

Location Services for Healthcare

Class 1: Overview

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This Week's Agenda

Monday	Overview
Tuesday	Tags and Sensors
Wednesday	Systems and Software
Thursday	Implementation Issues
Friday	Available Products and Future Trends

Course Description

Location service refers to a set of devices and software that allow the tracking of all manner of items in an enterprise. In general these are real time tracking services. Thus, an enterprise has a real time picture of where everything that needs to be tracked is and can deploy, resupply and maintain all these items in a consistent manner. This is a truly Internet of Things (IoT) environment. In the healthcare environment, this level of management can be critical, and can also lead to major efficiencies. In this course we will review the general field of Real Time Location Services (RTLS) and then discuss their application of and use in a healthcare setting.

Today's Agenda

- What are Location Systems
- Real Time Considerations
- General Architecture
- The World of Tags
- Conclusion/Next Class

What are Location Systems

- Locate things, people
 - Absolute
 - Relative
 - Proximity
- Report on location
 - Provide interfaces to report on locations
 - Provide history (movement, path)

What are Location Systems

- The Location System consists of a number of components, both hardware and software, that work together to provide a picture of where items are located and, in many cases, what status they are in
- As we shall see, there are a number of different technologies in use, often simultaneously, to effect this

Real Time Considerations

- To be useful, Location Systems need to report on tagged items in real-time
- This requires a connected infrastructure of sensors and tags
- It also requires a layered hardware and software infrastructure
- Tag types are important (we shall review later) as are sensor types and locations

