

Network Sensing through Smartphone-based Crowdsourcing



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Introduction

Issue

Sensing large-scale networks requires great computing and economical resources.

Solution: Crowdsourcing

- Work split over a large set of participating users
- Evaluation of performance carried out at the periphery of the network, where the vast majority of end users is located
- Collection of fine-grained measurements scattered over wide geographical regions

Smartphones advantages

- Exponential growth of devices (aggregate power almost unlimited)
- Highly mobile and always on (single device – multiple observation points)
- Easily geolocalized via GPS

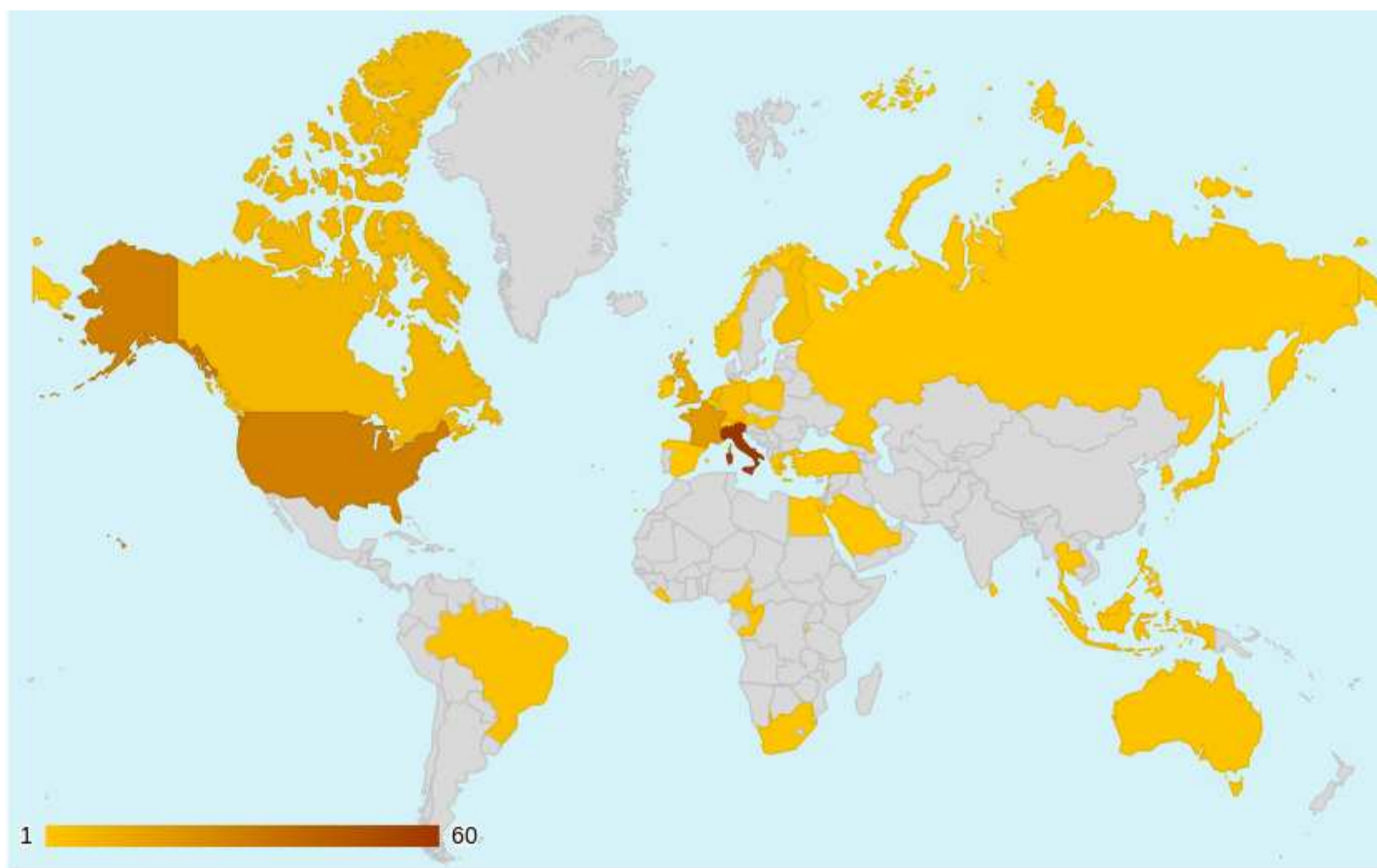


Fig. 1: Portolan smartphones: distribution map

Internet mapping

Discovering the Internet structure at the Autonomous System (AS) level of abstraction.

