



Wireless Networking

Presentation Outline

- What is wireless networking?
- Comparison to wired networks
- Why go mobile?
- Types of wireless devices
- Mobile objects
- Moving object databases (MOD)
- Query language for MOD
- Applications of mobile computing
- Challenges
- Future of mobile computing
- Conclusion

What Is Wireless Networking?

- What is computing?

Operation of computers (according to oxfords advance learner's dictionary)

- What is the mobile?

That someone /something can move or be moved easily and quickly from place to place

- What is wireless networking?

Users with portable computers still have network connections while they move

What Is Mobile Computing? (Cont.)

- Is using a digital camera “Mobile Computing”, or using an MP3 player or handheld computer (e.g. 3Com’s Palm Pilot or Compaq’s iPAQ 3660)?

What Is Wireless Networking? (Cont.)

- **A simple definition could be:**

Mobile Computing is using a computer (of one kind or another) while on the move

- **Another definition could be:**

Mobile Computing is when a (work) process is moved from a normal fixed position to a more dynamic position.

- **A third definition could be:**

Mobile Computing is when a work process is carried out somewhere where it was not previously possible.

What Is Mobile Computing? (Cont.)

- **Mobile Computing** is an umbrella term used to describe technologies that enable people to access network services anyplace, anytime, and anywhere.

Comparison to Wired Net.

■ Wired Networks

- high bandwidth
- low bandwidth variability
- can listen on wire
- high power machines
- high resource machines
- need physical access (security)
- low delay
- connected operation

■ Mobile Networks

- low bandwidth
- high bandwidth variability
- hidden terminal problem
- low power machines
- low resource machines
- need proximity
- higher delay
- disconnected operation

Why Go Mobile?

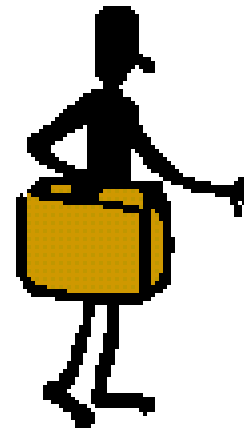
- Enable anywhere/anytime connectivity
- Bring computer communications to areas without pre-existing infrastructure
- Enable mobility
- Enable new applications
- An exciting new research area

