Signal Strength Measurements for Localisation of Mobile Wireless Interaction Spaces

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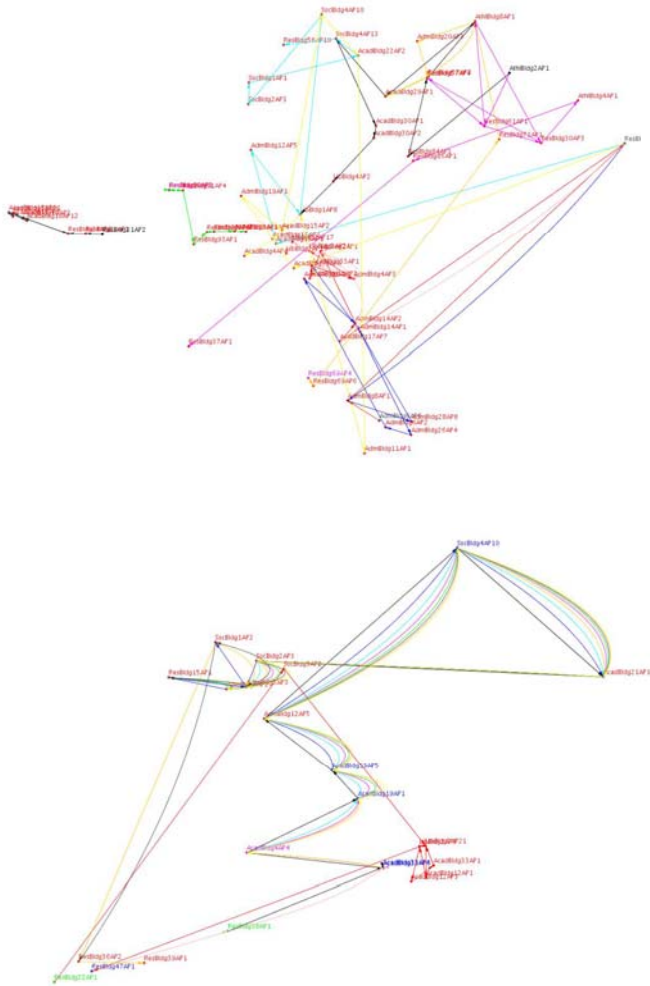
The Navigation Problem

- Objective: to reduce information overload in ubiquitous computing environments
- Use trails to assist navigation in pervasive computing spaces
- Trails are sequences of recorded interactions with landmarks
- Landmarks are *significant* “wireless mobile interactions spaces”
  - definition as per Vassilis, Tim and Eamon

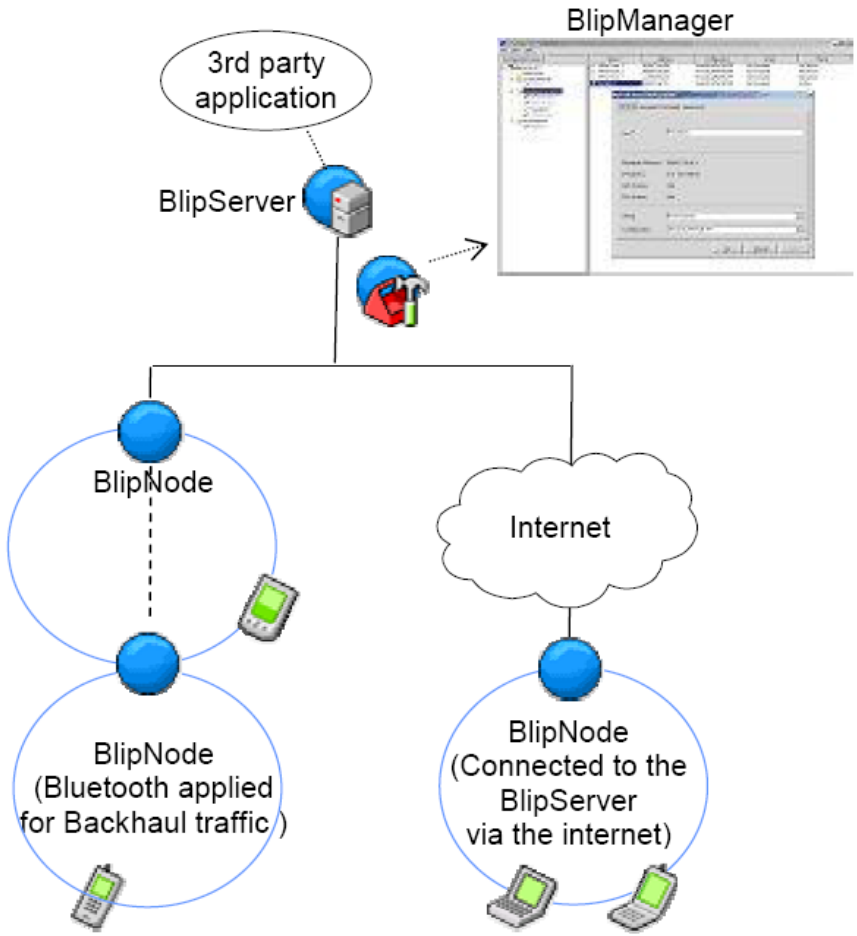
Analysis

- Record interactions with landmarks
- Analyse patterns using a tree-structure
  - Query, ranking, inference
- Some interaction spaces have both physical and information attributes
  - e.g. an interaction space may be restricted due to visual constraints
- Museum exhibit example
  - Time, distance, angle of orientation
  - Use Bluetooth signal strength measurements to achieve that



