,

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the Bluetooth specification, but rather concern themselves on implementation of the existing Bluetooth 1.1 spec and the use/development of profiles. However, the recent release of cores based on preliminary Bluetooth 1.2 and speculation on the abilities of Bluetooth 2.0, means that far-sighted developers should not stand still in approaching Bluetooth optimisations. This article explains the features on a broad level of Bluetooth 1.2 and examines the reports on Bluetooth 2.0. *more...*

❍ **Bluetooth Additional Profiles - Overview**
Currently in the final stages of evaluation and approval, the Bluetooth SIG is in the process of releasing 12 new profiles. In conjunction with this,

Bluetooth SIG, The piconet kingdom, Bluetooth architecture and operation.

❍ **Bluetooth Radio** **
Radio architecture, Bluetooth Radio Modem IC, Bluetooth Controller IC, Radio bands and channels, Transmitter and Receiver requirements.

❍ **Bluetooth Baseband** **
ACL and SCO links, Logical Channels, Bluetooth Addressing, Bluetooth packets, Error correction, Flow control and synchronization, Controller States.

❍ **Link manager and controller** **
Authentication and Encryption Management, Information Exchange and Request, Mode

palowireless has also published on-line [new tutorials to these profiles](). However, with the proliferation of profiles and acronyms it is sometimes hard to see what these profiles are designed to do. As an entry-level introduction, this article gives a brief outline of these new profiles and what roles they will allow Bluetooth units to fill. *more...*

- **Bluetooth and IEEE 802.11b** **
  Although aimed at different markets and roles, there has long been speculation about the effects 802.11b and Bluetooth have on each other, not just technical interference, but also whether they are in competition with each other commercially. Often these are simplistic press reports attempting to compare the two and

management and SCO connections.

- **Higher layer adaptation** **
  Connection Identifiers, Protocol Multiplexing, Segmentation and Reassembly, L2CAP Events and Actions, Signalling command codes.

- **Connecting Bluetooth Devices** **
  A detailed look at connection establishment.

- **FAQ** **
  Answers to some commonly-asked questions about Bluetooth.

Bluetooth Testing Tools Comparison Chart
Mike Ruscher's comparison of features for Bluetooth test equipment, protocol analyzers, sniffers and packet analysis tools including:

seeking to decide a winner. This article however explains the similarities and differences between Bluetooth & 802.11b on a broad level and tries to show that there is no serious competition between the two. In fact both have their own advantages and disadvantages, and both technologies can complement each other... *more...*

- ❍ **Bluetooth Mobility & Roaming** **

  Two major current limitations of Bluetooth are: that communication between devices must be direct; and secondly that they do not support the movement of an active terminal from one network interface device to another. This article briefly examines several theoretical ways in which these interpiconet issues could be handled and developed.... *more...*

- ❍ **Bluetooth Security - Part 1** **

  Nothing has caused more concern and confusion in Bluetooth than the

- ❍ Arca WaveCatcher & WaveMaker
- ❍ Catalyst BTAE
- ❍ CATC Merlin
- ❍ CATC Merlin Mobile
- ❍ CATC BTTracer/Trainer (NEW!)
- ❍ CETECOM BITE
- ❍ Frontline Test Equipment SerialBlue and FTS for Bluetooth
- ❍ IVT BlueTester / BlueAnalyzer
- ❍ Mobiwave / Yokogawa BPA-D10
- ❍ Rohde & Schwarz PTW 60
- ❍ Tektronix BPA100
- ❍ Yokogawa BX1000

More Bluetooth Information

- ❍ Don't forget to take a look at our Bluetooth Tutorial and FAQ!

- ❍ Click here to subscribe to our free Bluetooth email newsletter.

nature of Bluetooth security implementation. From those who insist that its security is a disaster area, prey to any half-capable opportunist, to the contrary view that's its security is second to none... *more...*

○ **Bluetooth Security - Part 2** **
Last month we examined the lower level of Bluetooth security (Link Level security). This month we look at the Security Mode 2 (the service level enforced security) and a possible implementation of it. We also evaluate the overall merits/drawbacks of Bluetooth in the security arena.... *more...*

○ **Bluetooth Security - Part 3** **
As shown in parts 1 & 2 of this article, Bluetooth has a comprehensive set

of security features, at both upper and lower levels. However for all of it's security features, Bluetooth does have some security issues..... *more...*

Contributed Articles

- ❍ Northstream
  [Bluetooth Opportunities and Threats from a Market Perspective (9/01) (34Kb, PDF)](#)
  Usage models, The business case of short-range networks, The business case of short-range networks and Coexistence.

- ❍ MindBranch
  [Bluetooth: Value Adds and Opportunities (8/01) (431Kb, PDF)](#)
  Uses of Bluetooth Technology, Competing Bluetooth Technologies, Devices: What does the future hold? Are Lap-Tops Leading

the Way? Applications: How much influence do they really have? Equipment: How will Bluetooth effect equipment forecasts? Bluetooth Opportunities, The Value of Bluetooth.

❍ Marcin Michalak **Multimedia Transmission in Bluetooth-based Networks (6/01) (1143Kb, PDF)** Includes: - short description of Bluetooth and multimedia transmission technologies, - creation of the testing environment, - performance tests and results of MPEG-1, MPEG-4 (QuickTime) and RealVideo transmissions.

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Market Research
Search
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Articles
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Books
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[Also see: **Wireless Events**   **Bluetooth News**]

Asia-Pacific Bluetooth News and Resources

◉ Welcome to our Asia-Pacific section. This page is to provide news and links of interest to those in this region.

Featured Market Research

Recommended reports from reputable researchers.

⭐ **Asia Pacific Mobile Analyst**

Asia Pacific Mobile Analyst, an electronic newsletter from the publishers of ASIAcom, is your essential fortnightly guide to the shifting power dynamic of Asian next generation mobile development. From new pricing and tariffing requirements to mergers and consolidation, every electronic issue includes the comprehensive analysis and data necessary to compete. In addition, Asia Pacific Mobile Analyst provides a consistent, strategic assessment of regional developments across Asia within a global context, invaluable for European, US and ROW players looking to secure a global

**What Is
Bluetooth?**

position.

Type: Newsletter
Published: Fortnightly
Published By: Baskerville

* * * *

Also Recommended:

⭐ **Asia Pacific Mobile Market for 3G Services - 2002 to 2005**

Several technical, regulatory and market issues are delaying the mass deployment of 3G networks and services in Asia Pacific. However, the demand for 3G services and applications is strong within the consumer population. APRG examines the future demand for Third Generation mobile services, with special emphasis on the 18-30 year old market.

Published: October 2003
Published By: Asia Pacific Research Group
Pages: 63

* * * *

See our Market Research section for more.

藍牙

Useful Links

Australia

- [Ericsson Australia](#)

- [HCV](#)

- [IBM Australia](#)

- [Intel Australia](#)

- [Nokia](#)

- [Palowireless](#)

China & Hong Kong

- [BluetoothInChina](#)

  - Chinese Bluetooth news & resource site

- [China WPAN](#)
  - WPAN News in China including Bluetooth, IEEE 802.11, HomeRF, IrDA and HiperLAN/2, etc.
  - [Some recent news](#)

- [Ericsson China](#)

- [The Chinese University Of Hong Kong](#)

- [Telecom Asia](#)

Japan

- [Association of Radio Industries and Businesses (ARIB)](#)

- [Ericsson Japan](#)

- [Hitachi, Ltd](#)

- [Matsushita Communication Industrial Co](#) (Panasonic)

- [Sony Japan](#)

- [Taiyo Yuden (Japan)](#) [Taiyo Yuden International](#)

- [Toshiba Japan](#)

- [NTT Mobile Communications Network (NTT DoCoMo)](#)

Korea

- [Ericsson Korea](#)

- [Tricomtek](#)
  - Bluetooth and other [Protocol Testing](#), Reseller of arca Serialcatcher and Wavecatcher.
  - Developers of short messaging applications for 3G SMSC and SMS platform.

New Zealand

- [Sony NZ](#)

  - Check out the website with our new MicroMV products. Internet ready handycams that do not need to link to a PC to get internet access and email your pictures straight from the handycam to your friends!

Singapore

- [Institute of Microelectronics (IME), Singapore](#)

- [Center for Wireless Communications Singapore](#)

- [National University Of Singapore](#)

Taiwan

- [Alltek Taiwan](#)

- [Industrial Technology Research Institute (ITRI)](#)

- [Macronix Taiwan](#)

    - EDTN [Taiwan's Macronix and U.S. partner ready Bluetooth wireless IC](#)

- [PC Home Taiwan](#) News

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2002: 3.27 million

2001: 2.15 million

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[Also see: Bluetooth Resource Center Books on Antennas Books on WLANs Top 10]

Bluetooth Books

● Welcome to our guide to the latest Bluetooth publications.

● Look for more books on this topic
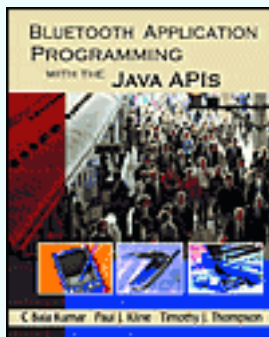
Bluetooth Application Programming with the Java APIs

Bluetooth technology allows a variety of devices, from cell phones to PDAs to desktop computers, to communicate with each other without connecting them via cables. Bluetooth has more applications in the mobile and embedded devices area where, according to industry observers, 80% of mobile

What's Hot:

Essential Guide to RF and Wireless, Second Edition

Complete Wireless Design with CD ROM

Mathematics Calendar 2004

Piloting Palm: The inside Story...

Smart Mobs: The Next Social Revolution

ARRL Antenna Book with CD-ROM

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phones will support Java by 2006. The reason for this is two-fold: the number of Java developers (and their technology demands) are increasingly on the rise and the standard Application Programming Interface (API) for Bluetooth technology was just defined for the Java programming language in February 2002. This book explains how to program to this API, gives details on why it was created, how it will help exploit the power of Java and Bluetooth, and show how to create an implementation of a device.

C. Bala Kumar
Format: Paperback
Publisher: Morgan Kaufmann Publishers
Published: September 2003

802.11 Wireless Networks: The Definitive Guide

GPS Land Navigation

Wireless Nation: The Frenzied Launch of the Cellular Revolution in America

Dilbert and the Way of the Weasel

Essential Guide to Wireless Communications Applications

Bluetooth for Java

Bluetooth 1.1: Connect Without Cables, Second Edition

OFDM Wireless LANs: A Theoretical and Practical Guide

Bluetooth for Java

Bluetooth for Java is not an overview of Bluetooth. In the book, Bruce Hopkins and Ranjith Antony describe how to develop wireless Java applications using Bluetooth for a variety of platforms. This includes an API overview of the Java library, development of Bluetooth-based services, highlights of security concerns, and walkthroughs for development with some of the different tools available. Programs will not be just J2ME (micro devices) based, but will also be for J2SE (client/desktop).

Bruce Hopkins, Ranjith Antony, John Zukowski
Format: Paperback, 352pp
Publisher: APress L. P.
Published: March 2003

Wireless Messaging Demystified: SMS,EMS, MMS and Others

IEEE 802.11 Handbook: A Designer's Companion

Wireless LANs: Implementing High Performance IEEE 802.11 Networks

RF Power Amplifiers

Wireless Spectrum Finder

Building a Cisco Wireless LAN

Wireless Java Programming with J2ME

Creating Location
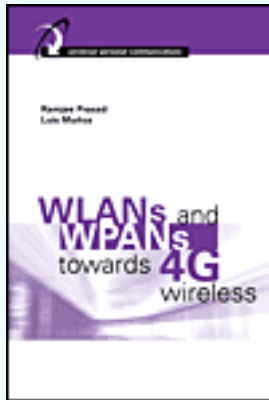
WLANs and WPANs Towards 4G Wireless

Explore the present and future trends of WLANs and WPANs with this new, forward-looking resource. You discover the path that these infrastructures are following from a perspective of synergies with 3G systems, and how they will pave the way for future 4G systems. An entire chapter is devoted to the WPAN domain, where a detailed treatment of Bluetooth as well as a second-generation outlook are provided. Moreover, the book explains how the PEP paradigm provides internetworking capabilities between WLANs and WPANs and how it enhances performance over these platforms.

Ramjee Prasad, Luis Munoz
Format: Hardcover, 245pp
Publisher: Artech House, Incorporated
Published: March 2003

Services for the Wireless Web

GPRS from A-Z

Smart Antennas for Wireless Communications

Windows XP for Dummies

Networking For Dummies

TCP/IP For Dummies

Internetworking with TCP/IP Vol.1 : Principles, Protocols, and Architecture

J2ME: The Complete Reference

More wireless books...
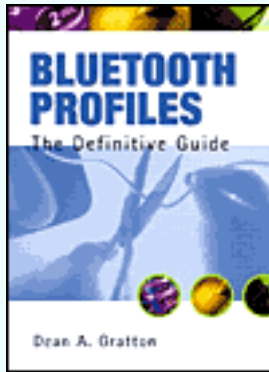
Bluetooth Profiles

Bluetooth Profiles are the key to delivering interoperable products that work reliably, "right out of the box." Now, leading Bluetooth expert Dean Anthony Gratton brings the Bluetooth Profiles to life, showing you exactly how to use them to build winning user-centered products. Gratton takes you "under the hood" of every significant Bluetooth Profile, from Bluetooth's essential Foundation Profiles to powerful emerging profiles for personal area networking, automotive applications and imaging. Drawing on his extensive experience with Bluetooth development, Gratton also offers practical guidance for creating innovative new profiles of your own.

Dean A. Gratton
Format: Hardcover, 550pp
Publisher: Pearson Education
Published: December 2002
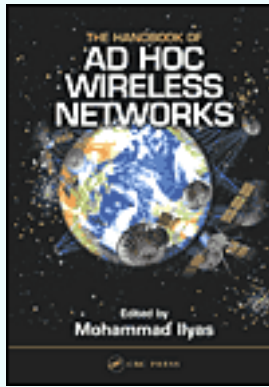
The Handbook of Ad hoc Wireless Networks

With rapid advances in hardware, software, and protocols, ad hoc networks are now coming of age, and the time has come to bring together into one reference their principles, technologies, and techniques.The Handbook of Ad Hoc Wireless Networks does exactly that. Experts from around the world have joined forces to create the definitive reference for the field. From the basic concepts, techniques, systems, and protocols of wireless communication to the particulars of ad hoc network routing methods, power, connections, traffic management, and security, this handbook covers virtually every aspect of ad hoc wireless networking. It includes a section that explores several routing methods and protocols directly related to implementing ad hoc networks in a variety of applications...

Mohammad Ilyas
Format: Hardcover

Publisher: CRC Press
Published: December 2002

Getting Started with Bluetooth

As the world continues to become more mobile and business is conducted in the blink of an eye, a new system is taking communication one step further. Bluetooth technology unites computing with telecommunication. This innovative breakthrough eliminates the need for cables by using short-range radio links. Equipped with features such as robustness, low complexity, low power and low cost, this technology incorporates any digital device, including PDAs and printers, into the Bluetooth system. Getting Started with Bluetooth *teaches you concepts about Bluetooth specifications, devices, and architecture, giving you the knowledge to gain a competitive edge!*

Madhushee Gangali
Format: Paperback,

416pp.
Publisher: Premier Press
Published: September 2002

Wireless Networks: LAN and Bluetooth

Wireless LAN and Bluetooth is a visual reference guide that provides a thorough introduction to establishing a wireless communication network. Create a home network for sharing emails and playing games.

Andreas Lerg
Format: Paperback, 160pp.
Publisher: Data Becker
Published: August 2002
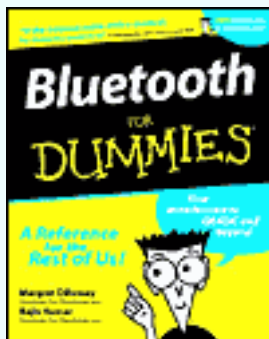
Bluetooth for Dummies

For corporations considering using Bluetooth in offices, this book details what Bluetooth is capable of and how it compares to other wireless technologies. For companies developing Bluetooth applications, it

tells of the complexities of creating one's own software stack vs. buying one pre-made; demonstrates three Bluetooth applications; and gives examples of various Bluetooth usage models. Sales and marketing folks find out, painlessly, how the technology works and what it can do. For the cutting-edge consumer, there are the applications (which are downloadable), what is coming up in the near and far future for Bluetooth, how Bluetooth works, and how Bluetooth will affect them in a useful way.

Margret Dilloway, Rajiv Kumar
Format: Paperback, 384pp.
Publisher: Hungry Minds, Incorporated
Published: May 2002

Bluetooth Operation and Use

Packed with priceless experience, Bluetooth Operation and Use *cuts the time it takes you to:*

- *Implement "wireless cable" for phones, other handhelds, and portables*
- *Build futuristic Bluetooth apps—for refrigerators that update PDA shopping lists, PDAs that survey local stores for the best prices, and as many others as you can dream up*
- *Examine operational characteristics in detail*
- *Solve security issues*
- *Get technical insights on Bluetooth's coexistence with other wireless devices*
- *Find the facts you want on packet structure, paging, host interfacing, and designing and testing the Bluetooth*

module
- *Probe the math behind the specifications for further research*

Robert Morrow
Format: Paperback, 567pp.
Publisher: McGraw-Hill Professional
Published: May 2002

[Bluetooth End to End](#)

Bluetooth End to End is a comprehensive look at the technology from the standpoint of the IT Professional. The book goes above and beyond a simple re-hashing of the specification to provide practical implementation information on Bluetooth technology application fundamentals, implementation, wireless networking, Bluetooth security considerations, chip technology and the required specifications for Bluetooth device development culled from networking professionals.

Dee Dee M. Bakker, Diane McMichael Gilster, Ron

Gilster (Editor)
Format: Paperback,
384pp.
Publisher: Hungry Minds
Published: March 2002

Bluetooth 1.1: Connect Without Cables, Second Edition

The Bluetooth specification has been updated to deliver dramatic improvements in both reliability and interoperability. Bluetooth 1.1: Connect Without Cables, Second Edition updates the industry's #1 Bluetooth guide to cover these critical new enhancements—and to offer detailed guidance on every aspect of Bluetooth 1.1 development.

- *The authoritative, in-depth guide to the new Bluetooth 1.1 specification*
- *Bluetooth 1.1's dramatic improvements in interoperability and reliability*
- *Includes thoroughly revised coverage of*

Bluetooth security and power conservation
- *New Bluetooth profiles—including the long-awaited Personal Area Networking profile!*

Jennifer Bray,Charles Sturman
Format: Hardcover, 2nd ed., 622pp.
Publisher: Prentice Hall PTR
Published: December 2001

[The Intelligent Wireless Web](#)

If you buy one book on the intelligent Internet, this should be it."—Minerva Tantoco-Hobbs, Director of Advanced Technology & Media Lab, Answerthink

"This book runs guns to the revolutionaries, detailing all the technologies, all the candidate protocols, and all the challenges to be met along the way to build the intelligent wireless Web."—Michael Swaine, Editor-at-Large, Dr. Dobb's

Journal

The Intelligent Wireless Web examines the convergence and synergy among five key technological components: speech used as a primary user interface; wireless personal area networks (WPANs); an integrated wired/wireless network infrastructure; supporting wireless protocols; and intelligent applications. It investigates available technologies and standards that are currently being developed to bring these goals into the mainstream of Internet use.

H. Peter Alesso, Craig Smith
Format: Paperback, 384pp.
Publisher: Addison Wesley Longman, Inc.
Published: December 2001
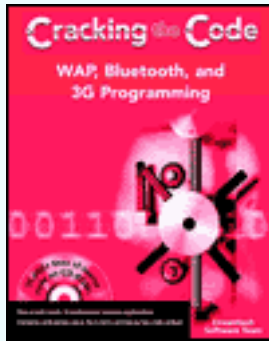
WAP, Bluetooth and 3G Programming: Cracking the Code

WAP, Bluetooth, and 3G: A Brief Introduction, WML and WML Script Programming: A Case Study, WAP Using Cold Fusion: A Project, WTA: An Advanced Interaction Technique for Mobile Phones, Integrating Java with WAP, Push Technology in WAP, Bluetooth: A Basic Introduction, Using WAP with Bluetooth, Bluetooth Programming, ...

Dreamtech
Format: Paperback, 552pp. & CD-ROM
Publisher: Wiley, John & Sons, Inc
Published: November 2001

[Bluetooth Application Developer's Guide](#)

Bluetooth Developer's Guide to Embedded Applications will provide developers with an advanced guide to the wireless frequencies governing the Bluetooth protocol. This book will give readers all of the insight, tool, and techniques necessary to write embedded Bluetooth applications. Written for advanced programmers, this book this book will be invaluable for the Bluetooth developer.

CD-ROM Featuring the Syngress Wallet CD. The book's CD-ROM includes all the source code from book along with a printable, HTML version of the book. Sample applications from award-winning Embedded Systems and Cambridge Silicon Radio Developers will also be included.

Jennifer Bray, Brian Senese
Format: Paperback, 556pp.
Publisher: Syngress

Publishing
Published: September
2001

An IEEE Guide: How to
Find What You Need in
the Bluetooth Spec

*This book is specifically
designed to streamline the
process of finding
information about the
Bluetooth wireless
technology. It provides
helpful hints about the
Spec so that you have a
fuller understanding of the
technology and how it
impacts you. Based on
what you will be doing with
the Spec, it helps answer
the question, "What do I
really have to read and
understand?"*

Tom Siep
Format: Hardcover,
150pp.
Publisher: IEEE
STANDARD OFFICE
Published: November
2000

Discovering Bluetooth

Discovering Bluetooth offers unparalleled insights into this new wireless technology, discusses its many potential applications, and shows you how you can integrate Bluetooth into your daily routine.

Michael Miller
Format: Paperback, 304pp.
Publisher: Sybex, Incorporated
Published: July 2001

Bluetooth Revealed

An Insider's Guide to the Open Specification for Global Wireless Communications.

For users, the new Bluetooth wireless standard will cut through the complexity of wireless communications, enabling devices to communicate seamlessly. Bluetooth Revealed offers the first insider's view of the Bluetooth standards: crucial information and

insight professionals need to start implementing Bluetooth solutions now.

Brent A. Miller, Chatschik Bisdikian
Format: Paperback
Publisher: Prentice Hall
Published: September 2000
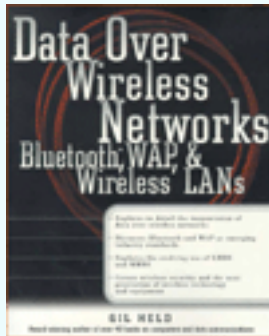
Data over Wireless Networks : Bluetooth, Wap, and Wireless LANs

A first look at the next generation of wireless networking technology and vendor-specific applications including Motorola and Cisco.

Develop state-of-the-art wireless applications using this detailed guide. Transmit data over wireless networks and develop cutting-edge applications with this hands-on reference. This in-depth guide fully explains how wireless technology works and introduces the next generation of applications that allow for the transmission of data

across wireless networks - in a manner that's both fast and secure.

Gilbert Held
Format: Paperback
Publisher: McGraw-Hill Professional Book Group
Published: December 2000

[Wireless Personal Communications](#) : [Bluetooth and Other Technologies](#)

Wireless Personal Communications: Bluetooth Tutorial and Other Technologies presents a broad range of topics in wireless communications, including perspectives from both industry and academia. This book serves as a reflection of emerging technologies in wireless communications and features papers from world-renowned authors on the subject. A new tutorial on the emerging Bluetooth technology is also presented.

William H. Tranter

Format: Hardcover
Publisher: Kluwer
Academic Publishers
Published: December
2000

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Bluetooth Resource Center

CATHAL'S CORNER Cathal Mc Daid

Welcome to Cathal's Corner - articles by Cathal Mc Daid covering a range of Bluetooth topics...

Future versions of Bluetooth - Bluetooth 1.2 & Bluetooth 2.0

● **Future versions of Bluetooth - Bluetooth 1.2 & Bluetooth 2.0** The recent release of cores based on preliminary Bluetooth 1.2 and speculation on the abilities of Bluetooth 2.0 means that far-sighted developers should not stand still in approaching Bluetooth optimisations. This article explains the features on a broad level of Bluetooth 1.2 and examines the reports on Bluetooth 2.0. *Read the full article...*
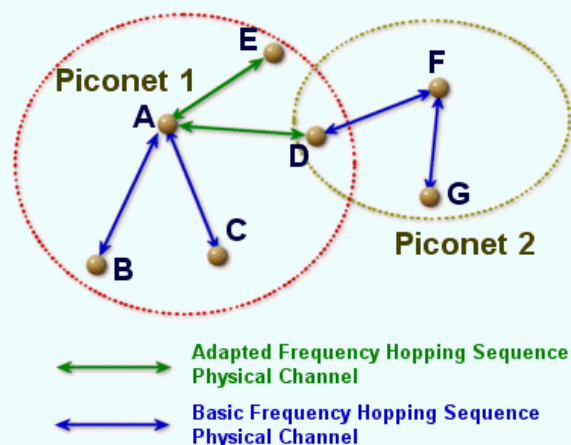
Piconet 1 — A B C E D
Piconet 2 — F G D

Adapted Frequency Hopping Sequence Physical Channel

Basic Frequency Hopping Sequence Physical Channel

Bluetooth Additional Profiles

Technology
Testing
Training
Tutorial
WLANs & BT

**What Is
Bluetooth?**

Bluetooth Additional Profiles

AVRCP - Audio/Video Remote Control Profile
ESDP - Extended Service Discovery Profile
CIP - Common ISDN Access Profile
PAN - Public Area Network Profile
HCRP - Hardcopy Cable Replacement Profile
GAVDP - Generic Audio/Visual Distribution Profile
A2DP - Advanced Audio Distribution Profile
VDP - Video Distribution Profile
HID - Human Interface Device Profile

GAP Based Profiles (9)

HFP - Hands-Free Profile
SIM - SIM Access Profile

SPP Based Profiles (2)

BIP - Basic Imaging Profile
BPP - Basic Printing Profile

GOEP Based Profiles (2)

Members

Member:

Password:

Forgot your
password?

New Member

*Have you
visited our
WAP
Games
section yet?*

● Bluetooth Additional Profiles -
Overview

Currently in the final stages of evaluation and approval, the Bluetooth SIG is in the process of releasing 12 new profiles. In conjunction with this, palowireless has also published on-line new tutorials to these profiles. However, with the proliferation of profiles and acronyms it is sometimes hard to see what these profiles are designed to do. As an entry-level introduction, this article gives a very brief outline of these new profiles and what roles they will allow Bluetooth units to fill. *Read the full article...*

Bluetooth and IEEE 802.11b

● Bluetooth and IEEE 802.11b

Although aimed at different markets and roles, there has long been speculation about the effects 802.11b and Bluetooth have on each other, not just technical interference, but also whether they are in competition with each other commercially. Often these are simplistic press reports attempting to compare the two and seeking to decide a winner. This article however explains the similarities and differences between Bluetooth & 802.11b on a broad level and tries to show that there is no serious competition between the two. In fact both have their own advantages and disadvantages, and both technologies can complement each other... *Read the full article...*

Bluetooth Mobility & Roaming

- ## [Bluetooth Mobility & Roaming](#)

Two major current limitations of Bluetooth are: that communication between devices must be direct; and secondly that they do not support the movement of an active terminal from one network interface device to another. Essentially in Bluetooth, a device in a piconet A cannot communicate with another bluetooth device in a different piconet B, regardless if it was a member of piconet A previously. This article briefly examines several theoretical ways in which these interpiconet issues could be handled and developed... *[Read the full article...](#)*

Bluetooth Security

- ## [Bluetooth Security - Part 1](#)

Nothing has caused more concern and confusion in Bluetooth than the nature of Bluetooth security implementation. From those who insist that its security is a disaster area, prey to any half-capable opportunist, to the contrary view that's its security is second to none... *[Read the full article...](#)*

● [Bluetooth Security - Part 2](#) Last month we examined the lower level of Bluetooth security (Link Level security). This month we look at the Security Mode 2 (the service level enforced security) and a possible implementation of it. We also evaluate the overall merits/drawbacks of Bluetooth in the security arena.... *more...*

● [Bluetooth Security - Part 3](#) As shown in parts 1 & 2 of this article, Bluetooth has a comprehensive set of security features, at both upper and lower levels. However for all of it's security features, Bluetooth **does** have some security issues.... *more...*

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- Looking for some help putting together a Bluetooth solution or a product design?
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Organisation	Primary Location	Overview
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7layers	Germany	Bluetooth Consultancy, Test Lab, BQB and more

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**What Is
Bluetooth?**

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Member:

Password:

Forgot your
password?

New Member

| AU-System | Sweden, UK, Italy, USA, Thailand, Singapore | AU-System is a leading international supplier of consulting services and technological solutions based on emerging technologies within IT and telecommunications. Along with our subsidiary SandbergTrygg, AU-System also provides marketing communication services. AU-System is active in all phases of development in information technology and telecommunications - from the development of new technologies, such as WAP and Bluetooth™, to complete solutions for end-users. Along with our subsidiary SandbergTrygg, one of Europe's leading business-to-business marketing communications agencies, AU-System also provides integrated strategic and marketing solutions. |

[BlueChip IC Design](#)	Sweden	BlueChip supplies design services for the design of complex integrated transcevier circuits. With our in-house design and verification capabilities we ensure efficiency and quality of our work to our customers, with services ranging from the specification, design and verification phases. All designers at BlueChip have long experience in RF IC design and are recruited from two of the main telecom manufacturers in the world. Several of the circuits are in volume production in technologies such as 0.13u RFCMOS to high end SiGe BiCMOS. BlueChip currently employs 10 designers.
[Blue Pulse](#)	Australia	Blue Pulse is the exclusive Australian distributor for Red-M products and solutions. We offer the full product suite of Red-M products plus training, support and a number of end-to-end bluetooth networking solutions.
[Cadence Design](#)	USA	Bluetooth IC and Software Design Services

[CETECOM](#)	Germany	Bluetooth Global Solutions. Testing, Approvals, Test Systems, Development & Support.
[ChipHelp](#)	USA	ChipHelp is a provider of [Electronic Design Services](#) (chip & board level), technical business consulting, semiconductor training courses and technical recruiting services. We offer capabilities in Bluetooth design, development and integration services.
[Clarinox](#)	Australia	The Home of Bluetooth and Embedded Systems Solutions. Custom Bluetooth-based wireless application development. Embedded systems solutions; software design, hardware design and device driver development.
[Code Blue Communications](#)	USA	Offering the services for your organization to learn more about Bluetooth wireless technology and help apply our expertise to your products and solutions.
[Combra AB](#)	Sweden	Swedish Bluetooth hardware and software consultants.

[connectBlue AB](#)	Sweden	connectBlue specializes in integrating Bluetooth based communication solutions in applications and products for industrial and commercial use. connectBlue offers you a wide range of services all depending on your needs and requirements. The services can range from feasibility study to product management both of hardware and software products.
[Cravewire](#)	USA	Wireless software tools, applications and communication services to assist and enhance the use of Bluetooth enabled devices.
[DCM Technologies](#)	USA	Bluetooth design services (USA / Japan / India)
[eCom](#)	UK	eCom specialise in providing expert solutions in the Bluetooth, WAP, Wireless, M-Commerce, E-Commerce and related fields.
[Electronic System Products (ESP)](#)	USA	ASIC design, RF engineering, digital and analog design, DSP-related development, software and embedded systems development.

[HCV Wireless](#)	Australia	HCV Wireless provides design, integration and manufacturing services to assist your product teams and market deadlines.
[IAR](#)	Sweden	IAR Systems have been involved in development of Bluetooth products for several years, and we have gained considerable experience in both hardware design and software development for Bluetooth related products. You can rely on IAR consultants as the true experts when it comes to development of embedded systems with Bluetooth capabilities!
[Ibex Technologies](#)	India	A technology company, focusing primarily on supplying embedded software solutions specifically in the areas of Telecom, Data Communication, Intelligent Internet Appliances and embedded networking solutions. Based in Bangalore, India.
[Impulsesoft](#)	India	Bluetooth Design Services, develop custom solutions and reference designs to OEMs.

[InterConnect Communications](#)	UK	Global approvals and certification management for radio and telecom products, including: Low Power Radio, Bluetooth, PMR, Fixed Links and TTE. InterConnects specialist consultancy portfolio includes: Approval Manuals, Legal & Regulatory services for manufacturers, equipment suppliers, regulatory and public bodies world-wide.
[IVT Corporation](#)	China	Ericsson Microelectronics AB Certified Bluetooth Solution Provider. Bluetooth Protocol, Bluetooth Profile Reference Designs, Bluetooth Conformance & Interoperability Testing...
[Innovative Wireless Technologies (IWT)](#)	USA	IWT provides industry proven experience in the wireless and telecommunications fields to solve your engineering design and outsourcing needs. IWT focuses it's development efforts on leading edge technologies such as WLANs (802.11a/b), Bluetooth, LMDS (Broadband Wireless), and digital satellite radio.

[LitePoint Wireless System Design](#)	USA	LitePoint Wireless System Design is a Silicon Valley company with a very experienced and talented team of engineers from the semiconductor and cell phone industry. LitePoint is your systems design expert resource, offering design consultancy services to semiconductor and systems companies.
[L.S. Research](#)	USA	L.S. Research has been a leader in RF and wireless design since 1980. With a core compentency of wireless product development, L.S. Research offers a broad range of services including RF design, antenna design, software design, PCB layout, prototyping, product verification, and FCC certification.
[Mentorport](#)	UK	Specialists in mobile radio communications design for low cost and high volume for systems such as pcs, gsm, dcs, umts and bluetooth transmitters and receivers. Mentorport offer design services to the Clients requirements from 1MHz to 10GHz,cellular communications to

		military electronics, high volume to one off's and both lumped component and microstrip designs.
[mepro communications](#)	Germany	Development and production services for specialised hands-free solutions using Bluetooth.
[Mezoe](#)	UK	Tools and knowledge to ease your entry into wireless communications product development. A division of Cambridge Consultants Limited.
[MindTree](#)	USA / India	Specialising in design services for the convergence technology. Developers of reusable components in WAP, Bluetooth, Integrated Messaging and Network Management.
[Mobiwave](#)	Singapore	Specialists in 3CIA – Communication, Consumer and Computer Internet Appliances.
[NewLogic](#)	Austria	IC Design Service for wireless communications, automotive and data processing.

[Nily Technologies](#)	France	Nily Technologies is a fabless company and aiming to be a leading supplier of RF GaAs and Silicon Intellectual Properties (IP) and RFIC Design Services. Nily technologies leverages advanced design automation capabilities of today modern simulation and layout tools to shorten your specific RF circuit needs. IEEE 802.11a, HyperLAN II, IEEE 802.11b, Bluetooth, ISM radio system, MMDS, MVDS
[NT Communications Ltd](#)	UK	Consultancy services.
[Open Interface](#)	USA	Leading provider of Bluetooth technology for the PC market.
[Penell](#)	Denmark	Bluetooth design, development and integration also within HealthCare and Medical Devices.

[Proticom](#)		Proticom provides consulting services to help our clients develop and implement successful quality assurance efforts. Proticom provides advanced quality solutions for emerging technologies such as Bluetooth, WAP, and mobile applications.
[Radio Frequency Investigation](#)	UK / USA	RFI provides independant compliance and regulatory services for the wireless communications industry. RFI is focusing on GSM, 3G, Bluetooth, WAP and Smartcard technology. RFI will be offering BQB, BQTF services and consultancy for Bluetooth products.
[RTX](#)	Denmark	RTX Telecom is one of the world's leading independent suppliers of Total Product development Solutions, focusing exclusively on advanced wireless communication standards such as DECT, DPRS, ISDN, WDCT, GSM, CDMA, UMTS, and Bluetooth.

[Sigma](#)	Sweden	A consulting company that focuses on turnkey solutions Sigma is a full member of UMTS Forum, WAP Forum, MAI (Mobile Applications Initiative) and Bluetooth SIG.
[Silicide](#)	Denmark	Wireless Microelectronics. Silicide a/s is a fabless semiconductor company that offers know how in RFIC and high-speed ASIC design.
[Silicon and Software Systems (S3)](#)	Ireland	S3 is a provider of Electronic Design Services with capabilities in Silicon Design, Software Development and Hardware Design, delivering an unrivalled service in Communications, Wireless and Consumer Design. S3 has been involved in the development of Bluetooth Wireless Technology since October 1998 and currently offers a complete design service based on the Ericsson Bluetooth Core (VWS2600X) and the Philips Bluetooth Core (PCD87750).

[Spagat A/S](#)	Norway	Integrated Bluetooth Product Development. A privately held company specialising in product development using Bluetooh components - hardware and software. We have in-depth knowledge of the Bluetooth protocol stack and various profiles with experience on the following platforms: Windows 2000, Pocket PC (Win CE) and Epoc (Symbian).
[Stollman](#)	Germany	ISDN and Bluetooth - Products and Protocol-Stacks. Custom development services.
[Stonestreet One](#)	USA	Bluetooth design, development and integration services.
[Strio](#)	USA	By developing innovative applications for Bluetooth In-Building Networks, Strio provides retailers with a suite of services, creating wireless communities inside brick and mortar environments.
[STS](#)	Netherlands	Custom Bluetooth solutions.

Syncore Technologies AB	Sweden	An expanding development company specializing in integrating communication solutions based on Bluetooth wireless technology in applications and systems for industrial or commercial use.
Tricomtek	Korea	Bluetooth and other Protocol Testing, Korean reseller of arca Serialcatcher and Wavecatcher. Developers of short messaging applications for 3G SMSC and SMS platform.
TÜV Rheinland/Berlin-Brandenburg	Germany	Test Consultance BQB, BQTF, Worldwide Regulary Type Approvals etc.
Wipro	India	Bluetooth Services Wipro provides complete design & implementation services for Bluetooth for mobile devices. Using the Bluetooth core stack developed in-house, GR&D offers the time-to-market advantage to the customers.

[Wireless Futures](#)	UK	Wireless Futures is a consultancy operating in the telecoms, wireless and high technology sectors. We are assisting product manufacturers in the development and test of leading edge products including GPRS, Bluetooth and EMS.
[Wireless Solutions](#)	Sweden	Wireless Solutions for Bluetooth and WLAN

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[Also see: **Bluetooth Antenna**   **Bluetooth Testing**   **Wireless Dev Tools**   **Wireless Testing**]

Bluetooth Design Tools

● Welcome to our listing of RF and digital design tools, simulators and other tools.

Agilent	**ADS Bluetooth DesignGuide** assists Bluetooth developers with optimization and verification of Bluetooth RF system designs. The ready-to-use Bluetooth reference transceiver model with adjustable parameters comes as part of the DesignGuide.
Cadence	NC-Sim tool is a single kernel simulator that can verify both mixed-language and mixed-signal designs. The Advanced Analysis Environment provides HDL analysis and linting while Verifault provides accurate fault coverage. The IP model packager enables secure distribution of HDL intellectual property for system-on-a-chip design.

What Is Bluetooth?