Types of Wireless Devices

- Laptops
- Palmtops
- PDAs
- Cell phones
- Pagers
- Sensors

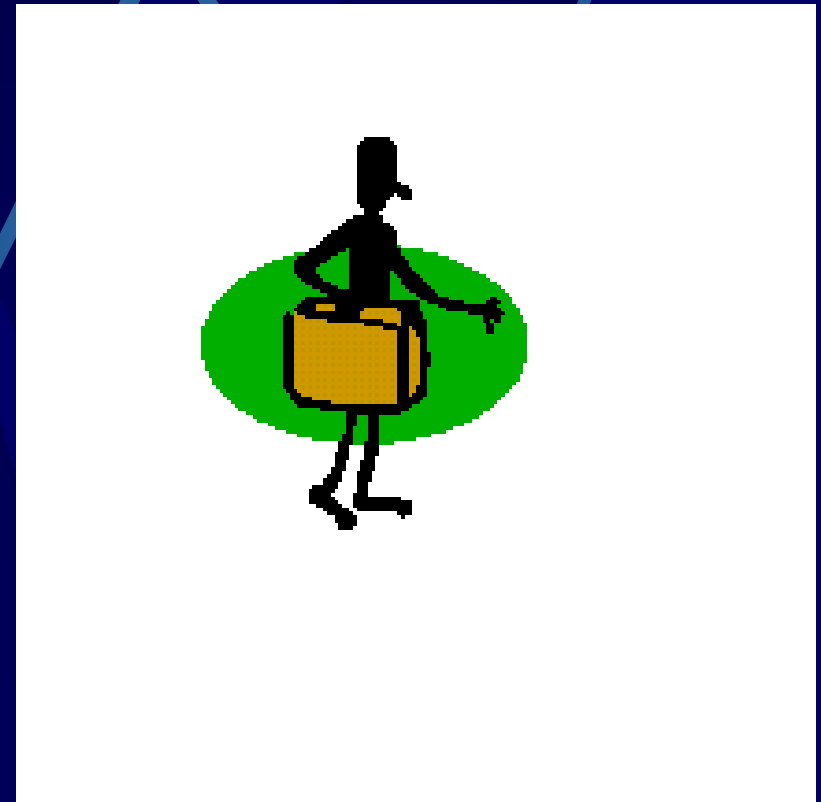
Mobile Objects

- *A mobile object is some code that carries a state*



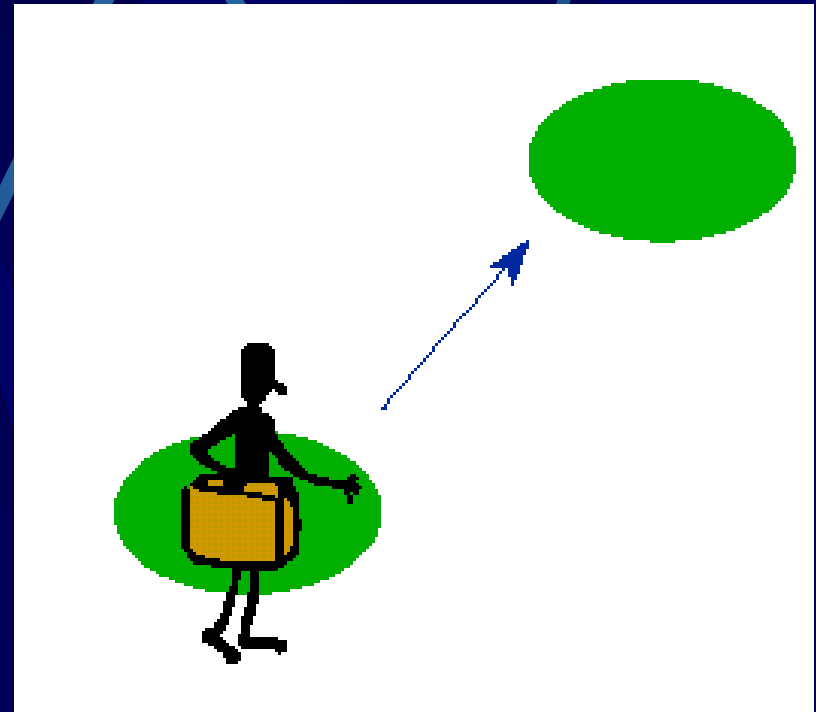
Mobile Objects (Cont.)

- *A mobile object is some code that carries a state*
- *that lives on a host*



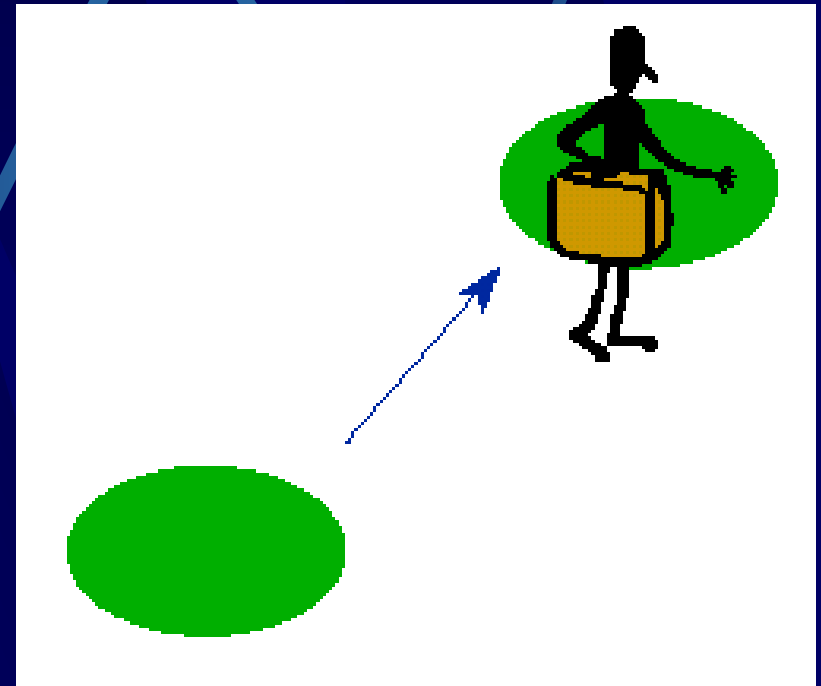
Mobile Objects (Cont.)

