



IEEE P1451.5 Wireless Sensor Interface Working Group Bluetooth Subgroup Proposal

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Why Bluetooth?

Enable short-range unconscious radio communications & personal area networks

Key enablers:

- Low cost
- Robust and reliable
- Low user maintenance
 - Easy to enable, easy to use
 - Upwards compatibility



Bluetooth Features for IEEE1451.5

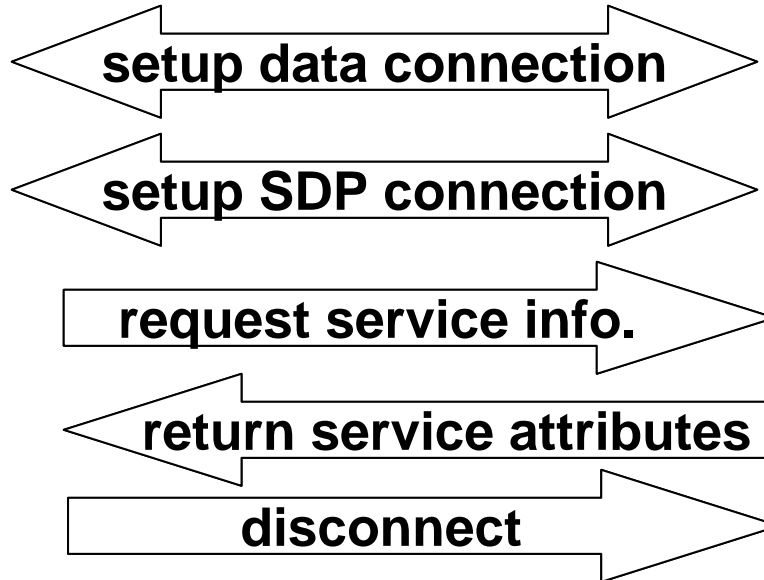
Bluetooth has many features that make it a suitable wireless technology for IEEE1451.5

- Device Discovery
 - Bluetooth Inquiry mode allows devices to be discovered
 - The Class of Device identified during inquiry allows filtering for device types
 - Bluetooth Service Discovery Profile (SDP) allows for browsing for features and services

