

# Slides for Chapter 19: Mobile and Ubiquitous Computing

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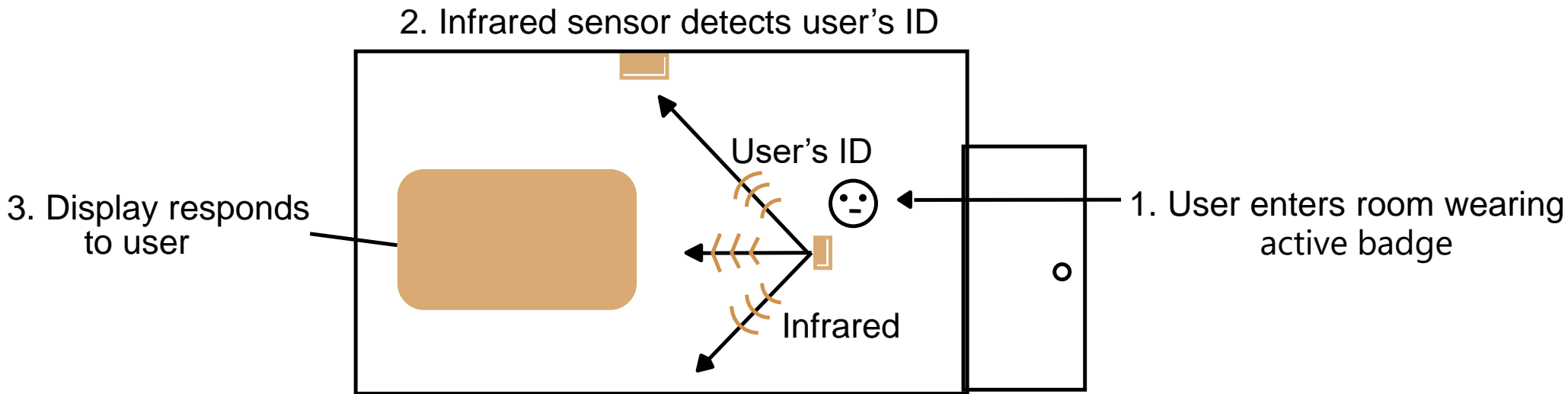


*From* **Coulouris, Dollimore, Kindberg and Blair**  
**Distributed Systems:**  
**Concepts and Design**

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## Figure 19.1

### A room responding to a user wearing an active badge



## Figure 19.2

### Examples of pre-configured versus spontaneous association

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#### Pre-configured

Service-driven:  
*email client and server*

#### Spontaneous

Human-driven:  
*web browser and web servers*

Data-driven:  
*P2P file-sharing applications*

Physically-driven:  
*mobile and ubiquitous systems*

Figure 19.3  
The interface to a discovery service

Methods for service de/registration	Explanation
<i>lease := register(address, attributes)</i>	Register the service at the given address with the given attributes; a lease is returned
<i>refresh(lease)</i>	Refresh the lease returned at registration
<i>deregister(lease)</i>	Remove the service record registered under the given lease
Method invoked to look up a service	
<i>serviceSet := query(attributeSpecification)</i>	Return a set of registered services whose attributes match the given specification