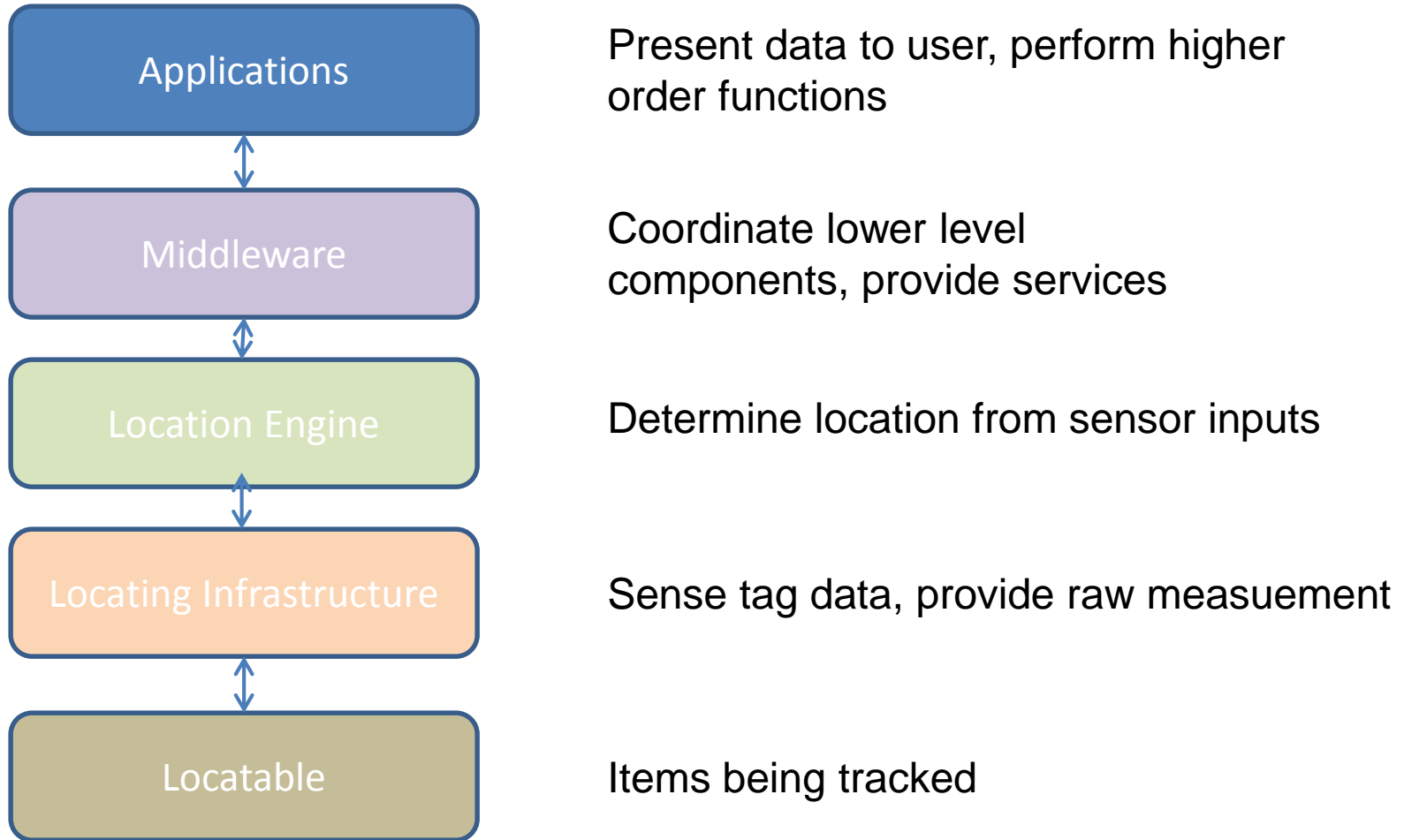
Real Time Considerations

- Location infrastructure is the key to achieving real time performance
 - Tags are of different types and have different rates of update, depending on application
 - Sensor placement is driven by physical considerations and sensor types
 - Cost considerations also come into play
- Generally, there will be many types of tags which influences real time performance

