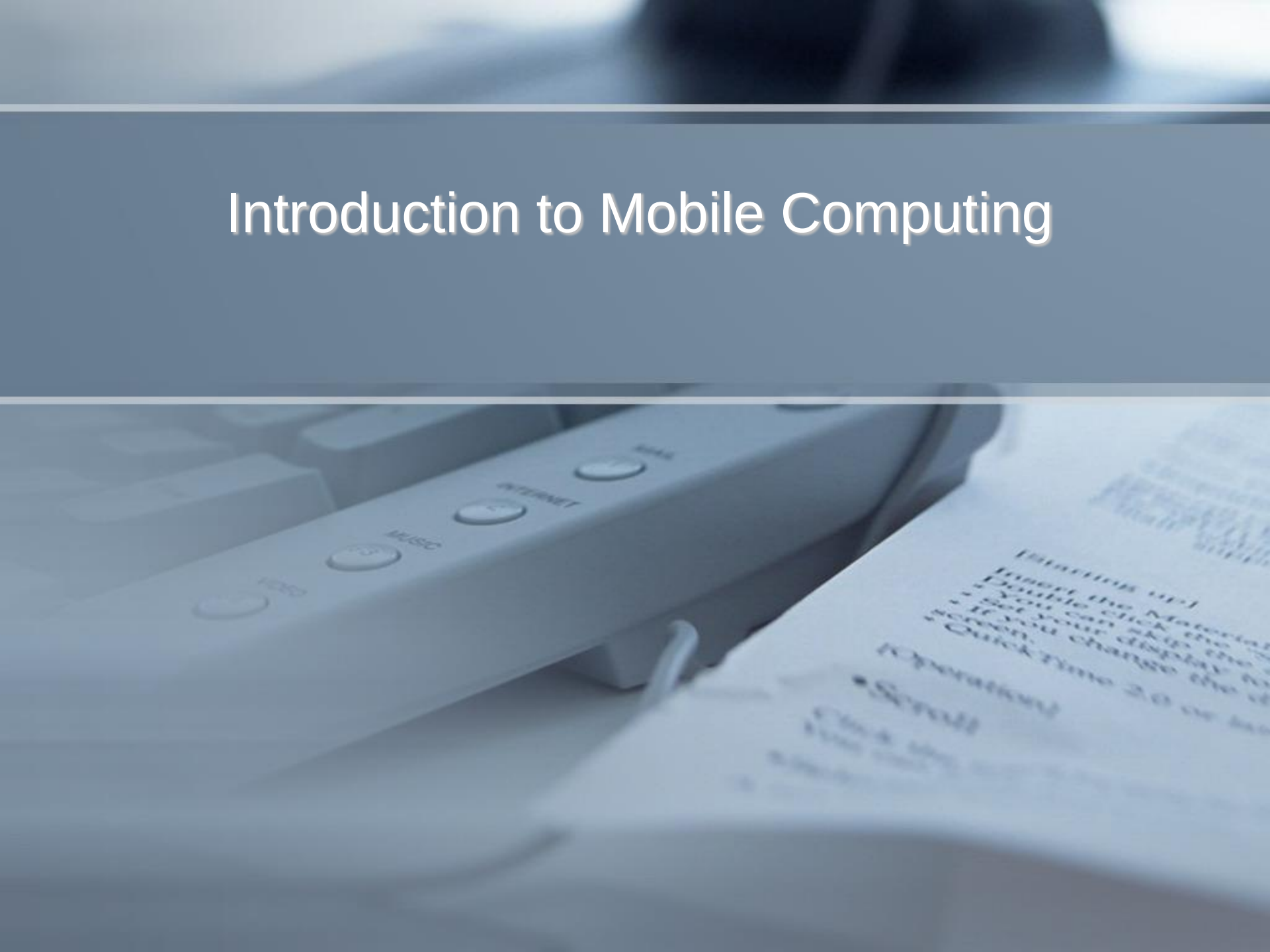
Introduction to Mobile Computing



What is Mobile Computing

- Mobile computing systems are computing systems that may be easily moved physically and whose computing capabilities may be used while they are being moved.
- Examples are laptops, personal digital assistants (PDAs), and mobile phones