Figure 19.4  
Service discovery in Jini

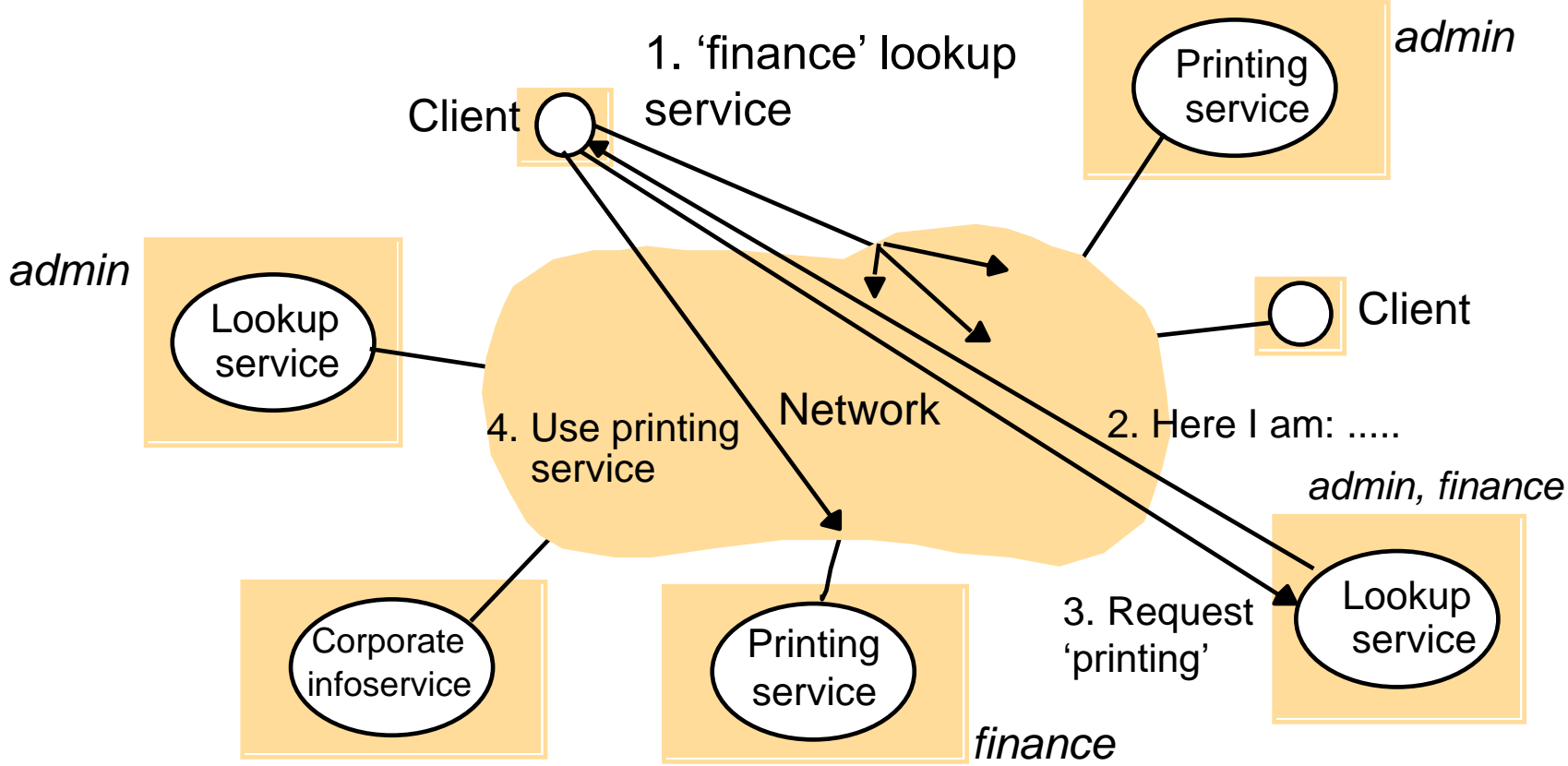


Figure 19.5  
The *IdentityPresence* widget class of the Context Toolkit

Attributes (accessible by polling)	Explanation
<i>Location</i>	Location the widget is monitoring
<i>Identity</i>	ID of the last user sensed
<i>Timestamp</i>	Time of the last arrival
Callbacks	
<i>PersonArrives(location, identity, timestamp)</i>	Triggered when a user arrives
<i>PersonLeaves(location, identity, timestamp)</i>	Triggered when a user leaves

