

# Announcements



**3-Apr-01**

**CSCI {4,6}900: Ubiquitous Computing**

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# Outline

- Bluetooth: Vision, Goals and Architecture



# Bluetooth

Pravin Bhagwat  
@ AT&T Labs



- A cable replacement technology
- 1 Mb/s symbol rate
- Range 10+ meters
- Single chip radio + baseband
  - at low power & low price point

Why not use Wireless LANs?

- power
- cost

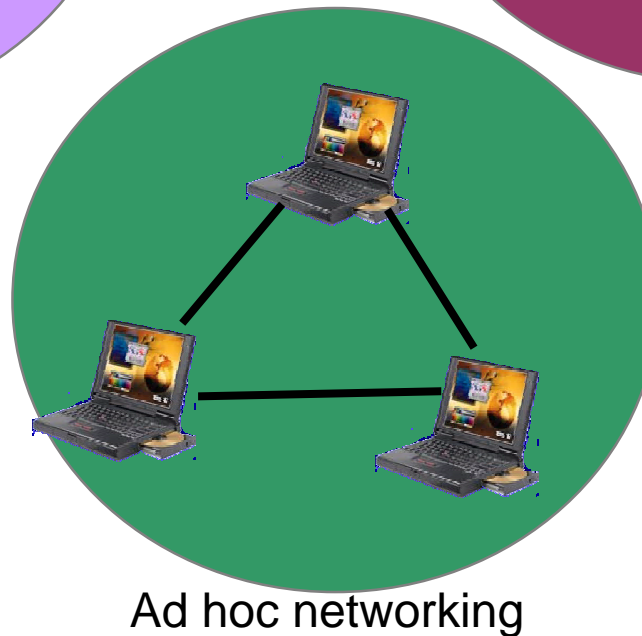
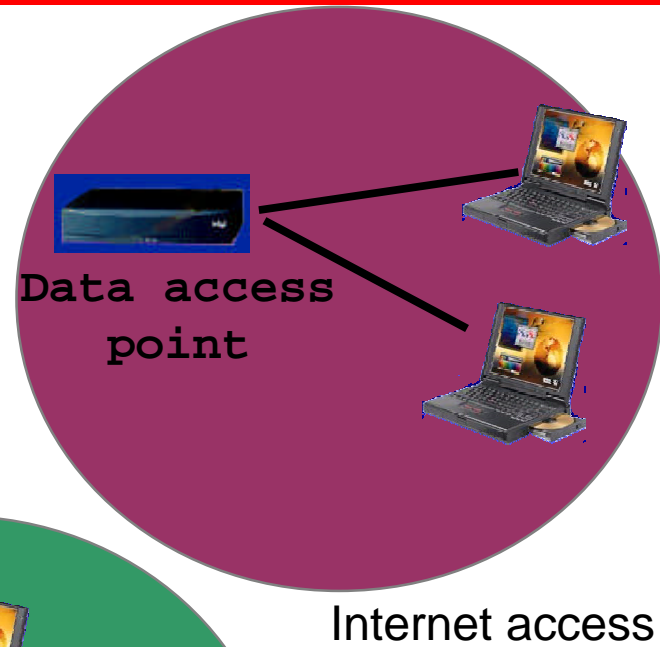
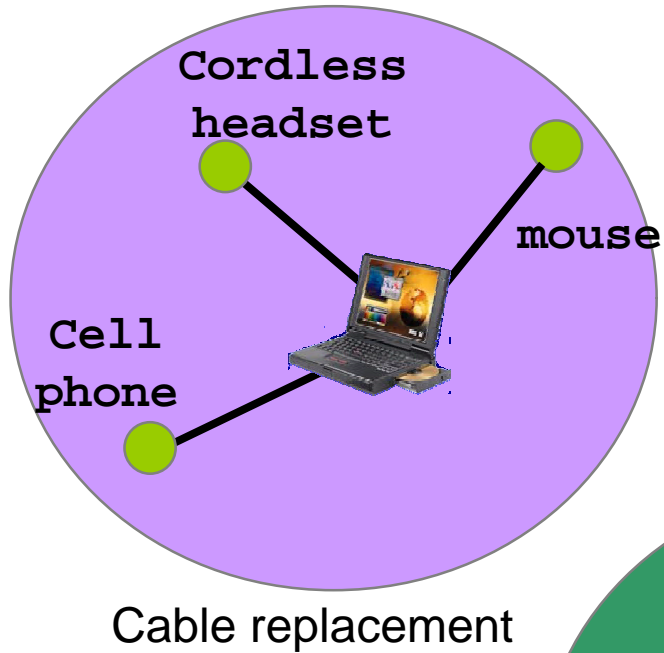


