



Mobile Computing

Lecture 1: Class Intro

Dr. Moustafa Alzantot



Course Overview

- An introductory class to mobile computing technologies and applications.
- Prerequisites:
 - Computer Programming
 - Computer Networks fundamentals
- Lectures:
Monday 11:30 AM - 2:30 PM
- Discussions:
 - Tuesday

Course Overview

- Course Staff:
 - Dr. Hany Aly El-ghaish (hany_elghaish@f-eng.tanta.edu.eg)
 - Dr. Moustafa Alzantot (m_alzantot@f-eng.tanta.edu.eg)
- Teaching Assistant
 - Eng. Heba Fathy (heba.fathi@f-eng.tanta.edu.eg)

Logistics

(Tentative Grading)

- Grading:
 - 60% final exam
 - 20% class project
 - 20% midterm and assignments

Course Topics

(Tentative Schedule)

Week	Topics
Week 1	Class Intro
Weeks 2 - 4	Wireless Communications
Week 5	Energy Efficiency
Weeks 6 - 8	Localization
Weeks 9-10	Sensing and Context Awareness
Week 11	Mobile Operating Systems
Week 12	TinyML
Week 13	Security and Privacy

Mobile Computing

Mobile computing

- **Mobile computing device:**
 - A computing device that is expected to be moving during operation.

Can you give an example for mobile computing devices?



