Rcat ::

Root Cause Analysis Tool

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Today's presentation agenda

- Rcat in a nutshell
  - Getting familiar with the tool and its principles
- Case study 1: January Mediterranean Cable Break
  - Getting some confidence in Rcat results
- Case study 2: A tiny not so tiny event
  - Maybe the most interesting feature of Rcat

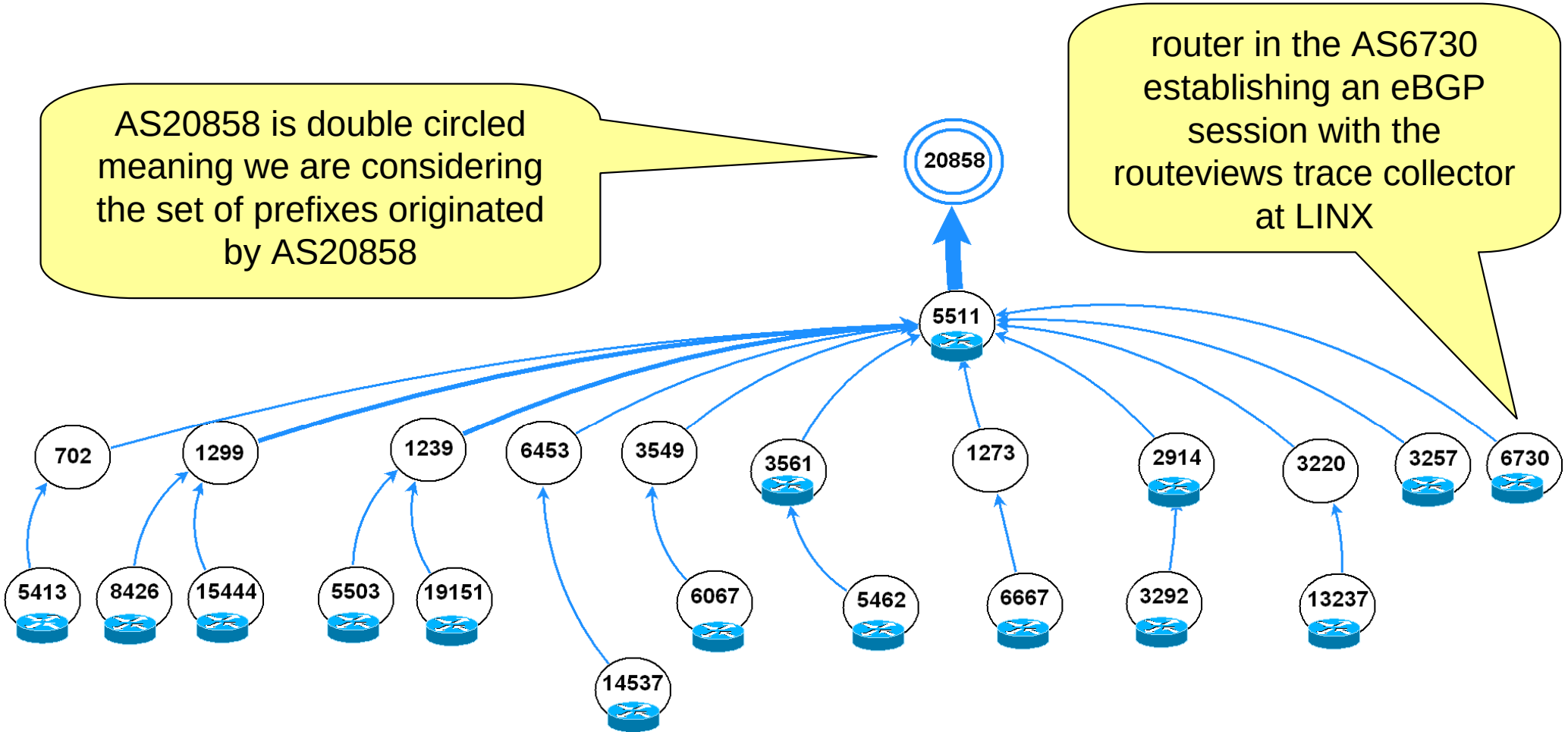
Rcat in a nutshell

Rcat in a nutshell

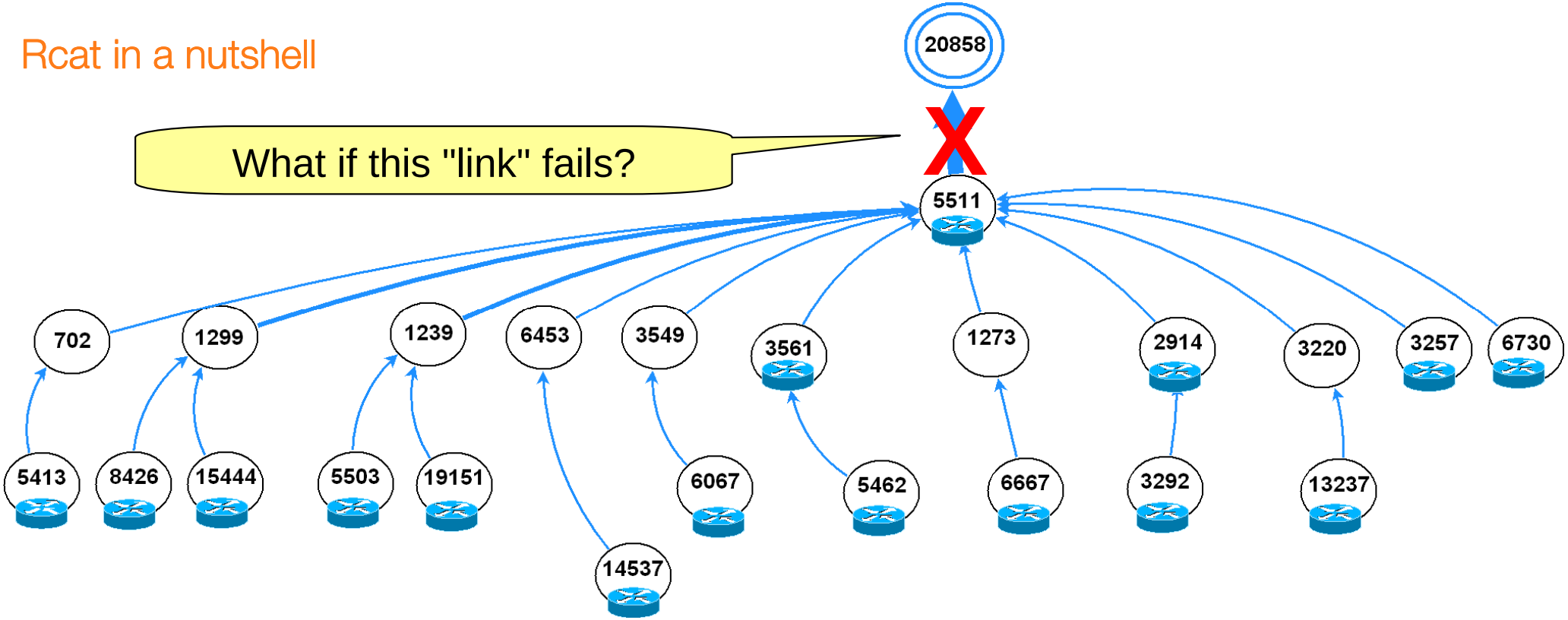
- Rcat is based on the method we presented last year at Nanog40:
  - **Revisiting Interdomain Root Cause Analysis from Multiple Vantage Points**, Anthony Lambert, Mickael Meulle, Jean-Luc Lutton, NANOG-40, June 2007
- As promised Rcat is publicly available at: http://rcat.rd.francetelecom.com/
- Rcat analyzes BGP announcements sent by route-views eBGP peers, so as to determine which ASs are the more likely to have originating the inter domain structure changes which have lead to the emission and spread of the BGP announcements collected.
- Rcat aims at helping NOCs providing them with:
  - an increased reactivity during outages
  - an increased proactivity, detecting small recurrent events for instance

Rcat in a nutshell

- For every router connected to the trace collector, one knows at every moment the AS path it uses to join any prefix.
- Observing the behavior of these paths, it appears that every router has a preferred path to join any prefix *p* over time: The "primary path" to *p*.
- It also appears that most of the time a source router uses the same primary path to join all the prefixes originated by a given AS.

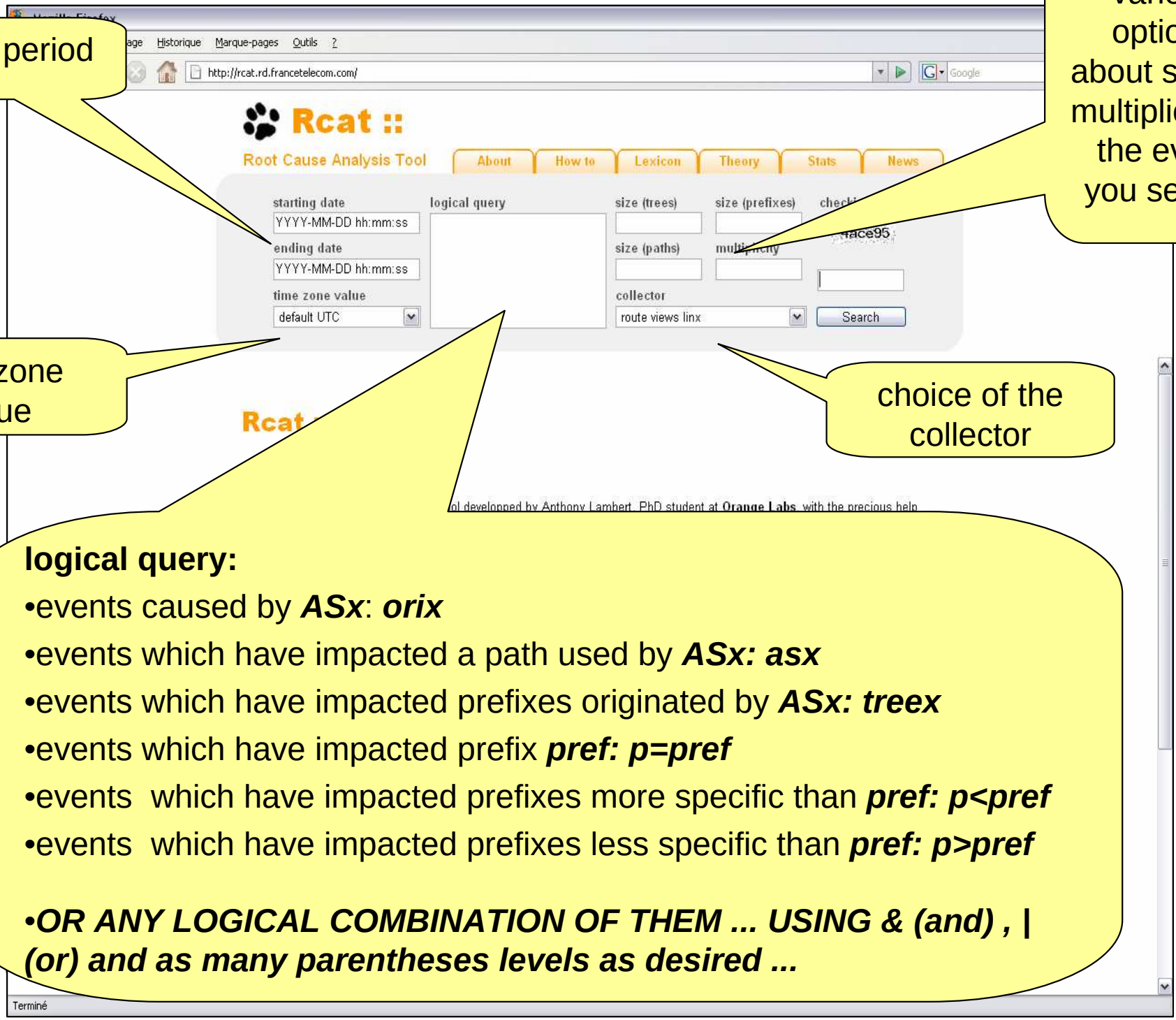


Rcat in a nutshell



- After some time, every router connected to the trace collector should announce a new path to join prefixes originated by AS20858 or at least withdraw its primary path.
- From our point of view, the primary paths used to join these prefixes become unavailable ... or said in another way the origin AS20858 tree is fading.
- Rcat can be seen as a very big state machine that keeps track for every primary path of its state: available or unavailable and correlates primary paths unavailabilities so as to extract the underlying events

