



EECE5155: Wireless Sensor Networks and the Internet of Things

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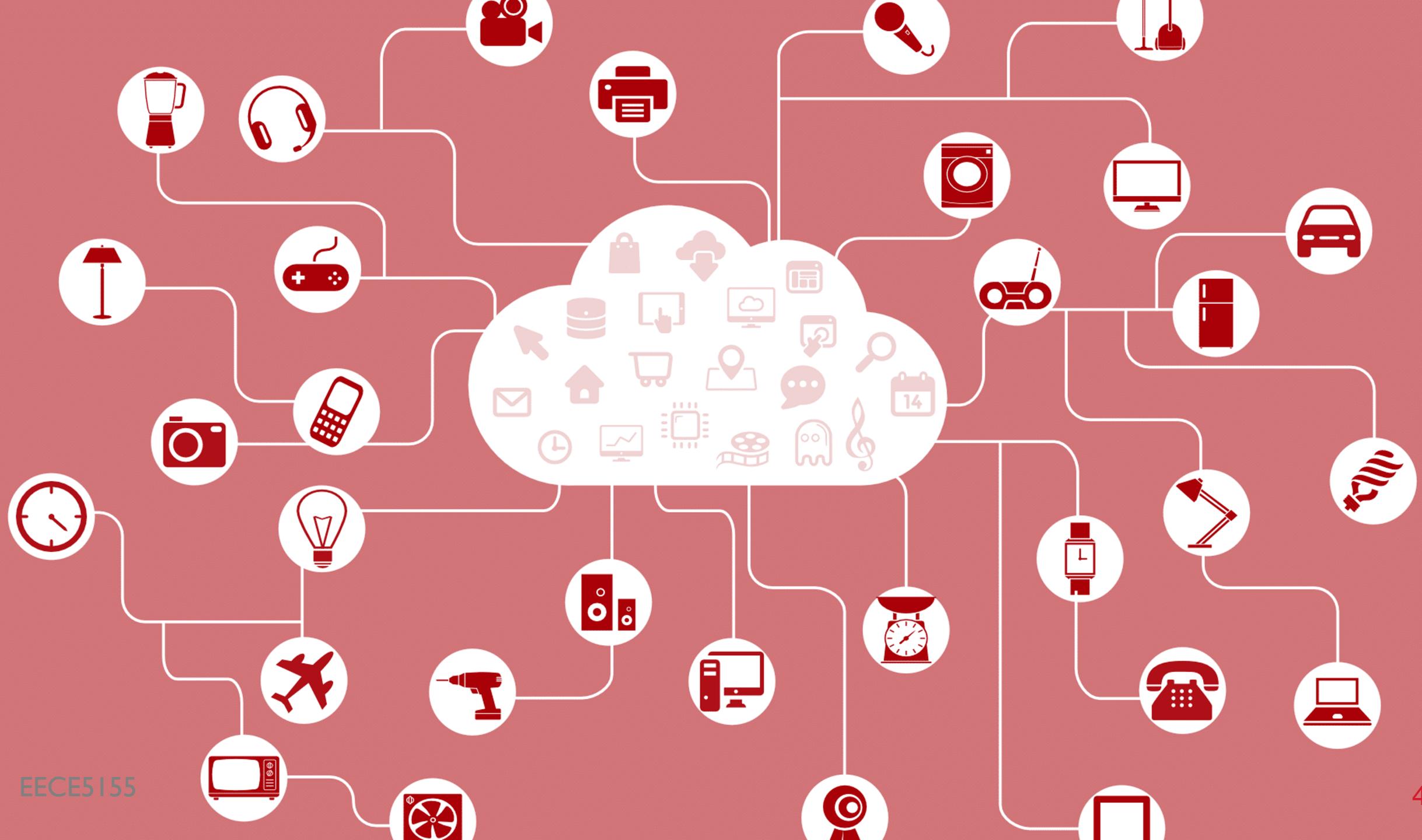
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Syllabus