Elanix	SystemView design software, 3G Design Studio, application libraries.
Highland Systems	Bluetooth/802.11 Simulation Suite Bluetooth Simulation Model Suite (Suitetooth) is an open, modular framework for advanced network performance engineering. Built for the OPNET simulation environment, the high-fidelity, discrete-event Suitetooth models allow users to predict performance characteristics and study behavioral interaction for personal area network (PAN) applications that use both existing and emerging wireless technologies.
IBM	BlueHoc Bluetooth ad-hoc network simulator. BlueHoc is an open source Bluetooth technology simulator. It simulates the baseband and link layers of the Bluetooth specifications www.bluetooth.com . It is capable of simulating an ad-hoc environment with several Bluetooth devices operating in an indoor wireless channel. It provides an extension to the 'Network simulator (ns)' available from www.isi.edu/nsnam/ns. It uses the TCP/IP simulations of 'ns' to enable performance evaluation of TCP/IP based applications over Bluetooth. It also provides an insight into the performance of device discovery and paging protocols specified in the Bluetooth baseband specifications. It provides a platform for evaluating proposals for improving performance of Bluetooth based systems.
RFGlobalNet	Design Tools
Virtio	On-line virtual prototyping of embedded systems and system-on-a-chip (SOC) products
Wireless Valley	SIRCIM and SMRCIM Software simulators of real-world wireless channels.

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[Also see: **Bluetooth Design Tools**   **Bluetooth Testing**   **Bluetooth Antennas**   **Wireless Dev Tools**]

Bluetooth Development Tools

● Bluetooth Development Tools including modules, chipsets, RF and digital kits, protocol implementations and other tools.

● Also see our listings for:

- **Bluetooth Antennas and Aerials**
- **Bluetooth Products**
- **Bluetooth Design Tools and Simulators**

- **Adamya**
  - ○ **Bluetooth Protocol Stack**
    Small size and high-performance stack.
    Implements HCI, L2CAP, SDP and RFCOMM layers.
    HCI conforms to HCI_RS232, HCI_UART.
    Developed in ANSI C.

- **Agere Systems** (formerly Lucent Technologies

What Is Bluetooth?

Microelectronics)

❍ W7020 is a complete, low-power Bluetooth radio subsystem in a single component. As part of Lucent's Bluetooth solution, the W7020 interfaces directly to the W7400 baseband controller and an antenna. Designed to operate at a low 2.7V and incorporating low power mode features, the W7020 is engineered for long battery life.

❍ Wireless Design Online: Bluetooth Radio Design Considerations for Cellular Handset Application

❍ Bluetooth Wireless Technologies Products, documentation, news...

- **Alcatel**
  ❍ An embedded stack Bluetooth solution for headset and cellular applications combines Alcatel's MTC-6018 Bluetooth chip with TTPCom's embedded software stacks, offering a complete solution with full reference design.

- **Alps Electric**
  ❍ UGXZ Series modules
  UGXZ1 Class 1 Module and the UGXZ2 Class 2 Modules have dimensions of 10.0mm x 13.5mm x 2.0mm and 10.0mm x 10.0mm and 1.9mm respectively. Weighing 0.5g, they are also approximately 75% lighter than earlier models.

- **Atinav**
  ❍ Atinav offers a fully developed Bluetooth Protocol Stack. The protocol stack conforms to Bluetooth 1.1 spec and is qualified by the Bluetooth SIG. The stack is implemented both ANSI C and Java and is very optimised. The stack could be easily ported to various platforms.

- **Atmel Corporation**

- ❍ [Atmel Bluetooth](#)

- ❍ [AT76C551 Single-chip Bluetooth Controller (PDF)](#)
  The AT76C551 is a single chip controller providing the functionality for high data rate, short distance wireless communications in the free ISM band. In conjunction with a 2.4 GHz transceiver, it provides a cost effective networking solution for a wide range of digital communication devices and computer peripherals. Integration is simplified due to the incorpo-ration of three different interfaces: USB and 16550 UART compatible interfaces and a PCMCIA interface conforming to the PC Card 95 specification. Additionally, a voice coding/ decoding module is provided. The AT76C551 is comprised of a baseband processor. This processor carries out all bit-level processing after modulation/demodulation of the Bluetooth bitstream. It controls the trans-ceiver and dedicated voice coding/decoding. The AT76C551 has an ARM7TDMI processor core with support for internal and external memory, as well as the interface core logic.

- ❍ [T7023 ISM 2.4 GHz Power Amplifier (PDF)](#)
  The T7023 is a monolithic SiGe power amplifier. It is especially designed for operation in TDMA systems like Bluetooth, DECT, IEE 802.11 FHSS WLAN, home RF and ISM proprietary radios.

- ❍ [T7024 Bluetooth/ ISM 2.4 GHz SiGe Front End IC (PDF)](#)
  A monolithic SiGe transmit/ receive end IC with power amplifier, low-noise amplifier and switch driver. It is especially designed for operation TDMA systems like Bluetooth, DECT, IEE 802.11 WLAN, HomeRF and ISM proprietary radios.

- ❍ [Bluetooth Development Kit](#)
  Kit includes two Bluetooth development boards and RF daughter cards. The development boards have three interfaces: PCMCIA, UART, and USB. Drivers, firmware, software utilities (object code), and documentation are

also provided.

- **AU-System**
  - ○ AU-system is a distributor for the Ericsson Bluetooth Host stack.

- **Axis Communication**
  - ○ Bluetooth Protocol Stack for Linux available under the GPL (Gnu Public License).

  - ○ Axis Developer Board

    The Axis Developer Board is based on the ETRAX 100 system-on-a-chip. The Developer Board also includes an Axis-developed, an embedded version of Linux, as well as the communications ports most commonly used with the ETRAX chip.

- **BlueMod**
  - ○ Bluemod is a compact, powerful, fully compliant computing platform incorporating Bluetooth technology. Using BlueMod, new and established solution developers can take advantage of an innovative, embedded wireless platform to accelerate the engineering process and bring their wireless products to market more rapidly. BlueMod features a small footprint, powerful 32-bit embedded processor and multiple connectivity accessories. With full Bluetooth 1.1 compliance and multiple profiles, BlueMod's Applications Programming Interface allows solution developers to quickly deploy their own application code inside a Personal Area Network (PAN) space.

- **Bluelogic**
  - ○ Qualified Bluetooth Protocol stack

- ❍ Embedded system development tool kit

- **[Bluesoft](#)**
  - ❍ Bluesoft provides unique positioning platforms and solutions for short-range wireless networking standards such as Bluetooth and Wi-Fi (IEEE 802.11).

- **[BlueTags](#)**
  - ❍ The BlueTags Development Kits will enable you to test and develop tracking and tracing solutions for your specific need and will be made available to six different segments: Mobile phone manufacturers, PDA manufacturers, PC manufacturers, Bluetooth access point vendors, Telco's and Bluetooth solution providers.

- **[BrightCom](#)**
  - ❍ [IntelliBLUE](#)
    Single chip Bluetooth processors , implementing complete on-chip Baseband, Protocol and Application.

  - ❍ [BIC2101](#)
    Bluetooth Serial Applications.
    BIC2101 is an IntelliBLUE based IC device designed to serve as a cost effective Bluetooth Application Processor for serial type cable replacement applications. Interfaces include UART (RS-232) and PCM.

  - ❍ [BIC2102](#)
    Bluetooth Serial/USB Applications.
    BIC2102 is an IntelliBLUE based IC device designed to serve as a cost effective Bluetooth Application Processor for USB and serial cable replacement type of applications. Interfaces include: USB with Host and Device operation modes, UART (RS-232) and PCM/CVSD.

  - ❍ [BIC2104](#)
    Ultra low power Bluetooth Applications.

BIC2104 is an IntelliBLUE based IC targeted to serve as an ultra low-power Bluetooth Application Processor designed for fully embedded cable replacement applications. Interfaces include UART (RS-232), Voice and extended GPIO.

- ❍ [BIC2201](#)

  Bluetooth Hi-Fi Audio Applications.
  BIC2202 is an IntelliBLUE based IC device designed to serve as a Bluetooth Application Processor for high-quality audio applications. The IC includes engines for MP3 and SBC streaming, handling reception and decoding of audio signals. Interfaces include stereo CODEC, PCM, CAN Bus and UART.

- ❍ [BIC2301](#)

  Bluetooth LANB Access Point Applications.
  BIC230x is an IntelliBLUE based IC device designed to serve as a Bluetooth Application Processor for LAN access point. The IC includes an integrated Ethernet interface.

- **[Broadcom](#)**
  - ❍ [BCM2002](#)

    2.4 GHZ Bluetooth FRAC-N Radio. Compatible with QUALCOMM Bluetooth-enabled MSM baseband chips. The BCM2002 is a Bluetooth 1.1 compliant integrated radio transceiver device operating in the 2.4 GHz band. It is ideal for integration in mobile phone applications where the radio has been designed to handle the harsh environments of mobile phones to provide the highest communicaion link quality of service.

- **[BSQUARE](#)**
  - ❍ Bluetooth Extension to WinDK.
    The Bluetooth Extension enables developers to seamlessly attach their Bluetooth hardware to a tested and robust Microsoft Windows® Bluetooth stack. The new

Bluetooth Extension to WinDK is a device driver development toolkit used for quickly developing hardware and protocol drivers for Bluetooth implementations based on the Digianswer A/S Bluetooth Software Stack.

- **BTDesigner**
  - ❍ Web site dedicated to designers of Bluetooth products.

- **Cadence Design**
  - ❍ IC and Software Design Services - also see Symbionics

- **Cambridge Silicon Radio**
  - ❍ Single-Chip Bluetooth Family.

  - ❍ Bluecore
    BlueCore is a single chip radio and baseband IC for Bluetooth, 2.4GHz radios, implemented in CMOS technology.

  - ❍ Casira Development kit
    Casira consists of a BlueCore radio module plugged onto a motherboard. This contains host I/O and man-machine interface elements including RS232 drivers (or USB), an audio codec to support headset applications, and various other interfaces, packaged in a plastic case which may be connected to a PC's serial port.

  - ❍ Casira
    Supporting development for host-side and embedded Bluetooth systems (interfacing at RFCOMM, and/or using BlueCore's on-chip RISC microcontroller).

  - ❍ MicroSira
    A platform for developing USB-connected host-side software.

  - ❍ CompactSira

A compact flash card providing a platform for developing host-side software for PCs and PDAs.

- **CC&C**
  - ❍ Bluetooth protocol stack
  - ❍ Bluetooth (USB/UART) Module
  - ❍ Bluetooth USB Dongle
  - ❍ Bluetooth Headset
  - ❍ Bluetooth Compact Flash card

- **DCM Technologies**
  - ❍ Bluetooth Protocol Stack

    DCM Bluetooth protocol stack is a high performance, interoperable and versatile IP solution. It is easily configurable for specific requirements and ideal for Mobile nodes, SoC supporting bluetooth, industrial applications and PC/CF cards etc. It provides flexibility of configuring the layers, selecting the required features and generating the application specific solution. DCM Bluetooth protocol stack is portable source code in ANSI C and qualified as per Bluetooth SIG qualification process.

- **Ericsson**
  - ❍ Ericsson Bluetooth Development Kit (BDK)

    The full featured professional Bluetooth Development Kit is mainly aimed for hardware development, evaluation of existing products and software development.
    - Bluetooth Application Tool Kit
    - Bluetooth Application and Training Tool Kit
    - Bluetooth HCI Toolbox
    - Bluetooth Script Engine
    - Ericsson Microelectronics Bluetooth Products BDK Overview

  - ❍ The Bluetooth Qualification Review Board (BQRB) has recognised two units as so called Blue Units. The

Bluetooth Development Kit by Ericsson is one of them, and Nokia offers the other. The purpose of the Blue Units is to fulfil the BQRB's desire to "establish confidence in the lower layer protocols of Bluetooth wireless technology before validated conformance test systems are available". Certain releases of the Bluetooth Development Kit by Ericsson meet Blue Unit standards. When ordering a Bluetooth Development Kit by Ericsson you must indicate that you want a [Blue Unit](#), and also state for what version of the Bluetooth Specification you intend to run the Bluetooth Development Kit by Ericsson as Blue Unit.

- ❍ [Bluetooth Radio Transceivers](#) Robust plug and play radio transceivers

- ❍ [Bluetooth Baseband Controllers](#) Generic Baseband Controllers designed for both host and embedded solutions.

- ❍ [Bluetooth Radio Core](#) has a high level of integration and is optimized for low power consumption. It uses 0.18-micron RFCMOS technology.

- ❍ [EBCP CherryRed](#) offers a Baseband intellectual property solution for use in System-on-Chip designs that is compatible with ASIC design flows and targeted to ARM7TDMI, thus compatible with ARM family CPU's. The concept is a mixed hardware and software solution. EBCP CherryRed is optimized in hardware for low-power operation and easy software integration with low interrupt demand.

- ❍ [EBCP RoseRed](#) provides a Bluetooth Baseband Intellectual Property product for handheld consumer electronics. It enables a low cost implementation of Bluetooth functionality in a great variety of products and can be used in both single-CPU and dual-CPU environments. EBCP RoseRed offers a baseband intellectual property solution for use in System-on-Chip designs that is compatible with ASIC design flows, and

targeted to ARM7TDMI, thus compatible with ARM family CPU's.

- **ETHERchip**
  - ○ Internet applications System on Chip with built in access to e-mail, calendaring, scheduling, messaging, groupware and collaborative functionality. It is an OEM/ODM solution for appliance manufacturers, enabling them to incorporate PIM functionality in interactive appliances and other devices. It uses Bluetooth technology to communicate with Internet gateways.

- **Extended Systems**
  - ○ Bluetooth Embedded Protocols
    XTNDAccess™ Blue SDK is a complete software development kit (SDKs) designed for use in any embedded device such as: cellular phones, PDAs, portable office equipment, digital cameras, medical equipment, industrial automation products and more.

  - ○ Bluetooth Windows Applications
    XTNDConnect™ Blue SDK for Windows® is a complete software development kit for implementing Bluetooth wireless technology in Windows-based devices. The kit includes the lower level Windows protocols as well as applications for Object Push, File Transfer and Synchronization profiles.

- **Galaxy Power, Inc**
  - ○ Manufacturer of Intelligent Power Management solutions for portable and wireless devices, including the first ARM-optimized, Bluetooth compliant, charge control code for efficiently charging rechargeable batteries. Offerings include QuickSaver charge control, SmartBat battery monitors, and system power.

- **GCT Semiconductor**
  - **Radio Transceiver**

    GDM1000 is a CMOS RF transceiver with a GFSK modem and frequency-hopping synthesizer for Bluetooth communications.

  - **Single Chip Solution**

    The GDM 1101 is a Bluetooth single-chip CMOS IC with integrated radio & baseband providing a complete Bluetooth 1.1 solution, which is comprised of a radio transceiver employing GCT's patented direct conversion technology, a Bluetooth baseband controller with bit processor, a GCT proprietary 32-bit embedded RISC processor, and UART/PCM/USB standard/peripheral interfaces. The on-chip 32-bit embedded RISC processor is powerful enough to support full rate Bluetooth data communications and includes sufficient embedded SRAM to support both embedded solutions or voice applications without external memory, which results in low-power consumption and a more cost-effective solutions. A few external elements such as external antenna, crystal and 128KB flash memory are needed for complete Bluetooth systems.

  - **Baseband Processor**

    The GDM1201 is one of several Bluetooth ICs offered in the GCT Bluetooth product family. The GDM1201 is a Bluetooth baseband IC implemented with CMOS technology. Together with the GDM1000 radio transceiver IC and an external flash memory, it provides a fully compliant Bluetooth solution for data and voice communications.

  - **Baseband Processor**

    GDM1202 consists of programmable seamless Bluetooth RF interfaces such as BlueQ or BlueRF RXMODE2/3, Bluetooth baseband and bit processor, GCT proprietary 96MIPS hybrid RISC/DSP embedded processor with 48bit resolution, and UART/PCM/USB/DAC standard interfaces.

The on-chip 32-bit hybrid RISC/DSP embedded processor is powerful enough to support full rate Bluetooth data/voice communications as well as full rate digital audio decoding and includes sufficient embedded SRAM (128Kbytes) to support both an on-chip Bluetooth stack, A/V protocols and several audio applications without external memory, thus providing cost-effective and low-power solution.

- **Himico**
  - Bluetooth Components

- **IAR**
  - Bluetooth Starter Kit

    The Bluetooth Starter Kit is an evaluation and development platform for the Bluetooth wireless technology. This product includes all hardware and software that is needed to set up a Bluetooth node for wireless communication and get started with Bluetooth development! The included software can be used for both data and/or voice communications.

  - MakeApp for the Bluetooth Protocol Stack

    This is the first development tool in the world that allows the developer to configure a Bluetooth protocol stack graphically, and then automatically generate an optimized Bluetooth protocol stack implementation as C source code. The stack is highly optimized according to the configuration, and becomes very compact with a minimum memory footprint and can be used in almost all PC and embedded systems, including many 8-bit microcontrollers!

  - USB Drivers for Bluetooth modules

    The IAR USB drivers for Bluetooth modules give Microsoft Windows based application programs both fast and accurate access to the Bluetooth module using an USB interface. The Bluetooth module can be connected to a computer via either a serial port or via a USB port. In

order to use the USB interface, you will need a compatible Bluetooth USB device driver for Microsoft Windows. The IAR USB drivers for Bluetooth modules works with Microsoft Windows 98, 2000 and NT!

- **Ibex Technologies**
  - ○ [Viking Bluetooth Protocol Stack](#).
    Manufacturers of products with Bluetooth wireless technology across all industries can integrate Viking easily. Viking is targeted at both embedded and non-embedded applications, and system-on-chip applications. It has been developed using a modular and portable software development approach. This approach enables users to tailor their implementation to suit their own requirements.

- **IBM**
  - ○ [BlueDrekar](#) protocol driver is IBM's new middleware based on Bluetooth specifications allowing Bluetooth wireless devices to reliably communicate with each other.

  - ○ BlueDrekar protocol stack for Linux and open-source driver for the [HCI UART transport layer](#).

- **Impart Technology**
  - ○ Impart Technology's Embedded Communication Platform (ECP) provides the reliable, extensible communications infrastructure necessary for the current and next generation of devices and appliances. ECP allows end users, developers and device manufacturers to create a dynamic, seamless Personal Area Network that provides high performance, direct peer-to-peer communication among embedded and mobile devices with extreme flexibility in device and application interoperability.

  - ○ [Availability of a revolutionary approach to peer-to-peer](#)

[wireless development (8/01)](#)
Bluetooth-supported version in the 4th quarter of 2001. The Impart Technology SDK is available from [Handango.com](#)

- **[Impulsesoft](#)**
  - ❍ Impulsesoft's Bluetooth Audio Solutions Impulsesoft's Bluetooth stereo solutions help your users realize their wireless dreams by delivering stereo quality music over Bluetooth.

  - ❍ iWISH Impulsesoft's Wireless Stereo Headphones. Developed using Bluetooth audio profiles, this ready-to-manufacture reference design helps OEM customers bring CD-quality stereo solutions to market quickly at a low cost.

  - ❍ iWISA Impulsesoft's Bluetooth Stereo Adapter reference design. iWISA is a plug-in device for existing audio systems that wirelessly transmits stereo quality audio to other wireless devices like stereo headphone.

- **[Infineon Technologies](#)**
  - ❍ Bluetooth system solution.
  - ❍ BlueMoon product family: BlueMoon Single, BlueMoon Single Voice, BlueMoon Multimedia and BlueMoon BlueStar.

- **[InnoCOMM](#)**
  - ❍ Single chip Bluetooth radio transceiver

- **[Innovent systems](#)**
  - ❍ Bluetooth Single-Chip RF ICs

- **Intel**
  - [Flash Data Integrator Software](#)
    Intel's FDI software is a fully-tested, debugged and Intel-supported data storage manager for use in real-time embedded applications.

  - [Architectural Overview of Intel's Bluetooth Software Stack](#)

- **Inventel**
  - [BlueBird Evaluation/Development Kit](#)
    BlueBird - Inventel's Bluetooth Module is designed for long range communications and is the vital ingredient allowing you to enter the wireless world with your product range. BlueBird operates within a frequency bandwidth of 2402 – 2500MHz and has a radio sensitivity of:-85dBm and a maximum power of 20dBm. With frequency hopping at 1600 hops per second and a maximum usable data rate of 721kb per second, it will work with 7 simultaneous connected terminals in a piconet. Inventel has maintained its independence and has written the entire software for the Bluetooth Baseband stack, whilst our Toothpaste solution ensures that interoperability with other Bluetooth products is achieved.

- **Inventop**
  - [BluePing Network SDK](#) a software development kit that enables developers to include peer-to-peer and peer-to-multipeer networking and communications features into their Bluetooth-enabled devices and applications. BluePing Networking technology enables hassle-free peer-to-peer networking, expanded effective range well beyond 10 meters, instantaneous "random area networks", and powerful communications capabilities for PDAs and other devices. BluePing Network technology is 100% compliant with the Bluetooth 1.1 specification and currently supports the PocketPC platform.

- **IVT Corporation**
  - IVT Bluelet™ Protocol Stack
    IVT Bluetooth Protocol Stack is a full implementation of the Bluetooth host protocol stack V1.0B in ANSI C. It contains all protocols in the Bluetooth host protocol stack including TCS, SDP, RFCOMM, L2CAP and HCI. The code is very efficient, reliable, small, and suitable for embedded applications as well as desktop applications. IVT validated protocol using the formal design technique Specification Description Language (SDL) to assure that protocols were correct before writing C code.

- **Lund University - Dept of Automatic Control**
  - A Bluetooth stack in Java.
    Harald is a small Bluetooth stack for wireless communication between Java applications. Harald accesses the Bluetooth chip via the serial port and therefore requires the JavaComm package to be installed. The stack will operate on any system where Java runs. The package is free for any use and for distribution.

- **Mecel**
  - Mecel Bluetooth Software Development Kit (SDK) includes the core layers of the Bluetooth protocol stack. Mecel Bluetoth SDK, developed in ANSI-C, is fully qualified according to the Bluetooth Qualification Program and is listed on the Bluetooth SIG web-site as a qualified component.The Mecel Bluetooth SDK is platform independent, resource efficient and offers a very unique flexibility. Free demo version of the SDK is available through the web site.

- **Mezoe** (also see **Cambridge Consultants**, **Cambridge Silicon Radio)**
  - BlueStack protocol software BlueStack is a flexible and configurable Bluetooth protocol stack that is suitable for a

wide variety of applications, including mobile phones, cordless headsets and PC-based applications.

- ❍ [Proto Developer software development kit](#) allows you to prototype concept products aimed at communicating with other Bluetooth devices, but without the concern of debugging custom hardware.

- ❍ [Interface Express toolkit for BlueStack Software](#)
  Easily and rapidly develop products using Bluetooth wireless technology without the need to understand the Bluetooth protocols in detail. Quickly tailor the generated Application Programming Interfaces to match exactly your interface requirements. Rapidly integrate applications onto Bluetooth wireless technology and prove the system concept using Proto Developer.

- **[Microtune](#) (acquired [Transilica](#) 2001)**
  - ❍ [OneChip](#) system-on-chip is one of the world's smallest and most highly integrated Wireless Personal Area Networking product on the market. It incorporates all the functions - RF, baseband, memory and processor - necessary for the total Bluetooth solution. Based on proprietary core technology, the OneChip system-on-chip brings customers time-to-market, cost, form-factor and power-efficiency advantages in adding wireless communications capability to their products.

- **[Microware](#)**
  - ❍ Port of Extended Systems Bluetooth protocol stack for OS-9.

- **[MindTree](#)**
  - ❍ [EtherMind](#) is MindTree's implementation of the Bluetooth software protocol.
    Modular and compact it has been designed to support various applications including LAN access point, printers,

handheld, mobile phones, residential gateways, etc. The optimized stack can easily be ported onto different platforms by using the OS Abstraction module.

- ❍ Ethermind Baseband Controller is available as silicon proven synthesizable Verilog core with LMP/HCI firmware. The IP can be reconfigured to work with any 8/16/32 bit microcontroller on which LMP/HCI firmware resides and be reconfigured to interface with many Bluetooth radio implementations.

- **Motorola**
  - ❍ BTPLATFORM Bluetooth Platform Solution Featuring fully integrated hardware, software, and associated development kits.

  - ❍ Platform Chipset
    - MC71000 Bluetooth Baseband Controller IC
    - MC13180 Bluetooth Low Power Wireless Data Transceiver
    - Optional MC13181 Wireless Power Management IC for Headset and Phone Accessory Applications
    - Optional MRFIC2408 External Power Amplifier IC for Class 1 Applications

- **National Semiconductor**
  - ❍ Single-chip 2.4GHz Radio

  - ❍ LMX3162 radio transceiver and LMX5001 link controller.

- **NewLogic Technologies**
  - ❍ The BOOST Core is a Bluetooth processor adapted for integration into an ASIC. With BOOST Software it provides an embeddable Bluetooth hardware Core. The BOOST software is a full Bluetooth protocol stack, co-developed with the BOOST core. Modular and flexible to

suit all Bluetooth applications.

- ❍ BOOST Radio is a Bluetooth radio processor for the integration into Bluetooth standard ICs and ASICs. Complemented by BOOST Core and BOOST Software, to implement a complete Bluetooth wireless technology system.

- ❍ BOOST Lite is a Bluetooth Baseband processor core for integration into programmable logic platforms. Complemented with BOOST Lite software, to implement a complete Baseband system.

- **Nokia**
  - ❍ Nokia Bluetooth

  - ❍ Nokia 7190 Bluetooth Developers Pack
    Nokia 7190 Bluetooth Developers Pack enables the testing of applications that utilize the phone's functionality and were developed using the Nokia Development Kit for Bluetooth Applications. Users can also take advantage of the dial-up networking and fax profiles that the phone supports. The Developers Pack allows users to use the Nokia 7190 as a GSM modem connecting to a laptop within the range of 10 meters. The Nokia 7190 Bluetooth Developers Pack includes a Bluetooth-capable Nokia 7190, GSM 1900 and the Nokia Connectivity Card DTL-1 to enable Bluetooth connection between the phone and a laptop.

  - ❍ Bluetooth for Nokia 6210

  - ❍ Nokia Development Kit for Bluetooth Applications enables you to create Windows applications that use the Bluetooth wireless technology. Currently Windows 95, 98, and Me are supported; Windows NT4.0 and 2000 support is coming in a few months.
    The Development Kit contains two compact flash cards,

two PC card type II (PCMCIA) adapters, Bluetooth Software Suite for Windows, tools, documentation, and sample applications. The Nokia Protocol Tracer tool enables you to analyse Bluetooth packets in real time, or record them for later reference. With the Nokia COM Port Router the combination of a laptop and a Nokia 6210 can emulate a Bluetooth phone, and you can trace the Bluetooth traffic the phone receives.

- **Oki**
  - ○ Bluetooth Chipsets and SDK

    - ■ LSI Products
    - ■ RF LSI in CMOS
    - ■ LSI and Module Data Sheets
    - ■ System Development Kit, SDK
    - ■ LSI Road Map
    - ■ BT Modules
    - ■ Module Data Sheets
    - ■ Bluetooth™ is for this...
    - ■ Brochure (650KB PDF)

- **Open Interface**
  - ○ BLUEmagic 3.0 embedded Bluetooth protocol stack The BLUEmagic 3.0 embedded Bluetooth protocol stack is a thorough implementation of a fully-configurable, resource-efficient protocol stack targeted at embedded Bluetooth devices and applications. The BLUEmagic 3.0 protocol stack is scalable, modular, and portable, with an innovative, high-performance, compact architecture targeted at embedded devices. The BLUEmagic 3.0 embedded Bluetooth software development kit is easy to learn and easy to use, giving full access to all configurable aspects of the BLUEmagic 3.0 protocol stack and enabling the production of robust application software. All of these features result in users of the BLUEmagic 3.0 SDK and BLUEmagic 3.0 protocol stack producing better,

cheaper, smaller, more easily maintained embedded Bluetooth products that reach the market faster and at lower development cost.

○ [BLUEmagic Solutions Program](#) The BLUEmagic Solutions Program has been designed to extend the scope of services offered by Open Interface to assist customers in the development, management, and deployment of wireless technology products. BLUEmagic Solutions Program services include porting the BLUEmagic 3.0 embedded Bluetooth protocol stack and profiles, application development, Bluetooth software optimization and customization, testing, system-level integration, and program management.

- **[OpenCores.org](#)**
  ○ Open source project for Bluetooth baseband controller design.

- **[Parthus](#)**
  ○ Parthus achieved an industry first with the successful qualification of Parthus' BlueStream IP in Fujitsu's initial Bluetooth baseband chip.

  ○ [Bluetooth Products](#) Parthus BlueStream is an ultra small and ultra low power Bluetooth silicon platform enabling mobile phone and electronics manufacturers to produce a 'single chip' Bluetooth solution today as well as a roadmap to develop a 'zero chip' to achieve the lowest possible cost Bluetooth product.

- **[Philips](#)**
  ○ [Philips Logic Products](#)

  ○ [Philips Semiconductors](#)

- ❍ [TrueBlue RF Modules](#)
  Bluetooth TrueBlue radio modules enable customers to enhance their products cost effectively with Bluetooth technology. Fully tested, plug-n-play solutions, these radio modules minimize design cost and are easy to integrate into existing systems.

- ❍ [BGB100](#) TrueBlue Bluetooth radio module
  The BGB100 TrueBlue Bluetooth radio module is a short-range radio transceiver for wireless links operating in the globally available ISM band, between 2402 and 2480 MHz. It is composed of a fully integrated, state-of-the-art near-zero-IF transceiver chip, an antenna filter for out-of-band blocking performance, a TX/RX switch, TX and RX baluns, the VCO resonator and a basic amount of supply decoupling. The device is a Plug-and Play module that needs no external components for proper operation.

- ❍ [Bandband Controllers](#)
  - ■ [PCF26002 Bluetooth baseband processor](#)
  - ■ [PCF26003 Bluetooth baseband processor](#)
  - ■ [PCF87750 Blueberry baseband IC](#)

- ❍ [Bluetooth RF ICs](#)

  - ■ [UAA3558 Bluetooth radio IC](#)
  - ■ UAA3559 Bluetooth radio IC

- ❍ [Reference designs and tools](#) development kits.

- **[Rococo Software](#)**
  - ❍ [Impronto](#) is a lightweight middleware platform that allows developers to rapidly build Bluetooth-enabled applications in Java, or to Bluetooth-enable existing applications through industry standard APIs.

- **[Rappore Technologies](#)**

- ❍ Bluetooth Protocol Stack for Embedded Linux.

- **RF Micro Devices**
  - ❍ RF2968, a low-cost transceiver for Bluetooth applications. The RF2968 is a complete transceiver solution, offering 1-Mbps data rates as defined in the Bluetooth specification.

  - ❍ RF2172 Bluetooth PA

- **RTX**
  - ❍ RTX IP, Protocol Stack, Baseband core

  - ❍ OEM Products ISDN Access Point, LAN Access Point, USB Dongle

- **SiGe Semiconductor** (formerly SiGe Microsystems)
  - ❍ Leaders in RF solutions using silicon-germanium technology, SiGe Semi supplies world-class partners with power amplifiers and RF front ends for Bluetooth, 2.4GHz WLAN and 5GHz WLAN.

- **Silicon and Software Systems (S3)**
  - ❍ S3 has a comprehensive range of Bluetooth software solutions; from Link Control to the Service Discovery Layer. As software is not enough, S3 has partnered with the major Bluetooth hardware suppliers to provide a complete solution.

- **Silicon Wave**
  - ❍ Silicon Wave is a leading provider of low-power, highly integrated RF communication system components for the global Bluetooth wireless market. Silicon Wave products and services include radio modems, baseband processors, software solutions and a baseband IP

licensing program.

- SiW1701 (Silicon Wave interface)
  SiW1702 (CDMA chipset-compatible interface)
  SiW1703 (GSM chipset-compatible interface)
  The SiW1701/02/03 Radio Modem ICs are new additions to Silicon Wave's product family for Bluetooth wireless communications. The SiW1702 and SiW1703 are specifically designed for cellular telephone applications and the SiW1701 is optimized for all other Bluetooth wireless communications.

- SIW1502
  The SiW1502 Radio Modem IC combines low-cost, low-power consumption with integrated RF logic and Bluetooth protocol stack for a wide variety of Bluetooth applications. The SiW1502 is a fully integrated 2.4 GHz radio transceiver with a GFSK modem contained on a single chip. Silicon Wave offers the SiW1502 as a stand alone IC or, in tandem with the SiW1601 Link Controller IC and a standard microprocessor, to complete a Bluetooth wireless communications system.

- SIW1750 (embedded ARM7TDMI processor)
  SIW1760 (integrated ROM)
  SiW1770 (integrated Flash)
  The SiW1750/60/70 Baseband ICs are new additions to Silicon Wave'is product family for Bluetooth wireless communications. The 1750/60/70 ICs provide all Bluetooth Baseband link control hardware and link management firmware in highly integrated system-on-chip packages.

- SIW1602
  The SiW1602 Baseband Processor interfaces directly with the SiW1502 Radio Modem IC and provides power control, data packet processing, error-detection/correction and other data processing functions. The SiW1602 also contains a USB controller which provides an easy method

to implement the USB host interface

- ❍ [Wireless Develpment System (WDS)](#)

  The WDS provides a reliable and flexible Bluetooth radio network intended for the development of both hardware and software products supporting the Bluetooth specification. Used in pairs, the WDS systems can create point-to-point and piconet applications.
- ❍ Silicon Wave's Bluetooth [baseband technology](#) is now available to OEMs through a flexible IP licensing program. OEMs now have a fast path to a Sub-$5 solution with the integration of Bluetooth baseband functionality into System on Chip ASIC designs. By adding Silicon Wave's 7mm x 7mm SiW1701 radio modem an OEM can achieve the world's smallest Bluetooth solution.

- **[Socket Communications](#)**
    - ❍ [Bluetooth Evaluation Program for Windows CE Developers](#) An evaluation program to help application designers use Socket's Bluetooth technology to create wireless solutions for Windows-powered Pocket PCs and notebooks. Socket's Bluetooth Evaluation Program is open to qualified developers and will include an evaluation kit that features two of Socket's Bluetooth-compatible Personal Network Cards plus Windows CE software and documentation.

    - ❍ [Bluetooth Development Products](#)

      Socket Communications is offering four different Bluetooth Software Development Kits.
        - [Bluetooth Card SDK](#) Provides a Bluetooth Card development solution supporting point-to-point connectivity

        - [LAN Access SDK](#) A combined Developer Kit between Socket & Pico Communications

        - [Embedded Developers Kit](#) Provides customized

OEM support through the Socket Bluetooth Embedded Module solution

- Platform Builder 3.0 Program Offers the ability for Embedded Windows CE developers to design-in Socket Bluetooth Products into their reference platforms based upon Windows CE Platform Builder 3.0 using any of the Kits listed above.

- **SourceForge.net**
  - AXIS OpenBT Stack An open source bluetooth stack for Linux (and other operating systems). Support for SDP/L2CAP/RFCOMM

  - BlueZ Bluetooth protocol stack for Linux.

- **Spirea**
  - Spirea is a fabless semiconductor company in the wireless communications market. Spirea develops and manufactures single and combo transceiver products for WLAN and Bluetooth applications.

  - BlueTraC a Bluetooth RF CMOS chip with no external components through a series of unique designs that have been patented. This true radio-on-a-chip design simplifies systems, modules or printed circuit boards and allows sizeable financial savings for the company's customers.

  - TripleTraC is a single radio system chip supporting multiple wireless LAN standards, the IEEE 802.11a, 802.11b and HIPERLAN/2 standards. The multi-standard approach allows for easy migration from current 11Mbit/sec 802.11b networks to faster 54Mbit/sec 802.11a/HIPERLAN/2 networks. It also allows for co-existence of different standards into portable and stationary devices which makes the converge between the WAN/LAN/PAN standards possible. The transceiver is

manufactured in a 0.18µm CMOS process.

- **STMicroelectronics**
  - ○ [ST Bluetooth Wireless Technology Solutions](#) provides customers with comprehensive, state-of-the-art designs optimized for integration into mobile computing, communication and media devices. ST's investments in R&D have allowed customers a guaranteed shrinkage roadmap, giving the ability to provide in-house, state-of-the-art manufacturing & logistics. These qualities make ST the ideal Bluetooth partner to guarantee high volume supply at optimal price-to-performance in the long-term.

  - ○ [Wireless Products](#) STMicroelectronics develops and markets complete semiconductor solutions addressing all communication standards in the digital cellular phone, cordless phone and pager markets including Bluetooth.

- **Stollman**
  - ○ ISDN and Bluetooth - Products and Protocol-Stacks

  - ○ Products:
    BlueTA+ Bluetooth - ISDN Gateway
    BlueUSB+ Bluetooth USB adapter
    BluePCMCIA+ Bluetooth PCMCIA adapter
    BlueRS+ Bluetooth serial adapter for industrial applications
  - ○ Protocol Stacks:
    BlueCode+ (Bluetooth upper layer Stack)
    BlueFace+ (API for Bluetooth aware applications)

- **Stonestreet One**
  - ○ [Bluetooth Developer's Kit](#)
    Stonestreet One's recently announced DP Series, provides Bluetooth developers a competitively priced, full-featured, hardware and software total Bluetooth

development solution. The DP Series includes a developer's license to the BQB-qualified Bluetooth Protocol Stack from Stonestreet One (Windows™ version) with fully documented APIs. Additionally, the DP Series, available with Bluetooth modules and components from Ericsson, Taiyo Yuden, Silicon Wave or Philips Semiconductors, includes two development boards that contain a Bluetooth radio, baseband, HCI, and Link Manager.

❍ Bluetooth Protocol Stack

Simplify your application development with the BQB-Qualified Bluetooth Protocol Stack from Stonestreet One. It features a simple API providing HCI and L2CAP functionality, as well as implementations of the Service Discovery Protocol (SDP), RFCOMM Protocol, Generic Access Profile (GAP), and Serial Port Profile (SPP).

❍ Bluetooth OEM Module

Provides a simple Bluetooth interface for your products. The OEM Module has the Ericsson module already mounted onto the module's circuit board and includes an integrated antenna interface. The Module consists of a baseband core, radio, and voltage regulators. It is available with the following interface options: • UART (with/without PCM audio) • RS232 (with/without PCM audio) • USB (built-in audio)

● **Synopsys**

❍ DesignWare BlueIQ

The DesignWare BlueIQ Core is a fully synthesizable, integrated Bluetooth Baseband Controller and Link Manager, which includes a royalty-free, embedded (6811-compatible) microcontroller to offload all real-time Bluetooth processing from the host processor. This makes adding Bluetooth functionality to any FPGA or SoC design fast and easy, while providing a low power and silicon cost solution. By handling all the Bluetooth functions directly within dedicated hardware, the BlueIQ Core allows the

host processor to deliver more performance to the application or run at a lower frequency, based on your application needs. In addition, the BlueIQ Baseband controller can be adapted to share a user-provided host CPU.

- **Taiyo Yuden (Japan)   Taiyo Yuden International**
  - ❍ 2.4 GHz band wireless module
    A fusion of the ultimate in multi-layer technology, high frequency circuitry, assembly know-how, and evaluation expertise. Features of the module are its handy size and the low power consumption. Taiyo Yuden is ready to provide a multitude of related shapes, interfaces, and software in order to meet the requirements of various target devices and appliances.