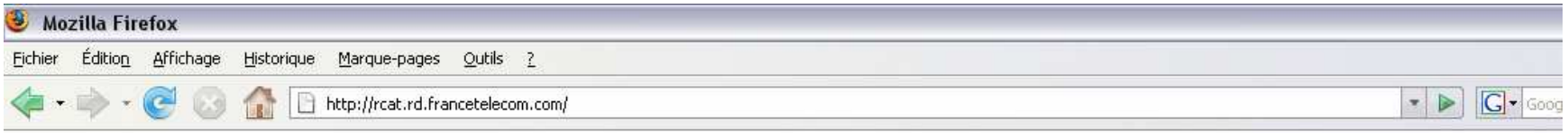
Rcat in a nutshell



logical query:

- events caused by ***ASx***: ***orix***
- events which have impacted a path used by ***ASx: asx***
- events which have impacted prefixes originated by ***ASx: treex***
- events which have impacted prefix ***pref: p=pref***
- events which have impacted prefixes more specific than ***pref: p<pref***
- events which have impacted prefixes less specific than ***pref: p>pref***

- ***OR ANY LOGICAL COMBINATION OF THEM ... USING & (and) , | (or) and as many parentheses levels as desired ...***



Rcat ::

Root Cause Analysis Tool

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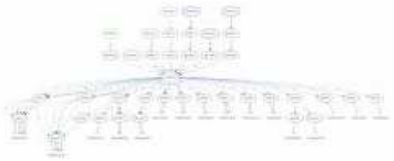
starting date: YYYY-MM-DD hh:mm:ss
ending date: YYYY-MM-DD hh:mm:ss
time zone value: default UTC
logical query
size (trees)
size (prefixes)
size (paths)
multiplicity
collector: route views linx
checking code: 4ace95
4ace95
Search

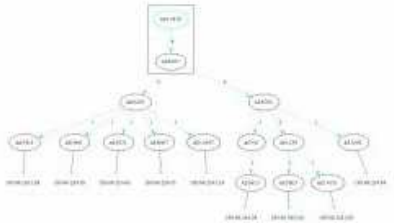


RV_LINX_2008_03_33864 :
size (trees|paths|prefixes) 8 | 35 |56
number of impacted prefixes 14
originators AS3356 - LEVEL3

> 1 occurence
2008-03-12 07:27:44

RV_LINX_2008_03_33865 :
size (trees|paths|prefixes) 70 | 110 |259
number of impacted prefixes 206
originators AS6453 - GLOBEINTERNET

> 1 occurence
2008-03-12 07:28:02



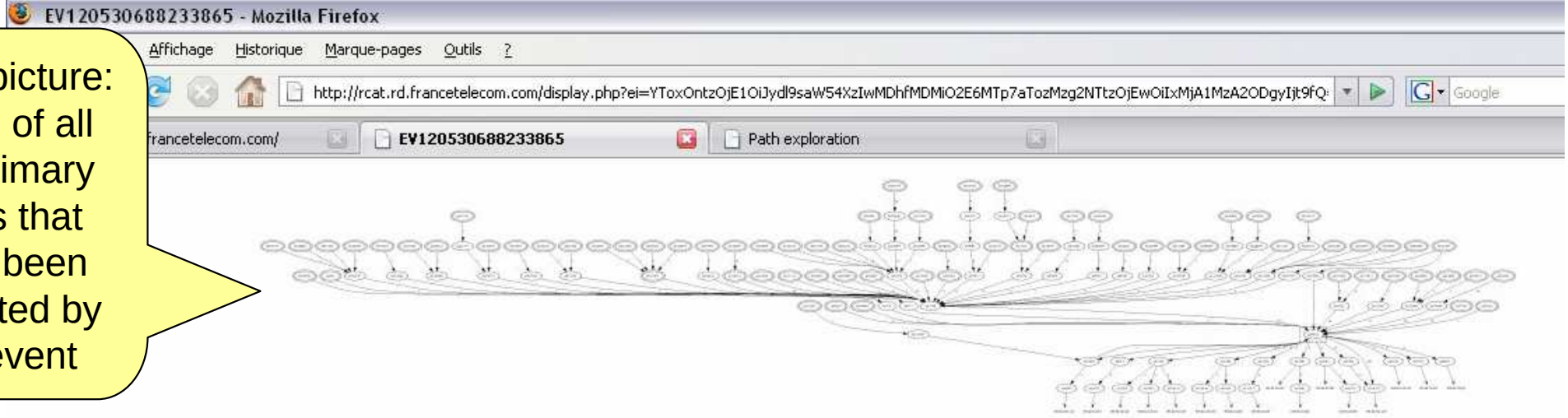
RV_LINX_2008_03_109 :
size (trees|paths|prefixes) 1 | 9 |9
number of impacted prefixes 1
originators AS8167 - TELESC
AS11835 - AS11835

> 95 occurences
2008-03-12 07:28:13
2008-03-12 08:04:34
2008-03-12 08:15:22
2008-03-12 08:23:38
2008-03-12 08:28:08
2008-03-12 08:47:03

For each event satisfying the options set, Rcat displays a thumbnail, basic information and the list of occurrences of this events during the search period

When clicking on the occurrence date you are interested in, Rcat displays the detail for this occurrence

event picture: graph of all the primary paths that have been impacted by the event



information about the size and the multiplicity of the event (number of times the event has occurred in the month)

TIME AT WHICH THE EVENT WAS EXTRACTED	2008-03-12 07:28:02
SIZE OF THE EVENT	
Number of different origin ASs whose paths were impacted	70
Number of different prefixes impacted	206
Number of different paths impacted, no matter the prefixes announced	110
Number of different paths impacted, taking into account the prefixes announced	259
NUMBER OF TIMES THIS EVENT HAS OCCURED IN THE MONTH	1
INFERRED ORIGINATORS	AS6453 - AS6453 **AS6453 - GLOBEINTERNET** VSNL International
IMPACTED ORIGIN ASs	**AS803 - SASKTEL** - SaskTel **AS1657 - LOUISVILLE** - University of Louisville **AS3714 - KEC-NET** - Kentucky Educational Computing Network **AS7545 - TPG-INTERNET-AP** - TPG Internet Pty Ltd **AS8888 - COMTAT-AS** - Comtat Inc. Autonomous System **AS9155 - AS9155** - QualityNet AS number **AS9583 - SIFY-AS-IN** - Sify Limited **AS10437 - UKY** - University of Kentucky, Communication Services **AS11727 - BMTS** - Bruce Municipal Telephone System **AS11853 - ASN-INTERNAP-BLK** - Internap Network Services **AS12210 - CWBANKNET** - Community West Bank **AS14178 - MEGACABLE** - COMUNICACIONES DE MEXICO, S.A. DEC.V. **AS14236 - ADARA-NET** - Adara Networks, Inc. **AS15122 - KVN** - Home Satelite Corporate **AS15140 - HAWKEYECOLLEGE** - Hawkeye Community College

inferred originators of the event

list of all the origin AS trees impacted by the event

Rcat in a nutshell

For each impacted origin AS, Rcat displays the primary paths each router was using to join the different impacted prefixes

Rcat also points out at what time these paths have become unavailable

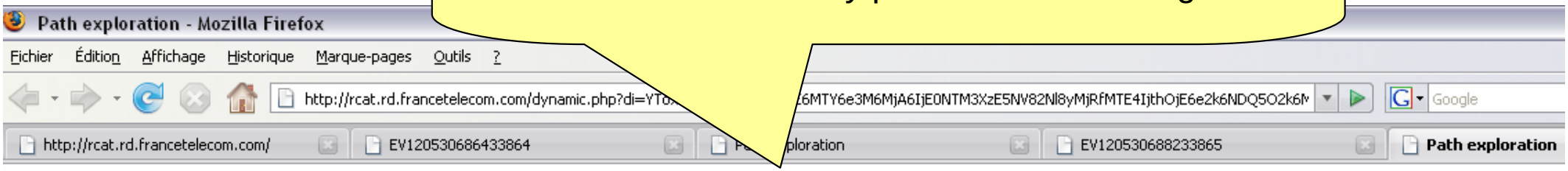
AS7545 - TPG-INTERNET-AP - TPG Internet Pty Ltd (2 prefixes impacted)

PREFIX	SOURCE ROUTER	PROPAGATION PATH	UNAVAILABILITY STARTING DATE
192.190.214.0/24	195.66.224.118	7545-7545-7545-6453-14537	2008-03-12 07:20:42
	195.66.224.64	7545-7545-7545-6453-1239-3292	2008-03-12 07:20:58
	195.66.224.39	7545-7545-7545-6453-3561	2008-03-12 07:20:40
	195.66.224.233	7545-7545-7545-6453-1239-19151	2008-03-12 07:21:31
	195.66.224.83	7545-7545-7545-6453-5511	2008-03-12 07:20:42
	195.66.226.101	7545-7545-7545-6453-1239-5503	2008-03-12 07:21:10
	195.66.224.109	7545-7545-7545-6453-1299-1299-15444	2008-03-12 07:21:03
	195.66.224.32	7545-7545-7545-6453-3257	2008-03-12 07:20:49
	195.66.224.138	7545-7545-7545-6453-2914	2008-03-12 07:20:49
	195.66.226.114	7545-7545-7545-6453-3549-6667	2008-03-12 07:21:20
	195.66.224.99	7545-7545-7545-6453-3320-13237	2008-03-12 07:20:47
	195.66.224.66	7545-7545-7545-6453-1299-8426	2008-03-12 07:21:12
	195.66.226.85	7545-7545-7545-6453-5511-6730	2008-03-12 07:21:20
	195.66.226.35	7545-7545-7545-6453-6067	2008-03-12 07:21:01
	195.66.224.29	7545-7545-7545-6453-701-5413	2008-03-12 07:21:31
	195.66.224.56	7545-7545-7545-6453-3561-5462	2008-03-12 07:21:06
0.209.0/24	195.66.224.118	7545-7545-7545-6453-14537	2008-03-12 07:20:42
	195.66.224.64	7545-7545-7545-6453-1239-3292	2008-03-12 07:20:58
	195.66.224.39	7545-7545-7545-6453-3561	2008-03-12 07:20:40
	195.66.224.233	7545-7545-7545-6453-1239-19151	2008-03-12 07:21:31
	195.66.224.83	7545-7545-7545-6453-5511	2008-03-12 07:20:42
	195.66.226.101	7545-7545-7545-6453-1239-5503	2008-03-12 07:21:10
	195.66.224.109	7545-7545-7545-6453-1299-1299-15444	2008-03-12 07:21:03
	195.66.224.32	7545-7545-7545-6453-3257	2008-03-12 07:20:49
	195.66.224.138	7545-7545-7545-6453-2914	2008-03-12 07:20:49
	195.66.226.114	7545-7545-7545-6453-3549-6667	2008-03-12 07:21:20
	195.66.224.99	7545-7545-7545-6453-3320-13237	2008-03-12 07:20:47
	195.66.224.66	7545-7545-7545-6453-1299-8426	2008-03-12 07:21:12
	195.66.226.85	7545-7545-7545-6453-5511-6730	2008-03-12 07:21:20
	195.66.226.35	7545-7545-7545-6453-6067	2008-03-12 07:21:01
	195.66.224.29	7545-7545-7545-6453-701-5413	2008-03-12 07:21:31
	195.66.224.56	7545-7545-7545-6453-3561-5462	2008-03-12 07:21:06

