



Ving

Bootstrapping the Desktop Area Network with a Vibratory Ping

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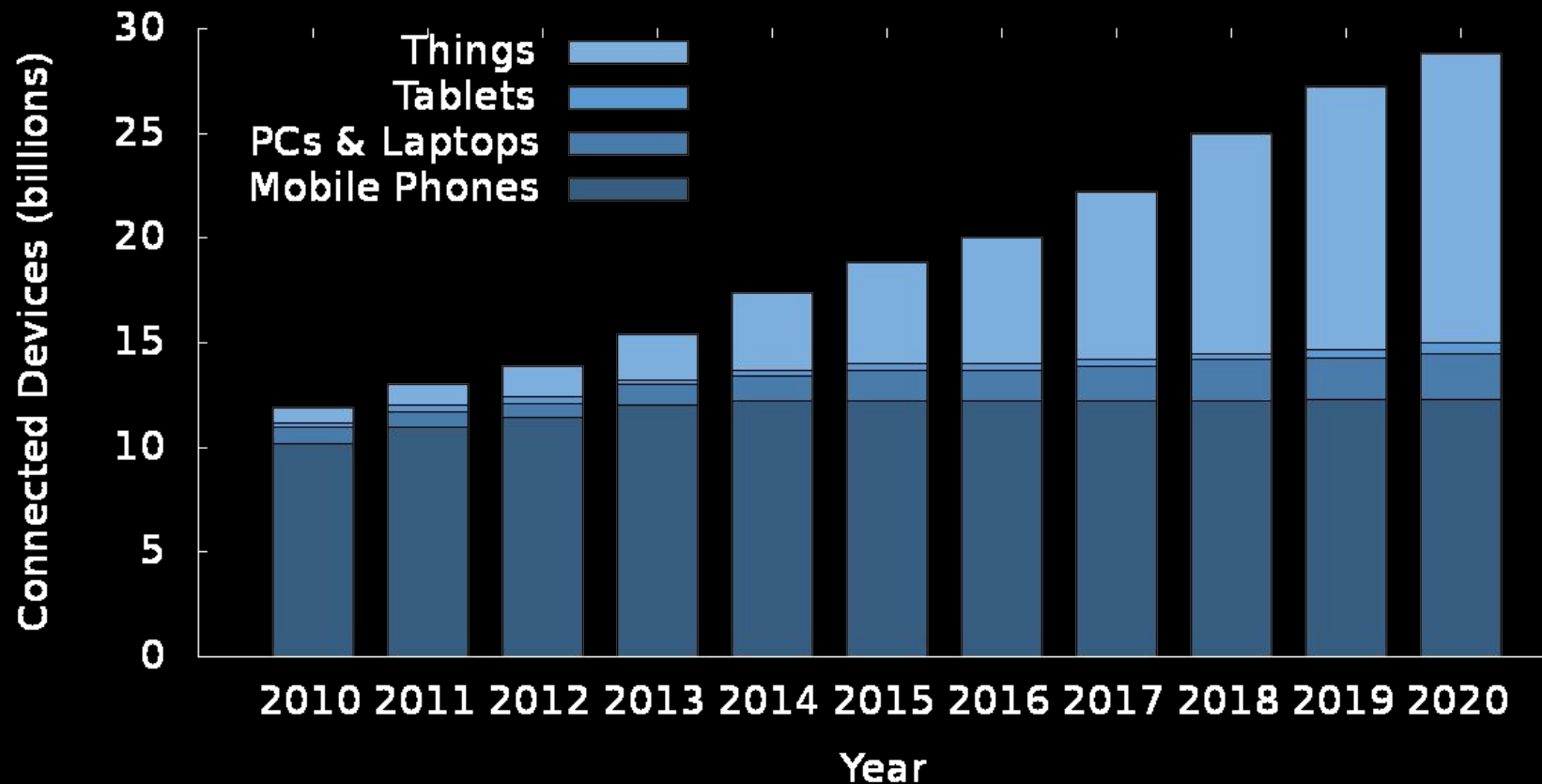
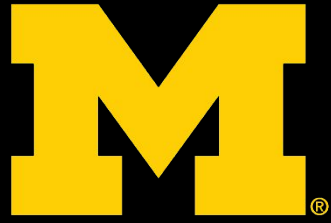
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HotWireless Workshop 2015

September 11, Paris, France

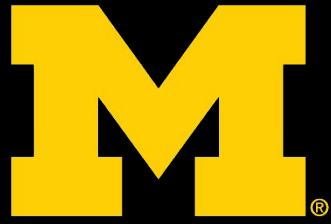
We are becoming increasingly surrounded by service-providing devices



