Connectify: Ad-Hoc Network with Bluetooth

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Abstract— Ad hoc networks are peer networks of mobile computational nodes. They are well explored in the contexts of sensor networks, habitat monitoring and robotic collaboration. A wireless ad-hoc network is a collection of nodes which are self-organizing and self-administering in nature. All nodes are connected by wireless links and are free to move randomly. Connectify is a wireless network in which each node can directly communicate with other node within the network. Each device (node) can directly communicate with each other. Using ad-hoc, the networks do not need any infrastructure or any access points (Fixed wired points) to work. Ad-hoc nodes from two networks cannot communicate if they are not with same radio range. This paper is based on study of ad-hoc wireless networks and new concept of Connectify in wireless architectures and protocols. This paper provides an overview of both.

Key words: Bluetooth, communication, routing, Wireless network, Ad hoc Network, Multi-hop, Routing protocols, Infrastructure less

I. Introduction to Ad-hoc Networks

Ad hoc networks are a new paradigm of wireless communication for mobile hosts (which we call nodes). In an ad hoc network, there is no fixed infrastructure such as base stations or mobile switching centers. Mobile nodes that are within each other's radio range communicate directly via wireless links, while those that are far apart rely on other nodes to relay messages as routers.

An ad hoc network is a network with temporary plug-in connections, in which the network devices are part of the network only for the duration of a communications session or, in the case of mobile or portable devices, while in some close proximity to the rest of the network.

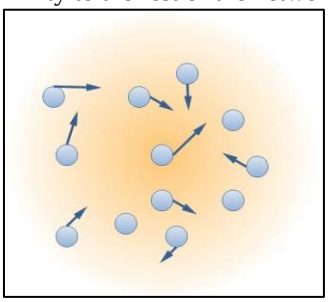

Fig. 1.1: Ad Hoc Network: Nodes mover randomly in different direction and different speeds

Ad hoc network is often local area network or other small area network formed by wireless devices. In Latin, ad hoc literally means "for this," further meaning "for this purpose only," and thus usually temporary. The term has been applied to future office, home and personal area networks in which new network nodes can be quickly added and removed. [1]. Bluetooth is one of the technologies that can be used for ad hoc networking. Bluetooth specification is a computing and telecommunications industry specification that describes how e.g. mobile phones, computers, and personal digital assistants (PDAs) can easily interconnect and communicate with each other by using wireless transmission in a short-range. The original idea of Bluetooth concept was that of cable replacement between portable and/or fixed electronic device. According to the specification, when two Bluetooth devices come into each other's communication range, one of them assumes the role of master of the communication and the other becomes the slave. This simple "one hop" network is called a piconet, fig 1.2., and may include up to seven active slaves connected to one master.

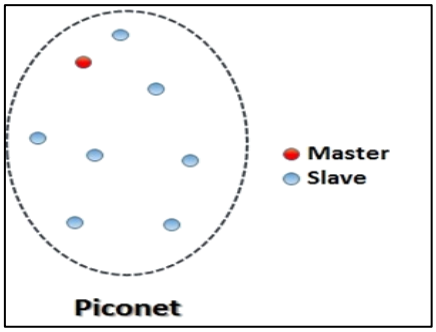

Fig. 1.2: Piconet

As a matter of fact, there is no limit on the maximum number of slaves connected to one master but only seven of them can be active at time, others have to be in so called parked state. [5] See Figure 1.3 for basic piconet topologies introduced.

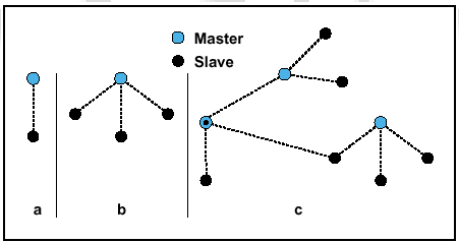

Fig. 1.3: Topologies: Piconets with single slave operation (a), multi-slave operation (b) and scatternet operation (c).

II. Introduction to Connectify

Connectify is an ad hoc network that consisted of set of self-organizing mobile nodes. The ad hoc network provides communication between without fixed infrastructure. Bluetooth is a low-cost and low-power short range technology that will equip cell phone, laptops, digital cameras, cordless headset and so on to interconnect these devices easily and quickly without cable. Bluetooth ad-hoc network enables effortless wireless connection between devices and other peripherals. Any Bluetooth device in ad hoc network has to decide whether to be a slave or a master. In addition, most Bluetooth can only support communication in limited range, i.e. 10m. When the area of Bluetooth ad hoc network is greater than 10m, a scatternet is defined in Bluetooth specification. In scatternet, figure 2.1, a joint device is a member of at least two piconets.

