1   Introduction

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 $\rightarrow$ OBEX $\rightarrow$ RFCOMM $\rightarrow$ L2CAP $\rightarrow$ 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.