

RFIDs, an introduction



CS-439

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Radio Frequency Identification

- Follows Server-Client model
 - Clients-> RFID tags
 - Server->RFID Reader (Interrogator)
- Can have unique ID or not
- Encrypted signal or not
- Frequencies 125 Khz, 13.56 Mhz, 433 Mhz

Commercial and Industrial use

- Access management
- Human and animal tracking
- Toll – market payment
- Anti-shop lifting mechanisms
- Airport baggage tracking
- Container -cargo tracking
- Race timing
- Sensor networks (not in a server-client model)

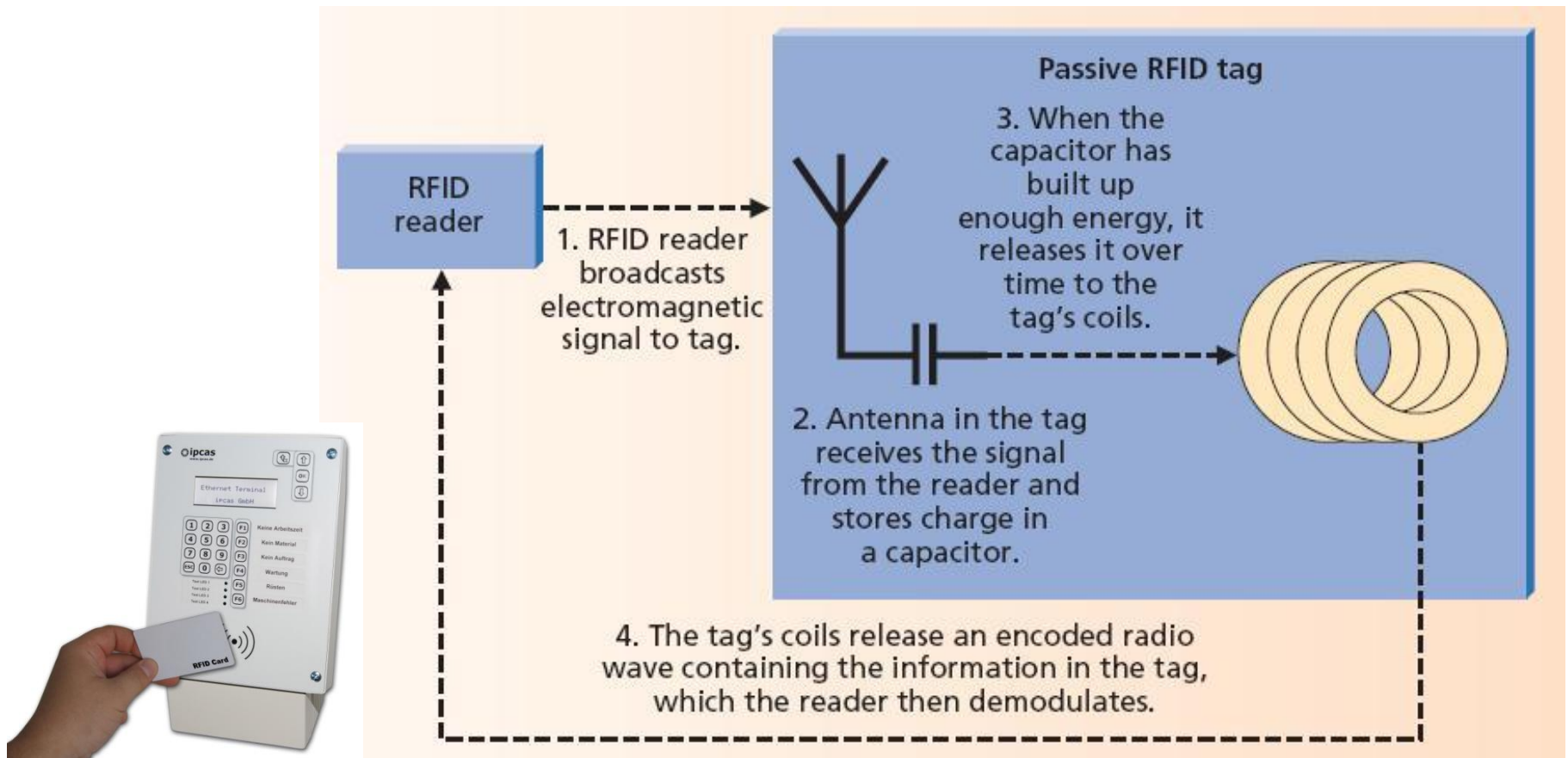
Passive and Active RFID tags

The category also defines the reader

- Passive Tags
 - No power source!
 - Very lightweight
 - Low range (up to 70 cm)
 - Very cheap (up to 20 cents)
 - Their corresponding reader has a panel-like antenna. The electromagnetic waves of the antenna charge the tag for a short period of time.