Smart Phones



Tablets



Smartwatches



Drones



Smart Glasses

The three waves of computing

First wave: Mainframe

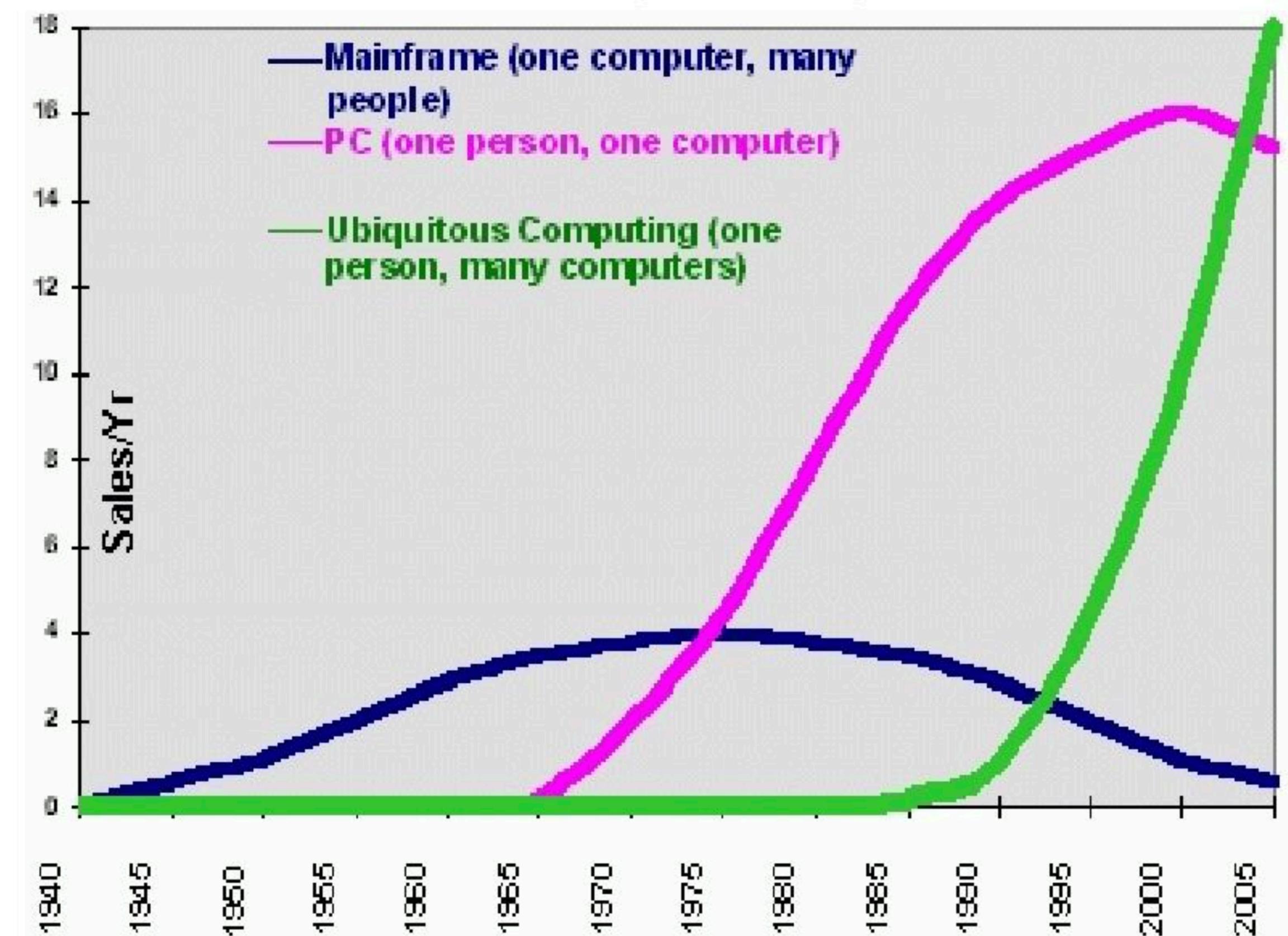
- *One device, many persons*

Second wave: PC

- *One device, one person*

Third wave: Ubiquitous Computing

- *One person, many devices*



Ubiquitous Computing

- Means computing “everywhere”
 - Commonly interchanged with “Pervasive Computing” means “Computing in-everything”.

Ubiquitous Computing

- Term coined by Marc Weiser, a computer scientist at Xerox PARC in 1988.
 - Now, known as “*father of ubiquitous computing*”.



Marc Weiser

- **Reading Assignment:** his 1991 paper titled “The Computer of the 21st Century”
[https://www.lri.fr/~mbl/Stanford/CS477/papers/
Weiser-SciAm.pdf](https://www.lri.fr/~mbl/Stanford/CS477/papers/Weiser-SciAm.pdf)

The Computer for the 21st Century

- Marc Weiser wrote:

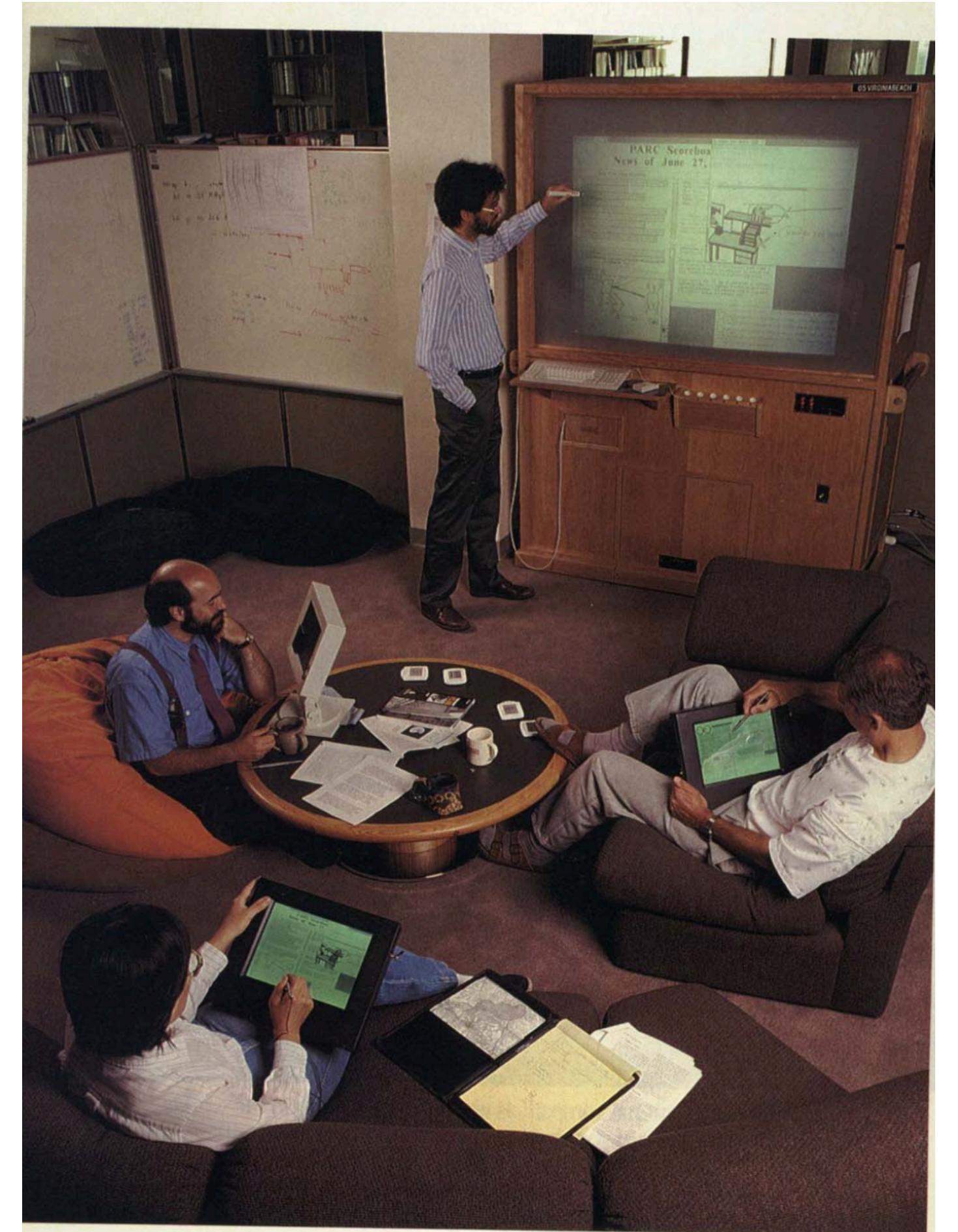
“The most profound technologies are those that disappear. They weave themselves into the fabric of everyday life until they are indistinguishable from it.”