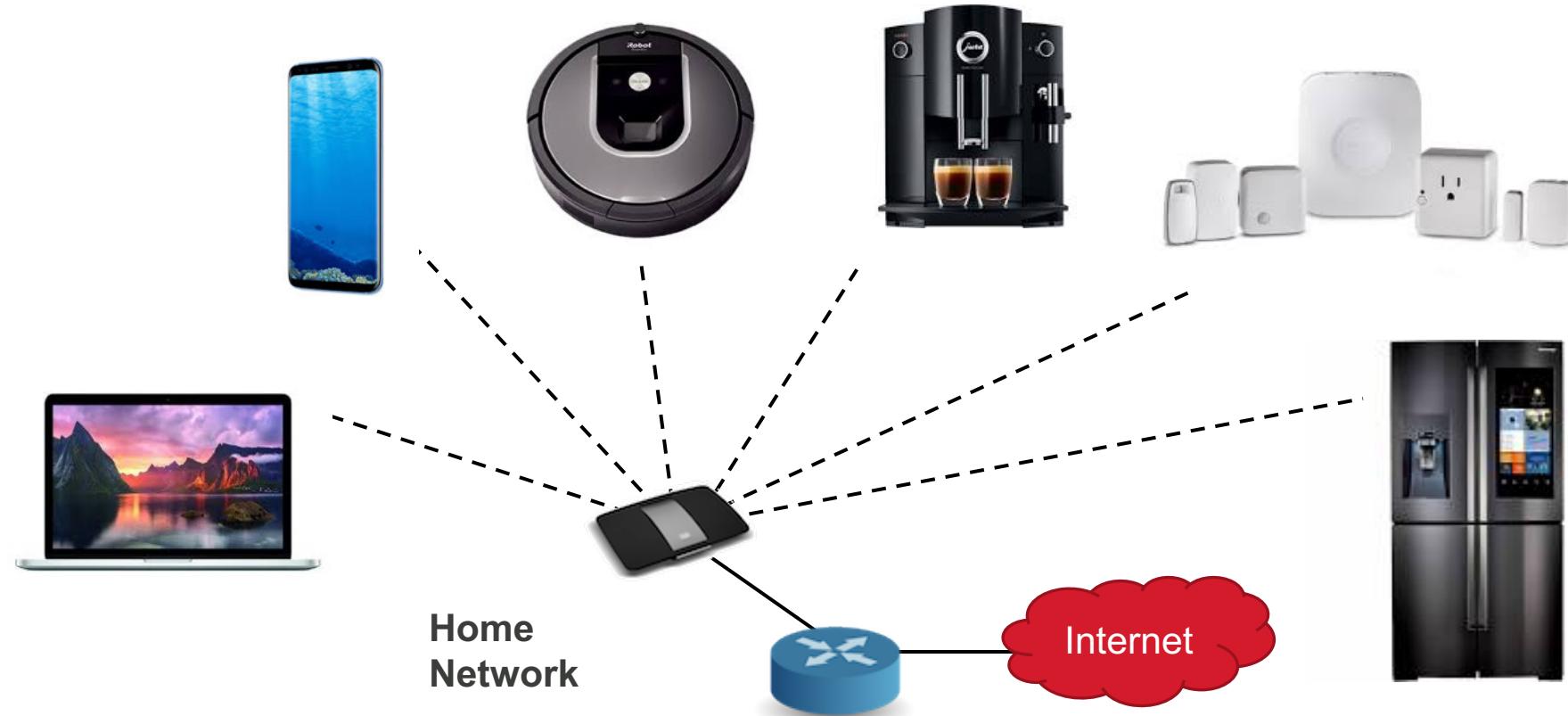
syllabus

Motivation

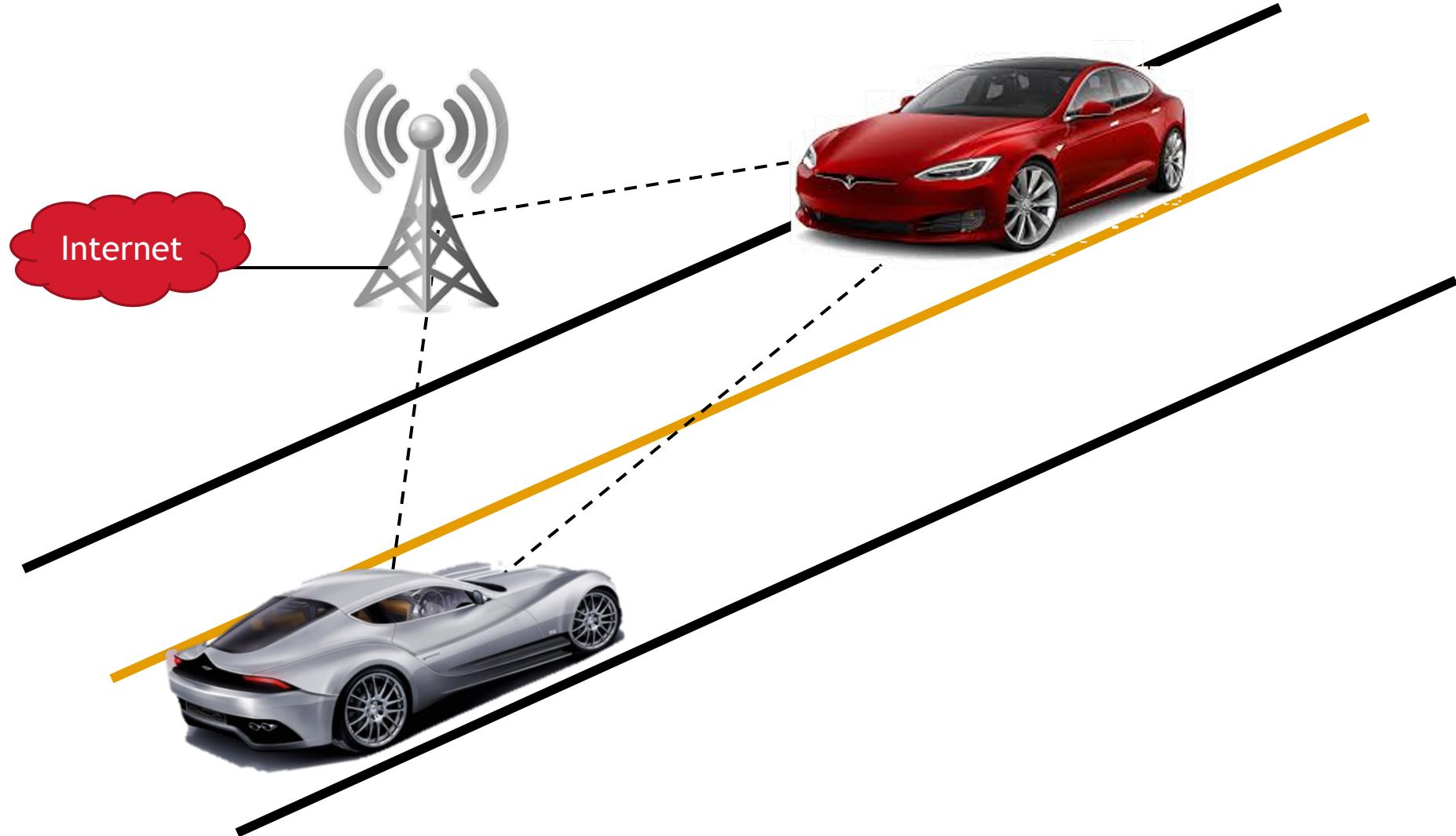
- Within the last two decades, major breakthroughs in the field of electronics, embedded systems and wireless communications have paved the way for the development of the **Internet of Things (IoT)**
 - **Definition:** A truly cyber-physical system in which all sorts of physical devices are interconnected and able to autonomously interact with each other
 - **Applications:**
 - Smart healthcare
 - Home monitoring and automation
 - Environmental monitoring and pollution control
 - Smart grid and infrastructure management
 - Real time monitoring of industrial processes
 - Intelligent transportation of people and goods
 - ...