- **Teleca Comtec** (formerly Sigma Comtec, merged Feb 2002 with AU-System)
  - ❍ Distributor of Bluetooth development tools.

  - ❍ Single Point Application Tool Kit, Multi Point Application Tool Kit

  - ❍ Bluetooth Development Kit and Bluetooth HOST Stack (Ericsson), software tools.

- **Texas Instruments**
  - ❍ BSN6030 ROM-based Bluetooth baseband controller including a fully integrated Bluetooth software stack up to the HCI interface.

- **Troy XCD**
  - ❍ WindStack a fully Bluetooth 1.1 qualified Bluetooth stack, for embedded applications. It has been successfully ported to a number of chipset platforms, including TI, Silicon Wave, Atmel, CSR, Ericsson, and Conexant.

Written in ANSI C, and developed using a highly modular API structure, it is easily portable and usable.
Also supports TMS320C54x Digital Signal Processor family.

❍ OEM Modules Custom embedded solutions to your applications, from middleware/firmware to turnkey hardware/firmware solutions.

● **TTPCom**
  ❍ TTPCom offers Bluetooth technology for licence. There are two products, which offer a full implementation of the Bluetooth v1.0 specification:

    ● Baseband Link Controller in portable VHDL with a modular RF interface to support a range of Bluetooth radio solutions

    ● Protocol Stack up to and including L2CAP.

● **Vaishali Semiconductor**
  ❍ Bluetooth Products
    ● VB8810 Blueband Controller for StrongARM
    ● VB8831 Blueband Integrated Controller
    ● VB8831DK1 Bluetooth Development Kit for Hosted Applications
    ● VB8831DK2 Bluetooth Development Kit for Fully Embedded Applications BPS Blueband Protocol Stack Software

● **Wireless Futures**
  ❍ BlueWAVE RS232 Modules - OEM Bluetooth enabling solution.

- **Wipro**
  - ❍ Bluetooth services

    Wipro offers Bluetooth Baseband Controller, Software Protocol Stack and solutions designed around Bluetooth enabled devices for Wireless LAN, PAN, Mobile Computing and home networking.

- **Widcomm**
  - ❍ Blue-Connect Visor™ Bluetooth enabler

  - ❍ Blue-Share desktop or notebook Bluetooth enabler in a single dongle package

  - ❍ Development Kits allow developers to create multi-platform Bluetooth applications. All DKs include WIDCOMM's rich APIs and extensive documentation.

  - ❍ Bluetooth Communications Software

  - ❍ Bluetooth Protocol Software Tester

- **Xemics**
  - ❍ Semiconductor solutions for Bluetooth targeting the industrial, home automation and handheld personal area networks.
  - ❍ Ultra Low Power Bluetooth baseband controller.
  - ❍ Ultra Low Power Bluetooth headset solution.

- **Zarlink Semiconductor** (formerly Mitel Semiconductor)
  - ❍ MT1020A Bluetooth Baseband Controller

    The MT1020A device is a highly integrated CMOS single chip Bluetooth baseband processor targeted at low power applications.
    - Bluetooth v1.1 Compliant Link Controller
    - Full Bluetooth Protocol Stack up to HCI
    - USB and UART Host Interfaces

- ■ Full Duplex Audio CODEC Including Filtering
- ■ Linear PCM to log PCM and CVSD Conversion
- ■ Advanced Block Power Management
- ■ Firefly embedded ARM7TDMI Microcontroller Core
- ■ Configurable I/O Supply 1.8 to 3.6V
- ■ 1.8V Internal Supply Option for Low Power
- ■ IP Hardware and Software Available for Embedded Applications
- ■ Single CPU Bluetooth System Capability

- **Zeevo** (formerly Telencomm)
  - ❍ RF-enhanced, System-On-Chip products for wireless applications. Integrated baseband, RF, analog, memory and software.

- **Zucotto**
  - ❍ XJB 100 Bluetooth protocol stack written in Java.

  - ❍ WHITEboard Software Development Kit, Bluetooth Edition is the first development kit to extend Bluetooth wireless technology to Java 2 Platform, Micro Edition (J2ME) application development.

  - ❍ Xpresso Java native processor is designed specifically to meet the performance demands of memory constrained, battery powered mobile Internet devices.

  - ❍ XPRESSOboard Hardware Development Kit (HDK) is a complete hardware and software development environment for the Xpresso Java native processor.

Crystals, Oscillators & Timing

[Commutek Electronics](#)	Your frequency control solution.
[e-crystek](#)	Crystals and oscillators for Bluetooth products.
[MTI-Milliren Technologies](#)	Precision Quartz Timing Solutions Enabling Increasingly Smaller Sub-Systems While Increasing Performance.
[Rakon](#)	Rakon Precision Quartz Products Crystals and oscillators for Bluetooth products.

Other Components and Product Catalogues

[Amkor Packaging](#)	[Packaging for Bluetooth Wireless Technology Applications](#) Amkor's extensive experience in semiconductor packaging is helping to enable Bluetooth wireless with both existing packages and the latest in packaging technology.
[Tyco Electronics](#)	[Electronics Catalog](#) Search by Brand, Product Type, Part Number...

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Events
Forums
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Europe

Event	Start Date	Location	Hotels/Flights
Open Mobile Alliance Plenary Open Mobile Alliance Plenary	9 Nov 2003	London, UK	
Mobile Internet Mobile Internet 2003 - Europe's Largest & Most Influential Mobile Content & Services Event The premier meeting place for content and application providers, mobile operators and technical solution providers, looking to capitalise on the phenomenal revenue potential of content and applications via the mass-market media channels of mobile devices. Including Two Co-located Conferences MMS Content & Applications Maximise	20 Nov 2003	Paris, France	

Revenues with a Creative Portfolio of Content & Applications BILLING For Content & Commerce Evaluating the Billing Evolution for New Services and Content		
Commercial Opportunities for Short Range Wireless Technologies As mobile phone technologies evolve to provide advanced, high speed data services, short range wireless technologies become increasingly useful for distributing data among mobile phones, notebooks and handheld computers. The aim of this conference is to bring together senior level decision makers in the telecoms & technology industry to learn how to exploit he commercial opportunities in the	14 Jan 2004	London, UK

short-range wireless technology market.			
OMA Technical Plenary OMA Technical Plenary. These events are only open to members of the Open Mobile Alliance.	25 Apr 2004	Munich, Germany	
ZigBee Member Meeting The mission of the ZigBee Working Group is to bring about the existence of a broad range of interoperable consumer devices by establishing open industry specifications for unlicensed, untethered peripheral, control and entertainment devices.	29 Nov 2004	Rome, Italy	

Asia-Pacific

Event	Start Date	Location	Hotels/ Flights

| **Asia Pacific Mobile Location Services & Content Delivery 2003**		
Mobile operators in their need to increase revenue streams through value-added services are investing in location technology to reduce churn and increase customer loyalty. However, in order to reach a profitable mass-market levels, critical success factors must be in place before operator LBS deployments can grow significantly. What are the key issues that need to be addressed before embarking on this dynamic new marketplace? IBC	24 Nov 2003	Hong Kong

AFR Telecom Summit Attend this event to: * Evaluate the challenges and opportunities for fixed, mobile & wireless telecommunications * Hear from the key carriers, government and the regulators * Find out the trends & developments in the telecommunications market IBC	27 Nov 2003	Sydney, Australia
Wireless LAN China 2003 Join the WLAN experts and hear first-hand Wireless LAN growth opportunities, technological developments, challenges, services and applications in China	1 Dec 2003	Beijing, China
AFR Telecom Summit		

Wireless LAN China Join the WLAN experts and hear first-hand Wireless LAN growth opportunities, technological developments, challenges, services and applications in China.	2 Dec 2003	Beijing, China
China Mobile Operator Forum 2003 The premier China Mobile Operator Forum 2003 aims to foster an increased understanding of how China's operators can maximise business opportunities with the new generation of mobile multimedia services and applications. Crucial areas to be explored include operator business models in China and overseas, strategies to expand the market for mobile data over GSM, GPRS and CDMA 1X networks, as well	4 Dec 2003	Beijing, China

as new service delivery platforms and development tools to speed deployment. IIR		
Telematics Asia Pacific Market Outlook, Market Drivers, & Potential Markets, Business Issues, Opportunities & Revenue Generating Models, Structure of the Value Chain, Telematics Technology & Advancements, Applications & Services, Case Studies & Lesson Learned... IBC	15 Mar 2004	Seoul, Korea
ZigBee Member Meeting The mission of the ZigBee Working Group is to bring about the existence of a broad range of interoperable consumer devices by establishing open industry specifications for unlicensed,	17 May 2004	Seoul, Korea

untethered peripheral, control and entertainment devices.			

Americas

Event	Start Date	Location	Hotels/ Flights
ZigBee Member Meeting The mission of the ZigBee Working Group is to bring about the existence of a broad range of interoperable consumer devices by establishing open industry specifications for unlicensed, untethered peripheral, control and entertainment devices.	17 Nov 2003	San Jose, CA	✈
GSM Americas GSM Americas is the key mobile event for the region and with GSM set to dominate wireless access across the Americas, it is the annual meeting place for all operators from	20 Nov 2003	Rio de Janeiro	✈

Latin America and the Caribbean.

IBC | | | |
| **2003 CDMA Americas Congress**

CDMA Americas Congress is the definitive event for North American and Latin American wireless industry leaders. The event features informative keynote presentations from top industry executives, up-to-the-minute technical information on CDMA2000 evolution, an extensive exhibit hall, and the latest next-generation devices. In addition, it features reliable, market-tested strategies for realizing revenue, a spotlight on recent Latin American success stories, interactive workshops, and the 9th Annual CDMA Test Forum, highlighting the latest developments in | 8 Dec 2003 | Miama, FLA | ✈ |

network optimization.			
Bluetooth Americas 2003 Bluetooth Americas, incorporating the Bluetooth Developers Conference, is the only official Bluetooth event held in the Americas. The focus of this event is broader to reflect the growing maturity of the Bluetooth market, the programme will retain a detailed technical level of content.	9 Dec 2003	San Jose, CA	✈
Hawaii International Conference on Computer Science The main goal of the 2004 Hawaii International Conference on Computer Sciences is to provide an opportunity for academicians and professionals from the computer sciences and related fields from all over the world to			

come together and learn from each other. An additional goal of the conference is to provide a place for academicians and professionals with cross-disciplinary interests related to computer sciences to meet and interact with members inside and outside their own particular disciplines. Because the Hawaii International Conference on Computer Sciences will be meeting concurrently with the Hawaii International Conference on Sciences, there will be many opportunities for computer scientists to interact with academicians and professionals from other science fields.	15 Jan 2004	Honolulu, USA	✈

Event	Date	Location	
OMA Technical Plenary OMA Technical Plenary. These events are only open to members of the Open Mobile Alliance.	1 Feb 2004	Los Angeles, CA	✈
ZigBee Member Meeting The mission of the ZigBee Working Group is to bring about the existence of a broad range of interoperable consumer devices by establishing open industry specifications for unlicensed, untethered peripheral, control and entertainment devices.	16 Feb 2004	USA	✈
ZigBee Member Meeting The mission of the ZigBee Working Group is to bring about the existence of a broad range of interoperable consumer devices by establishing open industry specifications for unlicensed, untethered	16 Aug 2004	Boston, MA	✈

peripheral, control and entertainment devices.		

Middle-East/Africa

Event	Start Date	Location	Hotels/ Flights
SatCom Africa 2004 SatCom Africa is Africa's most important annual satellite communications event. This is the place where technology, the know-how and the ideas come together to make Africa's satellite communications work.	17 Feb 2004	Johannesburg,South Africa	
Cards Middle East 2004 Cards Middle East 2004 will see the exhibition enter its fifth successful year and will feature displays from the most important and influential solution providers in the industry. Every year Cards Middle East attracts senior decision-makers			

from banking, government, telecoms, retail and major corporations from across the Gulf and the Middle East. No other event in the region is focused on payments and transactions and attracts the people you need to meet to make your business a success going forward.	17 May 2004	Dubai	
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Antennas
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Audio
Books
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Forums
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Bluetooth FAQ and Knowledge Base

● This FAQ and knowledge base is a continuous work in progress, and consists of the largest central FAQ of bluetooth information available today. I make no guarantees on the validity of information contained here, although every effort has been made to ensure the accuracy of the information contained herein.

   I don't reference the people who sent this, as I would be here forever if I did, even though this knowledge base could not be done without them. Instead I show from what Forum the questions/answers came from, and (if possible) what page number / post.

   And finally, this knowledge base is designed to help **you**, so ensure it stays valid and helpful, by submitting any relevant & correct pieces of information **here**.

Table Of Contents

What Is Bluetooth?

Members

Member:

Password:

Forgot your password?

New Member

Baseband:

- [TX/RX buffer of Bluetooth Baseband](#)
- [CVSD Encoder Input Issues](#)
- [TX/RX turn-around Time Definition](#)
- [Stream cipher System E0](#)
- [Differential Bitstream Encoding in Baseband?](#)
- [Page Scan Termination](#)
- [Differences Between LM and LC](#)
- [Hopping Sequences: Types vs. Number](#)
- [Master/Slave Scatternet Broadcast Control Issues](#)
- [Number of Masters in a Scatternet](#)
- [Explanation of Phase in Hopping Sequence](#)
- [Default Check Initialisation (DCI)Value](#)
- [Difference between Page and Inquiry](#)
- [Asymmetric Max. Rate Forward 723.2 kb/s or 721 Kb/s ?](#)
- [Direct Communication among Slaves: Questions/ Views](#)
- [Number of Slaves](#)
- [Sniff mode N_{sniff} Timeout Use](#)
- [Format of Clock Offset](#)

Companies:

- [Bluetooth IPRs (Intellectual Property Rights)](#)
- [Bluetooth Source Code](#)
- [Bluetooth Use on Airplanes](#)
- [Ericsson Development Kit Codec Use](#)
- [Ericsson Development Kit, CVSD/ PCM Voice Coding ?](#)

HCI

- [HCI Commands/Role in Connection Setup](#)
- [Little Endian Format (HCI RS232)](#)
- [Is the HCI Layer Optional?](#)
- [PCM & USB Simple Pros/Cons](#)
- [Host Mixing of Voice Data & HCI Commands to Accomplish this](#)
- [Enabling a Slave to Transmit Long Packets to Master](#)
- [Is the HCI Layer needed in an Embedded Solution?](#)
- [HCI Parameters Used in Remote Name Request](#)

Have you visited our [WAP Games](#) section yet?

- [used to Obtain CLKE](#)
- [Issues Relating to a Device Existing on Multiple Piconets](#)
- [Piconet Architecture Setup in a Bluetooth Enabled Computer Environment](#)
- [Slave initiated Communication/Slaves Polling Master?](#)
- [Starting a Piconet: Who Becomes Master First?](#)
- [Bluetooth Clock Accuracy/Resolution](#)
- [Variable/Fixed CVSD Encoder/Decoder Values?](#)
- [Changing CVSD Encoder/Decoder Values](#)
- [Access Code Correlator](#)
- [Butterfly Circuit Simple Theory](#)
- [Simple Differences Between Sniff Mode & Park Mode](#)
- [K-Offset Change Times](#)
- [Responsibility for & Storing of Inquiry/Paging Results](#)
- [Park Mode Availability for SCO Links](#)
- [Methods of Unparking a Slave Device in Park Mode](#)
- [Scanning Issues for a](#)

- [Enabling Limited Discoverable Mode](#)
- [Use of COBS within RS-232 HCI Interface](#)

General

- [Bluetooth Capacity and Throughput](#)
- [Bluetooth Range in Relation to Different Power Classes](#)
- [Bluetooth Bit Rate: Raw versus Actual](#)
- [Master-Slave Combinations/ Network change Possibilities](#)
- [Slaves Refusing a Master/ Defining Master Types](#)
- [Cost/Modifications to Improve Bluetooth Device Range](#)
- [Wireless Headset Audio Quality](#)
- [Bluetooth Chip size](#)
- [BT Device Compatibility for Different Hop Systems](#)
- [What is Bluetooth?, why is it going to be so popular?](#)
- [Power Consumption for Different Modes](#)
- [Master Unit Leaves a](#)

- Communicate to Multiple Slaves ?
- Reasons for Using a DV Packet
- Definition of new DIAC Values
- Sync Word Generation Questions

- Location/Features of Bluetooth Lower Layer QoS
- Setting Discoverable Modes
- ID Generation

SDP

L2CAP

- InMTU/OutMTU (L2CA_ConfigReq/ L2CA_ConfigRsp parameters)
- L2CAP Group Transmission
- HCI Connection_Handle to L2CAP CID Translation
- Dynamically Assigning PSM Values to Support Multiple Upper Protocol Implementations
- L2CAP Implementation in Real-time Devices
- L2CAP Segmentation of Voice Packets

- Service Discovery Methods
- SDP Service Search Questions
- SDP Attribute Lists
- SDP Involvement in Inquiry/Paging?
- UUID Alias Bit Conversion
- Definition/Use of New UUID Aliases?
- Use of SDP Error Code: 'Invalid PDU Size'
- Service Records for Headset Audio Gateway
- Continuation State Determination
- Service Discovery Application Definition
- SDP Database Implementation
- Service Record Handle Creation/Use
- PDU Fragmentation
- Questions on the Application interface with

RFCOMM

- RFCOMM-used ETSI standard TS 07.10 -

- Alternate Designation
- RFCOMM Application Message ACK/NACK
- RFCOMM DLCI & Server Channels
- RFCOMM Packet Segmentation
- C/R Bit use in TS 07.10 Packet Fields
- DLCI Allocation in Client/Server Applications 1
- Direction Bit use in Applications
- Reasons for Direction Bit use in DLCI
- DLCI Allocation in Client/Server Applications 2

Radio

- Carrier-to-Interference Ratio
- Receiver Sensitivity/ Block Error Rate (BER)
- Antenna Type
- RF Burst Profile
- Bandwidth Change in Spain & France
- Audio Level
- GFSK Modulation Calculation
- Exact Frequency Used
- EMC & Bluetooth

the SDP layer

Other Networks

- Bluetooth vs. Airport (802.11 Network)
- Bluetooth vs. CDMA
- Bluetooth Interference with Wireless LAN 802.11
- Bluetooth & Cordless Phone Interference
- Bluetooth & Jini 1
- Bluetooth & Java
- Bluetooth FHSS compared to WLAN DSSS
- Bluetooth Clock Compared to GPS
- Bluetooth - an Inferior LAN Concept?
- Bluetooth & Jini 2
- Use of the Salutation Consortium's Service Discovery Protocol within Future Bluetooth Profiles
- WAP over Bluetooth
- A Bluetooth Broadband Network?

LMP

- Master LM Sniff

- [RSSI Implementation Issues](#)
- [GFSK Differences & Advantages over FSK Modulation](#)
- [Access Code Sensitivity to BER](#)
- [RSSI Operation](#)

[Command Choice: LMP_Sniff or LMP_Sniff_Req ?](#)
- [LM Sniff Parameter Negotiation](#)
- [Link Manager Involvement in Inquiry/Paging?](#)

Security

- [Round Computations in Authentication Function E1](#)
- [Security/Protection Issues in Bluetooth](#)
- [Repeat Packet Encryption](#)
- [Encryption Sample Data Problem](#)

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What's new?

Home
Bookshop
Market Research
Search
Add a Link

Consulting
Database

Bluetooth
Antennas
Articles
Asia-Pacific
Audio
Books
Cathal's Corner
Consultants
Design Tools
Dev Tools
Downloads
Events
FAQ
Forums
Glossary
InfoTooth
News
Products
Profiles
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Security
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SIG

[Also see: **Wireless Forums**   **IEEE 802.15**   **Java**   **Radar SyncML**   **VoiceXML**   **WAP**]

Bluetooth Forums

● Links to mailing lists, newsgroups, discussion forums and other soapboxes related to Bluetooth and wireless data technology or marketing.

- **JSR 82 spec group** Interested in building Bluetooth applications in Java? Join members of the JSR 82 spec group for questions, issues, concerns and discussion about standard Java APIs for Bluetooth wireless technology.

- **Java API Bluetooth Wireless Technolology** questions, issues, concerns and discussion about standard Java APIs for Bluetooth wireless technology (JABWT).

- **Bluetooth Ideas Forum** *"E-mail discussion list and web-based message archive for everyone interested in solving engineering problems with Bluetooth. Membership is anonymous--you can just listen and no one will know you have joined unless you submit a message to the list. But say something, damn it. There's nothing more boring than a roomful of silent engineers".*

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What Is Bluetooth?

Members

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New Member

- Regional Bluetooth User Groups:
  - Boston area
  - India (primarily Bangalore)
  - Singapore and Hong Kong

- Ericsson Developers Zone
  - WAP, Bluetooth, EPOC, SMS, GPRS and Mobile Positioning

- Bill Austin's Blueinfo Bluetooth Mailing List take a look!

- Yahoo Bluesales Bluetooth Sales and Product postings

- SIG Bluetooth Specification Forum (members only)

- Techanoid.com Techanoid Bluetooth Forum

- Topica Bluetooth and PAN General Discussion

- Yahoo Groups idb-interop Harmonisation of communication message sets between Bluetooth/IrDA and IDB.

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Bluetooth Resource Center

What's new?

[Also see: Wireless LAN Glossary   Bluetooth Tutorial]

Bluetooth Glossary

● The following is a list of most of the terms used in the Bluetooth technology, and serves as a quick look-up guide. This glossary is partly based on the Glossary originally supplied in the Motorola Bluetooth website, my thanks to them. However this glossary contains much more lower layer information, removes the reams of superfluous terms, and elaborates on many points. In effect it is a totally different list, and (I think) much better and clearer.

2-in-1 Handset

The situation where a subscriber handset is acting as a remote handset to a base unit which provides a network connection.

3G

Third generation. Refers to the next generation of digital phone technology (such as UMTS). Also see 3G Resource Center.

802.11 WLAN

A Wireless Lan specification defined by the IEEE. Also see IEEE 802.11 Resource Center.

Access Code

Each baseband packet starts with an Access code, which can be one of 3 types, CAC, DAC & IAC. The CAC consists of a preamble, sync word and trailer, and its total length is 72 bits. When used as a self-contained message without a packet header, the DAC and IAC do not include the trailer bits and are of length 68 bits.

ACK

Acknowledge.

ACL

Asynchronous Connectionless Link.One of the two types of data links defined for the Bluetooth Systems, it is an asynchronous (packet-switched) connection between two devices created on the LMP level. This type of link is used primarily to transmit ACL packet data. The

other data link type is SCO.

ACO

Authenticated Ciphering Offset.

Active Mode

In the active mode, the Bluetooth unit actively participates on the channel. The master schedules the transmission based on traffic demands to and from the different slaves. In addition, it supports regular transmissions to keep slaves synchronised to the channel. Active slaves listen in the master-to-slave slots for packets. If an active slave is not addressed, it may sleep until the next new master transmission.

AM_ADDR

Active Member Address. It is a 3 bit number.It is only valid as long as the slave is active on the channel. It is also sometimes called the MAC address of a Bluetooth unit.

AP

Access Point.

AR_ADDR

Access Request Address. This is used by the parked slave to determine the slave-to-master half slot in the access window it is allowed to send access request messages in. It is only valid as long as the slave is parked and is not necessarily unique.

ARQN

Automatic Repeat reQuest Number is used as a 1-bit acknowledge indication to inform the source of a successful transfer of payload data with CRC.

authentication

The process of verifying 'who' is at the other end of the link. Authentication is performed for devices. In Bluetooth, this is achieved by the authentication procedure based on the stored link key or by pairing (entering a PIN).

authentication device

A device whose identity has been verified during the lifetime of the current link based on the authentication procedure.

AUX

An ACL link packet type for data. An AUX1 packet resembles a DH1 packet except it has no CRC code. As a result it can can carry up to 30 info bytes.

baseband

The baseband describes the specifications of the digital signal processing part of the hardware -- the Bluetooth link controller, which carries out the baseband protocols and other low-level link routines.

BB

Abbreviation of Baseband.

BD

Bluetooth device

BD_ADDR

Bluetooth Device Address. Each Bluetooth transceiver is allocated a unique 48-bit device address. It is divided into a 24-bit LAP field, a 16-bit NAP field and a 8-bit UAP field.

BER

Bit Error Rate

Bluetooth

An open specification for wireless communication of data and voice. It is based on a low-cost short-range radio link facilitating protected ad hoc connections for stationary and mobile communication environments. Also see Bluetooth Resource Center.

Bluetooth clock

Every Bluetooth unit has an internal system clock which determines the timing and hopping of the transceiver. It is never adjusted or turned off. It can be implemented as a 28-bit counter, with the LSB ticking in units of 312.5us, giving a clock rate of 3.2kHz.

Bluetooth device class

A parameter that indicates the type of device and which types of services that are supported. The class is received during the discovery procedure.

Bluetooth service type

One or more services a device can provide to other devices. The service information is defined in the service class field of the Bluetooth device class parameter.

BT

Bluetooth (unofficial short form).

business card

The electronic date equivalent to a printed business card. This electronic version of the business card is treated like a file and can be exchanged between Bluetooth devices.

CAC

Channel Access Code

CDMA

Code Division Multiple Access. CDMA is a digital cellular communications technology. Each call has a individual code to identify the call. Multiple calls can be grouped together on a single frequency. CDMA uses spread-spectrum techniques for handling radio communications. CDMA is an improvement on AMPS and TDMA cellular service. Also see CDMA Resource Center.

channel

A logical connection on the L2CAP level between two devices serving a single application or higher layer protocol.

Channel (hopping) sequence

This is a pseudo-random sequence of 79 (23 for the 23MHz system) frequencies, The frequency is calculated using the BD_ADDR of the master of the piconet. The phase in the sequence is derived from an estimate of the master's clock. The channel hopping sequence has a very long period length, does not show repetitive patterns over a short time interval, but which distributes the hop frequencies equally over the 79 (23 for the 23MHz system) MHz during a short time interval .See also Frequency sequence.

Circuit Switched

The application of a network where a dedicated line is used to transmit information. Only one user may employ the resources of the line at a time.

Circuit Switched Bluetooth

The application of a network where a dedicated line is used to transmit bluetooth data.

CL

Connectionless.

class of device

See Bluetooth device class. Also abbreviated as CoD.

CLK

Clock, typically the master device clock which defines the timing used in the piconet.

CLKE

Clock Estimate, a slave's estimate of the master's clock, used to synchronise the slave device to the master.

CLKN

Clock Native, the clock of the current Bluetooth Device

CO

Connection-oriented.

CoD

Class of Device.

connectable device

A Bluetooth device in range that will respond to a page message and set up a connection

CP

Capability Provider. A Capability Provider is a module within the local device that provides a service to other modules. Protocol stack modules (RFCOMM, L2CAP) are Capability Providers. So are "application interface modules" such as OBEX and ESC-AT. In fact, any module that registers a port that other modules can connect to is a Capability Provider.

CRC

Cyclic Redundancy Check. This is a 16-bit code added to the packet to determine whether the payload is correct or not. CRC data payloads can be carried only be DM, DH or DV packets. The CRC code is generated by the CRC-CCITT polynomial 0x11021 (hex).

CTP

Cordless Telephone Profile.

CVSD

Continuous Variable Slope Delta Modulation.

DAC

Device Access Code. It is used during page, page scan and page response substates. It is a code derived from the unit's BD_ADDR.

DCI

Default Check Initialisation. Within Bluetooth , the DCI is defined to be 0x00 (hexadecimal).

DCID

Destination Channel Identifier, used as the device local end point for an L2CAP transmission. It represents the channel endpoint on the device receiving the message. It is a device local name only. See also SCID.

destination

The Bluetooth device receiving an action from another Bluetooth device. The device sending the action is called the source. The destination is typically part of an established link, though not always (such as in inquiry / page procedures).

Device Discovery

The mechanism to request and receive the Bluetooth address, clock, class of device, used page scan
, and names of devices.

device name

See Bluetooth device name.

device security level

Access to a device can be denied based on the required device security level. There are two levels of device security: trusted device and untrusted device. See also service security level.

DH

Data-High Rate. An ACL link data packet type for high rate data. DH1 packets are similar to DM1 packets, except the info in the payload is not FEC encoded. This means the DH1 packet can carry up to 28 info bytes and covers a single time slot. The DH3 is the same except it can cover up to 3 time slots and contain up to 185 info bytes. The DH5 packet is the same again except it can cover up to 5 time slots and contains up to 341 info bytes See also Bluetooth packet types.

DIAC

Dedicated Inquiry Access Code, used when you wish to inquire for certain, specific types of devices.

discoverable device

A Bluetooth device in range that will respond to an inquiry message

DLCI

Data Link Connection Identifier. This is a 6-bit value representing an ongoing connection between a client and a server application. It is used in the RFCOMM layer.

DM

Data - Medium Rate. An ACL link data packet type for medium rate data. DM1 packets carry information data only, contining a 16-bit CRC code and up to 18 info bytes. They are encoded using 2/3 FEC and the packet can cover up to a single time slot. DM3 packets are the same except they can cover up to 3 time slots, and can carry up to 123 info bytes. DM5 packets are the same again except they can cover up to 5 time slots and can hold up to 226 info bytes. See also Bluetooth packet types.

DSR

Data Set Ready. A device sets an RS-232 DSR signal when it is ready to accept data.

DT

Data Terminal.

DV

Data Voice. A SCO link data packet type for data and voice.It is divided into a voice field of 80 bits and a data field of 150 bits. The voice field is not covered by FEC, but the data field is covered by 2/3 FEC. The voice and data fields are treated completely separate. The voice field is handled like normal SCO data and is never retransmitted; that is, the voice field is always new. The data field is checked for errors and is retransmitted if necessary. See also Bluetooth packet types.

ETSI

European Telecommunications Standards Institute.

FEC

Forward Error Correction. The purpose of the FEC scheme on the data payload is to reduce the number of retransmissions. Within Bluetooth , there are 2 versions of this, 1/3 FEC and 2/3 FEC. 1/3 FEC is a simple 3-times repetition of each info bit. 2/3 FEC is a (15,10) shortened Hamming code.

FH

Frequency Hopping.

FHS

Frequency Hopping Synchronization. This a special control packet revealing, among other things, the BD_ADDR and the clock of the source device. It contains 144 info bits and a 16-bit CRC code. The payload is coded with a rate 2/3 FEC which brings the total payload length to 240 bits. The FHS packet covers a single time slot. See also Bluetooth packet types.

FIFO

First In, First Out.

Frequency Hopping (Selection)

Bluetooth is characterised by its system of fast frequency hops. 10 different types of hopping sequences are defined, 5 of the 79 MHz range/79 hop system and 5 for the 23 MHz range/23 hop system. The different range system's hopping sequences differ only in frequency range 79MHz / 23MHz, and segment length : 32 hops(79MHz system) / 16 hops(23MHz system).

The individual hopping sequences include the **page sequence** and the **page response sequence**, these are used in the page procedure. Used in the inquiry procedure are the **inquiry sequence** and the **inquiry response sequence**. Finally the main hopping sequence used in the bluetooth system is the **channel hopping sequence**

GAP

Generic Access Profile. This profile describes the mechanism by which one device discovers and accesses another device when they do not share a common application.

GFSK

Gaussian Frequency Shift Keying. This is the modulation used in the radio layer of the Bluetooth system.

GIAC

General Inquire Access Code. The default inquiry code which is used to discover all devices in range.

GM

Group Management.

GOEP

Generic Object Exchange Profile.

GSM

Global System for Mobile communications. GSM is a digital cellular communications technology that is available in Europe and the US. GSM offers multiple services for the subscriber such as short message service.

GW

Gateway. A Bluetooth enabled basestation which is connected to an external network.

HCI

Host Controller Interface. An (application-optional) layer which provides a command interface to the LMP and Baseband layers.

headset

A microphone and earpiece used to conduct conversations. Headsets can be connected directly to a cellular device or remotely using Bluetooth communications technology.

HEC

Header-Error-Check. An 8-bit word normally generated by using the UAP of the master

device. There are 2 exceptions: in the case of FHS packets using the master page response, the slave UAP is used and for FHS packets sent in inquiry response the DCI value is used.

hold mode

Devices synchronised to a piconet can enter power-saving modes in which device activity is lowered. The master unit can put slave units into HOLD mode, where only an internal timer is running. Slave units can also demand to be put into HOLD mode. Data transfer restarts instantly when units transition out of HOLD mode. It has an intermediate duty cycle (medium power efficient) of the 3 power saving modes (sniff, hold & park).

HS

Headset.

HV

High quality Voice. A SCO link voice packet. HV1 packets carry 10 info bytes, which are protected by 1/3 FEC. HV2 packets carry 20 info bytes, and are protected by 2/3 FEC. HV3 packets carry 30 info bytes, and not protected by FEC. HV packets do not have a CRC or payload header.See also Bluetooth packet types.

IAC

Inquiry Access Code. Used in inquiry procedures, can be one of 2 types: Dedicated IAC, for specific devices, or Generic IAC for all devices.

ID packet

A 68-bit packet used in paging , inquiry and response routines. It is essentially the device access code (DAC) or inquiry access code (IAC). See also Bluetooth packet types.

Idle mode

A device is in idle mode when it has no established links to other devices. In this mode, the device may discover other devices. In general, a device sends inquiry codes (GIAC, DIAC to other devices. Any device that allows inquiries will respond with information. The devices may then decide to form a link.

IEEE

Institute of Electronic and Electrical Engineering.

Inquiry Procedure

The inquiry procedure enables a device to discover which devices are in range, and determine the addresses and clocks for the devices. The inquiry procedure involve a unit (the source)sending out inquiry packets (**inquiry** state) and then receiving the inquiry reply .The unit that receives the inquiry packets (the destination), will hopefully be in the **inquiry scan state** to receive the inquiry packets. The destination will then enter the **inquiry response state** and send an inquiry reply to the source.   After the inquiry procedure has completed, a connection can be established using the paging procedure.

Inquiry Response State

When a device have received an inquiry packet, it can respond with an inquiry reply packet (an FHS packet). It will send this using the inquiry response hopping sequence.

Inquiry State

When a device wishes to discover new devices , it enters the inquiry state, where it

broadcasts inquiry packets (ID packets), containing the IAC, to all devices in range. It will send these using the inquiry hopping sequence. The device in the Inquiry state can also receive inquiry replies (FHS packets), however it will not acknowledge these packets.

Inquiry Scan State

When a device wishes to receive inquiry packets it enters the inquiry scan mode. The scanning will follow the inquiry hopping sequence.

Inquiry (hopping) sequence

This is a sequence of 32 (16 for the 23MHz system) frequencies, The frequency is calculated using the GIAC LAP or the DIAC LAP. The phase in the sequence is derived from the native unit's clock. 32 frequencies are calculated , the **main centre frequency** and 31 other frequencies, these have an of offset of +/- 16. A new centre frequency is calculated every 1.28s. To handle all 32 frequencies , the inquiry hopping sequence switches between 2 inquiry trains , of 16 frequencies each. See also Frequency sequence.

Inquiry (hopping) response sequence

The inquiry response sequence covers 32 (16 for the 23MHz) unique response frequencies that all are in an one-to-one correspondence to the current inquiry hopping sequence. The master and slave use different rules to obtain the same sequence. See also Frequency sequence.

ISM

Industrial, Scientific, Medical.

ITU

International Telecommunication Union. http://www.ituaj.jp/index-e.html

known device

A device for which at least the BD_ADDR is stored.

L2CAP

Logical Link Controller and Adaptation Protocol. This protocol supports higher level protocol multiplexing, packet segmentation and reassembly, and the conveying of quality of service information.

L_CH

Logical Channel.

LAN

Local Area Network.

LAP

LAN Access Point.

LAP

Lower Address Portion. A 24-bit section of the BD_ADDR.See also NAP & UAP.

LC

Link Controller. The Link Controller manages the link to the other Bluetooth devices. It is the low-level baseband protocol handler.

LC Channel

Link Control control channel. One of the 5 logical channels defined for the bluetooth system. It is mapped onto the packet header. It control low level link control info. The LC is carried in every packet except the ID packet which has no packet header.

LFSR

Linear Feedback Shift Register. Used in bluetooth to generate the HEC and CRC.

link key

The authentication key used to establish a link between devices. See also bonding.

LM

Link Manager. The Link Manager software entity carries out link setup, authentication, link configuration, and other protocols.

LM Channel

Link Manager control channel. One of the 5 logical channels defined for the bluetooth system. It carries control info exchanged between the link managers of the master and the slave(s). It can be carried by either the SCO or ACL link.

LMP

Link Manager Protocol. The LMP is used for link setup and control. The LMP PDU signals are interpreted and filtered out by the Link Manager on the receiving side and are not propagated to higher layers.

LMP-authentication

An LMP level procedure for verifying the identity of a remote device. The procedure is based on a challenge-response mechanism using a random number, a secret key and the BD_ADDR of the non-initiating device. The secret key used can be a previously exchanged link key or an initialization key created based on a PIN (as used when pairing).

LMP-pairing

A LMP procedure that authenticates two devices based on a PIN and subsequently creates a common link key that can be used as a basis for a trusted relationship or a (single) secure connection. The procedure consists of the steps:
1: creation of an initialization key (based on a random number and a PIN),
2: LMP-authentication based on the initialisation key and
3: creation of a common link key.

Logical Channel

There are 5 logical channels defined for the Bluetooth system. The LC & LM control channels, and the UA, UI & US user channels.The LC channel is carried in the packet header, all other channels are carried in the packet payload. See the individual sections for more details.

LSB

Least Significant Bit.

MAC Address

3-bit address to distinguish between units participating in the [piconet](). Within Bluetooth, this is the [AM_ADDR]() .

MAN

Metropolitan Area Network.

.

master device

A device that initiates an action or requests a service on a [piconet](). Also the device in a piconet whose clock and hopping sequence are used to synchronize all other devices in the piconet.See also LocDev.

MS

Mobile Station. A generic term for the mobile device in question ([GSM]() phone, [Bluetooth]() device etc).

MSB

Most Significant Bit.

MSC

Message Sequence Chart.

MT

Mobile Terminal, same as [Mobile Station]().

MUX

Multiplexing Sublayer. A sublayer of the [L2CAP layer]().

Name Discovery

The mechanism to request and receive a device name.

NAP

Non-significant Address Portion. A 16-bit section of the [BD_ADDR](). See also [LAP]() & [UAP]().

non-connectable device

A device that does not responds to paging is said to be in non-connectable mode. The opposite of a non-connectable device is a [connectable device]().

non-discoverable device

A device that cannot respond to an inquiry is said to be in non-discoverable mode. The

device will not enter the inquiry response state in this mode.

NULL packet

A 126-bit packet consisting of the CAC and packet header only. It is used to return link information to the source. The NULL packet does not have to be acknowledged .See also Bluetooth packet types.

OBEX

Object EXchange Protocol.

Packet Format

Each packet consists of 3 entities, the access code, the packet header and the payload. Their are a number of different packet types.

Packet Header

The header contains link control info and consists of 6 fields: AM_ADDR : active member address, TYPE : type code , FLOW : flow control, ARQN : acknowledge indication, SEQN : sequence number & HEC : header error check. The total size of the header is 54-bits.

