Mobile Computing

Presentation Outline

- What is mobile computing?
- 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 Mobile Computing?

- 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 mobile computing?

  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 Mobile Computing? (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

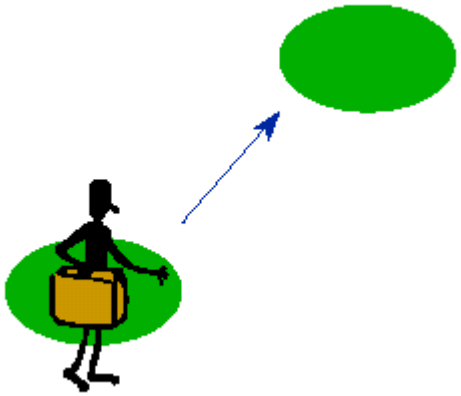
- *A mobile object is some code that carries a state*

Mobile Objects (Cont.)

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

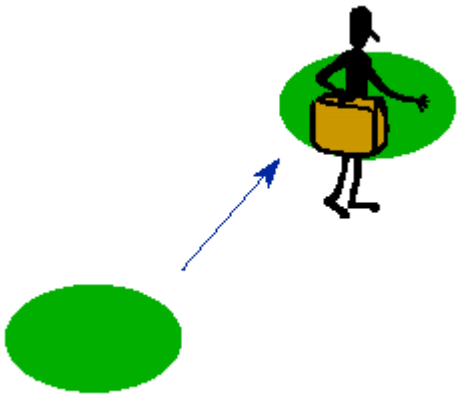
Mobile Objects (Cont.)

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



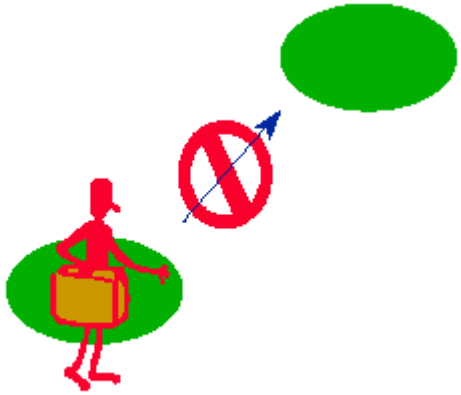
Mobile Objects (Cont.)

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



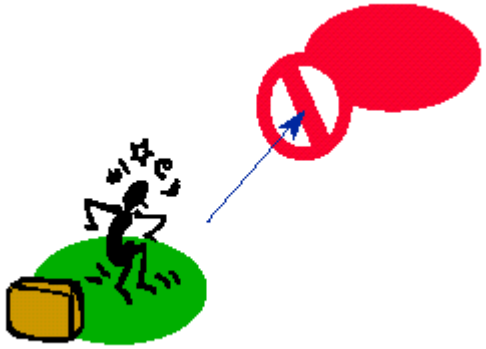
Mobile Objects (Cont.)

- *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*



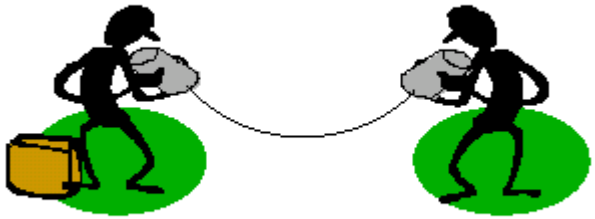
Mobile Objects (Cont.)

- *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*



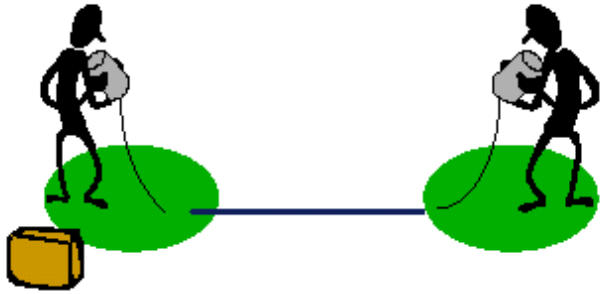
Mobile Objects (Cont.)

- *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*

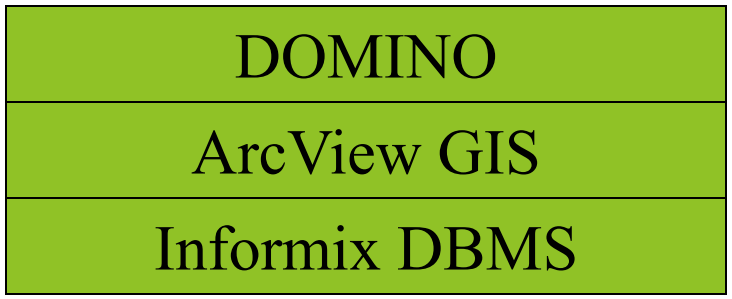


Moving Object Databases (MOD)

- 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



Moving Object Databases (MOD) (Cont.)