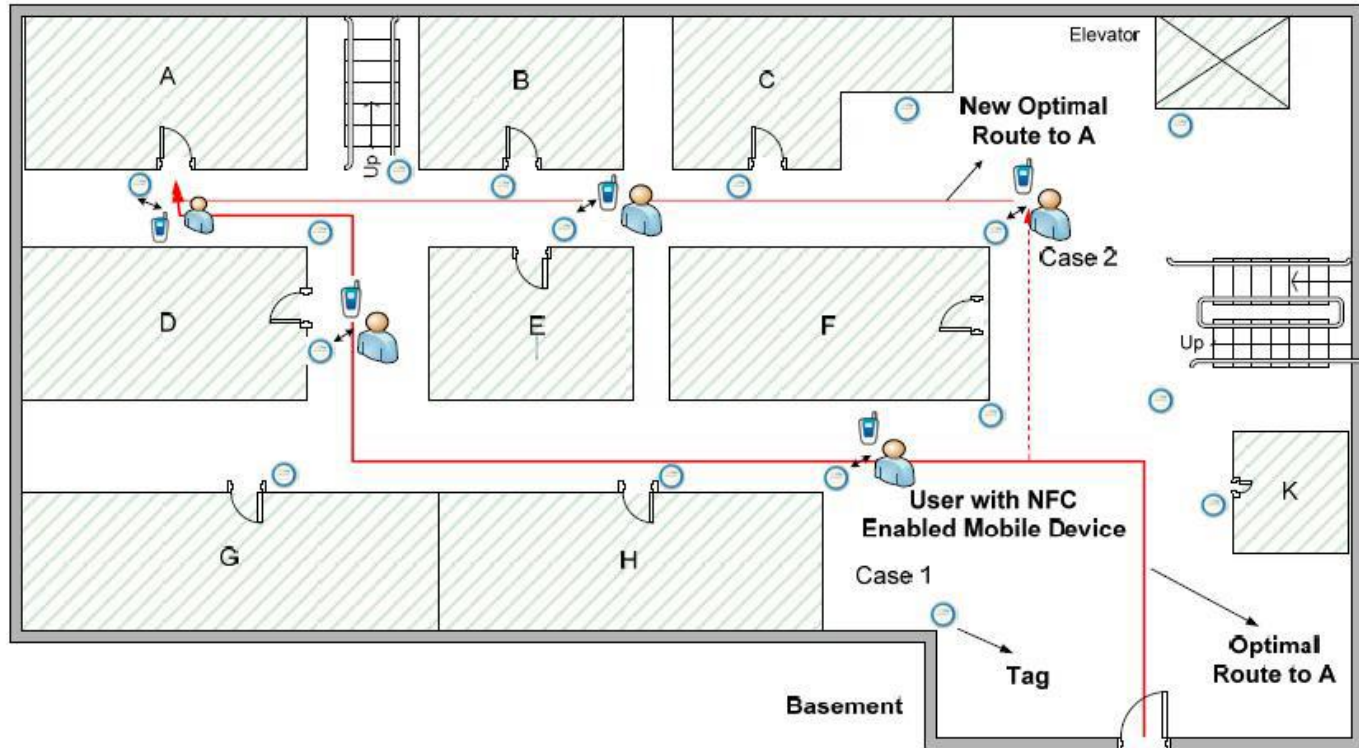
General Architecture

- Location Systems, of necessity, have a layered architecture
- There are two types of architecture:
 - Overall technology architecture
 - Location devices architecture
- At present, different vendors implement Location Systems in slightly different ways
 - We will discuss on day 5

General Architecture



General Architecture



Location of sensors is the second type of architecture. Placement needs to meet the needs of the applications.

The World of Tags

- Tags are of many types and have several dimensions.
 - They are the visible part of any location system
 - Each type of tag has its own attributes
 - Cost is a major driver in tag selection
 - Rule of thumb is to use the tag type that is most cost effective while meeting the requirements for the type of locatable
 - Tag types in use drive the locating infrastructure

The World of Tags

Attribute	Passive	Semi-passive	Active
Processing	None	Can read sensors	Full computational capability
Locatibility	Only when interrogated	Only when interrogated	Variable and under program control in the tag
Range	Seven to 100 meters	Same as passive	Typically 100 meters, but can be more
Battery Life	N/A	Up to 10 years	Up to 5 years
Size	From a grain of rice size on up (determines range)	Driven by battery; can be as small as passive	Depends of battery size (up to pack of cards size)
Cost	Less than a dollar	A few dollars	Tens of dollars

Presented by:

The World of Tags

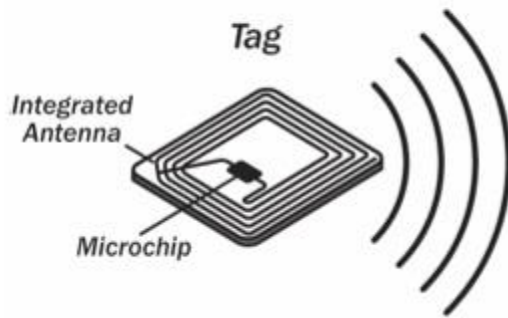
Passive

- Passive tags can be attached to, or embedded in, almost anything (or person)
- Tags have a fixed payload. They are not programmable once they leave the factory
- Having no battery they communicate only when interrogated
- They are generally called Radio Frequency ID (RFID) tags.