Trail Recording

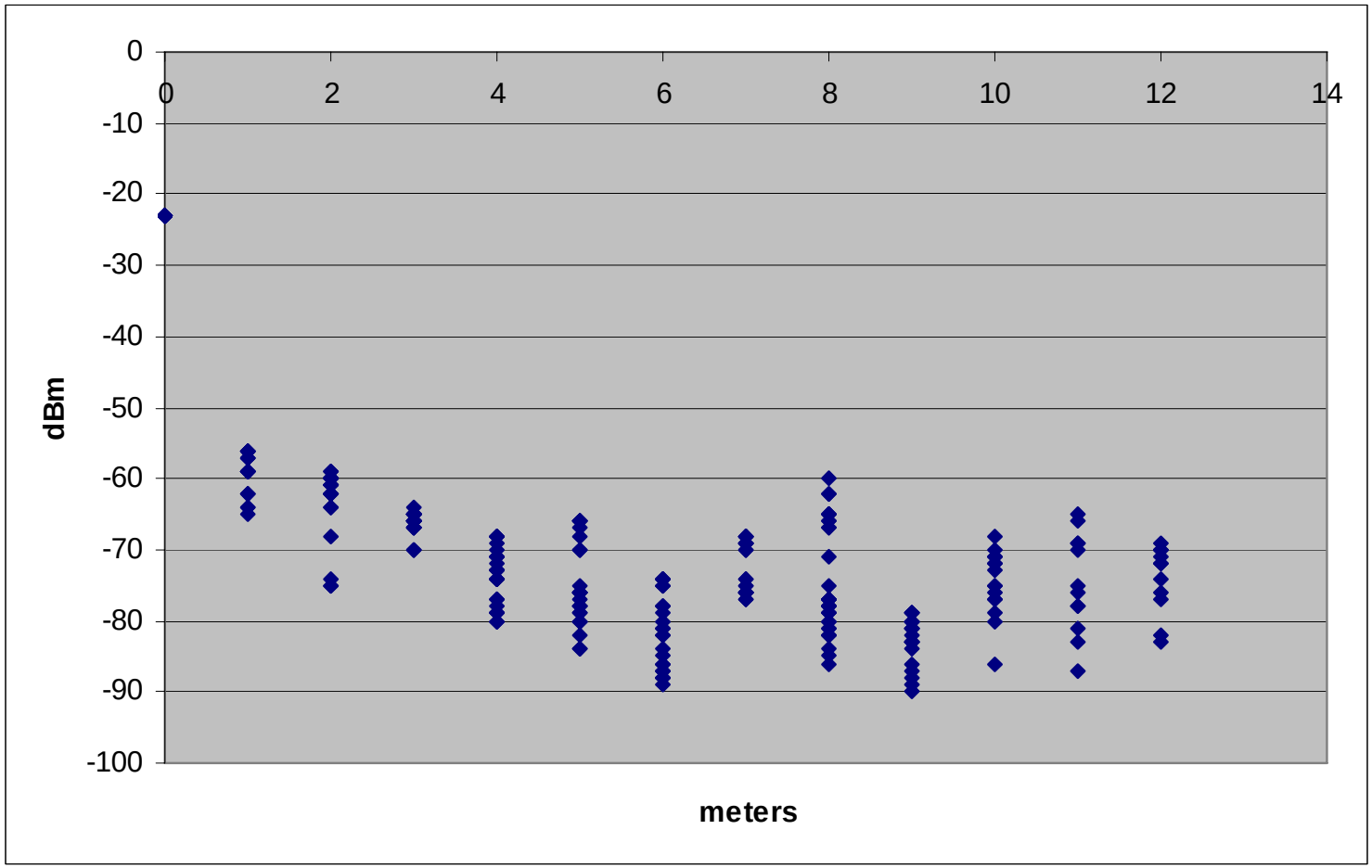
- BlipSystems
  - Platform for Bluetooth aware devices
  - Java API to write Bluetooth applications
  - Continues inquiry
- Identify location by closest blip node
  - Record discovered devices and signal strength in log files



