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Structuring A Fair Distributed Mutual Exclusion Algorithm for Mobile Hosts

[1]Deepshikha Sharma, [2]Atika Sharma
[1,2]Computer Science And Engineering , Bharat Institute of Technology , Meerut,India

***Abstract*—This parer presents an idea for Non Token Based Distributed Mutual Exclusion Algorithm in which processes communicate by message passing .IF we implement this idea then we can reduce the number of message per critical section execution. According to this system model we require only two messages rather than m -1 messages .when we have less number of messages then we require less power consumption and time required for per critical section access. . A Mobile host (MH) can connect to the network from different locations at different times. The classical approach of mutual exclusion and its variants need to be modified to suit the dynamic topology , low bandwidth and low processing capabilities of mobile ad-hoc network(MANET).**

I. INTRODUCTION

The design of distributed algorithm and protocols has traditionally been based on an underlying network architecture consisting of static hosts i.e. the location of a host does not change .Consequently, in the absence of site and link failures , the connectivity amongst host in the network remains fixed .Distributed algorithms thus assume a model comprising of a set of process executing the static hosts, that communicate by messages over point to point logical channels. Each channel may span multiple physical links of the network; this set of links and the host at the end points of the channels does not change with time. Solution to problem of synchronization and communication in distributed systems are based on this basic model .However , this model does not capture the features and constraints of a network with mobile hosts , and therefore , distributed algorithm based on this model , will need to be restructured for mobile computing.

Mobile computing quires integration of portable computers within existing data networks. A *mobile host* can connect to the network from different locations at different times. At the network layer, this has led to research on new addressing schemes and network protocols for routing messages to and from mobile hosts [6, 10, 13,14]. Mobile computing also has significant implications for distributed data management *[5, 5,*81**.** The problem of efficiently delivering a multicast message exactly-once to mobile recipients is considered in [I]. The characteristic features of a mobile computing environment are presented in [4]. Host mobility introduces new issues that were not present in distributed systems with static hosts. First ,to deliver a message to a mobile host, it is necessary that the destination be first located within the network which we term as *search***.** Second, as hosts move, the physical connectivity of the network changes. Hence, any logical structure, which many distributed algorithms exploit, cannot be statically mapped to a set of physical connections within the network. Third, mobile hosts have severe resource' constraints in terms of **limited** battery life and often operate in a "doze mode" or entirely disconnect from the network. Disconnection in a mobile environment is distinct from a failure: disconnections are ***voluntary*** and so, a mobile host can inform the system of an impending disconnection ***prior*** to its occurrence. Lastly, communication between a mobile host and the rest of the network usually occurs via a wireless link, whose bandwidth is **an** order of magnitude lower than wired links; further, transmission and reception of messages on the wireless link consumes power at a MH. These aspects are characteristic of mobile computing and **need** to be considered in the design of distributed algorithms.

This paper investigates how distributed algorithms should be structured for mobile hosts. It presents a operational system model for explicitly incorporating the effects of host mobility using cost parameters appropriate for the mobile computing environment. In this model, communication takes place only **through** exchange of messages between static and/or mobile hosts and Cordinator; hosts do not share memory or a common clock. All hosts and links are assumed to be **free** from failures. We propose the following principle for structuring efficient distributed algorithms for mobile hosts:

To the extent possible, computation *and* ***communication costs*** of ***an algorithm* is *bome by the static portion*** of ***the network This attempts to*** *avoid* ***locating a mobile participant and lowers the "search cost"*** of ***the algorithm; additionally, the number of operations performed at the mobile hosts and thereby, consumption of battery power, which is a critical resource for mobile hosts, is kept to a minimum.***

We first discuss the existing system model for mobile computing environment and then compare tat model with proposed model. This proposed model reduced "Search cost" as well as power consumption and fewer message over the low bandwidth wireless links.

II. BASIC SYSTEM MODEL

The term "mobile" implies *able* to *move while retaining its network connections* [lo]. A host that can move while retaining its network connections is a *mobile host* (MH). The infrastructure machines that communicate directly with the mobile hosts are called *mobile support stations* (MSS). **A** *cell* is a logical or geographical coverage area under a MSS. All MHs that have identified themselves with a particular MSS, are considered to be *local* to the MSS. **A** MH can *directly* communicate with a MSS (and vice versa) only if the MH is physically located within the cell serviced by the MSS. At any given instant of time, a MH may (logically) belong to only one cell; its current cell defines a MH's "location". we assume that all hosts and communication links are reliable. Further, for simplicity of presentation, we assume that all fixed hosts act **as** MSSs and use the terms MSS and "fixed host" interchangeably.