Marc Weiser

The Computer for the 21st Century

- Envisioned ubiquitous computers will come in different sizes.
- Weiser and his colleagues built three different sizes of devices:
 - **Tabs:** inch-scale device that approximate active post-notes.
 - **Pads:** foot-scale devices that looks like a sheet of paper.
 - **Boards:** A yard scale display that resembles blackboard or bulletin board.



The Computer for the 21st Century

- How many devices will be there in one room?
 - Depending on the room size, there may be more than 100 tabs , 10 or 20 pads, and one or two boards.



The Computer for the 21st Century

- **Active Badge**

- An example for “tabs” device.
- A clip-on computer roughly in the size of an employee ID card.
- Identifies themselves to receivers places throughout the building.
- Used to keep track of the people or object’s location.
- Used to automatically open doors to the wearer, forward phones calls the correct room, etc.



Example nowadays:

Nike+iPod

- Sensor fits into a hole under Nike+ running shoe.
- Sensor use piezoelectric accelerometer to detect the runner's footfalls.
- Processor transforms this information into runner's speed.
- Sensor broadcast the data using 2.4 GHz radio frequency to receiver connected to iPod.
- It also transmits a unique identifier to identify itself from other sensors in vicinity.



Challenges for mobile computing

The mobility requirement imposes new challenges:

- **Portability:** portable device have small size which constrains the hardware being used.
- **Connectivity:** How to maintain connectivity while moving? How to save bandwidth for enough devices?
- **Power:** How to save energy while
- **Security:** Devices are subject to different kinds of attacks.