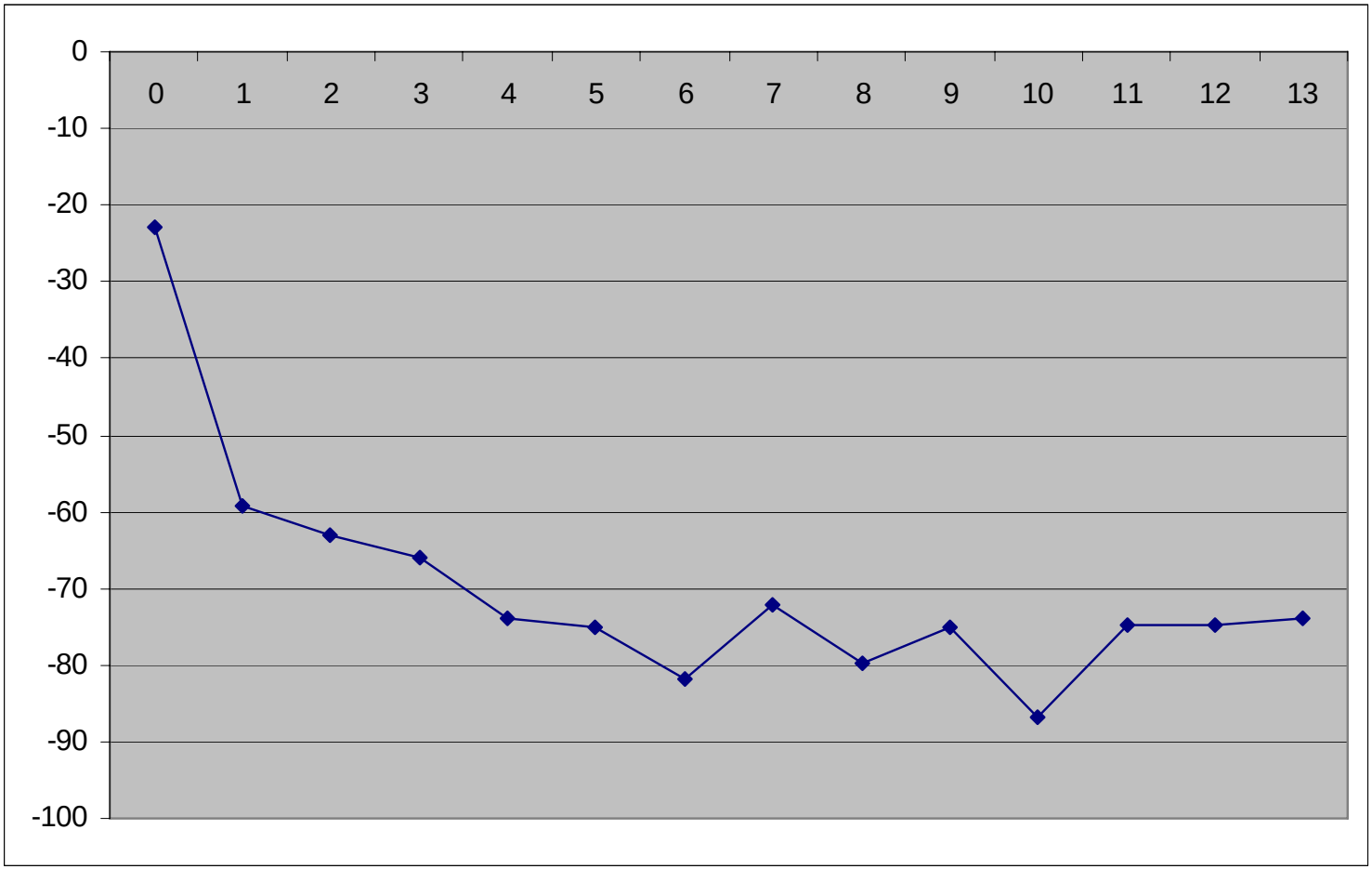
Sample Log Files

- Computer - Handheld PC/PDA (clam shell), 17/2/2005:3:31:13:453, 00:A0:96:09:1C:D0, 193.61.44.28, 00:02:C7:0D:97:8D, {-28 dBm}
- Imaging - Printer, 17/2/2005:3:31:21:556, 00:A0:96:09:1C:D0, 193.61.44.28, 00:30:6E:EA:29:2F, {-75 dBm}
- Imaging - Printer, 17/2/2005:3:31:22:8, 00:A0:96:09:1C:D0, 193.61.44.28, 00:30:6E:EA:29:2F, {-75 dBm}
- Computer - Handheld PC/PDA (clam shell), 17/2/2005:3:31:23:846, 00:A0:96:09:1C:D0, 193.61.44.28, 00:02:C7:0D:97:8D, {-28 dBm}
- Imaging - Printer, 17/2/2005:3:31:26:654, 00:A0:96:09:1C:D0, 193.61.44.28, 00:30:6E:EA:29:2F, {-73 dBm}
- Imaging - Printer, 17/2/2005:3:31:31:777, 00:A0:96:09:1C:D0, 193.61.44.28, 00:30:6E:EA:29:2F, {-85 dBm}
- Imaging - Printer, 17/2/2005:3:31:32:376, 00:A0:96:09:1C:D0, 193.61.44.28, 00:30:6E:EA:29:2F, {-79 dBm}

Distance Bluetooth signal strength - 1



Distance Bluetooth signal strength – 2



Conclusions

- Usable measurements for the first four meters
- Must identify and remove outliers
- Use aggregates over a brief time frame
  - E.g. 1 minute
  - Averages work
- 6-10 metres are indistinguishable
- Signal spill over up to 13 metres
- Signal strength of Blipnode effect (max range 200m)