The system model consists of two distinct sets of entities : a large number of mobile hosts and relatively fewer, but more powerful, fixed hosts (MSSs). The number of fixed hosts will be denoted by *M* and that of MHs by ***N*** with ***N*** >> *M.* All fixed hosts and the communication paths between them constitute the *static /fixed* network. **A** MSS communicates with the MHs within its cell via a wireless medium. The overall network architecture thus consists of a "wired" network of fixed hosts that connect the otherwise isolated, low-bandwidth wireless networks, each comprising of a MSS and the MHs local to its cell. Host mobility manifests itself **as** a migration of a MH from one cell to another.

To send a message from a MH *hl* to another **MH** *h2, hl* first sends the message to its local MSS over the wireless network. This MSS then forwards the message to the local MSS of *h2* which forwards it to *h2* over its local wireless network. Since, the location of a MH within the network is neither fixed nor universally known in the network, i.e. its "current" cell changes with every move, the local MSS of *hl* needs to first determine the MSS that currently serves *h2.* This is essentially the problem that has been tackled through a variety of routing protocols at the network layer (and below) in [6, 10, 13, 141. Thus, the cost incurred to route and deliver a message to.a mobile host, varies with the specific routing protocol being used. In this system model is not tied to any particular routing scheme for delivering a message to a mobile host; instead, we will assume that any message destined for a mobile host incurs a fixed *search cost.*

The static network provides reliable, sequenced delivery of messages between any two MSSs, with arbitrary message latency. Similarly, the wireless network with a cell ensures fifo delivery of messages between a MSS and a local MH. The cost of a message depends on the type of channel on which it is transmitted :

- ***Cfixed*** - cost of sending a point-to-point message between any two fixed hosts.

- ***Cwireless*** - Cost of sending a message from a MH to its local MSS over the wireless channel (and vice versa).

Csearch - cost incurred to locate a MH and forward a message to its current local MSS, from a source MSS. Note that this cost is always greater than or equal to ***cfixed,*** and in the worst case, require a source MSS to contact each of the other *M - 1* MSSs to determine the MH's current location.

Based on the above cost assignments, a message sent from a MH to another MH incurs a cost ***2xCwireless+ Csearch,*** while a message sent from a MSS to a non-local MH incurs a Cost ***Csearch + Cwirefess***.

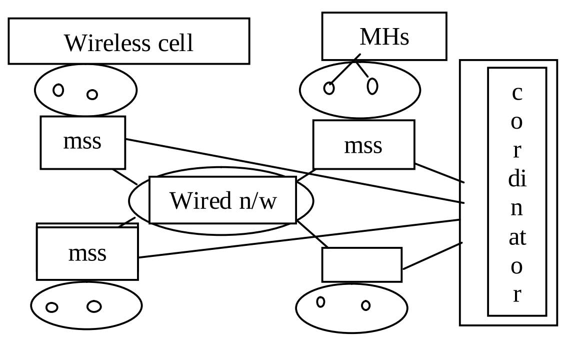
In this model, host mobility is asynchronous, i.e. there is no bound on the time interval between a **MH** leaving its current cell and entering a new one; however, a MH that leaves its current cell will *eventually* enter some cell in the system. A MH may leave its current cell at any time, However, it is assumed that a message destined for a MH will eventually **be** delivered to it (after incurring a search), regardless of the number of moves it makes.

As stated earlier, a fifo channel exists from a MH to its local MSS, and another fifo channel from the MSS to the MH. If a MH did not leave its cell, then every message sent to it from the local MSS will be received by it in the sequence in which they were sent. But, since a MH may leave its cell at any time, the sequence of messages received at the MH is a prefix of the sequence of messages sent from the MSS and eventual delivery of a message to the MH is not guaranteed, i.e. if *ml, m2, ...* ***ms*** be the sequence of messages sent from a MSS to a given local MH, then the sequence of messages received at the MH is *ml, m2, . . . mr,* where *s 2* ***r.*** The model requires that a MH send a *leave(r)* message on the MH-to-MSS channel supplying the sequence number of the last message, viz. *r,* received on the MSS-to-MH channel. Once this message is sent, the MH neither sends nor receives any further message within the current cell.Each MSS maintains a list of ids of MHs that are local to its cell; on receipt of ***leave()*** from a local MH, it is deleted from the list. When a MH enters a new cell, it sends a ***join(mh-id)*** to the new MSS; it is then added to the list of local MHs at the new MSS.

Some algorithms for mobile hosts [l] may utilize a handoff procedure: when a MH switches cells, MSSs of the two cells execute the ***handofl*** procedure. **A** MSS may maintain algorithm-specific data structures on behalf of a local MH. When a MH moves into a new cell, data structures from the previous MSS are transferred ("handed over") to the new MSS. For this to be realized, it is necessary that the MH either inform the previous MSS of the id of its new MSS or vice versa. In Section **4** of this paper, management of ***location view*** will require that a MH supply the id of its previous MSS after entering the new cell (with the ***join()*** message).