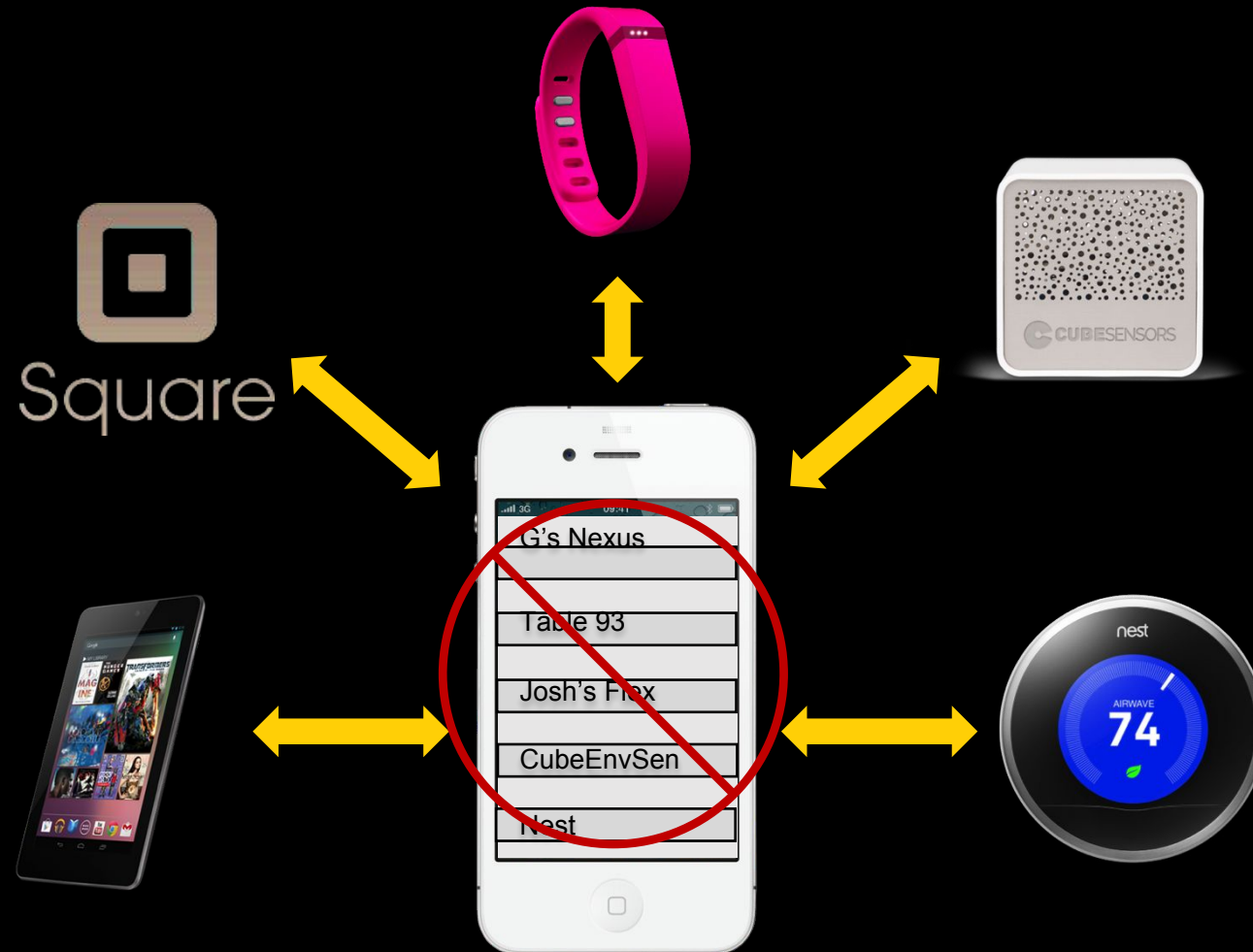
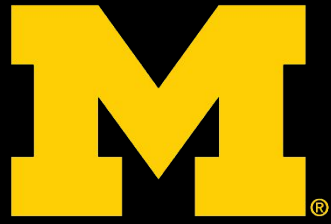
IoT devices are increasingly implementing soft user interfaces