- Plan business strategies between ISPs
- Design next generation routing protocols

Results

Campaign for discovering the Italian Internet structure as seen by three major ISPs.

- 1117 links discovered
- 244 links out of 1117 previously unknown (21.8%)

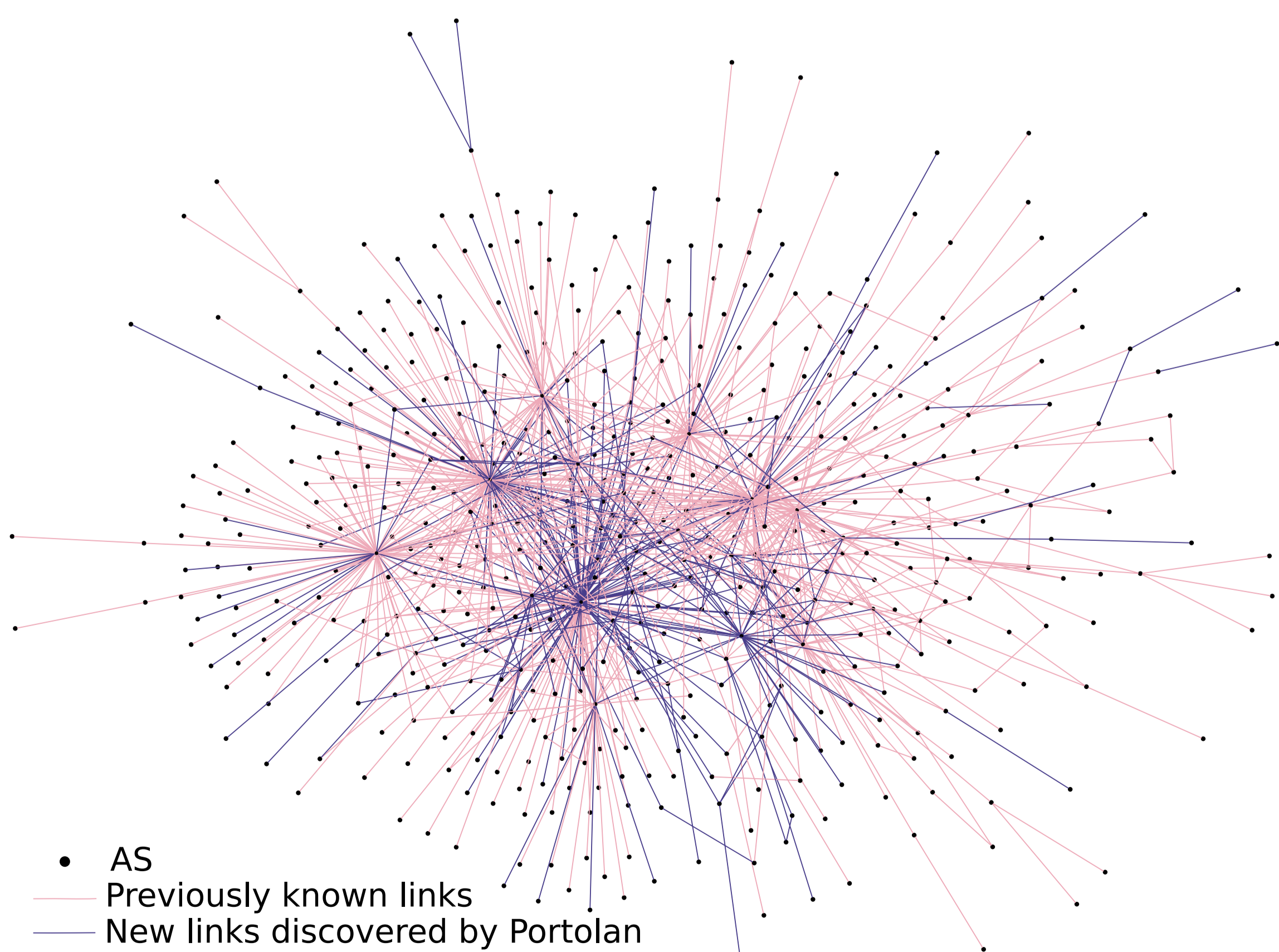


Fig. 4: Italian Internet structure discovered by Portolan

The Portolan system

Distributed client-server architecture. Smartphones perform local measures, collected and aggregated by the server.

