MOBILE AGENTS FOR TELECOMMUNICATION APPLICATIONS pdf

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This paper reports on a system for automated agent negotiation. It uses the JADE agent framework, and its major distinctive feature is the use of declarative negotiation strategies. The negotiation strategies are expressed in a declarative rules language, defeasible logic and are applied using the i The negotiation strategies are expressed in a declarative rules language, defeasible logic and are applied using the implemented defeasible reasoning system DR-DEVICE. The choice of defeasible logic is justified. The overall system architecture is described, and a particular negotiation case is presented in detail. Show Context Citation Context We will seek to integrate the agent negotiation and brokering functions in one system. As a foundation we will use the semantic brokering system of [39] which is also based on defeasible logic. We will implement a IOS , " Ontologies are a way to express semantics of concepts in a formal way. It has been specified to facilitate the development of e-commerce applications that need to be aware of rights associated to specific multimedia cont It has been specified to facilitate the development of e-commerce applications that need to be aware of rights associated to specific multimedia content. The paper describes the ontology and its possible uses. The dots in the tre Lecture Notes in Computer Science , " Our approach to content negotiation is a framework of mobile agents, where the agents can migrate from user devices to negotiation servers in order to get more resources. We took this approach and now we introduce new features in the architecture. The key idea is content customisation depe The objective is twofold. First, to improve consumer experience adjusting contents to consumption devices. Second, to rationalise network and device use spending only the necessary resources. Altogether, it is a new step in the direction marked by the use of mobile agents in mobile devices. This way, computation and bandwidth consumption can be moved out of mobile devices to network devices, where these resources are cheaper. Moreover, in contrast to direct browser-server content negotiation, our agent based negotiation framework provides independence between content negotiation and its consumption, i. All this would be especially relevant when third generation 3G mobile devices are widely available and more sophisticated multimedia content is available in mobile delivery contexts. A knowledge oriented approach has been chosen in order to make this development capable of dealing with this complicated domain. This requirement and the objective of easy Web integration have made the Semantic Web technologies the best choice. NewMARS is a semantics enabled metadata managing system. There are descriptive, rights and e-commerce ontologies for the different views on IPs. Semantic enabled metadata is then used to facilitate content providers to publish intellectual properties offers and customers to find and automatically negotiate purchase conditions. This has allowed developing very flexible project infrastructures that facilitates easy adaptation to new IP e-commerce scenarios. The metadata that models the negotiated offer and it This language is aimed to help building a reliable Web where IPR can be managed in an open, global and adaptable form, so people can share, sell, buy, This language is aimed to help building a reliable Web where IPR can be managed in an open, global and adaptable form, so people can share, sell, buy, etc. We are following a semantic approach to this problem, based on semantic web ontologies, that seems more appropriate than a syntactic one, e. IPROnto models the IPR core concepts for content, intellectual property rights and the basic kinds of actions that operate on intellectual property and allows developing licenses. IPROnto enables semantics-aware IPR applications that benefit from semantic queries, in contrast to the difficulties that emerge from the use of syntactic queries when the information space is as complicated as in the IPR field. Moreover, specialised reasoners can be used for license checking and retrieval. Once mapped, syntactic initiatives can also benefit from the semantic approach provided by Web ontologies. It means that this o

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Mobile Agents for Telecommunication Applications: 5th International Workshop, MATA , Marrakech, Morocco, October , Proceedings (Lecture Notes in Computer Science) Softcover reprint of the original 1st ed. Edition.