- Omnitracs
- 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 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?

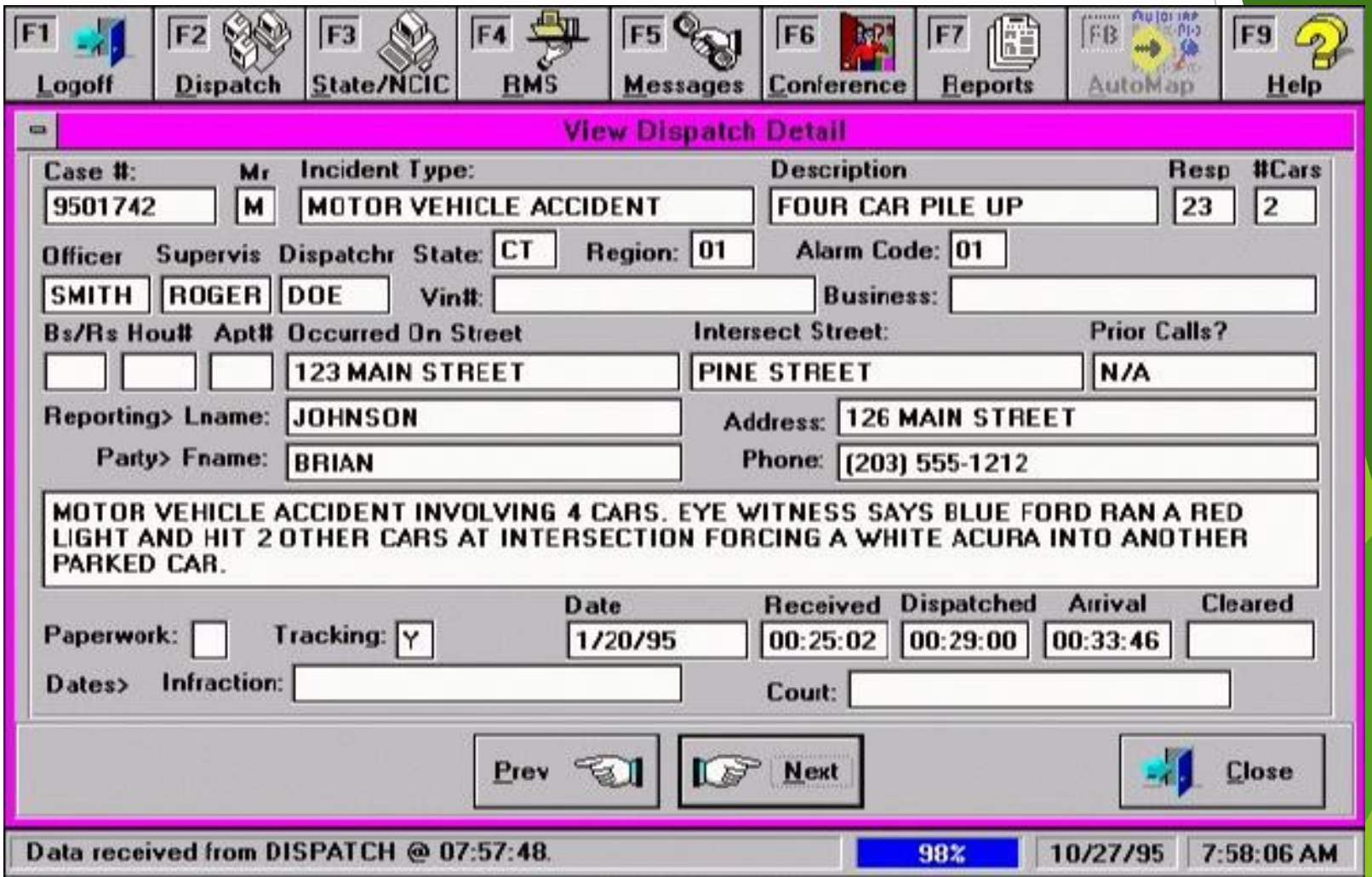
```
SELECT station.name, station.address
FROM station in Stations
WHERE NEAREST (HERE,station);
```

- „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



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 Chaamberlain and Liqin Jiang