Client

- App for Android implementing the measuring subsystems
- Internet mapping and Signal coverage mapping
- Suite of manual tools to motivate users (Figure 2)

Server

- Coordinates smartphones and assigns tasks
- Scalability achieved through peripheral units named Proxies
- Assignment of tasks via a polling mechanism

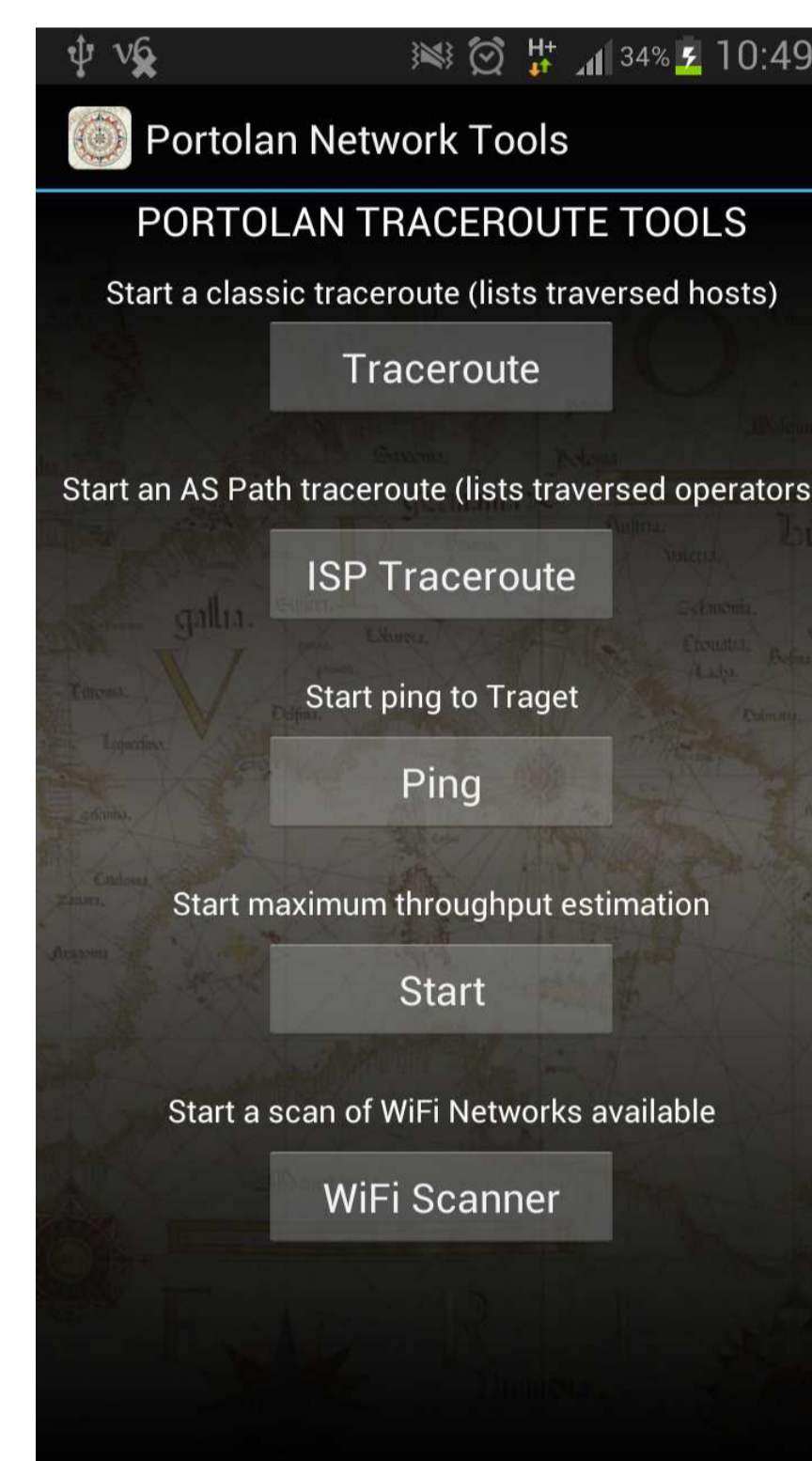


Fig. 2: App screenshot

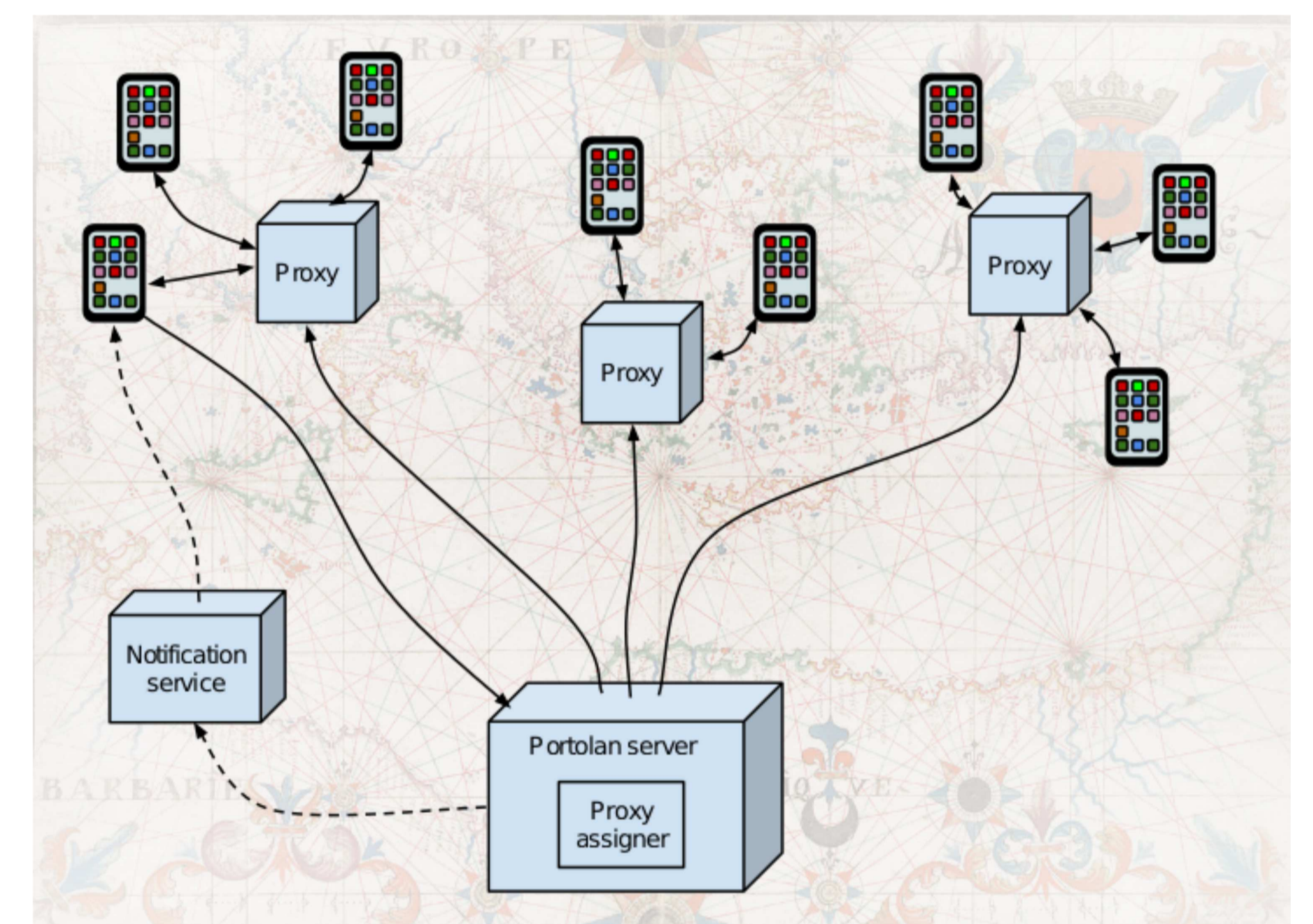


Fig. 3: Portolan system architecture

Signal coverage mapping

Gathering Received Signal Strength (RSS) samples associated with their geographic position.

