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Adaptive Traffic Management in Heterogeneous Wireless Networks

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Abstract— The adoption of wireless technologies is due to user requirement, small size of devices with multiple networking interfaces. The current issues which are perform major role of mobility, reassembly, routing, and security. Consistent mobility is one of the main challenges in the existing and future heterogeneous wireless networks. Consistent mobility in heterogeneous wireless network needs integration of different network technologies. Most of currently available communication and computing systems uses more system time for completing the job. Processing power and time limit for processing a task/query, a system is required that offers device mobility (BS mobility) and computational mobility as per the requirement of the applications. We have evaluated the MAC-SF for network selection, traffic management, load balancing, and network delay.

Keywords: MAC-SF, WSN, NS2.

I. INTRODUCTION

The MAC-SF for network selection, traffic management, load balancing, and network delay is presented. MAC-SF keeps information about the MAs and network stations (BS/BSC/MSC) in the networks. This system follows the record by keeping registration, authentication, security and mobility similar to the PMADE mobile agent system. MAC-SF extends it services for supporting clustering and grouping. A comparative study of the MAC-SF and using convention method (UCM) based HWNs is also done. MAC-SF framework uses agents with conventional process (MACP)[1]. Results show that MAC-SF improves the performance of the network when the population of MNs is very large[2].

Proliferation in communication networks is forcing invention of new technology which would be capable to manage mobile devices and wireless applications without affecting the performance, scalability, and QoS[1]. To cater these issues MAC-SF is developed. Thus, system enables the flexible and economical deployment of communication and computing MNs/NS with flexible management cost. This system takes overall low management cost at individual NS level. MAC-SF offers deployment of large scale communication and computing systems in absence cost-intensive distributed infrastructure to monitor large area network with long life network[4]. To evaluate the MAC-SC network development model. This system provides functionality for improving the system performance and integrates new ideas over the time.

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II. MAC-SF PRINCIPLE FOR DISTRIBUTED NETWORK MANAGEMENT

HWNs include a fixed wired network and one or more infrastructure/infrastructure-less wireless network(s). The devices like MNs, MNSs and FNSs have come from three distinct sets of entities and are key players in the system. A moving NS which stays connected to a network is called a MNS. The backbone network consists set of the FNSs and the required communication acquaintances between them. Few of the FNSs may work as base stations (BSs). These are equipped with diversity of interfaces, and offer a gateway for communicating different types of networks. Communication range is an issue wireless transreceivers, so, a MNS/MN communicates with a BS. The geographical area covered under a region is a function of the medium used for wireless communication. Suggested average size of a region may be in the order of 1-2 miles in diameter. In the regular changing environment, demand for services are increasing. So to maintain the required grade of services it is required to split the region for handling the increased traffic without increasing the bandwidth of the system[5]. A MN makes link to one BS at any given time. This BS is accountable for forwarding data between the MNS/MN and the fixed network. Due to mobility, MNS/MN may cross the boundary between two regions while being active. The initiative for a handoff may come from the MNS or the BSs. It offers an end-to-end communication connection in the dynamically reconfigurable network topology.

MAC-SF works on some assumptions for the distributed heterogeneous environment. Figure 1 presents setup of the MAC-SF based system. A MSC also keeps records of all the BSCs, i.e., regions in the network domain. It is accountable for providing unique names for every BSCs (regions). These BSCs are part of that network and helps to identify the region/BSC in/under which MNS/MN is present.

DMND stores the information in the form *MN*, *FD*, *r*. It symbolizes that a *MN* may be available in the region *r* of the foreign network domain *FD*, or moved through. Each entry of RMND of the form *MN*, *r*, *Nil* symbolizes the region *r* where *MN* is found or transited through. Similarly *MN*, *Nil*, *MNS* symbolizes *MN* which found in that region at a BS/MNS. For DMND and RMND, the primary key is the name of *MN*.

During inter domain movement the MN has to update location information in the DMND of the present domain and register in the DMND of the target network domain.