Passive and Active RFID tags



Picture taken from "RFID: A Technical Overview and its Application to the Enterprise" Ron Weinstein

Active and Passive RFID tags

- Active Tags
 - Battery operated
 - Up to 20 meters range indoors, up to 300 meters outdoors
 - Up to 30 euro
 - Can have integrated sensors (accelerometer, humidity meter, sound sensors etc)
 - Their corresponding reader most likely have omni directional antennas.

Active and Passive RFID tags



What do they do?

- Passive tags emit a signal when they get charged
- Active tags emit their signal at a fix rate
- That signal can be:
 - a simple “Hey” message (as an anti-theft mechanism)
 - a signal with ID and a report from any of the integrated sensors
- In this course we mostly care about the Signal Strength report
 - Which is reported from the reader not from the tag

Signal Strength

- RSSI (Received Signal Strength Indicator)
- Reader reports it for each tag

Assumption

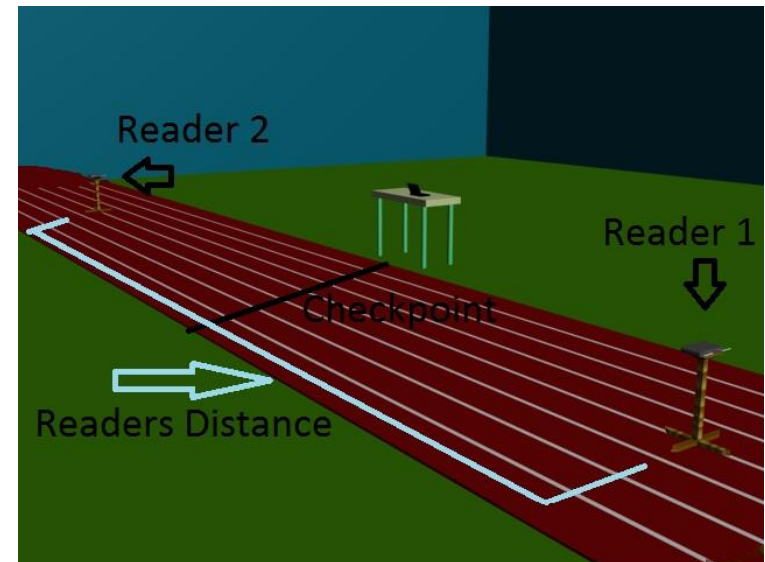
- Stronger Signal means the tag is closer to the reader

BUT

- We have problems
 - RSSI varies according to line of sight objects from tag to reader
 - RSSI varies according to the modulation technique used by the manufacturer
 - The object where the tag is mounted, tag orientation and reader's antenna orientation will impact the RSSI output

RFIDs in location sensing

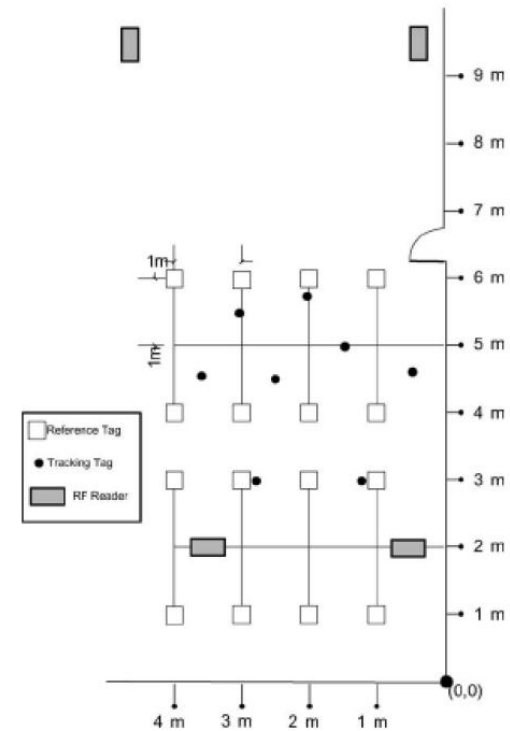
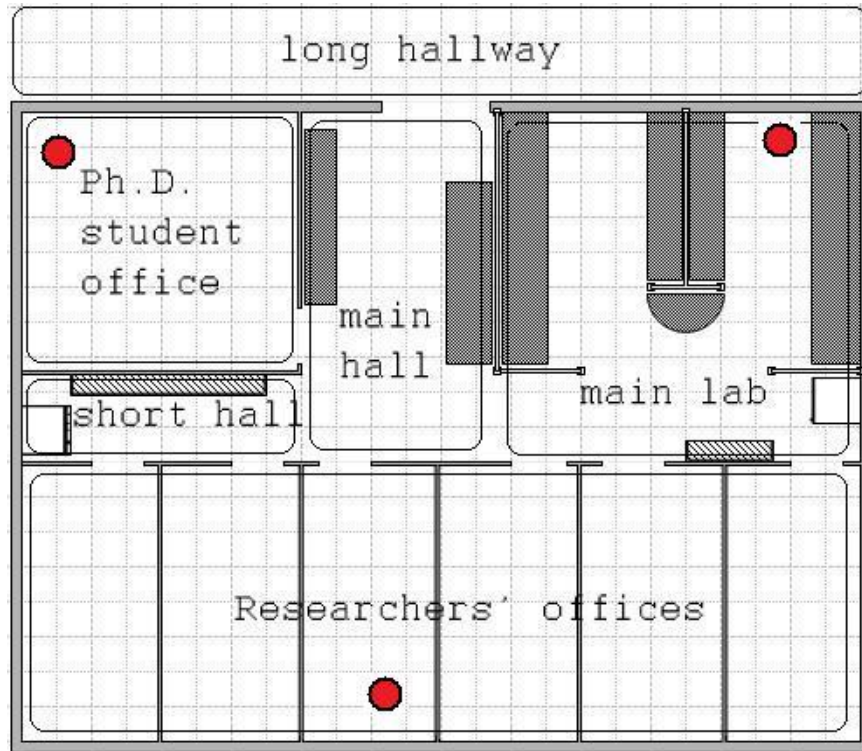
- Runners timing
 - With a big Antenna at the checkpoint for passive tags
 - Low tag cost
 - Costly antenna, difficult installation
 - Or with 2 readers and the checkpoint between them
 - High tag cost
 - Based on lowest RSSI
 - Readers can be used elsewhere