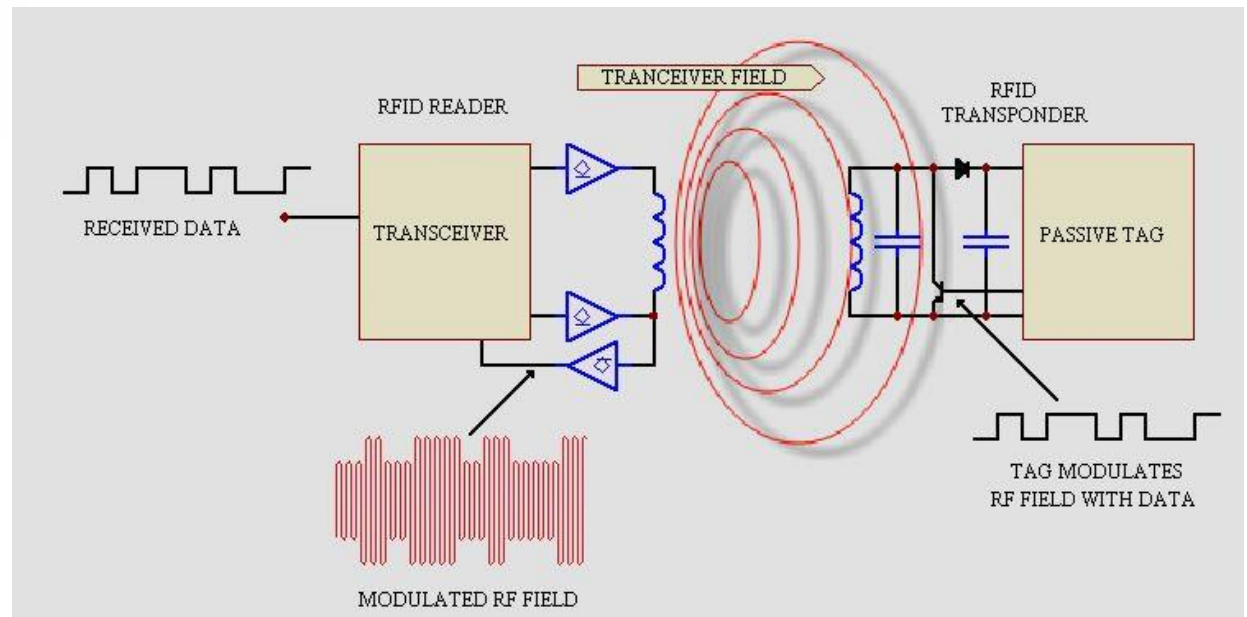
The World of Tags

Passive

Tag receives its energy from the transceiver field. When activated it sends its payload.



Payload is sent by modifying the received field in a process called backscatter.



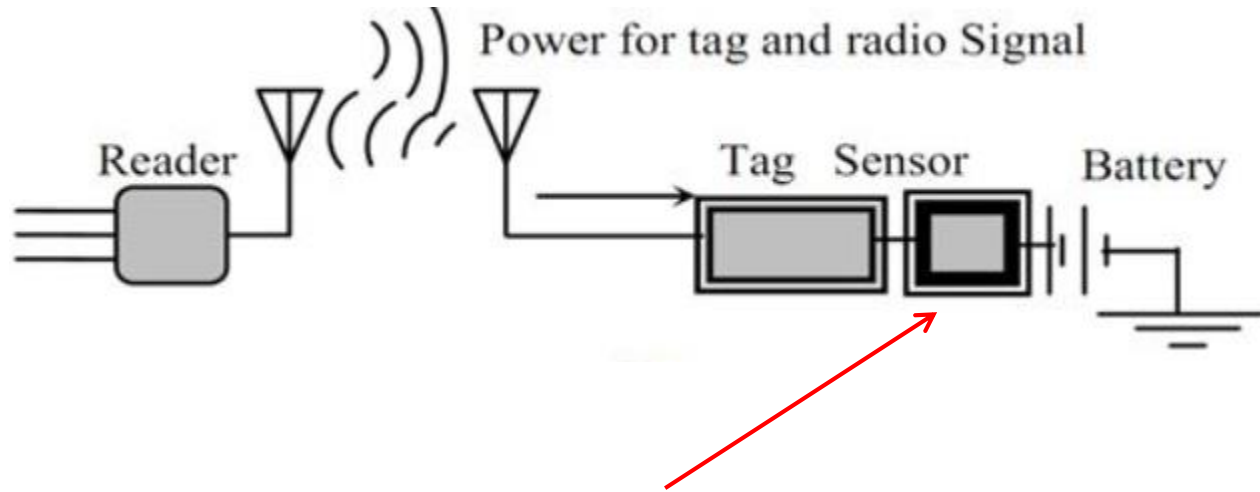
The World of Tags

Semi-Passive

- Semi-Passive tags use the communication approach of passive tags
- Having a battery, they are able to do processing to generate the tag payload
 - Used in monitoring and sensing applications
 - Can be reprogrammed
 - Can be used almost anywhere passive tags are used
 - The battery is not used to generate RF signals

The World of Tags

Semi-Passive



The main feature of the semi-passive tag is the sensor. Implied in this is processing power, as well. Many sensors have the ability to process the sensor data. The amount of processing will have an effect on the battery life.