# Bluetooth

- Low cost, low-power radio-based cable replacement
- Related technologies
  - IrDA – Uses Infrared
    - Pros: Less governmental restrictions, lower cost, lower standby power, higher bandwidth
    - Cons: Line of sight
  - IEEE 802.11 – Same wireless band
    - Wireless LAN capability for a larger range
  - HomeRF – Wireless for data and voice
    - Data similar to 802.11, voice ADPCM



# Value proposition of Bluetooth



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## Bluetooth working group history

- February 1998: The Bluetooth SIG is formed
  - promoter company group: Ericsson, IBM, Intel, Nokia, Toshiba
- May 1998: Public announcement of the Bluetooth SIG
- July 1999: 1.0A spec (>1,500 pages) is published
- December 1999: ver. 1.0B is released
- December 1999: The promoter group increases to 9
  - 3Com, Lucent, Microsoft, Motorola
- February 2000: There are 1,800+ adopters



# New Applications



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# Synchronization



## User benefits

- Automatic synchronization of calendars, address books, business cards
- Push button synchronization
- Proximity operation

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# Cordless Headset

## User benefits

- Multiple device access
- Cordless phone benefits
- Hands free operation



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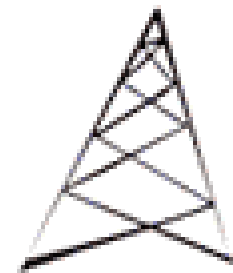
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## Three-in-one phone

- At home, your phone functions as a portable phone (fixed line charge). When you're on the move, it functions as a mobile phone (cellular charge). And when your phone comes within range of another mobile phone with built-in Bluetooth wireless technology it functions as a walkie talkie (no telephony charge).