RFIDs in location sensing

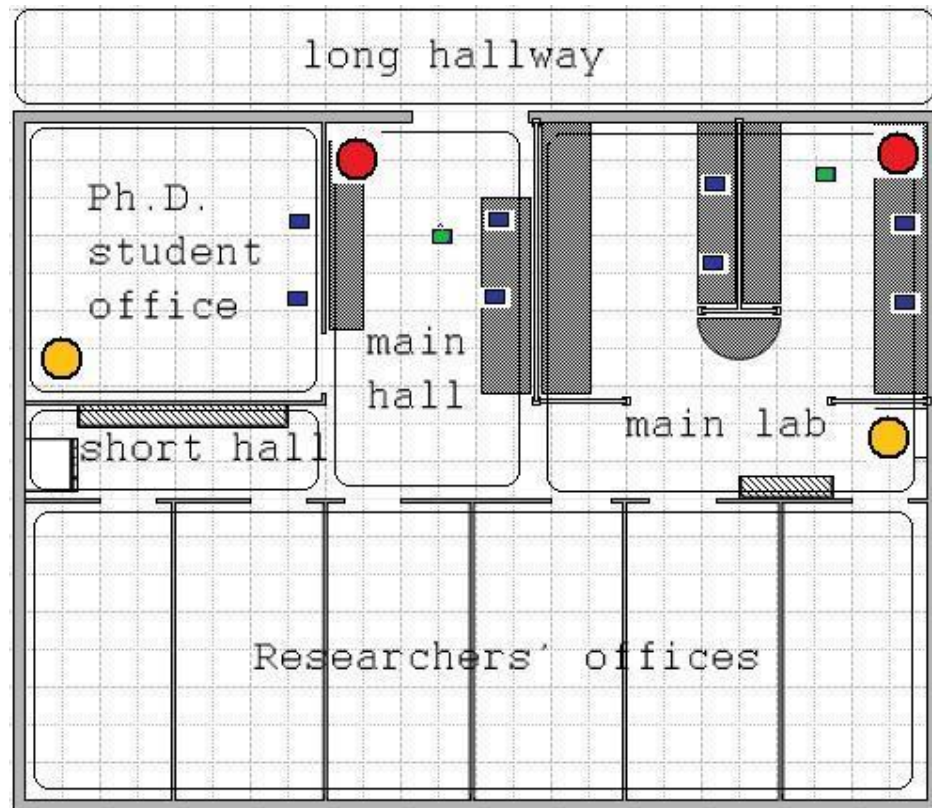
- **Fingerprinting**
 - Divide the area into cells
 - Measure the RSSI of all readers for each cell (training)
 - On runtime, the system tries to find the cell the user is located, based on the training set of RSSI measurements
- **Reference Tags**
 - Tags are positioned in known-fixed places in the area
 - On runtime the system tries to find the user based on the RSSI of the reference tags and the user tag

RFIDs in location sensing



RFIDs in location sensing

- Putting all together in a point of interest – centric system



RFIDs Lab Session

- Lets talk to the reader..
- How do we connect?
- Basic communication via Telnet
- What if we use our application?
 - Faster options
 - Better monitoring
 - Logs!
- Getting some measurements...