Figure 19.6

A *PersonFinder* widget constructed using *IdentityPresence* widgets

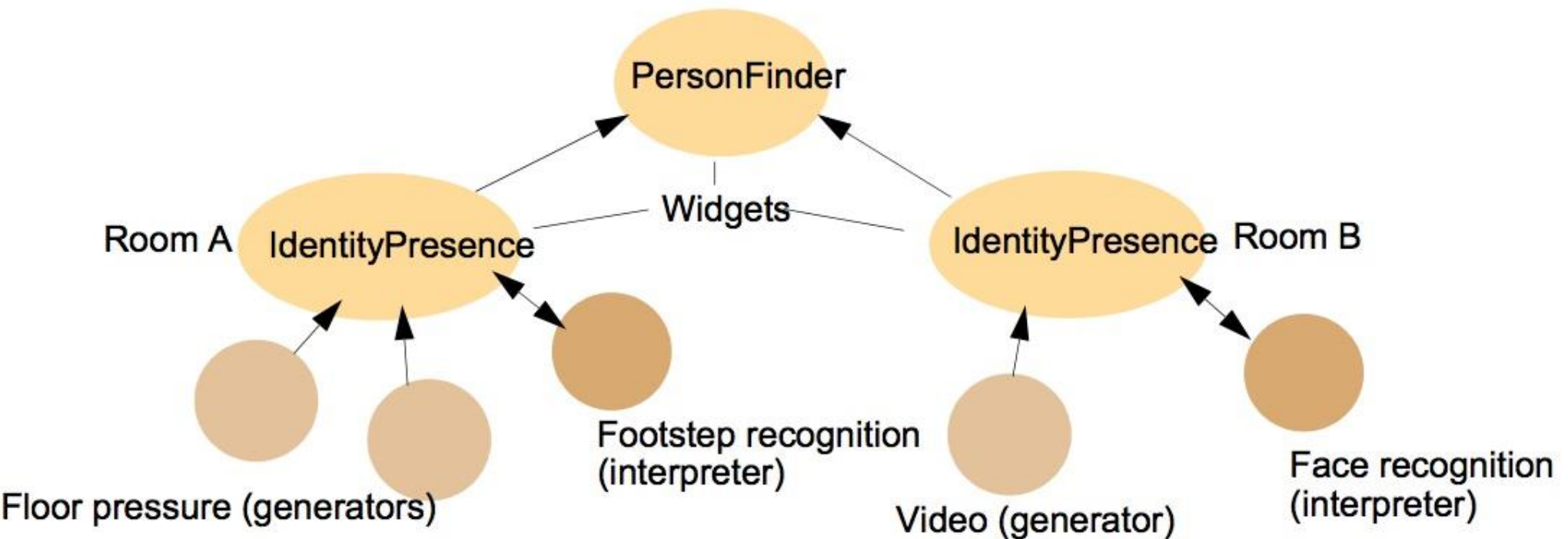
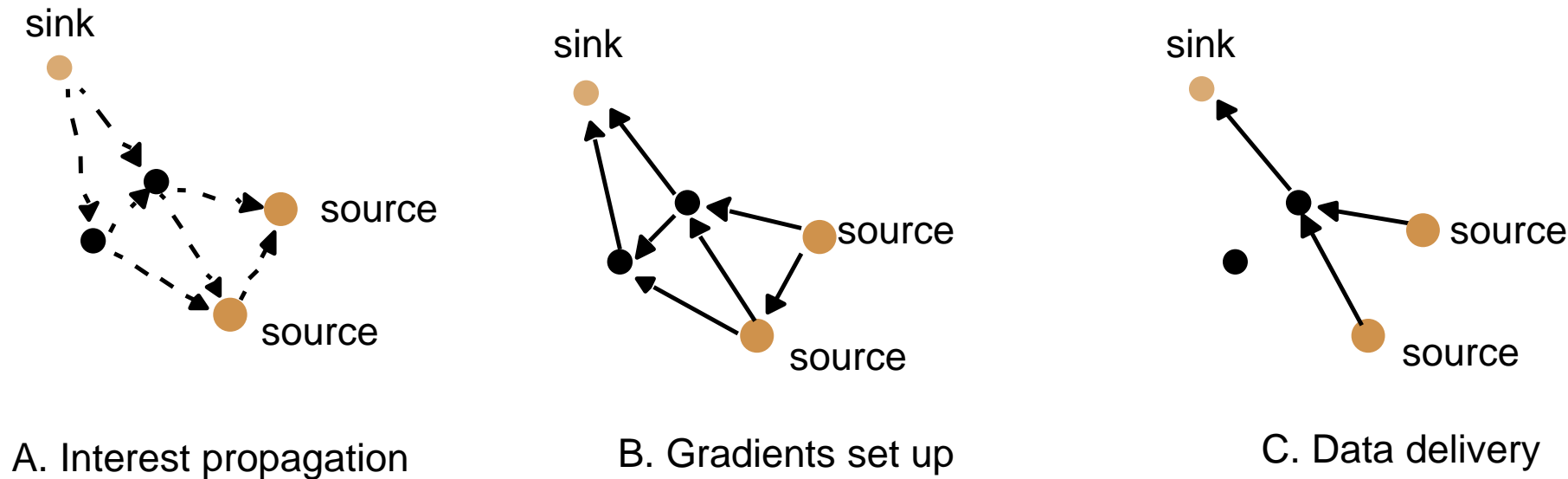


