Pub/Sub Content Sharing for Mobile Networks

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Outline

Introduction

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- Backbone exploitation
- Reputation

Performance assessment

Conclusions and future work

Introduction

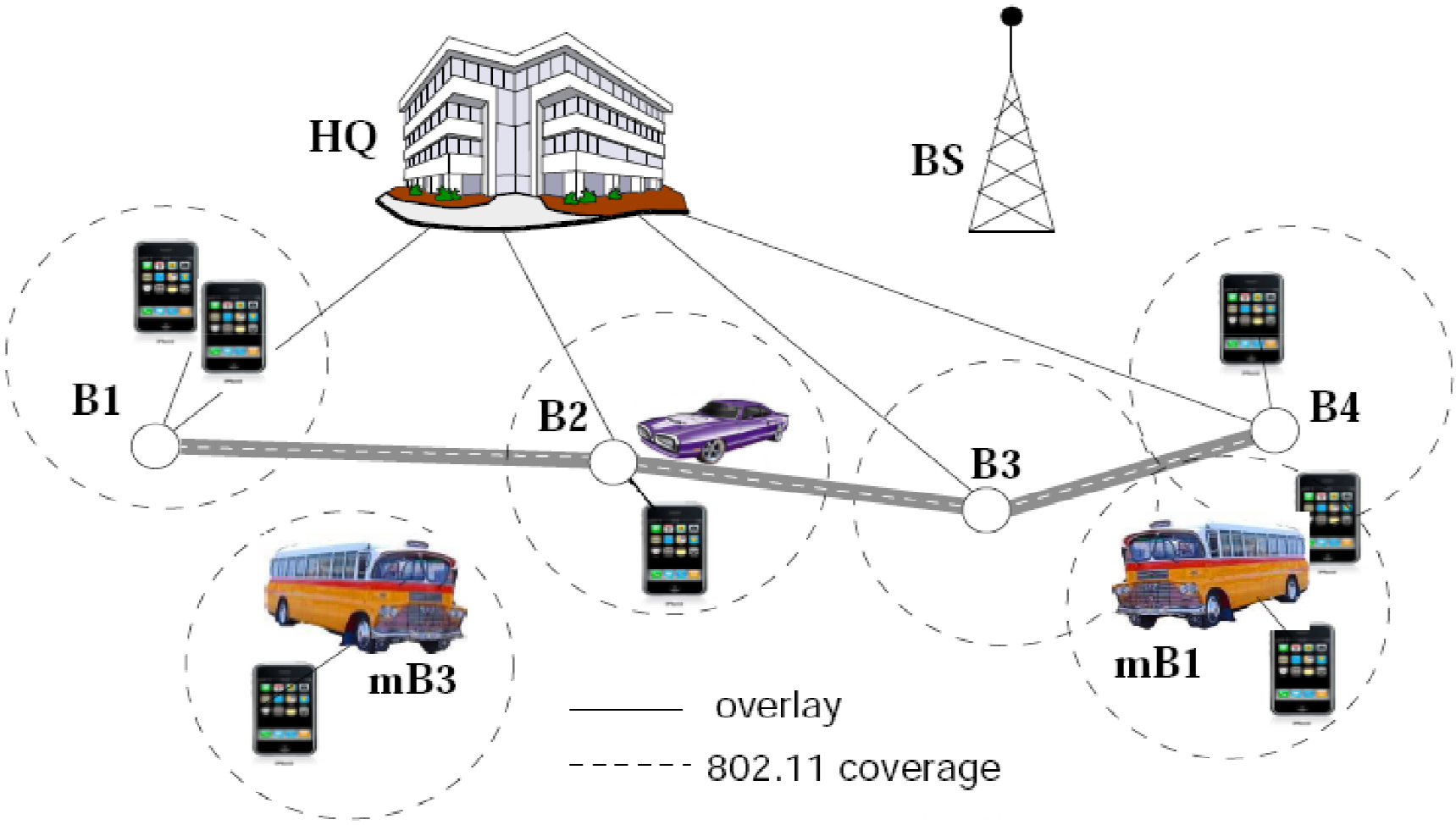
Figaro Overview

Figaro is a ***content discovery*** solution, based on the ***publish/subscribe*** paradigm:

