Bluetooth

→ Personal networks

– No physical access to cabled networks; no need for large communication rates, low cost.

Targets: low power, low cost, short-range, small number of devices.

→ Bluetooth

- Originally for replacing 'USB', not Ethernet.
- PAN → 1 Mbps connections, piconet routing, sync and async, voice connections.
- Small, cheap, low power, short-range radios.
- Master/slave config and scheduling.

↳ Bluetooth Higher Speeds.

EDR - Enhanced Data Rate: BT v2.0 → 3 Mbps

HS - High Speed: BT 3.0 HS – 24 Mbps but data does not go over the BT link itself it uses 802.11.

↳ Features

2.4 GHz worldwide, airplane friendly, piconets and scatternets, 720 kb/s, frequency hopping.

↓

signal broadcast over seemingly random series of frequencys. Receiver hops

between freqs. with transmitter.

↳ Picoнets

- Bluetooth devices connected in ad-hoc cell.
- Master with up to 7 slaves (active) and hundreds parked. Master defines clock and deviceID.
- Each picoнet has an unique FH patterns.

↳ Scatternet

- Connection of several picoнets through common bridge.
- One device can be M/S at same time
- picoнet BW < 1 Mbps

→ Picoнet Operation

All devices must share the same hopping pattern
If device in picoнet and not connected then must be in standby.
2 type of addresses (Active - 3bits, Parked - 8 bits)

↳ Estados de dispositivos bluetooth:

Standby → waiting to join picoнet
Inquire → ask about radios to connect
Page → connect to a specific radio
Connected → actively on a picoнet (master or slave)
Park/sniff/Hold → low power connected

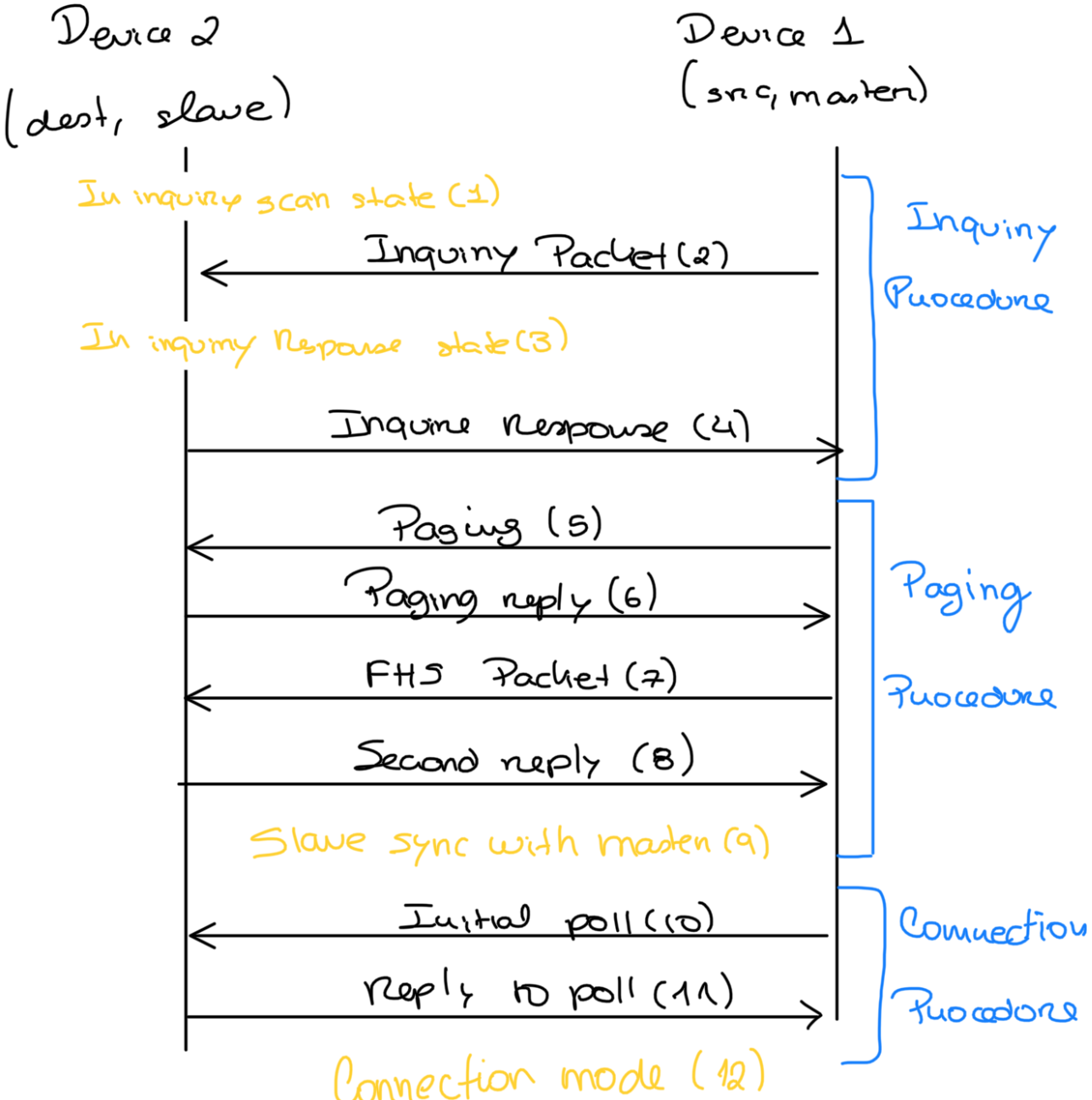
states.