mobile phone

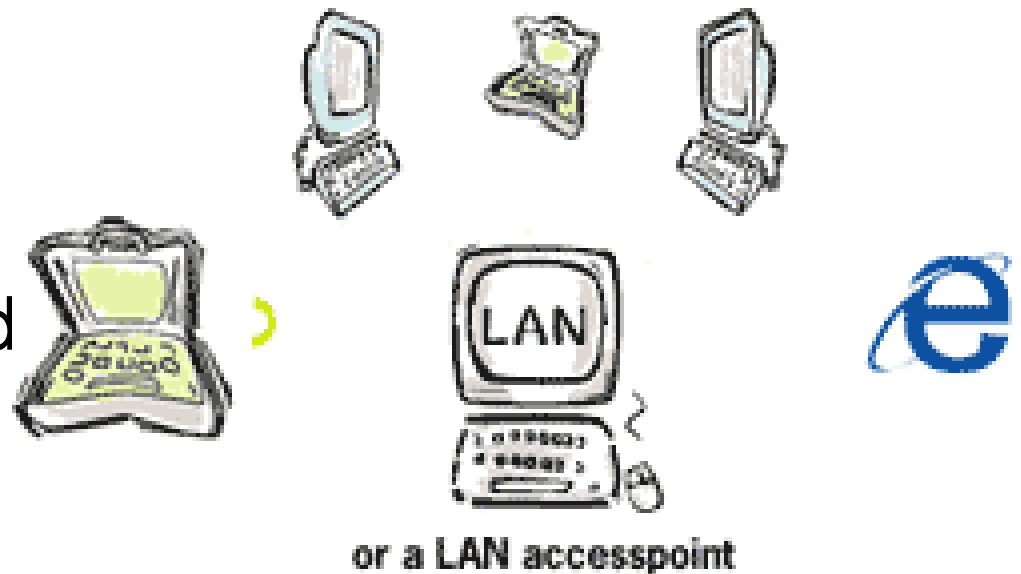


Source: [bluetooth.com](http://bluetooth.com)



# The Internet Bridge

- Use your mobile computer to surf the Internet wherever you are, and regardless if you're cordlessly connected through a mobile phone (cellular) or through a wire-bound connection (e.g. PSTN, ISDN, LAN, xDSL).

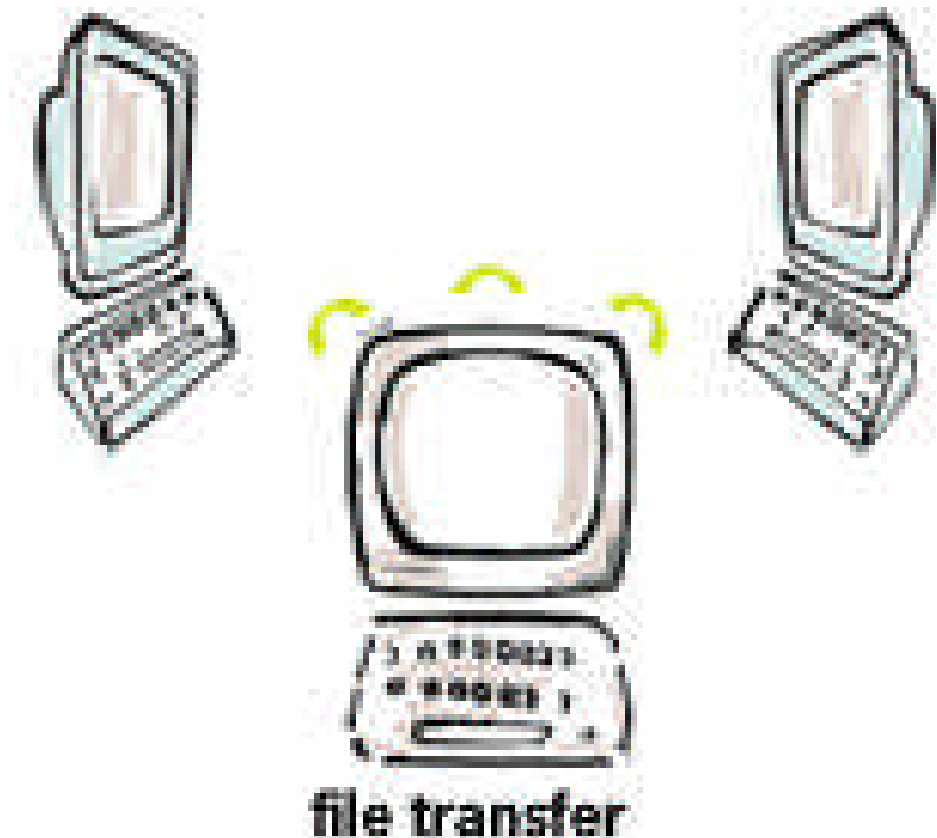


Source: [bluetooth.com](http://bluetooth.com)