Managing connections with many of these devices is necessary



These connections need to be user-transparent



Only some connections are immediately relevant



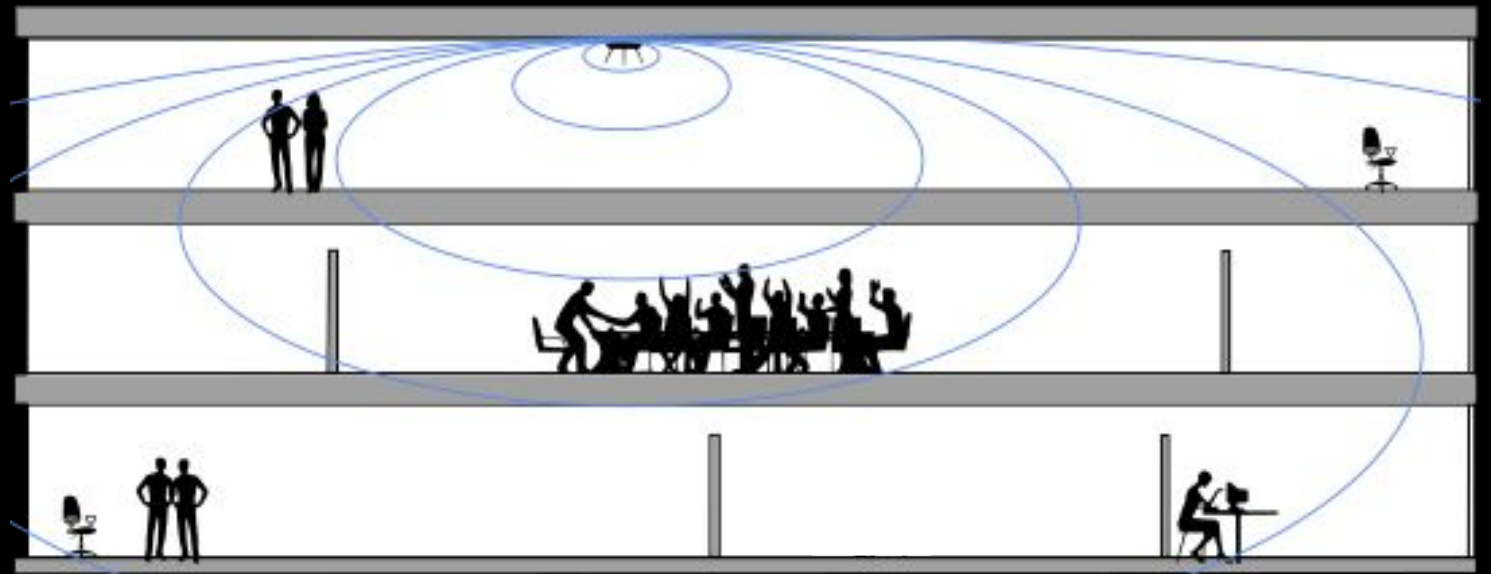
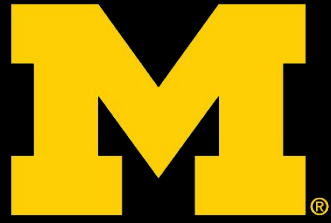
We need to selectively form connections with relevant devices



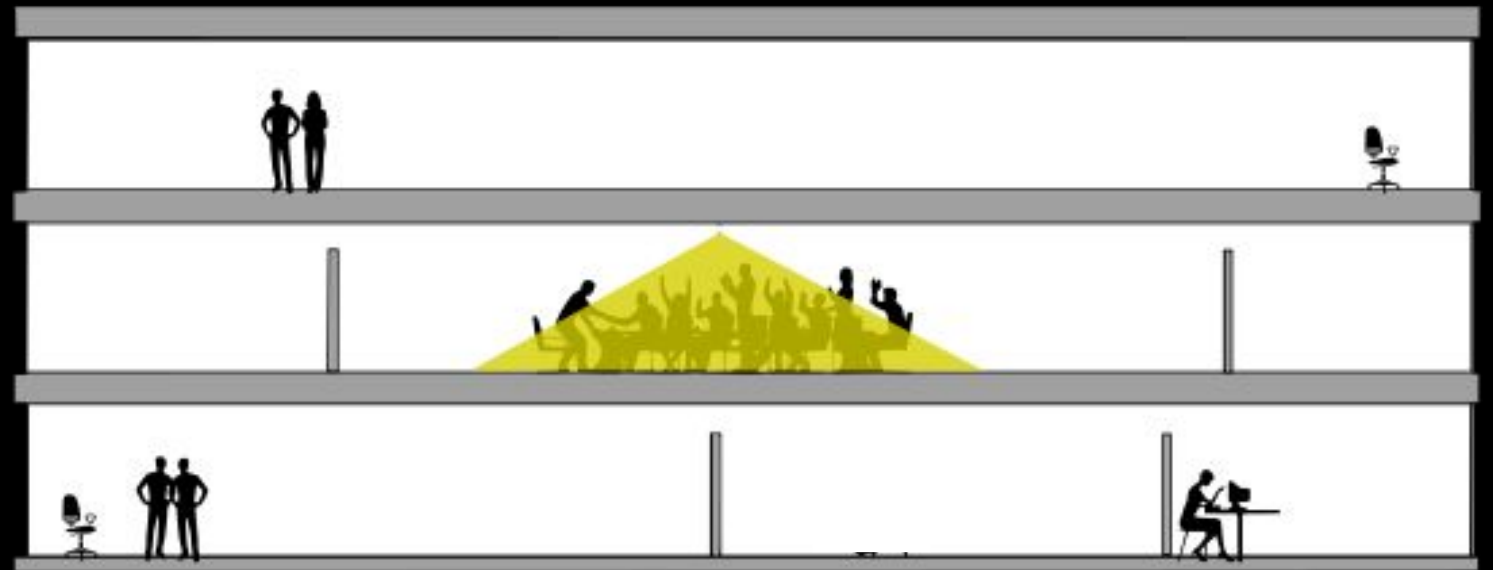
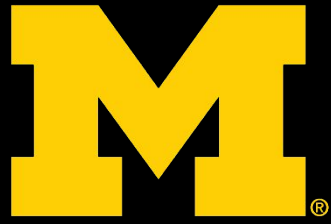