Figure 19.7  
Directed diffusion



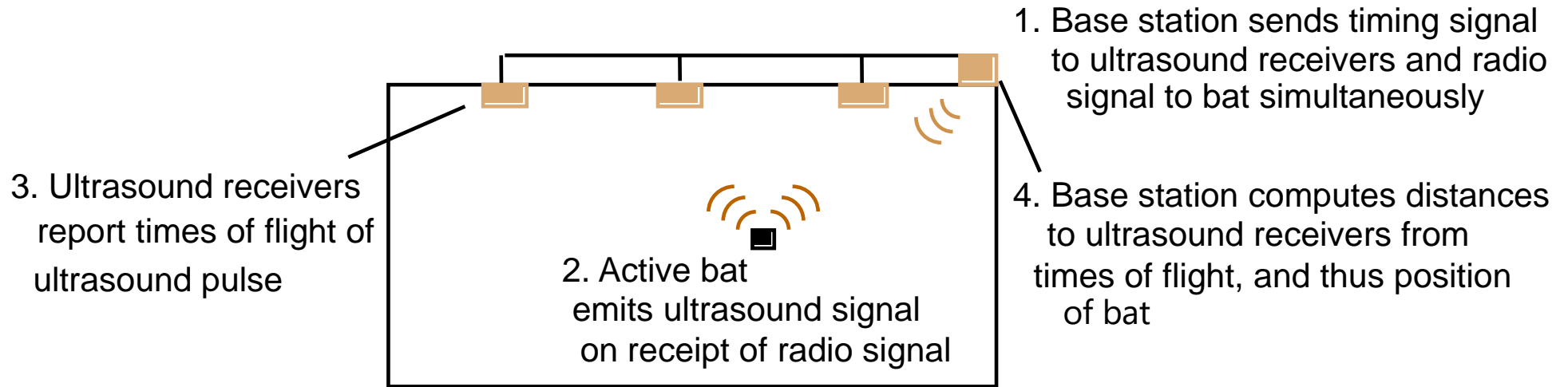


## Figure 19.8 Some location-sensing technologies

<i>Type</i>	<i>Mechanism</i>	<i>Limitations</i>	<i>Accuracy</i>	<i>Type of location data</i>	<i>Privacy</i>
GPS	Multilateration from satellite radio sources	Outdoors only (satellite visibility)	1–10m	Absolute geographic coordinates (latitude, longitude, altitude)	Yes
Radio beaconing	Broadcasts from wireless base stations (GSM, 802.11, Bluetooth)	Areas with wireless coverage	10m–1km	Proximity to known entity (usually semantic)	Yes
Active Bat	Multilateration from radio and ultrasound	Ceiling mounted sensors	10cm	Relative (room) coordinates.	Bat identity disclosed