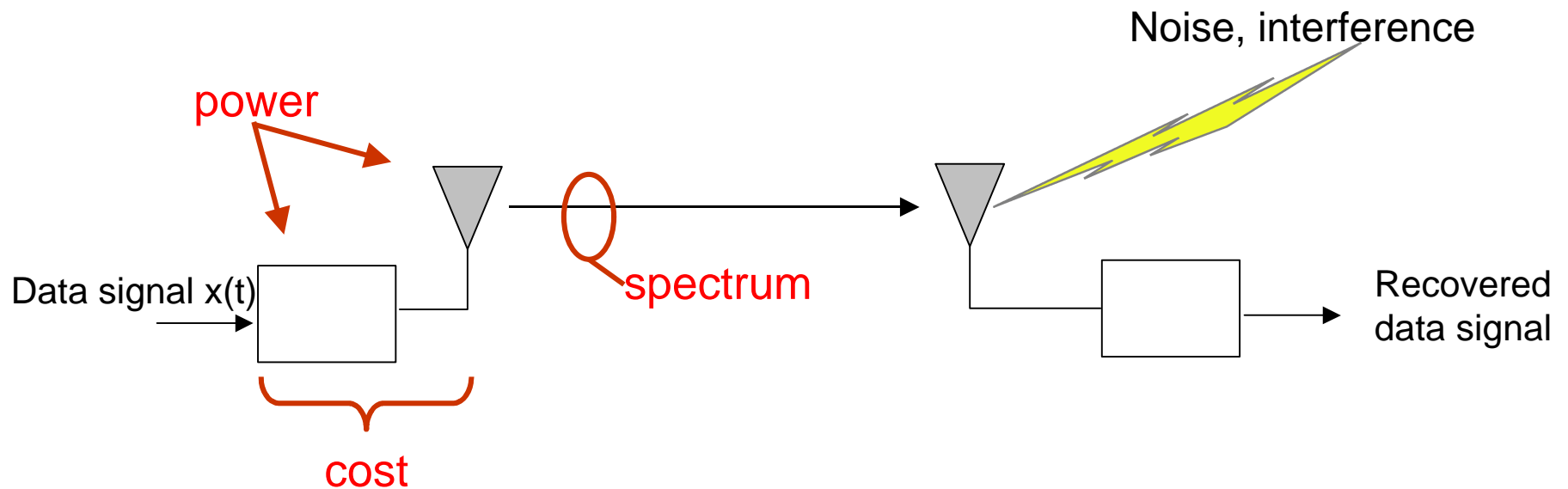
# The Interactive Conference

- In meetings and conferences you can transfer selected documents instantly with selected participants, and exchange electronic business cards automatically, without any wired connections

Source: [bluetooth.com](http://bluetooth.com)