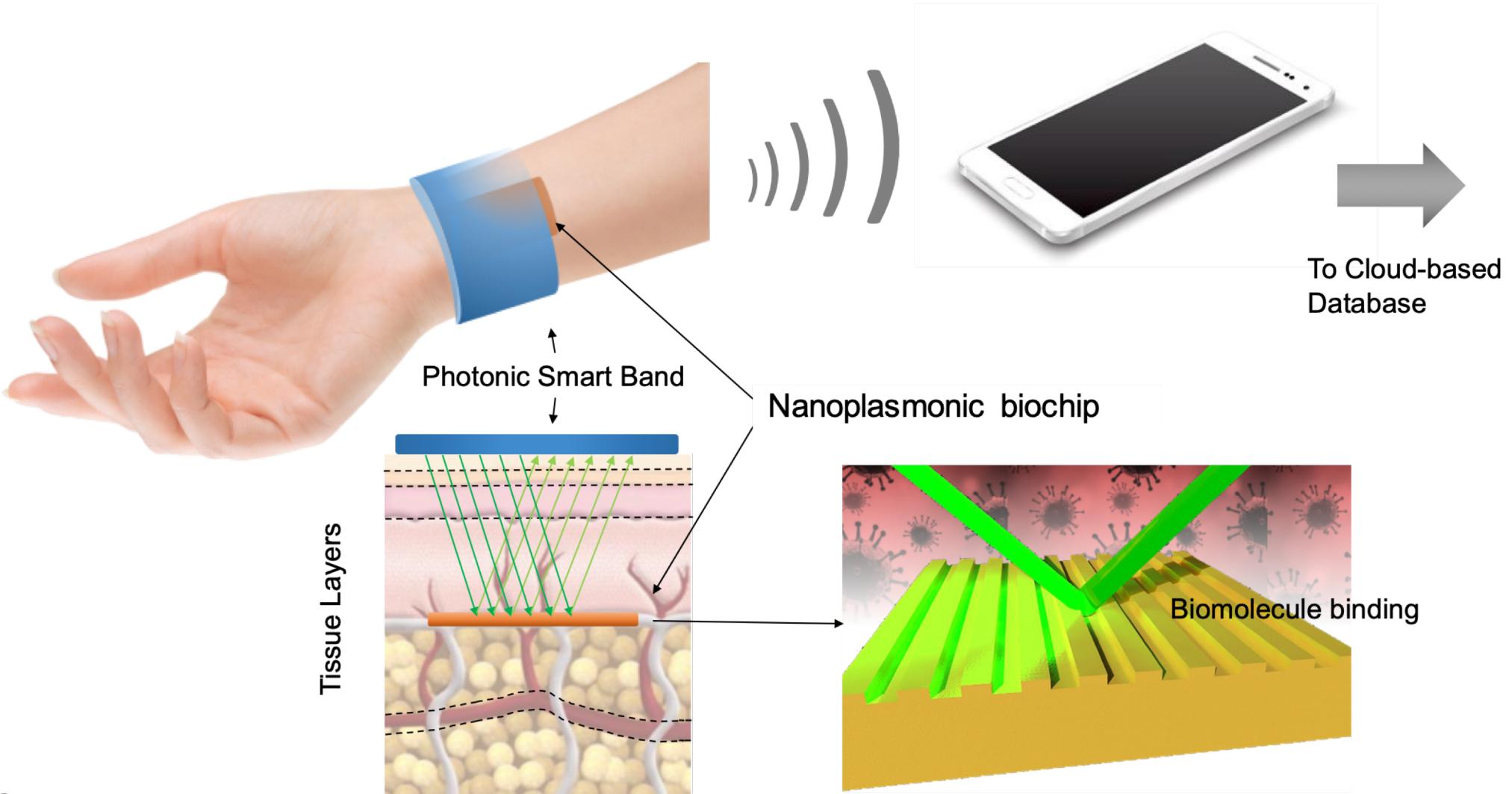
Examples: Smart Home



Examples: Smart Cars



Applications: Smart Healthcare



Observation

- Home + Sensors & Communications = Smart Home
- Car + Sensors & Communications = Smart Car
- Bio + Sensors & Communications = Smart Healthcare
- ...
- Student + Sensors & Communications = 

