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Maximizing P2P File Access Availability in Mobile Adhoc Network though Replication for Efficient File Sharing (MANET)

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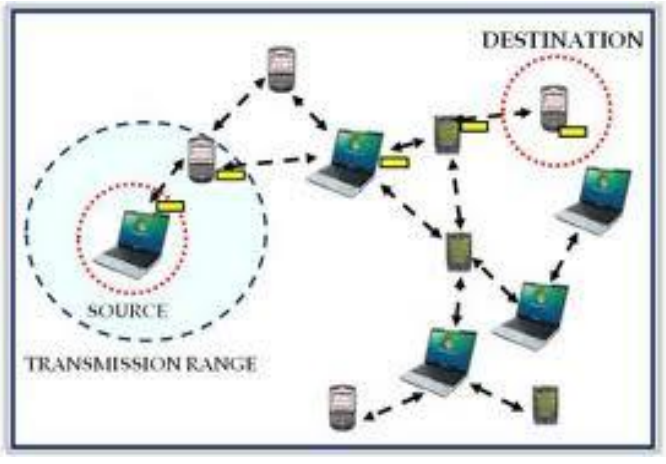
ABSTRACT

File sharing applications in mobile ad hoc networks (MANETs) have attracted more and more attention in recent years. The efficiency of file querying suffers from the distinctive properties of such networks including node mobility and limited communication range and resource. An intuitive method to alleviate this problem is to create file replicas in the network. However, despite the efforts on file replication, no research has focused on the global optimal replica creation with minimum average querying delay. Specifically, current file replication protocols in mobile ad hoc networks have two shortcomings. First, they lack a rule to allocate limited resources to different files in order to minimize the average querying delay. Second, they simply consider storage as available resources for replicas, but neglect the fact that the file holders' frequency of meeting other nodes also plays an important role in determining file availability. Actually, a node that has a higher meeting frequency with others provides higher availability to its files. This becomes even more evident in sparsely distributed MANETs, in which nodes meet disruptively. In this paper, we introduce a new concept of resource for file replication, which considers both node storage and meeting frequency. We theoretically study the influence of resource allocation on the average querying delay and derive a resource allocation rule to minimize the average querying delay. We further propose a distributed file replication protocol to realize the proposed rule. Extensive trace-driven experiments with synthesized traces and real traces show that our protocol can achieve shorter average querying delay at a lower cost than current replication protocols.

INTRODUCTION

What is MANET?

The term MANET (Mobile Ad hoc Network) refers to a multihop packet based wireless network composed of a set of mobile nodes that can communicate and move at the same time, without using any kind of fixed wired infrastructure. MANET is actually self organizing and adaptive networks that can be formed and deformed on-the-fly without the need of any centralized administration. Otherwise, a stand for "Mobile Ad Hoc Network" A MANET is a type of ad hoc network that can change locations and configure itself on the fly. Because MANETS are mobile, they use wireless connections to connect to various networks. This can be a standard Wi-Fi connection, or another medium, such as a cellular or satellite transmission.



Structure of MANET

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How MANET works?

The purpose of the MANET working group is to standardize IP routing protocol functionality suitable for wireless routing application within both static and dynamic topologies with increased dynamics due to node motion and other factors.

Approaches are intended to be relatively lightweight in nature, suitable for multiple hardware and wireless environments, and address scenarios where MANETs are deployed at the edges of an IP infrastructure. Hybrid mesh infrastructures (e.g., a mixture of fixed and mobile routers) should also be supported by MANET specifications and management features.

Using mature components from previous work on experimental reactive and proactive protocols, the WG will develop two Standards track routing protocol specifications:

- Reactive MANET Protocol(RMP)
- ProactiveMANETProtocol(PMP)

If significant commonality between RMRP and PMRP protocol modules is observed, the WG may decide to go with a converged approach. Both IPv4 and IPv6 will be supported. Routing security requirements and issues will also be addressed.

The MANET WG will also develop a scoped forwarding protocol that can efficiently flood data packets to all participating MANET nodes. The primary purpose of this mechanism is a simplified best effort multicast forwarding function. The use of this protocol is intended to be applied ONLY within MANET routing areas and the WG effort will be limited to routing layer designissues.