When clicking on a prefix, Rcat displays the path exploration the routers have undergone during the event

Rcat in a nutshell

For each router connected to the trace collector, one can see the paths it has explored during the event and the unreachability periods it has undergone

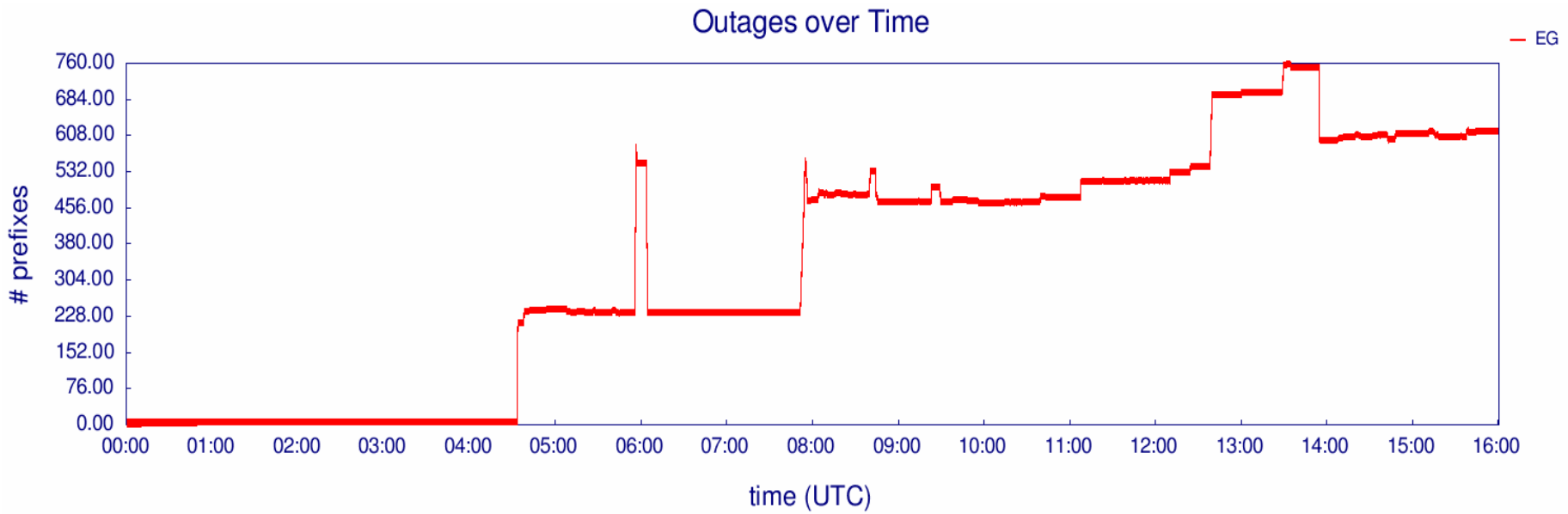


SOURCE ROUTER	PROPAGATION PATH	DATE	PATHS EXPLORED	ANNOUNCEMENT TYPE
195.66.224.118	7545-7545-7545-6453-14537	2008-03-12-07:20:42 2008-03-12-07:20:54 2008-03-12-07:21:36 2008-03-12-07:22:13	7545-7545-7545-6453-1239-5769-14537 7545-7545-7545-6453-701-14537 7545-7545-7545-6453-14537	update update withdrawn update
195.66.224.64	7545-7545-7545-6453-1239-3292	2008-03-12-07:20:58 2008-03-12-07:22:31	7545-7545-7545-6453-3549-3292 7545-7545-7545-6453-1239-3292	update update
195.66.224.39	7545-7545-7545-6453-3561	2008-03-12-07:20:40 2008-03-12-07:22:10	 7545-7545-7545-6453-3561	withdrawn update
195.66.224.233	7545-7545-7545-6453-1239-19151	2008-03-12-07:21:31 2008-03-12-07:23:01 2008-03-12-09:22:43	 7545-7545-7545-6453-1239-19151 7545-7545-7545-6453-1239-19151	withdrawn update update
195.66.224.83	7545-7545-7545-6453-5511	2008-03-12-07:20:42 2008-03-12-07:20:46 2008-03-12-07:21:41 2008-03-12-07:22:11 2008-03-12-07:22:21	 7545-7545-7545-6453-701-5511 7545-7545-7545-6453-5511 7545-7545-7545-6453-5511	withdrawn update withdrawn update update
195.66.226.101	7545-7545-7545-6453-1239-5503	2008-03-12-07:21:10 2008-03-12-07:22:11 2008-03-12-07:22:43 2008-03-12-07:23:13 2008-03-12-08:47:42 2008-03-12-08:48:12	 7545-7545-7545-6453-2914-5503 7545-7545-7545-6453-1239-5503 7545-7545-7545-6453-1239-5503 7545-7545-7545-6453-1239-5503 7545-7545-7545-6453-1239-5503	withdrawn update update update update update
195.66.224.109	7545-7545-7545-6453-1299-1299-15444	2008-03-12-07:21:03 2008-03-12-07:21:34 2008-03-12-07:23:04	7545-7545-7545-6453-3549-3549-15444 7545-7545-7545-6453-1299-1299-15444	update withdrawn update
195.66.224.33	7545-7545-7545-6453-3257	2008-03-12-07:20:49 2008-03-12-07:22:12	 7545-7545-7545-6453-3257	withdrawn update

Case study 1: January Mediterranean Cable Break

Case study 1: January Mediterranean Cable Break

- The cable break was very well documented by Renesys on their blog at:
  - http://www.renesys.com/blog/2008/01/mediterranean_cable_break.shtml



Outages over time for Egypt (Renesys sources)

Focusing on Egypt, one of the harder-hit countries, here is the challenge:

- "Redrawing" Renesys' unreachability curve using Rcat results
- Explaining the different peaks in the curve

Case study 1: January Mediterranean Cable Break

- According to Renesys and some other data sources, here are the Egyptian providers and their upstream providers:

Egyptian providers	LINKdotNET	TEDATA	EgyNet	Internet Egypt	Nile Online
ASN	24863	8452	20858	5536	15475
Upstream providers	FLAG UUNET	FLAG SEABONE UUNET	Internet Egypt OPENTRANSIT TEDATA	RAYA-AS TEDATA	RAYA-AS FLAG TEDATA
ASN	15412 701	15412 6762 701	5536 5511 8452	24835 8452	24835 15412 8452

- A cable breakdown can be seen as a multiple "link failures" between the ASs that peer through transmission link supported by the cable.
- Under our formalism, the cable breakdown should correspond to many origin ASs trees fading.
- We should then obtain in Rcat different events originated either by the regional providers, or their providers

Case study 1: January Mediterranean Cable Break

- More precisely we should observe events either caused by the Egyptian providers or caused by one their upstream providers and which have impacted the prefixes the Egyptian providers originate.

- For instance, for Nile Online the corresponding logical query is:

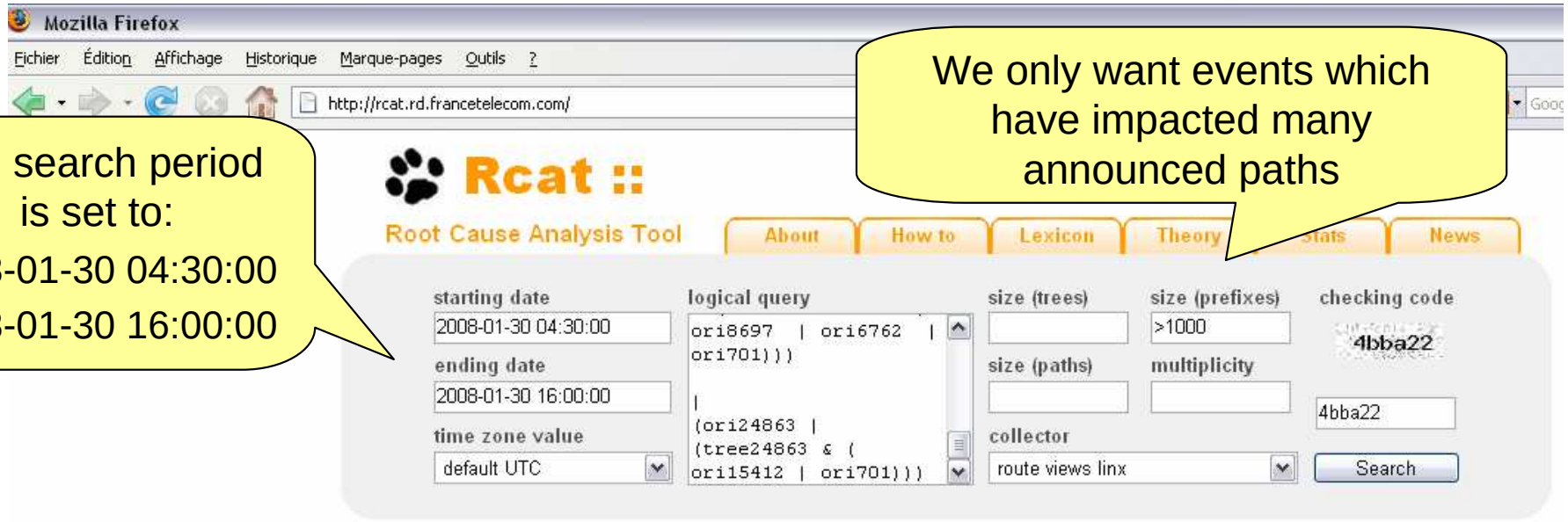
```
ori15475  |  (tree15475 & (ori15412 | ori24835 | ori8452))
```

events caused by Nile Online

events caused by a provider of Nile Online and impacting the prefixes Nile Online orignates

- The final Rcat logical query to get all the Egyptian events is therefore:

```
(ori15475 | (tree15475 & (ori15412 | ori24835 | ori8452)))
                                    |
        (ori5536 | (tree5536 & (ori24835 | ori8452)))
                                    |
    (ori20858 | (tree20858 & (ori5536 | ori5511 | ori8452)))
                                    |
(ori8452 | (tree8452 & (ori15412 | ori8697 | ori6762 | ori701)))
                                    |
        (ori24863 | (tree24863 & (ori15412 | ori701)))
```



The search period is set to:

2008-01-30 04:30:00

2008-01-30 16:00:00

We only want events which have impacted many announced paths

> 6 events found for a total of 6 occurences between 2008-01-30 04:30:00 and 2008-01-30 16:00:00

1

RV_LINX_2008_01_18643 :

size (trees|paths|prefixes)	7 | 109 |4084
number of impacted prefixes	269
originators	AS5511 - OPENTRANSIT AS20858 - EGYNET-AS

> 1 occurence

RV_LINX_2008_01_18685 :

size (trees|paths|prefixes)	194 | 539 |3504
number of impacted prefixes	1390
originators	AS6762 - SEABONE-NET

> 1 occurence

Rcat has found 6 events satisfying the previous logical query

Case study 1: January Mediterranean Cable Break

RV_LINX_2008_01_18643 :

size (trees|paths|prefixes)	7 | 109 |4084
number of impacted prefixes	269
originators	AS5511 - OPENTRANSIT AS20858 - EGYNET-AS