Packet Switched

A network that routes data packets based on an address contained in the data packet is said to be a packet switched network. Multiple data packets can share the same network resources.

Packet type

13 different packet types are defined for the baseband layer of the Bluetooth system. All higher layers use these packets to compose higher level PDU's. The packets are ID, NULL, POLL, FHS , DM1 ; these packets are defined for both SCO and ACL links. DH1, AUX1, DM3, DH3, DM5, DH5 are defined for ACL links only. HV1, HV2, HV3 , DV are defined for SCO links only

Page (hopping) sequence

This is a sequence of 32 (16 for the 23MHz system) frequencies, Each frequency is calculated using the unit being paged's BD_ADDR (this was obtained earlier, such as an inquiry operation). The phase in the sequence is derived from an estimate of the unit being paged's clock. Although it should be able to theoretically calculate the predicated hop frequency of the unit being paged, and page it straight away, inevitably clock drift will occur. 32 frequencies are used to handle this, using the calculated **main centre frequency** and 31 other frequencies, these have an of offset of +/- 16. A new centre frequency is calculated every 1.28s. To handle all 32 frequencies , the page hopping sequence switches between 2 paging trains , of 16 frequencies each. See also Frequency sequence.

Page (hopping) response sequence

The page response sequence covers 32 (16 for the 23MHz) unique response frequencies that all are in an one-to-one correspondence to the current page hopping sequence. The

master and slave use different rules to obtain the same sequence. See also Frequency sequence.

Page (Master) Response State

Step 1:When the source has received a reply to it's original page message, it will enter this state. It will then send an FHS packet to the destination device. It will send this using the page hopping sequence.

Step 2:When the source has received the second reply (**Page Slave Response State: Step2**), it knows that the destination device has received the FHS packet the source sent in Step 1. The source is now the master of the destination (the slave).

Page (Slave) Response State

Step 1: Once a destination device has received its own DAC from the source (in the ID packet), it will enter this state. It will send a response message (its DAC again) to the source .It will send this using the page response hopping sequence.

Step 2:Once the destination device has received the FHS packet from the source ,(**Page Master Response State: Step 1**), the destination will send a reply to the source (an ID packet containing the destination DAC).

Step 3: The destination will switch to the source's channel params. The destination is now the slave of the source (the master).

Page Scan State

A mode where a device listens for page trains containing its own device access code (DAC). When a device wishes to receive page packets it enters the page scan mode. The scanning will follow the page hopping sequence. If a device receives a page packet, it will enter the slave response state.

Page State

A mode that a device enters when searching for other devices. The device sends out a page packet (ID packet), using the page hopping sequence, to notify other devices that it wants to know about the other devices and/or their services.

Paging Procedure

With the paging procedure, an actual connection can be established. The paging procedure typically follows the inquiry procedure. Only the Bluetooth device address is required to set up a connection. Knowledge about the clock (clock estimate) will accelerate the setup procedure. A unit that establishes a connection will carry out a page procedure and will automatically be the master of the connection. The procedure occurs as follows:

1: A device (the source) pages another device (the destination) : **Page** state

2: The destination receives the page : **Page Scan** state

3: The destination sends a reply to the source. : **Slave Response** state: Step 1

4: The source sends an FHS packet to the destination : **Master Response** state: Step 1

5: The destination sends it's second reply to the source. : **Slave Response** state : Step 2

6: The destination & source then switch to the source channel parameters : **Master Response** state: Step 2 **&** **Slave Response** state: Step 3

pairable mode
A device that accepts pairing, is said to be in pairable mode. The opposite of pairing mode is non-pairable mode.

pairing
The creation and exchange of a link key between two devices. The devices use the link key for future authentication when exchanging information.

park mode
In the PARK mode, a device is still synchronized to the piconet but does not participate in the traffic. Parked devices have given up their MAC (AM_ADDR) address and occasional listen to the traffic of the master to re-synchronize and check on broadcast messages. It has the lowest duty cycle (power efficiency) of all 3 power saving modes (sniff, hold & park).

payload format
Each packet payload can have one of 2 possible fields, the data field (ACL) or the voice field (SCO). The different packets, depending on whether they are ACL or SCO packets can only have one of these fields. The one exception is the DV packets which have both. The voice field has a fixed length field, with no payload header. The data field consists of 3 segments: a payload header, a payload body and a CRC code (with the exception of the AUX1 packet).

PCM
Pulse Coded Modulation.

PDU
Protocol Data Unit. (i.e., a message.)

Physical link
A synchronized Bluetooth baseband-compliant RF hopping sequence. It is a baseband level association between two devices established using paging. A physical link comprises a sequence of transmission slots on a physical channel alternating between master and slave transmission slots.

Piconet
A collection of devices connected via Bluetooth technology in an ad hoc fashion. A piconet starts with two connected devices, such as a portable PC and cellular phone, and may grow to eight connected devices. All Bluetooth devices are peer units and have identical implementations. However, when establishing a piconet, one unit will act as a master and the other(s) as slave(s) for the duration of the piconet connection. All devices have the same physical channel defined by the master device parameters (clock and BD_ADDR).

PIN
Personal Identification Number. The Bluetooth PIN is used to authenticate two devices that have not previously exchanged link key. By exchanging a PIN, the devices create a trusted

relationship. The PIN is used in the [pairing](#) procedure to generate the initial link that is used for further identification.

PIN(BB)

The PIN used on the [baseband level](#). The PIN(BB) is used by the baseband mechanism for calculating the initialization key during the [pairing](#) procedure. (128 bits)

PIN(UI)

The PIN used on the user interface level. The PIN(UI) is the character representation of the PIN that is entered on the UI level.

PM_ADDR

Parked Member Address. It is a 8-bit member ([master](#)-local) address that separates the parked [slaves](#).The PM_ADDR is only valid as long as the slave is parked.

POLL packet

Similar to the [NULL packet](#), except it requires a confirmation from the [destination](#). Upon reception of a POLL packet the slave must respond with a packet. See also Bluetooth [packet types](#)

PPP

Point to Point Protocol.

PRBS

Pseudorandom Bit Sequence.

Profile

A description of the operation of a device or application.

PSTN

Public Switched Telephone Network. The general phone network.

QoS

Quality of Service.

Radio

The Radio layer of the Bluetooth system, the lowest defined layer. It details the requirements needed for a Bluetooth device transceiver to operate in the Bluetooth radio band . 2 different ranges have been defined for the radio layer, a 23MHz range and a 79MHz range , both are in the 2.4GHz ISM band. The 23MHz range is only used in certain countries (such as Spain, France) , that have national limitations on the amount of frequencies available. Different [hop systems](#) are used for both.

RF

Radio Frequency.

RFCOMM

> Serial Cable Emulation Protocol based on ETSI TS 07.10.

RS-232

> A serial communications interface. Serial communication standards are defined by the Electronic Industries Association (EIA).

RSSI

> Received Signal Strength Indication. An optional part of the radio layer, used to determine the link quality and thus whether to increase broadcast power.

RTX Timer

> The Response Timeout eXpired timer used in the L2CAP layer to terminate the channel when the remote endpoint is unresponsive to signalling requests. It is started when a signalling request is sent to a remote device.

RX

> Receiver.

S

> Short for Slave. See slave device.

SAP

> Service Access Points.

SAR

> Segmentation and Reassembly. A sublayer of the L2CAP layer.

Scatternet

> Multiple independent and non-synchronized piconets form a scatternet.

SCO

> Synchronous Connection Oriented link. One of the 2 bluetooth data link types defined.A synchronous (circuit-switched) connection for reserved bandwidth communications, e.g. voice, between two devices created on the LMP level by reserving slots periodically on a physical channel. This type of link is used primarily to transport SCO packets (voice data). SCO packets do not include a CRC and are never retransmitted. It primarily supports time-bounded information like voice. (Master to single slave.) SCO links can be established only after an ACL link has first been established. See also ACL.

SCID

> Source Channel Identifier. Used in the L2CAP layer to indicate the channel endpoint on the device sending the L2CAP message. It is a device local name only. See also DCID.

SDAP

> Service Discovery Application Profile.

SDDB

> Service Discovery Database.

SDP

Service Discovery Protocol. It is a Bluetooth defined protocol for provided for or available through a Bluetooth device. Essentially provides a means for applications to discover which services are available and to determine the characteristics of those available services.

SDP client

The SDP client may retrieve information from a service record maintained by the SDP server by issuing an SDP request.

SDP server

The SDP server maintains a list of service records that describe the characteristics of services associated with the server.

SDP Session

The exchange of information between an SDP client and an SDP server. The exchange of information is referred to as an [SDP transaction](#).

SDP Transaction

The exchange of an SDP request from an SDP client to an SDP server, and the corresponding SDP response from an SDP server back to the SDP client.

Security Mode 1

A device will not initiate any security. A non-secure mode.

Security Mode 2

A device does not initiate security procedures before channel establishment on [L2CAP level](#) This mode allows different and flexible access policies for applications, especially running applications with different security requirements in parallel. A service level enforced security mode.

Security Mode 3

A device initiates security procedures before the link setup on [LMP level](#) is completed. A link level enforced security mode.

SEQN

Sequential Numbering scheme. It provides a sequential numbering scheme to order the data packet stream.

Serial Interface

An interface to provide serial communications. service This term refers to a service that one device provides for others. Examples are printers, PIM. synchronization servers, modems (or modem emulators).

Service (SDP layer)

A service is any entity that can provide information, perform an action, or control a resource on behalf of another entity. A service may be implemented as software, hardware, or a combination of hardware and software.

Service Advisor

The portion of the UI that handles BT services for the UI.

Service Attribute

Each service attribute describes a single characteristic of a [service](#).

Service Discovery

See SDP.

Service Class

Each [service](#) is an instance of a service class. The service class definition provides the definitions of all [attributes](#) contained in [service records](#) that represent the instances of that class.

Service Layer

The group of protocols that provides services to the application layer and the driver layer in a Bluetooth device.

Service Record

A service record contains all of the information about a service that is maintained by an [SDP server](#).

Service Record Database

A database that contains the [service](#) discovery-related information.

Service Record Handle

A service record handle is a 32-bit number that uniquely identifies each [service record](#) within an [SDP server](#).

SIG

Special Interest Group. The Bluetooth SIG is located at www.bluetooth.com.

slave device

A device in a [piconet](#) that is not the master.There can be many slaves per piconet.

sniff mode

Devices synchronized to a piconet can enter power-saving modes in which device activity is lowered. In the SNIFF mode, a slave device listens to the piconet at reduced rate, thus reducing its duty cycle. The SNIFF interval is programmable and depends on the application. It has the highest duty cycle (least power efficient) of all 3 power saving modes ([sniff](#), [hold](#) & [park](#)).

source

The Bluetooth device initiating an action to another Bluetooth device. The device receiving the action is called the [destination](#). The source is typically part of an established link,   though not always (such as in [inquiry](#) / [page](#) procedures).

SR

Scan Repetition. A mode used in the [baseband layer](#) to determine how long the device will continue to [scan for a page response](#)

TCP/IP

Transport Control Protocol/Internet Protocol.

TCS

Telephone Control protocol Specification.

TCS-AT

A set of AT-commands by which a mobile phone and modem can be controlled in the multiple usage models. In BT, AT-commands are based on ITU-T recommendation v.250 and ETS 300 916(GSM 07.07). In addition, the commands used for fax services are specified by the implementation. TCS-AT will also be used for dial-up networking and headset profiles.

TCS Binary

Bluetooth Telephony Control protocol Specification using bit-Oriented protocol. It is also referred to as the TCS-BIN system. TCS-BIN will be used for cordless telephony profiles.

TDD

Time Division Duplex

TGAP

Timer used in the General Access Profile (GAP).

time slot

A single time slot in the Bluetooth system lasts 625us. It can be though of as the time it takes to send one packet from one Bluetooth device to another

TTP

Tiny Transport Protocol between OBEX and UDP [TBD].

TX

Transmit.

UA Channel

User Asynchronous data channel. One of the 5 logical channels defined for the bluetooth system. The UA channel carries L2CAP transparent asynchronous user data. It is normally carried in the ACL link.

UAP

Upper Address Portion. A 8-bit section of the BD_ADDR. See also LAP & NAP.

UART

Universal Asynchronous Receiver Transmitter. A device which converts parallel data into serial data for transmission, or it converts serial data into parallel data for receiving data.

UC

User Control.

UDP/IP

User Datagram Protocol/Internet Protocol.

UI Channel

User Isochronous data channel. One of the 5 [logical channels](#) defined for the bluetooth system. The UI channel carries [L2CAP](#) transparent isochronous user data. It is normally carried in the [ACL link](#). It is supported by timing start packets at higher levels

UMTS

Universal Mobile Telecommunications System. Also see [3G Resource Center](#).

US Channel

User Synchronous data channel. One of the 5 [logical channels](#) defined for the bluetooth system. The UI channel carries transparent synchronous user data. It is carried in the [SCO link](#) only.

UUID

Universal Unique Identifier. Used in the [SDP](#) layer.

WAN

Wide Area Network.

WLAN

Wireless Local Area Network. Also see [IEEE 802.11 Resource Center](#).

palowireless
Bluetooth Resource Center

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What Is Bluetooth?

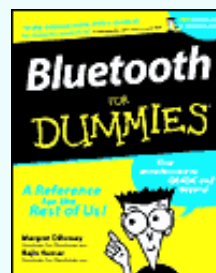*Have you visited our WAP Games section yet?*

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Current topics:

- **CATHAL'S CORNER: Future versions of Bluetooth - Bluetooth 1.2 & Bluetooth 2.0** The recent release of cores based on preliminary Bluetooth 1.2 and speculation on the abilities of Bluetooth 2.0, means that far-sighted developers should not stand still in approaching Bluetooth optimisations. This article explains the features on a broad level of Bluetooth 1.2 and examines the reports on Bluetooth 2.0. *more...*

- **Bluetooth Additional Profiles - Overview**
  Currently in the final stages of evaluation and approval, the Bluetooth SIG is in the process of releasing 12 new profiles. In conjunction with this, palowireless has also published on-line new tutorials to these profiles. However, with the proliferation of profiles and acronyms it is sometimes hard to see what these profiles are designed to do. As an entry-level introduction, this article gives a very brief outline of these new profiles and what roles they will allow Bluetooth units to fill. *more...*

- **Bluetooth and IEEE 802.11b**
  Although aimed at different markets and roles, there has long been speculation about the effects 802.11b (also called Wi-Fi, IEEE 802.11, Wireless LAN etc.) and Bluetooth have on each other, not just technical interference, but also whether they are in competition with each other commercially. Often these are simplistic press reports attempting to compare the two and seeking to decide a winner. This article however explains the similarities and differences between Bluetooth & 802.11b on a broad level and tries to show that there is no serious competition between the two. In fact both have their own advantages and disadvantages, and both technologies can complement each other. *more...*

- **Bluetooth Mobility & Roaming**
  Two major current limitations of Bluetooth are: that communication between devices must be direct; and secondly that they do not support the movement of an active terminal from one network interface device to another.... *more...*

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This month's topic:

Future versions of Bluetooth - Bluetooth 1.2 & Bluetooth 2.0

- **SoftTooth Bluetooth Overview** by Manoj Gupta and the guys from SoftTooth.
  A concise introduction to Bluetooth from the Bluetooth architecture, radio and baseband to a detailed look at connection establishment *more...*

- **Bluetooth Protocol Analyzer Comparison Chart**
  recently updated comparison of features for selected Bluetooth Test Equipment and Protocol Analyzers *more...*

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Myke Predko, Ben Wirz
McGraw-Hill Companies
Edition Desc: KIT

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- **Bluetooth SIG Bluetooth Core Specification Version 1.2 (11/03)** The Bluetooth SIG announces the availability of the Bluetooth Core Specification Version 1.2. It has been delivered as announced in the Fall of 2003, tested and is market ready. The newest Core Specification introduces many new innovative features that required countless hours of work and compromise. Features like Adaptive Frequency Hopping have not only made the technology better, but promote good citizenship in the unlicensed spectrum for other technologies.

- **Ericsson Ericsson awarded Bluetooth license agreement by Winbond (11/03)** Ericsson Technology Licensing today announced a licensing agreement with Winbond, a leading semiconductor manufacturer from Taiwan. The license agreement covers the Ericsson Core Bluetooth Radios KE-1 and KD-1. The license agreement enables Winbond to design and manufacture complete Bluetooth solutions together with a proprietary baseband. Winbond can tailor Ericsson's solutions for all of the major Bluetooth applications such as human interface devices, headsets and mobile phones.

- **Silicon Wave Silicon Wave and RF**

Recent Bluetooth Headlines

PRWeb XEMICS Looking to Expand Presence in India through Aarjay
XEMICS has appointed Aarjay International Pvt. Ltd. as Indian distributor for their complete range of ultra low power semiconductors for Wireless, Sensing, GPS and Bluetooth? systems. [PRWEB Oct 28, 2003]

Computerworld A touch of gray in Bluetooth's silver lining
Bluetooth, the short-range wireless technology, is showing signs of technical improvements and growing adoption, but it faces new challenges from other wireless technologies.

Computerworld A touch of gray in Bluetooth's silver lining
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allNetDevices Intel Purchases Bluetooth, Wi-Fi Developer

[Micro Devices Announce New Single-Chip Bluetooth Solution For Mobile Phones (11/06)](#) Silicon Wave and RF Micro Devices introduce the SiW3500 UltimateBlue IC, a complete single-chip CMOS Bluetooth® solution. The SiW3500 helps speed time to market and implements new features found in Bluetooth Specification Version 1.2, including faster connecting times, Adaptive Frequency Hopping (AFH) for improved coexistence of Bluetooth with other 2.4GHz devices, and extended SCO for improved voice transmissions. The highly integrated circuit combines a direct conversion radio modem with an ARM7TDMI processor core, Bluetooth baseband logic, and complete protocol software in ROM.

- **Silicon Wave [Silicon Wave and Clarity Technologies, Inc. Announce UltimateBlue Audio For Bluetooth Headsets and Mobile Devices (11/03)](#)** Silicon Wave announces the availability of its UltimateBlue Audio solution that combines Clear Voice Capture software from Clarity Technologies, Inc. with Silicon Wave's single-chip UltimateBlue Bluetooth ICs. The solution eliminates the need for a costly DSP (Digital Signal Processor), and has been optimized to run on the 32-bit ARM7TDMI processor core, which is embedded in the Silicon Wave SiW3000 and SiW3500 chips. UltimateBlue Audio delivers a low-cost, high-performance audio solution for Bluetooth wireless devices.

WirelessDevNet [Ericsson Awarded Bluetooth License Agreement By Winbond](#)
The license agreement covers the Ericsson Core Bluetooth Radios KE-1 and KD-1

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- **RFI [Radio Frequency Investigation approves Panasonic's first Bluetooth mobile phone (10/03)](#)** Radio Frequency Investigation Ltd (RFI) announces that it has listed Panasonic's first Bluetooth enabled mobile phone - the X70. Panasonic combined its Bluetooth Qualification with full GSM approval testing and regulatory compliance services, all carried out by RFI. Incorporating a full colour display with GPRS and WAP, and a digital camera with photo light, the X70 is one of the most highly specified mobile phones currently on the market.

- **Bluetooth SIG [Pre-PITs (10/03)](#)** The Bluetooth SIG would like to encourage Members to submit their product(s) as Pre-PITs. This is the first step toward your product(s) becoming a Designated Profile Interoperability Tester (DPIT). For a limited time, members will receive a credit on their on-going balance which may be applied to a future product listing for the next 15 Pre-PITs that are listed on the Qualweb Pre-PIT page and are subsequently approved as a DPIT. (A $5,000 USD to $7,500 USD value) In addition, the Bluetooth SIG will also sponsor and pay for the testing of these Pre-PITs at a BQTF. In order to take advantage of this opportunity, please contact your BQB today. This offer is valid through December 31st, 2003.

- **Silicon Wave [UltimateBlue Bluetooth Radio Modem Receives Certification For Use in CDMA](#)**

And 3G Mobile Phones (10/03)
SiW1712 radio modem accelerates integration of Bluetooth wireless technology. Silicon Wave announces that the SiW1712 UltimateBlue radio modem has received certification for use with CDMA chipsets with an integrated Bluetooth baseband. The SiW1712 radio modem, which is Bluetooth Specification Version 1.1 qualified and Version 1.2 compliant, enables CDMA chipset licensees to quickly, easily and inexpensively integrate Bluetooth wireless functions into their mobile phones. The SiW1712 radio modem is currently in volume production and is available in a 5mm x 5mm 32-pin QFN package or as RDL bumped die to enable under 5mm x 5mm modules. Samples are available exclusively from RF Micro Devices, Silicon Wave's global channel partner for its CMOS single-chip radio processor and stand-alone radio modem Bluetooth solutions.

- **Inventop Inventop Announces Availability Of Proximitymail With Anycom Bluetooth Compactflash Card (10/03)** Inventop announces the compatibility of ProximityMail with Anycom Bluetooth CompactFlash Card. ProximityMail turns Bluetooth- enabled PDA into a powerful community- messaging device. ProximityMail is a collaborative communications application for Bluetooth PDAs that enhances the way localized communities of people network, communicate, and collaborate. ProximityMail facilitates community building, professional networking,

and relationship building wherever groups of people are gathered for tradeshows, conferences, ballgames, coffee places, etc. Users can create and subscribe to groups, broadcast or send private messages and thereby more easily initiate contacts with other members of the community.

- **Ericsson [HP & Ericsson Expand Partnership For Bluetooth (10//03)](#)** Long time partners HP and Ericsson today announced that they are cooperating on the development of advanced Bluetooth-enabled wireless devices that will help people create, share and publish information no matter where they are. HP is the first IT company to have full access to Ericsson's Bluetooth design solutions. HP, as one of Ericsson's strongest partners in Bluetooth solutions, will combine licensed Bluetooth wireless technology from Ericsson with many of its own consumer wireless devices. With Bluetooth wireless technology built into the HP devices, consumers will enjoy the ability to communicate easily with other people or devices within an office, a home or on the move. The new version of Bluetooth also provides better voice and audio quality as well as improved coexistence with other wireless technologies.

- **vnunet.com [Avoid false Bluetooth, resellers warned (10/03)](#)** As counterfeit Bluetooth products flood the UK market, resellers caught selling them could face a court appearance and hefty

fines, according to wireless vendor TDK Systems. The firm, which is running a series of seminars for resellers next month, claimed up to 50 per cent of Bluetooth accessories have not undergone official qualification or violate trademark standards.

- **Blue2Net [Development continues at Blue2Net AB (10/03)](#)** Blue2Net AB has added Serial Port Profile in the Serial blue2link S232M, thus enabling machines and equipment with Serial RS-232 or Built-in Bluetooth to connect wirelessly to devices such as Laptops, PDA's, Cellular phones, Web Pads, and PC's point-to-point. There are currently 592 qualified Bluetooth products that supports the Serial Port Profile giving you a wide range of possibilities. The blue2link S232M ® is compatible with all major operating systems, as well as devices without operating systems. The blue2link® is a true plug-and-play product, since no extra software is needed in the connected device.

- **Bluetooth SIG [Mobile Phone Implementation Guide (9/03)](#)** The Mobile Phone Implementation Guide has been approved by the Bluetooth SIG Board of Directors.

- **Bluetooth SIG [Update: 1.2 Core Specification (9/03)](#)** Interoperability testing of the Bluetooth Core Specification 1.2 is now complete. The results of these tests confirm that Adaptive Frequency Hopping, eSCO, Enhanced Inquiry Scan,

L2CAP Flow and Error Control and revised QoS are mature features. However, the testing results also show that Anonymity mode, Absent mask, and Scatter mode are not mature enough to be included in the next Draft of the Bluetooth Core Specification. The Bluetooth Core Specification 1.2 in its current version (Draft 6) will not be adopted. While this draft is available on www.bluetooth.org for informational purposes, please note the disclaimer which identifies expected changes to future drafts. The Radio Working Group is producing a new draft. The Group's work plan targets publication before the end of the year.

- **Ericsson [Ericsson Announces License Agreement with ST for Bluetooth version 1.2 (9/03)](#)**
  Ericsson Technology Licensing today announced that they have signed a license agreement with ST for Ericsson's new Bluetooth baseband core, which implements the complete range of mandatory Bluetooth 1.2 features. ST will embed the Ericsson Core Bluetooth Baseband Platform Q-E1 in future Bluetooth products, starting with a single-chip Bluetooth solution with full v1.2 functionality that is currently in development. Products compliant with the Bluetooth v1.2 specification offer features such as faster connection times, enhanced voice quality and adaptive frequency hopping, for improved coexistence with other wireless technologies. ST's new chip will be fully compliant with the new standard, backwards

compatible with all v1.1 solutions and interoperable with all current Bluetooth solutions.

- **CSR [Advanced CSR BlueCore Chips Selected for Apple's New PowerBook G4 Notebooks (9/03)](#)** Cambridge Silicon Radio announces that Apple has selected CSR's BlueCore chips with Adaptive Frequency Hopping (AFH) to Bluetooth-enable its line of professional PowerBook G4 notebooks. Apple offers its PowerBook G4 customers Bluetooth wireless technology to easily enable wireless exchange of data between other Bluetooth-enabled devices including computers, cellular phones, PDAs and the new Apple Wireless Keyboa rd and Apple Wireless Mouse. The BlueCore chip offers AFH, a system that eliminates interference between Bluetooth and other RF devices, such as WiFi (802.11) that operate in the 2.4GHz radio frequency band, by coordinating the frequency channels of all 2.4GHz devices.

- **Silicon Wave [UltimateBlue Coexistence Technology From Silicon Wave Minimizes Interference Between Bluetooth and Wi-Fi Wireless Technologies (9/03)](#)** Silicon Wave, Inc. announces that their UltimateBlue Coexistence Technology is now available to customers using the single-chip SiW3000 Bluetooth radio processor. UltimateBlue Coexistence Technology is designed to minimize the interference between devices

enabled with Wi-Fi and Bluetooth wireless technologies. UltimateBlue Coexistence Technology complements the Adaptive Frequency Hopping techniques found in the upcoming Bluetooth Specification Version 1.2 while minimizing interference and enhancing performance in situations where legacy Bluetooth Specification Version 1.1 devices are still in use. UltimateBlue Coexistence Technology is a software-based solution that does not require hardware or driver modifications and is implemented entirely on Silicon Wave's SiW3000 Bluetooth chip.

- **Silicon Wave [Silicon Wave Bluetooth Solution Featured In Intel's Digital Motor Coach Wireless Coexistence Demonstration (9/03)](#)** Silicon Wave announces that their Bluetooth solution is being used in Intel's Digital Motor Coach to demonstrate coexistence between Bluetooth and Wi-Fi wireless technologies. The Digital Motor Coach features hands-on demonstrations highlighting Intel's latest desktop and mobile platforms and wireless connectivity solutions. Silicon Wave's Bluetooth solution is part of the Intel Wireless Coexistence System and is fully compatible with Intel Centrino mobile technology. The Intel Digital Motor Coach is the first certified Wi-Fi hotspot on wheels.

- **connectBlue [FDA approves first medical system using Bluetooth (9/03)](#)** connectBlue's Serial Port

Adapter, supplied by Code Blue Communications, Inc., has been integrated as a key wireless component of the first Bluetooth medical application to be granted market approval by the US Food and Drug Administration. An OEM version of the Serial Port Adapter will enable wireless communication between operating room equipment and a central control system developed by Stryker Endoscopy - a leading supplier of medical equipment for operating room applications worldwide.

- **CETECOM [CETECOM Spain to build a new BQTF for SGS Japan (9/03)](#)** CETECOM, in Spain, and SGS Japan, in Japan, announce their recent agreement to build a Bluetooth Qualification Test Facility (BQTF) in Japan. CETECOM Spain will supply test systems for the test facility and will also provide technical assistance, consultancy and training. The test laboratory will be established using the BITE family of test platforms. It is planned to have this facility up, running and fully operative during September 2003.

- **Bluetooth SIG [Basic Imaging Profile (9/03)](#)** An adoption meeting for Bluetooth Specifications will be held on 25 September 2003. The adoption votes will be held for the Basic Imaging Profile 1.0. The documents are available on the Bluetooth SIG [member web site](#).

- **Bluetooth SIG [Proposed Interoperable Prototype](#)**

Verification Testing: SIM Access Profile (9/03) The Bluetooth Car Working Group will be sponsoring an Interoperable Prototype Verification Testing event for the Bluetooth SIM Access Profile (SAP) next month. This event is intended to determine the completeness of the SAP profile by verifying the interoperability of prototypes supporting this profile. Please note that participation in this event will not qualify your product for certification of the SAP. This event is a critical step in the Bluetooth SIG specification approval process and is required before a 1.0 version of the profile can be adopted. Event Details: 20 - 24 Oct 2003 during UPF-12. Intercontinental Hotel, Frankfurt, Germany.

- **NEAsia J-Phone Starts Selling Nokia's Bluetooth 3G Mobile Phone Handset (8/03)** J-Phone Co, Ltd said it has started selling a 3G cellular phone made by Nokia Corp of Finland, called V-NM701, which is compatible with J-Phone's W-CDMA service as well as 900-1,800MHz GSM service. Nokia's 6650 is IrDA, Bluetooth capable The handset can be used in Europe, the Oceania region and Asian countries. The V-NM701 comprises a Nokia 6650 handset and a USIM card, the Vodafone Global Standard Card. It has Bluetooth and IrDA interfaces that allow users to easily connect outside equipment such as notebook PCs and PDAs.

- **Korea Herald Bluetooth devices debut in Korea (8/03)** South

Koreans are quick to embrace new technologies and gadgets. Just look at the pervasive broadband network and ubiquitous mobile handsets. Now tech-savvy local consumers are flirting with Bluetooth wireless technology. Bluetooth, a technology that connects electronic devices to each other within short distances, has gained some ground in Europe and Japan. Sony-Ericsson, Nokia and other mobile device makers are actively launching Bluetooth products, but somehow Korea has been relatively indifferent to the short-range wireless capability.

- **Electronic News [Everyday Objects Get Bluetooth (8/03)](#)** Lancaster University in the U.K. is leading a project to wirelessly connect everyday objects. The European Union project, called Smart-Its, is attempting to enable ordinary objects such as coffee cups, chairs and tables with processing power, memory, sensors and short-range communications, all for the same cost as an RF tag.

- **palowireless [August Bluetooth Newsletter (8/03)](#)** Bluetooth News, Upcoming Bluetooth Events, Market Research, Site News, From the Wireless Bookshop, Interesting Articles, Bluetooth Resources...

- **CSR [CSR Saves Stranded Mice (8/03)](#)** CSR announces that it has added HID Proxy capability to the features a CSR BlueCore based USB dongle can support, allowing Bluetooth HIDs (Human Interface

Devices, such as mice and keyboards) to be used when a PC is booting - before the main OS has loaded. Current USB Bluetooth dongles are generic devices that rely on software running under the main OS to provide the full range of Bluetooth functions - including connections to mice and keyboards. The BIOS that allows the main OS to load does not contain similar software and cannot therefore drive a generic Bluetooth dongle to form mouse and keyboard connections. However, a keyboard must still be used to configure the BIOS, choose the OS on multiple-boot machines, or enter OS "safe" modes.

- **Broadcom [New Broadcom High-Performance Blutonium Radio Combines with QUALCOMM's MSM Chipset to Drive Integration of Bluetooth in 3G CDMA Devices (8/03)](#)** Broadcom Corporation announces availability of its Blutonium BCM2004 Bluetooth radio chip, developed and qualified specifically to be combined with the QUALCOMM Incorporated Mobile Station Modem (MSM) Code Division Multiple Access (CDMA) baseband solutions. The MSM chips include fully integrated Bluetooth baseband technology to provide a complete, fully tested Bluetooth solution for third generation (3G) CDMA devices.

- **Ericsson [Employees take over Ericsson product BlipNet (8/03)](#)** With the establishment of BLIP Systems A/S, 10 employees from

Ericsson in Denmark have taken over responsibility for the globally competitive product, BlipNet. BlipNet is a widely applicable Bluetooth infrastructure with a central Application Programming Interface (API) and management functionality. Typical applications for BlipNet include indoor positioning, hot-spot services and payment systems. BLIP Systems A/S is able to offer the widely applicable BlipNet as a turnkey solution developed in-house or in conjunction with partners, as well as Bluetooth-related consultancy services for companies that wish to evaluate wireless technology. BLIP Systems A/S becomes operational on 1 August 2003 and has been set up following a management buy-out of the product BlipNet. A total of 10 employees from Ericsson in Denmark are transferring to the new company.

- **Ericsson [Ericsson and Parrot team up with Bluetooth in cars (7/03)](#)** Ericsson Technology Licensing has signed a licensing agreement with Parrot, a provider of Bluetooth products for the automotive market. The license covers Ericsson's new Bluetooth baseband core, which holds the complete range of mandatory Bluetooth version 1.2 features. The Ericsson Core Bluetooth Baseband Platform Q-E1 is based on the Bluetooth v1.2 specification with for example better voice and audio quality and improved coexistence with other wireless technologies. Parrot will use Ericsson's Core

Baseband to develop their own system-on-a-chip (SoC), Parrot5, to be used in Parrot's next generation Bluetooth products. Parrot also has an option to license Ericsson's full portfolio of software and all profiles suitable for the automotive industry.

- **CETECOM [BITE Bluetooth Qualification (7/03)](#)** CETECOM Spain announces that on July 23rd the BITE Protocol & Profile Tester was validated by the Bluetooth Qualification Review Board for additional profiles and protocols, RFCOMM and Serial Port Profile of the Bluetooth Systems Specifications V1.1. This new validation comes to complete the existing validation range of BB, LM, GAP and SDP. Andres Moreno, Telecommunications Director at CETECOM Spain commented "This is another step forward to make BITE the most effective solution for the qualification testing in the Bluetooth community. CETECOM is fully committed to the Bluetooth Wireless Technology and it is already working for the evolution of BITE (Bluetooth Qualification Testers) to cover the Bluetooth System Specification V 1.2".

- **palowireless [July Bluetooth Newsletter (7/03)](#)** Bluetooth News, Upcoming Bluetooth Events, Market Research, Site News, From the Wireless Bookshop, Interesting Articles, Bluetooth Resources...

- **Bluetooth SIG [Proposed Interoperable Prototype](#)**

Verification Testing: Basic Printing Profile (7/03) The Bluetooth Printing Working Group will be sponsoring an Interoperable Prototype Verification Testing event for the Bluetooth Basic Printing Profile (BPP) next month. This event is intended to determine the completeness of the BPP profile by verifying the interoperability of prototypes supporting this profile. Date: 13 - 15 August 2003, Location: CA USA.

- **Bluetooth SIG Video Distribution Profile IPR Review (7/03)** The Audio Video Working Group has released version 0.95 of its Video Distribution Profile specification for review. The draft is available on the Bluetooth member web site for the 74-day IP review period.

- **Bluetooth SIG Local Positioning Profile (7/03)** The Local Positioning Working Group has released version 0.9 of its Local Positioning Profile specification for review. The draft is available on the Bluetooth member web site for the 74-day IP review period.

- **PRWeb Wireless Physiological Monitoring System Demonstrated (7/03)** Wireless Physiological Monitoring System Demonstrated at Fort Detrick's Forward Digital Deployable Medical Treatment Facility (FDDMTF). Sensitron has recently conducted the installation of a wireless medical monitoring system designed to capture, display and manage the vital signs of

patients at the FDDMTF site, a prototype of a military hospital, at Ft. Detrick, MD. This system incorporates and uses the Bluetooth and WiFi enabled CareTrends System developed by Sensitron, Inc.

- **palowireless June Bluetooth Newsletter (6/03)** Bluetooth News, Upcoming Bluetooth Events, Market Research, Site News, From the Wireless Bookshop, Interesting Articles, Bluetooth Resources...

- **Impulsesoft Impulsesoft and Zeevo launch Reference Design for Single-Chip Bluetooth Stereo Headphone (6/03)** Impulsesoft Private Limited and Zeevo announce the launch of iWISH - Impulsesoft Wireless Stereo Headphone - a ready-to-manufacture reference design for Bluetooth Stereo Headphones. Targeted at applications like portable players, mobile phones, in-car entertainment systems, music systems and the PC, iWISH enables OEM customers to bring CD-quality Bluetooth Stereo Headphones to the market quickly at a low cost. iWISH delivers 44.1 KHz and 48 KHz, 16 bit stereo at a low bill of material cost and with a long battery life. iWISH reference design provides complete hardware and software components eliminating the need for any development by the OEMs, thereby providing significant time-to-market and cost advantage. With Bluetooth 1.1 compliant software and support for Advanced Audio Distribution profile (A2DP), iWISH is guaranteed to work with any Bluetooth enabled music player

that supports A2DP.

- **Impulsesoft [Impulsesoft and PortalPlayer Release Bluetooth Audio Solution for Portable Entertainment Products (6/03)](#)** Impulsesoft Private Limited and PortalPlayer Inc announce the release of a high quality Bluetooth stereo audio solution for portable music players. The solution provides a ready-to-manufacture implementation for both the Bluetooth-enabled portable player and the Bluetooth stereo headset. The solution uses PortalPlayer's audio system-on-chip and firmware and Impulsesoft's Bluetooth components, while the stereo headphone is based on iWISH - Impulsesoft Wireless Stereo Headphone. Built around iBTStack - Impulsesoft's embedded Bluetooth protocol stack, and PortalPlayer's Development Platform, the solution delivers 44.1 KHz and 48 KHz, 16-bit stereo at a low bill-of-material cost and with long battery life.

- **Silicon Wave [Silicon Wave And RF Micro Devices Announce Availability Of Bare Die Single-Chip CMOS Bluetooth® Components (6/03)](#)** Silicon Wave and [RF Micro Devices, Inc](#) announce that Silicon Wave's newest single-chip Bluetooth components, the UltimateBlue 3000 radio processor and the SiW1712 radio modem, are now available as stand-alone bare die products, also known as Known Good Die (KGD). Both the UltimateBlue 3000 and

SiW1712, introduced in March 2003, are also available as fully packaged products. By supplying customers with fully tested, exceptionally small and ultra-thin die, Silicon Wave enables Bluetooth functionality in a reduced size ideally suited for high-density integration into miniature assemblies. This strategy is expected to meet existing customer requirements for cost-effective, small form factor Bluetooth solutions, especially for module products in mobile phones. Samples of the KGD are available from RF Micro Devices, Silicon Wave's exclusive worldwide distributor.

- **CSR [CSR's new generation of Bluetooth silicon pushes the Bluetooth market (6/03)](#)** Cambridge Silicon Radio announces its third generation single chip silicon. CSR continues to lead the market by developing its Bluetooth solutions to provide increased integration, higher performance and a range of devices optimised for different applications whilst driving down costs. BlueCore3 is also the first complete implementation of the Bluetooth v1.2 standard (including all optional features of the standard) which improves coexistence of Bluetooth with other 2.4GHz systems. CSR is launching the first products in the BlueCore3 range which will satisfy the needs of both OEMs and consumers and ensure that CSR has the technology to maintain its leadership in Bluetooth for the foreseeable future. The two products demonstrate the two ends of the Bluetooth market: for enhanced

audio devices, BlueCore3-Multimedia is the world's first Bluetooth device to offer a user-programmable DSP and enables new breakthrough consumer applications such as Bluetooth wireless stereo headphones; for low cost, high-volume applications, BlueCore3-ROM sets new standards for a highly integrated product that is both reliable and robust. Its compact size and competitive price makes it particularly suited to mobile handset applications.