# Design considerations



## Goal

- high bandwidth
- conserve battery power
- cost < \$10

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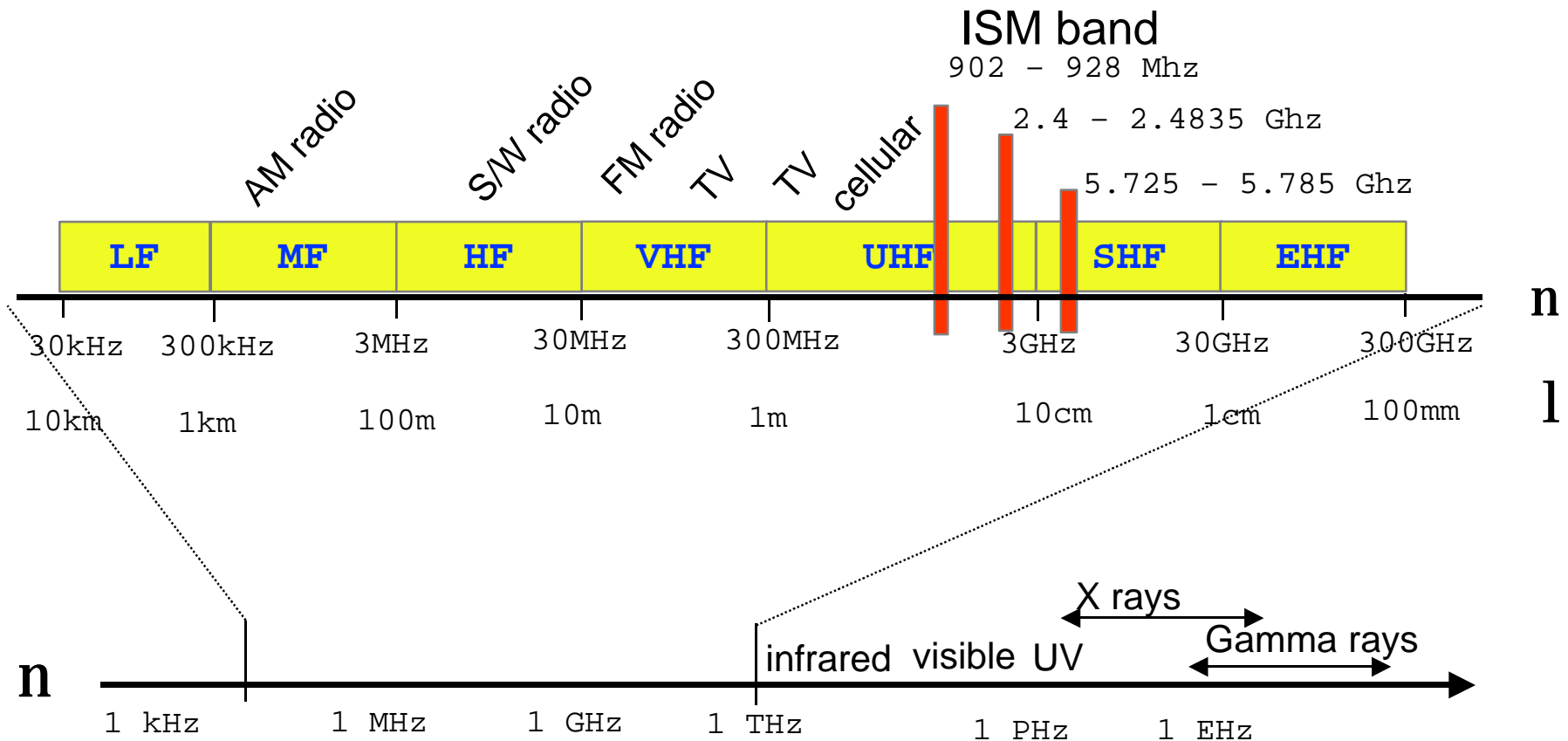


