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GENI Experiments on P2P, MANET, WSN Networks

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Abstract

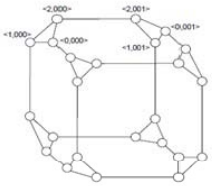
Today's society is witnessing a tremendous increase in digital information. Myriads of applications call for the pooling and sharing of massive amounts of widely-scattered data at ever increasing scales that require a commensurate infrastructure of powerful networked distributed systems across wide and diverse areas. We will implement three existing data sharing algorithms on the P2P, MANET and WSN networks, thus identify and investigate potential issues in the data sharing applications in heterogeneous networks. We use GENI to as the testbed for simulating the P2P, MANET, WSN and the heterogeneous network environments.

Research Objectives

The goal of this project is to first deploy the following three file sharing algorithms:
(1) Data sharing in P2P networks (Cycloid P2P).
(2) Locality-based distributed data sharing protocol (LORD) in MANETs.
(3) Spatial-temporal similarity data sharing (SDS) in WSNs.
Then, we aim to investigate the following issues:
(1) The performance of individual data sharing systems on the GENI real-world testbed.
(2) The challenges in achieving data sharing across the real network environment.

Data sharing in P2P networks (Cycloid P2P)

Features:
(1) Constant maintenance overhead regardless of the system scale.
(2) Scalability, reliability, dynamism-resilience, self-organizing.



Cycloid topology

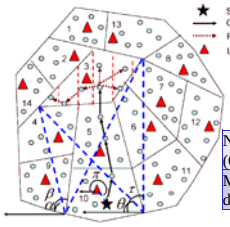
Initial platform: Planetlab

Number of nodes:	100
Dimension:	6
Node failure rate:	0.1-1 natural
Lookup/Insert interval	10-100s to every node
Total lookups	10000

Planed Exp. Parameter

Locality-based distributed data sharing protocol (LORD) in MANETs

Features:
(1) Energy-efficient & scalable.
(2) Reliable & dynamism-resilient.
(3) Similarity search capability



Algorithm overview

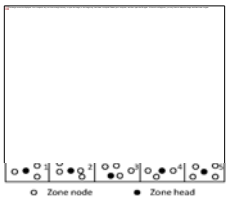
Initial platform: Orbit

Number nodes (ORBIT)	100
Moving speed dist. (m/s)	[0.5-2.5], [1-5], [20-30]

Planed Exp. Parameter

Spatial-temporal similarity data sharing (SDS) in WSNs

Features:
(1) Efficient spatial/temporal similarity data storage.
(2) Fast query speed.
(3) Low energy consumption.



Algorithm overview

Initial platform: Kansei or ViSe

Number of sensors	**128**
Node in zone	9
LSH destinations	5

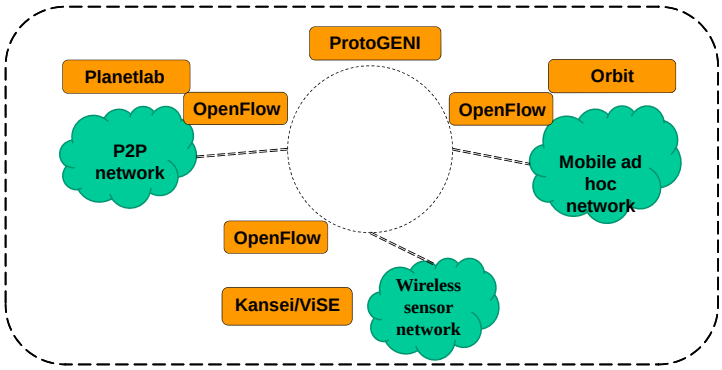
Planed Exp. Parameter

Experiments on Planetlab

We have already deployed a Cycloid P2P structure, over the Planetlab with 100 nodes. We select 10 nodes as querying nodes. The results are:

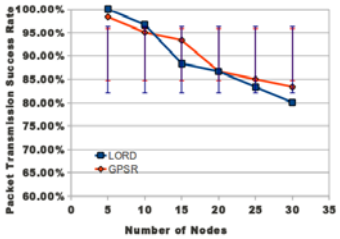
Node	Delay (ms)	Hops	Ave. Matched Item
1	1303.49	6.5597	3.45
2	1335.98	6.8227	3.48
3	1748.68	6.4009	3.50
4	1394.68	6.3861	3.44
5	1319.04	6.1926	3.54
6	1382.84	6.5244	3.46
7	1538.96	6.1289	3.46
8	1344.29	6.6868	3.46
9	1377.81	6.7996	3.48
10	1124.91	6.3338	3.47

Experiment Overview



Experiments on Orbit

We have implemented Greedy Perimeter Stateless Routing (GPSR) algorithm and basic LORD over ORBIT. The results are



Tx Node #	Packet Tx Success Rate		
1	80%		
2	70%	76.67%	
3	83.33%	73.33%	76.67%

Future Work

a. Finish the deployment of the SDS over the wireless sensor network.
b. Fully Implement the designed algorithms and compare its performance to the simulation results to verify the benefits.
c. Obtain a good understanding of the factors affecting the performance of data sharing in different networks.

Use of GENI Infrastructure

We first deploy three algorithms on three parts of GENI: Planetlab, Orbit and Kansei/ViSE. Currently, we can use the Omni tool to request Planetlab resources through the ProtoGENI control framework. We will use this tool to request the heterogeneous resources in the next step. Further, we hope the communication between nodes from different parts can be realized.

Reference papers:

•H. Shen, C. Xu, and G. Chen, "Cycloid: A scalable constant-degree P2P overlay network," *Performance Evaluation*, vol. 63, 2006, pp. 195-216.
• Z. Li and H. Shen, A Mobility and Congestion Resilient Data Management System for Mobile Distributed Networks, Proc. of MASS, 2009.
• H. Shen, L. Zhao, Z. Li, A Distributed Spatial-Temporal Similarity Data Storage Scheme in Wireless Sensor Networks, TMC, 2011

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