Communication contexts can be used to
establish device relevance

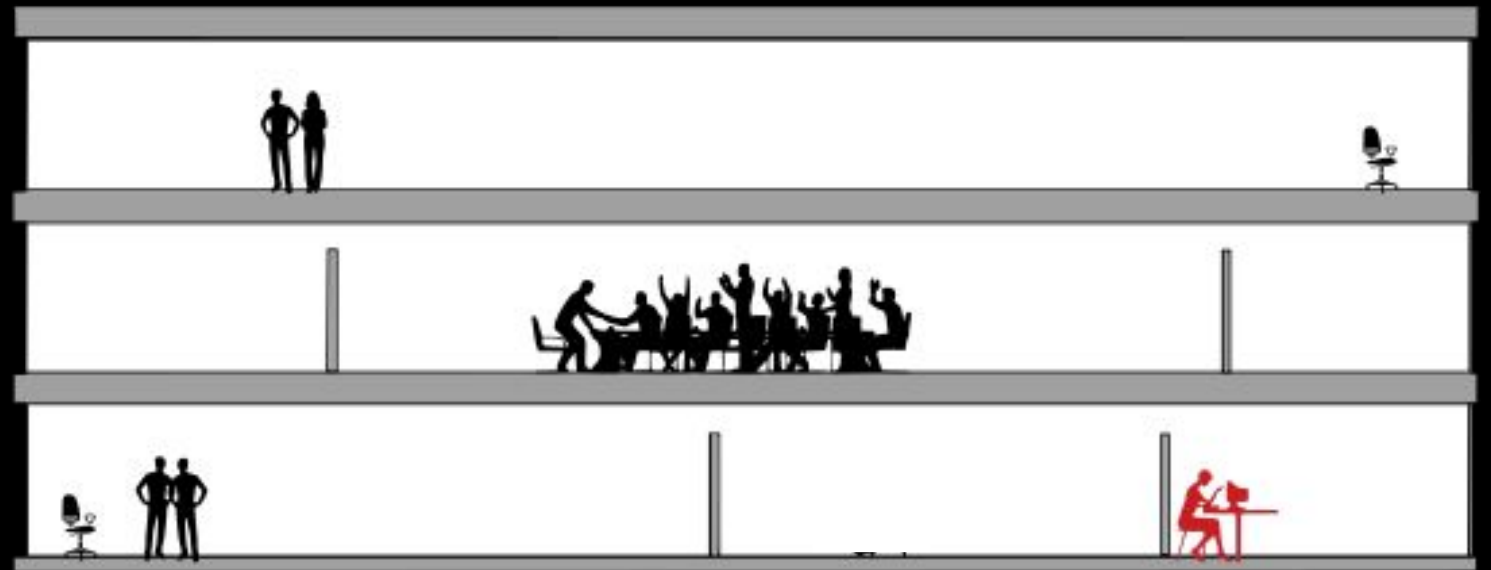
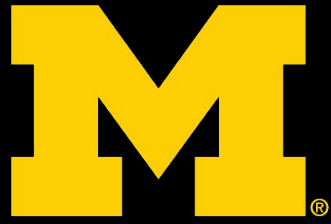
Long range RF provides building-level context



Visible Light Communication provides room-level context



Desktop-level context can be provided by vibratory communication



Vibratory communication overview

- Vibratory motor transmits, accelerometer receives
- Hardware ubiquitous in mobile devices
- Transmission rates of 20-80 bps on smartphones¹



Vibratory communication overview

- Vibratory motor transmits, accelerometer receives
- Hardware ubiquitous in mobile devices
- Transmission rates of 20-80 bps on smartphones¹
- A short transmission can contain a unique ID or address





Ving (Vibratory Ping) Architecture

1. Detect that device is set on flat surface
2. Advertise RF connection
3. Transmit Ving
4. Receive Ving
5. Scan for RF advertisements
6. Initiate wireless connection