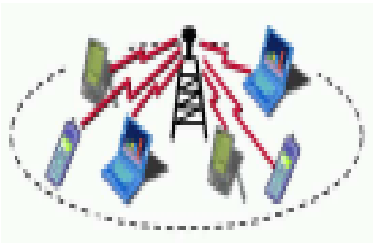
The MANET WG will pay attention to the OSPF-MANET protocol work within the OSPF WG and IRTF work that is addressing research topics related to MANET environments.

Characteristics of MANET's:

- In MANET, each node acts as both host and router. That is it is autonomous in behavior.
- Multi-hop radio relaying- When a source node and destination node for a message is out of the radio range, the MANETs are capable of multi-hop routing.
- Distributed nature of operation for security, routing and host configuration. A centralized firewall is absent here.
- The nodes can join or leave the network anytime, making the network topology dynamic in nature.
- Mobile nodes are characterized with less memory, power and light weight features.
- The reliability, efficiency, stability and capacity of wireless links are often inferior when compared with wired links.
- This shows the fluctuating link bandwidth of wireless links.
- Mobile and spontaneous behavior which demands minimum human intervention to configure the network.
- All nodes have identical features with similar responsibilities and capabilities and hence it forms a completely symmetric environment.
- High user density and large level of user mobility.
- Nodal connectivity is intermittent.

Infrastructure-based Networks:

- Fixed backbone
- Nodes communicate with access point
- Suitable for areas where APs are provided



Infrastructure-less Networks

- Without any backbone and access point
- Every station is simultaneously router

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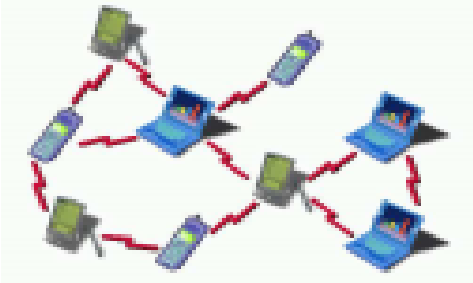

Nodes:

- limited resources
- dynamic topology
- Address assignment

Wireless channels:

- relatively high error rate
- high variability in the quality
- low bandwidth
- broadcast nature
- security aspect

Types of MANET:

There are different types of MANETs including:

In VANETs – Intelligent vehicular ad hoc networks make use of artificial intelligence to tackle unexpected situations like vehicle collision and accidents.

Vehicular ad hoc networks (VANETs) – Enables effective communication with another vehicle or helps to communicate with roadside equipments.

Internet Based Mobile Ad hoc Networks (iMANET) – helps to link fixed as well as mobile nodes.

Types of routing protocols in the MANET:

Two types of routing protocols:

- Table-Driven Routing Protocols
- Destination-Sequenced Distance-Vector Routing (DSDV)
- Cluster head Gateway Switch Routing (CGSR)
- The Wireless Routing Protocol (WRP)

Source-Initiated On-Demand Routing Protocols

- Ad-Hoc On-Demand Distance Vector Routing (AODV)
- Dynamic Source Routing (DSR)
- Temporally-Ordered Routing Algorithm (TORA)
- Associativity-Based Routing (ABR)
- Signal Stability Routing (SSR)

Advantages of MANET's:

- Wireless communication
- Mobility
- Do not need infrastructure
- but can use it, if available
- small, light equipment

SYSTEM ANALYSISEXISTING SYSTEM:

- In the former, redundant replicas are easily created in the system, thereby wasting resources. In the latter, though redundant replicas are reduced by group based cooperation, neighboring nodes may separate from each other due to node mobility, leading to large query delay.
- There are also some works addressing content caching in disconnected MANETs/ DTNs for efficient data retrieval or message routing. They basically cache data that are frequently queried on places that are visited frequently by mobile nodes. Both the two categories of replication methods fail to thoroughly consider that a node's mobility affects the availability of its files.