Ultra Wide Band	Multilateration from reception of radio pulses	Receiver installations	15cm	Relative (room) coordinates	Tag identity disclosed
Active badge	Infrared sensing	Sunlight or fluorescent light	Room size	Proximity to known entity (usually semantic)	Badge identity disclosed
Automatic identification tag	RFID, Near Field Communication, visual tag (e.g. barcode)	Reader installations	1cm–10m	Proximity to known entity (usually semantic)	Tag identity disclosed
Easy Living	Vision, triangulation	Camera installations	Variable	Relative (room) coordinates	No

## Figure 19.9

### Locating an active bat within a room



## Figure 19.10

### Secure device association using physical contact

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1. Fresh secret key  $K$  exchanged by physical contact
2. Devices communicate using secure channel constructed over  $W$  using  $K$

## Figure 19.11

### Detecting a man-in-the-middle

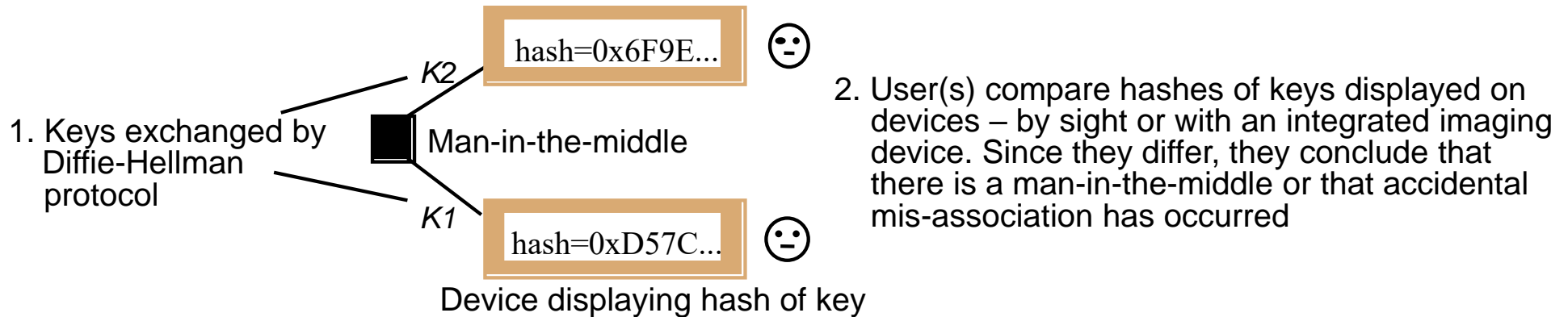
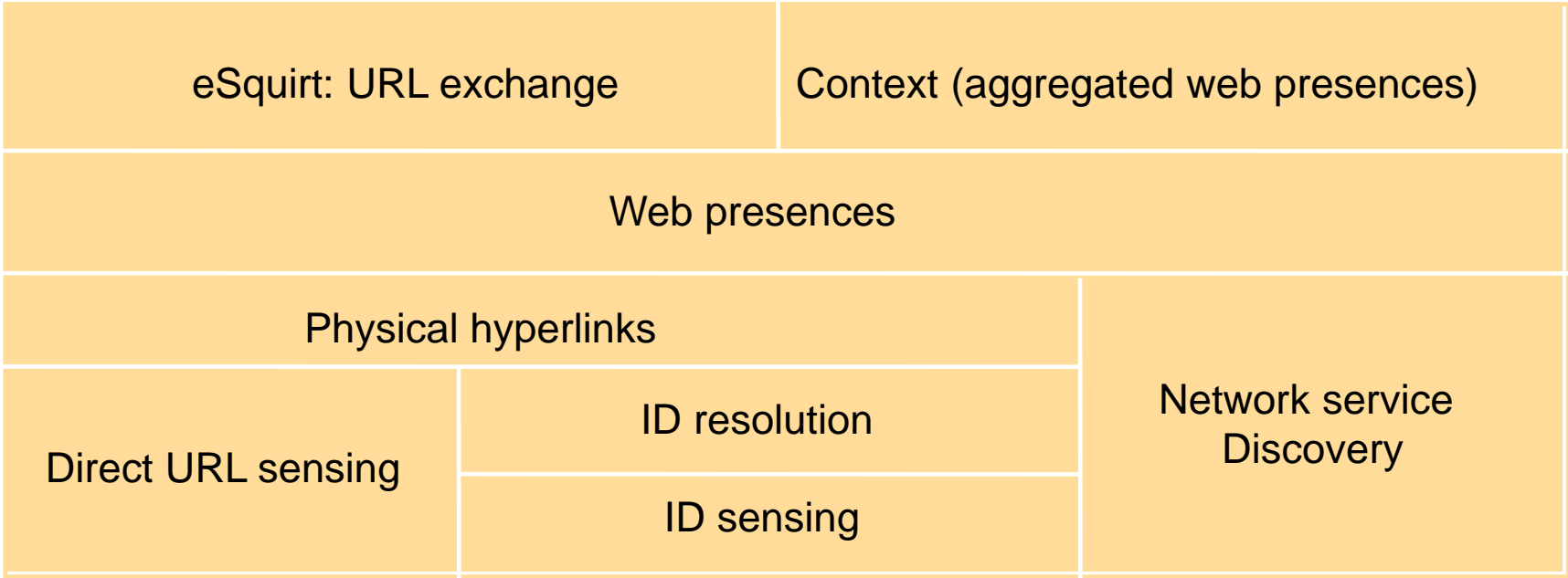
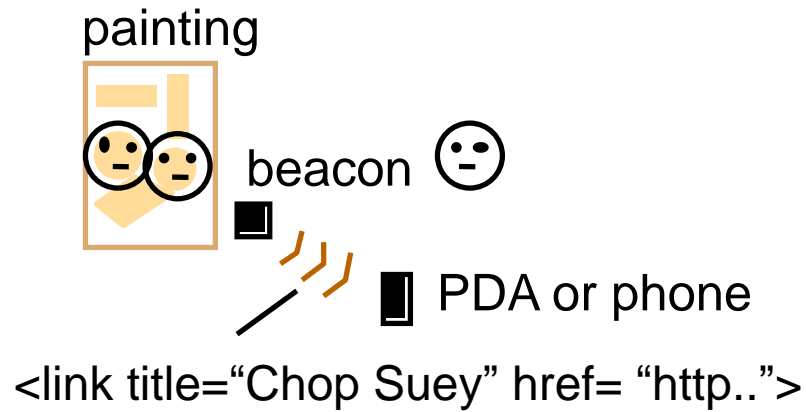


Figure 19.12  
Cooltown layers

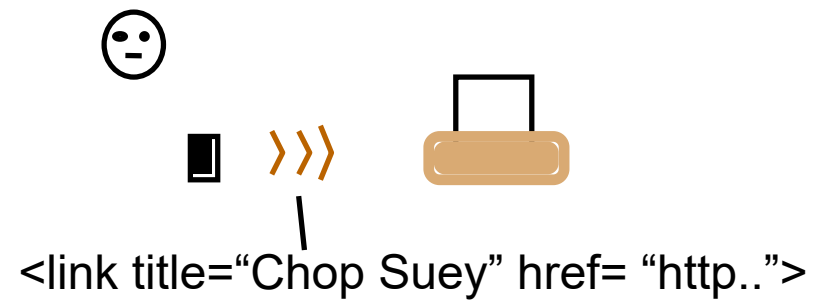


## Figure 19.13

### Capturing and printing the web presence of a painting



a. User captures URL of painting's web presence



b. User sends URL to printer using eSquirt, to print painting's web presence