> 1 occurence

2008-01-30 04:38:47

Date of the occurence is near the first peak

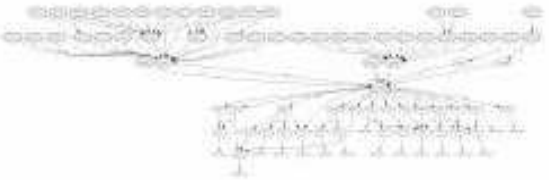
RV_LINX_2008_01_18685 :

size (trees|paths|prefixes)	194 | 539 |3504
number of impacted prefixes	1390
originators	AS6762 - SEABONE-NET

> 1 occurence

2008-01-30 04:49:13

Date of the occurence is near the first peak



RV_LINX_2008_01_18952 :

size (trees|paths|prefixes)	42 | 598 |5538
number of impacted prefixes	459
originators	AS6762 - SEABONE-NET

> 1 occurence

2008-01-30 06:01:21

Date of the occurence is near the second peak

Case study 1: January Mediterranean Cable Break

RV_LINX_2008_01_19541 :

size (trees|paths|prefixes) 73 | 789 |2964

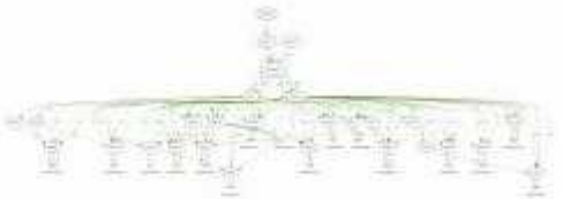
number of impacted prefixes 275

originators AS15412 - FLAG-AS

> 1 occurence

2008-01-30 07:57:49

Date of the occurence is near the third peak



RV_LINX_2008_01_19575 :

size (trees|paths|prefixes) 4 | 67 |3247

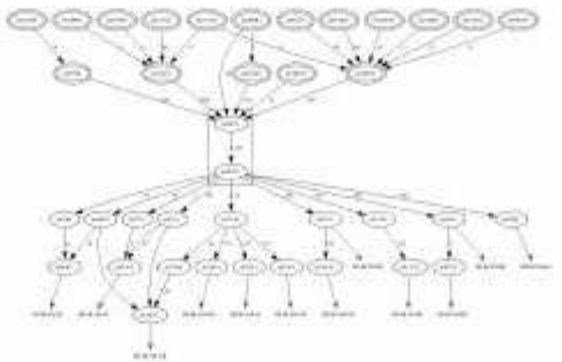
number of impacted prefixes 361

originators AS24863 - AS24863

> 1 occurence

2008-01-30 08:04:37

Date of the occurence is near the third peak



RV_LINX_2008_01_20370 :

size (trees|paths|prefixes) 17 | 182 |1214

number of impacted prefixes 152

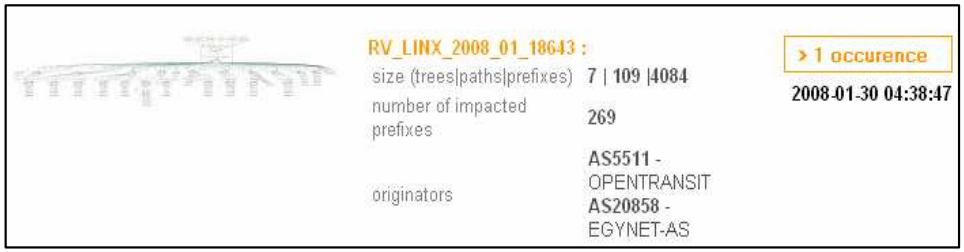
originators AS6762 - SEABONE-NET
AS8452 - TEDATA

> 1 occurence

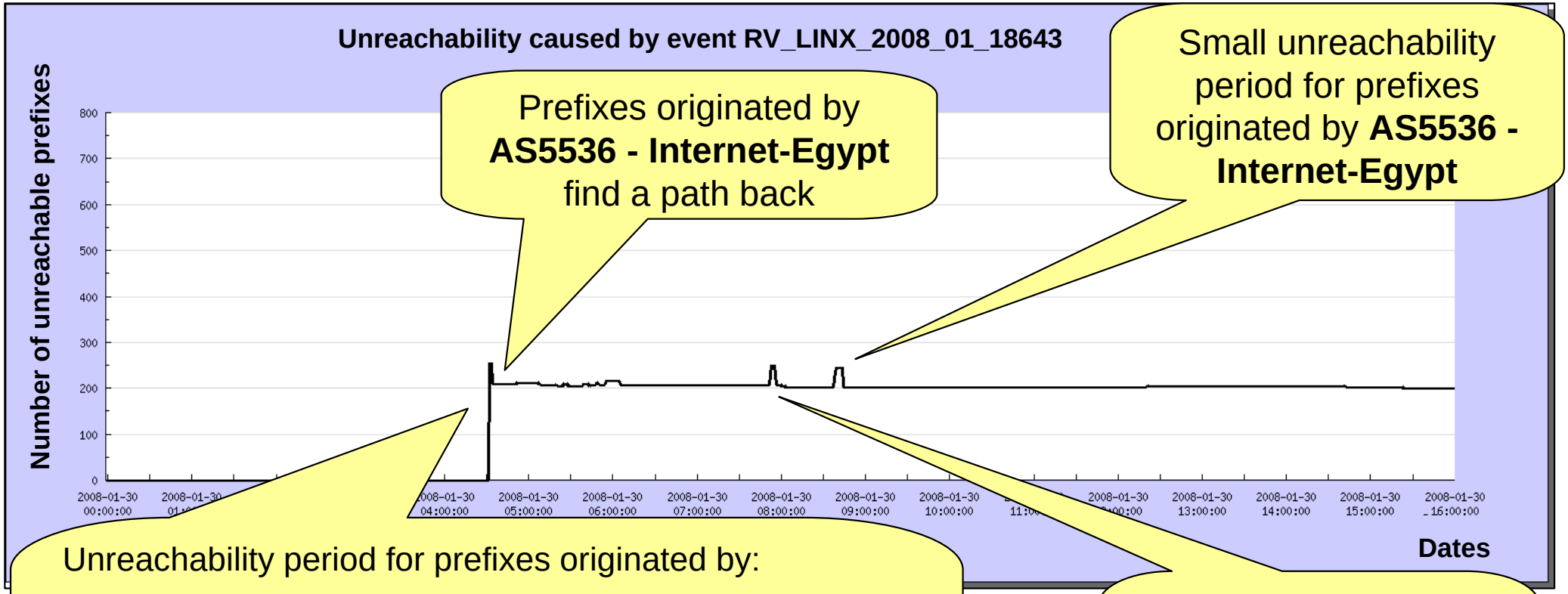
2008-01-30 12:24:55

Date of the occurence is near the fourth peak

Case study 1: January Mediterranean Cable Break



Using Rcat details about this event (impacted prefixes for each origin AS, path exploration for each impacted prefix), we can draw the corresponding unreachability curve and give explanations about it:



Prefixes originated by **AS5536 - Internet-Egypt** find a path back

Small unreachability period for prefixes originated by **AS5536 - Internet-Egypt**

Unreachability period for prefixes originated by:

AS20858 - EGYNET (174 prefixes impacted)

AS5536 - Internet-Egypt (52 prefixes impacted)

AS21152 - SOFICOM (32 prefixes impacted)

AS31619 - CITYSTARS (3 prefixes impacted)

AS25576 - AFMIC (1 prefix impacted)

Small unreachability period for prefixes originated by **AS5536 - Internet-Egypt**

Case study 1: January Mediterranean Cable Break

RV_LINX_2008_01_18685 :

size (trees|paths|prefixes)	194 | 539 |3504
number of impacted prefixes	1390
originators	AS6762 - SEABONE-NET

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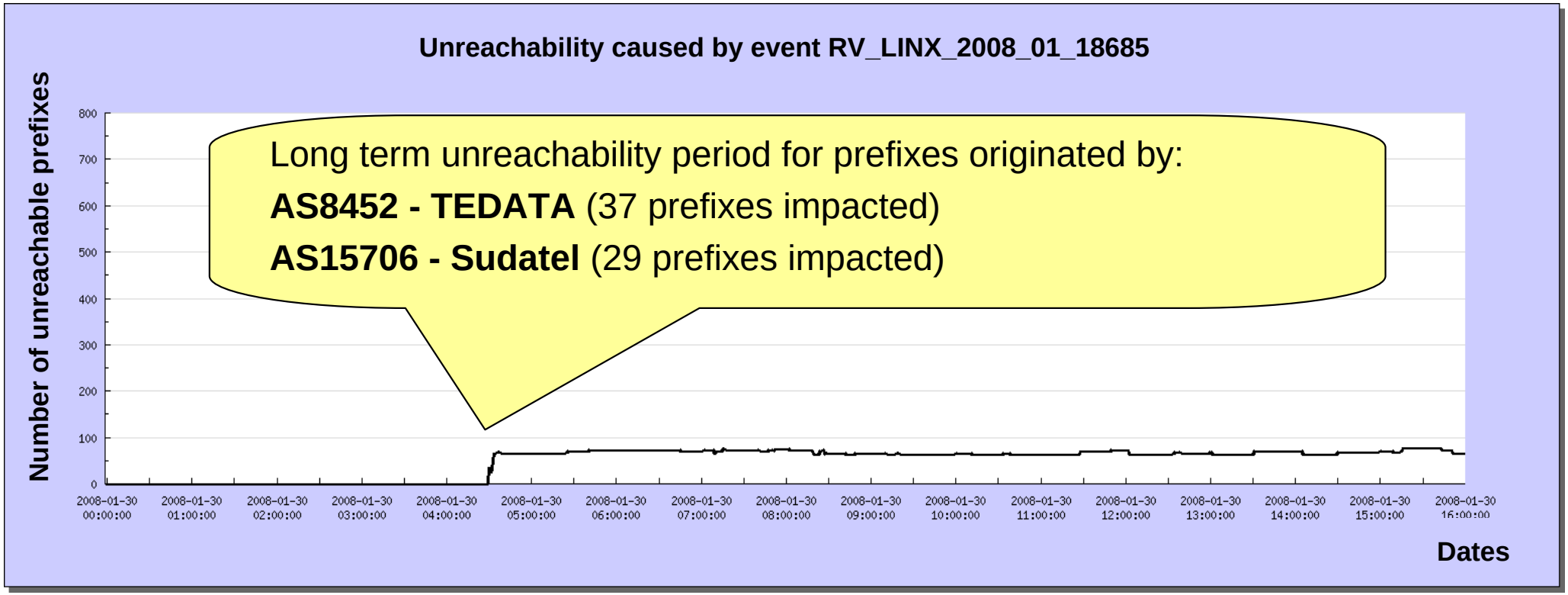
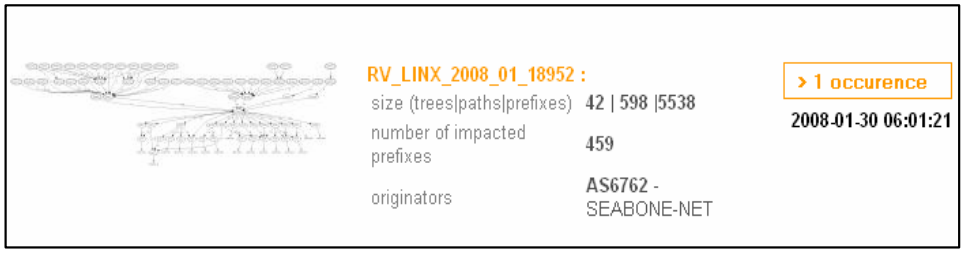