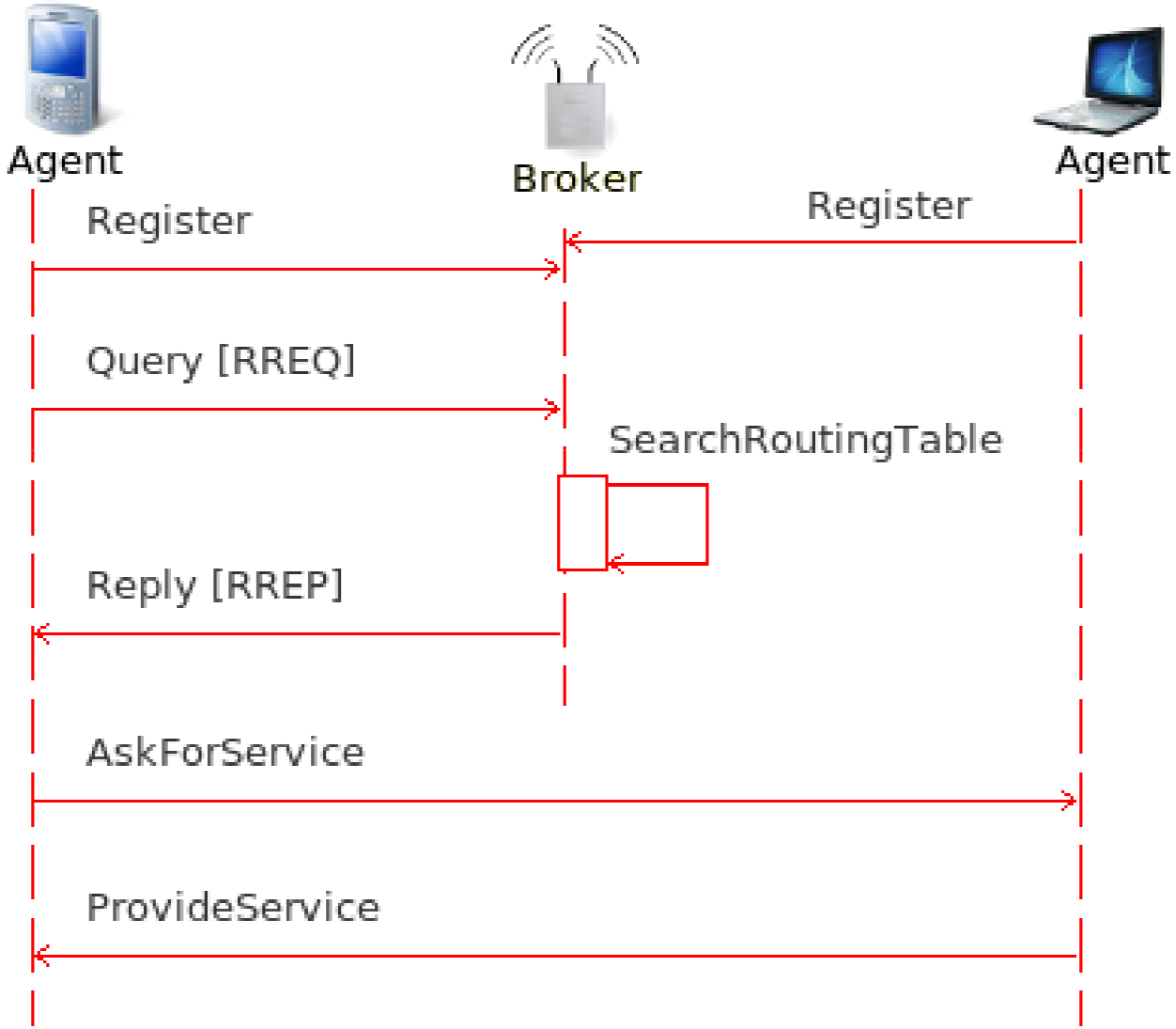
- ***Agents*** provide and consume content
- The network infrastructure brings demand and offer in contact (***Brokers***)
- A Broker and the Agents associated to it form a ***Colony***

Figaro could be deployed over a (public) transportation system

Scenario



In-Colony interaction between Agent and Broker



Architecture and Protocol improvements

Exploiting the Backbone

A (wired/wireless) ***backbone*** may connect the Brokers-APs

It is assumed to be:

- ***cheap***
- (reasonably) ***fast***
- (very) ***reliable***

Brokers may use the backbone to connect to a ***Proxy*** to allow inter-colony information retrieval

Proxy

A Proxy acts a Brokers' "parent":

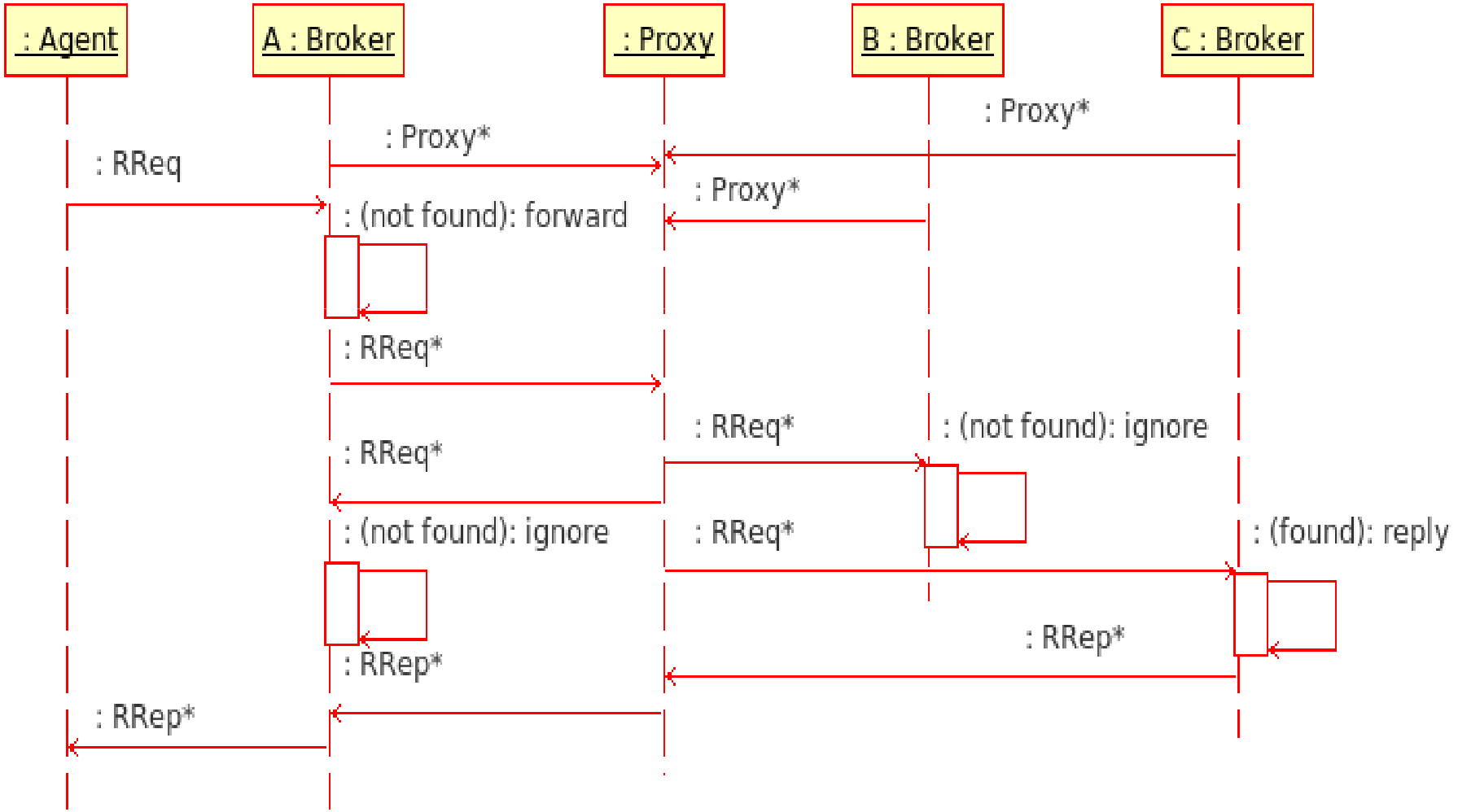
- If a Broker cannot find a service, it asks the Proxy
- The Proxy asks its "children" Brokers

    If a "child" answers, the answer is ***returned*** to the original broker

    Else, failure is reported to the original broker

Proxies can have "parents" (scalable ***tree*** structure)

