

the **real-time** Internet routing observatory

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2/6 mayo - la habana, cuba



Unveiling the Internet structure with BGP data

BGP route collectors

BGP data collected up to date has been invaluable to reveal the Internet inter-domain characteristics, but it is known to be largely *incomplete*



How much incomplete? (March 2016)

It was possible to discover the full connectivity of:

- 833 out of 8683 ASes (9.59%) which transit traffic for other ASes
- 164 out of 726 ASes (22.59%) of those operating in LACNIC region

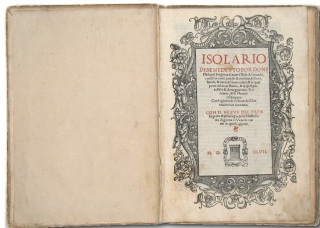
Main cause: small number of small ASes connected

Do AS administrators see any direct outcome in sharing their routing information?

Isolario project

Objective: push more ASes to join

The more the ASes, the more the completeness of public BGP data



Isolario - The Book of Islands

"where we discuss about all islands of the world, with their ancient and modern names, histories, tales and way of living..."

Benedetto Bordone
(Italian cartographer)

Approach: Do-ut-des

- Participants open a BGP session with Isolario providing the BGP full routing table and its evolution over time
- In change, Isolario offers **real-time** and **historic** analysis applications based on the aggregation of every routing information collected

Data we plan to provide to research community

MRT data (same format as RIPE RIS, Route Views, ...)

- 1 RIB feeder snapshots every 2 hours
- 2 UPDATE collections every 5 minutes

Periodic analyses (daily, weekly, monthly, ...)

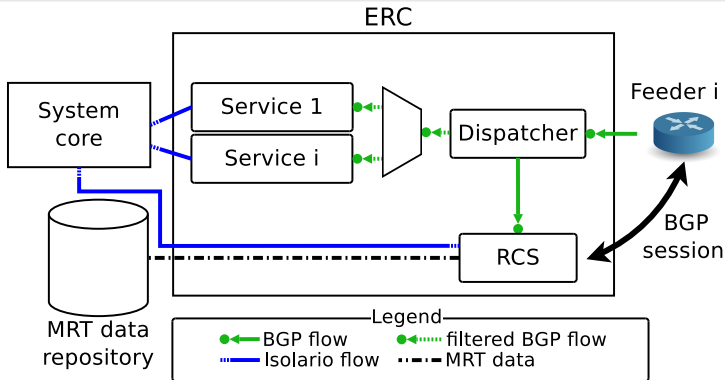
- 1 AS-level Topologies (Global and Geographic)
- 2 AS characteristics
- 3 Feeder contribution
- 4 Total coverage of RCs



work in progress

Enhanced BGP Route Collector

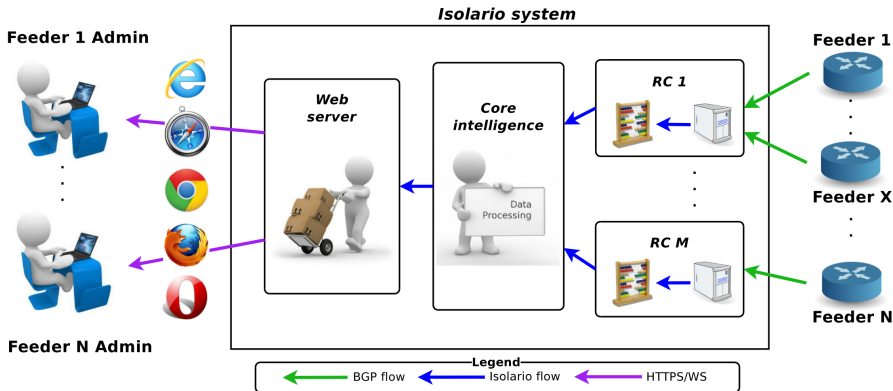
Incoming flows are duplicated as soon as they arrive and feed both the Route Collecting Software (RCS) and service modules



As usual, RCs only collect routing information and **not** user traffic

Isolario system overview

Incoming BGP flows are used as **real-time streams** for services dedicated to participants



Results are provided to users via WebSockets

Isolario free services for feeders

Every feeder has free access to a set of services tailored to monitor and analyse BGP data coming into Isolario system

Real-time services

- BGP flow viewer
- Routing table viewer
- Route flap detector
- Website reachability
- Subnet reachability