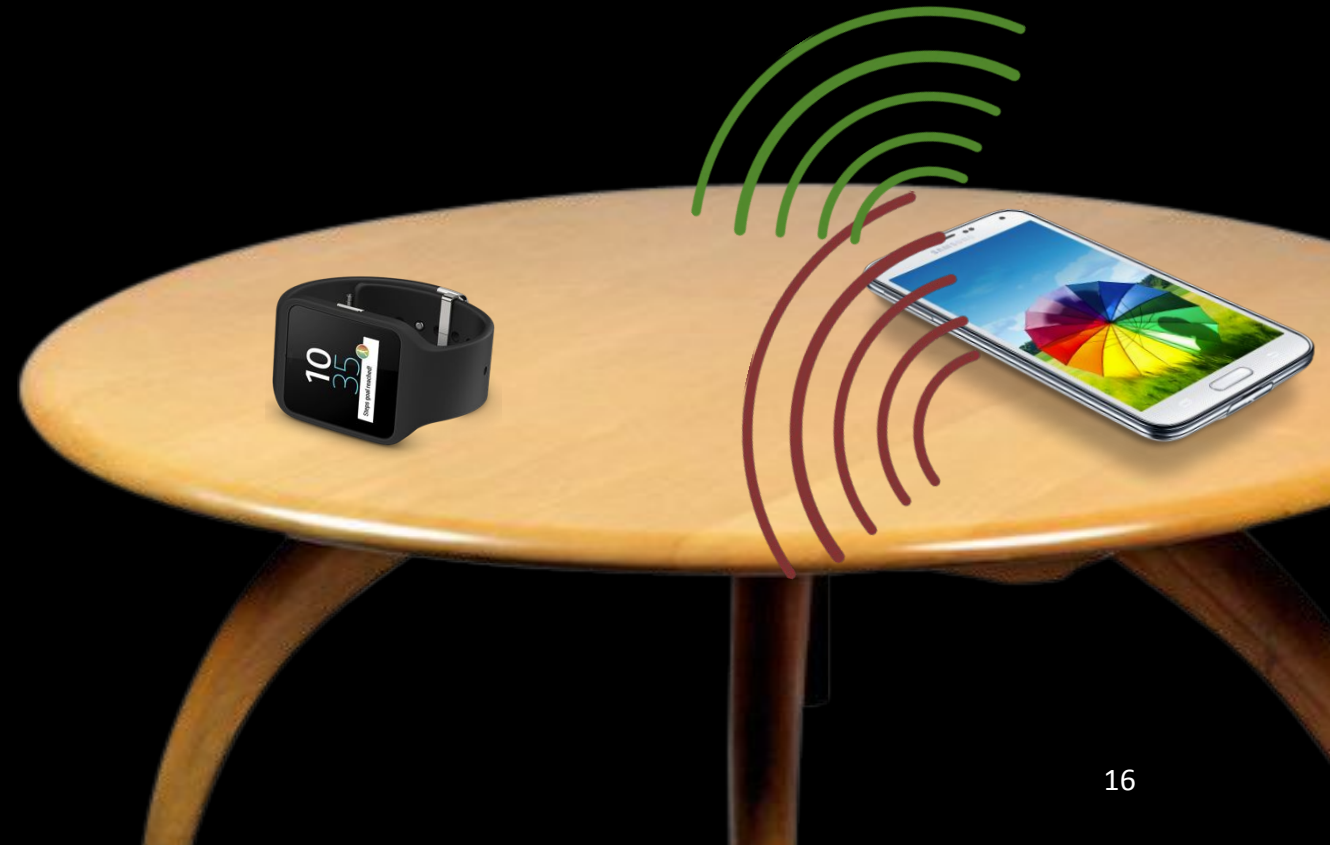
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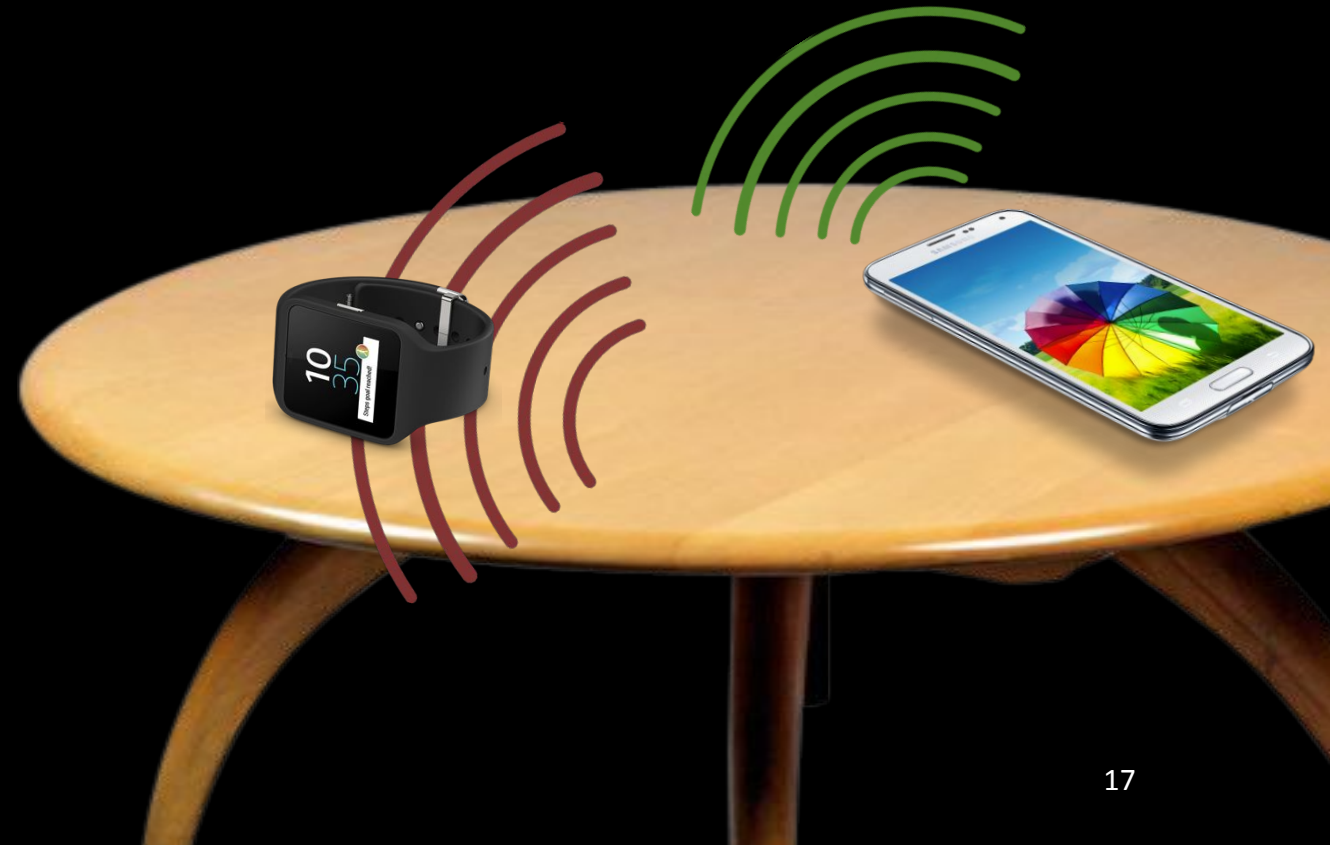
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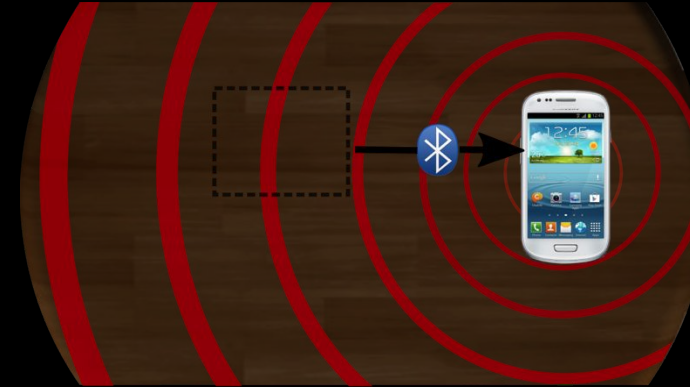
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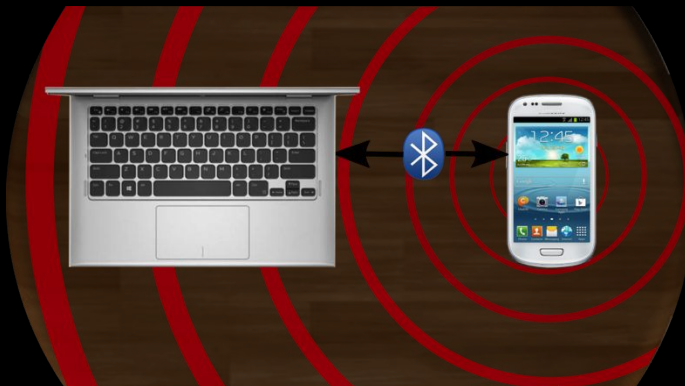
Ving connection patterns and applications