Interaction between Agent and Brokers/Proxy



Fighting Free-riders

Free-riders are ***misbehaving*** Agents that do not actually provide the services they advertise

Figaro enforces a ***reputation***-based system

Agents and Brokers ***cooperate*** to reach this goal

Agents ***report*** misbehavior, Brokers ***punish*** it

Feedback and Reputation

Feedback from the Agents is used by the Broker to compute a reputation score for each Agent, then compared to a reputation threshold T_R

The ***reputation score*** of an Agent *i* at time *t* is computed from positive/negative feedbacks

Positive feedback count

Negative feedback count

$$r(i,t) = \begin{cases} \frac{P(i,t)-N(i,t)}{P(i,t)+N(i,t)} & \text{if } P(i,t)+N(i,t) \geq T_S(t) \\ 0 & \text{otherwise} \end{cases}$$

significance threshold

Banishment

If $r(i,t) < T_R$, Agent *i* is ***banned***

Banishment only takes place when the reputation score falls below a ***threshold***

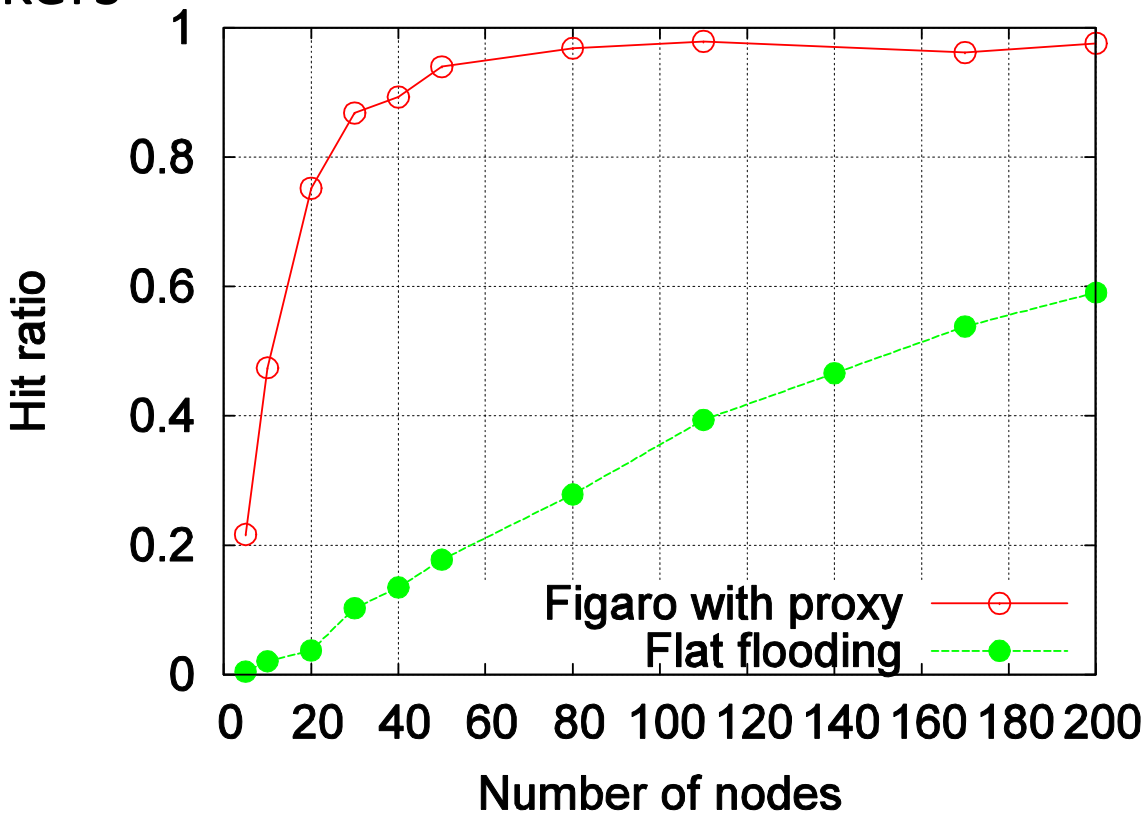
It is important to avoid ***false positives***, e.g. Agents that could not provide a single service for connectivity problems

Bans are ***temporary***, so Agents can "repent"