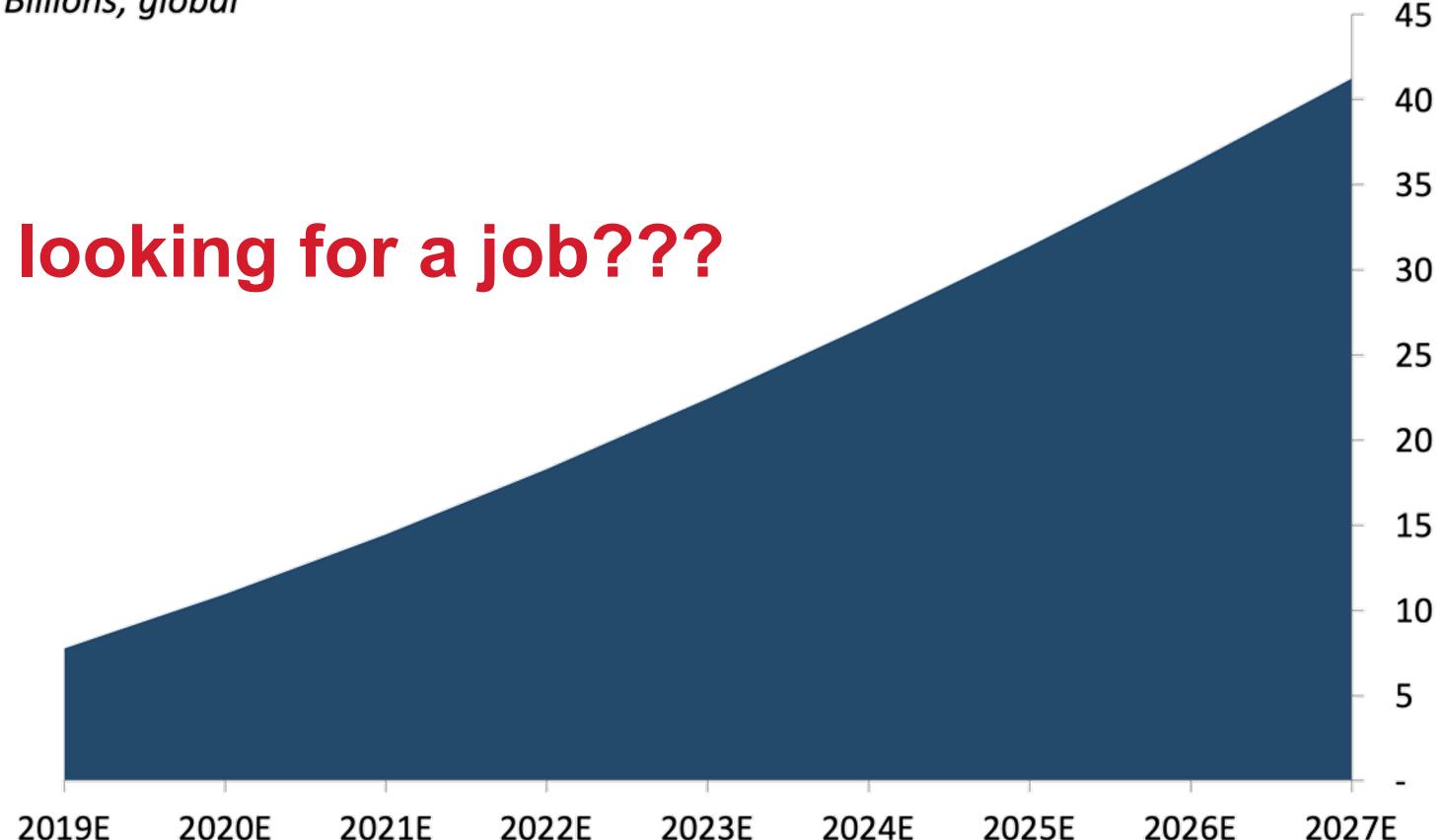
Great opportunity for experts in communication + electronics!!!

The Market

FORECAST: Total IoT Device Installation Base

Billions, global

Anyone looking for a job???



IoT = Data

Data = \$\$\$

IoT = \$\$\$

Internet of Things

Networks

Embedded Systems

Communications

Sensors

Signal Processing

Electromagnetics

In this course...

- We will study the state of the art in communication, networking, and data collection technologies for the IoT through a series of:
 - **Theoretical lectures**, where we will cover the main steps in the data path, including data acquisition, local data processing, data communication, data streaming, data storage & cloud, and data analytics, with a special emphasis on communication protocols and standards
 - **Computer laboratory assignments**, where computer-based experimental assignments with advanced network simulation using ns-3 and monitoring tools such as Wireshark will be conducted to better illustrate and solidify the concepts learned in the class
- +
 - **A final team project**, focused on different application areas of the IoT (e.g., the Internet of Underwater Things, the Internet of Underground Things, the Internet of Nano-Things, etc.)

Objectives and Expected Outcomes

- By the end of the course, students will be able to:
 - Identify and describe **network architectures and device components** of IoT systems
 - Identify and describe **data collection, transmission, storage and analysis tools** for the IoT
 - Analyze and interpret **packet traffic from real networks** by means of software monitoring tools
 - Design and **simulate simple network architectures** by means of software tools
 - Recognize and describe common **telecommunication standards** and standardization entities
 - Participate effectively (and, if needed, remotely) in a team project and assess the **strengths and weaknesses of the individual team members** (including himself or herself) and the team as a unit
 - Find **relevant sources of information** about a specified topic in the library and on the web
 - Write an effective **project report** to present technical knowledge to a variety of audiences
 - Generate an **oral presentation** on a topic related to class material using electronic tools