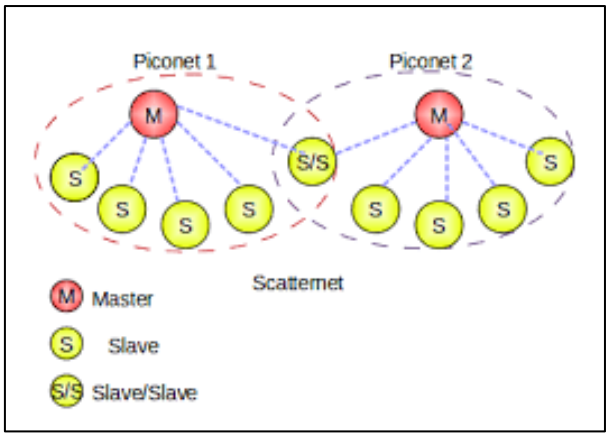

Fig. 2.1: Scatternet

A slave can be slave or master in another piconet, while a master can only be slave in another piconet. The masters in a scatternet choose different hopping sequences to minimize the interference between piconets. A Bluetooth ad hoc network (scatternet) must be formed in advance. Then, the routing protocols can be run over the scatternet.

Connectify is a wireless network in which each node can directly communicate with other node within the network. Each device (node) can directly communicate with each other. Using ad-hoc, the networks do not need any infrastructure or any access points (Fixed wired points) to work. Ad-hoc nodes from two networks cannot communicate if they are not with same radio range.

This Ad-hoc network is implemented by using WLAN (802.11), but this WLAN is specially meant for high bandwidth and large ranges. If we use this for small ranges there is wastage in bandwidth. So for small range of networks we use Bluetooth for wireless communication as alternative of cable replacement technique.

Network formed by Bluetooth are called as piconets. Group of piconets forming a network is called a scaternet. In a piconet the network consists of master, slave, parked and some standby nodes. At a time a master can serve up to seven nodes because Bluetooth uses only three bit address (3 bits i.e . . . 2power3=8).that is only eight nodes are linked. Parked nodes are those nodes which are ready for participation but the master is busy with seven slaves. Standby nodes are those which are not interested in network formation.

The nodes present at the borders of a piconet are used for inter cluster communication. A server node cannot be used for inter cluster communication.

III. Objective

The main objective is to develop ad-hoc networks using Bluetooth so that mobile nodes in one network can send messages to nodes in other networks. Means if we send a message using Bluetooth, by a group of Bluetooth enabled mobile devices a network is dynamically established and message will be sent to the receiver. So even if the receiver out of coverage of sender's range even then also he will receive the messages in multi hop fashion as shown below.

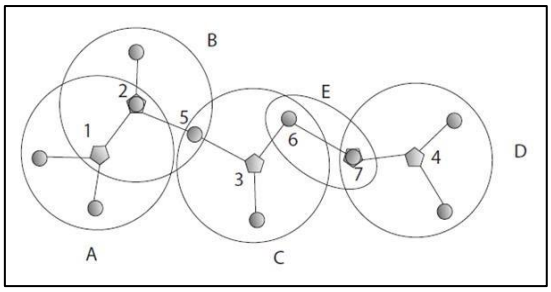

Fig. 3.1: Connection of nodes

We can also say that the main aim is to develop a scatternet by using Bluetooth.

- To handle the low bandwidth requirements.
- To handle the lossy links by constant topology change.
- To handle the network management techniques.
- To analyze the requirements and challenges in the project

IV. Problem Statement

The main purpose of the system is to implement the ADHOC network for message transfer between the Mobile devices Using the Bluetooth.