For intra region movement, it updates its location information in the RMND of the region. RMND database

update is known as Intra Region Location Update. When inter region movement takes place, the MN updates the location information in the RMND of visiting region and registers in the RMND of the destination region, specifying the BS/MNS in that region to which it is moving. The location protocol used for managing the MNs deals with three processes: name binding, movement and location where each of them are related to a particular phase in the MN's lifetime. We have defined four atomic operations on DMND and RMND.

Bind procedure is performed when a name is assigned to a newly registered MN. Its birth location is also maintained in the database. This procedure inserts a new tuple. New loc procedure is performed when the MN changes its location, by migrating to a new one. This procedure updates the tuple existing in the database.

Find procedure is performed when a MN requires an interaction on the network. Then before interaction it is located. This procedure returns the current location of the said MN. Unbind procedure is performed when a MN is no longer in use. This procedure causes deletion of the relative tuple from the database.

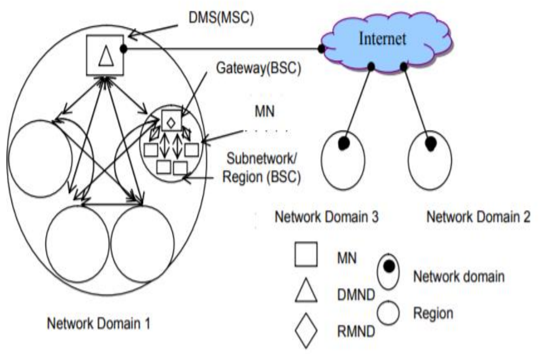

Figure 1: MAC-SF Network Policy

Every DMS, BSC, BS and MNS may be integrated with an intelligent agent and a MA to keep updated network map and present grade of its adjacent stations. To expedite the network selection process MAC-SF uses the TOPSIS, and Intuitionist fuzzy TOPSIS, and for prediction of traffic loads in the network it uses Grey method. Further it uses MSA for fault tolerance, load balancing and location management.

III. MOVEMENT POLICY ALGORITHM & RESULTS

In the proposed system a basic procedure for an optimization is computation of movement times of different used movement policies. A performance comparative study is made before selecting a best movement policy. An agent normally uses the MMPA for obtaining an optimal movement policy regarding movement times for parts of its itinerary or even for the complete itinerary. A simplest variation is to optimize the task movement to next hop only by comparing the movement policies push-all-to-next, pull-all, pull-tasks and push-all-to-all. A MA wants to hop from BSC processing element PE_i, PE_{i+1} . The MA's home site is PE_0 (home processing element) client's NS (BS). The proposed procedure is summarized as under.

[Compute network transfer time] [Push-all-to-next: Transfer tasks to the next visiting BSC]

T_push_all_task_to_next_NS= delay PE_i , PE_j +Task_size/bandwidth PE_i , PE ;

[Pull-all: Download tasks from home site (BS/BSC) at the next visiting BSC]

T_pull_all_tasks_from_home_to_next_NS=delay PE_0 , PE_j +Task_size/bandwidth PE_0 , PE_j;

[Pull-task: Download each task from home site (BS/BSC) at the next visiting BSC]

T_push_A_task_from_home_to_NS = delay PE_0 , PE_j + SUM(Probability(k)*(Task(k)+Request))/bandwidth PE_0 , PE_j ;

[Only for the first hop: push-all-to-all: and Distribute tasks from home site (BS/BSC) to all BSC]

for s in servers

begin

T_push_all_to_all_tasks= T_push_all_to_all_tasks+ delay PE_0 , PE_s + Task_size/bandwidth PE_0 , PE_s;

end

[Select movement policy]

T_min = T_push_all_task_to_next_NS;

{time required to push all tasks to next NS} MS = "push-all-to-next";

if (T_pull_all_tasks_from_home_to_next_NS < T_min)

begin

T-min = T_pull_all_tasks_from_home_to_next_NS

{time required to push all tasks from home NS} MS = "pull-all";

end

Else if (T_pull_tasks < T_min)`

begin

T_min = T_pull_tasks ;

{time required to pull tasks} MS = "pull-tasks";

end

else (T_push_all_to_all_tasks < T_min)

begin

T_min = T_push_all_to_all_tasks;

{time required to push all tasks to next NS} MS = "push-all-to-all";

end

The home site (BS/BSC) uses only the movement policy push-all-to-all. There onwards, all tasks are transferred to NSs an agent visits. After that an agent only requires to be transferred between the BSC available in the itinerary. This operation does not require additional tasks to be performed. When an agent at end of the itinerary returns to its home site (BS/BSC) a special case is performed. The gathered information in itinerary and the MA are transmitted only. Thus, there is no optimization for this hop.