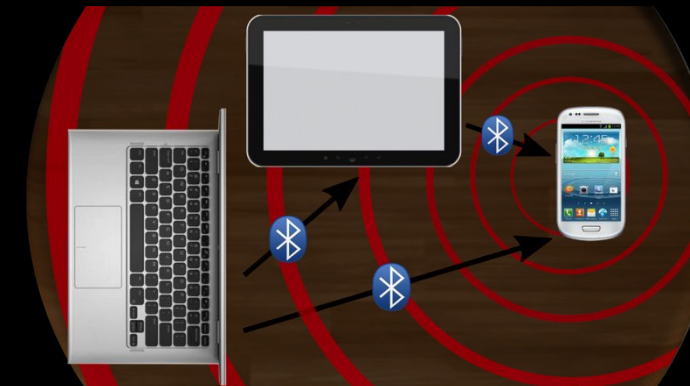
1. First-time connection



2. Table-level services



3. Presence detection



4. Desktop area network

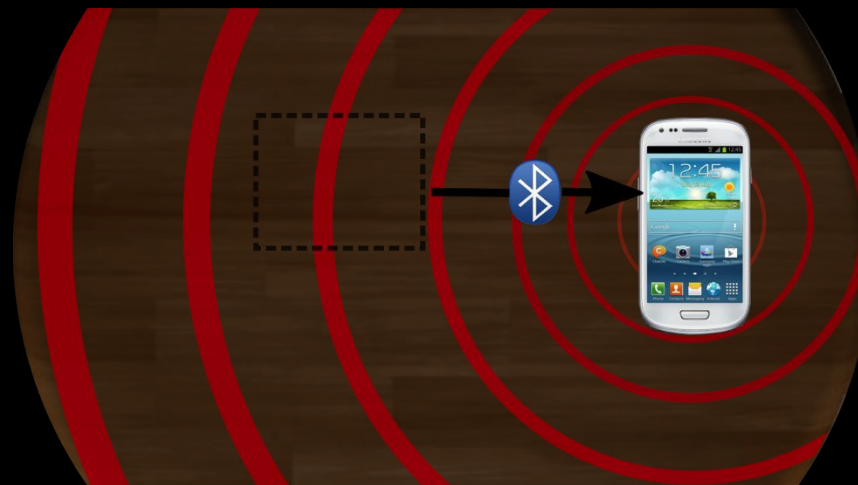
1. First-time connection

- Initiate a persistent and trusted connection
- Useful in crowded RF spaces
- Could be achieved with range-limited RF