DISADVANTAGES OF EXISTING SYSTEM:

- Node mobility, limited communication range and resource, have rendered many difficulties in realizing such a P2P file sharing system.
- Broadcasting can quickly discover files, but it leads to the broadcast storm problem with high energy consumption.
- In spite of efforts, current file replication protocols lack a rule to allocate limited resources to files for replica creation in order to achieve the minimum average querying delay, i.e.,

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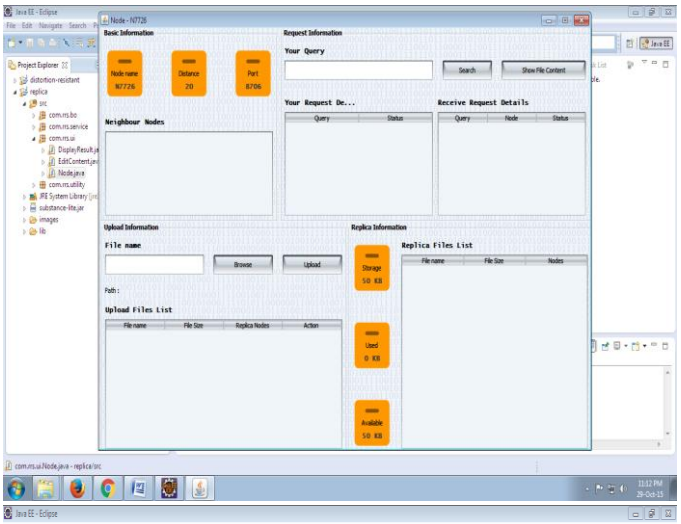
global search efficiency optimization under limited resources. They simply consider storage as the resource for replicas, but neglect that a node's frequency to meet other nodes (meeting ability in short) also influences the availability of its files. Files in a node with a higher meeting ability have higher availability.

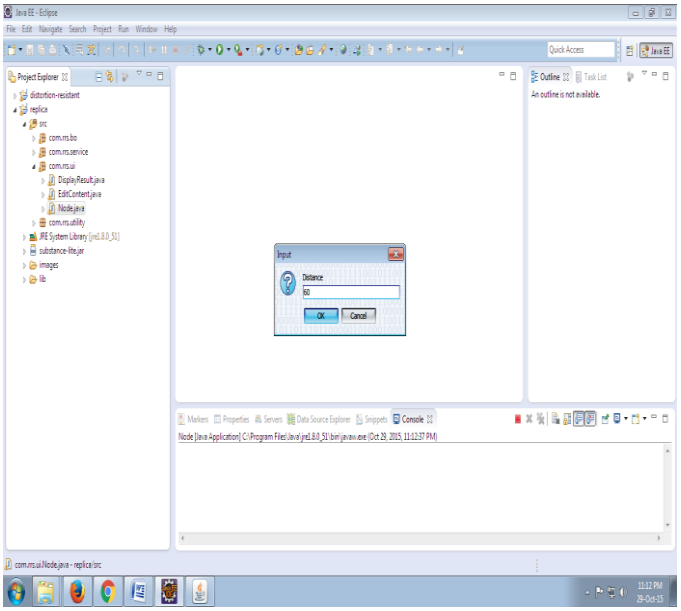
PROPOSED SYSTEM:

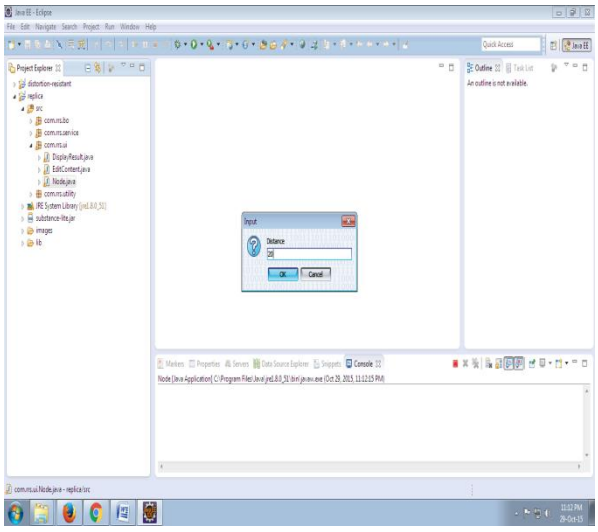
- In this paper, we introduce a new concept of resource for file replication, which considers both node storage and node meeting ability. We theoretically study the influence of resource allocation on the average querying delay and derive an optimal file replication rule (OFRR) that allocates resources to each file based on its popularity and size. We then propose a file replication protocol based on the rule, which approximates the minimum global querying delay in a fully distributed manner.
- We propose a distributed file replication protocol that can approximately realize the optimal file replication rule with the two mobility models in a distributed manner.