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# EM Spectrum



Propagation characteristics are different in each frequency band

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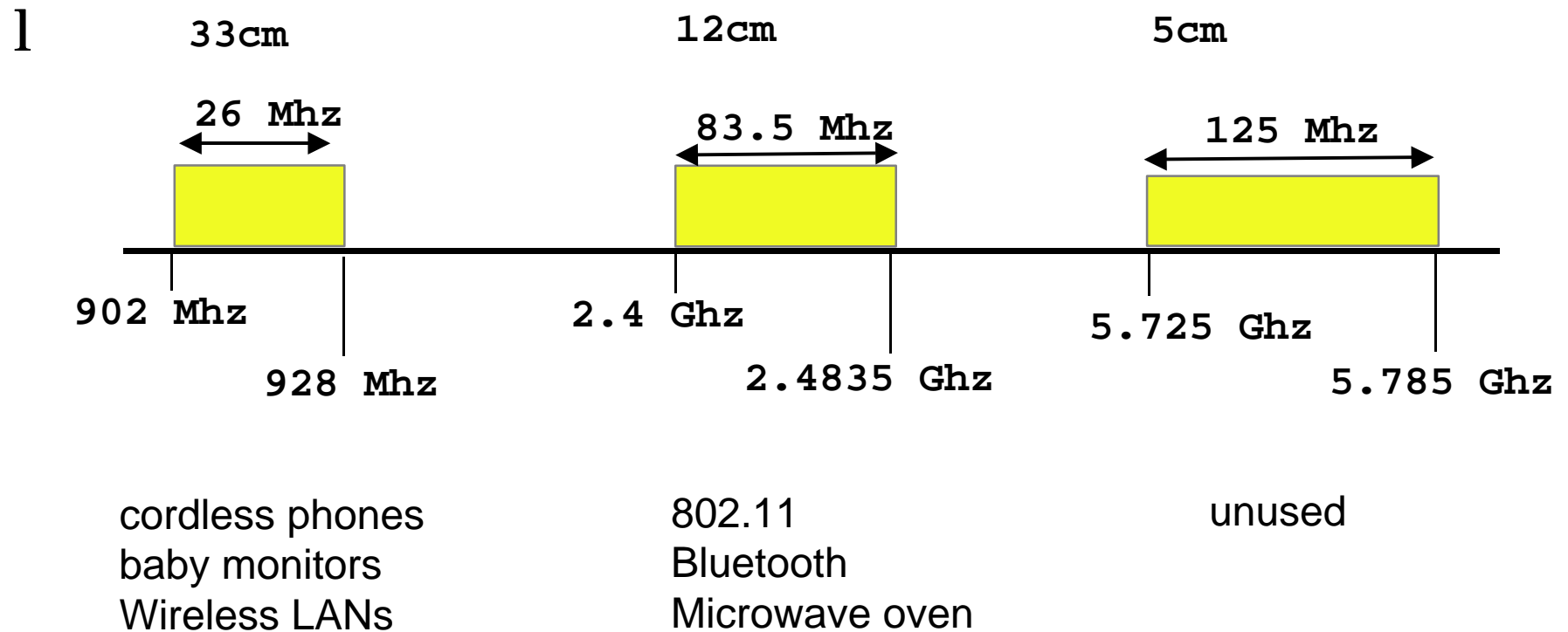


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# Unlicensed Radio Spectrum



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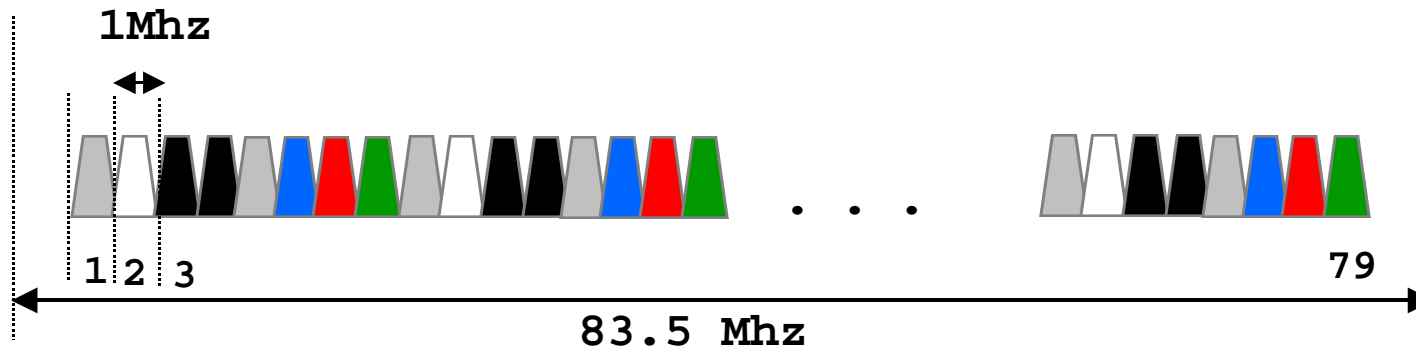


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# Bluetooth radio link



- frequency hopping spread spectrum
  - $2.402 \text{ GHz} + k \text{ MHz}$ ,  $k=0, \dots, 78$
  - 1,600 hops per second
- GFSK modulation
  - 1 Mb/s symbol rate
- transmit power
  - 0 dbm (up to 20dbm with power control)