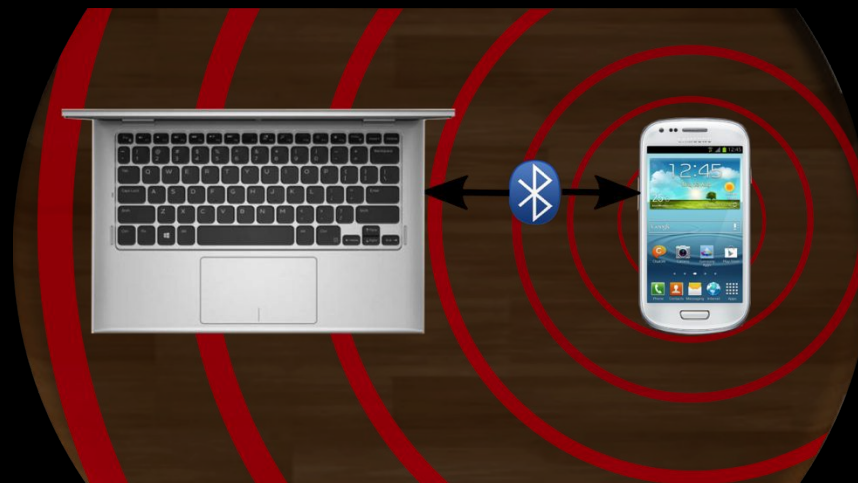
2. Table-level services

- Temporary and user-transparent
- Allows table-specific and headless connections
- Difficult to scale using range-limited RF, non-distance based indicator



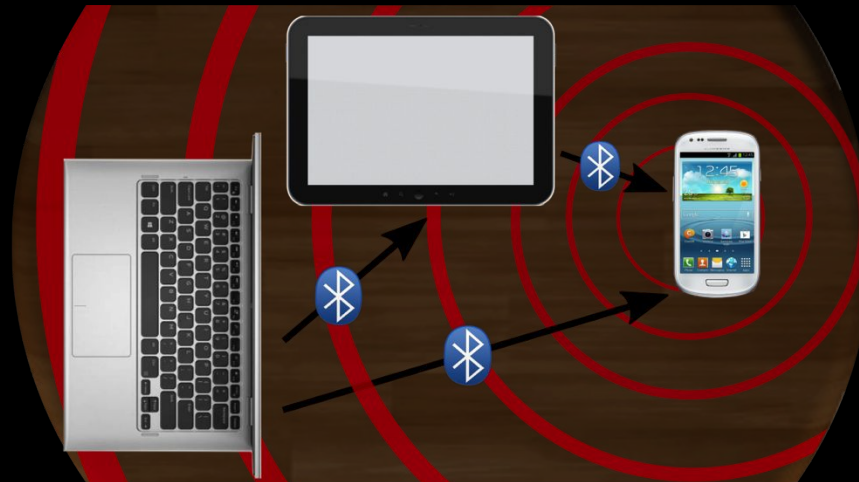
3. Presence detection

- Indication of shared desktop context
- Between trusted and pre-connected devices
- Distance based RF methods would lead to unwanted connections