Very low power
Used to admit more
than 7 slaves.
Wakes up periodically
to listen for broadcasts
to 'unpark'

slave wakes up
periodically to
talk to master,
in sniff intervals.

node sleeps
for defined
interval. No
ACL packets.

Connection procedure



↳ Inquiry Scaning : summary

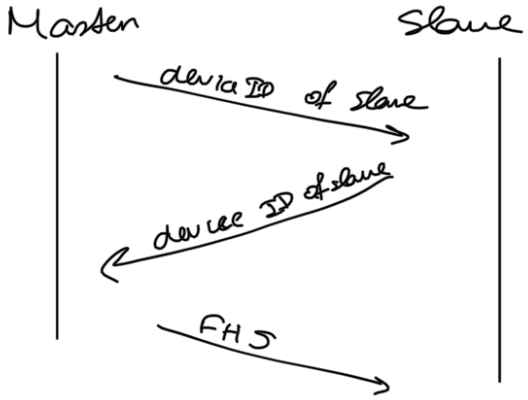
Inquiry scaning has a common address and devices can page this address. All machines hearing an inquiry will answer the inquiry request. There is a detection (connection hit) in the slaves that detects inquirys.

If there is a collision on answering to a scan, they also wait a random period.

↳ Paging.

Very similar to inquiries. Still have not sync clocks or freqs. Establishes actual piconet connections (6 step to connect).

FHS packet: contains deviceID and clock (from master).



→ Bluetooth stack

App support

Control Interface (Host)

Links Manager and Layer 2 CAP

Radio and Baseband Control

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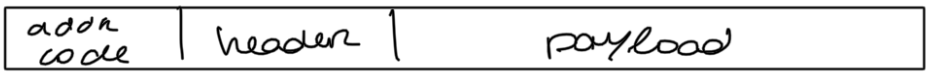
→ Radio layer

Defines requirements for Bluetooth radio transciever (2.4 GHz band, specs for Spread-Spectrum Frequency Hopping, classify devices).

Frame includes two packets

→ Baseband

Manages physicall channels and logical links
Works closely with link controller.
Baseband packet :



↙

channel access code, device access code, inquiry access code.

→ Links Manager : carries out links setup with authentication, links configuration

→ Link layer Control : links control protocol, connection oriented and connectionless data to upper

layer.

→ HCI : allows command line access to baseband layer and LM for control.

→ Middleware :

• Service Discovery Protocol (SDP) provides a way for apps to detect which services are available and characteristics.

↳ Protocol question ↔ answer

• Protocol message (aims to reuse older protocols)

→ Profiles and security

→ Interoperability : Profiles

Profile : base for BT interoperability, vertical cut in BT stack, a given usage model. Each BT device supports one or more profiles.

→ Security

Levels : mode 1 → no security

mode 2 → security at service level

mode 3 → security at link level

Mechanisms : fast frequency hoping, low

manage, auth., cypher, pin and shared keys.

Link keys in a product: are generated via PIN entry, different for each pair of devices, auth., permanent storage of keys.