In this Course

Wireless Connectivity

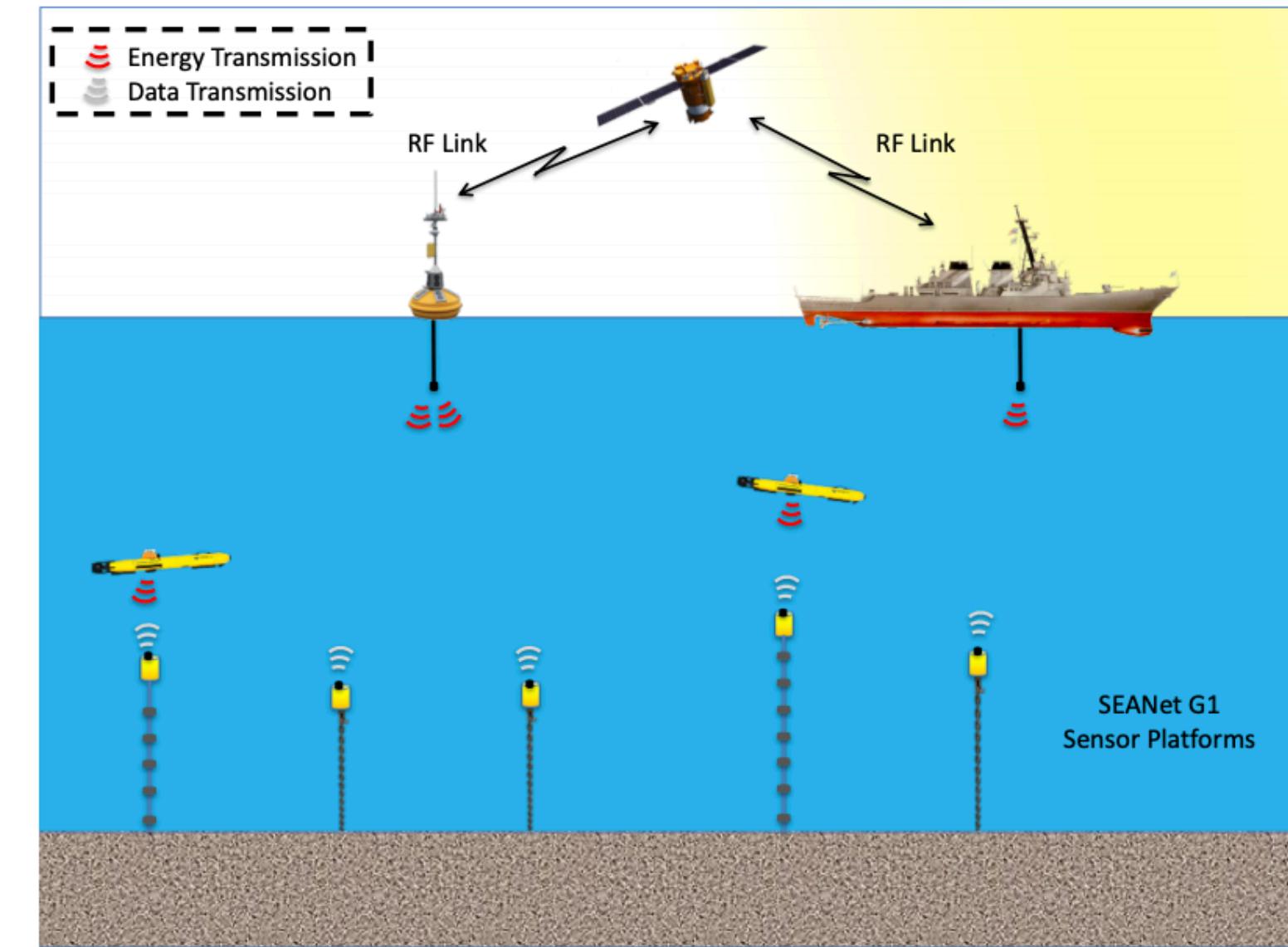
An overview of major technologies
for wireless communications

- Cellular
- WiFi
- Bluetooth



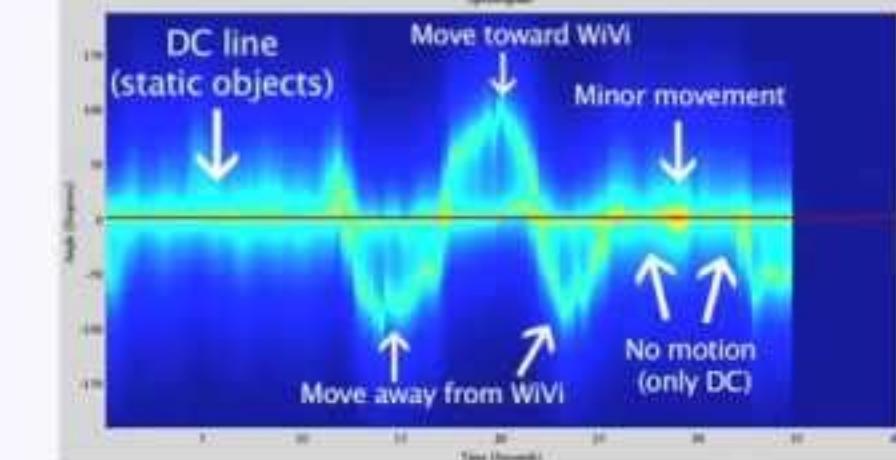
Energy Efficiency

- Techniques for energy efficiency in mobile devices.
- Energy harvesting and battery-less devices