- **Stonestreet One [Stonestreet One Teams with Clarity to Offer Embedded Bluetooth Voice Solutions (6/03)](#)** Stonestreet One and Clarity have joined forces to offer a fully integrated Bluetooth voice solution. Clarity's award-winning CVC (Clear Voice Capture) software will be combined with Stonestreet One's industry-leading Bluetooth protocol stack, Bluetopia, and the resulting solution will be licensed through Stonestreet One. Both companies' global distribution channels will field inquiries and coordinate customer demonstrations; however, customers will have the convenience of purchasing a combined software solution from just one company.

- **Stonestreet One [Stonestreet One and Wind River Partner for Embedded Bluetooth Solutions (6/03)](#)** Stonestreet One has been chosen by Wind River Systems, Inc. to offer a Bluetooth solution to embedded devices developers. The

solution will integrate Stonestreet One's Bluetooth protocol stack, Bluetopia, with Wind River's market-specific integrated embedded platforms - WIND RIVER PLATFORMS, and will be ideal for any embedded short-range wireless application in the automotive, medical, industrial, aerospace, and defense industries.

- **RFI [RFI becomes first UK Lab to be accredited for complete Bluetooth Testing Service (6/03)](#)**
  Radio Frequency Investigation (RFI) Ltd is now accredited by the Bluetooth Qualification Review Board to provide Bluetooth Protocol and Profile conformance testing. RFI is the first Bluetooth Qualification Test Facility (BQTF) in the UK to be accredited for both radio conformance testing and protocol\profile conformance testing covering RF, Baseband, Link Manager, L2CAP, SDP, GAP, RFCOMM and SPP. It is an important milestone for RFI in rounding out its Bluetooth test services, giving its customers full support for mandatory category A test cases. Coupled with its established regulatory services and two BQB's RFI can offer a complete 'one-stop-shop' for Bluetooth based product designs. RFI was the first lab in the UK to become an accredited BQTF in May last year - achieving accreditation in only four months following installation of its BITE RF conformance tester. At the time there were only 10 BQTFs worldwide - the number now stands at 22.

- **connectBlue [connectBlue delivers the world's first qualified Bluetooth SIM Access Profile software (6/03)](#)** connectBlue has delivered the world's first qualified Bluetooth SIM Access Profile software, developed initially for one of its customers, THB Bury, Germany. The SIM Access Profile utilizes a Bluetooth link between a mobile phone's SIM card and an external device to enable seamless transfer and operation of SIM information. The automotive industry has already expressed interest in the new profile with initial applications expected to focus on a built-in car phone receiving information from a user's mobile phone SIM card.

- **Ericsson [Ericsson Delivers Bluetooth Version 1.2 (6/03)](#)** Ericsson Technology Licensing announces the availability of its baseband platform fully supporting Bluetooth 1.2. The platform provides manufacturers of semiconductors with a complete baseband development environment to facilitate the design of chips intended for virtually any Bluetooth product requiring 1.2 functionality. The Core Bluetooth Baseband platform Q-E1 from Ericsson is a fully scalable IP Core allowing semiconductors to select desired capacity and functionality for any particular Bluetooth product. The platform includes full Bluetooth implementation, i.e. 7 slaves and both voice and data functionality. In addition, it has several Ericsson proprietary techniques and the

features found in Bluetooth 1.2. All essential 1.2 features are implemented, tested and proven, including AFH for improved coexistence with WLAN, Extended SCO (ESCO) and improved quality of service for enhanced sound quality, and Scatternet functionality for running multiple Bluetooth networks or piconets simultaneously. Bluetooth 1.2 also provides faster connection time than 1.1.

- **RFI [RFI invests in Japan for Bluetooth and 3G (6/03)](#)** Radio Frequency Investigation Ltd (RFI) has become a shareholder in RFI Japan as part of its commitment to the development of Bluetooth and 3G products and services in Asia. For the past year, engineers from RFI have been supporting customers in Japan working with ORIX Rentec Corporation (ORC), providing laboratory support, training, project management and sales support for the roll out ORC's wireless conformance services including Bluetooth and SAR testing. More recently RFI secured an important validation contract with Anritsu for its 3G products.

- **CETECOM [World-Wide Agreement Between CETECOM Spain & Agilent Technologies (6/03)](#)** CETECOM announces the new agreement reached with Agilent Technologies in order to guarantee a global support for CETECOM Test Systems. This co-operation is the result of CETECOM continuous efforts to maintain the utmost quality for its after sales services.

CETECOM test systems will be maintained, calibrated and repaired through Agilent's global network of service centers World-wide.

- **Bluetooth SIG [HID & Audio-Video Profiles (6/03)](#)** The Bluetooth SIG announces the 1.0 adoption of the Human Interface Device Profile (HID) specification and the Audio-Video package consisting of the Advanced Audio Distribution Profile, Audio-Video Remote Control Profile, Generic Audio-Video Distribution Profile, Audio-Video Distribution Protocol and the Audio-Video Control Transport Protocol.

- **Bluetooth SIG [Profile Deprecations (6/03)](#)** During the review of exisiting profiles and protocols taking place for the upcoming version 1.2 release of the Bluetooth core specifications and profile updates, the members of the SIG have determined that the following profiles and protocol should be deprecated: LAN Access Profile, WAP running over LAN Access Profile, ESDP over L2CAP and LAN Access Profile. These profiles and protocols are being deprecated as part of the migration to the PAN profile. Devices wishing to provide access to networks should implement the NAP role defined in the PAN profile. The DUN profile is still available for using a mobile phone as a modem to perform network access. In the future it will be replaced by the NAP role defined in the PAN profile. Similarly, the proposed WAP profiles should now run over the PAN profile

instead of the LAN Access Profile. Finally, to simplify the ESDP profile, the options to run ESDP over L2CAP and LAN Access Profile are being deprecated. Instead, ESDP should be run over the PAN profile. Beginning with the 1.2 version of the Bluetooth specifications, the deprecated profiles and protocols will no longer be published as part of the specifications.

- **CSR [CSR ships its 10 millionth Bluetooth chip (5/03)](#)** Cambridge Silicon Radio announces that it has shipped its 10 millionth single-chip device for Bluetooth. The company's BlueCore devices are designed into more than 350 Bluetooth approved products, from 130 different customers - including many of the world's major suppliers of electronic equipment such as CompaqHP, GN Netcom, IBM, Logitech, Microsoft, Motorola Corp, NEC, Siemens and Sony.

- **connectBlue [connectBlue and ABB provide new solution for industrial Bluetooth implementation (5/03)](#)** connectBlue has signed an agreement with ABB to supply a specially tailored version of its award winning Bluetooth Web Enabler (BWE) to ABB divisions and customers worldwide. The new BWE 800C is a multifunctional communication interface that has been specifically designed to be integrated into the ABB process controller AC 800C, providing flexibility and cost savings for the industrial automation market. The BWE 800C features an Ethernet

interface between the ABB controller and a customer's LAN or WAN with the added benefit of Bluetooth wireless connectivity (LAN Access Point), allowing machinery and devices to be controlled or reprogrammed onsite with a regular Bluetooth enabled laptop computer or PDA.

- **palowireless [May Bluetooth Newsletter (5/03)](#)** Bluetooth News, Upcoming Bluetooth Events, Market Research, Site News, From the Wireless Bookshop, Interesting Articles, Bluetooth Resources...

- **Bluetooth SIG [Bluetooth V1.2 IOP-2 (5/03)](#)** The second interoperability testing session for the Core 1.2 Specification will be held in conjunction with the upcoming UnPlugFest 11, in Copenhagen, Denmark 23 - 27 June. The focus of this Interoperability session will be: eSCO, Absence Masks, Anonymity Mode, Scatter Mode, L2CAP Flow and Error Control, QoS Improvements, AFH role switch. Faster Connections and AFH will not be part of the focus features of this session. However, all platforms participating in the Interoperability event are required to support AFH.

- **Bluetooth SIG [New Release: Draft 4 of the Bluetooth v1.2 Core Specification (5/03)](#)** The Bluetooth SIG is pleased to announce the release of the interim draft 4 of the Bluetooth v1.2 Core Specification. This is a scheduled drop release document that has integrated

changes from the prototyping draft (draft 3 revision 2) based on IOP-1 last month. Changes to this document from the previous version are annotated by change bars. The next drop release (draft 5) is scheduled for 18 July 2003 and will incorporate further changes from IOP-2 in Copenhagen next month.

- **CSR [CSR launches new 'Fast Attach' Bluetooth mobile phone chip (5/03)](#)** Cambridge Silicon Radio announces the launch of its latest application specific chip, BlueCore2-Gateway. The new chip is designed to reduce the complexity of adding Bluetooth onto the motherboard of mobile phones and also enable low cost retrofit Bluetooth adaptors for non Bluetooth phones. To accompany the chip, the company is making available a full example design for a 'Fast Attach' Bluetooth solution. The ultra-low cost design with an innovative circuit gives OEMs the ability to make one basic design that will connect to any phone. The design offers support for wireless headset and all Bluetooth connections to a PC including file exchange, PIM synchronisation, DUN and FAX using the Audio Gateway, Serial Port Profile, Dial-Up Networking and FAX profile on the BlueCore2-Gateway chip. BlueCore2-Gateway is ROM-based and supplied in a small 6x6mm BGA package with user configurable software. The chip makes extensive use of an on-chip audio CODEC for quality processing of the audio signals. CSR utilises configurable ROM meaning OEMs can benefit

from the low cost ROM chips but still have the flexibility to tailor their designs using configurable registers for certain attributes.

- **Blue2Net [blue2access point firmware release R2H (5/03)](#)**
  Blue2Net is proud to release their latest firmware for the blue2access point with 3 brand new features and with higher reliability and speed. Firewall built-in for safer surfing on the Internet NAT-Router for ADSL-, Cable-, and LAN-Internet with DHCP-support Bluetooth address list with pin-code protection. The brand new firewall in the access points allows home users as well as office users to protect their computer from intrusion from hackers and other harmful channels into the user's computer. The new NAT-Router allows you to connect your access point to ADSL and Cable modems to create a wireless Internet connection in your home or office. Today most Internet suppliers only supplies home users and offices with a single DHCP IP-address allowing only one user to access the Internet. This demands users to buy a router to create an internal network to allow several computers to access internet, with our access point you receive a router and a wireless internal network. Bluetooth address list - With the added feature you will be able to decide what units you allow to have access to the access point by typing their MAC address into a list and adding a user specific PIN-code. This allows you to control what units can access your network or Internet adding to the security.

- **CSR [CSR and BridgeCo launch design for new generation wireless speakers (5/03)](link)** CSR (Cambridge Silicon Radio) has announced that it is delivering its BlueCore wireless technology to BridgeCo AG for its wireless speaker designs. BridgeCo's simple reference designs for wireless speakers offer a combination of high performance signal processing and networking connectivity and provides manufacturers with the shortest time to market and lowest system cost implementation. The reference designs bring in BridgeCo's Entertainment Network Adapter (ENA) technology, which consists of embedded and secure software running on its DM1000 integrated network and signal processor. CSR's BlueCore technology has been selected for the designs to deliver high performance Bluetooth wireless connectivity.

- **Bluetooth SIG [Adopted Specification Notice (5/03)](link)** The Bluetooth SIG announces the 1.0 adoption of the Hands-Free Profile (HFP) specification and Errata Service Release 1 (ESR01).

- **Bluetooth SIG [Adoption Meeting Notice (5/03)](link)** This is the Formal Notice that an adoption meeting for Bluetooth Specifications will be held on 24 May 2003. The adoption vote will be held fo rthe Human Interface Device (HID) Profile v1.0 and the Audio/Video profile package v1.0.

- **Bluetooth SIG [Profile Updates](link)**

(5/03) The next generation Bluetooth Core specification v1.2 is scheduled for release in September of this year. A draft was published a few weeks ago. Consequently the Bluetooth SIG has now started an initiative to update the adopted profiles to match the new core specifications. Obviously, editorial changes need to be made to all Profile Specifications to formally allow Qualification in combination with Radios compliant to v1.2. In addition, using new radios features will in some cases need additional definitions in the profiles. The first step in this project will be the evaluation of which radio features need to be addressed in each Profile. The Bluetooth Architecture Review Board (BARB) has started an assessment. The current findings are a starting point for an open discussion among interested members.

- **Vnunet Taking Bluetooth for granted (5/03)** Almost any standardised component technology goes through several phases of development. First, there's the initial hype while the standards work is being done, usually followed by a lull when people realise the technology doesn't do quite what they had hoped it would. After this comes a resurgence when the bugs are sorted out, followed by a period when the technology is seen as a must-have feature for every type of system. Finally, there's the stage when the technology is taken for granted, at which point it is so ubiquitous nobody even sees fit to

mention it any longer. Not every technology follows this route, of course, but Bluetooth is one that appears to be playing it strictly by the book...

- **Wireless NewsFactor [Sony Ericsson Set To Launch New Bluetooth Phone (5/03)](#)** Bluetooth wireless technology, touted as the best way to cut the ties that bind a broad array of computing, imaging and communications devices, has yet to live up to its promise. Yet it continues to find its way into new products. The most recent of these is the first Bluetooth-enabled CDMA phone, produced by Sony Ericsson for Sprint PCS. The Sony Ericsson T608, designed specifically for the U.S. market, communicates with other Bluetooth-enabled products via a radio link, enabling users to take advantage of compatible headsets and other hands-free technology. The Bluetooth technology also permits short-range wireless connections with printers, MP3 players, cameras and other handheld hardware.

Earlier News

- See our [Bluetooth News Archive 2003](#) (* palowireless [Premium Membership](#) required)

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[Also see: **Bluetooth Chipsets and Dev Tools Bluetooth Design Tools WLAN Products**]

Bluetooth Products

● Products, vendors and solutions including PCMCIA cards, access points, headsets, etc...

● If you'd like to recommend or include a product for this listing click here.

● If you're looking for electronic component catalogues, chipsets, kits or protocol software then see our Bluetooth Development Tools page.

● This section is divided into 2 sections: Announced products and Qualified products.

What Is Bluetooth?

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Bluetooth Products and Solutions - announced

These are announced Bluetooth products and solutions which may not yet be qualified. See below for qualified products.

3Com	3Com Corporation and Extended Systems announced at Bluetooth UnPlugFest-3 an agreement to co-develop Bluetooth solutions for the Microsoft Windows platforms. The companies will cooperate to deliver a complete suite of Bluetooth data management applications, protocol stacks and hardware adapters to consumers, manufacturers, businesses and OEM customers.
Adamya	RS232 dongle, Bluetooth protocol stack.

[Airlogic Co Ltd](#)	Developers of [Bluetooth-based wireless communication solutions](#) including Bluetooth USB IP Share, USB Dongle & Flash Memory, USB Serial Adapter and Bluetooth USB Headset.
[AmbiCom](#)	Air2Net Bluetooth solutions PC Card, CompactFlash Card, USB Adapter, Home Gateway.
[AnyCom](#)	Bluetooth products providing users with a complete end-to-end wireless solution. From PC Cards to CF Cards to Palm Pilot Sleeves, the world's first Printer Module and an up coming Access Point.
[Axis Communications](#)	The [Axis 9010](#) is a wireless access point based on the Bluetooth specification, supporting both voice and data.
[Blue2Net](#)	Hardware and software solutions for networking within the Bluetooth standard, providing a complete family of services and products.
[BlueGiga](#)	Wireless Remote Access Platform is an integrated hardware and software solution. It combines standard Networking and Internet technologies and the Bluetooth wireless technology in a turn-key platform enabling remote access to devices and systems. WRAP products can intelligently and independently run all needed protocols and application software without the need for a host processor. It is designed to significantly lower the investment

	and "time-to-market" for OEMs in developing new wireless applications or adding wireless and network connectivity into existing devices.
[Bluelinx](#)	[Q-Zone](#) interruption control for mobile phones and pagers
[Bluelogic](#)	WINKEY Bluetooth keyboard, Bluetooth Headset, VoIP Phone, Bluetooth PC camera...
[BluePosition](#)	Bluetooth Location Information System (BLIS4). The BLIS4 enables a wealth of new highly integrated mobility solutions, based on automatic discovery and location determination of Bluetooth enabled consumer products including mobile phones, PDAs, and Bluetooth enabled tags.
[Bluesocket](#)	Bluetooth networking products.
[Bluesoft](#)	[Bluetooth Positioning Module](#) providing a fully compliant Bluetooth wireless chipset for data and voice communications with the addition of Bluesoft's patented distance measurement (DM) technology. The DM function enables accurate (1 meter) and reliable measurement of distance between two modules - even in indoor, high multi-path environments when the modules are in motion.

[Brainboxes](#)	[Bluetooth PCMCIA Cards and Dongles](#) USB to Bluetooth Dongle, RS232 to Bluetooth Dongle, PCI Bluetooth Card, Printer Port Bluetooth Converter, RS232 to Bluetooth Converter, Compact Flash Bluetooth.
[BrightCom](#)	Silicon & Software solutions for Personal Area Networking over Bluetooth. IntelliBLUE Single chip Bluetooth processors. Iincludes: BIC2000 - Bluetooth Protocol Processor for Bluetooth evaluation, testing systems and "getting hands-on" the technology. BIC2101 - Bluetooth USB Application Processor for cost effective USB, serial (UART) and PCM/CVSD appliances BIC2301 - Bluetooth LAN Access Point targeted for the LAN access point converging voice, VoIP and data services over the Bluetooth media BIC2201 - Bluetooth Hi-Fi Audio/MP3 Application Processor
[CC&C](#)	Bluetooth (USB/UART) Module, Bluetooth USB Dongle, Bluetooth Headset, Bluetooth USB Keyboard, Bluetooth USB Hub, Bluetooth Compact Flash card

[Classwave](#)	Bluetooth Network Infrastructure provider. Its turnkey m-commerce and Bluetooth ISP solutions transform the way personalized content can be exchanged with mobile phones, or dynamically accessed via the Internet through wireless Smart Network Access Points using mobile Bluetooth devices. (Bluetooth support announced Oct 2000)
[COM One](#)	[Platinium Bluetooth PC Card - MC310](#) - connect seamlessly and effortlessly PCs, mobile phones and other devices to share information.
[Commil](#)	The Commil innovative solution is a private "cellular-like" network for buildings (such as airports, office building, campuses, or shopping malls) that allows users to get transparent connection to corporate or telephony and data infrastructure and services using standard, off-the-shelf handheld devices.
[CompuPen](#)	Pen2Net's CompuPen device automatically captures handwriting strokes on any writing surface, digitizes the data, and uses Bluetooth connectivity and encryption to communicate the data securely to mobile appliances such as handheld and laptop computers, cellular phones, email pagers, and personal information appliances and to the wireless Internet.
[DCM Technologies](#)	[Bluetooth Modem](#) and various Bluetooth Solutions, available both in RTOS & Windows.

[Eagle Wireless](#)	Bluetooth-enabled settop boxes announced July 2000.
[ELSA](#)	Bluetooth automotive, home control and networking products. USB adapter for computers with Windows operating systems, analog modem, ISDN modem.
[Ensure](#)	While many vendors are developing Bluetooth devices, what's crucial is the development of real world applications to take advantage of this new standard. XyLoc is a wireless PC security solution that will allow Bluetooth devices to positively recognize and identify authorized users and make Bluetooth phones and PDAs more convenient to use.
[Ericsson...](#)	Various [products and services](#) [Bluetooth Local Infotainment Point (BLIP)](#)
[Extended Systems](#)	3Com Corporation and Extended Systems announced at Bluetooth UnPlugFest-3 an agreement to co-develop Bluetooth solutions for the Microsoft Windows platforms. The companies will cooperate to deliver a complete suite of Bluetooth data management applications, protocol stacks and hardware adapters to consumers, manufacturers, businesses and OEM customers.
[Free2move](#)	Free2move develop OEM products and is also a provider of technology expertise. Embedded Wireless System, LAN access point, Serial cable replacer, RFID
[GigaAnt](#)	Swivel, snap-in and SMD antennas.

[G&W Instruments](#)	Bluetooth Serial Port Adapter, Bluetooth PCI Adapter, Bluetooth Host Stack
[HCV Enterprises](#)	BlueMod is a miniature standalone Bluetooth module incorporating a router and introduces a common language for interoperability between disparate devices.
[HuneTec](#)	Bluetooth Total Solution and productions. Development Kit, LAN Access Point, USB Dongle for IP Share, HeadSet.
[IBM...](#)	Products and services including [new ThinkPad laptops (8/00)](#) IBM Japan have announced a Bluetooth-compliant 09N9812 PCMCIA card option for the ThinkPad notebook PC series models ThinkPad A, T, X and the i series 1620.
[i-data](#)	PlusCom Xpress PRO 10/100 BT PrintServer is designed for instant wireless connection with other Bluetooth-enabled devices such as mobile phones, PDAs and laptops. The PlusCom Xpress PRO 10/100 BT is Internet ready with a complete Fast Ethernet connection and full support for the Internet Printing Protocol (IPP). (Announced Oct 2000).
[IDmicro](#)	Integrating smart chip automation into industry.

[Impulsesoft](#)	Bluetooth Serial Port Adapter provides complete out of the box solution for 'Bluetooth enabling' devices with serial port.
[Intel...](#)	Products and services
[Inventel](#)	Bluetooth 'Long Range' Access Points - EtherBlue (Ethernet wireless LAN Access Point) and the revolutionary one box 'BlueDSL' (Bluetooth wireless ADSL router). Includes Inventel's own Bluetooth module ('BlueBird') ready to accept your applications. Inventel's Partner Program offers the resource and technology to make your products communicate wirelessly - contact us for more details.
[Inventop](#)	[ProximityMail](#) is the first community messaging application creating on the fly ad-hoc spontaneous networks and offering Bluetooth messaging capabilities. It's like a mobile chat room or news group with anonymous, public or private communications to create groups, subscribe or not to those of interest. ProximityMail application is a plug and play product without any user configuration needed, as it is simple, intuitive and natural to use and with only a one time annual fee. ProximityMail facilitates community building, professional networking, and relationship building wherever groups of people are gathered (i.e. tradeshows, corporate and university

	campus, ballgames, shopping malls, hotels, etc). ProximityMail is based on BluePing Network Platform,a patent-pending Peer-to-peer Platform for Distribution of Proximity Content to Bluetooth devices.
[Johnson Controls](#)	Automotive Applications
[KINGENE Tech. Corp](#)	Bluetooth Module, Bluetooth USB Dongle, Bluetooth CF Card, Bluetooth Headset, Bluetooth HID.
[Lesswire](#)	lesswire offers the LocalNavigator an integrated platform of software and hardware components that provide the infrastructure for mobile, personalized, topical, and location-aware services. lesswire`s Bluetooth networks build the wireless LAN for the LocalNavigator.
[Microsage Wireless Inc.](#)	Microsage Wireless Inc. is a software developer specializing in advanced applications for local area wireless technologies such as Bluetooth and 802.11. The company's SageNet product is an intelligent thin-client application that allows users to efficiently and easily make use of services in a Personal Area Network.
[Motorola](#)	PC Card Adapter, USB Adapter, Hands-free Car Kit [New products](#) including new Timeport Bluetooth-enabled phones

[MPI Tech](#)	[Bluetooth Printer Adapter](#) Bluetooth Printer Adapter enables easy wireless printing from Bluetooth enabled devices such as Laptops, PDAs and mobile phones.
[Nokia...](#)	Products and services
[Norwood Systems](#)	EnterpriseMobility is the first Enterprise-focused solution to demonstrate delivery of scalable voice and data services over a multi-cell Bluetooth office network.
[NSM Technology](#)	[Bluetooth USB Dongle (PDF)](#), [Bluetooth UART Dongle (PDF)](#)
[Parrot](#)	Parrot CK3000: Feature-Rich Car Kit for All Bluetooth Phones. Parrot car kits are DSP-based platforms that run dedicated application software independently from the phone's own software.
[Pico Communications](#)	Pico manufactures and markets access points based on Bluetooth technology that allow users with Bluetooth handhelds and PDAs to rapidly and securely connect to the LAN and Internet while preserving their handheld battery life, size and weight. Pico serves customers in the enterprise and in vertical markets such as healthcare, telecommunications, retail and education. Enterprise-grade security and management, enhanced range, simultaneous interoperability with many different types of Bluetooth-capable devices and easy to use applications are the hallmarks of Pico's networking solutions.

[Plantronics](#)	Bluetooth Headsets
[Primax](#)	PCMCIA card, USB dongle, USB adapter
[Red-M](#)	Wireless Internet server product solutions based on Linux operating system and Bluetooth technology The Red-M 3000AS integrates Bluetooth technology with Internet access capabilities for rapid and low cost deployment in a wide range of environments. The 3000AS incorporates WAN and LAN interfaces, plus web page caching, secure firewall and VPN functions. In addition, the 3000AS hosts an email and web server for delivery of local email and web content to the Bluetooth devices. The Red-M 1000AP access points can be connected to the 3000AS access server over a standard LAN connection.
[RTX](#)	Tailored turnkey solutions.
[Socket Communications](#)	[Bluetooth Products](#) including Bluetooth Personal Network Card Socket's Personal Network Card is a CompactFlash CF+ Type I Bluetooth adapter. It is constructed using Socket's proprietary "Battery Friendly" low power ASIC technology and a "radio on a chip" IC from Cambridge Silicon Radio (CSR). Expected availability is the second half of 2000.

Sphinx Elektronik	PICO Card: PCMCIA PC Card, PICO Plug: RS 232, Centronics
Stonestreet One	The Stonestreet One Bluetooth OEM Module provides a simple Bluetooth interface for your products. The OEM Module has the Ericsson module already mounted onto the module's circuit board and includes an integrated antenna interface. The Module consists of a baseband core, radio, and voltage regulators. It is available with the following interface options: • UART (with/without PCM audio) • RS232 (with/without PCM audio) • USB (built-in audio)
SysOnChip	Suppliers of Bluetooth PCMCIA cards (Korea).
Tactel	Bluetooth for Palm Pilot, serial cable replacement and security products.
Tadlys	Bluetooth access point (BAP), bluetooth solutions, bluetooth systems.
TDK	Bluetooth Companion for New Palm 'm' Series, Bluetooth accessories. The 'Go Blue' range includes a clip-on device for handheld computers and a USB adapter for laptops and PCs.
Toshiba...	Toshiba Bluetooth site
Tricomtek Co.,Ltd	Tricomtek is a leading supplier of Bluetooth products and development tools. smartBLUE-USB, smartBLUE-Headset and smartBLUE-HiFi.

[Troy XCD](#)	Bluetooth stack and the world's first product for printing from PCs across a Bluetooth wireless link.
[Widcomm](#)	[Widcomm Bluetooth Products](#) [Blue-Connect](#) Visor™ Bluetooth enabler, [Blue-Share](#) desktop or notebook Bluetooth enabler in a single dongle package, [Bluetooth Protocol Stack](#) [BlueGate 2100](#) is a standalone point-to-multipoint Bluetooth device that provides wireless access to the Internet, email, and other LAN resources.
[ZebraPass](#)	Wireless ticketing and mobile commerce
[Zupera Technology Corporation](#)	[Z-Bluetooth Key (ZBK)](#) is an external adapter with a USB interface that could connect to any devices with a USB port or embedded Bluetooth module.

Bluetooth Products and Solutions - qualified

These are products which have been through the formal qualification process (also see our Bluetooth Development Tools page). (The list below was compiled in Nov 2000).

This list is growing rapidly (165 as at May 2001). For the latest details see the Bluetooth SIG Members Site.

Acer Communications and Multimedia	Acer BT100 Bluetooth PC Card. It enables Bluetooth wireless technology for desktop / laptop computers or PDAs equipped with a PCMCIA interface. The package of Acer BT100 includes one PC card, software drivers and applications. It provides you with the freedom of mobility. Through Bluetooth wireless technology, you can enjoy file transfer, dial-up networking, FAX, and also serial-port based applications such as peer-to-peer chat without any limitation of cables.
ALPS Electric Co Ltd	Bluetooth Module contains Radio, BB and LMP with USB, UART (11/00)
Arca Technologies	WaveCatcher Bluetooth Protocol Analyzer It allows all messages being sent between Bluetooth devices in a single piconet to be captured and provides a detailed decode of this information. The level of detail presented can be selected for each protocol layer.

Cambridge Silicon Radio	Casira Development kit Casira consists of a BlueCore™ radio module plugged onto a motherboard. This contains host I/O and man-machine interface elements including RS232 drivers (or USB), an audio codec to support headset applications, and various other interfaces, packaged in a plastic case which may be connected to a PC's serial port.
Canon Information Technologies Philippines, Inc	ci-tech BT Protocol Stack (11/00)
CATC	Merlin Analyzer (12/00)
connectBlue	connectBlue's Serial Port Adapter allows any device with an RS232/422/485 port to communicate wirelessly without extra software installation in your device or system. The second generation of the Serial Port Adapter is not just based on the well-tested prior generation but also enhanced with new improvements and features. It is smaller with better performance and higher throughput. Choose from long range or short range depending on your system requirements. The new feature, Wireless Multidrop™ - Multipoint, enables the product to simultaneously communicate with up to seven remote Bluetooth devices and to automatically form a wireless multidrop network.

Ericsson	Bluetooth HOST Stack
Extended Systems	XTNDAccess Blue SDK
GN Netcom	GN 9000 Bluetooth telephone headsets
HuneTec	Class 1 Module (SMD Type, etc).
IBM	Bluetooth PC-Card
Impulsesoft	BluePC Software Suite (11/00)
Intel	Personal Wireless Software
Infineon	BlueMoon I chipset. Complete system solution including the baseband integrated circuit (IC), the radio frequency transceiver as well as the link manager (LM) and host controller interface (HCI) firmware. The qualified BlueMoon solution supports both voice and data.
KC Technology	MicroPAX Bluetooth Controller
Motorola	Bluetooth Phone Module Bluetooth 0dBm PC-Card Bluetooth PC-Card
NEC Corporation	Bluetooth Printer Adaptor (11/00)
Nokia	LRB-1 Components (12/00)
Siemens	Siemens Bluetooth Radio SurfBlue Bluetooth Software Stack

[Signia Technologies](#)	Bluetooth Compact Flash Card (12/00)
[Silicon Wave](#)	Odyssey Link Manager Software (11/00) Odyssey SiW 1601 Link Controller IC and Software (11/00) Odyssey SiW1502 Radio Modem IC WDS Wireless Development System Radio Modem Evaluation System
[Stonestreet One](#)	Bluetooth Software Stack (12/00)
[Taiyo Yuden International](#)	Bluetooth RM Module Components (12/00)
[Texas Instruments](#)	TI Bluetooth Baseband (11/00)
[Toshiba](#)	Wireless Modem Station PC-Card
[Troy XCD](#)	BT-PAD-I
[Widcomm](#)	BlueStack

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Bluetooth Tutorial - Profiles

   The profiles have been developed in order to describe how implementations of user models are to be accomplished. The user models describe a number of user scenarios where Bluetooth performs the radio transmission. A profile can be described as a vertical slice through the protocol stack. It defines options in each protocol that are mandatory for the profile. It also defines parameter ranges for each protocol. The profile concept is used to decrease the risk of interoperability problems between different manufacturers' products.

   Note: *A number of additional Bluetooth profiles are currently in the final stages of development. To stay up to date check this page regularly or subscribe to our* *Bluetooth Newsletter.*

Bluetooth Profile Dependencies:

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Antennas
Articles
Asia-Pacific
Audio
Books
Cathal's Corner
Consultants
Design Tools
Dev Tools
Downloads
Events
FAQ
Forums
Glossary
InfoTooth
News
Products
Profiles
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**What Is
Bluetooth?**
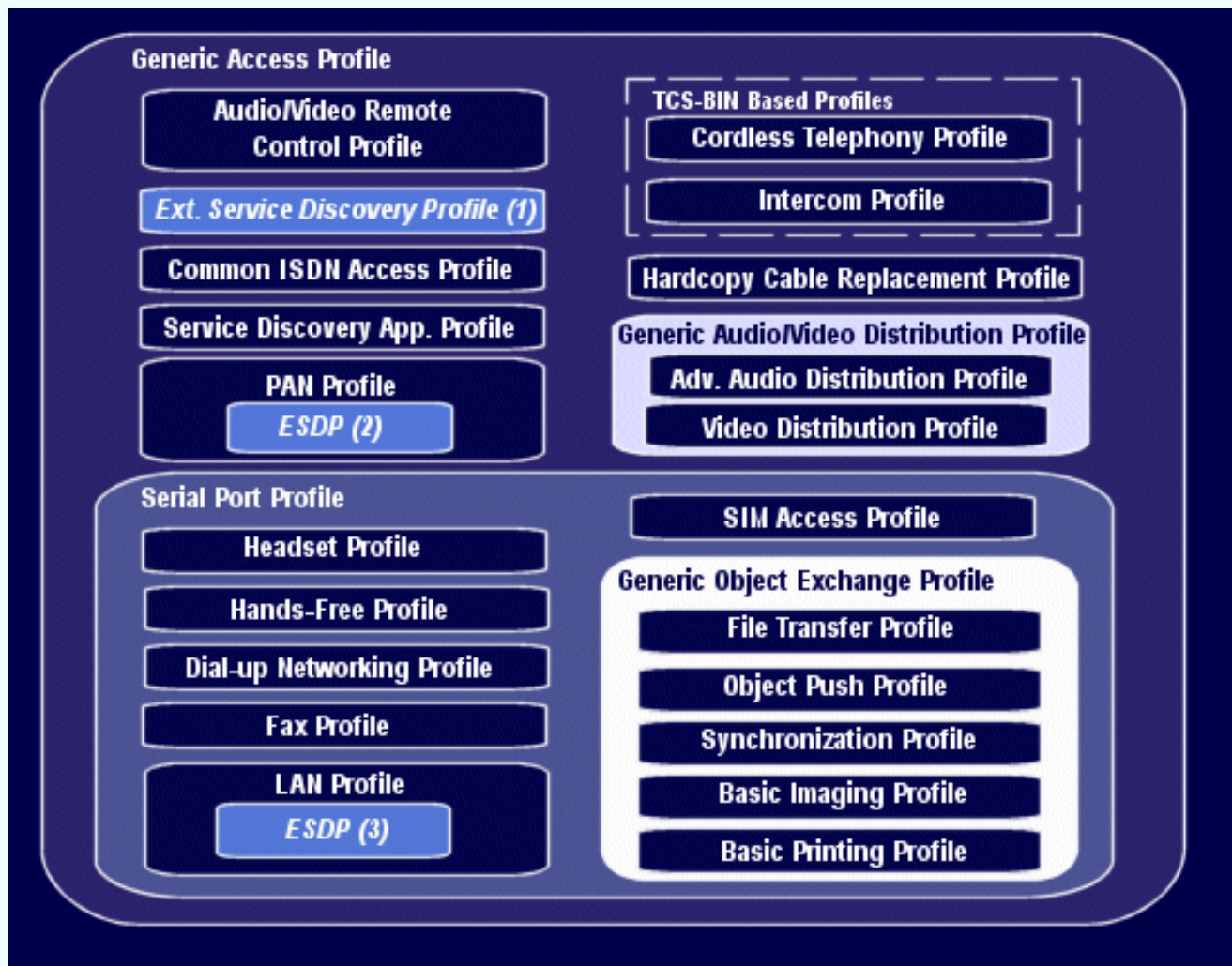
Click on a section of the diagram* above, for a tutorial of its functions

The Bluetooth profile structure and the dependencies of the profiles are depicted above. A profile is dependent upon another profile if it re-uses parts of that profile, by implicitly or explicitly referencing it. Dependency is illustrated in the figure: a profile has dependencies on the profile(s) in which it is contained – directly and indirectly. For example, the Object Push profile is dependent on Generic Object Exchange, Serial Port, and Generic Access profiles.

Click on a section below for detailed information.

Profiles Table Of Contents

	Code	Version	Profile Name
K1	**GAP**	1.1	Generic Access Profile

K2	**SDAP**	1.1	Service Discovery Application Profile
K3	**CTP**	1.1	Cordless Telephony Profile
K4	**IP**	1.1	Intercom Profile
K5	**SPP**	1.1	Serial Port Profile
K6	**HS**	1.1	Headset Profile
K7	**DNP**	1.1	Dial-up Networking Profile
K8	**FP**	1.1	Fax Profile
K9	**LAP**	1.1	LAN (Local Area Network) Access Profile
K10	**GOEP**	1.1	Generic Object Exchange Profile
K11	**OPP**	1.1	Object Push Profile
K12	**FTP**	1.1	File Transfer Profile
K13	**SP**	1.1	Synchronization Profile

The following are new profiles which are currently in the final stages of development/approval:

Additional Profiles:

Available Now	**ESDP**	0.95a	Extended Service Discovery Profile (for Universal Plug and Play)
Premium Access *	**A2DP**	0.95b	Advanced Audio Distribution Profile
Premium Access *	**AVRCP**	0.95b	Audio Video Remote Control Profile
Premium Access *	**BIP**	*1.0*	Basic Imaging Profile
Premium Access *	**BPP**	0.95a	Basic Printing Profile
Premium Access *	**CIP**	*1.0*	Common ISDN Access Profile

Premium Access *	**GAVDP**	0.95b	Generic Audio Video Distribution Profile
Premium Access *	**HFR**	0.96	Hands-Free Profile
Premium Access *	**HCRP**	0.95a	Hardcopy Cable Replacement Profile
Premium Access *	**HID**	0.95c	Human Interface Device Profile
Premium Access *	**PAN**	0.95a	PAN (Personal Area Networking) Profile
Premium Access *	**SAP**	0.95c	SIM Access Profile

* Palowireless Premium Membership required.

Note: Check out the information available in our Bluetooth Articles and Documentation page, for overviews and details on the different layers.

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	Title	Published	Price
1	**Mobile Communications Subscription**	11-01-2003	$32500

Special Offer Discount Available to CTIA Members. Call your Research Manager for more information. Frost & Sullivan's Mobile Communications Subscription focuses heavily on the new Next Generation Mobile Data Services and Mobile Internet Applications as well as the infrastructure necessary to bring them about. Frost & Sullivan Mobile Communications research covers all the core areas of development in Next Generation Mobile Communication product and services. more ...

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2	**Planet Wireless**	11-01-2003	$1691

Planet Wireless - Personal and Local Area Networking via Wireless technologies - is the first and only combined monthly newsletter and research service covering the key markets, applications, strategies and players that are driving and meeting demand for short-range radio technologies. more ...

Order Code: N130-019   Published by: Baskerville

3	**Hotspot Markets**	11-01-2003	$795

Hotspot Markets is a new monthly newsletter covering Wi-Fi hotspot operators, suppliers and end-users. Each issue delivers invaluable data and analysis on the public WLAN business cases, rollout strategies and services of mobile, fixed-line and start up operators. Hotspot Markets also covers the new products and services of public WLAN vendors and service providers. more ...

Order Code: N130-024   Published by: Baskerville

| 4 | **Electronic Materials Update** | 11-01-2003 | $450 |

Each monthly issue of ELECTRONIC MATERIALS UPDATE will keep you informed on what technologies are being developed and commercialized, where the growing fields are, which events are likely to shape the trends in the industry and why, and who the newest and major players are.   more ...