All rights are reserved, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, re-use of illustrations, recitation, broadcasting, reproduction on microfilms or in any other way, and storage in data banks. Duplication of this publication or parts thereof is permitted only under the provisions of the German Copyright Law of September 9, , in its current version, and permission for use must always be obtained from Springer-Verlag. Violations are liable for prosecution under the German Copyright Law. Most of the current research work on the mobile agent paradigm has two general goals: These two goals stem directly from the desire to reduce information overload and to efficiently use network resources. There are certainly many motivations for the use of a mobile agent paradigm; however, intelligent information retrieval, network and mobility management, and network services are currently the three most cited application targets for a mobile agent system. The aim of the workshop is to provide a unique opportunity for researchers, software and application developers, and computer network technologists to discuss new developments in the mobile agent technology and applications. Yet Another Active Platform. Enabling Secure Distributed Computations. Extensive research on mobile agents has been rife with the growing interests in network computing. In this paper, we have discussed a mobile multi-agent-based framework to address the aspect of topology discovery in ad hoc wireless network environment. In other words, we have designed a multi-agent based protocol to make the nodes in the network topology aware. Our primary aim is to collect all topology-related information from each node in the network and distribute them periodically as updates to other nodes through mobile agents. The notion of stigmergic communication has been used through the implementation of a shared information cache in each node. Moreover, we have defined a concept of link stability and information aging based on which a predictive algorithm running on each node can predict the current network topology based on the current network information stored at that node. We have demonstrated through performance evaluation of a simulated system that the use of mobile multi-agent framework would be able to make each node in the network topology aware, without consuming large portion of network capacity. As a direct outcome of infiltrating topology information into the nodes, the foundations for designing efficient routing scheme, distributed network management and implementing communication awareness get automatically laid. Introduction A mobile agent is a program that can move through a network under its own control, capable of navigating through the underlying network and performing various tasks at each node independently [1]. Mobile agents are an effective paradigm for distributed applications, and are particularly attractive in a dynamic network environment involving partially connected computing elements [2]. In this paper, we propose to use a mobile multi-agent-based framework to address the E. Bandyopadhyay, and Krishna Paul aspect of topology discovery in a highly dynamic ad hoc wireless network environment [3,4,5,6]. As a direct outcome of infiltrating topology information into each node, the foundations for designing efficient routing scheme, distributed network management and implementing communication awareness [7] get automatically laid. As an example, the dynamics of wireless ad hoc networks as a consequence of mobility and disconnection of mobile hosts pose a number of problems in designing proper routing schemes for effective communication between any source and destination[5]. The conventional proactive routing protocols that require to know the topology of the entire network is not suitable in such a highly dynamic environment, since the topology update information needs to be propagated frequently throughout the network. On the other hand, a demand-based, reactive route discovery procedure generates large volume of control traffic and the actual data transmission is delayed until the route is determined. Because of this long delay and excessive control traffic, pure reactive routing protocols may not be applicable to real-time communication. At the same time, pure proactive schemes are likewise not appropriate for the ad-hoc network environment, as they continuously use a large portion of the network capacity to keep the routing information current [4]. In this work, we have demonstrated through performance evaluation of a

simulated system that the use of mobile multi-agent framework would be able to make each node in the network topology aware without consuming large portion of network capacity. This would eventually help us to implement a proactive routing protocol without much overhead. Mobile agents or messengers that hop around in the network are a novel solution to the problem of topology discovery. The agents hop from node to node, collect information from these nodes, meet other agents in their journey, interact with both to collect updates of parts of the network that they have not visited or have visited a long time back, and gift these collected data sets to newly visited nodes and agents. A node therefore receives updated information about the network from the agents visiting them at short regular intervals. However with agent navigation beginning, the nodes slowly get information about the other nodes and their neighbors. For example, let us assume that an agent migrates at every K time tick between nodes. At time t0, each of the nodes has only information about their immediate neighbors. Thus the current host node now has data about a new neighboring node and its neighbors since the agent has carried this information to it. In the next K time tick, a node gets information regarding two more nodes from another agent. It is to be noted that by controlling K, it is possible to control the agent traffic in the network. Moreover, the agent would always migrate from a node to only one of its neighbor after K time -tick. So, the network would never get flooded with propagation of agents. Related Work Currently, there is a growing interest in using mobile agents as part of the solution to implement more flexible and decentralized network architecture [1, 8]. Most research examples of the mobile agent paradigm as reported in the current literatures have two general goals: Some authors have suggested that agents can be used to implement network management [9, 10] and to deliver network services [11]. The mobile agent systems have been popularly simulated in close resemblance to an ant colony [12]. Of particular interest is a technique for indirect inter-agent communication, called stigmergy, in which agents leave behind the information in the cache of the node that they have visited. Stigmergy serves as a robust mechanism for information sharing. Worker ants that leave pheromone trails when they venture outside their nest are using stigmergic communication. This notion has been used in [13,14]. Mobile agents are on the use for multifarious purposes ranging from adaptive routing [13], distributing topology information [14], offline message transfer[15] and distributed information management [16]. In this paper, our primary aim is to collect all topology-related information from each node in ad hoc wireless network and distribute them periodically as updates to other nodes through mobile agents. The basic idea of using agents for topology discovery has been explored in MIT Media Lab [14] earlier with certain limitations: Second, the information convergence convergence of the difference between actual topology information and the topology information as perceived by a node at any point of time and its relationship with number of agents and agent migration frequency has not been clearly defined. Third, the navigation strategies used do not ensure a balanced distribution of recent topology information among all the nodes. We have tried to overcome these difficulties. Description of Relevant Terms 3. We define the neighbors of n as the set of nodes within the transmission range R of n. It is assumed that when node n transmits a packet, it is broadcast to all of its neighbors. However, in the wireless environment, the strength of connections to all the members of the neighbor set with respect to any node n are not uniform. For example, a node m in the periphery of the transmission range of n is weakly connected to n compared to a node u which is closer to n. Thus, the chance of m 4 Romit Roy Choudhuri, S. Bandyopadhyay, and Krishna Paul going out of the transmission range of n due to an outward mobility of either m or n is more than that of u. Since the signal strength perceived by m is a function of R and the current distance r between n and m, we can predict the current distance r at time t between n and m. Since the agent navigation is asynchronous and there is an obvious time gap between the procurement of information by an agent from one node and its delivery by the same agent to another node, it becomes imperative to introduce a concept of recency of information. For example, let us assume two agents A1 and A 2 arrive at node n, both of them carrying information about node m which is multihop away from node n. In order to update the topology information at node n about node m, there has to be a mechanism to find out who carries the most recent information about node m: To implement that, every node in the network has a counter that is initialized to 0. When an agent leaves a node after completing all its tasks at the node, it increments that counter by one. We term this counter as recency token. Thus at any point of time, the magnitude of the recency token of any node