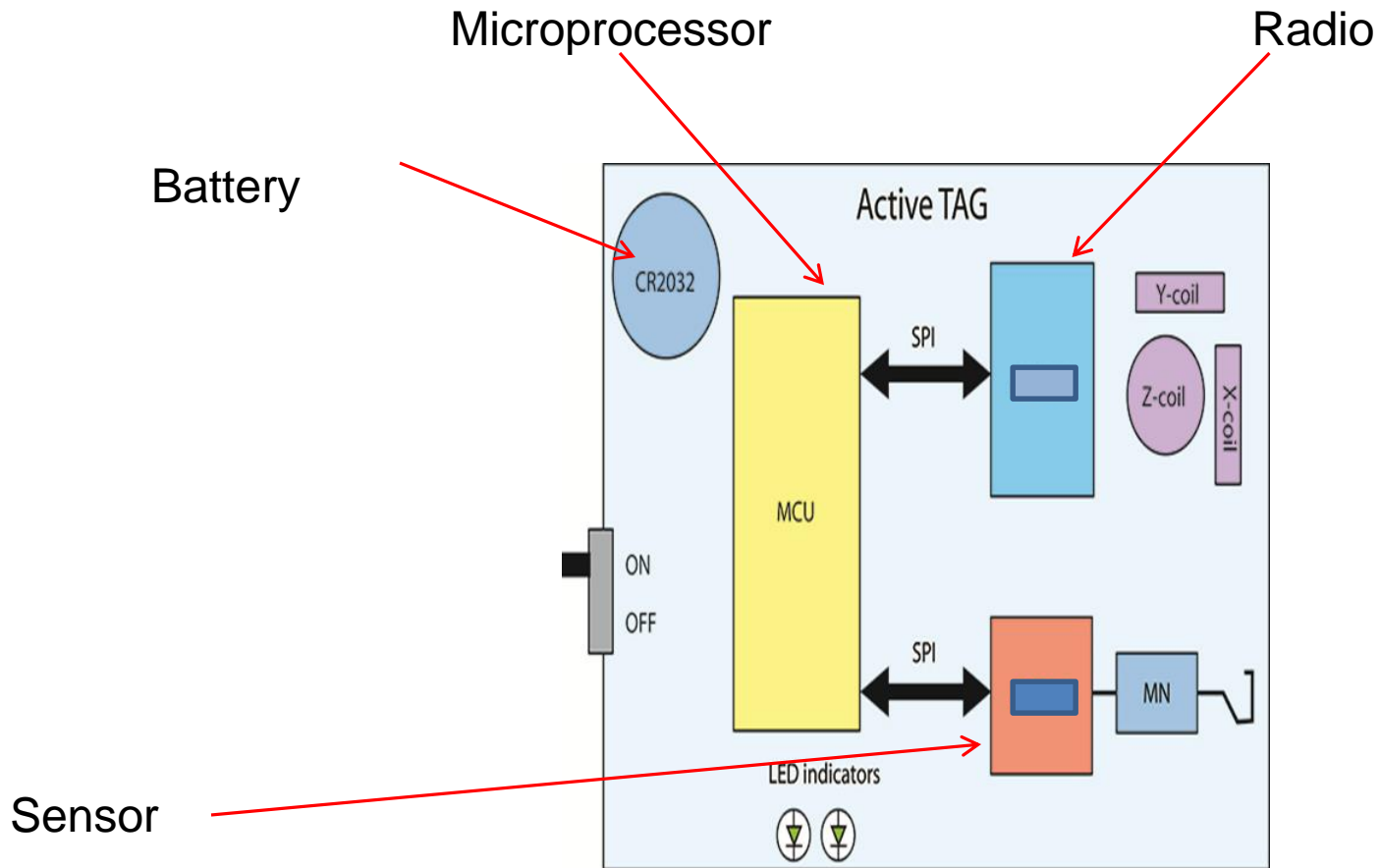
The World of Tags

Active

- These tags have built in radio transmitters
 - Can transmit long distances (relatively) and at various rates, depending on conditions
- They are highly programmable
 - Basically small computers
 - Reprogramming can take place when physically connected, or over the air
- Generally larger and more costly, so used only when necessary

The World of Tags

Active



The World of Tags

- Real world applications will consist of a number of types of tags (and attendant tag readers)
- Cost and function determine which type of tag will be used
- Flexibility of more semi-passive and active tags is an important consideration in the healthcare field

Conclusion/Next Class

- Today we introduced the basic architecture and ideas of real time location services
- We saw an overview of the architecture and the core of the system, the tags
- We have not talked about sensors and sensing methods/accuracy. This will be covered tomorrow