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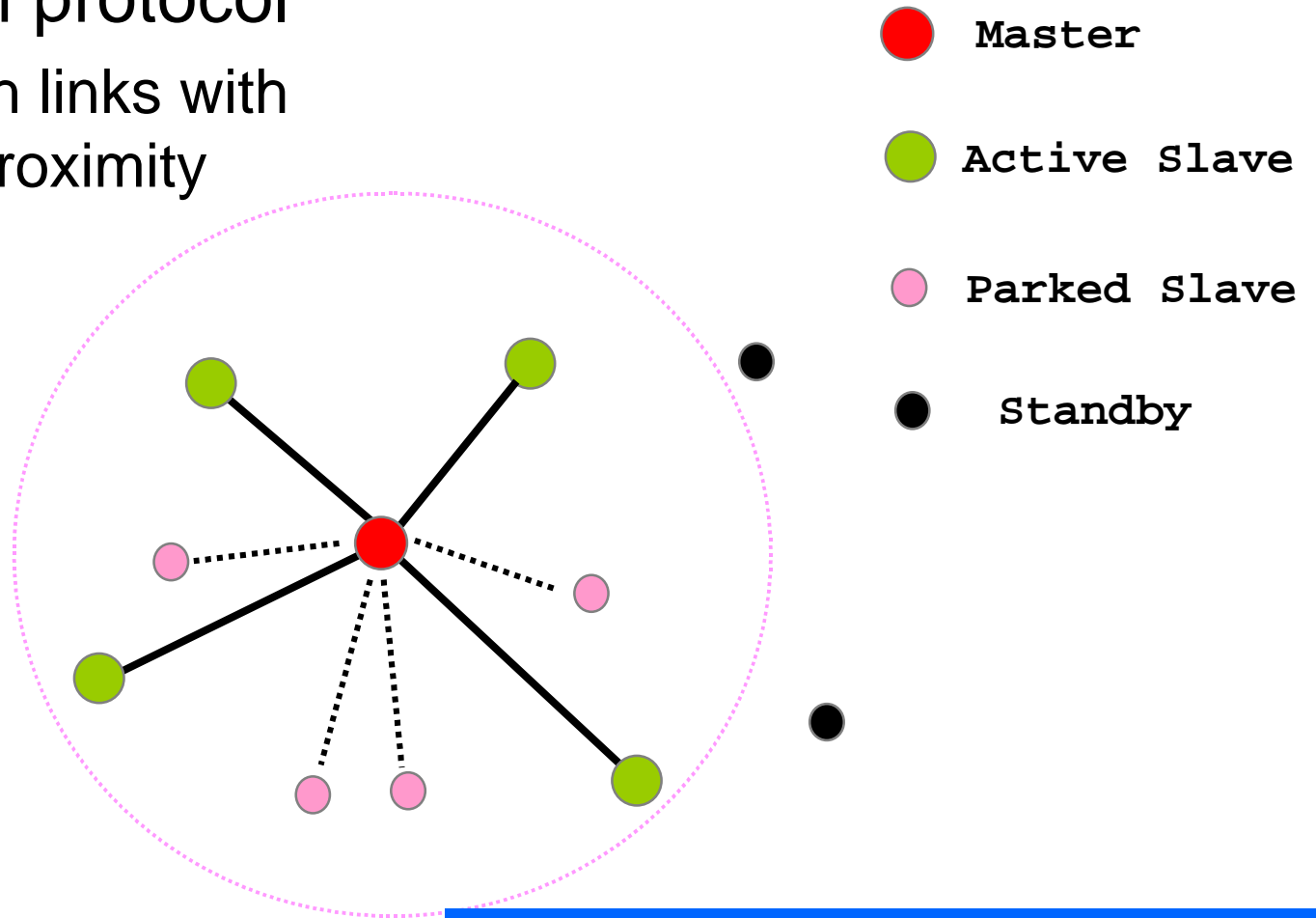
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# Piconet formation