represents the number of times that node was visited by agents since the commencement of the network. This also implies that if two agents have a set of data concerning the same node, say node x, then the agent carrying the higher recency token value of node x has more current information about it. The far-reaching advantages derived from this scheme would be pointed out in further illustrations where the recency token is extensively used. In other words, an agent will be forced to stay in a node for a pre -specified period of time, termed as time-to-migrate TtM , before migrating to another node. By controlling TtM, the network congestion due to agent traffic can be controlled. Issues in Implementing Agent Paradigm 4. Multiple Agents The topology traversing could well be performed using a single agent. However this strategy fails to perform well in conditions of low transmission range where clusters gets formed due to groups of nodes, moving to some spatially remote portion of the bounded region. Quite obviously, since the agent is going to be in only one of the clusters, the other clusters have no agents at all in them although the members belonging to those clusters may be connected to quite a number of other nodes. Thus, the deprived clusters can no more get topology maps and might even get misled by the old, and thus incorrect, information they might be having regarding the connectivity of the network. Although we have not addressed the issue of agent loss during transit in this paper, it can be well understood that the single agent system would also suffer in the event of the agent getting lost during transit. This consequently means that the system no longer has an agent and the nodes are not even aware of it, since each would indefinitely wait for an agent to come to it. The above mentioned issues cause no serious concern in the case of a multiagent system. There are two factors to be considered in multi-agent system: With the increase in number of agents, less and less number of nodes is free of agents at any instant of time. Since more and more agents are held in agent queues, the effective number of agents in the system decreases. This decrease in the effective number of agents compensates for the advantage of having more agents in the system which otherwise means that the convergence could be better. The issue of common intentions in multi-agent systems: As the number of agents increase, the information that each of them get after the exchanges become identical and thus the corresponding decisions that they take regarding migration gradually becomes similar [14]. As a result agents crowd together at certain parts of the topology and the very essence of homogeneous topology exploration gets lost. It is this observation in our work that served as the motivation to analyze the dependence of Topology Discovery in ad hoc Wireless Networks Using Mobile Agents 7 performance on agent population and agent TtM. Thus we have determined the optimal number of agents in a system of N nodes to obtain the best optimal service. It can be seen from the graph that the performance of the agency improves with greater number of agents up to a certain point after which the performance is not discernable. Increase in agent population in the system clearly indicates the increase in congestion in the system. Thus, to keep congestion under control, we rationally choose that agent population for which the agent traffic is tolerable and the requirements are well met. We have chosen the critical agent population to be half the number of nodes in the system. We propose that, if the number is even, then the node spawns an agent in the network. This in dicates that the network commences with an agent population which is roughly half the number of nodes in the network.

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Age- based applications and services such as network management, e-commerce, information gathering on the Internet, mobile communications, active networking, and most recently ad hoc communications are becoming increasingly popular and continue to contribute to the development and to the success of mobile agent technology.

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