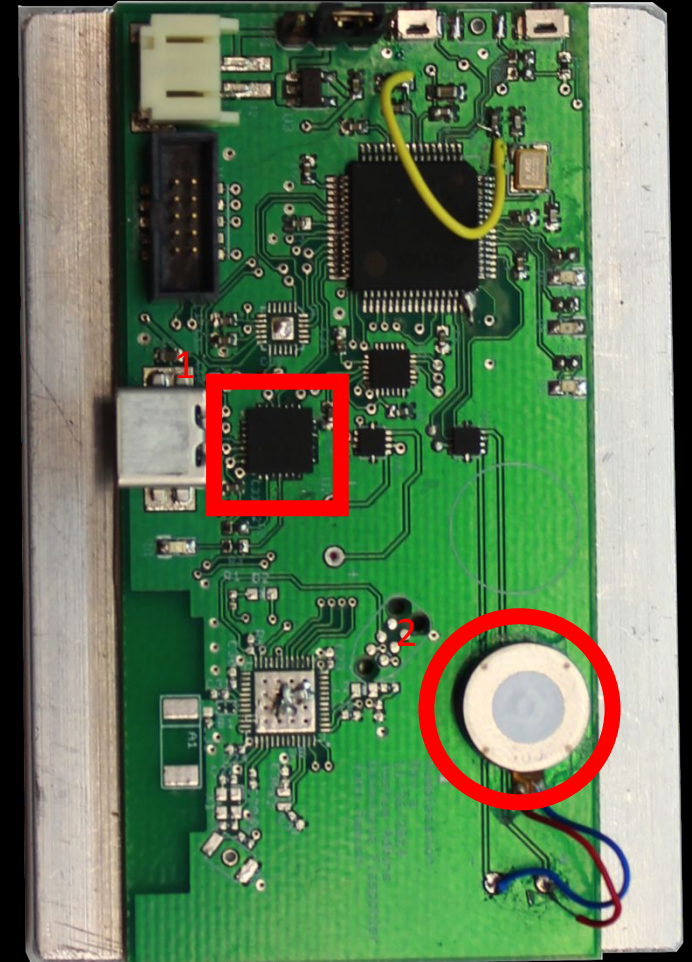
4. Desktop area network

- Temporary, ad-hoc network between unknown devices
- Constrained to a physical table
- Cumbersome connection using both long and short range RF

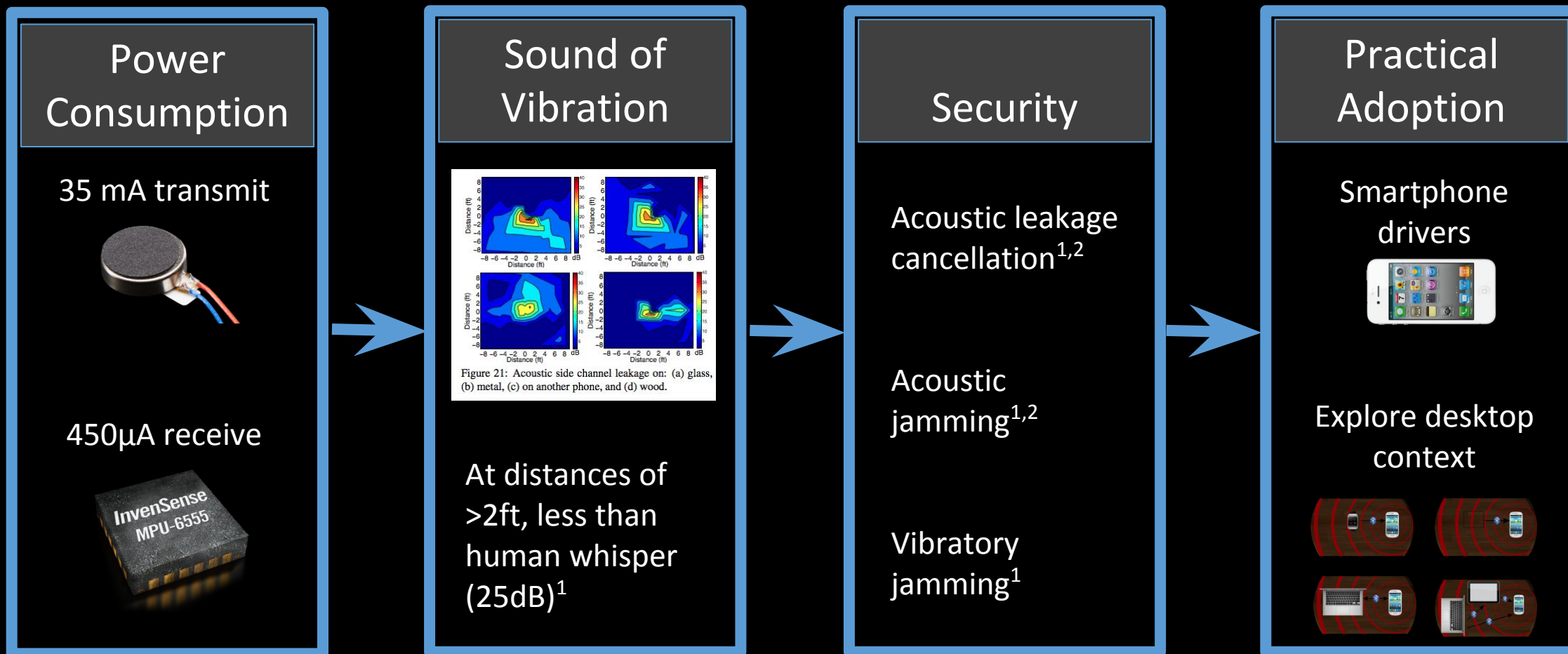


Preliminary test-bed development

- Custom embedded device mimics smartphone hardware
- OS access issues with smartphone implementation
- Basic on-off-keying and parity error checking



Evaluation and future work



[1] N. Roy, M. Gowda, and R. R. Choudhury. Ripple: Communicating through physical vibration.

[2] Nandakumar, R., Chintalapudi, K. K., Padmanabhan, V., and Venkatesan, R. Dhvani: Secure peer-to-peer acoustic NFC.



*Ving: Bootstrapping the desktop area network
with a vibratory ping*

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<https://github.com/lab11/ving>

lab11.eecs.umich.edu