Case study 1: January Mediterranean Cable Break



Using Rcat details about this event (impacted prefixes for each origin AS, path exploration for each impacted prefix), we can draw the corresponding unreachability curve and give explanations about it:

Small unreachability period for prefixes originated by:

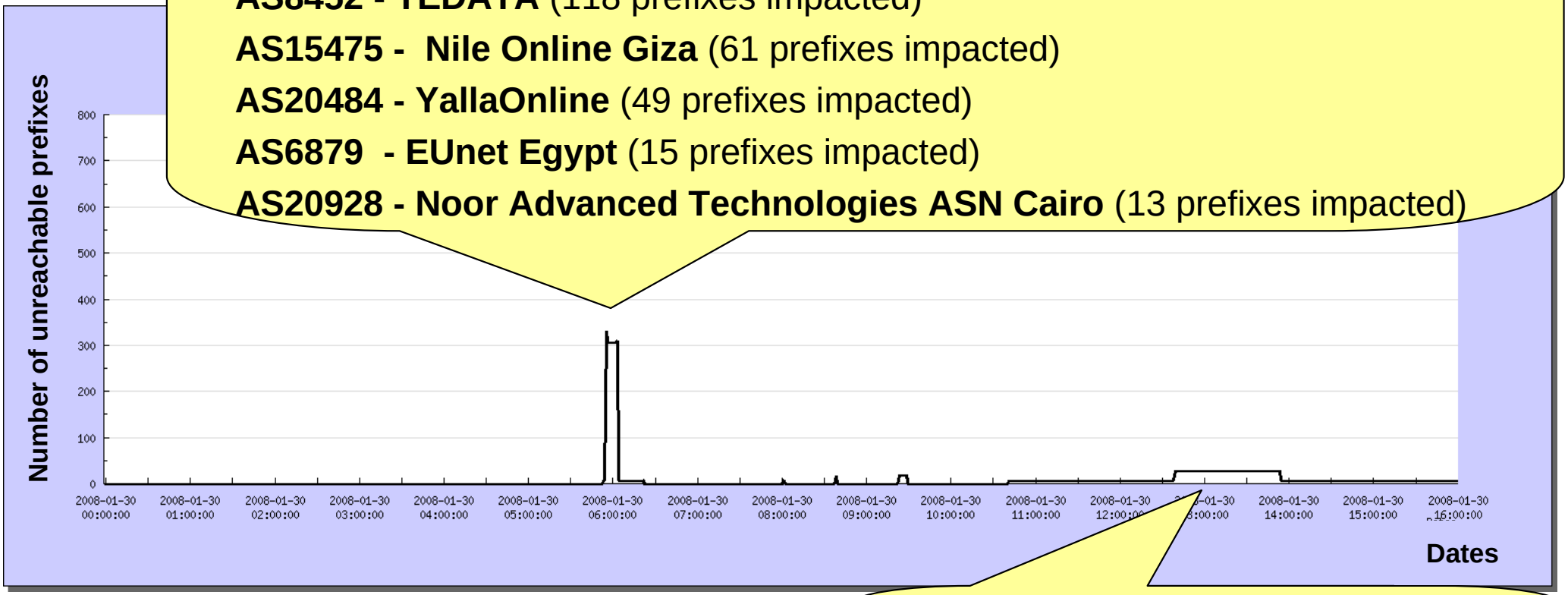
AS8452 - TEDATA (118 prefixes impacted)

AS15475 - Nile Online Giza (61 prefixes impacted)

AS20484 - YallaOnline (49 prefixes impacted)

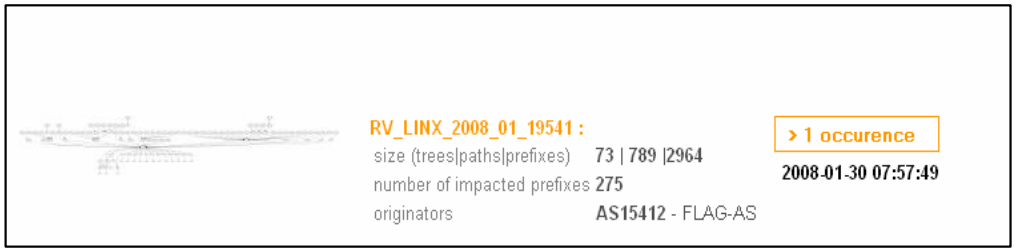
AS6879 - EUnet Egypt (15 prefixes impacted)

AS20928 - Noor Advanced Technologies ASN Cairo (13 prefixes impacted)

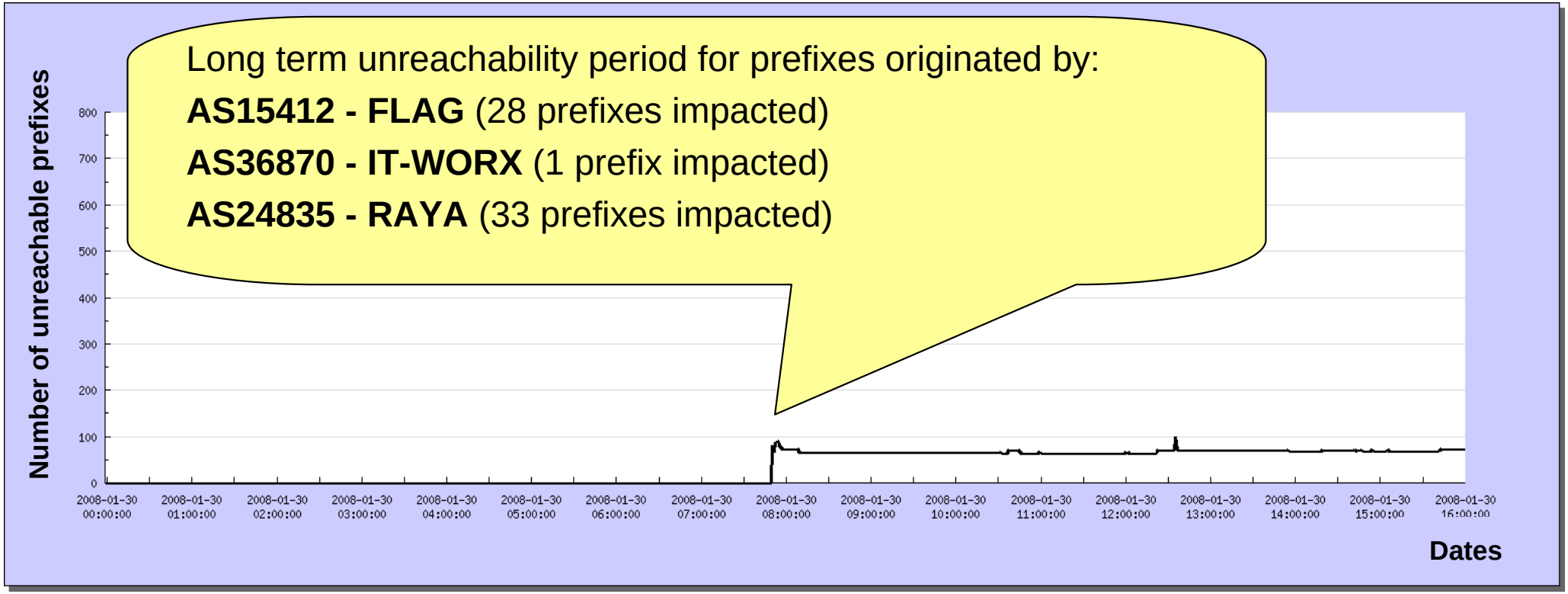


Another unreachability period for some prefixes originated by **AS15475 - NOL**

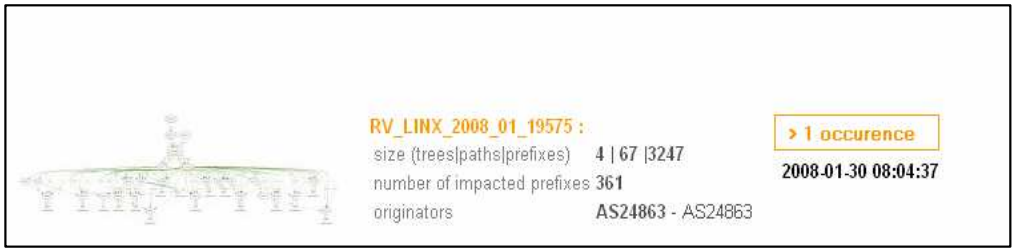
Case study 1: January Mediterranean Cable Break



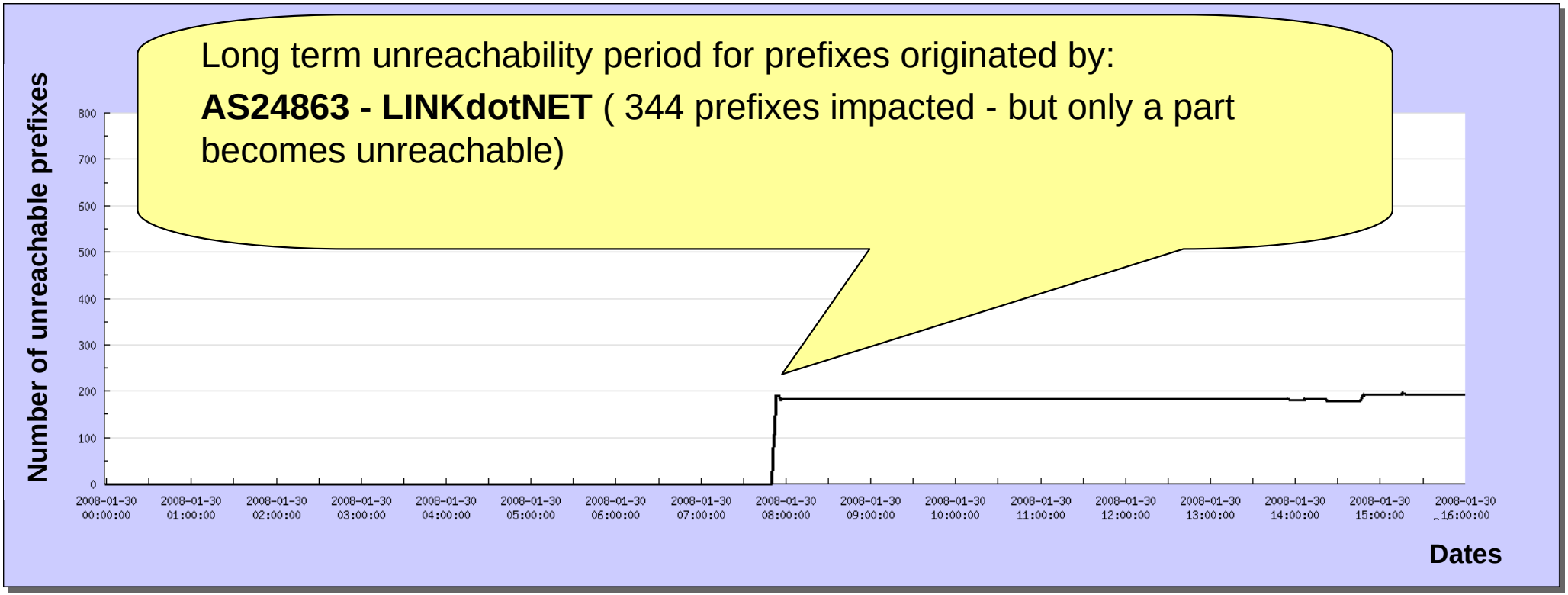
Using Rcat details about this event (impacted prefixes for each origin AS, path exploration for each impacted prefix), we can draw the corresponding unreachability curve and give explanations about it:



