Mobile Computing

- Migration is important for survival.
- Mobility originated from the desire to move either toward resources or away from scarcity.
- Mobile computing about both physical and logical computing entities that move.
- Physical entities are computers that change locations
- Logical entities are instances of a running user application or a mobile agent.
- Mobile agents can migrate any where over internet.
- But active applications can only move to a local cluster of computers.

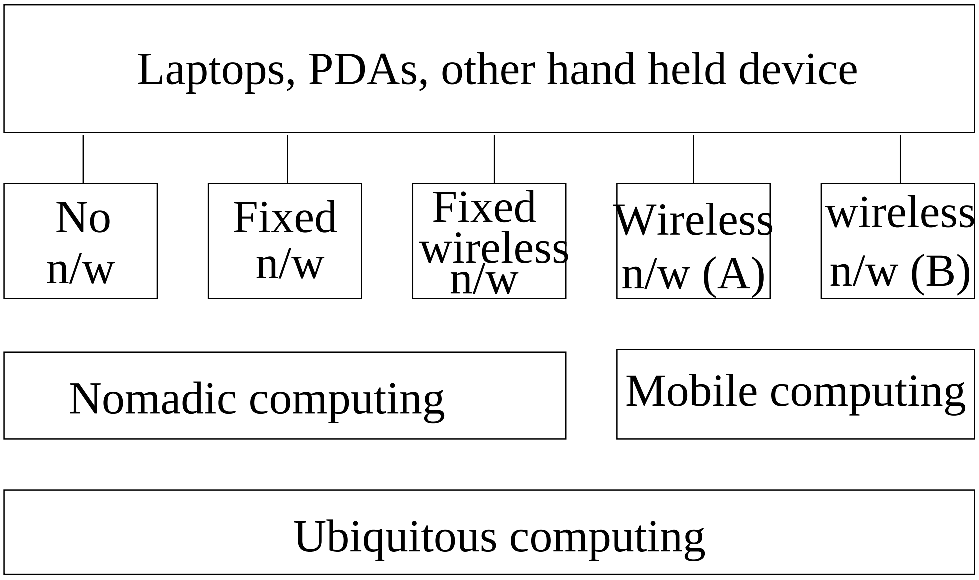
Buzzwords

- Mobile, ubiquitous, nomadic, untethered, pervasive and any time, any where, any person computing are used by researchers to refer to computing that uses small portable devices and wireless communication n/w.
- Nomadic computing refer to limited migration.
  - Migration is within a building at a pedestrian speed.
  - Interleaved pattern of user relocation and indoor connections
- In the same vein, users carrying laptop with DIAL-UP modems are engaged in nomadic computing.

Buzzwords

- Mobile computing requires
  - wireless n/w to support outdoor mobility and handoff from one n/w to the next at a pedestrian or vehicular speed.
- Traveler in car using laptop connected with a GSM phone – engaged in mobile computing.
- Ubiquitous computing or pervasive computing refers to access to computer network all the time at any location by any person.
- Ubiquitous computing can not be realized unless mobile computing matures.

Relationships: Nomadic–Mobile



Challenges

- Mobility/context aware applications
- Naming and locating
- Routing data and messages
- Reliability in presence of disconnection
- Data management
- Transaction models
- Security

Challenges

- Mobile computing affects entire spectrum of issues in computing.
- First of all it is distributed + mobile computing.
- Distributed computing as we know works on static wired network.
- Node may initiate computation some where and migrate to another place.
- So two major problem that arise due to mobility
  - Searching for current location of a mobile node.
  - To impose a communication structure among nodes.

Challenges

- Physical location of mobile is not the network address, so how do we route the message to a mobile host.
- This question is being addressed by two different communities: Internet community and cellular community
- Work of Internet community involves Mobile IP
  - Aims at standards that can extend IP in order to deal with location of Mobile host.
  - Mobile IP work assumes connection-less, packet switching scenario.

Challenges

- Cellular community's effort based on location management of cellular phone users.
- It deals with connection oriented communication, since it is motivated by issues in call-setup in telephony.
- Main problem in mobility management is to find an appropriate trade-off between searching and informing.
- Searching is performed when address of the message recipient is not known – at least not known precisely.

Challenges

- Informing is a responsibility of the mobile unit when it migrates.
- Extreme situations can be
  1. Mobile unit never informs – works for units receiving few messages and for units which don't move during receiving.
  2. Always informs – works well for units receiving messages frequently.

Challenges

- Ad hoc network routing is the ultimate challenge.
- Ad hoc networks arise in rapid deployment scenarios:
  1. Emergency disaster management.
  2. Military operation in remote sites.
  3. Business meeting venues without infrastructure support.
- Many routing algorithms are designed: AODV, DSR, DSDV, TORA, FSR, LAR, ABR, etc.
- There are interesting application of conventional graph theoretic problems in ad hoc network routing.

Challenges

- Main cause of loss of packets in wired network is congestion because error rates are very low.
- In wireless n/w congestion still remains a problem, but he situation is some what reversed.
- Wired and wireless n/w require different techniques to achieve reliability and flow control.
- TCP works is unsuitable for wireless n/w as it interprets errors as packet loss.

Challenges

- ITCP (split/indirect TCP) splits TCP into two parts
  - One between sender and local MSS of the recipient.
  - The other between local MSS and recipient.
  - If MH switches cell during life time of a ITCP connection center point of connection moves to new MSS. sender remains completely unaware about it.

Challenges

- Disconnection/weak connection support is important.
- CODA file system provides support for this.
- It is implemented as a client side cache management system.
- The issue concerns making a file system highly available while maintaining consistency.
- Caching in mobile environment is quite different. MSS can not keep state information (due to scale) for all client. So invalidation by notification.

Challenges

- Categories of information dissemination:
  1. Wide area services – such as stock quotes on national scale
  2. Macroservices – such weather on a regional scale.
  3. Microservices – traffic condition in an immediate vicinity.
- Can be extend to even picocells – such finding a parking slot.

Challenges

- Providing services will require addressing of following new issues
  - Interoperability and adaptability to n/w environments ranging from high to low bandwidths and infra red communication links
  - Energy efficient data access.
  - Support for mobility and disconnection.
  - Support for active services, triggers (even notification), periodic data delivery.

Challenges

- Two modes of information dissemination are
  1. Publish.
  2. Provide on demand.
- Published data is filtered by client and server provides directory information for assisting the filtering.
- Advantages of information dissemination by publishing are:
  - Hot spots can be broadcast frequently – which saves energy at client, avoid congestion.
  - Directory helps client to tune in selectively.

Challenges

- Handoff management – an MH moves from one cell to another while being connected.
- Desirable features are:
  - probability of call dropping is minimized.
  - ping-pong handoffs avoided.
  - interruption is minimized.

Challenges

- Conventional model will not work.
- Kangaroo-joey transaction
- Two-tier transaction
- Team transaction
- Isolation-Only transaction

Challenges

- Security is a major concern.
- Authentication schemes.
- Encryption schemes.
- Payment schemes.
  - E-tickets – getting a service by producing a ticket.
  - E-currency – issues like anonymity, credit-worthiness, non-repudiation, etc.
- Mobile agent security.