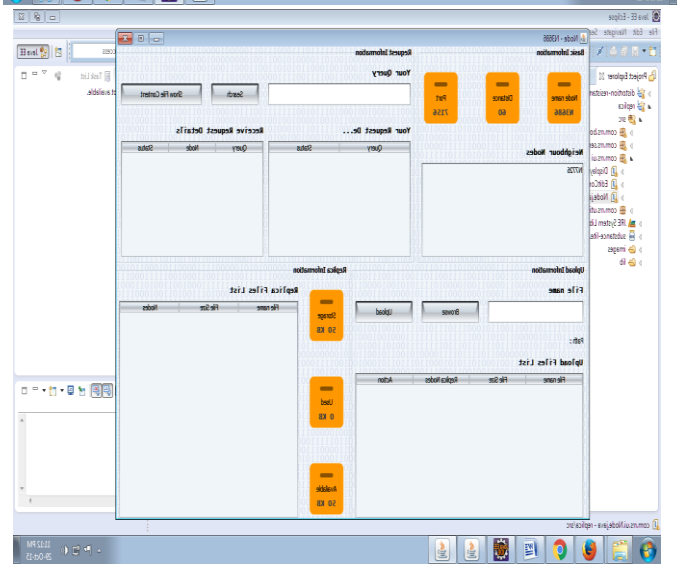
ADVANTAGES OF PROPOSED SYSTEM:

Our experiment and simulation results show the superior performance of the proposed protocol in comparison with other representative replication protocols.









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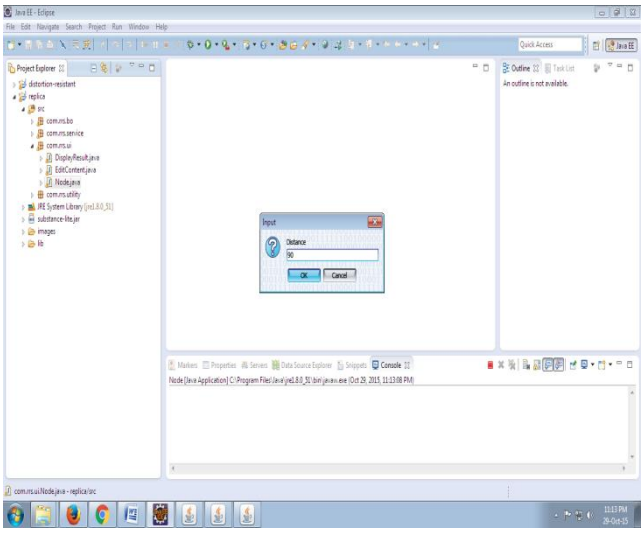