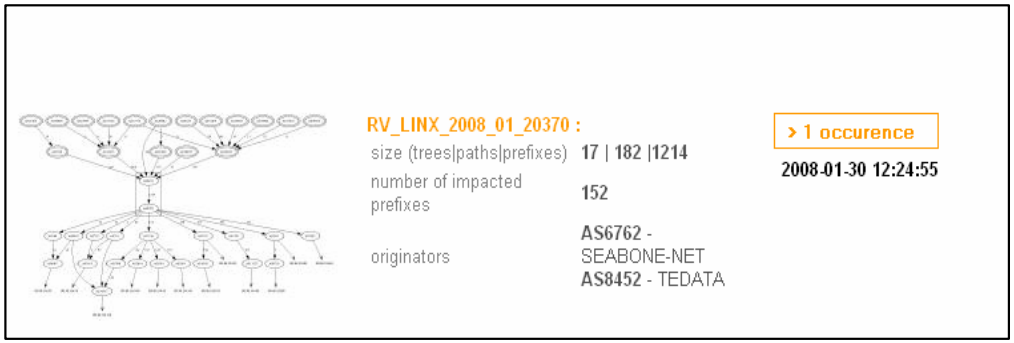
Case study 1: January Mediterranean Cable Break



Using Rcat details about this event (impacted prefixes for each origin AS, path exploration for each impacted prefix), we can draw the corresponding unreachability curve and give explanations about it:



Case study 1: January Mediterranean Cable Break



Using Rcat details about this event (impacted prefixes for each origin AS, path exploration for each impacted prefix), we can draw the corresponding unreachability curve and give explanations about it:

Unreachability period for prefixes originated by:

AS15475 - Nile Online Giza (61 prefixes impacted)

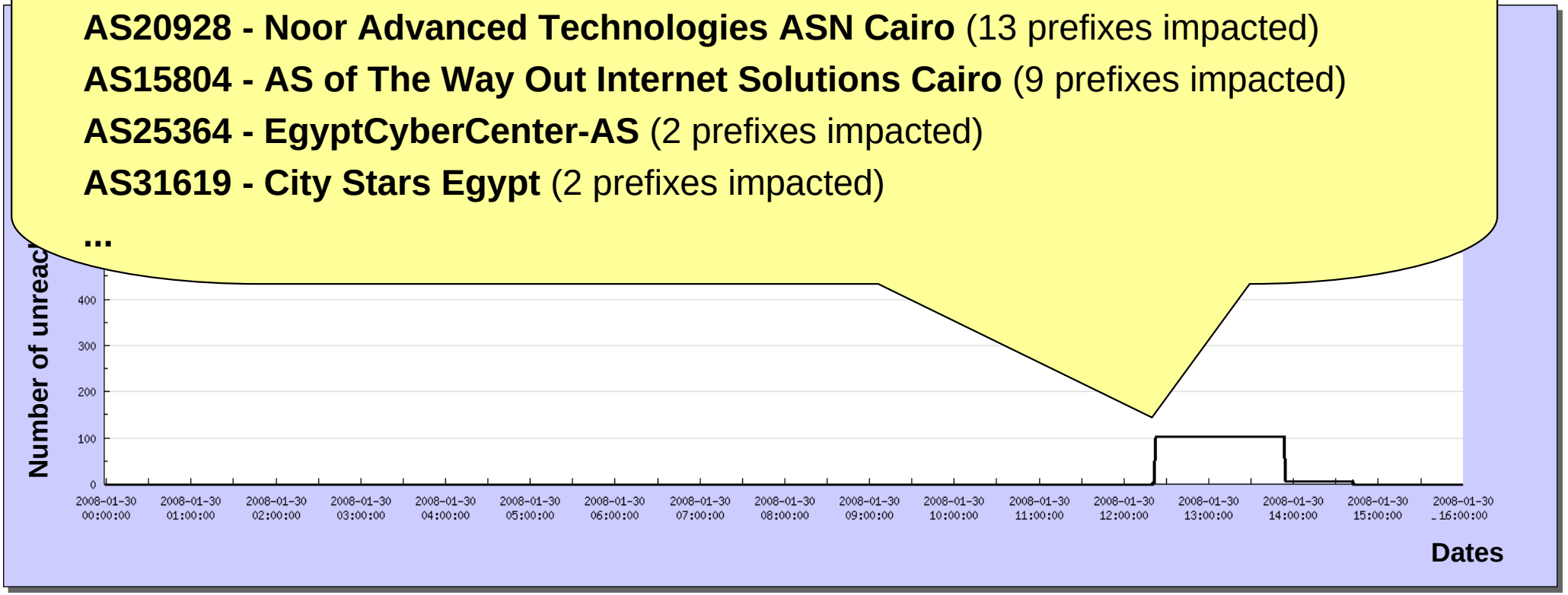
AS20928 - Noor Advanced Technologies ASN Cairo (13 prefixes impacted)

AS15804 - AS of The Way Out Internet Solutions Cairo (9 prefixes impacted)

AS25364 - EgyptCyberCenter-AS (2 prefixes impacted)

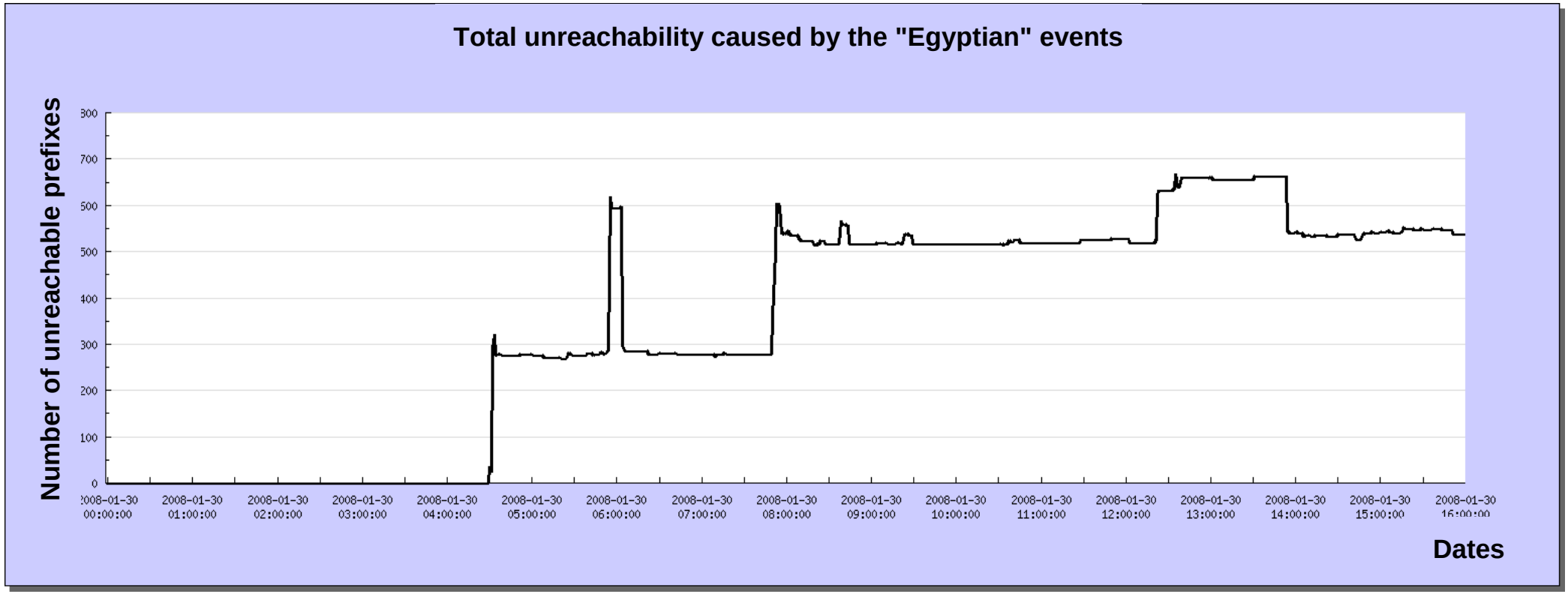
AS31619 - City Stars Egypt (2 prefixes impacted)

...



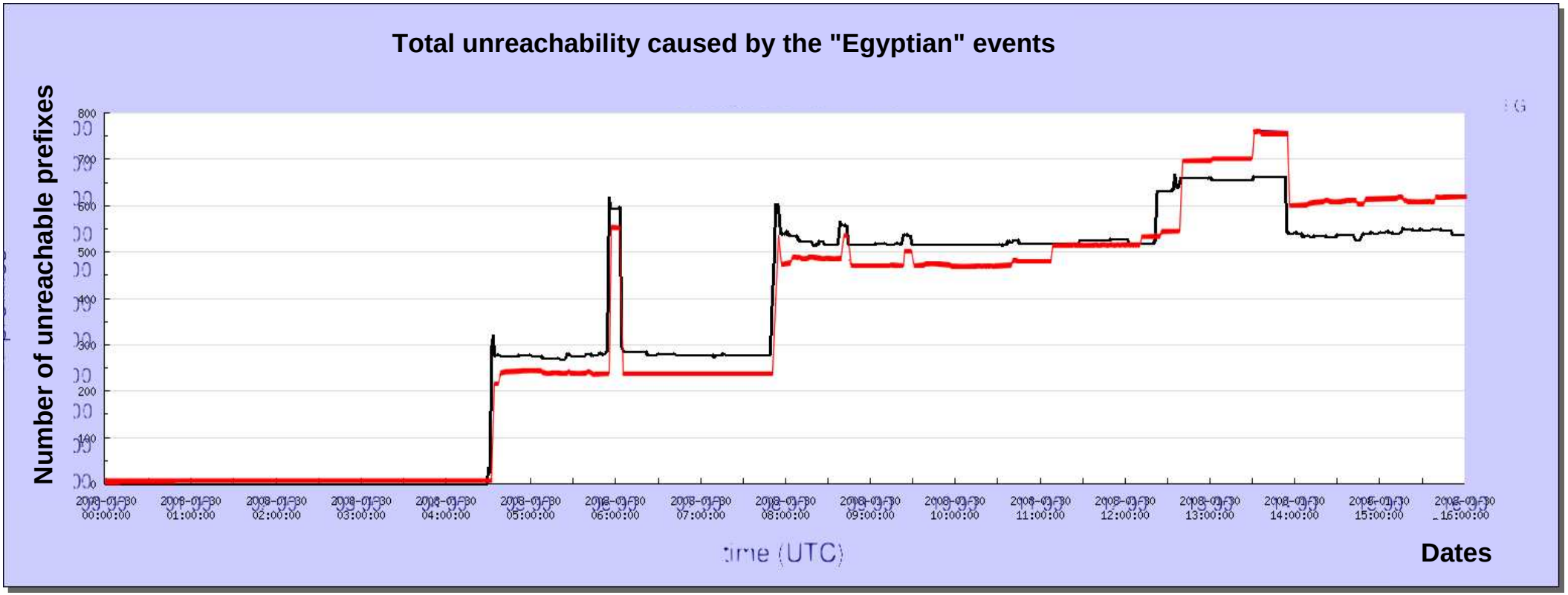
Case study 1: January Mediterranean Cable Break

- So plotting the total unreachability caused by these events, we get:

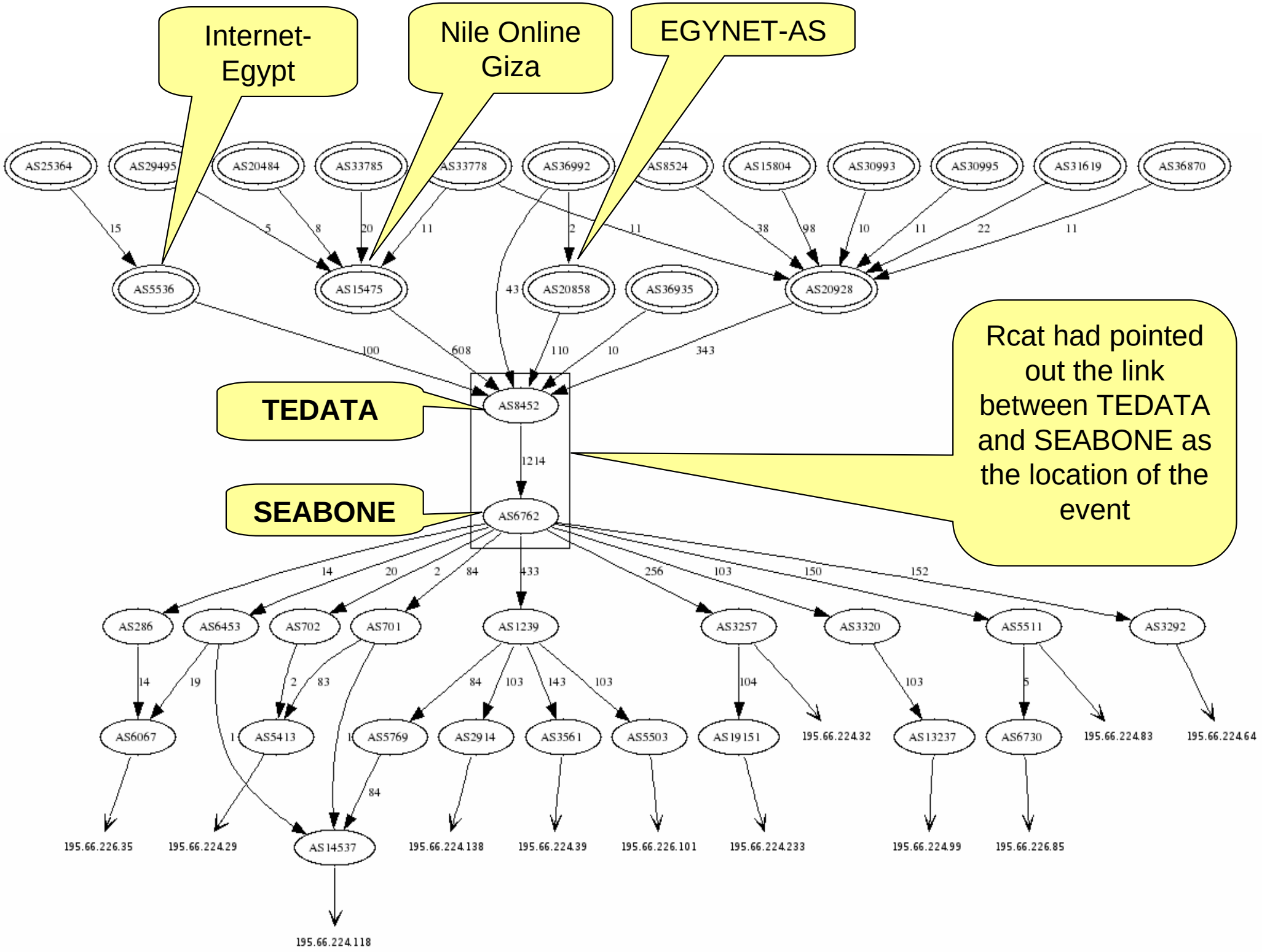


Case study 1: January Mediterranean Cable Break

- If we compare with results presented by Renesys we obtain:

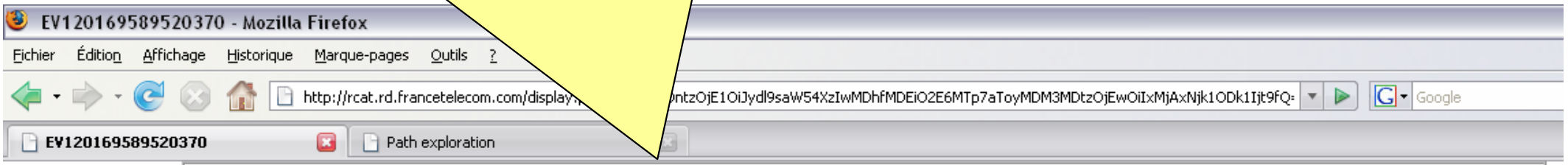


- So, we indeed succeeded in rebuilding Renesys' curve using Rcat results, explaining what the different peaks were corresponding to.
- Now, let's see the details Rcat provides for the last event (for instance).


Internet-Egypt
Nile Online Giza
EGYNET-AS
AS25364
AS29495
AS20484
AS33785
AS33778
AS36992
AS8524
AS15804
AS30993
AS30995
AS31619
AS36870
15
5
8
20
11
2
11
38
98
10
11
22
11
AS5536
AS15475
43
AS20858
AS36935
AS20928
100
608
110
10
343
TEDATA
AS8452
1214
SEABONE
AS6762
Rcat had pointed out the link between TEDATA and SEABONE as the location of the event
14
20
2
84
433
256
103
150
152
AS286
AS6453
AS702
AS701
AS1239
AS3257
AS3320
AS5511
AS3292
14
19
2
83
84
103
143
103
104
103
5
AS6067
AS5413
AS5769
AS2914
AS3561
AS5503
AS19151
195.66.224.32
AS13237
AS6730
195.66.224.83
195.66.224.64
84
195.66.226.35
195.66.224.29
AS14537
195.66.224.138
195.66.224.39
195.66.226.101
195.66.224.233
195.66.224.99
195.66.226.85
195.66.224.118

Impact of the event for the Nile Online Giza's prefixes

For every prefix, Rcat displays all the impacted primary paths and specifies when they became unavailable

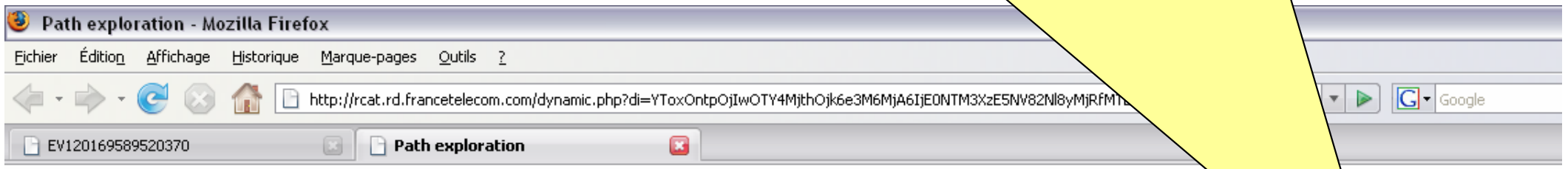


AS15475 - NOL - Nile Online Giza (61 prefixes impacted)

PREFIX	SOURCE ROUTER	PROPAGATION PATH	UNAVAILABILITY STARTING DATE
217.53.0.0/16	195.66.224.118	15475-15475-15475-15475-15475-15475-8452-6762-701-14537	2008-01-30 12:23:28
	195.66.224.64	15475-15475-15475-15475-15475-15475-8452-6762-3292	2008-01-30 12:23:20
	195.66.224.39	15475-15475-15475-15475-15475-15475-8452-6762-1239-3561	2008-01-30 12:23:27
	195.66.224.233	15475-15475-15475-15475-15475-15475-8452-6762-3257-19151	2008-01-30 12:23:16
	195.66.224.83	15475-15475-15475-15475-15475-15475-8452-6762-5511	2008-01-30 12:22:58
	195.66.226.101	15475-15475-15475-15475-15475-15475-8452-6762-1239-5503	2008-01-30 12:23:46
	195.66.224.32	15475-15475-15475-15475-15475-15475-8452-6762-3257	2008-01-30 12:22:51
	195.66.224.138	15475-15475-15475-15475-15475-15475-8452-6762-1239-2914	2008-01-30 12:23:46
	195.66.224.99	15475-15475-15475-15475-15475-15475-8452-6762-3320-13237	2008-01-30 12:22:45
	195.66.226.35	15475-15475-15475-15475-15475-15475-8452-6762-286-6067	2008-01-30 12:23:15
	195.66.224.29	15475-15475-15475-15475-15475-15475-8452-6762-701-5413	2008-01-30 12:23:30
217.54.192.0/18	195.66.224.118	15475-8452-6762-1239-5769-14537	2008-01-30 12:23:36
	195.66.224.64	15475-8452-6762-3292	2008-01-30 12:23:20
	195.66.224.39	15475-8452-6762-1239-3561	2008-01-30 12:23:27
	195.66.224.233	15475-8452-6762-3257-19151	2008-01-30 12:23:16
	195.66.224.83	15475-8452-6762-5511	2008-01-30 12:22:58
	195.66.226.101	15475-8452-6762-1239-5503	2008-01-30 12:23:46
	195.66.224.32	15475-8452-6762-3257	2008-01-30 12:22:51
	195.66.224.138	15475-8452-6762-1239-2914	2008-01-30 12:23:46
	195.66.224.99	15475-8452-6762-3320-13237	2008-01-30 12:22:45
217.54.160.0/20	195.66.224.118	15475-8452-6762-1239-5769-14537	2008-01-30 12:23:36
	195.66.224.64	15475-8452-6762-3292	2008-01-30 12:23:20
	195.66.224.39	15475-8452-6762-1239-3561	2008-01-30 12:23:27
	195.66.224.233	15475-8452-6762-3257-19151	2008-01-30 12:23:16
	195.66.224.83	15475-8452-6762-5511	2008-01-30 12:22:58
	195.66.226.101	15475-8452-6762-1239-5503	2008-01-30 12:23:46
	195.66.224.32	15475-8452-6762-3257	2008-01-30 12:22:51
	195.66.224.138	15475-8452-6762-1239-2914	2008-01-30 12:23:46