Fig- Laptop, PDA, Mobile phone respectively

What is Mobile Computing

- **Distinguishing aspects of Mobile Computing**
  - Wireless Network Connectivity
  - Small size
  - Mobile Nature of their use
  - Power Sources
  - Functionalities
- **Mobile Condition**: the set of properties that distinguishes the mobile user from the user of a typical, stationary computing system.
- **Dimensions of Mobility**: the set of properties that distinguishes the mobile computing system from the stationary computing system.

A Brief History of Mobile Computing

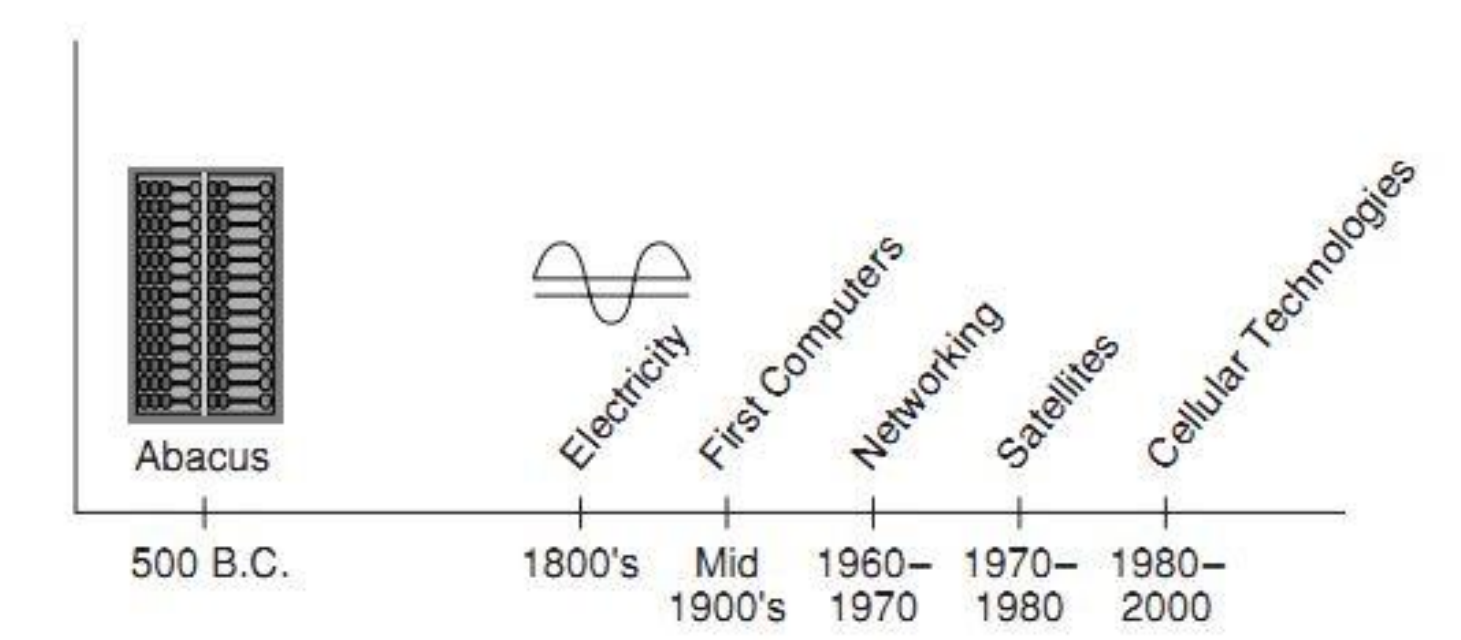


Fig- A Timeline of Mobile Computing

Is Wireless Mobile or Is Mobile Wireless?