Disconnection of a MH is handled similar to a MH switching cells. However, there is an important difference between the two. When a MH leaves a cell, it will ***eventually*** show up in some cell. On the other hand, when a MH disconnects, there is no guarantee that it will reconnect to the system at a later time. A MH disconnects by sending a ***disconnect(r)*** message to its local MSS, where ***r*** is the sequence number of the message last received from the MSS (similar to a ***leave(r)*** message). The local MSS deletes the MH from its list of local MHs; however, it sets a "disconnected" flag for the particular MH-id. If and when, the MH reconnects at some MSS with a ***reconnect(mh-id, previous mss-id)*** message supplying the location where it had previously disconnected, the "disconnected" flag is unset **as** part of the handoff procedure. The MH may not always be able to supply the id of its previous MSS with the ***reconnect()*** message; in that case, the new MSS may have to query each fixed host to determine the previous location of the MH and then execute a handoff procedure. If some MSS attempts to search for a MH that has disconnected, the local MSS of the cell where the MH disconnected informs it of the disconnected status of the MH.

III. PROPOSED SYSTEM MODEL



Our system model consists of three distinct sets of entities : a large number of mobile hosts and relatively fewer ,but more powerful ,fixed host (MSSs) and a COORDINATOR. The number of fixed hosts will be denoted by M and that of MHs by N with N>>M. The Coordinator denoted by Cr. All fixed hosts and the communication path between them constitute the static/fixed network . A MSS communicates with the MHs within its cells via a wireless medium.The overall network architecture that consist of a wired network of fixed host and a coordinator that connect the otherwise isolated low bandwidth wireless network .each comprising of a MSS and the MHs local to its cells . Host mobility manifests itself as a migration of a Mobile host from one cell to another.

According to our model ; To send a message from a Mobile Host (MH) to another mobile host first of all send a message to its local MSS .then that MSS forward this request message to the coordinator. This request message consists of a timestamp and host number. A coordinator maintain all the information about MSS and their Mobile hosts .When a coordinator receive a request message from MSS then it search for corresponding MH and then forward it to relative MSS. Then that MSS forward it to requesting MH.

Location of the mobile host within the network is neither fixed nor universally known in the network ie. Its current cell change with every move .The wireless network within a cell ensure fifo channel delivery of message depends on the type of channel on which it is transmitted.

Cfixed: cost of sending a point to point message between any two fixed host ie. MSS to coordinator and coordinator to MSS.

- *Cwireless* - Cost of sending a message from a MH to its local MSS over the wireless channel (and vice versa).

Csearch - cost incurred to locate a MH and forward a message to its current local MSS, from coordinator .

Based on the above cost assignment , a message sent from a MH to another MH incur a cost

2 * *Cwireless* + 2 * *Cfixed* + *Csearch*

In our model ,host mobilityis asynchronous ie. There is no bound on the time interval between a MH leaving its current cell with eventually enter some cell in the system .A MH may leave its current cell at any time.

The major difference is that when a MH leave its cell then it send a leavemsg to its local MSS and that local MSS inform to the coordinator and then that MSS deletes the MH from its list of local MHs.As well as the coordinator .when a MH join to new cell then it send the join message to the MSS related to this cell .and updated the list of the coordinator.

IV. ADVANTAGES OF THE PROPOSED MODEL OVER THE EXISTING SYSTEM MODEL

The guiding principle for structuring distributed algorithm for MHs in our model is that the computation and communication demands of an algorithm should be satisfied within the static segment of the system to the extent possible. Below we present justification for this choice. And compare this system model with existing model.

I. It reduce the overall message complexity because we does not require to broadcast the message to all other MSS .it only require send a single message to the coordinator and it forward it to the corresponding MSS .

II. Each message in the algorithm is addressed to a coordinator not the MSS.

III. Existing model incur a search overhead proportional to M , while our model incur only a constant search cost per execution. The overall message cost is lower for our model.

IV. CORRECTNESS :

This model ensures that if the timestamp of a request R1 is less than that of another request R2 , then R1 will be satisfied before R2.In our model a request from a MH is timestamped when the init() message is received by its local MSS i.e. through MHs do not maintain logical clocks ,the timestamp assigned to request(h1) by m1 can be considered as the timestamp of h1's request for mutual exclusion. Since the Coordinator execute the concept of Mutual exclusion and a grant_request message will be sent to h1 before another MH h2 if the timestamp assigned to request (h1) is less then that of request (h2).

V. CONCLUSIONS :

The design algorithms for distributed system and their communication costs have been based on the assumption that the location of the hosts in the network do not change and the connectivity amongst the host is static in the absence of failures .However ,with the emergence of mobile computing these assumptions are no longer valid .Additionally , mobile hosts have severe constraints on energy consumption , computing power and size of available memory ,compared to fixed hosts.

This paper presented a new system model for the mobile computing environment and describe a simple and useful principle for structuring distributed mutual exclusion algorithm.

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