بسم الله الرحمن الرحيم

نحمد الله العلي العظيم و نصلي على رسوله الكريم

History of mobile ad hoc networks

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Mobile ad hoc networks

- What's in this presentation
- General less technical
- a brief overview of mobile ad hoc networks
- Will focus on the origin of mobile ad hoc networks only
- First , second and third generation mobile ad hoc networks systems.
- Main focus will be on ad hoc network from the time of origin till today ?

Ad hoc networks what are they?

- ‘Ad-hoc’ Latin word means ‘for this’ or for this only
- Collection of mobile nodes forming short live or temporary networks without the aid of any centralized structure.
- Benefits
- Can turn the dream of networking at any place and at time into reality. We are almost there by the way i.e. Bluetooth enabled mobile phones such as 3G
- In short
- Lots of benefits at-least ideally ; Likewise some unique problems.

First , second and third generation mobile ad hoc networks

- First generation they were used for different military scenarios.
- Packet radio networks was the first ad-hoc network system
- Second generation from 1980s' to the mid 1990's
- Main aim were the same as for the first generation ad-hoc networks system i.e. aiding combat operations.
- second generation developments focused on the further advancement of the previously build ad-hoc network structure.
- some important developments ; Global mobile information Systems, Near term Digital Radio (NTDR)
- Third generation ad-hoc network systems are also known as commercial ad-hoc network systems.
  - developments , Bluetooth – ad-hoc sensor networks etc.

Origin of mobile ad hoc networks; first generation ad-hoc network systems

- Back in 1973 …..
- DARPA (Defense Advanced Research Projects Agency) http://www.darpa.mil/
- the Defense Advanced Research Projects Agency (DARPA) initiated research on the feasibility of using packet-switched radio communications to provide reliable computer communications.
- Came up with packet radio network 1973-1987
- The DARPA PRNET has evolved through the years (1973-1987) to be a robust, reliable, operational experimental network.
- The DARPA PRNET projects includes network devices, routing protocols and protocols for automatic distributed network management.

First generation ad-hoc network systems continue

- Packet radio network components
- **Firmware**
- Firmware can be loaded into a PR either locally (via serial interface) or from the PRNET.
- The firmware in each PR gathers information about bidirectional link quality, nodal capacity and route characteristics and provides this knowledge to debugging and monitoring
- **Communication**
- use radio frequency technology to transmit and receive data
- The implemented packet radios support omni-directional, spread-spectrum, half-duplex transmission and reception at 400kbit/s and 100kbit/s rates
- They implement the physical, data link and network layer (OSI model).

First generation ad-hoc network systems continue

- Measuring
- Several measurements are available to the firmware: Receive power, signal/noise, noise, multi-path, Error Handling
- Cyclic Redundancy Checksum (32bit) is used to provide a "good" error detection. If a packet fails, it is discarded and the receiving node waits for retransmission, which follows automatically if there is no acknowledgement.
- Chip Modulation
- The devices implement chip modulation at a 12.8 mchips/s rate which produces a direct-sequence, spread-spectrum waveform using a pseudo-noise sequence.
- Radio Frequency Capabilities
- 20 frequencies between 1718.4MHz and 1840.0MHz are available for the channel selection.

First generation ad-hoc network systems.

- Routing
- The routing protocols used in PRNet are designed to enable reliability, speed and correctness and thus include network management facilities.
- Network Management
- Automatic and distributed network management results from the use of the protocols above. The result of this network management is that the DARPA PRNet can be installed and deployed quickly and easily.
- That all about first generation ad-hoc network systems

Second generations ad hoc network systems

- In 1980;s -1993
- Survivable adaptive radio networks program
- Main aim
  - Providing packet switched networking to the mobile battlefield elements in infrastructure- less environments.
  - Beneficial in improving
    - Radios performance by making them smaller, cheaper and power-thrifty.
    - Scalability of algorithms
    - Resilience to the electronic attacks.
- GloMo (Global Mobile Information Systems) project
  - The goal of the project is to make the mobile environment a first-class citizen in the Defense Information Infrastructure by providing user friendly connectivity and access to services for wireless mobile users.

GloMo (Global Mobile Information Systems) project continue

- GloMo initiatives include:
  - self organizing/self healing networks; both flat and hierarchical multihop routing algorithms;
    - ATM over wireless;
    - Georouting; Satellite communications networks; heterogeneous networking with IP overlays; end-to-end network enhancements; and security & survivability for ad-hoc networks.
  - GloMo technologies are applicable to
    - Wide-Area Information Systems, Information Systems for Dismounted Forces, and Information System for Rapid Deployment of Forces.

Near term Digital Radio Systems

- The NTDR system is a DA-directed, experimental, mobile packet data radio network that links Tactical Operations Centers in a brigade area.
- The NTDR provides a self-organizing, self-healing, network capability. Radio network management is provided by a Network Management Terminal.
- The primary purpose of the NTDR is to provide data transport for the Army Battle Command System automated systems to units at brigade and below
- Lessons learned from this experimental fielding provide a portion of the technical baseline for radios being designed for future fielding

Third generation mobile ad hoc network systems

- 1990's- onwards
- Invention of notebook computers and viable communication devices based on radio waves concept of commercial ad-hoc networks has arrived.
- Idea of collection of mobile nodes were purposed in research conferences.
- Mobile ad-hoc networks was revived as a potential technology
- When it comes to commercial applications
- We see two main and important applications of mobile ad-hoc networks
  - Bluetooth
  - Ad-hoc sensors

Third generation ad-hoc networks systems

- Bluetooth (my article Bluetooth a commercial application of mobile ad-hoc networks at http://www.computingunplugged.com/issues/issue200411/00001397001.html)
- Bluetooth was first introduced in 1998.
- Bluetooth uses radio waves to transmit wireless data over short distances
- Bluetooth can support many users in any environment.
- Eight devices can communicate with each other in a small network known as piconet.
- At one time, ten of these piconets can coexist in the same coverage range of the Bluetooth radio.

Third generation ad-hoc networks systems

- A Bluetooth device can act both as a client and a server.
- A connection must be established to exchange data between any two Bluetooth devices.
- In order to establish a connection a device must request a connection with the other device
- Ad-hoc Sensor networks (my article Sensor networks and ad-hoc networking at http://www.computingunplugged.com/issues/issue200410/00001398001.html
- Unlike typical sensor networks, which communicate directly with the centralized controller, a mobile ad-hoc sensor network follows a broader sequence of operational scenarios, thus demanding a less complex setup procedure.

Third generation ad-hoc sensors networks

- A mobile ad-hoc sensor or hybrid ad-hoc network consists of a number of sensor spreads in a geographical area.
- Each sensor is capable of mobile communication and has some level of intelligence to process signals and to transmit data.
- In order to support routed communications between two mobile nodes, the routing protocol determines the node connectivity and routes packets accordingly.
- This makes a mobile ad-hoc sensor network highly adaptable so that it can be deployed in almost all environments.
- Mobile ad-hoc sensor networks are very beneficial in different scenarios.
- These networks advance operational efficiency of certain civilian applications. i.e. military ; business; parking area etc.

What next

- **application of mobile ad hoc networks**
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