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RESPONSIBLE Riku Mettala	E-MAIL ADDRESS riku.mettala@nmp.nokia.com		STATUS

# Bluetooth Protocol Architecture

Version 1.0

This white paper describes the protocol architecture developed by the Bluetooth Special Interest Group (SIG). Various usage models are presented and complemented with a description of the protocols relevant to their implementation.

**Samsung Exhibit 1047**

## Special Interest Group (SIG)

The following companies are represented in the Bluetooth Special Interest Group:

Ericsson Mobile Communications AB  
IBM Corp.  
Intel Corp.  
Nokia Mobile Phones  
Toshiba Corp.

## Contributors

Bisdikian, Chatschik	IBM Corporation
Bouet, Stephane	Nokia Mobile Phones
Inouye, Jon	Intel Corporation
Mettälä, Riku	Nokia Mobile Phones
Miller, Brent	IBM Corporation
Morley, Ken	3Com Corporation
Muller, Thomas	Nokia Mobile Phones
Roter, Martin	Nokia Mobile Phones
Slotboom, Erik	Ericsson Mobile Communications AB

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## 1 Introduction

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The Bluetooth Special Interest Group (SIG) has developed the Bluetooth Specification Version 1.0 Draft Foundation (thereafter to be referred to as the "Specification"), that allows for developing interactive services and applications over interoperable radio modules and data communication protocols. The objective of this paper is to provide an overview of the protocols in the Specification, their capabilities and the relation to each other (referred to as the "Bluetooth protocol architecture"). Moreover, a number of usage models identified by the Bluetooth SIG will be presented and it will be shown how (and which of) these protocols are stacked to support these usage models.

### 1.1 Bluetooth Protocol Stack

The ultimate objective of the Specification is to allow applications written in a manner that is conformant to the Specification to interoperate with each other. To achieve this interoperability, matching applications (e.g., corresponding client and server application) in remote devices must run over identical protocol stacks. The following protocol list is an example of a (top-to-bottom) protocol stack supporting a business card exchange application: vCard → OBEX → RFCOMM → L2CAP → Baseband. This protocol stack contains both an internal object representation convention, vCard, and "over-the-air" transport protocols, the rest of the stack.

Different applications may run over different protocol stacks. Nevertheless, each one of these different protocol stacks use a common Bluetooth data link and physical layer, see more details on the protocol layers in the next section. Figure 1 shows the complete Bluetooth protocol stack as identified in the Specification on top of which interoperable applications supporting the Bluetooth usage models are built. Not all applications make use of all the protocols shown in Figure 1. Instead, applications run over one or more vertical slices from this protocol stack. Typically, additional vertical slices are for services supportive of the main application, like TCS Binary (Telephony Control Specification), or SDP (Service Discovery Protocol). It is worth of mentioning that Figure 1 shows the relations how the protocols are using the services of other protocols when payload data needs to be transferred over air. However, the protocols may also have some other relations between the other protocols. E.g., some protocols (L2CAP, TCS Binary) may use LMP (Link Manager Protocol) when there is need to control the link manager.

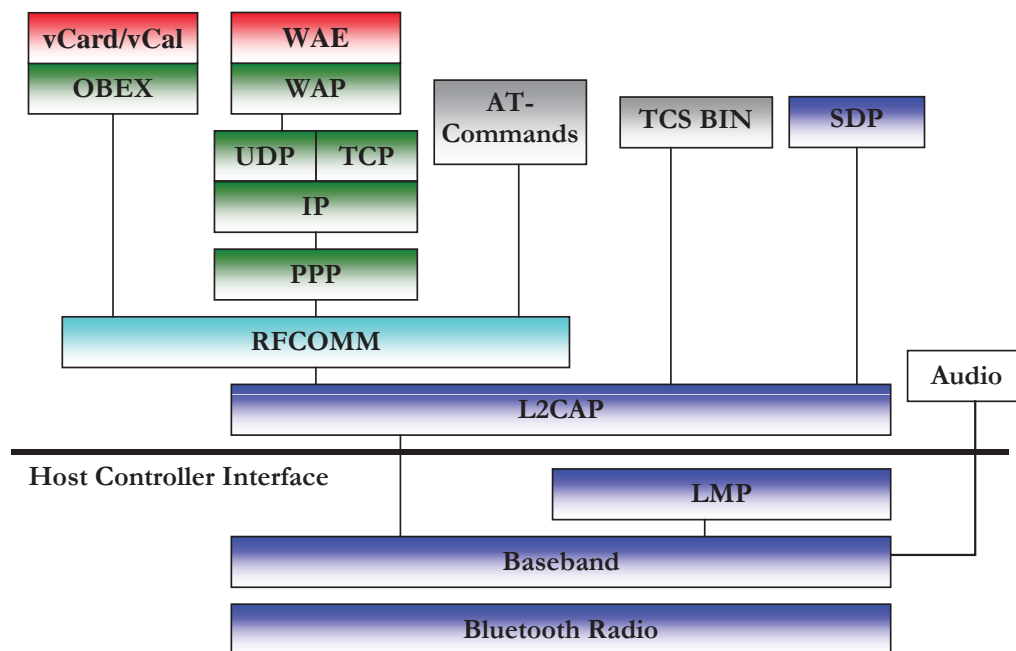


Figure 1 Bluetooth Protocol Stack

As seen in Figure 1, the complete protocol stack comprises of both Bluetooth-specific protocols like LMP and L2CAP, and non-Bluetooth-specific protocols like OBEX (Object Exchange Protocol) and UDP (User Datagram Protocol). In designing the protocols and the whole protocol stack, the main principle has been to maximize the re-use of existing protocols for different purposes at the higher layers, instead of re-inventing the wheel once again. The protocol re-use also helps to adapt existing (legacy) applications to work with the Bluetooth technology and to ensure the smooth operation and interoperability of these applications. Thus, many applications already developed by vendors can take immediate advantage of hardware and software systems, which are compliant to the Specification. The Specification is also open, which makes it possible for vendors to freely implement their own (proprietary) or commonly used application protocols on the top of the Bluetooth-specific protocols. Thus, the open Specification permits the development of a large number of new applications that take full advantage of the capabilities of the Bluetooth technology.

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