Order Code: N2-026   Published by: Business Communications Co.

| 5 | **Asia Pacific Mobile Analyst** | 11-01-2003 | $1181 |

Asia Pacific Mobile Analyst, an electronic newsletter from the publishers of ASIAcom, is your essential fortnightly guide to the shifting power dynamic of Asian next generation mobile development. From new pricing and tariffing requirements to mergers and consolidation, every electronic issue includes the comprehensive analysis and data necessary to compete. In addition, Asia Pacific Mobile Analyst provides a consistent, strategic assessment of regional developments across Asia within a global context, invaluable for European, US and ROW players looking to secure a global position.   more ...

Order Code: N130-016   Published by: Baskerville

| 6 | **Computer Equipment - Markets and Connector Use** | 10-01-2003 | $3500 |

Bishop and Associates has just released a new ten-chapter research report covering Computer Equipment - Markets & Connector Use. This report provides a detailed view of computer system hardware and connector content. Hardware is defined as: palmtops, notebooks, desktop PCs, motherboards, workstations, servers, (PC servers, proprietary/RISC servers) mainframes and super computers. Details are also provided by region of the world (North America, Europe, Japan, China, Asia Pacific, ROW). more ...

Order Code: R53-83   Published by: Bishop & Associates

| 7 | **The Role and Impact of Emerging Wireless Technologies** | 10-01-2003 | $3040 |

The harmonious evolution from standards-based second-generation cellular wireless systems, such as GSM, to 3G is now threatened by a combination of uncertain service demand and the emergence of a raft of new wireless technologies. Network operators, service providers and equipment vendors are faced with major decisions to position themselves for the future. more ...

Order Code: R51-144   Published by: Analysys Ltd.

| 8 | **Wireless M2M and Telematics: Gaining Value in Vertical Markets** | 09-29-2003 | $2950 |

This report examines which wireless technologies are best suited to different M2M and Telematics applications, assessing more than 70 different types of application in 16 application groups, and analysing their prospects in major vertical market sectors worldwide. more ...

Order Code: R533-0001   Published by: e-principles

| 9 | **Cellular M2M: Generating Profit from the Business Opportunities** | 09-29-2003 | $2950 |

This report explores indicative examples of M2M application areas suited to using cellular networks, defines the main application groups and compares differences in service requirements and type of end user. It provides an outline of alternative wireless technologies, comparing them with cellular, and explores M2M market development - including significant government issues. more ...

Order Code: R533-0002   Published by: e-principles

10 **European In-Car Infotainment Markets**   09-14-2003 $7500

This Frost & Sullivan research is a comprehensive study of the European in-car infotainment market, examined by aftermarket and OE market. It discusses infotainment technologies, vendors' product strategies and major market and technology trends. This research also profiles selected vehicle manufacturers and key value chain participants, offering valuable competitive intelligence.   more ...

Order Code: R1-2488   Published by: Frost & Sullivan

Title	Published	Price

10 **European In-Car Infotainment Markets**

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Bluetooth links for the SIG, Promoters and Official Sites

● Quick and useful links to the SIG, founder, promoters and the official Bluetooth sites

---

- **www.bluetooth.com/** The Bluetooth public web site (and old members area < Aug 2000)
  - Bluetooth SIG
  - Press Releases

- **www.bluetooth.org** Members Area
  - Stay tuned for more links and news soon!

Useful Links to SIG Promoters

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Ericsson (ERICY)	Telefonaktiebolaget LM Ericsson is the sole legal owner of the Bluetooth brand, and has assumed the responsibility to protect its name and mark through trademark registration. **Ericsson's Bluetooth web site** **Ericsson Australia**
IBM (IBM)	**IBM corporate web site**
Intel (INTC)	**Intel corporate web site**
Lucent (Microelectronics Group) (LU)	
Microsoft (MSFT)	**Microsoft Bluetooth**
Motorola (MOT)	**Motorola Bluetooth**
Nokia (NOK)	**Nokia corporate web site**
Toshiba (TOSBF)	**Toshiba Bluetooth site**

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[Also see: **Bluetooth Tutorial**   **Bluetooth and WLANs**   **Bluetooth Security**   **Wireless Technology**]

Bluetooth and Related Technology

● Bluetooth, WPANs, wireless personal networks, wireless data technology, articles, libraries and other sources of technical information.

Technical Specifications

- **Bluetooth SIG**
  - Bluetooth V1.1 Specifications (PDF, 10Mb)
  - Bluetooth V1.1 Profiles (PDF)

Technical Articles:

- **African Cellular**
  - Preventing Bluetooth Interference

- **BTDesigner**
  - Bluetooth Technology, Applications and Compatibility (Word Doc, 800kb)

    What is Bluetooth? Is it the technology? Is it the

What Is Bluetooth?

applications? Is there compatibility amongst itself and other standards? Are there products? This is an overview of the Bluetooth wireless technology and its key features. Through exploring the concept of a Personal Area Network (PAN) discover how the Bluetooth Special Interest Group (SIG) plays a key role in maintaining standards for specification of the protocol, profiles, testing and qualification, interoperability and compatibility. As well as giving a flavour of the sort of devices and products Bluetooth Technology can be applied to.

- **Cambridge Silicon Radio**
  - Adding Bluetooth to GSM phones via battery packs (PDF)

- **CETECOM**
  - Bluetooth Type Approval Site is a web site developed by CETECOM which contains invaluable information about the existing approval regimes world-wide focused on Bluetooth products.

- **Communications Systems Design**
  - The many keys to wireless IEEE 802.11b high rate HomeRF Bluetooth
  - Bluetooth protocol stack
  - Designing Cableless Devices with the Bluetooth Specification
  - Bluetooth – Wireless Local Access
  - Bluetooth – Baseband and RF Interfaces
  - Bluetooth Link Management

- **Counterpoint Systems**
  - IrDA versus Bluetooth: A Complementary Comparison

- **DevX**
  - Make Bluetooth Work for You (4/03) Build a Sample Chat Application Learn how to write applications that

work over Bluetooth short-range networks, using the .NET Compact Framework. Extend the sample chat application in this story to build any kind of Bluetooth applications you'd like.

- **EE Times**
  - **Piecing Together the Bluetooth/Mobile Phone Puzzle (3/02)** Mobile phones are seen as the biggest growth sector for Bluetooth radios. Embedding this radio in a mobile architecture, however, causes big RF and software integration challenges. Integrating Bluetooth functionality in to a cell phone is not an easy task. While Bluetooth and cell phones operate at different frequencies, costly interference can be encountered in the RF front end. Additionally, implementing Bluetooth in a mobile architecture forces design engineers to make some tough hardware and software choices in the baseband section of a mobile architecture.

- **Ericsson**
  - **Bluetooth Pages**

- **Extended Systems**
  - **Synchronization in Bluetooth (PDF)**

- **ExtremeTech**
  - **Bluetooth Real World (7/02)** Right now in order to get two Bluetooth devices to work together you generally need to be technically inclined, and have lots of time to figure out the lengthy setup and connection process. There are pleasant exceptions, however, and signs that real world Bluetooth product interoperability and connection management user interfaces are improving quickly.

- **IBM Systems Journal**
  - **Wireless networked digital devices: A new paradigm for**

- computing and communication
  - ❍ A universal information appliance

- **IEEE 802.15 Working Group for Wireless Personal Area Networks (WPANs)**
  - ❍ HIPERPAN: a COFDM Scheme for IEEE's High Rate WPAN (9/00) (PDF)

- **Intel**
  - ❍ Bluetooth Architecture Overview
  - ❍ Architectural Overview of Intel's Bluetooth Software Stack
  - ❍ Integrating Bluetooth Technology into Mobile Products

    - Components of a Complete Bluetooth System Implementation
    - The System Interface
    - Antenna Types and Trade-offs
    - System Mechanical and Material Effects
    - Bluetooth Products on Aircraft
    - Regulatory
    - Qualification
    - Challenges

- **ISPWorld**
  - ❍ Breaking The 2.4 GHz Traffic Jam ...the IEEE formed a working group to try to minimize the conflicts between Bluetooth, 802.11b, and 802.15, the IEEE's own proposed WPAN standard.

- **Java Community Process**
  - ❍ JSR 82 Java APIs for Bluetooth Bluetooth is an important emerging standard for wireless integration of small devices. The specification will standardize a set of Java (J2ME) APIs to allow these Java-enabled devices to integrate into a Bluetooth environment.

- **Marcin Michalak**

- ❍ [Multimedia Transmission in Bluetooth-based Networks (1143Kb, PDF)](#)
  Includes: - short description of Bluetooth and multimedia transmission technologies, - creation of the testing environment, - performance tests and results of MPEG-1, MPEG-4 (QuickTime) and RealVideo transmissions.

- **[Microsoft](#)**
  - ❍ [Bluetooth](#) information about Bluetooth and Windows® operating systems
  - ❍ [Windows CE Features for Platform Developers](#) Bluetooth Implementation Considerations. Considerations to be taken into account when implementing Bluetooth on Windows CE.

- **[Motorola](#)**
  - ❍ [Motorola Bluetooth](#)
  - ❍ [Bluetooth Glossary](#)

- **[Palm](#)   [Bluetooth Wireless Technology](#)**

  - ❍ White Paper, Product Plans, Early Access Program

- **[Portable Design](#)   [Bluetooth suits mobile information management](#)**
  - ❍ Bluetooth is emerging as the standard that will enable devices to connect to a global network. Technological innovation is rapidly transforming how we use and manage information when we're on the move. As the workplace changes from a stationary office to a moving platform, the PC era is giving way to mobile devices that extend our ability to manage and exchange information wherever we go and whenever we choose. Increasingly, mobile workers need to access, manage, and update information on demand, regardless of their physical location.
- **[RadioRegs](#)**

- ❍ RTTE / R&TTE EC Directive - European regulations for Bluetooth, GSM, etc. CE mark / marking, certification, regulatory approval.

- **RFDesign / Silicon Wave**
  - ❍ [Integrating Bluetooth in the GSM cell phone infrastructure (PDF)](#) Embedding a Bluetooth subsystem in a cellular telephone may be the first step toward complete wireless integration.

- **[RFGlobalNet](#)**
  - ❍ [Building a Bluetooth Radio](#)
    - Process technology
    - Performance
    - Technological Issues
    - Cost & Other Issues

- **[Sun](#)**
  - ❍ [JSR-000082 Java APIs for Bluetooth](#) The specification will standardize a set of Java APIs to allow these Java-enabled devices to integrate into a Bluetooth environment.

  - ❍ [Wireless Application Programming with J2ME and Bluetooth (2/03)](#) This two-part series of articles will show you how to use J2ME and Bluetooth to develop next-generation wireless applications for tomorrow's market. This first article covers the basics of Bluetooth; the next one will concentrate on using the Java APIs for Bluetooth Wireless Technology (JSR 82) to develop Java technology-enabled applications for Bluetooth-enabled devices.

  - ❍ [Part II: The Java APIs for Bluetooth Wireless Technology (4/03)](#) The Java 2 Platform, Micro Edition (J2ME) and Bluetooth technology are two of the most exciting offerings in the wireless industry today. J2ME, most compact of the three Java platforms, is inherently portable because it shares the Java "write once run

anywhere" philosophy and thus enhances developer productivity. Bluetooth is a short-range universal wireless connectivity standard for electronic appliances and mobile devices.

- ## **WLAN Association**
  - ○ [Reliability of IEEE 802.11 Hi Rate DSSS WLANs in a High Density Bluetooth Environment (PDF)](#) The issue of coexistence between IEEE 802.11 high speed Direct Sequence Spread Spectrum (DSSS) and Bluetooth radios with both radio types located within a mixed environment is studied. A network topology, propagation model, and user traffic loads are postulated. The reliability of IEEE 802.11 Hi Rate DSSS radios is then estimated under the stated conditions...

- ## **Wireless Design Online**
  - ○ [Bluetooth Radio Design Considerations for Cellular Handset Application](#) The W7020 LTCC (Low-Temperature Co-fired Ceramic) Module provides an optimal Bluetooth Radio solution for the Cellular Handset Application issues including stringent RF System Requirements and critical aspects for high volume manufacturing such as small size and cost-effective technology usage.

- ## **ZDNet**
  - ○ [Bluetooth versus WLANs](#) If asked to construct a wireless local area network (WLAN), most IT managers would think of 802.11b wireless Ethernet technology. Few would consider using another short-range radio technology, Bluetooth, on its own or in combination with 802.11b-based equipment. The reason for its neglect is that Bluetooth has been marketed as a technology for linking devices such as phones, headsets, PCs, digital cameras and other peripherals, rather than as a technology for LANs. However, Bluetooth could become a serious WLAN option, partly because a lot more Bluetooth devices will be released over the next 12

months. But IT managers may think twice before supporting this technology - because 802.11b and Bluetooth use the same 2.4GHz spectrum to transmit data, interference is a real possibility.

SOC and Silicon Articles:

- [Grasping Particle-Beam Isolation Technology, and Winning in Coming SOC Era (PDF)](#)
  - The advent of ultra deep sub-micron silicon technology (of gate length 0.13 µm and below) has triggered a strong motive to integrate multiple existing functions onto a single chip, called system-on-a-chip or SOC. This is desirable from the consumers' perspective, as it will, eventually, reduce the overall system cost, size, and power consumption dramatically while enhancing product performance and functionality. However, this worldwide trend provoked mixed feelings among production firms. On the bright side, it gives enormous hopes for a variety of potentially large markets; on the dark side, SOC-related problems are much more involved and deceiving than at first glance. Aside from complicated verification issues related to IP (intellectual property) re-use integration in general, it is technically very challenging to place extremely noise-sensitive RF or analog blocks side by side with relatively noisy digital (or even analog) blocks on the same silicon (or SiGe) substrate.

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[Also see: **Bluetooth Products**   **Bluetooth Design Tools** **Bluetooth Dev Tools**   **Bluetooth Consultants**]

Bluetooth Testing, Test Equipment, BQB, Certification Organisations

● Bluetooth Test Equipment, Sniffers, Protocol Analysers, BQB Testing and Certification Organisations.

● Also take a look at:

- **Bluetooth Testing Tools Comparison Chart** **(Recently updated!)**

  Mike Ruscher's comparison of features for: Catalyst BTAE, Mobiwave / Yokogawa D10, IVT BlueTester / BlueAnalyzer, Tektronix BPA100, CATC Merlin, CATC Merlin Mobile, CATC BTTracer/Trainer, Arca Wavecatcher and Serialcatcher, Rohde & Schwarz PTW 60, CETECOM BITE, Yokogawa BX1000 and Frontline Test Equipment SerialBlue.

- CETECOM's Type Approval Site. This is a web site developed by CETECOM which contains information about the existing approval regimes worldwide, focused on the approval of Bluetooth products. The site shows you both general

What Is Bluetooth?

information about the approvals and specific information about worldwide regulation applicable to Bluetooth products.

| Agilent | New Design and Test Solutions for W-CDMA/EDGE/Bluetooth in the Agilent 89400 Series New options enhance the 89400 series vector signal analyzers to keep up with evolving standards such as EDGE and W-CDMA. These enhancements build on the 89400 series and its existing measurements for GSM and BTS transmitter tests of W-CDMA experimental systems. Advanced digital RF transmission techniques are also being applied to short range, low power applications. The Bluetooth standard combines digital modulation, bursting and a frequency hopping spread-spectrum technique.

RF Testing

ESG Family of RF Signal Generators, 89600 series PC-based vector signal analyzer family

Also see Bluetooth Products

Planet Analogue Test tools keep Bluetooth on track (3/01) |

[Anritsu](#)	[Bluetooth Pre Qualification Test System](#) Anritsu has added to the support it offers to developers of Bluetooth wireless technology with the introduction of the ME7865A Bluetooth RF Pre Qualification Test System (PQTS). The ME7865A is the most cost-effective and compact system to offer comprehensive analysis of Bluetooth radios. It addresses all 16 test cases in the Bluetooth RF Test specification at frequencies up to 3GHz. Higher frequency capability is provided by options. [Bluetooth Wireless Testing Technology](#) Anritsu Company introduces the industry's choice for Bluetooth test instrumentation. The Anritsu MT8850A Bluetooth Test Set is the first instrument that can conduct measurements in accordance with RF Test Specification v.0.9.
[Arca Technologies](#)	[WaveCatcher](#) a powerful tool for developers of Bluetooth products. It allows the messages being sent between Bluetooth devices in a single piconet to be captured and provides a detailed decode of this information. arca|Wavecatcher has comprehensive filtering capabilities and decodes the following layers:- Baseband, LMP, L2CAP, HCI, RFCOMM, SDP and TCS. [Serialcatcher](#) to capture and decode L2CAP, HCI, RFCOMM, SDP, TCS and OBEX travelling over your serial

	comms. [WaveMaker](#) Bluetooth Profile Simulator. Simulates the behaviour of an active Bluetooth device allowing test technicians and developers to quickly and easily generate, test and analyse Bluetooth traffic.
[BABT Product Service](#)	Compliance Services for Equipment Manufacturers.
[BVS](#)	Mantis is a low-cost, wireless receiver designed specifically for identifying, installing and verifying Bluetooth wireless devices and connections. The instrument locates any nearby Bluetooth devices, identifies them and follows their frequency-hopping signature allowing detailed RSSI measurement in true dBm, Packet Error Rate breakdowns as well as other device parameters and identification.
[Computer Bus Tools](#)	[Bluetooth Testers / Analyzers](#), [training](#) and [consulting](#).
[CATC](#)	Test equipment includes [BTTracer/Trainer](#), [Merlin Mobile](#), [Merlin](#) [Merlin Bluetooth analyzer](#) Merlin supports the functionality required to analyze all levels, including the baseband, of the Bluetooth wireless protocol. The featured Radio Interface allows users to probe and analyze transactions at the lowest level within the Bluetooth architecture.

[CETECOM (Spain)](#) [CETECOM (USA)](#) [CETECOM Bluetooth Services](#)	CETECOM is a network of Test Houses and Competence Centres focused on Wireless Technologies (GSM, DECT, Bluetooth, etc..). CETECOM provides RF Testing, Protocol And Profile Testing, Interoperability Testing, Regulatory Testing as well as a range of Bluetooth Testing and Qualification Services and Test Tools. [Qualification Testing](#): Blue Units, Protocol, Profile and RF conformance testing and profile interoperability testing according to the BluetoothTM Qualification Program. [Test Systems](#) for the Bluetooth Qualification, [BITE](#) (Bluetooth Qualification Tester), Blue Unit Tester, Protocol/Profile Tester, RF Tester & Enginering Tester.
[Da Vinci Communications](#)	Written in Java and completely cross-platform compatible, the Da Vinci Communications' [Leonardo Synergy Solution](#) combines the Rohde & Schwarz PTW60 protocol tester and Da Vinci Communications' Leonardo Editor Pro into one integrated development environment. Leonardo Synergy Solution / PTW60 can control the operation of the TTCN compiler/syntax and semantic checker on the PTW60 protocol tester. The plug-in's debugging mode enables developers to simply feed error messages from the TTCN compiler back to the Leonardo editor for further editing. Highly flexible, it also allows

	the management and version control of abstract test suites on the PTW60.
[Ericsson](#)	The Bluetooth Qualification Review Board (BQRB) has recognised two units as so called [Blue Units](#). The Bluetooth Development Kit by Ericsson is one of them, and Nokia offers the other. The purpose of the Blue Units is to fulfil the BQRB's desire to "establish confidence in the lower layer protocols of Bluetooth wireless technology before validated conformance test systems are available". Certain releases of the Bluetooth Development Kit by Ericsson meet Blue Unit standards. When ordering a Bluetooth Development Kit by Ericsson you must indicate that you want a [Blue Unit](#), and also state for what version of the Bluetooth Specification you intend to run the Bluetooth Development Kit by Ericsson as Blue Unit. [Bluetooth Log Analyzer](#) is a Bluetooth Development Tool that allows you to view the internal signalling of the Equipment Under Test (EUT) as Message Sequence Charts (MSC) in a standard WEB browser. It makes your problem-solving easier and faster by facilitating exact communication with your support personnel. It also gives a deeper understanding of the internal behavior of the Equipment Under Test. Bluetooth Log Analyzer integrates seamlessly with the entire Bluetooth product portfolio from Ericsson.

ETS Dr.Genz	Global testing and certification - BQB - BQTF - CE Marking - FCC.
Frontline Test Equipment	SerialBlue Bluetooth analyzer for the HCI UART and L2CAP protocols. Capture and analyze Bluetooth serial data as it travels between a host and a host controller. FTS for Bluetooth is an affordable PC-based, Bluetooth protocol analyzer capable of sniffing Bluetooth data in three ways: - Through the air; - From the serial HCI interface between a Bluetooth Host CPU and a Bluetooth Host Controller; - By "virtual" sniffing via the product's Live Import feature, which permits any application to feed data into FTS for Bluetooth.
Hyper Corp	Hyper Corp provides Bluetooth Qualification Services to product manufacturers, making the complex process of bringing products with Bluetooth wireless technology to market much easier. BlueVision RF Development and Conformance Test System Model RDC2401A for Bluetooth Wireless Technology Qualification to the Bluetooth System.

[IAR](#)	Bluetooth test and verification services IAR Systems offers to perform the necessary tests of your product before you send it to the BQB/BQTF, thereby ensuring first-time success. IAR PreQual Profile tester & Conformance tester PreQual profile tester is a Windows 2000 debug and test instrument executing all the SIG specified test suites. The tool includes both Bluetooth aware debug functionality and all the features necessary for Bluetooth certification such as a test report generator. All test suites are written in the Bluetooth SIG official test script language TTCN and fully compliant with the Informal Test Specifications (ITS). Available profile test suite are: SPP, GAP, FTP. Headset, LAN access, Sync, Push, DUN. Available protocol test suites are: L2CAP, SDP, RFCOMM. Available interface test suites are: HCI, Blue unit
[IBM](#)	[BlueHoc](#) Bluetooth ad-hoc network simulator BlueHoc is an open source Bluetooth technology simulator. It simulates the baseband and link layers of the Bluetooth specifications. It is capable of simulating an ad-hoc environment with several Bluetooth devices operating in an indoor wireless channel. It provides an extension to the 'Network simulator (ns)' available from www.isi.edu/nsnam/ns.

	[Download BlueHoc](#)
[IFR](#)	[2026A/B MultiSource Generator](#) with Bluetooth test capability. Multi-Source Signal Generator for Bluetooth. For critical Bluetooth interoperability testing, the 2026B with Bluetooth Option 117 is more cost effective than buying two or three separate signal sources. The 2026B multi-source generator with Bluetooth allows the user to simultaneously generate two Bluetooth modulated carriers and one GSM carrier in a single instrument.
[IVT Corporation](#)	IVT interoperability and conformance testers. [BlueTester](#) was developed based on the latest Bluetooth Test Specifications for conformance and interoperability testing. IVT hides the tedious testing terminology from the testing personnel in order to shorten the learning curve and to reduce the time to market. [BlueAnalyzer](#) is a powerful tool for analyzing Bluetooth protocols. All of the real-time data units in the Bluetooth protocols are intercepted, decoded and displayed in the MSC chart. Detailed data units and decoding information are also logged in the trace window in real time. In addition, the online HTML helps the system to save time in looking up the explanation of those numerous and complicated data units. Developers can easily find out whether the protocol stack is functioning or not.

	It can be used not only as an effective debugging device, but also as a desirable data logging tool.
[LTX](#)	Test Solutions
[Maxsys](#)	Automated test systems for high-volume manufacturing including comprehensive Wireless Functional Test Solutions.
[Mobiwave](#)	BPA-D10 Bluetooth protocol analyzer "Network ready Bluetooth protocol analyzer with intuitive user interface and other useful features plus the right price point".
[Product Quality Partners / Sony Ericsson](#)	[Sony Ericsson Bluetooth Compatibility Testing](#) for 3rd party developers/manufacturers of hardware and/or software compatible with Sony Ericsson Bluetooth enabled phones. Product Quality Partners is an independent testing company chosen by Sony Ericsson to execute the Sony Ericsson Bluetooth Compatibility Testing. This testing service has been customized and designed in partnership between Sony Ericsson and Quality Partners.
[Rococo Software](#)	[Impronto Simulator](#) runs Java applications in a simulated Bluetooth environment, allowing developers to simply test and configure applications before deploying them on Bluetooth devices. Impronto Developer Kit makes creating wireless applications easy by hiding complex Bluetooth protocols behind standard Java APIs. Supports J2SE and J2ME. Works with any JABWT-compliant implementation.

[Rohde & Schwarz Bluetooth Testing](#)	Test and measurement solutions for Bluetooth R&D, Production, Qualification and Maintenance. [PTW60](#) Tester, [CMU200](#), [TS8960](#)...
[Tektronix](#)	[BPA100](#) Bluetooth Protocol Analyzer Fully Bluetooth Approved Product Based on Proven Digianswer Technology Provides Reliable Analysis and Debug.
[Teradyne](#)	Leading supplier of Automatic Test Equipment for Wireless/RF devices (modules and integrated circuits), including Bluetooth and Wireless LAN. Teradyne's Catalyst system has enabled the highest throughput in production testing, including quad-site production of Bluetooth SOC's.
[Testel](#)	RF Test Equipment, RF Test Fixtures for Bluetooth products.
[TÜV](#)	[TÜV Rheinland/Berlin-Brandenburg](#): Test Consultance BQB, BQTF, Worldwide Regulary Type Approvals etc. [Bluetooth services](#)
[Validation AB](#)	Testhouse and Certification center. Bluetooth Services: Testing,Blue Unit Tester, Protocol/Profile Tester, Bluetooth qualification and Interoperability testing services Bluetooth Pre-Qualification testing.

Wireless Futures	Bluetooth qualification and Interoperability testing services Bluetooth Pre-Qualification testing Development of TTCN test cases for Bluetooth profiles Management of qualification process
Yokogawa	**BX1000** Bluetooth Protocol Analyzer ● Bluetooth specification ver. 1.0b compliance ● Analysis function for core protocol (L2CAP, SDP, RFCOMM) ● Data sending function ● Generates HCI commands and captures events ● Connection to user's PC with USB ● Compact and light ● Low price

Interesting Articles:

- CommsDesign Testing Interoperability Between Bluetooth Devices With Bluetooth deployments heating up, interoperability should be at the forefront of an engineer's mind. When running interoperability tests, there are a few key parameters that design engineers should be examining. Issues such as service discovery, PPP connection, and data throughput must be addressed. Here's a guide that will help you sort through some of these key interoperability tests...

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Radio	Baseband	LMP	HCI	L2CAP	RFCOMM	SDP	Profiles

Bluetooth Radio

   The Bluetooth Radio (layer) is the lowest defined layer of the Bluetooth specification. It defines the requirements of the Bluetooth transceiver device operating in the 2.4GHz ISM band.

For more details : Download the Radio Specification from the SIG website, or visit the Documents Page.

Table Of Contents

1.1 Frequency Bands and Channel Arrangement

   The Bluetooth radio accomplishes spectrum spreading by frequency hopping in 79 hops displaced by 1 MHz, starting at 2.402GHz and finishing at 2.480GHz. In a few countries (i.e France) this frequency band range is (temporarily) reduced, and a 23-hop system is used. In order to comply with out of band regulations in each country. In both systems a guard band is used at the lower and upper band edge

1.2 Transmitter Characteristics

Power Classes: Each device is classified into 3 power classes, Power Class 1, 2 & 3.

- Power Class 1: is designed for long range (~100m) devices, with a max output power of 20 dBm,
- Power Class 2: for ordinary range devices (~10m) devices, with a max output power of 4 dBm,
- Power Class 3: for short range devices (~10cm) devices, with a max output power of 0 dBm.

   The Bluetooth radio interface is based on a nominal antenna power of 0dBm. Each device can optionally vary its transmitted power.Equipment with power control capability optimizes the output power in a link with LMP commands (see Link Manager Protocol). It is done by measuring RSSI and report back if the power should be increased or decreased.

Modulation Characteristics: The Bluetooth radio module uses GFSK (Gaussian Frequency Shift Keying) where a binary one is represented by a positive frequency deviation and a binary zero by a negative frequency deviation. BT is set to 0.5 and the modulation index must be between 0.28 and 0.35.

Spurious Emissions: The spurious emission, in-band and out-of-band, is measured with a frequency hopping transmitter hopping on a single frequency; this means that the synthesizer must change frequency between receive slot and transmit slot, but always returns to the same transmit frequency.

Radio Frequency Tolerance: The transmitted initial center frequency accuracy must be ±75 kHz from Fc. The initial frequency accuracy is defined as being the frequency accuracy before any information is transmitted. Note that the frequency drift requirement is not included in the ±75 kHz.

1.3 Receiver Characteristics

Sensitivity Level: The receiver must have a sensitivity level for which the bit error rate (BER) 0.1% is met. For Bluetooth this means an actual sensitivity level of -70dBm or better.

Interference Performance: The interference performance on Co-channel and adjacent 1 MHz and 2 MHz are measured with the wanted signal 10 dB over the reference sensitivity level. On all other frequencies the wanted signal shall be 3 dB over the reference sensitivity level.

Out-of-Band blocking: The Out of band blocking is measured with the wanted signal 3 dB over the reference sensitivity level. The interfering signal shall be a continuous wave signal. The BER shall be less than or equal to 0.1%.

Intermodulation Characteristics: The reference sensitivity performance, BER = 0.1%, shall be met under the following conditions.

- The wanted signal at frequency f_0 with a power level 6 dB over the reference sensitivity level.
- A static sine wave signal at f_1 with a power level of –39 dBm
- A Bluetooth modulated signal at f_2 with a power level of -39 dBm

Such that $f_0 = 2f_1 - f_2$ and $|f_2 - f_1| = n*1$ MHz, where n can be 3, 4, or 5. The system must fulfil one of the three alternatives.

Maximum Usable Level: The maximum usable input level the receiver shall operate at shall be better than –20 dBm. The BER shall be less or equal to 0,1% at –20* dBm input power.

RSSI: Receiver Signal Strength Indicator (Optional):   A transceiver that wishes to take part in a power-controlled link must be able to measure its own receiver signal strength and determine if the transmitter on the other side of the link should increase or decrease its output power level. A Receiver Signal Strength Indicator (RSSI) makes this possible. The way the power control is specified is to have a **golden receive power range**. This golden receive power is defined as a range with a lower and higher threshold levelsand a high limit. The lower threshold level corresponds to a received power between -56 dBm and 6 dB above the actual sensitivity of the receiver. The upper threshold level is 20 dB above the lower threshold level to an accuracy of +/- 6 dB. The instructions to alter the TX power are carried in the LMP link

Note , the above text contains excerpts from the Bluetooth SIG's Specification, as well as various interpretations of the Specs. For complete details of the various sections, consult the actual Bluetooth Specification.

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Home
Bookshop
Market Research
Search
Add a Link

Consulting
Database

| **Radio** | **Baseband** | **LMP** | **HCI** | **L2CAP** | **RFCOMM** | **SDP** | **Profiles** |

Bluetooth Baseband

   The Baseband is the physical layer of the Bluetooth. It manages physical channels and links apart from other services like error correction, data whitening, hop selection and Bluetooth security. The Baseband layer lies on top of the Bluetooth radio layer in the bluetooth stack. The baseband protocol is implemented as a Link Controller , which works with the link manager for carrying out link level routines like link connection and power control. The baseband also manages asynchronous and synchronous links, handles packets and does paging and inquiry to access and inquire Bluetooth devices in the area. The baseband transceiver applies a time-division duplex (TDD) scheme. (alternate transmit and receive). Therefore apart from different hopping frequency (frequency division), the time is also slotted.

For more details : Download the Baseband Specification from the SIG website, or visit the Documents Page.

Table Of Contents

Bluetooth
Antennas
Articles
Asia-Pacific
Audio
Books
Cathal's Corner
Consultants
Design Tools
Dev Tools
Downloads
Events
FAQ
Forums
Glossary
InfoTooth
News
Products
Profiles
Research
Security
SIG
Shop
Subscribe
Technology
Testing
Training
Tutorial
WLANs & BT

What Is Bluetooth?

2.1 Physical Characteristics

2.1.1 Physical Channel

Bluetooth operates in the **2.4 GHz ISM band**. In the US and Europe, a band of 83.5 MHz width is available; in this band, 79 RF channels spaced 1 MHz apart are defined. In France, a smaller band is available; in this band, 23 RF channels spaced 1 MHz apart are defined.

The channel is represented by a **pseudo-random hopping sequence** hopping through the 79 or 23 RF channels. Two or more Bluetooth devices using the same channel form a **piconet**. There is one **master** and one or more **slave**(s) in each piconet. The hopping sequence is unique for the piconet and is determined by the Bluetooth device address (BD_ADDR) of the master; the phase in the hopping sequence is determined by the Bluetooth clock of the master. The channel is divided into time slots where each slot corresponds to an RF hop frequency. Consecutive hops correspond to different RF hop frequencies.
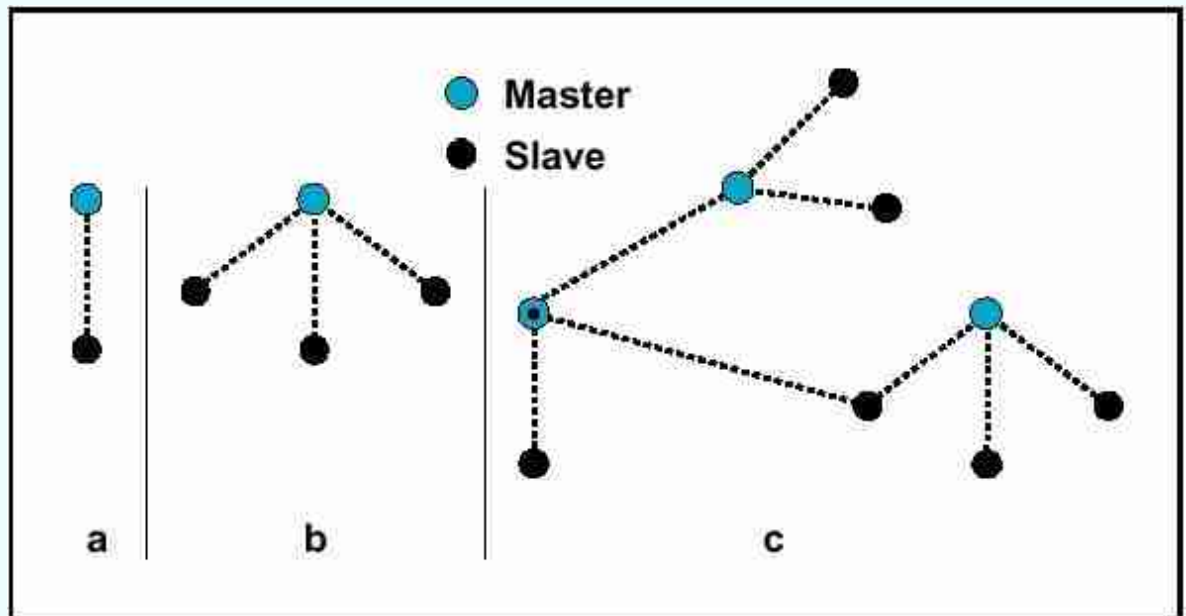
*Diagram Source: Courtesy of Bluetooth SIG, Baseband Spec, Figure 1.2 , p 42

The channel is divided into time slots, each 625 us in length. The time slots are numbered according to the Bluetooth clock of the piconet master.

A TDD scheme is used where master and slave alternatively transmit. The master shall start its transmission in even-numbered time slots only, and the slave shall start its transmission in odd-numbered time slots only. The packet start shall be aligned with the slot start.

2.1.2 Physical Links

The Baseband handles two types of links : SCO (Synchronous Connection-Oriented) and ACL (Asynchronous Connection-Less) link. The SCO link is a symmetric point-to-point link between a master and a single slave in the piconet. The master maintains the SCO link by using reserved slots at regular intervals (circuit switched type). The SCO link mainly carries voice information. The master can support up to three simultaneous SCO links while slaves can support two or three SCO links. SCO packets are never retransmitted. SCO packets are used for 64 kB/s speech transmission.

The ACL link is a point-to-multipoint link between the master and all the slaves participating on the piconet. In the slots not reserved for the SCO links, the master can establish an ACL link on a per-slot basis to any slave, including the slave already engaged in an SCO link (packet switched type). Only a single ACL link can exist. For most ACL packets, packet retransmission is applied.

2.1.3 Logical Channels

Bluetooth has five logical channels which can be used to transfer different types of information. LC (Control Channel) and LM (Link Manager) channels are used in the link level while UA, UI and US channels are used to carry asynchronous, isosynchronous and synchronous user information.

2.1.4 Device Addressing

4 possible types of addresses can be assigned to bluetooth units, BD_ADDR, AM_ADDR, PM_ADDR & AR_ADDR

|	
BD_ADDR: Bluetooth Device Address.	Each Bluetooth transceiver is allocated a unique 48-bit device address. It is divided into a 24-bit LAP field, a 16-bit NAP field and a 8-bit UAP field.
AM_ADDR: Active Member Address	It is a 3-bit number. It is only valid as long as the slave is active on the channel. It is also sometimes called the MAC address of a Bluetooth unit.
PM_ADDR: Parked Member Address	It is a 8-bit member (master-local) address that separates the parked slaves. The PM_ADDR is only valid as long as the slave is parked.
AR_ADDR: Access Request Address	This is used by the parked slave to determine the slave-to-master half slot in the access window it is allowed to send access request messages in. It is only valid as long as the slave is parked and is not necessarily unique.

2.2 Packets

All data on the piconet channel is conveyed in packets.

2.2.1 Packet Types

13 different packet types are defined for the baseband layer of the Bluetooth system. All higher layers use these packets to compose higher level PDU's. The packets are ID, NULL, POLL, FHS , DM1 ; these packets are defined for both SCO and ACL links. DH1, AUX1, DM3, DH3, DM5, DH5 are defined for ACL links only. HV1, HV2, HV3 , DV are defined for SCO links only.

2.2.2 Packet Format

Each packet consists of 3 entities, the **access code** (68/72 bits), the **header** (54 bits) , and the **payload** (0-2745 bits).

LSB 72	54	0 - 2745	MSB
ACCESS CODE	HEADER	PAYLOAD	
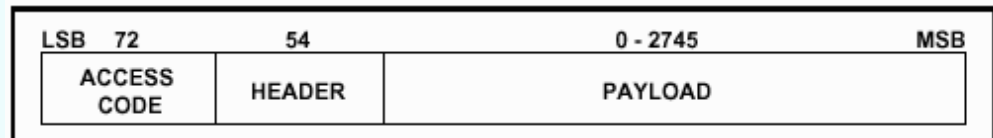
*Diagram Source: Courtesy of Bluetooth SIG, Baseband Specs, Fig 4.1 , p 47

- **Access Code**: Access code are used for timing synchronization, offset compensation, paging and inquiry. There are three different types of Access code: Channel Access Code (CAC), Device Access Code (DAC) and Inquiry Access Code (IAC). The channel access code identifies a unique piconet while the DAC is used for paging and its responses. IAC is used for inquiry purpose.
- **Header**:The header contains information for packet acknowledgement, packet numbering for out-of-order packet reordering, flow control, slave address and error check for header.
- **Payload**: The packet payload can contain either voice field, data field or both. It it has a data field, the payload will also contain a payload header.

