

# PORTOLAN

## Probing the Internet through Smartphone-based Crowdsourcing

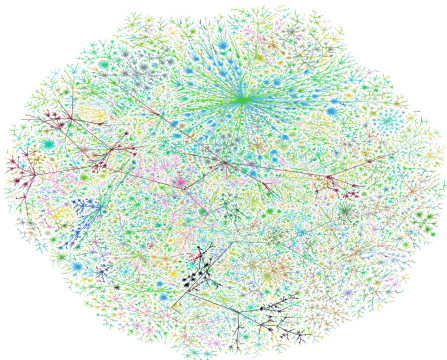
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**RIPE 67 – Athens 14-18 October 2013**

# Monitoring Regional Internet Infrastructure

Discover the **map of the Internet at the Autonomous System level** of abstraction with active and passive techniques



# Isolario Project

Isolario



- ◉ **Area**

- ▷ Internet AS-level passive measurement

- ◉ **Goals**

- ▷ Provide ready-to-use AS-level data
- ▷ Become a route collector project
  - do-ut-des: services in change of BGP data

# Isolario Project

Isolario



## ⦿ Input Data

- ▷ Raw BGP messages provided by **RouteViews RIS** and **PCH**
- ▷ Month by month since July 2000

## ⦿ Output Data

- ▷ AS-level Topology (Global and Geographic)
- ▷ Economic AS-level Topology (Global and Geographic)
- ▷ AS characteristics
- ▷ AS Covering

# Portolan Project



- ◉ **Area**
  - ▷ Internet probing with active measurement
- ◉ **Crowdsourcing** approach
- ◉ **Smartphone-based**
  - ▷ Client app for Android OS

# Why crowdsourcing?

## The power of crowds



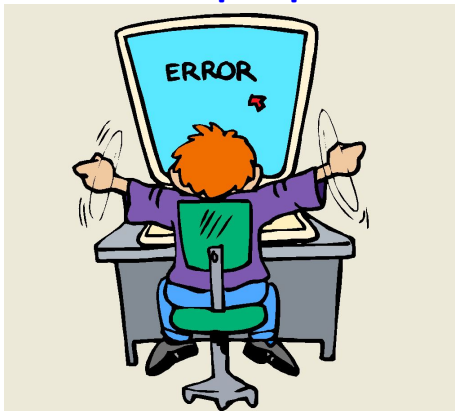
# Why crowdsourcing?

## Multiple observation points



# Why crowdsourcing?

## End user perspective





# Why smartphones?

## Exponential growth of devices



# Why smartphones?

High mobility and always on



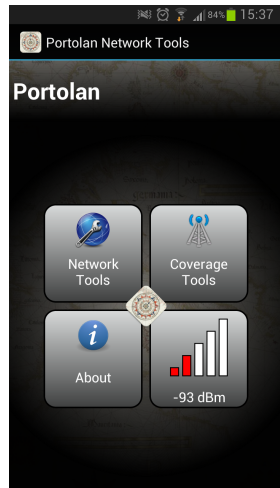
# Why smartphones?

Easily geolocalized (GPS)



# Portolan - Mobile App

- ◉ Application for **Android OS**
- ◉ Available on Italian Google Store since **6th December, 2012**
- ◉ Available on World Google Store since **16th June, 2013**

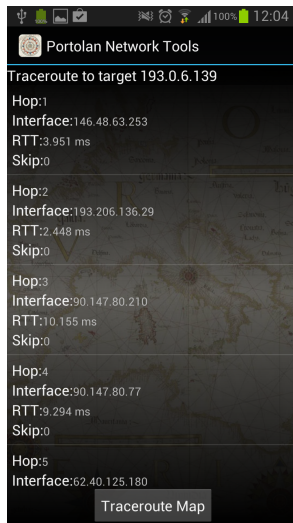


# Methodology

- ⊙ **User-driven** measurements (incentive)
  - ▷ User can perform Traceroute, AS-Traceroute, Throughput Estimation, Ping or RSS measurement
  - ▷ The app shows results and send them to our server
  - ▷ The user is responsible for the amount of bandwidth and energy consumed
- ⊙ **Background** measurements
  - ▷ Our server can trigger traceroutes in order to discover AS links
  - ▷ When user start geolocation apps (e.g. GoogleMaps, SportTracker etc.) Portolan collects RSS samples in background without costs for user
  - ▷ **Low battery consumption** (less than 1%/day) and **Low network traffic** (less than 2 MB/day)

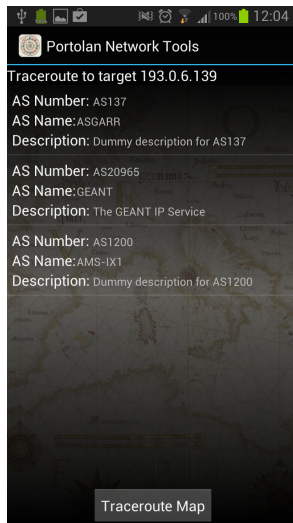
# User-driven measurements (incentive) - Network Tools