Clicking on a prefix we see the path exploration undergone by the routers

Pointing out the unreachability period

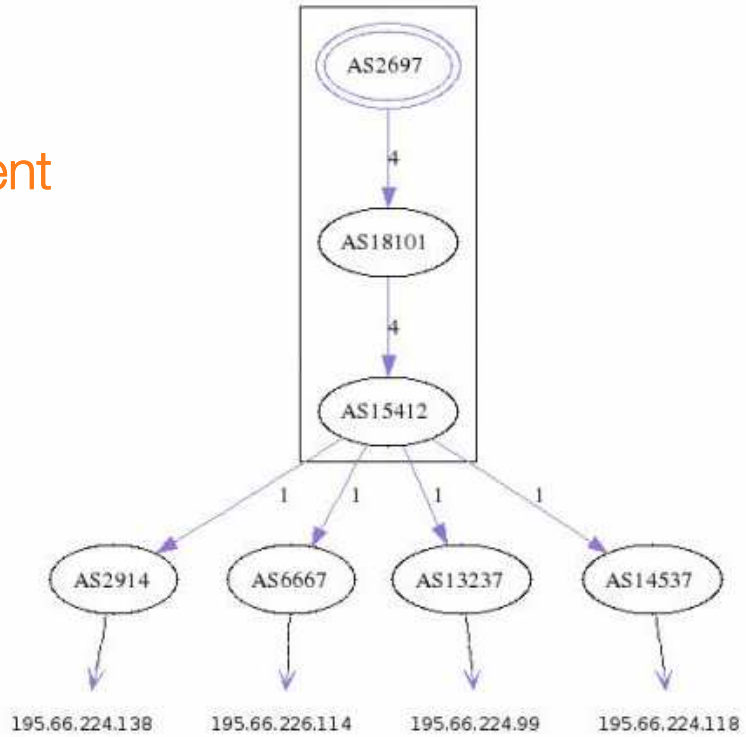


SOURCE ROUTER	PROPAGATION PATH	DATE	PATHS EXPLORED	ANNOUNCEMENT TYPE
195.66.224.118	15475-8452-6762-1239-5769-14537	2008-01-30-12:23:36 2008-01-30-12:24:07 2008-01-30-12:39:07 2008-01-30-13:54:44	15475-8452-6762-1239-3561-5769-1453 15475-8452-6762-3356-14537 15475-8452-6762-1239-5769-14537	update update withdrawn update
195.66.224.64	15475-8452-6762-3292	2008-01-30-12:23:20 2008-01-30-12:39:27 2008-01-30-13:55:00 2008-01-30-16:15:56 2008-01-30-16:16:26	15475-8452-6762-3549-3292 15475-8452-6762-3292 15475-8452-6762-3292 15475-8452-6762-3292	update withdrawn update update update
195.66.224.39	15475-8452-6762-1239-3561	2008-01-30-12:23:27 2008-01-30-13:54:36 2008-01-30-13:54:47 2008-01-30-13:55:17	 15475-8452-6762-1239-3561 15475-8452-6762-1239-3561 15475-8452-6762-1239-3561	withdrawn update update update
195.66.224.233	15475-8452-6762-3257-19151	2008-01-30-12:23:16 2008-01-30-13:54:52 2008-01-30-16:15:18 2008-01-30-16:15:49 2008-01-31-09:39:55	 15475-8452-6762-3257-19151 15475-8452-6762-3257-19151 15475-8452-6762-3257-19151 15475-8452-6762-3257-19151	withdrawn update update update update
195.66.224.83	15475-8452-6762-5511	2008-01-30-12:22:58 2008-01-30-12:23:13 2008-01-30-12:23:32 2008-01-30-12:24:35 2008-01-30-13:54:35 2008-01-30-13:54:48 2008-01-30-16:15:21	15475-8452-6762-1239-5511 15475-8452-6762-1239-701-5511 15475-8452-6762-5511 15475-8452-6762-5511 15475-8452-6762-5511	update withdrawn update withdrawn update update update

Case study 2:
A tiny not so tiny event

Case study 2:

a tiny not so tiny event



TIME AT WHICH THE EVENT WAS EXTRACTED	2008-02-07 22:33:49
SIZE OF THE EVENT	
Number of different origin ASs whose paths were impacted	1
Number of different prefixes impacted	1
Number of different paths impacted, no matter the prefixes announced	4
Number of different paths impacted, taking into account the prefixes announced	4
NUMBER OF TIMES THIS EVENT HAS OCCURED IN THE MONTH	CENSORED
INFERRED ORIGINATORS	AS2697 - AS18101 AS15412 - AS18101 **AS2697** - **ERX-ERNET-AS** Education and Research Network **AS18101** - **RIL-IDC** Reliance Infocom Ltd Internet Data Centre, **AS15412** - **FLAG-AS** Flag Telecom Global Internet AS
IMPACTED ORIGIN ASs	**AS2697** - **ERX-ERNET-AS** - Education and Research Network

A small event at first sight:

just one prefix impacted ...

just 4 routers loosing their primary paths ...

Case study 2: a tiny not so tiny event

SOURCE ROUTER	PROPAGATION PATH	DATE	PATHS EXPLORED	ANNOUNCEMENT TYPE
195.66.224.118	2697-18101-15412-14537	2008-02-07-22:33:13 2008-02-07-22:33:13 2008-02-07-22:33:13 2008-02-07-22:33:37	2697-18101-15412-2914-701-14537 2697-18101-15412-2914-6453-5769-14537 2697-18101-15412-6461-14537 2697-18101-15412-14537	update update update update
195.66.224.138	2697-18101-15412-2914	2008-02-07-22:33:14 2008-02-07-22:33:16	2697-18101-15412-2914	withdrawn update
195.66.226.114	2697-18101-15412-6667	2008-02-07-22:33:14 2008-02-07-22:33:14 2008-02-07-22:33:15	2697-18101-15412-2914-3549-6667 2697-18101-15412-6667	withdrawn update update
195.66.224.99	2697-18101-15412-13237	2008-02-07-22:33:13 2008-02-07-22:33:13 2008-02-07-22:33:15	2697-18101-15412-2914-3549-13237 2697-18101-15412-13237	withdrawn update update

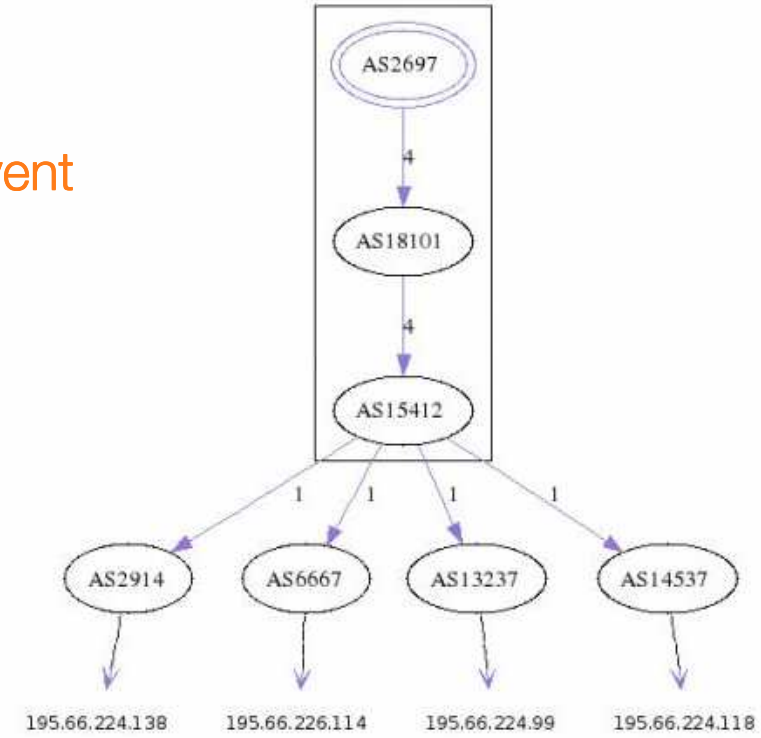
Fast reconvergence: the event lasts from 1 to 24 second depending on the router observed

Neglectable unreachability: at most 2 seconds

Yes, but ...

Case study 2:

a tiny not so tiny event

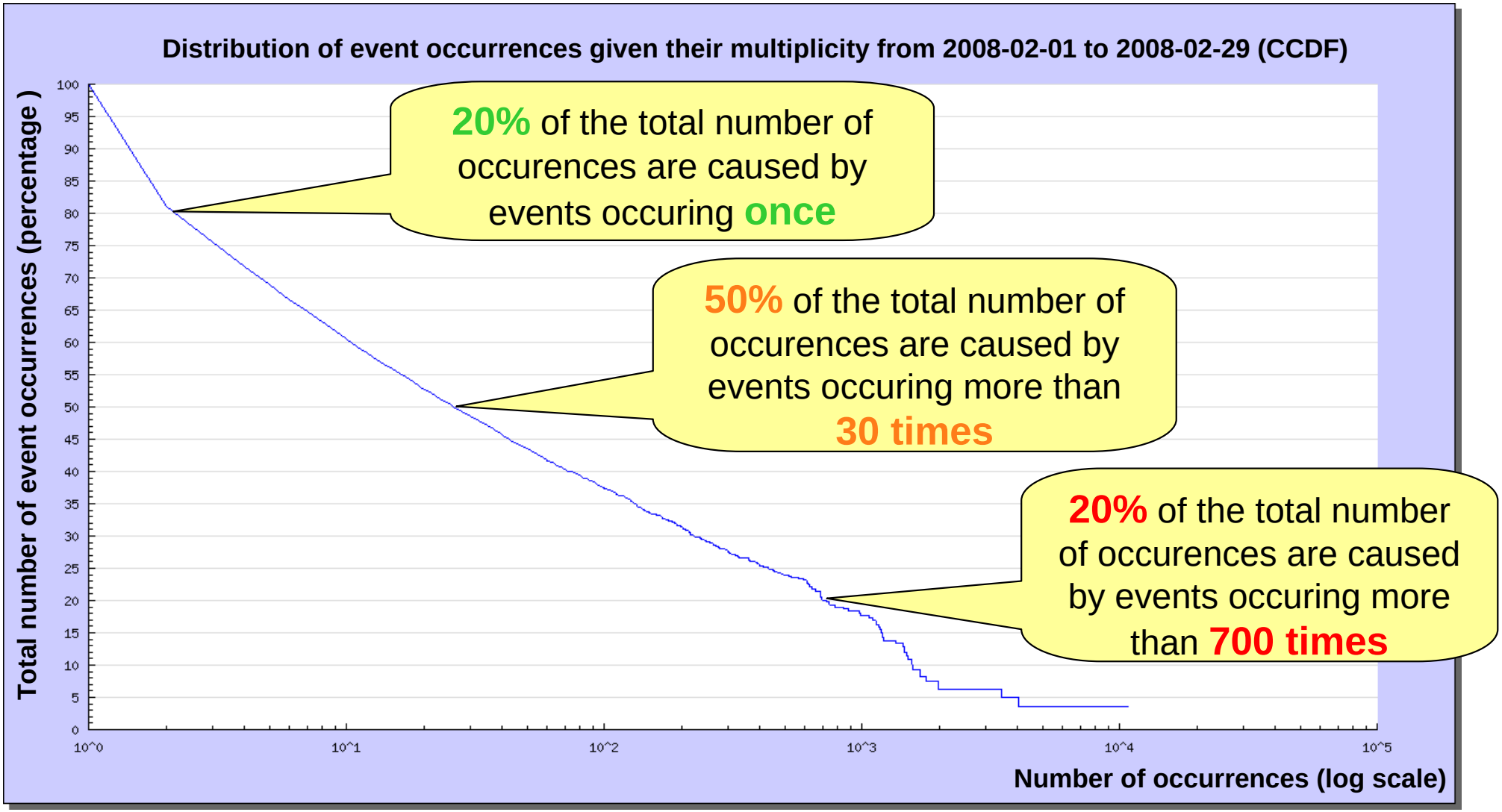


TIME AT WHICH THE EVENT WAS EXTRACTED	2008-02-07 22:33:49
SIZE OF THE EVENT	
Number of different origin ASs whose paths were impacted	1
Number of different prefixes impacted	1
Number of different paths impacted, no matter the prefixes announced	4
Number of different paths impacted, taking into account the prefixes announced	4
NUMBER OF TIMES THIS EVENT HAS OCCURED IN THE MONTH	10757
INFERRED ORIGINATORS	AS2697 - AS18101 AS15412 - AS18101 **AS2697** - **ERX-ERNET-AS** Education and Research Network **AS18101** - **RIL-IDC** Reliance Infocom Ltd Internet Data Centre, **AS15412** - **FLAG-AS** Flag Telecom Global Internet AS
IMPACTED ORIGIN ASs	**AS2697** - **ERX-ERNET-AS** - Education and Research Network

This event has occured 10757 times in february 2008, so on average an occurrence every 4 minutes

Consequently, every 4 minutes, the routers loose their primary paths, run their decision process, elect new path and reconverge to their primary path few seconds after

A pretty useless stress which should not exist



- Fixing events which occur so many times would reduce tremendously the rate of BGP updates and thus the stress on routers.
- Rcat can point out such events, allowing network operators to find out why they occur and to fix them.

thank you

orange™