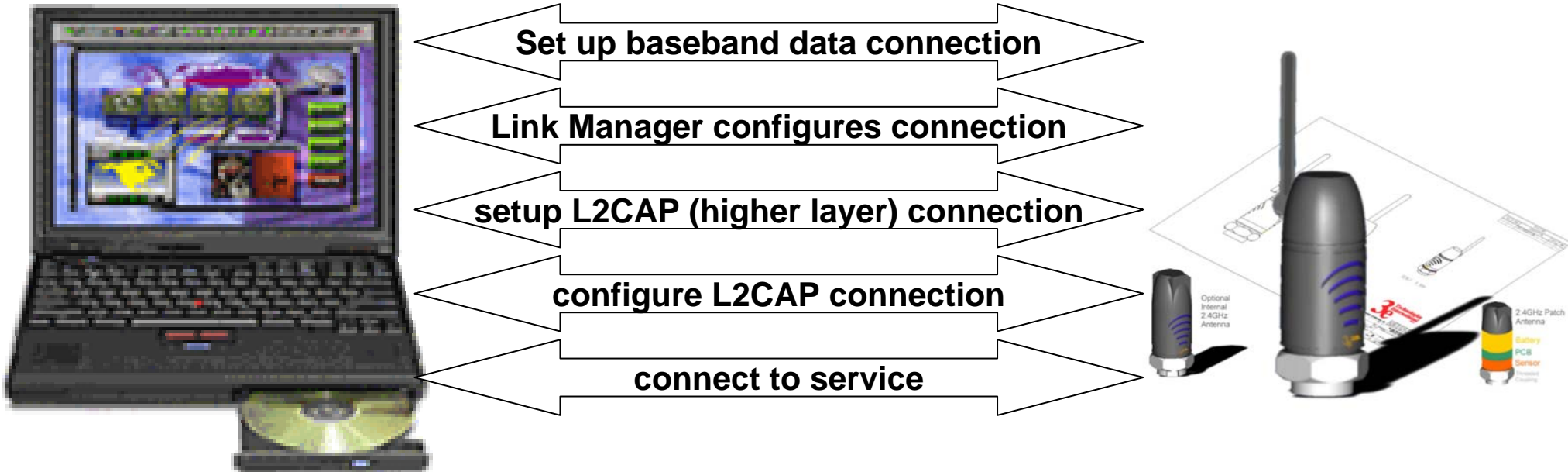
Device Discovery



Service Discovery



Connection to a service

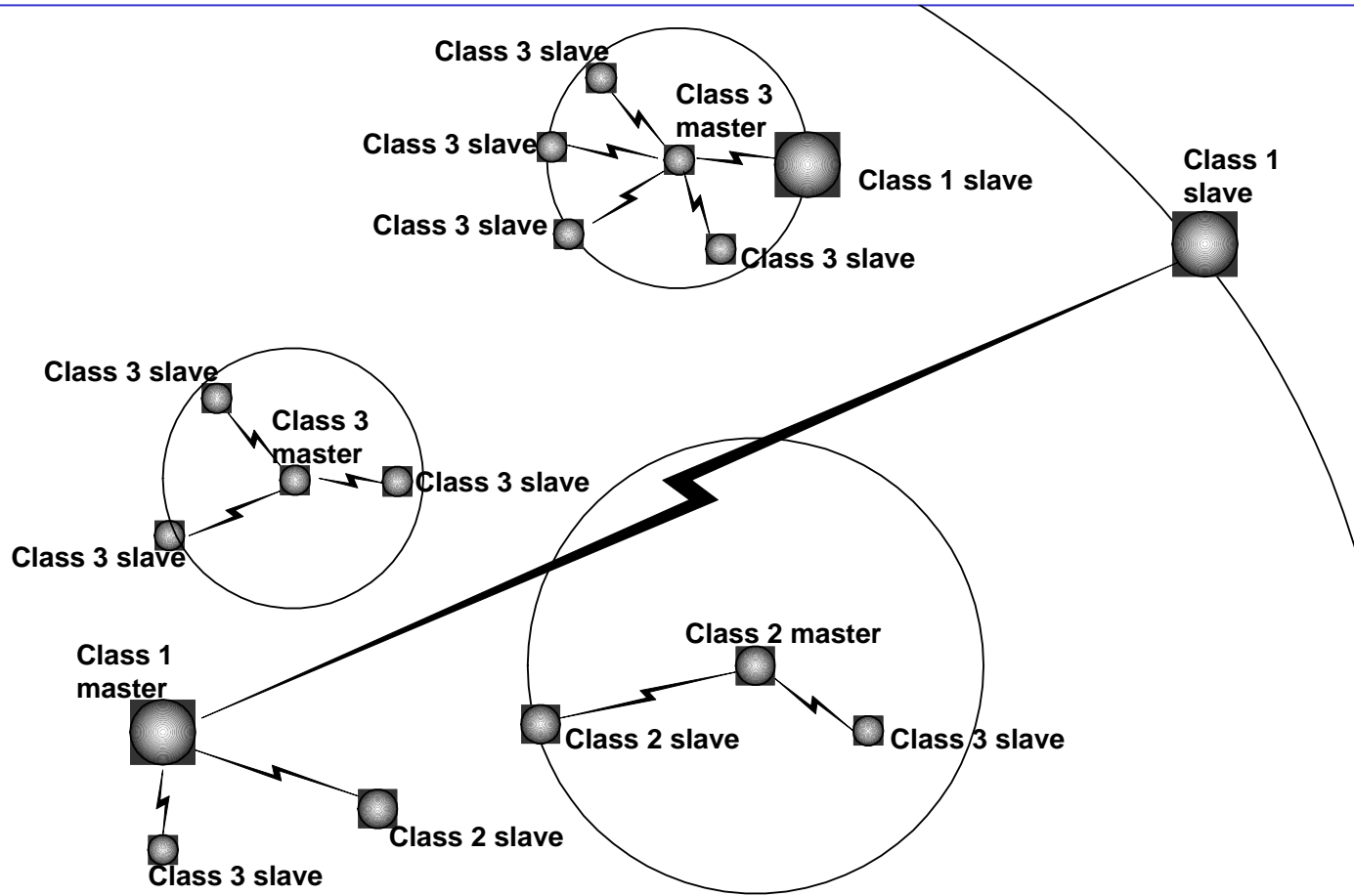


Bluetooth Features for IEEE1451.5

Bluetooth has many features that make it a suitable wireless technology for IEEE1451.5

- Connections
 - Bluetooth allows piconets with point to multipoint connections of up to 7 slaves to one master
 - More devices can be served by making fast connections (as low as 40 msec)
 - Data rates up to 723 Kbytes using asynchronous (ACL) channels
 - Synchronous (SCO) channels for data streaming
 - Reliable ACL channels (with retransmission)
 - L2CAP layer implements service multiplexing and fragmentation and reassembly
 - Quality of Service is negotiable to include low latency or high reliability channels
 - The Bluetooth clock can be used to implement time synchronization across a piconet
 - Low power modes to allow battery powered devices with projected life in years

Masters and slaves in piconets



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Advantages that Bluetooth Features offer IEEE1451.5

Architecture

- Bluetooth protocol stack can be implemented on two processors as a host and controller (radio) using the Host Controller Interface (HCI)
- NCAP can implement the host on a second processor with controller on a single chip Bluetooth device for maximum performance in multipoint scenarios
- TIM can be implemented on a single chip Bluetooth device (no extra microcontroller)
- Complete single chip TIM measurement systems possible with re-use of chips containing ADCs and DSPs designed for commercial audio applications

Commercial

- Many commercial HHDs, PCs and mobile phones support Bluetooth
- Low cost re-use of commercial technology for industrial market
- Bluetooth is shipping now in volume – over 120 M solutions predicted for 2004
- Chip prices now below \$4, falling to \$2 in 2006



Bluetooth Proposal for IEEE1451.5

Architecture

- IEEE1451.5 implemented using Bluetooth Network Encapsulation Protocol (BNEP) transport
- BNEP is lightweight protocol with as low as single byte overhead
- Allows re-use of Bluetooth address (MAC address) to reduce protocol overhead in point to point links
- BNEP can also transport IP packets, so alternative implementations or extensions to include routing are possible.