- Help cellular operators evaluate and possibly improve their coverage
- Help end-users select the most suitable operator for their needs

Results

Over 1,000,000 RSS samples collected shown on a map at the Portolan website (<http://portolan.iet.unipi.it/>)

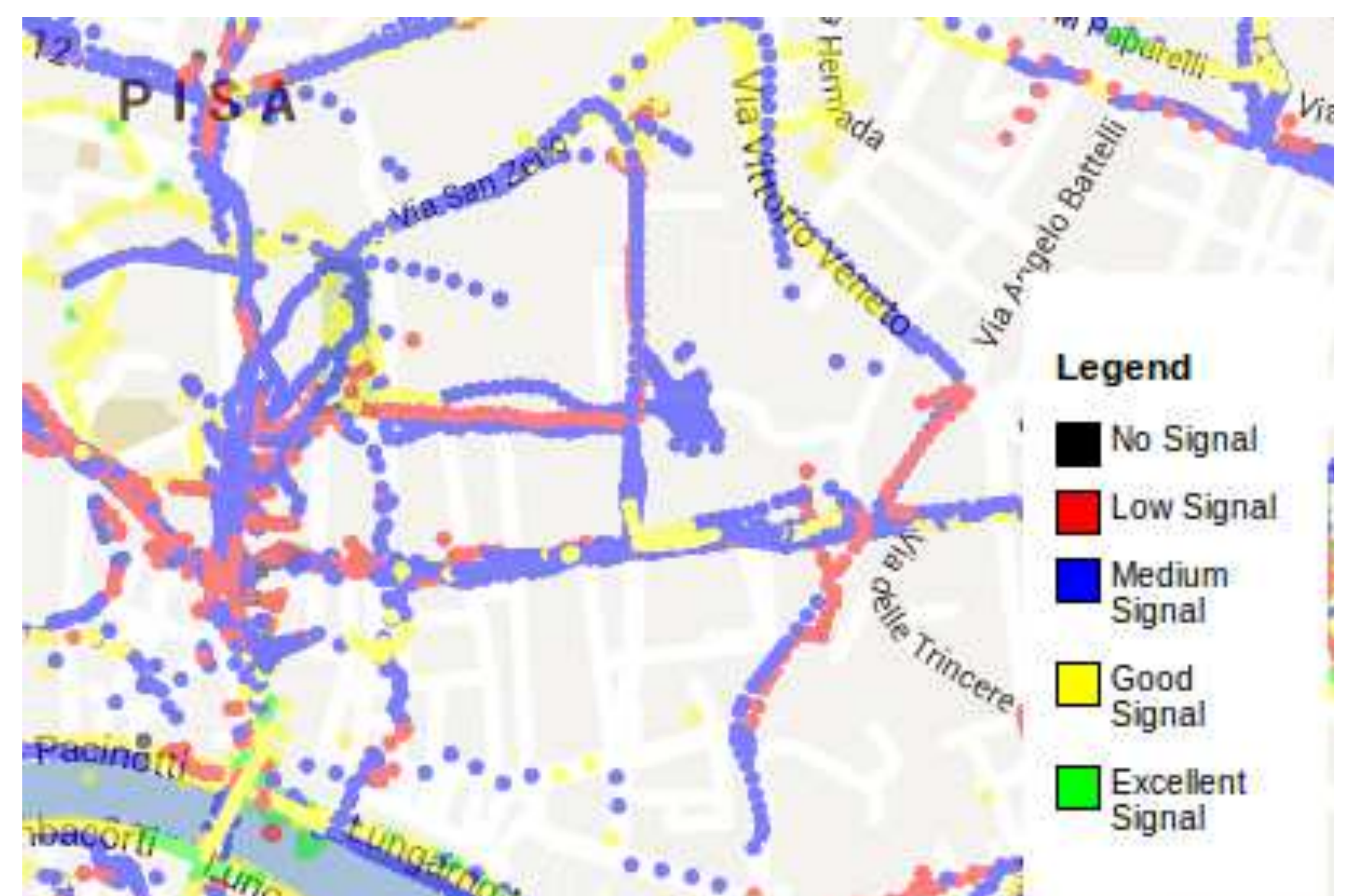


Fig. 5: RSS coverage in the surroundings of Pisa (Map data ©2013 Google)