- *A mobile object is some code that carries a state*
- *Lives in a host*
- *That visits places*



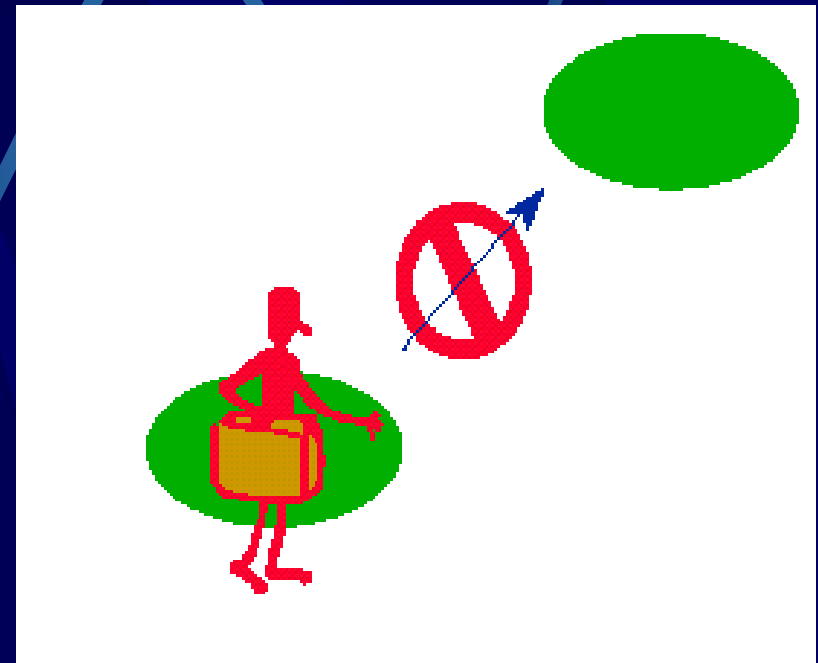
Mobile Objects (Cont.)

- *A mobile object is some code that carries a state*
- *Lives in a host*
- *That visits places*
- *which is let in when trusted*



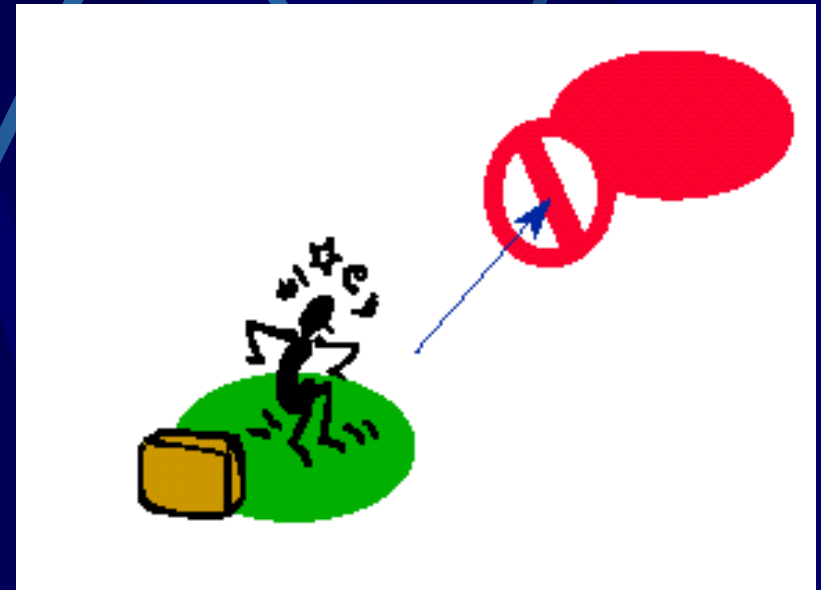
Mobile Objects (Cont.)