It adopts similar optimization alternative for optimizing the mobility of the agent for more than one hop. The computation of transmission times is taken into account for all movements. Thus, it is required to fix the movement policy for all hops in the itinerary. This method improves when movement policy is varying in nature. The complexity of the computation is increased for this method.

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3.1. Evaluation Metrics

Two metrics are chosen to evaluate the system. The execution time metric is used, to evaluate the performance of the UCM and MACP models. The task completion time is defined as the time spent to finish a processing task. Parameters and assumptions. Since the number of BSs n_s in comparison to MNs n_m is very less. For the conventional scheme, the total execution time.

$t_{cs}\, n_{ma} * n_{mam} * s_m / r_n\ 2 * n_{ma} * n_{mam}\, o_m\, n_{ma} * n_{mam} * s_m / r_p$ ....(1)

Where the data transfer time is $t_{rc}\ n_{ma} * n_{mam} * s_m / r_n$, the overhead time is $2 * n_{ma} * n_{mam}\, o_m$

and the data processing time is $t_{pr}\, n_{ma} * n_{mam} * s_m / r_p$ (For the MACP the total execution time

$t_{ma}\ n_{ma}\ n_{mam} * s_{ma} / r_n\ 2 * n_{ma}\ n_{mam} * o_{ma}\, n_{ma}\, n_{mam} * s_{ma} / r_p$ ....(2)

Where the time required to transfer the MAs is $t_{tr}\, n_{ma}\, n_{mam} * s_{ma} / r_n$ since it takes $n_{mam} * s_{ma} / r_n$ for n_{ma} MAs to migrate among the n_s (n_b and m_s) MNs simultaneously and it takes $n_{ma} * s_{ma} / r_n$ additional times for the BSC to receive the MAs in sequence after they finish the movement, the MA overhead time is $t_{oh}\ 2 * n_{ma}\, n_{mam} * o_{ma}$ as it takes $2 * n_{ma} * o_{ma}$ for the MAM to dispatch and receive n_{ma} MAs and $2 * n_{mam} * o_{ma}$ for all the local MNs to send and receive each MA, and the time used to execute the task code locally is $t_{pr}\, n_{ma}\, n_{mam} * s_{ma} / r_p$. In order to study the real scenario of the data transfer time estimation, MAC-SF is implemented and tested for actual data transfer time t_{tr}.

3.2 Computing Movement Time

In more detail, a computation of the movement time for different movement policies for a hop is done according to the following scheme: A MA wants to hop from NS PE_i to PE_{i+1} . The MA's home site is PE_0 *client's* NS (BS/MN/MSA/NS). The latency between two BSC is defined by the function. Function denotes the available bandwidth between two NSs. The amount of bytes which will be transmitted is B_c for amount of time is required push-all-to-next is

$T_1 = \partial(PE_i , PE_{i+1}) + B_c /(\tau(PE_i , PE_{i+1}))$

$T_0 = \partial(PE_0 , PE_{i+1}) + B_c /(\tau(PE_0 , PE_{i+1}))$

Furthermore, it is difficult to determine the probability for the usage of a certain task at a remote NS if same is not designated. When it is designated it is very easily traced with the database mapping. Thus, worst case assumption is preferred that every task will be downloaded as long as no other options is available. A time computation can be size of the k^{th} task code of the MA. *B* represents the size of a request for downloading a certain task code.

3.3 MAC-SF Network Selection

To study the behavior of MAs four candidate networks are selected. Each network with six attributes associated in heterogeneous wireless networks environment. Three different technologies are used such as two UMTS networks, one WiMAX and one WLAN. We have used- Packet Delay, Packet Loss, Available Bandwidth, Network Load, and Security and Cost attributes in the study. These attribute values are shown.