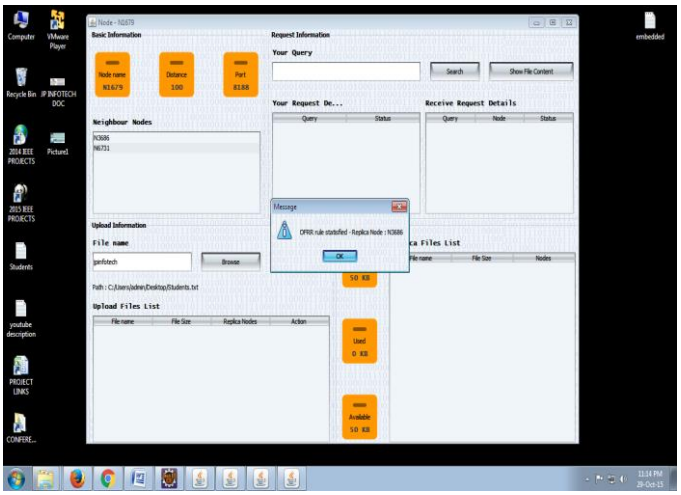

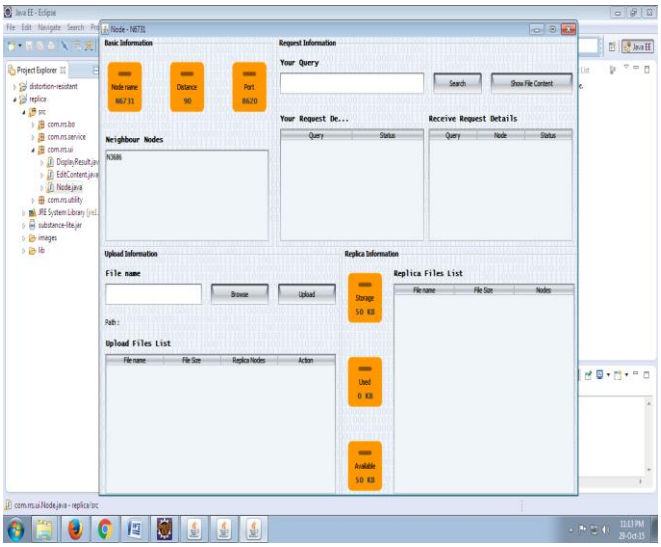

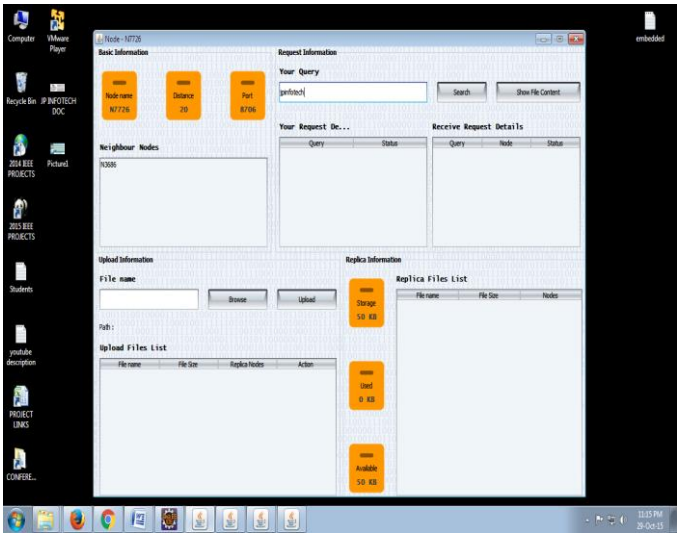

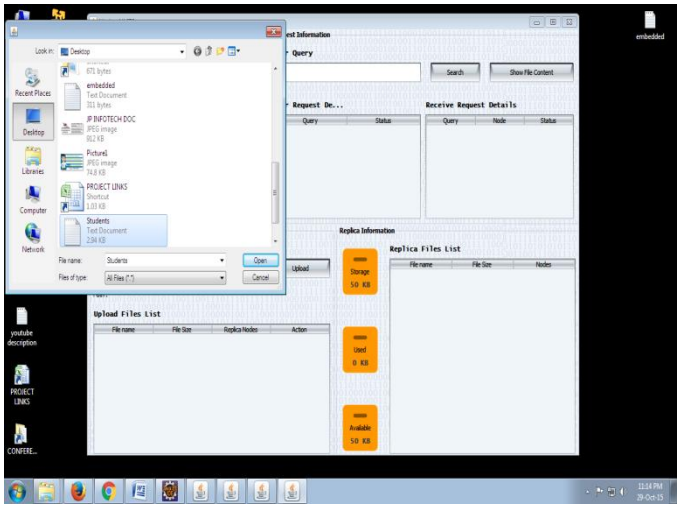

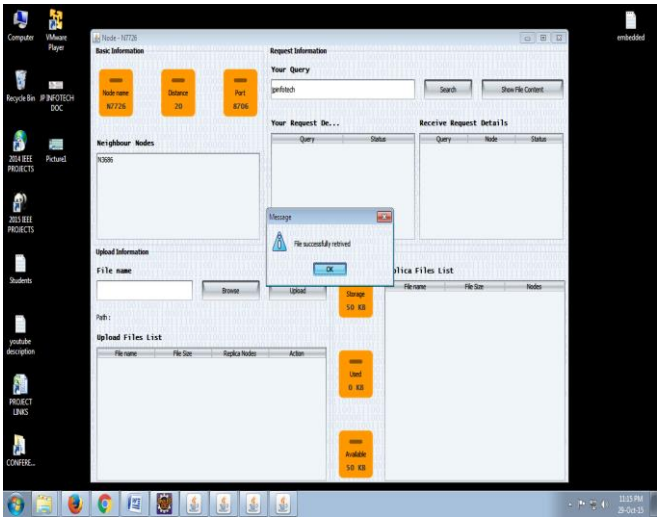

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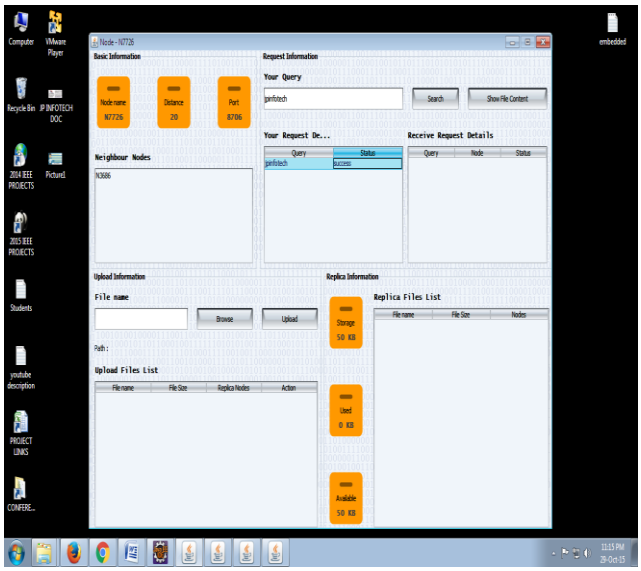

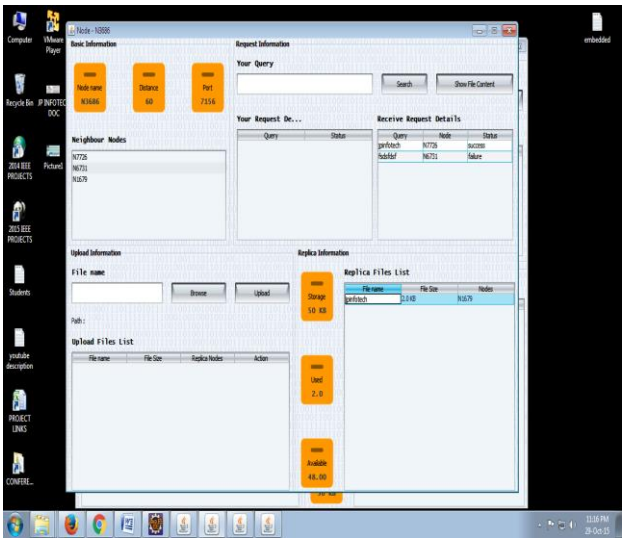

CONCLUSION AND FUTURE SCOPE

In this paper, we investigated the problem of how to allocate limited resources for file replication for the purpose of global optimal file searching efficiency in MANETs. Unlike previous protocols that only consider storage as resources, we also consider file holder's ability to meet nodes as available resources since it also affects the availability of files on the node. We first theoretically analyzed the influence of replica distribution on the average querying delay under constrained available resources with two mobility models, and then derived an optimal replication rule that can allocate resources to file replicas with minimal average querying delay. Finally, we designed the priority competition and split replication protocol (PCS) that realizes the optimal replication rule in a fully distributed manner. Extensive experiments on both GENI testbed, NS-2, and event-driven simulator with real traces and synthesized mobility confirm both the correctness of our theoretical analysis and the effectiveness of PCS in MANETs. In this study, we focus on a static set of files in the network. In our future work, we will theoretically analyze a more complex environment including file dynamics (file addition and deletion, file timeout) and dynamic node querying pattern.

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