

SIPCache: A Distributed SIP Location Service for Mobile Ad-Hoc Networks

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Motivation

Previous Work

SIPCache

Evaluation

Conclusions

Introduction

- ▶ Many wired Internet Services assign special roles to some participants
 - ▶ Routing
 - ▶ Domain Name Service (DNS)
 - ▶ Session Initiation Protocol (SIP)
- ▶ Hard to do in ad-hoc networks because:
 - ▶ The list of participants change
 - ▶ Nodes move away
 - ▶ New nodes arrive
 - ▶ Nodes fail
 - ▶ Nodes have limited battery power

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Session Initiation Protocol (SIP)

- ▶ Composed of different services

Location Service Defines bindings between Address of Records (AOR) and contact address(es)

AOR User ID

Contact Addresses IP, phone number,...

Bindings stored in Domain Registrars

Other services Availability, Negotiation of communication parameters...

- ▶ Many applications

- ▶ e.g. advertises users interests
 - ▶ Wants to play chess on-line
 - ▶ Wants to chat about FIFA World Cup

Using the Location Service

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Alice's UA



Alice's Proxy



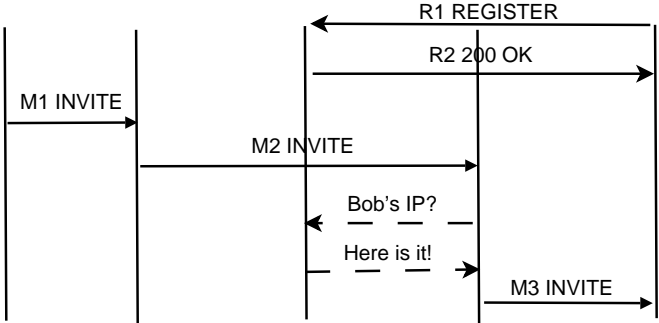
Bob's Registrar



Bob's Proxy



Bob's UA



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SIP in MANETs

- ▶ Where to store the mapping between an user and an address (binding)?

Push When connecting, the user stores the binding in every device

- ▶ Requires periodic updates to push the binding to devices joining later

Pull Users flood to learn the binding for some ID

- ▶ Requires one flood per query

Hybrid Stores replicas in a small number of devices

- ▶ Expected to reduce the number of nodes forwarding each query

Distributed SIP (dSIP)

- ▶ SIP for MANETs
- ▶ Replicates server components on every node
- ▶ Uses the same API as SIP
 - ▶ Compatible with legacy SIP applications
- ▶ Uses the *Pull* model
- ▶ No message forwarding
 - ▶ All nodes must be in range of each other

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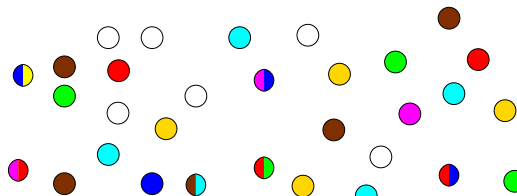
PCache

- ▶ An algorithm to replicate data in ad-hoc networks
- ▶ Replicas are stored only at some of the participants
 - ▶ Considering the geographical distribution of the nodes
 - ▶ Number of replicas adapts to the network density
- ▶ Uses a smart algorithm for broadcasting (Pampa)
- ▶ Only generates messages by request of the participants
- ▶ Three operations

Dissemination Replicates data

Query Queries for the value associated with a key

Gathering Queries for data satisfying some condition



dSIP + PCache = SIPCache

- ▶ SIPCache: a distributed SIP location service for MANETs
- ▶ Bindings are replicated using PCache dissemination
 - ▶ Stored in a limited number of nodes, depending on network density
- ▶ Retrieved using PCache queries
 - ▶ Simulation shows that many of the bindings can be found in the 1-hop neighborhood of any node
 - ▶ Bounds the number of nodes forwarding a message
- ▶ Users see “who’s around” with the gathering operation
 - ▶ A limited flood of the gathering message retrieves a large proportion of the bindings

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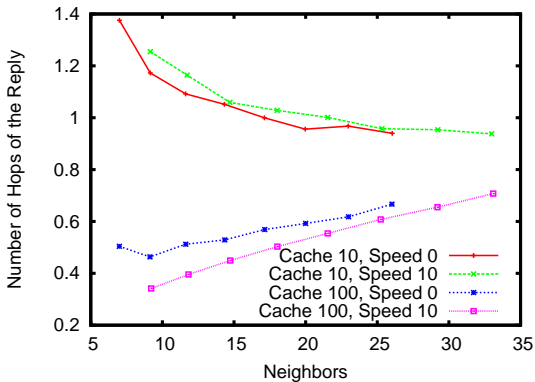
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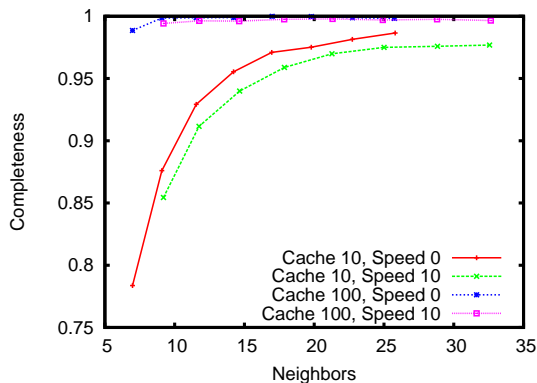
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Distance of the replies



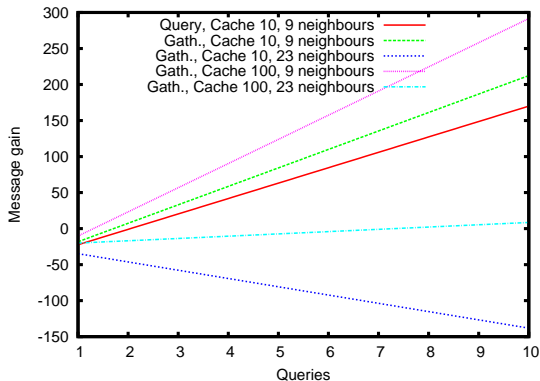
- ▶ When each node stores 10% of the advertised items
 - ▶ Replies between 1 and 1.4 hops away
 - ▶ Most of the queries just need to be propagated to 1-2 hops away
- ▶ When nodes are able to store all bindings
 - ▶ Average below 1
- ▶ PCache adapts the diameter of the search

Completeness of data gathering



- ▶ Condition is satisfied by 10% of the bindings
- ▶ Query propagated 2 hops away from the source
- ▶ When each node stores 10% of the advertised items
 - ▶ Results depend of the number of nodes
 - ▶ Influences the number of bindings available in the neighborhood

Traffic



- ▶ Compares the gains of SIPCache against naïve *pull*
- ▶ x is the number of queries for one item
- ▶ In general, PCache performs better
- ▶ Losses in some gathering operations are due to an excessive number of replies
 - ▶ Are attenuated with the gains in other operations

Conclusions

- ▶ Centralized implementations of Internet services are inadequate for MANETs
 - ▶ Distribution and replication are fundamental to achieve scalability and reliability
- ▶ PCache has shown to efficiently replicate data
 - ▶ Accounts with node density
 - ▶ Requires a low number of messages
- ▶ SIPCache provides an implementation of SIP for MANETs compatible with legacy applications