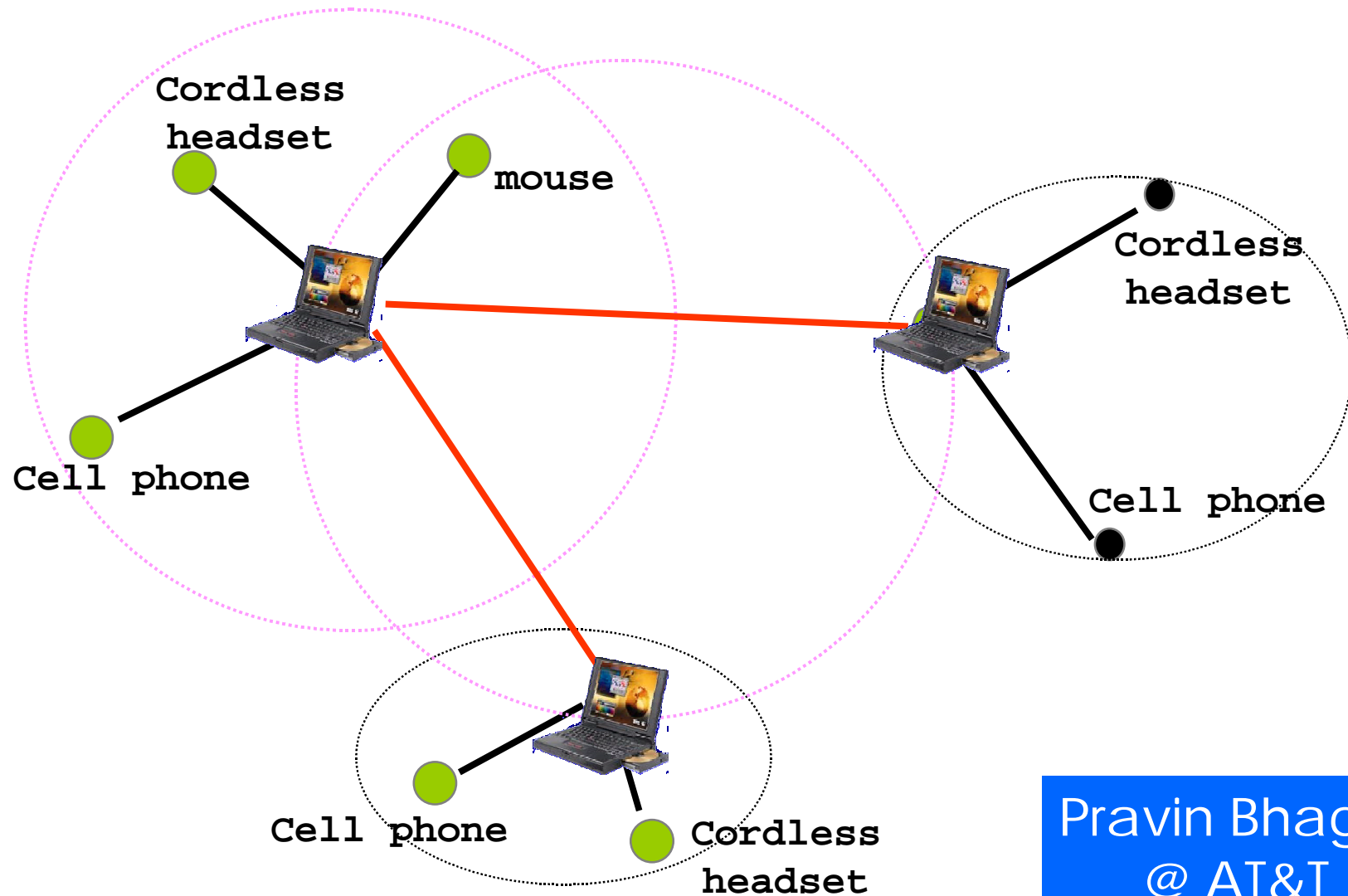
- Page - scan protocol
  - to establish links with nodes in proximity



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# Inter piconet communication



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## Discussion

- Wanted – killer app!!