## ⊙ Traceroute



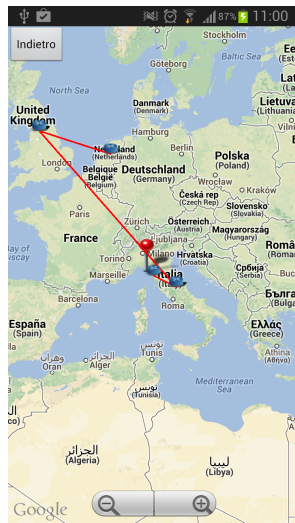
# User-driven measurements (incentive) - Network Tools

- ⊙ **Traceroute**
- ⊙ **AS-Traceroute**



# User-driven measurements (incentive) - Network Tools

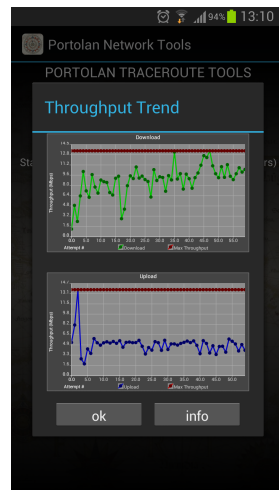
- ◉ Traceroute
- ◉ AS-Traceroute
- ◉ Visual Traceroute





# User-driven measurements (incentive) - Network Tools

- ⦿ **Maximum throughput estimator**



# User-driven measurements (incentive) - Network Tools

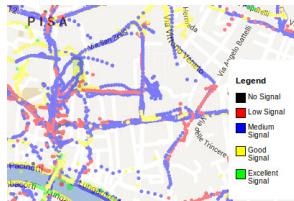
- ⦿ **Maximum throughput estimator**
- ⦿ **Ping**

# User-driven measurements (incentive) - Network Tools

- ◉ **Maximum throughput estimator**
- ◉ **Ping**
- ◉ **BitTorrent Test** (available soon)
  - ▷ Check if your ISP blocks or shapes your BitTorrent traffic

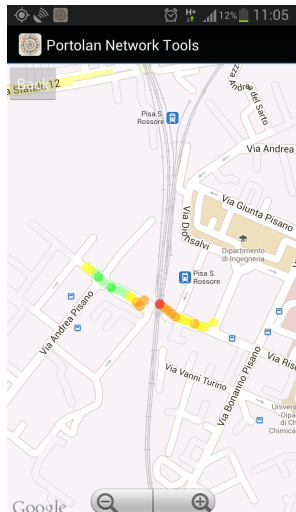
# User-driven measurements (incentive) - Coverage Tools

- ⊙ **Signal coverage tools**
  - ▷ Coverage map with every data collected



# User-driven measurements (incentive) - Coverage Tools

- ◉ **Signal coverage tools**
  - ▷ Coverage map with every data collected
  - ▷ Trace signal coverage along user's path



# Background measurements

- ◉ UDP-traceroute tool based on **Paris Traceroute** and **Multipath Detection Algorithm**
- ◉ **Regional Traceroute Campaigns**
  - ▷ Short range measurements
  - ▷ Smart measurements driven by collected BGP data
  - ▷ Active and passive techniques cooperation
  - ▷ Default measurement campaign
  - ▷ User-interface to tailor specific measurement campaigns
  - ▷ Discover the structure of the periphery of the Internet

## Results - Setup

- ⊙ Measurement campaign for discovering the Italian Internet structure (May - June 2013)
- ⊙ **Sources:** 12 Italian ASes hosting a Portolan monitor
- ⊙ **Destinations:** All the Italian Stub ASes (566 ASes)

# Results - Statistics

- Number of Devices: 101

ASes	Devices
137 (GARR)	40
1267 (WIND)	23
12874 (Fastweb)	11
16232 (TIM)	23
3269 (Telecom)	30
8612 (Tiscali)	17
24608 (H3G)	11
30722 (Vodafone)	21
15589 (Clouditalia)	1
5396 (McLink)	2
2595 (Piemonte Research Net)	1
15691 (LeoNet)	1



## Results - Links

- ◉ 1464 links discovered
- ◉ Results compared with CAIDA *IPv4 Routed /24 AS Links* dataset
  - ▷ **528 links out of 1464 (36.07%) previously unknown**

	Portolan Discovered Links	Previously unknown
Direct	1093	215 (19.67%)
IXP	386	<b>316 (81.86%)</b>
Total	1464	528 (36.07%)

# Portolan Monitor Distribution



**Currently Portolan counts about 300 active installations**

# Conclusion

- ◉ **Mobile Phones** a new opportunity for network monitoring
  - ▷ **Android OS** is more flexible than other mobile OS.
  - ▷ **iOS** and **WindowsPhone** are strongly limited environments
- ◉ Challenge: **large user base**
- ◉ Smart Traceroute:
  - ▷ Short-range
  - ▷ BGP driven
- ◉ Collaboration with legacy traceroute infrastructures (such **ATLAS**)
  - ▷ **Increase** the number of **vantage points**
  - ▷ Use **ICMP Paris traceroute** (unavailable on Android and able to discover more links than UDP Paris)

# The end

**Thank you for your attention!**

**Questions?**

`http://portolan.iet.unipi.it`

Available at Google Play store