Localization

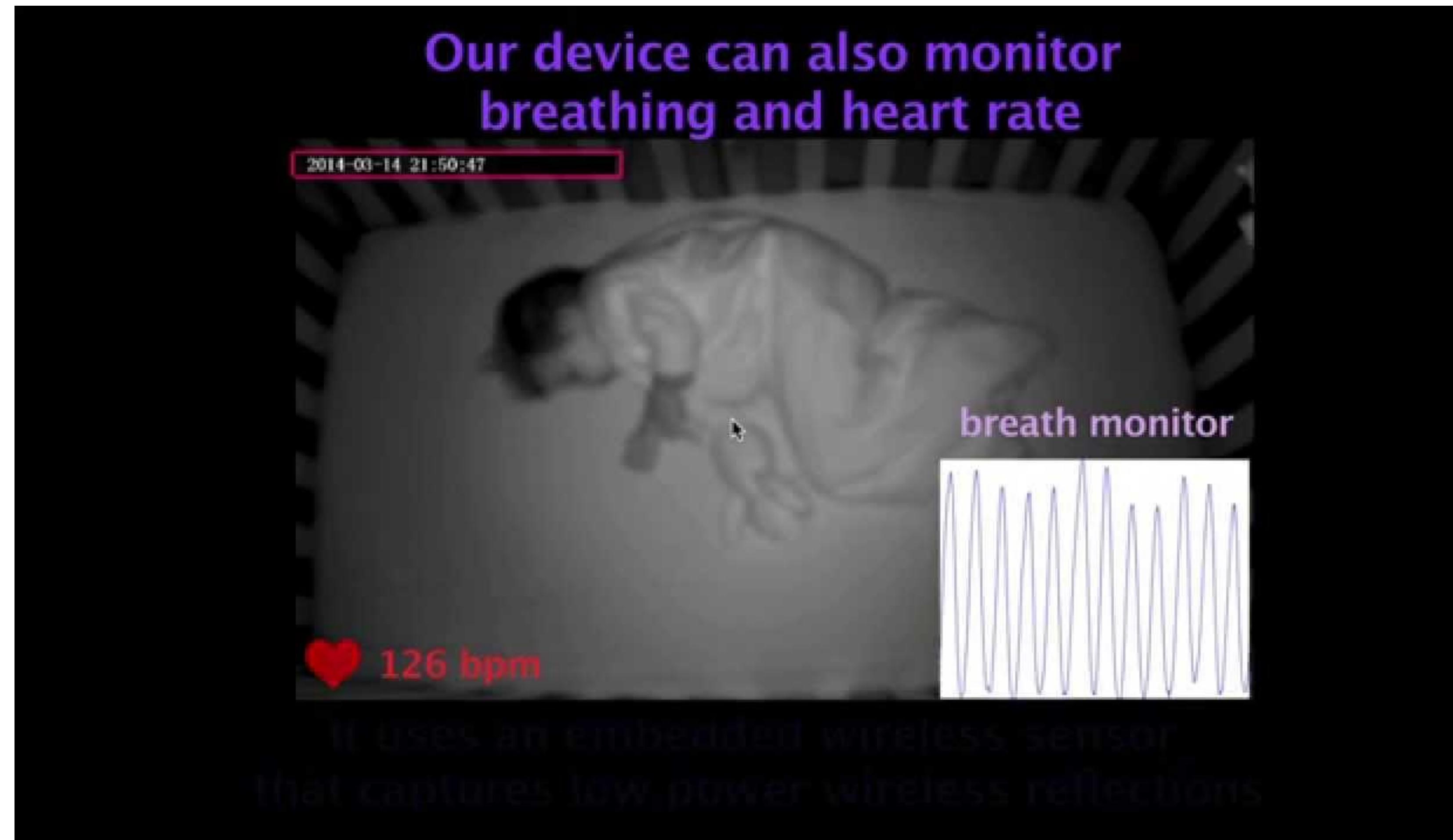
- Techniques for location determination
 - GPS
 - WiFi localization
 - IMU motion tracking
 - Device free localization



Wi-Vi: See through walls

Sensing and Context Awareness

- Activity Recognition
- Health monitoring



Sensing and Context Awareness

- Smart watch based gesture tracking

**I am a Smartwatch and
I can Track my User's Arm**

MobiSys 2016

Monday, June 27



Association for
Computing Machinery

Security and Privacy

- Recent attacks and security threats against smart devices.

E.g. inaudible voice commands