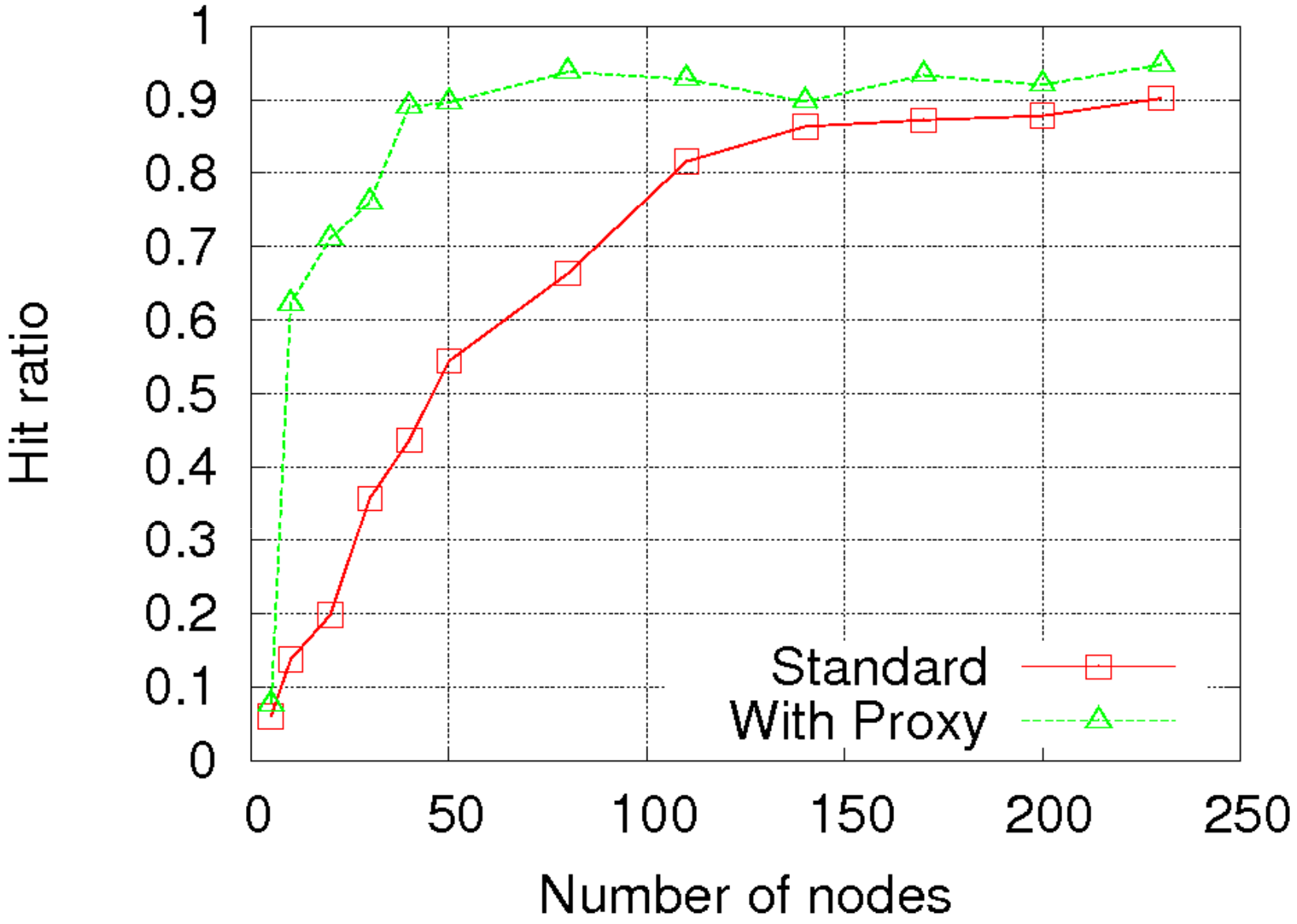
Performance assessment

Performance evaluation

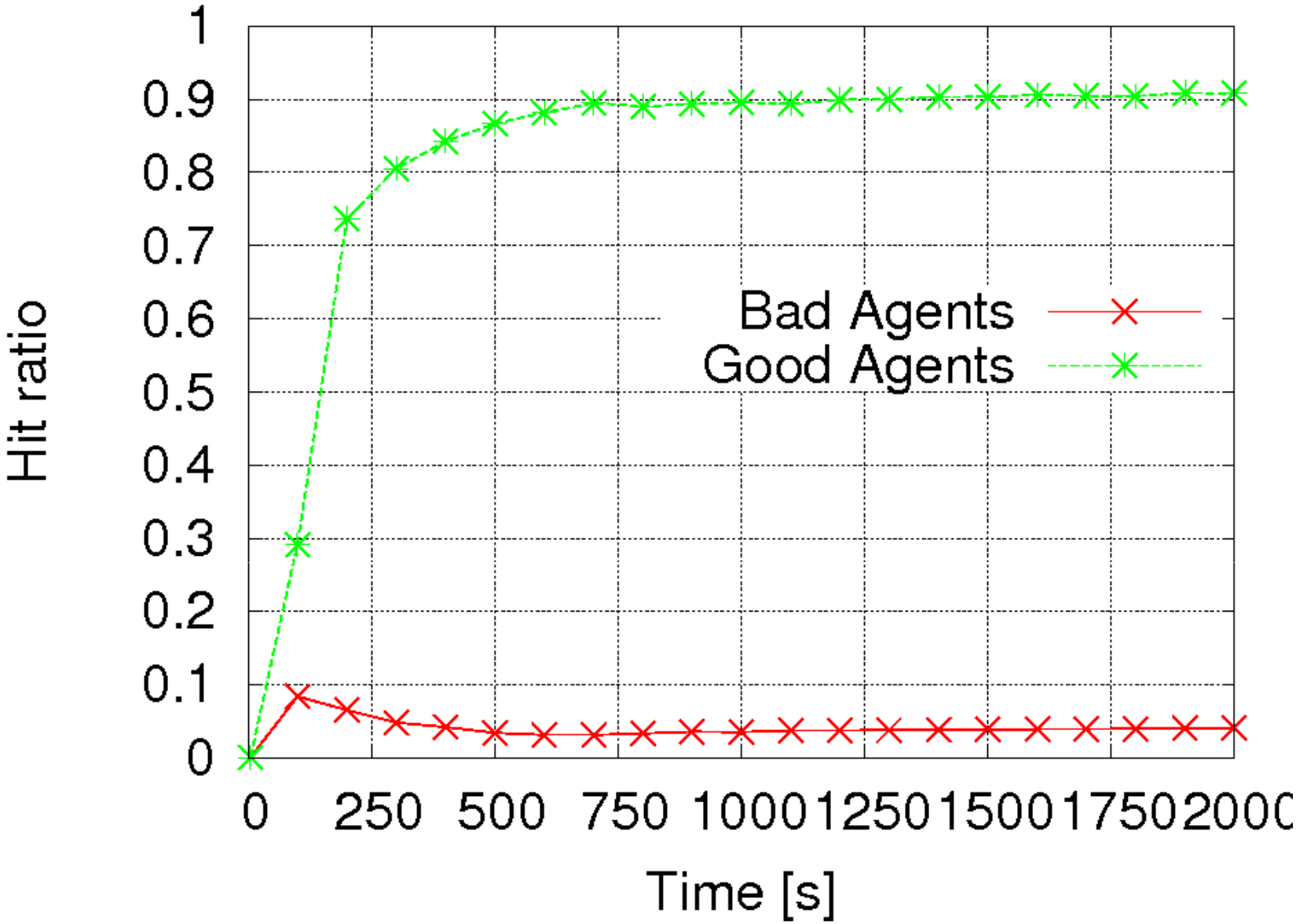
- Ns-3 emulation
- 4 APs acting as Brokers in 1 km^2
- mobile Agents and Brokers use 802.11 interface
- each agent advertises 10% of available content
- pedestrian mobility model



Figaro greatly outperforms ***flat peer-to-peer solutions***



Using a ***Proxy*** results in a major performance boost



The ***reputation*** mechanism is able to quickly and precisely tell good and bad Agents apart

Conclusions and future work

Conclusions

Figaro is a content-discovery solution for mobile wireless networks

Based on the ***publish-and-subscribe*** paradigm

We addressed several ***advanced scenarios*** – backbone usage, misbehaving Agents…

Performance were evaluated via ns-3 ***emulation***

Future work

More rigoruous ***mathematical*** characterization of problems and solutions

Investigate ***additional scenarios***

E.g., how to operate colonies when infrastructure is ***not available***