Table 1. Attributes of network

Criteria Technology	Delay(D)(ms)	Packet Loss	Available Bandwidth (Mbps)	Network Load	Security	Cost
UMTS-1	35	70	0.0122	15	80	0.6
UMTS-2	30	40	0.0122	0	80	0.8
WiMAX	60	30	2	20	70	0.7
WLAN	15	15	0.3	0	60	0.1

Using TOPSIS method an agent gets the following normalized decision matrix ri,j where value of *i* is available alternative network varying from 1 to 4 and *j* is varying from 1 to 6 and is corresponding network attribute. The matrix is given below.

Criteria Technology	Packet Loss	Available Bandwidth (Mbps)	Network Load	Security	Cost
0.453743	0.641016	0.006032	0.6	0.5482	0.49
0.388922	0.73259	0.006032	0	0.5482	0.653
0.777844	0.183147	0.9889	0.8	0.4796	0.572
0.194461	0.137361	0.148335	0	0.4111	0.082

The weighted normalized decision matrix (Vi,j) where value of *i* is available alternative network varying from 1 to 4 and *j* is varying from 1 to 6 and is corresponding network attribute. The matrix is given below. In the computation Wj = [.3 .15 .05 .05 .05 .4] matrix is used. The weighted normalized decision matrix is given below.

Delay(D) (ms)	Packet Loss	Available Bandwidth (Mbps)	N/W Load	Security	Cost
0.136123	0.096152	0.000302	0.03	0.0274	0.196
0.116677	0.109888	0.000302	0	0.0274	0.261
0.233353	0.027472	0.049445	0.04	0.024	0.229
0.058338	0.020604	0.007417	0	0.0206	0.033

Positive and Negative Ideal Solutions are

A^+ = [0.197038 0.264376 0.212612 0.204976]

A^- = [0.130275 0.106873 0.189131 0.228729]

A relative distance of each alternative network from positive ideal and negative ideal solution is as follows.

C = [0.398012 0.287874 0.470776 0.527384] UMTS-1 = 0.398012, UMTS-2= 0.287874, WiMAX= 0.470776, WLAN= 0.527384

Since, WLAN yields highest value, thus it is best network for selection. It is reasonably good value for identifying WLAN as the best network. This network is more useful and fulfils the demands of the agents in better way. Normally WLAN uses the following metrics- delay, packet loss, overhead and bandwidth allocation, etc.

IV. CONCLUSION

The results also show that the MACP does not always perform better than the UCM in different scenarios. However, in the context of HWNs with hundreds or even thousands of MNs, unreliable communication connection and reduced bandwidth, the MACP takes less execution time. If the population of MNs is less in the network the MACP experiences longer network latency because of its larger overhead.

REFERENCES

1. Abid, A., Hussain, M. heterogeneous sensor networks. 12th International Conference on Network-Based Information Systems, IEEE, 19-21, Aug. pp. 316-320.
2. Ahmed, A., Merghem-Boulahia, L. and Gaiti, D., 2010. Cooperative agent based vertical handover scheme for heterogeneous networks. Sixth Advanced International Conference on Telecommunications (AICT), IEEE, Barcelona, Spain, 9-15 May, pp. 410-415
3. Ahmed, T., Kyamakya, K. and Ludwig, M., 2006. Design and implementation of a context-aware decision algorithm for heterogeneous networks. In Proceedings of the 2006 ACM symposium on Applied computing, ACM, 23-27 April, pp. 1134-1138.
4. Akbani, R., Korkmaz, T. and Raju, G.V.S. 2008. HEAP: A packet authentication scheme for mobile ad hoc networks. Ad Hoc Networks, 6(7):1134-1150.
5. Akyildiz, I.F., Mcnair, J., Ho, J.S., Uzunalioglu, H. and Wang, W., 1999. Mobility management in next-generation wireless systems. Proceedings of the IEEE, 87(8), pp.1347-1384.

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