Historic services

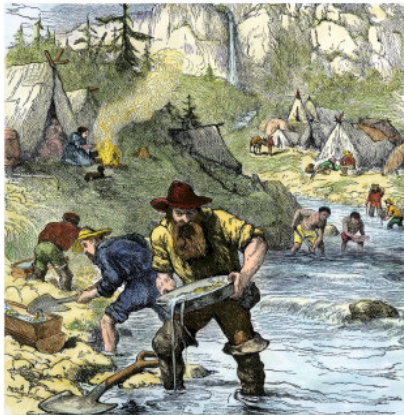


- Routing table viewer
- Subnet reachability

Diagnostic services

- Alerting system
- Daily report

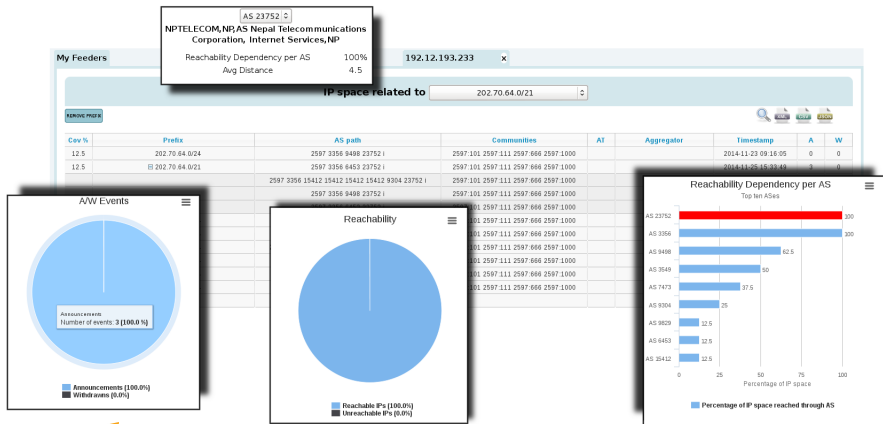
Real-time services



Real-time services allow to monitor BGP data flowing into Isolario system

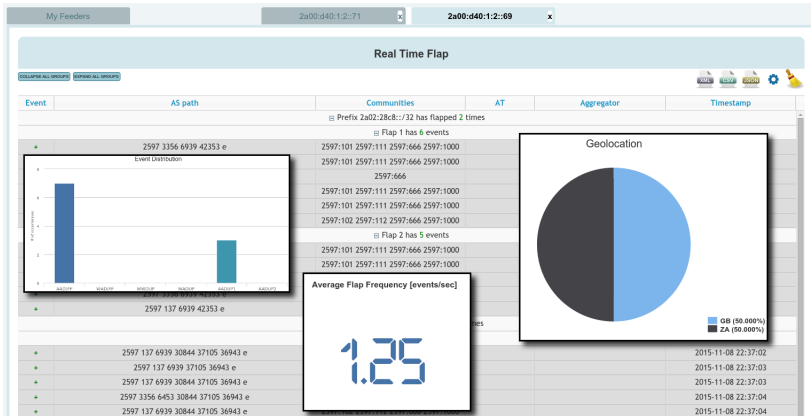
Routing table viewer

Allows to analyse in real-time the routes that a feeder is currently announcing to Isolario to reach a portion of the IP space



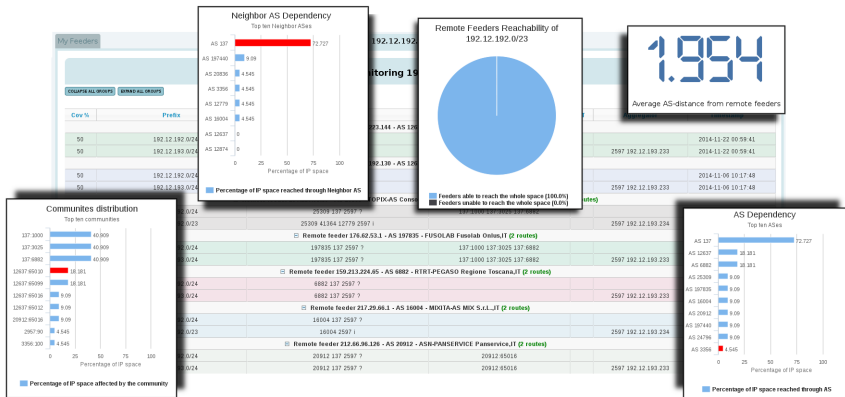
Flap detector

Allows to detect and analyse in real-time the routes that are experiencing flap events



Subnet reachability

Allows to analyse in real-time the routes that every Isolario feeder is announcing to Isolario to reach a portion of the IP space



The more the feeders, the more SR is useful!