2.3 Channel Control

2.3.1 Controller States

Bluetooth controller operates in two major states: **Standby** and **Connection** . There are seven substates which are used to add slaves or make connections in the piconet. These are **page, page scan, inquiry, inquiry scan, master response, slave response and inquiry response** .

The **Standby** state is the default low power state in the Bluetooth unit. Only the native clock is running and there is no interaction with any device whatsoever. In the **Connection** state, the master and slave can exchange packet , using the channel (master) access code and the master Bluetooth clock. The hopping scheme used is the channel hopping scheme.The other states (page, inquiry etc are described below)

2.3.2 Connection Setup (Inquiry/Paging)

Normally, a connection between two devices occur in the following fashion: If nothing is known about a remote device, both the inquiry(**1**) and page(**2**) procedure have to be followed. If some details are known about a remote device, only the paging procedure (**2**) is needed

Step 1:
　　The **inquiry procedure** enables a device to discover which devices are in range, and determine the addresses and clocks for the devices.

1.1: The inquiry procedure involve a unit (the source) sending out inquiry packets (**inquiry state**) and then receiving the inquiry reply

1.2: The unit that receives the inquiry packets (the destination), will hopefully be in the **inquiry scan** state to receive the inquiry packets.

1.3: The destination will then enter the **inquiry response state** and send an inquiry reply to the source.

After the inquiry procedure has completed, a connection can be established using the paging procedure.

Step 2:

With the **paging procedure**, an actual connection can be established. The paging procedure typically follows the inquiry procedure. Only the Bluetooth device address is required to set up a connection. Knowledge about the clock (clock estimate) will accelerate the setup procedure. A unit that establishes a connection will carry out a page procedure and will automatically be the master of the connection. The procedure occurs as follows:

2.1:	A device (the source) pages another device (the destination).	**Page** state
2.2:	The destination receives the page.	**Page Scan** state
2.3:	The destination sends a reply to the source.	**Slave Response** state : (Step 1)
2.4:	The source sends an FHS packet to the destination.	**Master Response** state : (Step 1)
2.5:	The destination sends it's second reply to the source.	**Slave Response** state : (Step 2)
2.6:	The destination & source then switch to the source channel parameters.	**Master Response** state: Step 2 **& Slave Response** state: Step 3

The **Connection** state starts with a POLL packet sent by the master to verify that slave has switched to the master's timing and channel frequency hopping. The slave can respond with any type of packet.

2.3.3 Connection Modes

A Bluetooth device in the **Connection** state can be in any of the four following modes: **Active, Hold, Sniff** and **Park** mode.

- **Active Mode:** In the active mode, the Bluetooth unit actively participates on the channel. The master schedules the transmission based on traffic demands to and from the different slaves. In addition, it supports regular transmissions to keep slaves synchronized to the channel. Active slaves listen in the master-to-slave slots for packets. If an active slave is not addressed, it may sleep until the next new master transmission.

- **Sniff Mode:** Devices synchronized to a piconet can enter power-saving modes in which device activity is lowered. In the SNIFF mode, a slave device listens to the piconet at reduced rate, thus reducing its duty cycle. The SNIFF interval is programmable and depends on the application. It has the highest duty cycle (least power efficient) of all 3 power saving modes (sniff, hold & park).

- **Hold Mode**: Devices synchronized to a piconet can enter power-saving modes in which device activity is lowered. The master unit can put slave units into HOLD mode, where only an internal timer is running. Slave units can also demand to be put into HOLD mode. Data transfer restarts instantly when units transition out of HOLD mode. It has an intermediate duty cycle (medium power efficient) of the 3 power saving modes (sniff, hold & park).

- **Park Mode:** In the PARK mode, a device is still synchronized to the piconet but does not participate in the traffic. Parked devices have given up their MAC (AM_ADDR) address and occasional listen to the traffic of the master to re-synchronize and check on broadcast messages. It has the lowest duty cycle (power efficiency) of all 3 power saving modes (sniff, hold & park).

2.3.4 Scatternet

Multiple piconets may cover the same area. Since each piconet has a different master, the piconets hop independently, each with their own channel hopping sequence and phase as determined by the respective master. In addition, the packets carried on the channels are preceded by different channel access codes as determined by the master device addresses. As more piconets are added, the probability of collisions increases; a graceful degradation of performance results as is common in frequency-hopping spread spectrum systems.

If multiple piconets cover the same area, a unit can participate in two or more overlaying piconets by applying time multiplexing. To participate on the proper channel, it should use the associated master device address and proper clock offset to obtain the correct phase. A Bluetooth unit can act as a slave in several piconets, but only as a master in a single piconet. A group of piconets in which connections consists between different piconets is called a **scatternet**.

Sometimes an existing master or slave may wish to swap roles (i.e a **master-slave switch**) , this can take place in two steps:

1. First a TDD switch of the considered master and slave, followed by a piconet switch of the both participants.
2. Then, if so desired, other slaves of the old piconet can be transferred to the new piconet.

When a unit have acknowledged the reception of the FHS packet, this unit uses the new piconet parameters defined by the new master and the piconet switch is completed.

2.4 Other Baseband Functions

2.4.1 Error Correction

There are three kinds of error correction schemes used in the baseband protocol: 1/3 rate FEC, 2/3 rate FEC and ARQ scheme.

- In **1/3 rate FEC** every bit is repeated three times for redundancy,
- In **2/3 rate FEC** a generator polynomial is used to encode 10 bit code to a 15 bit code,

- In the **ARQ scheme** , **DM, DH** and the data field of **DV** packets are retransmitted till an acknowledgement is received (or timeout is exceeded). Bluetooth uses fast, unnumbered acknowledgement in which it uses positive and negative acknowledgements by setting appropriate ARQN values. If the timeout value is exceeded, Bluetooth flushes the packet and proceeds with the next.

2.4.2 Flow Control

The Baseband protocol recommends using FIFO queues in ACL and SCO links for transmission and receive. The Link Manager fills these queues and link controller empties the queues automatically.

If these RX FIFO queues are full, flow control is used to avoid dropped packets and congestion. If data cannot be received, a **stop** indication is transmitted inserted by the Link Controller of the receiver into the header of the return packet. When the transmitter receives the **stop** indication, it freezes its FIFO queues. If receiver is ready it sends a **go** packet which resumes the flow again.

2.4.3 Synchronization

The Bluetooth transceiver uses a time-division duplex (TDD) scheme ,meaning that it alternately transmits and receives in a synchronous manner. The average timing of master packet transmission should not drift faster than 20 ppm relative to the ideal slot timing of 625 us. Jitter from average timing should be less than 1 microsecond.

The piconet is synchronized by the system clock of the master.To transmit on the piconet channel you need 3 pieces of information, The (channel) hopping sequence, the phase of the sequence, and the CAC to place on the packets

1	**Channel Hopping Sequence**	The Bluetooth Device Address (BD_ADDR) of the master is used to derive this frequency hopping sequence.
2	**Phase**	The system clock of the master determines the phase in the hopping sequence.
3	**Channel Access Code**	This is derived from the Bluetooth Device Address (BD_ADDR) of the master.

The slaves adapt their native clocks with a timing offset in order to match the master clock, giving then an estimated clock value. The offset is zero for the master as it's native clock **is** the master clock. The Bluetooth clocks should have the LSB ticking in units of 312.5us, giving a clock rate of 3.2kHz.

A 20us uncertainty window is allowed around the exact receive time in order for the access correlator for the receiver to search for the correct channel access code and get synchronized with the transmitter. When a slave returns from the hold mode, it can correlate over a bigger uncertainty window till they don't overlap slots. A parked slave periodically wakes up to listen to beacons from the master and re-synchronizes its clock offset.

2.4.4 Bluetooth Security

   At the link layer, security is maintained by [authentication](#) of the peers and encryption of the information. For this basic security we need a public address which is unique for each device (BD_ADDR), two secret keys (authentication keys and encryption key) and a random number generator. First a device does the authentication by issuing a challenge and the other device has to then send a response to that challenge which is based on the challenge, it's BD_ADDR and a [link key](#) shared between them. After authentication, encryption may be used to communicate. See our [Bluetooth Security](#) page and [Bluetooth article(s)](#) for more details

Note , the above text contains excerpts from the Bluetooth SIG's Specification, as well as various interpretations of the Specs. For complete details of the various sections, consult the actual Bluetooth Specification.

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Radio	Baseband	LMP	HCI	L2CAP	RFCOMM	SDP	Profiles

Home
Bookshop
Market Research
Search
Add a Link

Consulting
Database

Bluetooth
Antennas
Articles
Asia-Pacific
Audio
Books
Cathal's Corner
Consultants
Design Tools
Dev Tools
Downloads
Events
FAQ
Forums
Glossary
InfoTooth
News
Products
Profiles
Research
Security
SIG
Shop
Subscribe
Technology
Testing
Training
Tutorial
WLANs & BT

**What Is
Bluetooth?**

Link Manager Protocol (LMP)

The Link Manager carries out link setup, authentication, link configuration and other protocols. It discovers other remote LM's and communicates with them via the Link Manager Protocol (LMP). To perform its service provider role, the LM uses the services of the underlying Link Controller (LC).

The Link Manager Protocol essentially consists of a number of PDU (protocol Data Units), which are sent from one device to another, determined by the AM_ADDR in the packet header. LM PDUs are always sent as single-slot packets and the payload header is therefore one byte.

DM1 packets are used to transport LM PDUs except if an SCO link is present using HV1 packets and length of content is less than 9 bytes. In this case DV packets are used.

The following is a brief list of the types of PDU's available and their function/operation. These PDU are either Mandatory : M (must be supported), or Optional : O (optionally supported)

For more details : Download the LMP Specification from the SIG website, or visit the Documents Page.

Table Of Contents

3.1 LMP PDUs

3.1.1 General Response

(M) LMP_accepted , LMP_not_accepted

These PDU's are used as response messages to other PDU's in a number of different procedures, containing the opcode of the message that is being responded to.

3.1.2 Authentication

(M) LMP_au_rand , LMP_sres

The authentication procedure is based on a challenge-response scheme. The verifier sends an LMP_au_rand PDU which contains a random number (the challenge) to the claimant. The claimant calculates a response, which is a function of the challenge, the claimant's BD_ADDR and a secret key. The response is sent back to the verifier, which checks if the response was correct or not. A successful calculation of the authentication response requires that two devices share a secret key. Both the master and the slave can be verifiers.

3.1.3 Pairing

(M) LMP_in_rand , LMP_au_rand , LMP_sres , LMP_comb_key , LMP_unit_key

When two devices do not have a common link key an initialization key (K init) is created based

on a PIN and a random number. When both devices have calculated K init the link key is created, and finally a mutual authentication is made. The pairing procedure starts with a device sending LMP_in_rand; this device is referred to as "initiating LM" or "initiator" in. The other device is referred to as "responding LM" or "responder".

3.1.4 Change Link Key

(M) LMP_comb_key

If the link key is derived from combination keys and the current link is the semi-permanent link key, the link key can be changed. If the link key is a unit key, the units must go through the pairing procedure in order to change the link key. The contents of LMP_comb_key is protected by a bitwise XOR with the current link key.

3.1.5 Change the Current Link Key

(M) LMP_temp_rand , LMP_temp_key , LMP_use_semi_permanent_key

The current link key can be a semi-permanent link key or a temporary link key key. It can be changed temporarily, but the change is only valid for the session. Changing to a temporary link key is necessary if the piconet is to support encrypted broadcast.

3.1.6 Encryption

(O) LMP_encryption_mode_req , LMP_encryption_key_size_req , LMP_start_encryption_req , LMP_stop_encryption_req

If at least one authentication has been performed encryption may be used. If the master wants all slaves in the piconet to use the same encryption parameters it must issue a temporary key (K master) and make this key the current link key for all slaves in the piconet before encryption is started. This is necessary if broadcast packets should be encrypted.

3.1.7 Clock Offset Request

(M) LMP_clkoffset_req, LMP_clkoffset_res

When a slave receives the FHS packet, the difference is computed between its own clock and the master's clock included in the payload of the FHS packet. The clock offset is also updated each time a packet is received from the master. The master can request this clock offset anytime during the connection. By saving this clock offset the master knows on what RF channel the slave wakes up to PAGE SCAN after it has left the piconet. This can be used to speed up the paging time the next time the same device is paged.

3.1.8 Slot Offset Request

(O) LMP_slot_offset

   With LMP_slot_offset the information about the difference between the slot boundaries in different piconets is transmitted. This PDU carries the parameters slot offset and BD_ADDR. The slot offset is the subtraction of time in us of the start of the master's TX slot in the piconet where the PDU is transmitted from the time in us of the start of the master's TX slot in the piconet where the BD_ADDR device is master modulo 1250.

. Before doing a master-slave switch, this PDU shall be transmitted from the device that becomes master in the switch procedure. The PDU can also be useful in inter-piconet communications.

3.1.9 Timing Accuracy Information Request

(O) LMP_timing_accuracy_req , LMP_timing_accuracy_res

   LMP supports requests for the timing accuracy. This information can be used to minimize the scan window for a given hold time when returning from hold and to extend the maximum hold time. It can also be used to minimize the scan window when scanning for the sniff mode slots or the park mode beacon packets. The timing accuracy parameters returned are the long term drift measured in ppm and the long term jitter measured in μs of the clock used during hold, sniff and park mode. These parameters are fixed for a certain device and must be identical when requested several times.

3.1.10 LMP Version

(M) LMP_version_req , LMP_version_res

   The LMP layer supports requests for the version of the LM protocol. The requested device will send a response with three parameters: VersNr, CompId and Sub-VersNr. VersNr specifies the version of the Bluetooth LMP specification that the device supports. CompId is used to track possible problems with the lower Bluetooth layers. All companies that create a unique implementation of the Link Manager shall have their own CompId. The same company is also responsible for the administration and maintenance of the SubVersNr. It is recommended that each company has a unique SubVersNr for each RF/BB/LM implementation.

3.1.11 Supported Features

(M) LMP_features_req , LMP_features_res

   The Bluetooth radio and link controller may support only a subset of the packet types and features described in Baseband Specification and Radio Specification. A device may not send any packets other than ID, FHS, NULL, POLL, DM1 or DH1 before it is aware of the supported features of the other device. After the features request has been carried out, the intersection of the supported packet types for both sides may also be transmitted. Whenever a request is issued, it must be compatible with the supported features of the other device. For instance, when establishing an SCO link the initiator may not propose to use HV3 packets if that packet type is not supported by the other device.

3.1.12 Switch of Master-Slave Role

(O) LMP_switch_req , LMP_slot_offset

    Since the paging device always becomes the master of the piconet, a switch of the master-slave role is sometimes needed. Suppose device A is slave and device B is master. The device that initiates the switch finalises the transmission of the current L2CAP message and then sends LMP_switch_req. Note: in a slave initiated master-slave switch the slave (A) will first send LMP_slot_offset, then LMP_switch. In a master initiated master-slave switch, the master (B) will first send LMP_switch, before receiving LMP_slot_offset from the slave (A). If the switch is accepted, the other device finalises the transmission of the current L2CAP message and then responds with LMP_accepted. The switch procedure then takes place, and afterwards device A is master and device B is slave.

3.1.13 Name Request

(M) LMP_name_req , LMP_name_res

    LMP supports name request to another Bluetooth device. The name is a user-friendly name associated with the Bluetooth device and consists of a maximum of 248 bytes coded according to the UTF-8 standard. The name is fragmented over one or more DM1 packets.

3.1.14 Detach

(M) LMP_detach

    The connection between two Bluetooth devices can be closed anytime by the master or the slave. A reason parameter is included in the message to inform the other party of why the connection is closed.

3.1.15 Hold Mode

(O) LMP_hold , LMP_hold_req

    The ACL link of a connection between two Bluetooth devices can be placed in hold mode for a specified hold time. During this time no ACL packets will be transmitted from the master. The hold mode is typically entered when there is no need to send data for a relatively long time. The transceiver can then be turned off in order to save power. But the hold mode can also be used if a device wants to discover or be discovered by other Bluetooth devices, or wants to join other piconets. What a device actually does during the hold time is not controlled by the hold message, but it is up to each device to decide.

3.1.16 Sniff Mode

(O) LMP_sniff_req , LMP_unsniff_req

To enter sniff mode, master and slave negotiate a sniff interval T sniff and a sniff offset, D sniff , which specifies the timing of the sniff slots. The offset determines the time of the first sniff slot; after that the sniff slots follows periodically with the sniff interval T sniff . When the link is in sniff mode the master can only start a transmission in the sniff slot. Two parameters control the listening activity in the slave. The sniff attempt parameter determines for how many slots the slave must listen, beginning at the sniff slot, even if it does not receive a packet with its own AM address. The sniff timeout parameter determines for how many additional slots the slave must listen if it continues to receive only packets with its own AM address.

3.1.17 Park Mode

(O) LMP_park_req , LMP_unpark_PM_ADDR_req , LMP_unpark_BD_ADDR_req , LMP_set_broadcast_scan_window , LMP_modify_beacon

If a slave does not need to participate in the channel, but still should be FH-synchronized, it can be placed in park mode. In this mode the device gives up its AM_ADDR but still re-synchronizes to the channel by waking up at the beacon instants separated by the beacon interval. The beacon interval, a beacon offset and a flag indicating how the first beacon instant is calculated determine the first beacon instant. After this the beacon instants follow periodically at the predetermined beacon interval. At the beacon instant the parked slave can be activated again by the master, the master can change the park mode parameters, transmit broadcast information or let the parked slaves request access to the channel.

All PDUs sent from the master to the parked slaves are broadcast. These PDUs are the only PDUs that can be sent to a slave in park mode and the only PDUs that can be broadcast. When a slave is placed in park mode it is assigned a unique PM_ADDR, which can be used by the master to unpark that slave.

3.1.18 Power Control

(O) LMP_incr_power_req , LMP_decr_power_req , LMP_max_power , LMP_min_power

If the RSSI value differs too much from the preferred value of a Bluetooth device, it can request an increase or a decrease of the other device's TX power. Upon receipt of this message, the output power is increased or decreased one step. At the master side the TX power is completely independent for different slaves; a request from one slave can only effect the master's TX power for that same slave.The power adjustment requests can be made at anytime following a successful baseband paging procedure. If a device does not support power control requests this is indicated in the supported features list.

3.1.19 Channel Quality-Driven Change (between DM and DH)

(O) LMP_auto_rate , LMP_preferred_rate

The data throughput for a given packet type depends on the quality of the RF channel. Quality measurements in the receiver of one device can be used to dynamically control the packet type transmitted from the remote device for optimization of the data throughput. If a device A wants the remote device B to have this control it sends LMP_auto_rate once. The device B can then send back LMP_preferred_rate to device A whenever it wishes to change the packet type that A transmits.

This PDU has a parameter which determines the preferred coding (with or without 2/3FEC) and the preferred size (in slots) of the packets. Device A is not required to change to the packet type specified by this parameter and may never send a packet that is larger than the maximum allowed number of slots even if the preferred size is greater than this value.

3.1.20 Quality of Service

(M) LMP_quality_of_service , LMP_quality_of_service_req

The LM provides Quality of Service capabilities. A poll interval, which is defined as the maximum time between subsequent transmissions from the master to a particular slave, is used to support bandwidth allocation and latency control. In addition, master and slave negotiate the number of repetitions for broadcast packets (NBC).

3.1.21 SCO Links

(O) LMP_SCO_link_req , LMP_remove_SCO_link_req

When a connection has been established between two Bluetooth devices the connection consists of an ACL link. One or more SCO links can then be established. The SCO link reserves slots separated by the SCO interval, T_{sco} . The first slot reserved for the SCO link is defined by T_{sco} and the SCO delay, D_{sco} . After that the SCO slots follows periodically with the SCO interval. Each SCO link is distinguished from all other SCO links by an SCO handle.

3.1.22 Control of Multi-Slot Packets

(M) LMP_max_slot , LMP_max_slot_req

The number of slots used by a device can be limited. A device allows the remote device to use a maximal number of slots by sending the PDU LMP_max_slot providing max slots as parameter. Each device can request to use a maximal number of slots by sending the PDU LMP_max_slot_req providing max slots as parameter. After a new connection, as a result of page, page scan, master-slave switch or unpark, the default value is 1 slot. Two PDUs are used for the control of multi-slot packets.These PDUs can be sent at anytime after connection setup is completed.

3.1.23 Paging Scheme

(O) LMP_page_mode_req , LMP_page_scan_mode_req

In addition to the mandatory paging scheme, the Bluetooth system defines optional paging schemes. LMP provides a means to negotiate the paging scheme, which is to be used the next time a unit is paged.

3.1.24 Link Supervision

(M) LMP_supervision_timeout

Each Bluetooth link has a timer that is used for link supervision. This timer is used to detect link loss caused by devices moving out of range, a device's power-down, or other similar failure cases. An LMP procedure is used to set the value of the supervision timeout.

3.1.25 Connection Establishment

(M) LMP_host_connection_req , LMP_setup_complete

When the paging device wishes to create a connection involving layers above LM, it sends LMP_host_connection_req. When the other side receives this message, the host is informed about the incoming connection. The remote device can accept or reject the connection request by sending LMP_accepted or LMP_not_accepted.

If LMP_host_connection_req is accepted, LMP security procedures (pairing, authentication and encryption) can be invoked. When a device is not going to initiate any more security procedures during connection establishment it sends LMP_setup_complete. When both devices have sent LMP_setup_complete the first packet on a logical channel different from LMP can then be transmitted.

3.1.26 Test Mode

(M) LMP_test_activate , LMP_test_control

LMP has PDUs to support different Bluetooth test modes, which are used for certification and compliance testing of the Bluetooth radio and baseband.

3.1.27 Error Handling

(M) LMP_not_accepted

If the Link Manager receives a PDU with unrecognised opcode, it responds with LMP_not_accepted with the reason code *unknown LMP PDU.* The opcode parameter that is echoed back is the unrecognised opcode. If the Link Manager receives a PDU with invalid parameters, it responds with LMP_not_accepted with the reason code *invalid LMP parameter*s. If the maximum response time is exceeded or if a link loss is detected the party that waits for the response shall conclude that the procedure has terminated unsuccessfully.

Erroneous LMP messages can be caused by errors on the channel or systematic errors at the

transmit side. To detect the latter case, the LM should monitor the number of erroneous messages and disconnect if it exceeds a threshold, which is implementation-dependent.

Note , the above text contains excerpts from the Bluetooth SIG's Specification, as well as various interpretations of the Specs. For complete details of the various sections, consult the actual Bluetooth Specification.

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Tutorial
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What Is Bluetooth?

| Radio | Baseband | LMP | HCI | L2CAP | RFCOMM | SDP | Profiles |

Host Controller Interface (HCI)

The HCI provides a command interface to the baseband controller and link manager, and access to hardware status and control registers. Essentially this interface provides a uniform method of accessing the Bluetooth baseband capabilities.The HCI exists across 3 sections, the Host - Transport Layer - Host Controller. Each of the sections has a different role to play in the HCI system.

For more details : Download the HCI Specification from the SIG website, or visit the Documents Page.

Table Of Contents

4.1 HCI Functional Entities

The HCI is functionally broken up into 3 separate parts:
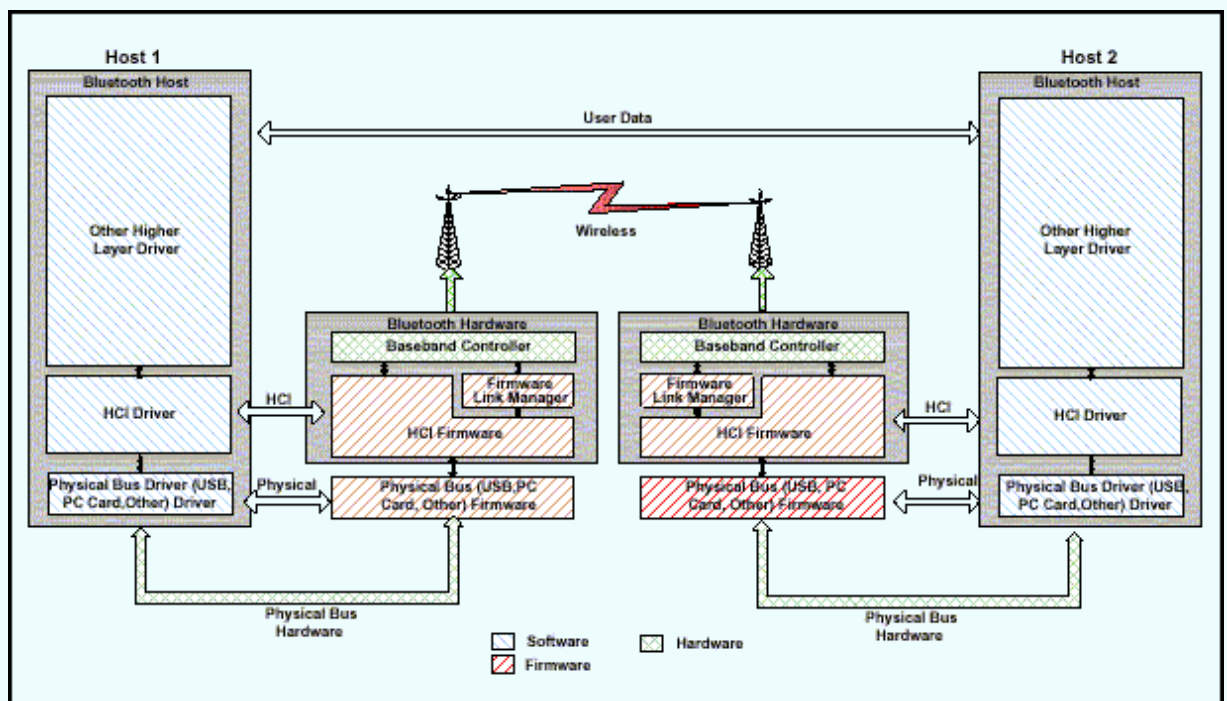
*Diagram Source: Courtesy of Bluetooth SIG,HCI Specs, Fig 1.2 , p 544

4.1.1 HCI Firmware   (location: Host Controller)

HCI Firmware , is located on the **Host Controller** , (e.g. the actual **Bluetooth hardware device**). The HCI firmware implements the HCI Commands for the Bluetooth hardware by accessing baseband commands, link manager commands, hardware status registers, control registers, and event registers. The term **Host** Controller means the **HCI-enabled** Bluetooth device

4.1.2 HCI Driver   (location: Host)

HCI Driver , which is located on the **Host** (e.g. **software entity**). The Host will receive asynchronous notifications of HCI events, HCI events are used for notifying the Host when something occurs. When the Host discovers that an event has occurred it will then parse the received event packet to determine which event occurred. The term **Host** means the **HCI-enabled** Software Unit.

4.1.3 Host Controller Transport Layer   (location: Intermediate Layers)

The HCI Driver and Firmware communicate via the **Host Controller Transport Layer** , i.e. a definition of the several layers that may exist between the HCI driver on the host system and the HCI firmware in the Bluetooth hardware. These intermediate layers, the Host Controller Transport Layer, should provide the ability to transfer data without intimate knowledge of the data being transferred. Several different Host Controller Layers can be used, of which 3 have been defined initially for Bluetooth : **USB** , **UART** and **RS232.** The Host should receive asynchronous notifications of HCI events independent of which Host Controller Transport Layer is used.

4.2 HCI Commands

The HCI provides a uniform command method of accessing the Bluetooth hardware capabilities. The HCI Link commands provide the Host with the ability to control the link layer connections to other Bluetooth devices. These commands typically involve the Link Manager ([LM](#)) to exchange [LMP](#) commands with remote Bluetooth devices. The HCI Policy commands are used to affect the behaviour of the local and remote LM. These Policy commands provide the Host with methods of influencing how the LM manages the piconet. The *Host Controller and Baseband commands*, *Informational commands* , and *Status commands* provide the Host access to various registers in the Host Controller.

4.2.1 HCI-Specific Information Exchange

The Host Controller Transport Layer provides transparent exchange of HCI-specific information. These transporting mechanisms provide the ability for the Host to send HCI commands, [ACL](#) data, and [SCO](#) data to the Host Controller. These transport mechanisms also provide the ability for the Host to receive HCI events, ACL data, and SCO data from the Host Controller. Since the Host Controller Transport Layer provides transparent exchange of HCI-specific information, the HCI specification specifies the format of the commands, events, and data exchange between the Host and the Host Controller.

4.2.2 Link Control Commands

The Link Control commands allow the Host Controller to control connections to other Bluetooth devices. When the Link Control commands are used, the Link Manager (LM) controls how the Bluetooth [piconets](#) and [scatternets](#) are established and maintained. These commands instruct the LM to create and modify link layer connections with Bluetooth remote devices, perform [Inquiries](#) of other Bluetooth devices in range, and other LMP commands.

4.2.3 Link Policy Commands

   The Link Policy Commands provide methods for the Host to affect how the Link Manager manages the piconet. When Link Policy Commands are used, the LM still controls how Bluetooth piconets and scatternets are established and maintained, depending on adjustable policy parameters. These policy commands modify the Link Manager behaviour that can result in changes to the link layer connections with Bluetooth remote devices.

4.2.4 Host Controller & Baseband Commands

   The Host Controller & Baseband Commands provide access and control to various capabilities of the Bluetooth hardware. These parameters provide control of Bluetooth devices and of the capabilities of the Host Controller, Link Manager, and Baseband. The host device can use these commands to modify the behaviour of the local device.

4.2.5 Informational Parameters

   The Informational Parameters are fixed by the manufacturer of the Bluetooth hardware. These parameters provide information about the Bluetooth device and the capabilities of the Host Controller, Link Manager, and Baseband. The host device cannot modify any of these parameters.

4.2.6 Status Parameters

   The Host Controller modifies all status parameters. These parameters provide information about the current state of the Host Controller, Link Manager, and Baseband. The host device cannot modify any of these parameters other than to reset certain specific parameters.

4.2.7 Testing Commands

   The Testing commands are used to provide the ability to test various functionality's of the Bluetooth hardware. These commands provide the ability to arrange various conditions for testing.

4.3 HCI Events/ Error Codes/ Flow Control

4.3.1 Flow Control

   Flow control is used in the direction from the Host to the Host Controller to avoid filling up the Host Controller data buffers with ACL data destined for a remote device (connection handle) that is not responding. It is the Host that manages the data buffers of the Host Controller.

4.3.2 HCI Events

   A number of different events are defined for the HCI layer. The events provide a method to return parameters and data associated for each event. 32 HCI different events have been implemented so far, they range from *Inquiry Complete Event* to *Page Scan Repetition Mode Change Event.* See the main HCI specs for mode details.

4.3.3 HCI Error Codes

   A large number of error codes have been defined for the HCI layer. When a command fails, Error codes are returned to indicate the reason for the error. 35 HCI error codes have so far been defined, from *Unknown HCI Command* to *LMP PDU Not Allowed.*See the main HCI specs for mode details.

4.4 Bluetooth-defined Host Controller Transport Layers

4.4.1 UART Transport Layer

   The objective of the HCI UART Transport Layer is to make it possible to use the Bluetooth HCI over a serial interface between two UARTs on the same PCB. The HCI UART Transport Layer assumes that the UART communication is free from line errors. Event and data packets flow through this layer, but the layer does not decode them.

4.4.2 RS232 Transport Layer

   The objective of the HCI RS232 Transport Layer is to make it possible to use the Bluetooth HCI over one physical RS232 interface between the Bluetooth Host and the Bluetooth Host Controller. Event and data packets flow through this layer, but the layer does not decode them.

4.4.3 USB Transport Layer

   The objective of the Universal Serial Bus (USB) Transport Layer is to the use a USB hardware interface for Bluetooth hardware (which can be embodied in one of two ways: as a USB dongle, or integrated onto the motherboard of a notebook PC). A class code will be used that is specific to all USB Bluetooth devices. This will allow the proper driver stack to load, regardless of which vendor built the device. It also allows HCI commands to be differentiated from USB commands across the control endpoint.

Note, the above text contains excerpts from the Bluetooth SIG's Specification, as well as various interpretations of the Specs. For complete details of the various sections, consult the actual Bluetooth Specification.

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| **Radio** | **Baseband** | **LMP** | **HCI** | **L2CAP** | **RFCOMM** | **SDP** | **Profiles** |

Logical Link Control and Adaptation Protocol

The Logical Link Control and Adaptation Layer Protocol (L2CAP) is layered over the Baseband Protocol and resides in the data link layer. L2CAP provides connection-oriented and connectionless data services to upper layer protocols with protocol multiplexing capability, segmentation and reassembly operation, and group abstractions. L2CAP permits higher level protocols and applications to transmit and receive L2CAP data packets up to 64 kilobytes in length.

Two link types are supported for the Baseband layer : Synchronous Connection-Oriented (SCO) links and Asynchronous Connection-Less (ACL) links. SCO links support real-time voice traffic using reserved bandwidth. ACL links support best effort traffic. The L2CAP Specification is defined for only ACL links and no support for SCO links is planned.

For more details : Download the L2CAP Specification from the SIG website, or visit the Documents Page

Table Of Contents

5.1 L2CAP Functional Requirements

L2CAP supports several important protocol requirements:

5.1.1 Protocol Multiplexing

L2CAP must support protocol multiplexing because the Baseband Protocol does not support any 'type' field identifying the higher layer protocol being multiplexed above it. L2CAP must be able to distinguish between upper layer protocols such as the Service Discovery Protocol , RFCOMM , and Telephony Control .

5.1.2 Segmentation & Reassembly

Compared to other wired physical media, the data packets defined by the Baseband Protocol are limited in size. Exporting a maximum transmission unit (MTU) associated with the largest Baseband payload (341 bytes for DH5 packets) limits the efficient use of bandwidth for higher layer protocols that are designed to use larger packets. Large L2CAP packets must be segmented into multiple smaller Baseband packets prior to their transmission over the air. Similarly, multiple received Baseband packets may be reassembled into a single larger L2CAP packet following a simple integrity check. The Segmentation and Reassembly (SAR) functionality is absolutely necessary to support protocols using packets larger than those supported by the Baseband.

5.1.3 Quality of Service

The L2CAP connection establishment process allows the exchange of information regarding the quality of service (QoS) expected between two Bluetooth units. Each L2CAP implementation must monitor the resources used by the protocol and ensure that QoS contracts are honoured.

5.1.4 Groups

Many protocols include the concept of a group of addresses. The Baseband Protocol supports the concept of a piconet, a group of devices synchronously hopping together using the same clock. The L2CAP group abstraction permits implementations to efficiently map protocol groups on to piconets. Without a group abstraction, higher level protocols would need to be exposed to the Baseband Protocol and Link Manager functionality in order to manage groups efficiently.

5.2 L2CAP General Operation

The L2CAP layer is based around the concept of *'channels'*. Each one of the end-points of an L2CAP channel is referred to by a *channel identifier.*

5.2.1 Channel Identifiers

Channel identifiers (CIDs) are local names representing a logical channel end-point on the device. Implementations are free to manage the CIDs in a manner best suited for that particular implementation, with the provision that the same CID is not reused as a local L2CAP channel endpoint for multiple simultaneous L2CAP channels between a local device and some remote device.

 CID assignment is relative to a particular device and a device can assign CIDs independently from other devices (with the exception of certain reserved CIDs , such as the signalling channel). Thus, even if the same CID value has been assigned to (remote) channel endpoints by several remote devices connected to a single local device, the local device can still uniquely associate each remote CID with a different device.

5.2.2 Operation between Devices

The connection-oriented data channels represent a connection between two devices, where a CID identifies each endpoint of the channel. The connectionless channels restrict data flow to a single direction. These channels are used to support a channel 'group' where the CID on the source represents one or more remote devices. There are also a number of CIDs reserved for special purposes. The signalling channel is one example of a reserved channel. This channel is used to create and establish connection-oriented data channels and to negotiate changes in the characteristics of these channels. Support for a signalling channel within an L2CAP entity is mandatory. Another CID is reserved for all incoming connectionless data traffic.

5.2.3 Operation between Layers

L2CAP implementations follow the general architecture described here:

- L2CAP implementations must transfer data between higher layer protocols and the lower layer protocol.
- Each implementation must also support a set of signalling commands for use between L2CAP implementations.
- L2CAP implementations should also be prepared to accept certain types of events from lower layers and generate events to upper layers. How these events are passed between layers is an implementation-dependent process.

5.2.4 Segmentation & Reassembly

Segmentation and reassembly (SAR) operations are used to improve efficiency by supporting a maximum transmission unit (MTU) size larger than the largest Baseband packet. This reduces overhead by spreading the network and transport packets used by higher layer protocols over several Baseband packets. All L2CAP packets may be segmented for transfer over Baseband packets. The protocol does not perform any segmentation and reassembly operations but the packet format supports adaptation to smaller physical frame sizes.

An L2CAP implementation exposes the outgoing (i.e., the remote host's receiving) MTU and segments higher layer packets into '**chunks**' that can be passed to the Link Manager via the Host Controller Interface (HCI), whenever one exists. On the receiving side, an L2CAP implementation receives '**chunks**' from the HCI and reassembles those chunks into L2CAP packets using information provided through the HCI and from the packet header.

5.3 L2CAP State Machine

This section describes the L2CAP connection-oriented channel state machine. The section defines the states, the events causing state transitions, and the actions to be performed in response to events. This state machine is only pertinent to bi-directional CIDs and is not representative of the signalling channel or the uni-directional channel.
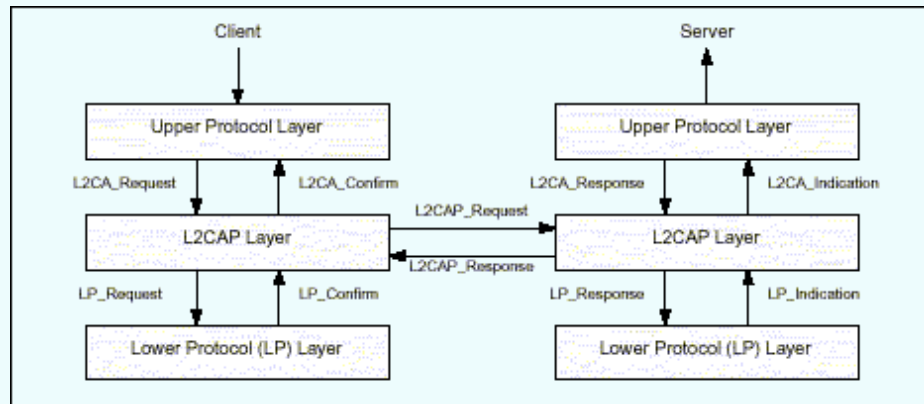
*Diagram Source: Courtesy of Bluetooth SIG, L2CAP Specs, Fig 3.1 , p 258

The figure* above illustrates the events and actions performed by an implementation of the L2CAP layer. Client and Server simply represent the initiator of the request and the acceptor of the request respectively. An application-level Client would both initiate and accept requests. The naming convention is as follows.