A. Current System

Policy-driven approaches have been suggested for ADHOC network management such as SNMP,ANMP, Phanse's PBNM, PECAN and Guerilla. In such approaches, policy servers or mobile agents are deployed in a distributed manner in the network. This distribution may be full or partial. The agents carry policies for monitoring and reporting of local events to a central reporting node. Examples of policies implemented at the agents include "report event if cpu utilization exceeds 50%" or "do not report events if bandwidth of the reporting interface is less than 1 Mbps". If the agents are not fully distributed, the agents could be placed in certain locations in the network where they collect information about the hosting node as well as neighboring nodes. The strategy for locating the agents can be static or dynamic. If the network is not mobile and the topology remains fairly static, the agents can be placed based on an off-line algorithm that optimizes their location based on some metric like topology, traffic profile etc. If the topology changes quite often due to mobility or otherwise, then a dynamic placement policy is required. These approaches enable specific policies to be enforced such that the management framework only responds to certain types of events or changes in the network. This minimizes the amount of data collection but the information granularity and its accuracy depends on whether a correct policy has been devised for the situation that the node is experiencing at any given moment. This is because anticipating, defining and deploying the correct policies is not feasible for all possible situations.

These wireless networks use WLAN for communication. WLAN is used for high bandwidth and large ranges. There is wastage of bandwidth if it is used for short range networks.

B. Proposed system

Network management involves two steps:

- The collection and dissemination of the network state (obtaining information about the network)

– Intelligent Decision based on that information (such as provisioning or assigning QoS priorities to data traffic).

SOLOMON focuses on the collection and dissemination of network state since that is the critical high-overhead component of ad-hoc mobile network management. SOLOMON reduces the network overhead compared to traditional SNMP protocol by summarizing network state before sending the information. This is a reversal of the SNMP paradigm, where the summarization of network state is done at the administrator node.

In SOLOMON, even though packets are sent unreliably using UDP, message redundancy is obtained via gossiping to offset packet losses. We note that in the SOLOMON paradigm there is a computational cost trade-off with bandwidth (or network messaging overhead), but we assume that this computational overhead is negligible. The collection of network state involves three key operations:

1) The creation of a management hierarchy through clustering.
2) The dissemination of information between clusters.
3) The dissemination of information within clusters.

The proposed system well suited for limited range networks and it also uses Bluetooth for the node communication. So there is no wastage of bandwidth as compared to the WLAN.

V. Characteristics of Ad-hoc Networks

A. *Mobility*

Nodes can be quickly repositioned. We can have individual random mobility, group mobility etc. The mobility model can have mainly significant force on the selection of a routing method and can thus influence the performance.

B. *Multihopping*

A multihop network is a network where the paths from source to destination pass through numerous nodes. Ad hoc nets frequently reveal multiple hops for obstacle negotiation, spectrum reuse and energy conservation.

C. *Self-organization*

The ad hoc network must unconventionally determine its own configuration parameters including addressing, routing, clustering, identification of position, power control etc.

D. *Energy conservation*

Most ad hoc nodes (e.g., laptops, PDAs, sensors, etc.) have limited power supply and no capability to generate their own power (e.g., solar panels). Energy efficient protocol design (e.g., MAC, routing, resource discovery, etc) is critical for longevity of the mission.

E. *Scalability*

In some applications (e.g., large environmental sensor fabrics, battlefield deployments, urban vehicle grids, etc) the ad hoc network can grow up to numerous thousand nodes.

F. *Security*

The ad hoc networks, however, are even more exposed to attacks than the infrastructure counterpart. Both active and passive attacks are possible. In active attack attacker tries to interrupt operations (control and data packets; reintroduces bogus control packets; damages the routing tables beyond repair; unleashes denial of service attacks, etc.). Passive attacks are unique in ad-hoc network and can be more hazardous than the active attack. The active attacker is eventually discovered and physically disabled. The passive attacker is never discovered by the network. It monitors data and control traffic patterns and thus infers the normal operation. Defence from passive attacks require powerful novel encryption techniques coupled with careful network protocol designs.

G. *Connection to the Internet*

As discussed, there is merit in extending the infrastructure wireless networks opportunistically with ad hoc appendices. The integration of ad hoc protocols with infrastructure standards is thus becoming a hot issue.

VI. Conclusion & Future Scope

The current work i.e. ADHOC communication using bluetooth is implemented for multi hop transmission through flooding routing protocol. In future this can be enhanced by using other routing protocols like point to point, multipath or link state routing protocol to monitor the routing decisions in the network. Doing so may increase the desired communication between the nodes. In this system we are having client server nodes. The system can be enhanced to increase the look and feel of the application and also give some more advanced features.

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