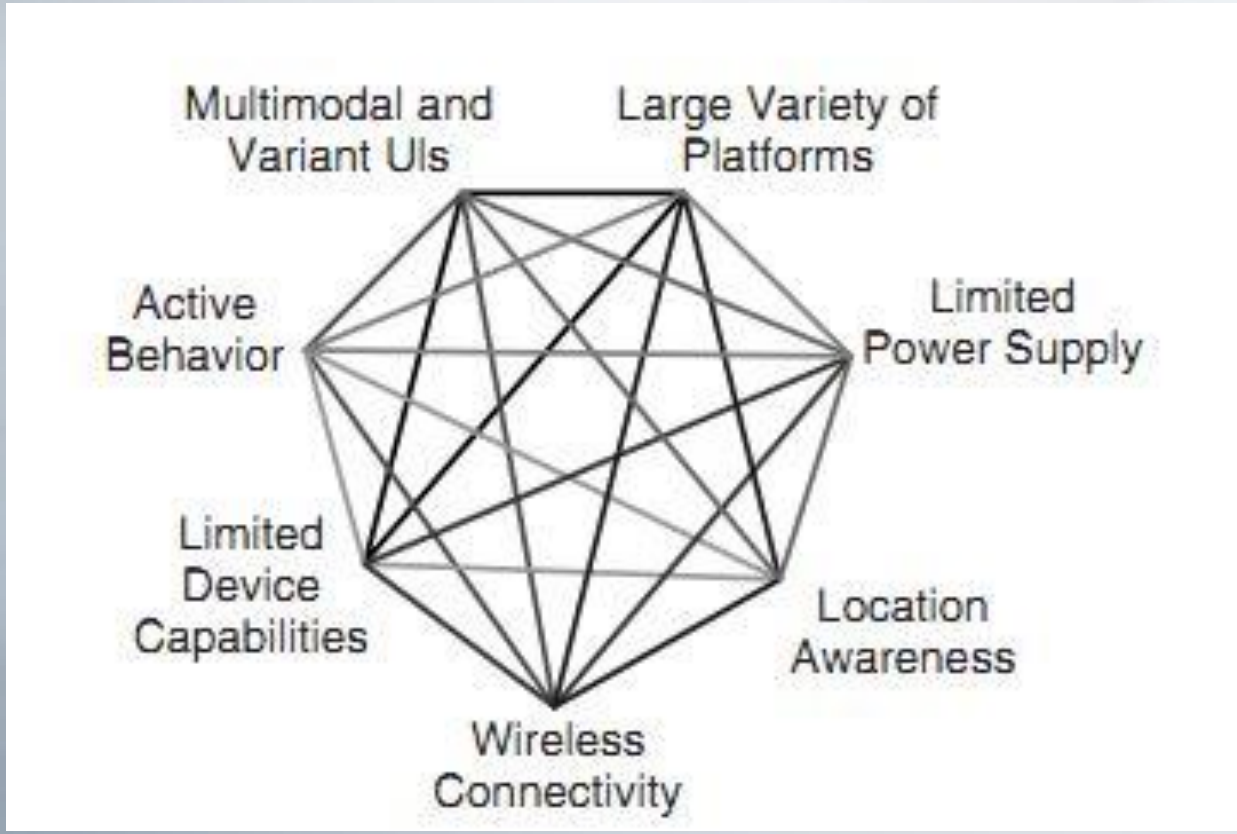
- Mobile computing devices need not to be wireless.
- Laptop computers, calculators, electronic watches and many other devices are all mobile computing devices. None of them use any sort of wireless communication means to connect to a network.

- Wireless communication systems are a type of communication system. What distinguishes a wireless communication system from others is that the communication channel is space itself. Wireless communication systems do not use a wave-guide to guide along the electromagnetic signal from the sender to the receiver.