BGPlay real-time

Type: A > pathchange Involving: 10.10.10.0/24

Short description: The route 65026 65700 65195 65196 65197 65305 65103 is changed to 65026 65700 65195 65196 65666

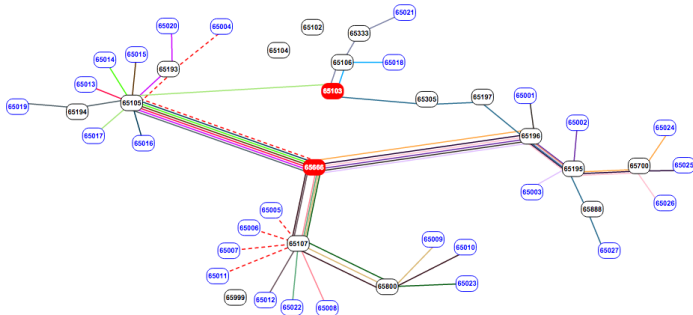
Path: 65026, 65700, 65195, 65196, 65666.

Date and time: 2015-09-26 17:06:51 Collected by: isolario-127.254.0.26

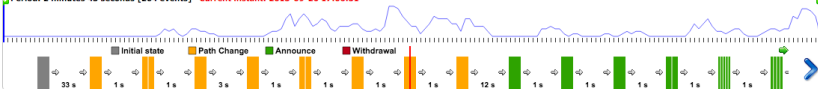


Static path

BGPlay



Period: 2 minutes 43 seconds [204 events] Current instant: 2015-09-26 17:06:51



Diagnostic services



Diagnostic services exploit incoming BGP flows and/or historic data to report anomalies of the inter-domain routing status

Alerting system

Alerting system

- **BGP attributes:** BGP UPDATEs matching attributes of interest
- **Flap events:** a prefix UPDATE rate is larger than a threshold
- **Hijack attempts:** BGP UPDATEs hijacking a feeder subnet
- **Prefix reachability:** (un)reachability of prefixes of interest

Alerting Management | Notifications | Current configured alerts

Create new alert (Tip: often the elements of the interface displayed below have a help text that will be shown simply by leaving the mouse on the element itself.)

General Alert Options

Available feeder IPs

☐ 127.254.0.1 (ASN 65001)
☐ 127.254.0.10 (ASN 65010)
☐ 127.254.0.11 (ASN 65011)
☐ 127.254.0.13 (ASN 65013)
☐ 127.254.0.19 (ASN 65019)
☐ 127.254.0.2 (ASN 65002)
☐ 127.254.0.20 (ASN 65020)
☐ 127.254.0.21 (ASN 65021)
☐ 127.254.0.22 (ASN 65022)

Alert Type

BGP attributes
Flap Detector
Session Watchdog
Hijack
Reachability

Action upon event
☒ Email s
☐ POST HTTP(s)

Save Alert

BGP attributes

Prefix

Prefix Subnet

Community

Prefix Related

AS path end

AS path substring

AS path begin

AS path exact

Origin

Aggregator

You can specify one or more BGP attribute types on which the monitoring will run. Multiple types can be combined by means of `and/or` operators and round brackets. For each attribute type you can insert one or more values that the attribute should match. The system will report any BGP_UPDATE message advertised by one of the selected feeder IPs matching the inserted attributes.

EXAMPLE

Current BGP attribute types selected

Daily report

Summary about the feeder inter-domain routing status as perceived by the Isolario system

For example...