- *A mobile object is some code that carries a state*
- *Lives in a host*
- *That visits places*
- *which is let in when trusted*
- *and barred when untrusted*



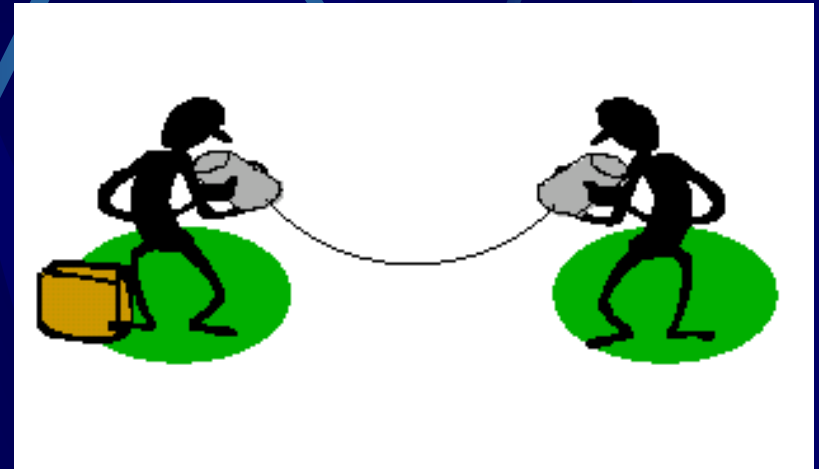
Mobile Objects (Cont.)

- *A mobile object is some code that carries a state*
- *Lives in a host*
- *That visits places*
- *which is let in when trusted*
- *and barred when untrusted*
- *and will refuse to go to untrustworthy places*



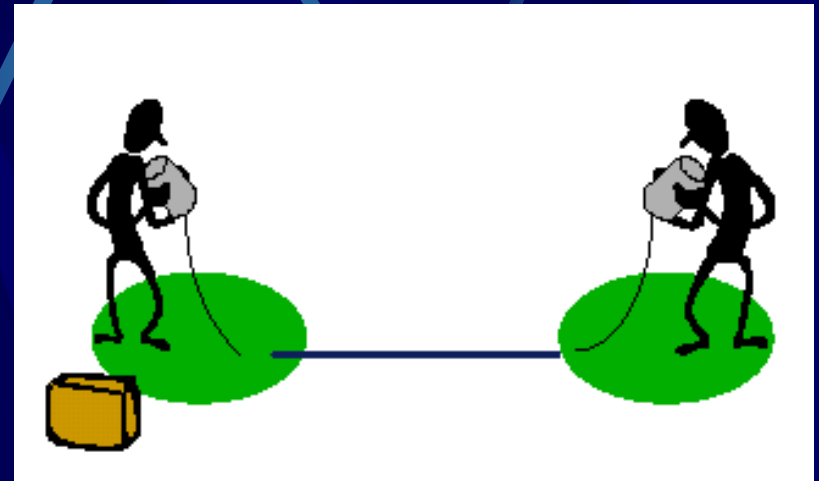
Mobile Objects (Cont.)

- *Mobile objects can talk to their friends*



Mobile Objects (Cont.)

- *Mobile objects can talk to their friends*
- *but only by co-operation of the hosts*



Moving Object Databases (MOD)

- Deals with Mobile Objects whose geometry, position changes over time
- Traditional DBMS alone is incapable for this purpose
- MOD is built on top of existing DBMS to support a critical set of capabilities

Moving Object Databases (MOD) (Cont.)

- DOMINO (Databases for Moving Objects Tracking) Approach
- System Architecture

DOMINO

ArcView GIS

Informix DBMS

Moving Object Databases (MOD) (Cont.)