- Wireless communication systems are often used in mobile computing systems to facilitate network connectivity, but they are not mobile computing systems.

- Though it is not a requirement for a mobile system to be wireless, most mobile systems are wireless.

Added Dimensions of Mobile Computing



1. Location Awareness

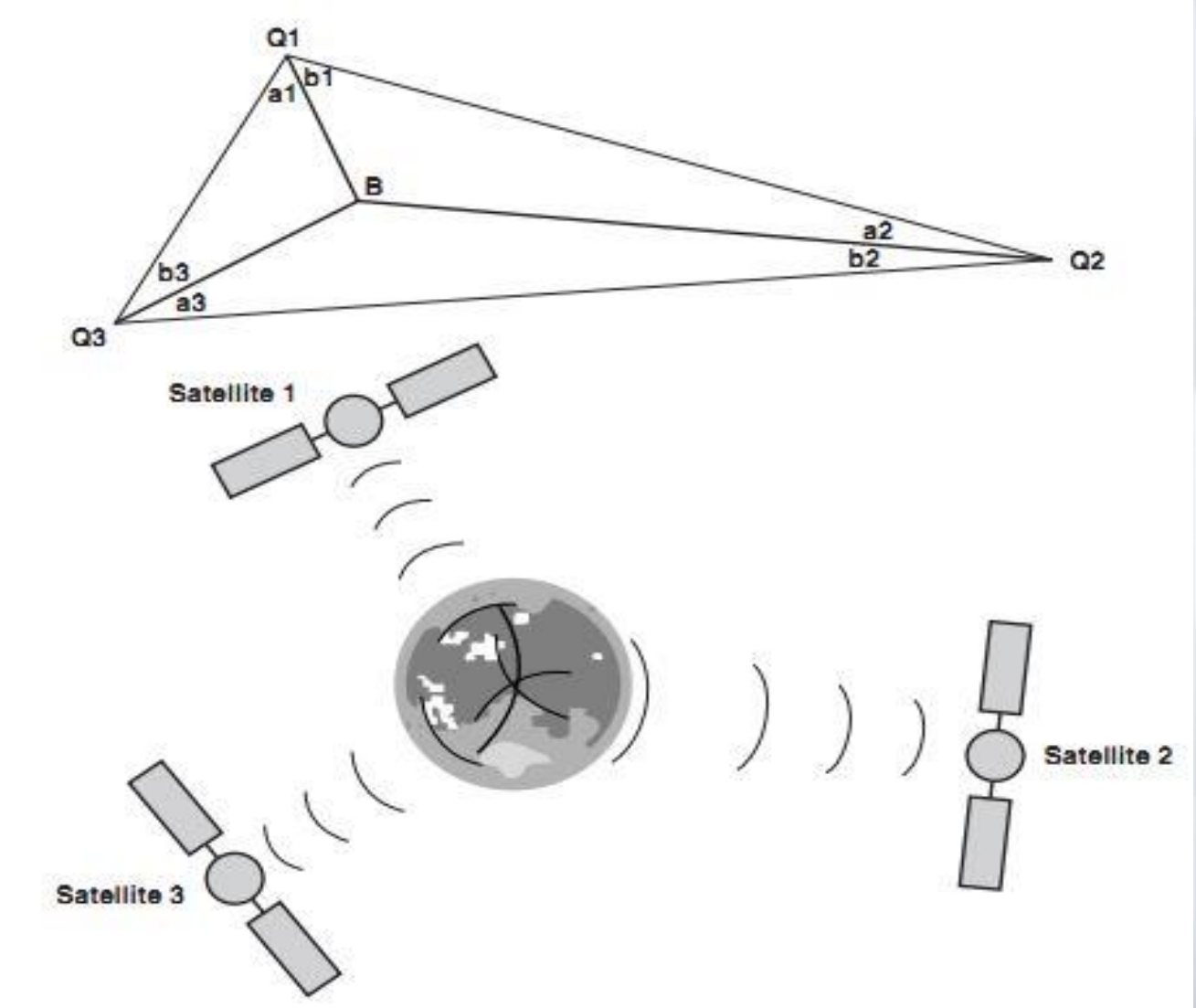
- **Localization:** the ability of the architecture of the mobile application to accommodate logic that allows the selection of different business logic, level of work flow, and interfaces based on a given set of location information

- **Location Sensitivity:** the ability of the device and the software application to first obtain location information while being used and then to take advantage of this location information in offering features and functionality.