- The interface between two layers (vertical interface) uses the prefix of the lower layer offering the service to the higher layer, e.g., L2CA.
- The interface between two entities of the same layer (horizontal interface) uses the prefix of the protocol (adding a P to the layer identification), e.g., L2CAP.
- Events coming from above (starting above) are called Requests (Req) and the corresponding replies are called Confirms (Cfm).
- Events coming from below (starting below) are called Indications (Ind) and the corresponding replies are called Responses (Rsp).
- Responses requiring further processing are called Pending (Pnd). The notation for Confirms and Responses assumes positive replies. Negative replies are denoted by a 'Neg' suffix such as L2CAP_ConnectCfmNeg.

5.4 Other L2CAP Features

5.4.1 Data Packet Format

L2CAP is packet-based but follows a communication model based on *channel*s. A channel represents a data flow between L2CAP entities in remote devices. Channels may be connection-oriented or connectionless. All packet fields use Little Endian byte order.

5.4.2 Signalling

Various signalling commands can be passed between two L2CAP entities on remote devices. All

signalling commands are sent to CID 0x0001 (the signalling channel). The L2CAP implementation must be able to determine the Bluetooth address (BD_ADDR) of the device that sent the commands. Multiple commands may be sent in a single (L2CAP) packet and packets are sent to CID 0x0001. MTU Commands take the form of Requests and Responses. For a complete list see the L2CAP specs.

5.4.3 Configuration Parameter Options

Options are a mechanism to extend the ability to negotiate different connection requirements. Options are transmitted in the form of information elements comprised an option type, an option length, and one or more option data fields.

5.4.4 Service Primitives

Several services are offered by L2CAP in terms of service primitives and parameters. The service interface is required for testing. They include primitives to :

- **Connection**: setup , configure , disconnect
- **Data**: read , write
- **Group**: create, close, add member, remove member , get membership
- **Information**: ping, get info, request a call-back at the occurrence of an event
- **Connection-less Traffic**: enable, disable

Note , the above text contains excerpts from the Bluetooth SIG's Specification, as well as various interpretations of the Specs. For complete details of the various sections, consult the actual Bluetooth Specification.

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Glossary
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SIG
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Testing
Training
Tutorial
WLANs & BT

What Is Bluetooth?

| Radio | Baseband | LMP | HCI | L2CAP | RFCOMM | SDP | Profiles |

RFCOMM Protocol

The RFCOMM protocol provides emulation of serial ports over the L2CAP protocol. The protocol is based on the ETSI standard TS 07.10. Only a subset of the TS 07.10 standard is used, and some adaptations of the protocol are specified in the Bluetooth RFCOMM specification.

For more details: Download the RFCOMM Specification from the SIG website, or visit the Documents Page.

6.1 RFCOMM Overview/Service

RFCOMM is a simple transport protocol, which provides emulation of RS232 serial ports over the L2CAP protocol.The protocol is based on the ETSI standard TS 07.10. Only a subset of the TS 07.10 standard is used and an RFCOMM - specific extension is added, in the form of a mandatory credit based flow control scheme.

The RFCOMM protocol supports up to 60 simultaneous connections between two BT devices. The number of connections that can be used simultaneously in a BT device is implementation-specific. For the purposes of RFCOMM, a complete communication path involves two applications running on different devices (the communication endpoints) with a communication segment between them.

6.1.1 Device Types

Basically two device types exist that RFCOMM must accommodate.

- **Type 1 Devices** are communication end points such as computers and printers.
- **Type 2 Devices** are those that are part of the communication segment; e.g. modems.

Though RFCOMM does not make a distinction between these two device types in the protocol, accommodating both types of devices impacts the RFCOMM protocol.

The information transferred between two RFCOMM entities has been defined to support both type 1 and type 2 devices. Some information is only needed by type 2 devices while other information is intended to be used by both. In the protocol, no distinction is made between type 1 and type 2. Since the device is not aware of the type of the other device in the communication path, each must pass on all available information specified by the protocol.

6.1.2 Control Signals

RFCOMM emulates the 9 circuits of an RS-232 interface. The circuits are listed below.

Pin Circuit Name
102 Signal Common
103 Transmit Data (TD)
104 Received Data (RD)
105 Request to Send (RTS)
106 Clear to Send (CTS)
107 Data Set Ready (DSR)

108 Data Terminal Ready (DTR)
109 Data Carrier Detect (CD)
125 Ring Indicator (RI)

6.1.3 Null Modem Emulation

RFCOMM is based on TS 07.10. When it comes to transfer of the states of the non-data circuits, TS 07.10 does not distinguish between DTE and DCE devices. The RS-232 control signals are sent as a number of DTE/DCE independent signals.

The way in which TS 07.10 transfers the RS-232 control signals creates an implicit null modem when two devices of the same kind are connected together. No single null-modem cable wiring scheme works in all cases; however the null modem scheme provided in RFCOMM should work in most cases.

6.1.4 Multiple Emulated Serial Ports

Two BT devices using RFCOMM in their communication may open multiple emulated serial ports. RFCOMM supports up to 60 open emulated ports; however the number of ports that can be used in a device is implementation-specific. A **Data Link Connection Identifier** (DLCI) identifies an ongoing connection between a client and a server application. The DLCI is represented by 6 bits, but its usable value range is 2…61. The DLCI is unique within one RFCOMM session between two devices.

To account for the fact that both client and server applications may reside on both sides of an RFCOMM session, with clients on either side making connections independent of each other, the **DLCI value space is divided** between the two communicating devices using the concept of RFCOMM server channels.

If a BT device supports multiple emulated serial ports and the connections are allowed to have endpoints in different BT devices, then the RFCOMM entity must be able to run multiple TS 07.10 multiplexer sessions. Note that each multiplexer session is using its own L2CAP channel ID (CID). The ability to run multiple sessions of the TS 07.10 multiplexer is optional for RFCOMM.

6.2 TS 07.10 Adaptations for RFCOMM

6.2.1 Media Adaption

The opening flag and the closing flags in the 07.10 basic option frame are not used in RFCOMM, instead it is only the fields contained between the flags that are exchanged between the L2CAP layer and RFCOMM layer. There is always exactly one RFCOMM frame contained in each L2CAP frame.

6.2.2 TS 07.10 Multiplexer Startup & Closedown Procedure

The start-up and closedown procedures as specified in section 5.7 in TS 07.10 are not supported.

At any time, there must be at most one RFCOMM session between any pair of devices. When establishing a new DLC, the initiating entity must check if there already exists an RFCOMM session with the remote device, and if so, establish the new DLC on that. A session is identified by the Bluetooth BD_ADDR of the two endpoints.

Step 1:

Startup Procedure: The device opening up the first emulated serial port connection between two devices is responsible for first establishing the multiplexer control channel. This involves the following steps, after which DLCs for user data traffic can be established:

1: Establish an L2CAP channel to the peer RFCOMM entity, using L2CAP service primitives

2: Start the RFCOMM multiplexer by sending SABM command on DLCI 0, and await UA response from peer entity.

Step 2:

Closedown Procedure: The device closing the last connection (DLC) on a particular session is responsible for closing the multiplexer by closing the corresponding L2CAP channel.

Closing the multiplexer by first sending a DISC command frame on DLCI 0 is optional, but it is mandatory to respond correctly to a DISC (with UA response).

Step 3:

Link Loss Handling: If an L2CAP link loss notification is received, the local RFCOMM entity is responsible for sending a connection loss notification to the port emulation/proxy entity for each active DLC. Then all resources associated with the RFCOMM session should be freed.

6.2.3 DLCI Allocation with RFCOMM Server Channels

To account for the fact that both client and server applications may reside on both sides of an RFCOMM session, with clients on either side making connections independent of each other, the DLCI value space is divided between the two communicating devices using the concept of RFCOMM server channels and a direction bit. The RFCOMM server channel number is a subset of the bits in the DLCI part of the address field in the TS 07.10 frame.

Server applications registering with an RFCOMM service interface are assigned a Server Channel number in the range 1…30. For an RFCOMM session, the initiating device is given the direction bit D=1 (and conversely, D=0 in the other device). When establishing a new data link connection on an existing RFCOMM session, the direction bit is used in conjunction with the Server Channel to determine the DLCI to use to connect to a specific application. This DLCI is thereafter used for all packets in both directions between the endpoints.

An RFCOMM entity making a new DLC on an existing session forms the DLCI by combining the Server Channel for the application on the other device, and the inverse of its own direction bit for the session.

6.2.4 Multiplexer Control Commands

Note that in TS 07.10, some Multiplexer Control commands pertaining to specific DLCIs may be exchanged on the control channel (DLCI 0) *before* the corresponding DLC has been established.

Remote Port Negotiation (RPN) Command:	The RPN command can be used before a new DLC is opened and should be used whenever the port settings change.
Remote Line Status (RLS) Command:	This command is used for indication of remote port line status.
DLC Parameter Negotiation (PN) Command:	This is mandatory to use for RFCOMM implementations conforming to the Bluetooth specification version 1.1 and later. This command *must* be used at least before creation of the first DLC on an RFCOMM session, and the initiator has to try to turn on the use of credit based flow control,

6.3 Flow Control Methods Used

Wired ports commonly use flow control such as RTS/CTS to control communications. On the other hand, the flow control between RFCOMM and the lower layer L2CAP depends on the service interface supported by the implementation. In addition RFCOMM has its own flow control mechanisms. The following describes the different flow control mechanisms.

6.3.1 L2CAP Flow Control

L2CAP relies on the flow control mechanism provided by the [Link Manager layer](#) in the baseband. The flow control mechanism between the L2CAP and RFCOMM layers is implementation specific.

6.3.2 Wired Serial Port Flow Control

Wired Serial port flow control falls into two camps

- **Software flow control** using characters such as XON/XOFF
- **Hardware flow control** using RTS/CTS or DTR/DSR circuits.

These methods may be used by both sides of a wired link, or may be used only in one direction.

6.3.3 RFCOMM Flow Control

The RFCOMM protocol provides two flow control mechanisms:

- The RFCOMM protocol contains flow control commands that operate on the aggregate data flow between **two RFCOMM entities;** i.e. all DLCIs are affected.
- The Modem Status command is the flow control mechanism that operates on **individual DLCI.**

6.3.4 Port Emulation Entity: Serial Flow Control

On Type 1 devices some port drivers (Port Emulation Entities plus RFCOMM) will need to provide flow control services as specified by the API they are emulating. An application may request a particular flow control mechanism like XON/XOFF or RTS/CTS and expect the port driver to handle the flow control.

On type 2 devices the port driver may need to perform flow control on the non-RFCOMM part of the communication path; i.e. the physical RS-232 port. This flow control is specified via the control parameters sent by the peer RFCOMM entity (usually a type 1 device). The description of flow control in this section is for port drivers on type 1 devices.

Since RFCOMM already has its own flow control mechanism, the port driver does not need to perform flow control using the methods requested by the application. In the ideal case, the application sets a flow control mechanism and assumes that the COMM system will handle the details. The port driver could then simply ignore the request and rely on RFCOMM's flow control. The application is able to send and receive data, and does not know or care that the port driver did not perform flow control using the mechanism requested. **However, in the real world some problems arise :**

- The RFCOMM-based port driver is running on top of a packet-based protocol where data may be buffered somewhere in the communication path. Thus, the port driver cannot perform flow control with the **same precision** as in the wired case.
- The application may decide to apply the flow control mechanism itself **in addition** to requesting flow control from the port driver.

These problems suggest that the port driver must do some **additional work** to perform flow control emulation properly. Here are the basic rules for flow control emulation.

- The port driver will **not solely rely** on the mechanism requested by the application but use a combination of flow control mechanisms.
- The port driver **must be aware of the flow control mechanisms** requested by the application and behave like the wired case when it sees changes on the non-data circuits (hardware flow control) or flow control characters in the incoming data (software flow control). For example, if XOFF and XON characters would have been stripped in the wired case they must be stripped by the RFCOMM based port driver.
- If the application sets a flow control mechanism via the port driver interface and then proceeds to invoke the mechanism on its own, the port driver must behave in a manner similar to that of the wired case (e.g. If XOFF and XON characters would have been passed through to the wire in the wired case the port driver must also pass these characters).

6.3.5 Credit Based Flow Control

This is a mandatory feature that did not exist in RFCOMM in Bluetooth specifications 1.0B and earlier. Therefore, its use is subject to negotiation before the first DLC establishment. Implementations conforming to this specification must support it, and must try to use it when connecting to other devices.

The credit based flow control feature provides flow control on a per - DLC basis. When used, both devices involved in a RFCOMM session will know, for each DLC, how many RFCOMM frames the other device is able to accept before it buffers fill up for that DLC. A sending entity may send as many frames on a DLC as it has credits; if the credit count reaches zero, the sender must stop and wait for further credits from the peer. It is always allowed to send frames containing no user data (length field = 0) when credit based flow control is in use. This mechanism operates independently for each DLC, and for each direction. It does not apply to DLCI 0 or to non-UIH frames.

6.4 Other Entity Interaction

6.4.1 Port Emulation and Port Proxy Entities

This section defines how the RFCOMM protocol should be used to emulate serial ports.

Type 1 devices are communication endpoints such as computers and printers.Type 2 devices are part of a communication segment; e.g. modems.

- **Port Emulation Entity :** The port emulation entity maps a system specific communication interface (API) to the RFCOMM services.
- **Port Proxy Entity :** The port proxy entity relays data from RFCOMM to an external RS-232 interface linked to a DCE. The communications parameters of the RS-232 interface are set according to received RPN commands,

6.4.3 Service Registration and Discovery

Registration of individual applications or services, along with the information needed to reach those (i.e. the RFCOMM Server Channel) is the responsibility of each application respectively (or possibly a Bluetooth configuration application acting on behalf of legacy applications not directly aware of Bluetooth).

6.4.3 Reliability

RFCOMM uses the services of L2CAP to establish L2CAP channels to RFCOMM entities on other devices. An L2CAP channel is used for the RFCOMM/TS 07.10 multiplexer session.

Some frame types (SABM and DISC) as well as UIH frames with multiplexer control commands sent on DLCI 0 always require a response from the remote entity, so they are acknowledged on the RFCOMM level (but not retransmitted in the absence of acknowledgement). Data frames do not require any response in the RFCOMM protocol, and are thus unacknowledged.

Therefore, RFCOMM must require L2CAP to provide channels with maximum reliability, to ensure that all frames are delivered in order, and without duplicates. Should an L2CAP channel fail to provide this, RFCOMM will expect a link loss notification, which should be handled by RFCOMM.

6.4.4 Low Power Modes

If all L2CAP channels towards a certain device are idle for a certain amount of time, a decision may be made to put that device in a low power mode i.e hold, sniff or park mode. This will be done without any interference from RFCOMM. RFCOMM can state its latency requirements to L2CAP. This information may be used by lower layers to decide which low power mode(s) to use.

The RFCOMM protocol as such does not suffer from latency delays incurred by low power modes, and consequentially, this specification does not state any maximum latency requirement on RFCOMM's behalf. Latency sensitivity inherently depends on application requirements, which suggests that an RFCOMM service interface implementation could include a way for applications to state latency requirements, to be aggregated and conveyed to L2CAP by the RFCOMM implementation. (That is if such procedures make sense for a particular platform.)

Note, the above text contains excerpts from the Bluetooth SIG's Specification, as well as various interpretations of the Specs. For complete details of the various sections, consult the actual Bluetooth Specification.

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**What Is
Bluetooth?**

| Radio | Baseband | LMP | HCI | L2CAP | RFCOMM | SDP | Profiles |

Service Discovery Protocol (SDP)

The service discovery protocol (SDP) provides a means for applications to discover which services are available and to determine the characteristics of those available services.

A specific Service Discovery protocol is needed in the Bluetooth environment, as the set of services that are available changes dynamically based on the RF proximity of devices in motion, qualitatively different from service discovery in traditional network-based environments. The service discovery protocol defined in the Bluetooth specification is intended to address the unique characteristics of the Bluetooth environment.

For more details : Download the SDP Specification from the SIG website, or visit the Documents Page.

Table Of Contents

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7.1 SDP Protocol Setup

7.1.1 Overview

SDP is a simple protocol with minimal requirements on the underlying transport. It can function over a reliable packet transport (or even unreliable, if the client implements timeouts and repeats requests as necessary). SDP uses a request/response model where each transaction consists of one request protocol data unit (PDU) and one response PDU. However, the requests may potentially be pipelined and responses may potentially be returned out of order.

SDP uses a request/response model where each transaction consists of one request protocol data unit (PDU) and one response PDU. In the case where SDP is used with the Bluetooth L2CAP transport protocol, only one SDP request PDU per connection to a given SDP server may be outstanding at a given instant. In other words, a client must receive a response to each request before issuing another request on the same L2CAP connection. Limiting SDP to sending one unacknowledged request PDU provides a simple form of flow control.
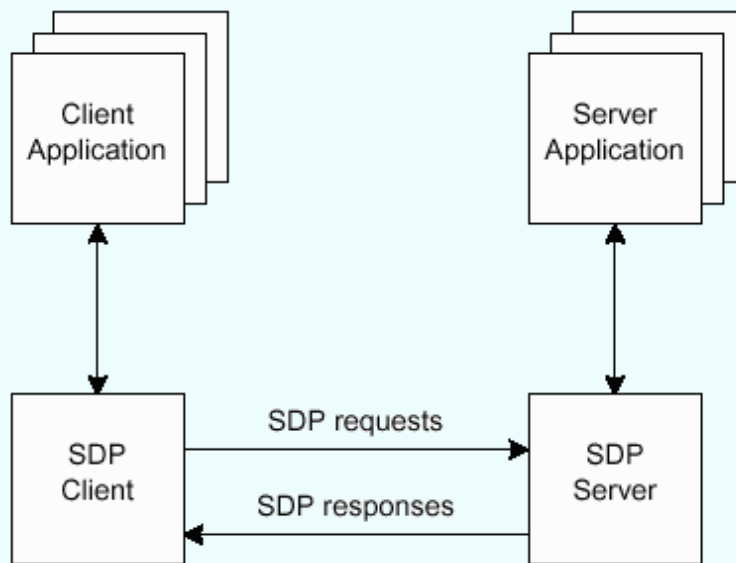
*Diagram Source: Courtesy of Bluetooth SIG, SDP Specs, Fig 2.1 , p 330

7.1.2 PDU Format

Every SDP PDU consists of a PDU header followed by PDU-specific parameters. The header contains three fields:

- **PDU ID** field identifies the type of PDU. I.e. its meaning and the specific parameters.

- **TransactionID** field uniquely identifies request PDUs and is used to match response PDUs to request PDUs.
- **ParameterLength** field specifies the length (in bytes) of all parameters contained in the PDU.

Parameters may include a **continuation state** parameter, described below; PDU-specific parameters for each PDU type are described later in separate PDU descriptions.

7.1.3 Partial Responses and Continuation State

Some SDP requests may require responses that are larger than can fit in a single response PDU. In this case, the SDP server will generate a partial response along with a continuation state parameter. The continuation state parameter can be supplied by the client in a subsequent request to retrieve the next portion of the complete response.

7.1.4 Error Handling

Each transaction consists of a request and a response PDU. Generally, each type of request PDU has a corresponding type of response PDU. However, if the server determines that a request is improperly formatted or for any reason the server cannot respond with the appropriate PDU type, it will respond with an error PDU (*SDP_ErrorResponse*) .

7.2 SDP Services

The following section describe how the individual characteristics (**services**) of the different devices are stored.

7.2.1 Service Record

A [service](#) is any entity that can provide information, perform an action, or control a resource on behalf of another entity. A service may be implemented as software, hardware, or a combination of hardware and software. All of the information about a service that is maintained by an SDP server is contained within a single [service record](#). The service record consists entirely of a list of service attributes.

7.2.2 Service Attribute

Each [service attribute](#) describes a single characteristic of a service. Some examples of service attributes are *ServiceClassIDList* & *ProviderName* . Some attribute definitions are common to all service records , but service providers can also define their own service attributes.

A service attribute consists of two components: an attribute ID and an attribute value.

- An **attribute ID** is a 16-bit unsigned integer that distinguishes each service attribute from other service attributes within a service record. The attribute ID also identifies the semantics of the associated attribute value.
- The **attribute value** is a variable length field whose meaning is determined by the attribute ID associated with it and by the service class of the service record in which the attribute is contained. In the Service Discovery Protocol, an attribute value is represented as a data element. See the section '**Data Representation**' below for more information.

7.2.3 Service Class

Each service is an instance of a [service class](). The service class definition provides the definitions of all attributes contained in service records that represent instances of that class. Each attribute definition specifies the numeric value of the attribute ID, the intended use of the attribute value, and the format of the attribute value. A service record contains attributes that are specific to a service class as well as universal attributes that are common to all services.

Each service class is assigned a unique identifier ,this service class identifier is contained in the attribute value for the ServiceClassIDList attribute, and is represented as a UUID. A [UUID]() is a universally unique identifier that is guaranteed to be unique across all space and all time. UUIDs can be independently created in a distributed fashion. No central registry of assigned UUIDs is required. A UUID is a 128-bit value.

7.3 Service Discovery

The whole point of the SDP is to allow bluetooth devices to discover what other bluetooth devices can offer (what **services**). SDP allows this in various means. **Searching** means looking for specific service, while **Browsing** means looking to see what services are actually being offered.

7.3.1 Searching for Services

The Service Search transaction allows a client to retrieve the service record handles for particular service records based on the values of attributes contained within those service records.

The capability search for service records based on the values of arbitrary attributes is not provided. Rather, the capability is provided to search only for attributes whose values are Universally Unique Identifiers (UUIDs). Important attributes of services that can be used to search for a service are represented as UUIDs. Service search pattern are used to locate the desired service. A service search pattern is a list of UUIDs (service attributes) used to locate matching service records.

7.3.2 Browsing for Services

This process of looking for any offered services is termed browsing. In SDP, the mechanism for browsing for services is based on an attribute shared by all service classes. This attribute is called the **BrowseGroupList** attribute. The value of this attribute contains a list of UUIDs. Each UUID represents a browse group with which a service may be associated for the purpose of browsing.

When a client desires to browse an SDP server's services, it creates a service search pattern containing the UUID that represents the root browse group. All services that may be browsed at the top level are made members of the root browse group by having the root browse group's UUID as a value within the BrowseGroupList attribute.

7.4 Data Representation

As mentioned above, In the Service Discovery Protocol, an attribute value is represented as a

data element. A data element is a typed data representation. It consists of two fields: a header field and a data field.

7.4.1 Data Element header field

The header field is composed of 2 parts, a **Type Descriptor** and a **Size Descriptor.**

- **Type Descriptor**: A data element type is represented as a 5-bit type descriptor. The type descriptor is contained in the most significant (high-order) 5 bits of the first byte of the data element header.
- **Size Descriptor**: The data element size descriptor is represented as a 3-bit size index followed by 0, 8, 16, or 32 bits. The size index is contained in the least significant (low-order) 3 bits of the first byte of the data element header.

7.4.2 Data Element data field

The data is a sequence of bytes whose length is specified in the size descriptor and whose meaning is (partially) specified by the type descriptor.

7.5 Service Discovery Background info

7.5.1 Service Discovery

As computing continues to move to a network-centric model, finding and making use of services that may be available in the network becomes increasingly important. Services can include common ones such as printing, paging, FAX-ing, and so on, as well as various kinds of information access such as telecon-ferencing, network bridges and access points, eCommerce facilities, and so on — most any kind of service that a server or service provider might offer. In addition to the need for a standard way of discovering available services, there are other considerations: getting access to the services (finding and obtaining the protocols, access methods, "drivers" and other code necessary to utilize the service), controlling access to the services, advertising the services, choos-ing among competing services, billing for services, and so on. This problem is widely recognized; many companies, standards bodies and consortia are addressing it at various levels in various ways. Service Location Protocol (SLP), Jini^{TM}, and Salutation ^{TM}, to name just a few, all address some aspect of service discovery.

7.5.2 Bluetooth Service Discovery

The Bluetooth Service Discovery Protocol (SDP) addresses service discovery spe-cifically for the Bluetooth environment. It is optimized for the highly dynamic nature of Bluetooth communications. SDP focuses primarily on discovering services available from or through Bluetooth devices. SDP does not define methods for accessing services; once services are discovered with SDP, they can be accessed in various ways, depending upon the service. This might include the use of other service discovery and access mechanisms such as those mentioned above; SDP provides a means for other protocols to be used along with SDP in those environments where this can be beneficial. While SDP can coexist with other service discovery protocols, it does not require them. In Bluetooth environments, services can be discovered using SDP and can be accessed using other protocols defined by Bluetooth.

Note , the above text contains excerpts from the Bluetooth SIG's Specification, as well as various

interpretations of the Specs. For complete details of the various sections, consult the actual Bluetooth Specification.

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What Is Bluetooth?

● Well it isn't some strange form of tooth decay as you might initially imagine. Bluetooth is the name of a new technology that is now becoming commercially available. It promises to change significantly the way we use machines.

Bluetooth™

1 Take a look around

Look around you at the moment, you have your keyboard connected to the computer, as well as a printer, mouse, monitor and so on. What (literally) joins all of these together?, they are connected by cables. Cables have become the bane of many offices,

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homes etc. Most of us have experienced the 'joys' of trying to figure out what cable goes where, and getting tangled up in the details. Bluetooth essentially aims to fix this, **it is a cable-replacement technology**

2 How?

Conceived initially by Ericsson, before being adopted by a myriad of other companies, Bluetooth is a standard for a **small , cheap radio chip to be plugged into computers, printers, mobile phones, etc**.A Bluetooth chip is designed to replace cables by taking the information normally carried by the cable, and transmitting it at a special frequency to a receiver Bluetooth chip, which will then give the information received to the computer, phone whatever.

3 How about ?

That was the original idea, but the originators of the original idea soon realised that a lot more was possible. If you can transmit information between a computer and a printer, why not transmit data from a mobile phone to a printer, or even a printer to a printer?. The projected low cost of a Bluetooth chip (~$5), and its low power consumption, means you

could literally **place one anywhere**.

4 Ideas, ideas...

With this viewpoint interest in Bluetooth is soaring, lots of ideas are constantly emerging, some practical and feasible e.g.: Bluetooth chips in freight containers to identify cargo when a lorry drives into a storage depot, or a headset that communicates with a mobile phone in your pocket, or even in the other room, other ideas not so feasible : Refrigerator communicating with your Bluetooth-enabled computer, informing it that food supply is low, and to inform the retailer over the internet.

5 The future, this website

Whatever the ideas, Bluetooth is set to take off. To be honest it's going to be forced down the consumers necks, whether they want it or not, as too many companies have invested in it. This website is generally geared towards the technical issues surrounding Bluetooth, and its implementation in real life. But free feel to have a look around anyway, and see why this technology will have such a big impact on our lives. If you're a complete beginner & you want to know more go to the other pages on the

website: the Tutorial has a reasonably in-depth guide to Bluetooth (can be quite technical in parts though), our members-only Download** page has some more general introductions to Bluetooth to download. Also check out the Resource Center, Articles, Glossary & Knowledge Base to further enhance your Bluetooth education. There are also related Resource Centers on IEEE 802.11 Wireless LANs, HomeRF, SyncML and other mobile and wireless technologies. Enjoy!

** Note that although many sections of this web site are freely available, some require a free membership and others are available only to paid members.

6 Looking after your teeth

By the way if, you're wondering where the Bluetooth name originally came from, it named after a Danish Viking and King, Harald Blåtand (translated as Bluetooth in English), who lived in the latter part of the 10th century. Harald Blåtand united and controlled Denmark and Norway (hence the inspiration on the name: uniting devices through Bluetooth). He got his name from his very dark hair which was unusual for Vikings, Blåtand means dark complexion. However

a more popular, (but less likely reason), was that Old Harald had a inclination towards eating Blueberries , so much so his teeth became stained with the colour, leaving Harald with a rather unique set of molars. And you thought your teeth were bad...

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IDL IT Development Labs

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The program aims at creating a strong base to the students in Systems programming aimed at building proficiency in the advanced concepts of C, C++ Programming, Linux System programming and finally Bluetooth. A detailed study of the different layers of the Bluetooth stack is followed by training students in developing applications for the Bluetooth environment.

[LEVER Technology Group](#)

[Overview of Bluetooth](#)

A fast-track introduction to Bluetooth technology, standards and the latest Bluetooth developments.

[Understanding Bluetooth Technology](#)

A fast-track coverage of Bluetooth technology, including Bluetooth operation, testing and troubleshooting.

[NetConsulate](#)

The NetConsulate Center Of Excellence for Bluetooth Wireless Technology offers training for Bluetooth wireless technology.

Rococo Software

Building Bluetooth Applications in Java

This one-day workshop gives software developers a basic understanding of the structure, behaviour and issues surrounding building applications against JABWT standard Bluetooth APIs. Throughout the workshop, the working code used to explain each topic will be demonstrated on Rococo's Impronto Simulator.

Introduction to Bluetooth for Software Developers Gives software developers an overview of the Bluetooth Standard, and an understanding of the structure and behaviour of a Bluetooth application.

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Rococo Software

Sigma

Sigma, together with Ericsson, provides the Bluetooth Academy 4-day course covering the latest Bluetooth technology:
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The University of Southern California will be the first well-known research university to offer a minor in game design when it rolls out a new program next fall. By Katie Dean.

PRWeb New Home Brew Video Game System - "XGameStation" brings Game Development and Engineering to the Masses is Making Steady Progress!
Nurve Networks LLC is making progress on what is undoubtedly the most unexpected kind of new video game system: one that users will build and program themselves! [PRWEB Nov 12, 2003]

PRWeb www.rollthebet.com offers Free 25 $ to sign-up and play online casino games.
rollthebet.com gives uses a $25 dollar free cash to sign up and play the internets #1 online casino games. We also give users the choice to run and operated the very own Free Web Portal Casino, hosted designed by rollthebet.com [PRWEB Oct 25, 2003]

PRWeb A Rival for Lotteries Worldwide? - You Help Pick the Winner in a Revolutionary New Web Competition.
Even with the continual launch of new Lottery games, Lottery companies the world over are only just managing to stem a continual decline of interest in their Lottery games. Why? Because

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★ **World Mobile Gaming Markets**

With mobile voice services becoming increasingly commoditized, network operators are turning to mobile data-related offerings to boost falling revenues. Mobile gaming applications will be a key part of that strategy. By attracting a huge pool of customers and boosting network traffic, gaming promises to raise profits and become a mainstay of operators' mobile data strategies. This study analyzes the world markets for messaging-based, web-based, and downloadable mobile gaming. It examines the potential for variety of game types, evaluates a range of business models, and pinpoints the most successful strategies. With such an essential guide to the marketplace, users of this study will be poised to capitalize on a burgeoning field.

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Published By: Frost & Sullivan

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Have you visited our MMS Games or Java Games sections yet?

Interesting Articles

- Wired Mobile Gamers Need Better Devices (10/02) Mobile gaming stands poised to become a billion-dollar business - but not on today's cell phones, a Sony executive told an audience at the Cellular Telecommunications and Internet Association show. Despite the proliferation of cell phones this year, none of the handsets is good enough for serious gamers, said John Smedley, chief operations officer for Sony Online Entertainment. But that doesn't mean that cell-phone service providers can't and shouldn't bank on games. There are dozens of games written in J2ME that are available.

- Siemens Mobile betting shops — place your bets live (7/02) Siemens Information and Communication Mobile (IC Mobile) has added the option of "live betting" to its portfolio for mobile data services. M.traction Gambling enables mobile phone carriers to offer platforms for mobile betting all over the world. In practice, this means you can use mobile devices such as PDAs and cellphones to place bets electronically with the teller wherever you are and whenever you want. Traditionally, and this includes the internet, bets could only be placed up to just before the

people have realised that, although 'it could be you', it probably won't be, and worse still, the ?lucky winner? is chosen completely at random making the frustration continue week after week for Lottery ticket purchasers.A new skill-based alternative has recently been launched on the web, which is offering a novel altern...

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From The Wireless Bookshop

Physics for Game Developers

Colliding billiard balls. Missile trajectories. Cornering dynamics in speeding cars. By applying the laws of physics, you can realistically model nearly everything in games that bounces around, flies, rolls, slides, or isn't sitting still, to create compelling, believable content for computer games, simulations, and animation.

Game Developer's Market Guide

actual event started; now, thanks to m.traction Gambling, a new form of betting is possible, based on "dynamic odds" and allowing wagers to be laid while the match or race is still in progress. The Siemens solution is based on an application from scaraboo, a start-up company sponsored by Siemens Mobile Acceleration GmbH.

- HUGIN [Get ready for some serious mobile fun! (3/02)](#) The Nokia 3410 features Java technology for the mass market. Nokia introduces a new phone for its expression category, the Nokia 3410, featuring Java(TM) 2 Micro Edition (J2ME(TM)) support for downloading exciting and fun new applications. Other new features include a 3D graphics engine and a Picture Editor. The Nokia 3410 is scheduled to start shipping in Europe and Africa in the 2nd quarter, 2002. J2ME is a version of Java technology optimized for small consumer electronics devices. The J2ME platform of the Nokia 3410 is based on the industry standard Mobile Information Device Profile 1.0 (MIDP 1.0) which provides the essential functionality to create compelling applications for mobile use. Users of the Nokia 3410 can personalize their phone by downloading new Java applications such as games, virtual pets and animations via the phone's WAP browser. The Nokia 3410 has a 150 kB memory reserved for downloading Java applications.

- Siemens [Siemens and Beyond Solutions Europe (BSE) team up to bring games onto the wireless Internet (10/01)](#) Siemens Information and Communication Mobile Group and Beyond Solutions Europe are cooperating in the field of games services for mobile networks. Based on BSE's gaming platform and an attractive catalog of games, Siemens will compile customer-specific packages for mobile gaming and integrate them into mobile networks.

- Afterdawn.com [Nokia releases a new entertainment phone (10/01)](#) Finnish mobile phone giant Nokia released a new "entertainment phone" dubbed as [Nokia 5510](#). Phone will be available for GSM900/1800 markets later this year and is aimed at young consumers.
  [Take a closer look](#) - Nokia 5510 interactive demo!

- Telecom.Paper [Java games for mobile phones at Djuice (8/01)](#) Telenor Mobil's mobile Internet portal, djuice.no, says it is offering seven new games that can be downloaded from the internet site and stored on the mobile phone. The games are Java-applications that allow the user to play without having to be constantly logged on to the Internet. This opens up for more advanced games at a lesser price.

- [Wireless Developer Network](#) [The Basics of WAP Game Design](#)
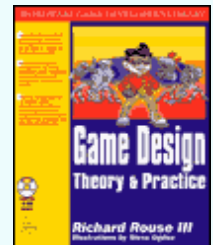
- [Datamonitor says 200 million people will be playing Web games on mobile phones by 2005 (9/00)](), valuing the wireless gaming market at $6 billion. That's a big jump up from the $3 million in 2000!!

Useful Links

agotchi wap.agotchi.net	A virtual pet - hours of fun. Cheat codes for secret access - and much more.
Cartoonscape wap.cartoonscape.com	Free cartoons, daily comics, humor, funny animations, online games, e-toons and a cartoon service by professional cartoonists.
CartooZine www.cartoozine.com/wap	WAP comix from cartoonists from around the globe.
Cellular Magic	Content development, games creation Cellular games portal Trivia, Ratings, Puzzles, Tic Tac Toe, Slot Machines, Black Jack, Lotto... Demos
Cosmic Infinity Cosmic Infinity WAP Site www.cosmicinfinity.com/wap/cosmic.wml	Dedicated to making the joy of gaming portable on a variety of platforms, including WAP devices, the Palm OS, palm computers, handheld gaming systems, and more.
Crawler Games wappy.to/cgames	Crawler Games provides "downloadable" WAP games. Connect once - play by hours. Play offline - save money! Try "Hunt the W@Pus" - downloadable WAP game with prerendered 3D animation and fun pictures.

[Fommy.com](#)	America's latest and the un-matched wireless entertainment website. Our Ring tones, Games, Color Graphics and MMS shall blaze away all primitive conventions. Providing mind-blowing downloads for leading cellular phones - Nokia, Motorola, Samsung, SonyEricsson, Siemens. GSM Operators supported - AT&T, Cingular, T-Mobile.. Add the Zing to your phone, today...
[GameIsLive](#)	GameisLive.com is a WAP/WEB cross-platform game village. It is designed for online game players. Yazimi, Black Jack, Tic-tac-toe, Combat, Circle Diary, Connect 4, Blind Chess, Reversi, Pipe, Card Battle.
[Hailstorm Entertainment](#)	Hailstorm are developers of mobile games, using technologies such as WAP, SMS, iMode, Java and other wireless platforms.
[Handy Games](#)	Handy Games Ltd. is a German software producer specializing in embedded, WAP-, SMS-, I-Mode, J2ME and MMS games for mobile phones. Latest examples of the company's work include the games "Stack Attack" and "Balloon Shooter", which can be found on the new Siemens mobile phones C45, S45 and ME45 (embedded). Handy Games' applications can also be downloaded at E-Plus' new i-Mode portal as well as MobilCom (J2ME).
[JAMDAT Mobile](#)	JAMDAT'S product development strategy is to create high-quality mobile entertainment products that appeal to the broadest possible user base...
[JSmart Games and Entertainment](#)	We do fun and intuitive games and entertainment for WAP, VoiceXML and Java.
[KJ Soccer WAP Site](#) buzzed.co.uk/mobile/?kjsoccer	WAP Soccer Game

Lightplay Studios	Lightplay Studios designs and develops Mobile Entertainment content for the wireless Internet, for use on handheld devices. In addition to our development efforts for WAP and SMS, Lightplay Studios is uniquely positioned to exploit the migration to more robust wireless platforms such as J2ME, GPRS and 3G mobile telecommunications.
Ludiwap	Games and leisure content for WAP enabled cellular phones and small handheld wireless devices.
Mobi Software	Mobi has developed advanced session based SMS/WAP games. Such as multiplayer battleship and an airtime gambling game.
mobile phone games	Welcome to "play mobile games" here you can easily download the largest selection of quality mobile games straight to your handset.
MobyVia	Wireless and free! WapJack & Colossal Cave adventure on your WAP...
Nokia	Nokia Games
Picofun	Wall Street Wizard, Knights of Honour, M-Builders, Starship and Speedster...
Play Totally Wireless Millionaire www.ptwm.com	Trivia Game for your WAP phone
Radio Gamer	Radio Gamer is a bi-lingual (English/German) online magazine that offers information on the mobile entertainment market. Apart from daily news updates, Radio Gamer regularly conducts interviews with key figures from the wireless development industry as well as mobile games tests. There is also a link list to various companies related to the mobile industry (mobile phone manufacturers, mobile phone operators, developers of mobile applications etc.).

[SpringToys](#)	Interactive games and entertainment content for mobile, wireless platforms.
[TheFunniest To Go](#)	July 2000 — TheFunniest ToGo, the world's premiere producer of humor content specifically for wireless devices. Have a web-enabled wireless device? Point it to: www.thefunniest.com
[Unplugged Games](#)	Wireless games for a wireless world. Developer of wireless games and supporting technology. Unplugged Games develops technology that allows wireless carriers to monetize wireless games.
[Wirelessgames.com](#)	WAP and wireless games on your mobile phone or wireless.
[Yuks](#)	Celebrity parody, political satire, spurious news, fake fotos, addicting games, funny jokes, cool graphics & weird portals. Available via WAP.