- Omnitrac
 - developed by Qualcomm
 - Is a commercial system used by the transportation industry
 - Provides location management by connecting vehicles, via satellites, to company DB
 - Vehicles are equipped with GPS, and they automatically and periodically report their location

Query Language for MOD

- Regular query language (SQL) is nontemporal
- For MOD we need Spatial and Temporal Query language
- “Where is the nearest station?”
- “What is the distance of the closest taxicab?”

Query Language for MOD (Cont.)

- Some proposed query language:
 - Future Temporal Logic (FTL)
 - MobSQL
- SQL like query languages with specific predicates and operators to address temporal issues

Query Language for MOD (Cont.)

- What is the nearest station?

```
SELECT station.name, station.address  
FROM station in Stations  
WHERE NEAREST (HERE,station);
```

- “At what time truck 12A arrive to Windsor ”

```
SELECT t  
FROM v in Trucks, c in Cities  
WHERE v WITHIN(t) c and v.id = 12A  
and c.name=Windsor
```

Applications of Mobile Computing

Emergency services

F1	F2	F3	F4	F5	F6	F7	F8	F9
Logoff	Dispatch	State/NCIC	RMS	Messages	Conference	Reports	AutoMap	Help

View Dispatch Detail								
Case #:	Mr	Incident Type:	Description	Resp	#Cars			
9501742	M	MOTOR VEHICLE ACCIDENT	FOUR CAR PILE UP	23	2			
Officer	Supervis	Dispatchr	State:	CT	Region:	01	Alarm Code:	01
SMITH	ROGER	DOE	Vin#:		Business:			
Bs/Rs	Hou#	Apt#	Occurred On Street	Intersect Street:	Prior Calls?			
			123 MAIN STREET	PINE STREET	N/A			
Reporting>	Lname:	JOHNSON	Address:	126 MAIN STREET				
Party>	Fname:	BRIAN	Phone:	(203) 555-1212				
MOTOR VEHICLE ACCIDENT INVOLVING 4 CARS. EYE WITNESS SAYS BLUE FORD RAN A RED LIGHT AND HIT 2 OTHER CARS AT INTERSECTION FORCING A WHITE ACURA INTO ANOTHER PARKED CAR.								
Paperwork:	<input type="checkbox"/>	Tracking:	<input checked="" type="checkbox"/>	Date	Received	Dispatched	Arrival	Cleared
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Applications of Mobile Computing (Cont.)

- For Estate Agents
- In courts
- In companies
- Stock Information Collection/Control
- Credit Card Verification
- Taxi/Truck Dispatch
- Electronic Mail/Paging

Challenges

- Disconnection
- Low bandwidth
- High bandwidth variability
- Low power and resources
- Security risks
- Wide variety terminals and devices with different capabilities
- Device attributes
- Fit more functionality into single, smaller device

Future of Mobile Computing

- Use of Artificial Intelligence
- Integrated Circuitry -> Compact Size
- Increases in Computer Processor speeds

Conclusion

- Mobile computing has severe limitations
 - however, it is far from impossible, and technology improves all the time
- Lots of challenges
 - some have (good) solutions, many others are still waiting to be solved

References

■ Papers:

- “Moving Object Databases: Issues and Solution” by Ouri Wolfson, Bo Xu, Sam Chamberlain and Liqin Jiang
- “DOMINO: Databases for Moving Objects Traking” by Ouri Wolfson, Bo Xu, Sam Chamberlain, Liqin Jiang and Prasad Sistla
- “MobSQL, An SQL Like Query Language for Mobile Objets Databases” by Ahmed Lbath and Mourad Ouziri

■ WWW Links:

- http://www.doc.ic.ac.uk/~nd/surprise_96/journal/vol4/vk5/report.html
- http://www.doc.ic.ac.uk/~nd/surprise_96/journal/vol1/vk5/article1.html
- <http://www.cs.ucsb.edu/~ebelding/courses/284/w04/slides/intro.pdf>
- <http://www.ansa.co.uk/ANSATech/ANSAhtml/98-ansa/external/9807tb/9807mose.pdf>
- <http://www.danishtechnology.dk/it/9238>

Thank You

■ Questions and
Comments?