Contents: Theory Modules

- **Module T1:** Introduction to the Internet of Things
- **Module T2:** Data Acquisition
- **Module T3:** Local Data Processing
- **Module T4:** Data Communication
- **Module T5:** Data Streaming
- **Module T6:** Data Storage & Cloud
- **Module T7:** Data Analytics

Contents: Computer Laboratory Modules

- **Module L1:** Introduction to ns-3 and Wireshark
- **Module L2:** Simulation of LoRaWAN networks
- **Module L3:** Routing in Wireless Sensor Networks
- **Module L4:** Development of new protocols for the IoT

Prerequisites

- Working knowledge of:
 - Networking
 - Communications
 - Embedded systems
- Ideally, at least, students should have taken:
 - EECE 2540. Fundamentals of Networks

OR

 - EECE 7374. Fundamentals of Computer Networks

OR

 - A course in networking

Course Meeting Time and Location

- Tuesdays and Fridays, 1:35 – 3:15 PM in Snell Library 035
 - To course follows the NUflex system:
 - You should indicate before Wednesday each week whether the following week you want to join in person or remotely
 - By Thursday, an algorithm (on which I have no control) will select the students approved to come to class
 - Only if you are selected, you can come to class!
- **Live lectures will be streamed through Zoom**, following the meeting link on Canvas and available only to registered Northeastern students
- **Recorded* lectures will be permanently available in Canvas** only to registered students, the hourly course assistant and instructor of this course

**Please contact the instructor if you have any concerns about being recorded.*

Let's all go to Canvas for a second...

Organization

- **Homework Assignments:**
 - 2 assignments to be solved individually
- **Laboratory assignments:**
 - 4 assignments to be solved individually or in couples
- **Quizzes:**
 - 2 online quizzes (after Module T4 and after Module T6, obviously open book)
- **Final exam:**
 - there is NO final exam

Grading Policy

- **Grade Distribution:**
 - **Homework Assignments:** 25%
 - **Laboratory Assignments:** 25%
 - **Quizzes:** 25%
 - **Final Project:** 25%

Total Points	Final Grade
95-100	A
90-94	A-
85-89	B+
80-84	B
75-89	B-
70-74	C+
65-69	C
60-64	C-
55-59	D
<55	F

Expectations of Students

- Students are expected to act in a professional manner:
 - **Use professional style in all communications** with the instructors, teaching assistants and classmates
 - In Class
 - In Zoom
 - In Canvas/Discussion Boards
 - Over email
 - **Respect:**
 - You are expected to treat your instructor and all other participants in the course with respect
 - Your comments to others should be factual, constructive, and free from harassing statements
 - You are encouraged to disagree with other students and the instructor, but such disagreements need to be respectful and be based upon facts and documentation (rather than prejudices and personalities)
 - Falling to adhere to this expectation may result in a lower grade
 - Part of the learning process in this course is respectful engagement of ideas with others

Expectations of Students

- To avoid late penalty deductions, assignments should be submitted on or prior to the due date.
 - There will be an automatic 10-point per day deduction in assignments submitted pass the deadline
- Students can share ideas regarding homework and laboratory assignments, but each student must independently write and submit their own solution
- Makeup quizzes will be given provided that the two following conditions are simultaneously satisfied:
 - You contact the instructor prior to the quiz
 - You have a valid and documented reason to miss the quiz
 - Serious illness or family emergency are acceptable excuses
 - Sleeping in, lack of preparation, ennui, grogginess, etc. are not acceptable excuses

Course Materials

- All the course materials will be available in **Canvas**:
 - Lecture notes
 - Additional reading materials
 - Assignments

Office Hours

- **Efficient ways to get doubts solved (sorted by preference):**
 1. Ask during the class!
 2. Use the Canvas Discussion Board:
 - Feel free to answer your classmates' questions too!
 3. Send me an email (jmjornet@northeastern.edu)
 - Either to get an immediate response or to set up an appointment to meet at our earliest convenience
- **Weekly office hours:**
 - Wednesdays, 4-6 PM, on Zoom: <https://northeastern.zoom.us/my/jmjornet>

Teaching Assistant (HCA)

- **Tushar Goel, MS Candidate**
 - **E-mail:** goel.tu@northeastern.edu
 - **Office Hours:** Tuesdays, 10 AM – 12 PM, on Zoom: <https://northeastern.zoom.us/j/93582307514>
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- The role of the TA is to help answer doubts that you might have from the lectures or in the computer laboratory assignments, and assist the instructor with grading:
 - **The TA is not a debugger for your codes...**

Questions?

Questions