Channels

- Use ACL channels for datagram triggering and streaming services
- Use Bluetooth clock for synchronization
- Use QoS interface to configure data channels



Bluetooth Proposal for IEEE1451.5

Device Discovery

- Using Bluetooth Inquiry and Paging modes

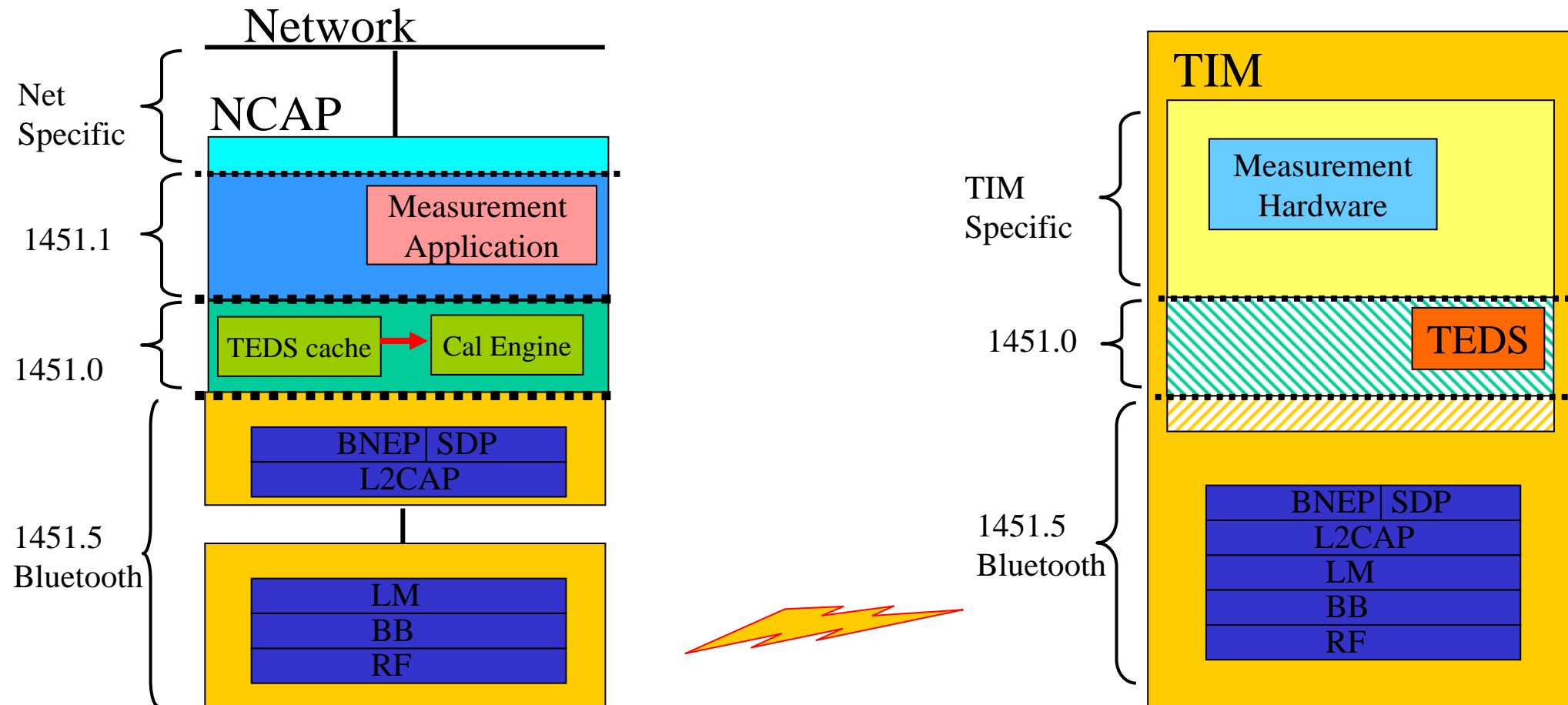
TEDS

- Single chip TIMs can use SDP database to store TEDS
- SDP protocol allows for efficient TEDS browsing and retrieval from NCAP

Performance

- Proposed IEEE1451.0 datagram has 13 byte header
- Smallest Bluetooth packet has 17 byte payload so single readings can be transported in a single data packet for maximum throughput and minimum latency

Bluetooth IEEE1451.5 Example





Summary

- Bluetooth offers industrial users a low cost, high performance and secure wireless technology that is mature and in mass commercial production
- The Bluetooth IEEE1451.5 proposal will allow re-use of low cost commercial technology to deliver high performance smart sensor handling capability
- The proposal will make use of existing Bluetooth protocols and profiles so only thin dot0/dot 5 applications will have to be implemented
- The proposal will be extendable to take advantage of future developments in Bluetooth, including Enhanced Data Rate (EDR) which increases data rate to over 2 Mbps, and is scheduled for Q4 2004