- Three Techniques for collecting and using the location of the user and the device
  - Triangulation
  - Proximity
  - Scene analysis

1. Location Awareness

- **1) Triangulation**
- **2) Proximity**
- **3) Scene analysis**



2. Quality of Service (QOS)

- Whether wired or wireless connectivity is used, mobility means loss of network connectivity reliability.

- Moving from one physical location to another creates physical barriers that nearly guarantee some disconnected time from the network.

- In the case of wireless network connectivity, physical conditions can significantly affect the quality of service (QOS). For example, bad weather and a variety of other climate-related conditions can negatively affect the (QOS).
- Mobile applications have to know how to continue to operate even after they are disconnected from the network or while they connect and disconnect from the network intermittently and frequently.

Limited Device Storage and CPU

- The physical size limitation imposes boundaries on volatile storage, non-volatile storage, and CPU on mobile devices.
- There are physical boundaries on the size of transistors on modern microchips.
- Limitations of storage and CPU of mobile devices put yet another constraint on how we develop mobile applications.
- Storage and processing issues are largely addressed by the various operating systems and platforms on the mobile devices.

Limited Power Supply

- Batteries are the primary power source for mobile devices.
- The power supply has a direct or an indirect effect on everything in a mobile device. For example, the brighter the display, the more battery power is used, so the user interface is indirectly coupled to the power supply.
- Most power management functionality is built into the operating system of the mobile device.
- Some platforms allow monitoring of the remaining power and other related power information.
- Operating systems and platforms are largely responsible for handling the power consumption issues.

Varying User Interfaces

- Voice user interfaces, smaller displays, stylus and other pointing devices, touch-screen displays, and miniature keyboards are common issues in mobile devices.
- Entering text on the small display of a cellular phone and through the numeric keys of a phone is very cumbersome.
- User interfaces are difficult to design and implement for the following reasons
  - Designers have difficulties learning the user's tasks.
  - The tasks and domains are complex.
  - A balance must be achieved among the many different design aspects, such as standards, graphic design, technical writing, internationalization, performance, multiple levels of detail, social factors, and implementation time.
  - The existing theories and guidelines are not sufficient.
  - Iterative design is difficult.
  - There are real-time requirements for handling input events.
  - It is difficult to test user interface software.

Platform Proliferation

- Mobile devices are small and there is much less hardware in them than in a PC, they are typically less costly to assemble for a manufacturer.

- Platform proliferation heightens the importance of designing and developing devices independent of the platform.

Active Transactions

- Passive systems
- Push Model (Active System):
  - an information producer announces the availability of certain types of information
  - an interested consumer subscribes to this information
  - the producer periodically publishes the information (pushes it to the consumer)
- Active Transactions
  - Synchronous: Time dependent
  - Asynchronous: Time independent

- Properties of Synchronous Active Transaction:

- Properties of Asynchronous Active Transaction:

Condition of Mobile User

- The mobile user is fundamentally different from the stationary user in the following ways:
  - 1. The mobile user is moving, at least occasionally, between known or unknown locations.
  - 2. The mobile user is typically not focused on the computing task.
  - 3. The mobile user frequently requires high degrees of immediacy and responsiveness from the system.
  - 4. The mobile user is changing tasks frequently and/or abruptly.
  - 5. The mobile user may require access to the system anywhere and at any time.

References

- Chap 1 of “MOBILE COMPUTING PRINCIPLES” By Reza B’Far