

# Mobile and Ubiquitous Computing

## Revision

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# Wireless Communication

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- Signal propagation through the air
- Reasons that the signal is influenced
  - fading (frequency dependent)
  - shadowing
  - reflection at large obstacles
  - refraction depending on the density of a medium
  - scattering at small obstacles
  - diffraction at edges
- Especially difficult case: multi-path

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## Wireless comms, part 2

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- Especially difficult case: multi-path
- Hidden and exposed terminal
- Far and near terminal

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# Wireless Techniques

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- Sharing the air
- Ways of multiplexing communication
  - space ( $s_i$ )
  - time (t)
  - frequency (f)
  - code (c)
- Cellular networks as an example
- Communications algorithms (aloha etc)

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## Example: Wireless Characteristics

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- Implication: signal interacts with the environment
  - noise, echoes (multi-path, timing), blocking
  - objects, walls, other sources, weather
- Implication: network topology very dynamic
  - hosts come and go, loss of connectivity, variable density
- Result: degradation/variability of capability to communicate, errors
- Networks and applications must deal with this

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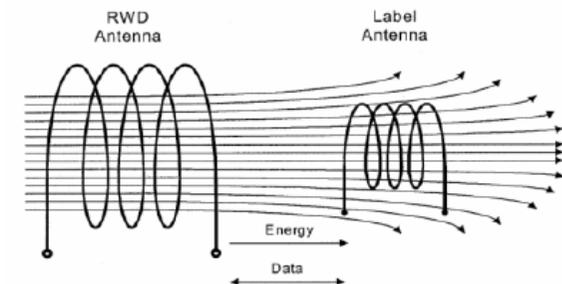
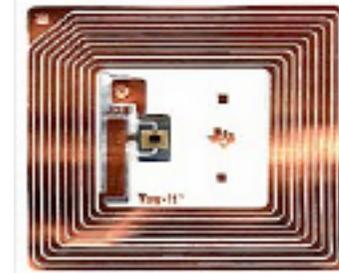
# Mobile IP

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- Actors and roles
- Basics of operation
- What does it give us over standard IP

# RFID Operating Principle

- Tag and reader components
- Energy transmission techniques
- RFID types
  - Magnetic (near) field (LF or HF)
  - Electric (UHF)
- Choice influences parameters of operation
  - e.g. range, bandwidth, size
- Standard types



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## RFID flavours

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- Classification (e.g. HF, UHF etc)
- Advantages and disadvantages
- Appropriate uses
  
- Gen2 tags in more detail
  - Memory organisation
  - Numbering scheme
  - Inventory and singulation protocols

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# Network Services

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- Resolution
- Information
- Authentication
- Role of each
- Operation and examples

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# Middleware

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- Role in the RFID infrastructure
- Operating principle
- Filtering and aggregation
  - With examples

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# Location sensing

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- Location sensing techniques
  - Triangulation
    - Principle of operation (without the math)
  - Proximity
  - Scene analysis
- Location sensing systems
  - Properties, examples
  - Advantages and disadvantages of each

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## Location sensing, cont.

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- Choosing the right one for a specific application
  - Properties of location systems
  - Limitations of specific systems
  - Implications of location data for privacy
- Extra emphasis on GPS due to its importance
  - principle of operation, timings, influence on accuracy of environment

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# Privacy

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- Initial entitlement:
  - Allocation of property rights
  - Who should get the initial right to control the information generated by location sensing?
- Coercion and choice:
  - If you want discount you will get the technology.
- Societal overrides:
  - When does society, regardless of your preference, get access to the data anyway?

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## 2010 question sample

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- 1c. Explain how tunneling works in Mobile IP and how mobility agents can implement it using IP-within-IP encapsulation

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## Model answer

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In Mobile IP the home agent redirects packets from the home network to the care-of address by constructing a new IP header that contains the mobile node's care-of address as the destination IP address. This new header then shields or encapsulates the original packet, causing the mobile node's home address to have no effect on the encapsulated packet's routing until it arrives at the care-of address. Such encapsulation is also called tunneling, which suggests that the packet burrows through the Internet, bypassing the usual effects of IP routing.

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## Another 2010 sample question

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- The object naming service (ONS) developed within the EPCglobal specification matches the unique item identifier of an individual product item with the location of information about it. Is it possible to use the ONS to build applications that track the movement of a product item during its lifetime from production until purchased by a consumer? Justify your answer.

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## Model answer

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- No, because the ONS points only to one network location, namely the information service of the original manufacturer of the specific product. As a result the service does not maintain the information required to identify the chain of custodians of the specific item and thus lacks the capability to build a complete trace of the movement of this product.