Routing statistics

- #Announce, #Withdrawn
- Most (un)stable prefixes

Reachability statistics

- Inbound reachability

BGP attributes statistics

- AS path anomalies



Daily report

Feeder 192.65.131.235 (AS 2598)

Thursday 21st May, 2015



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Daily report: Summary of statistics

1 General statistics

Analysis start date: *Thursday 21 May 2015 at 00:00:00*

Analysis end date: *Thursday 21 May 2015 at 23:59:59*

Number of non overlapping IPv4 space covered¹: *2739704260 (98.581001 %)*

The remaining 1.418999 % is covered by a default route

Packets received: *227490*

Feeder status at end date: *up*

Downs experienced since start date: *0*

2 Route statistics

Subnets: *532099*

Unstable subnets: *57727 (10.848 %)*

Stable subnets: *474372 (89.151001 %)*

Number of reserved subnets: *1* – see Sect. 2.4 for further details

Geolocated subnets²: *475610 (89.383003 %)*

5 AS statistics

ASes seen: *50241*

Private ASes: *34 (0.067 %)*

Public ASes: *50207 (99.931999 %)*

Public ASes on 16 bits: *42864 (85.316002 %)*

Public ASes on 32 bits: *7343 (14.615 %)*

Number of public ASes at start date: *50089*

Number of public ASes at end date: *50142*

Difference: *+53 ASes (+0.105 %)*

7 My subnet statistics

Total number of subnets perceived as proprietary: *1*

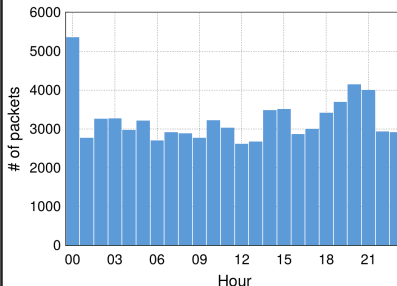
Subnet
192.65.131.0/24

Number of events related to proprietary subnets: *0*

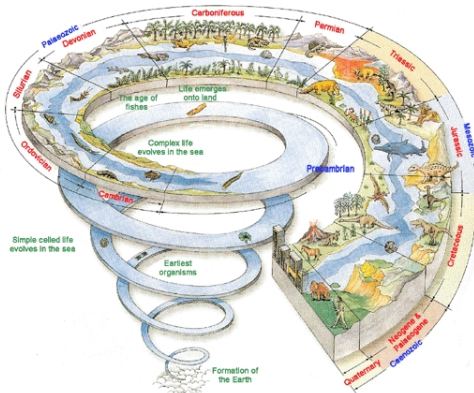
Number of announcements related to proprietary subnets: *0*

Number of withdrawals related to proprietary subnets: *0*

Figure 1: Amount of packets received per hour



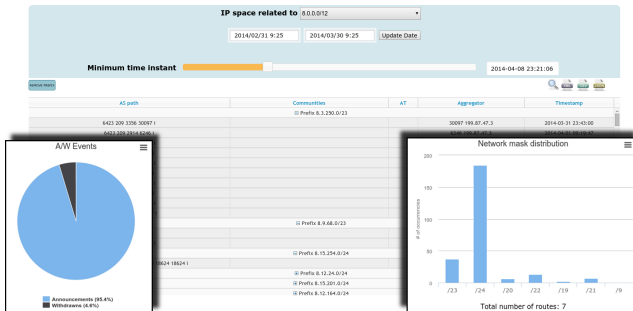
Historic services



Historic services exploit every BGP data available (Route Views, RIPE NCC RIS, Isolario) to show how routes evolved in the past

Applications

- **Routing table viewer:** Allows to analyse portion(s) of the routing table that each feeder announced to Isolario
- **Subnet reachability:** Allows to analyse the reachability of the IP space portions from every feeder available in the past



Summary: how to use Isolario?

Real-time services

Something is happening

How is my RIB(s) evolving?
How is my reachability affected?

Alerting System

Something is happening NOW!

Check real-time services!
Do something! (if needed)

Daily report

Did something happen yesterday?

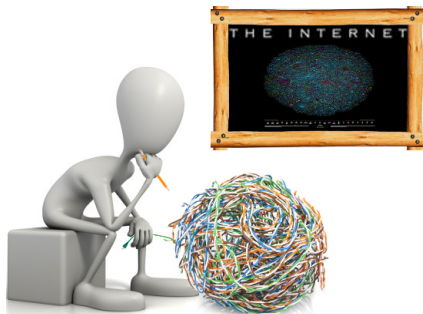
Check historic services!
Do something! (if needed)

Historic services



Something happened

How was my RIB(s) evolving?
How was my reachability affected?



Thank you for your attention



Join us and help us to unveil the Internet AS-level structure!

To participate, contact us at:
info@isolario.it

Thank you for your attention

alessandro.improta@iit.cnr.it



Please, try Isolario services!

Username: *guest*

Password: *guest*

<https://www.isolario.it>