# SpamTracer
# Tracking Fly-By Spammers

NANOG60

Pierre-Antoine Vervier

Symantec Research Labs

Pierre-Antoine_Vervier@symantec.com

# BGP hijacking

- CAUSES
  - The injection of **erroneous** routing information into BGP
  - No widely deployed security mechanism yet
    - E.g., ROA, BGPsec

- EFFECTS
  - **Blackhole** or **MITM** [Pilosof:Defcon'08] of the victim network

- EXPLANATIONS
  - Router misconfiguration, operational fault
    - E.g., Hijack of part of Youtube network by Pakistan Telecom
  - **Malicious intent?**

# Where it all begins

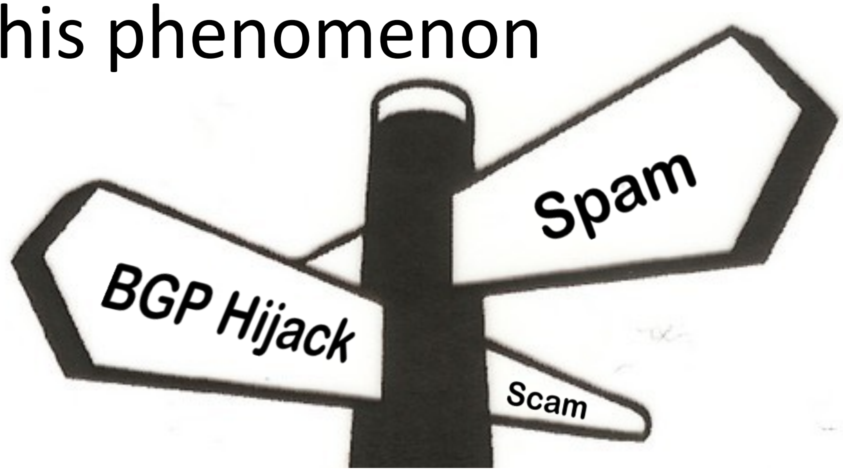
- CONJECTURE
  - Spammers would use **BGP hijacking** to send **spam** from the stolen IP space and remain stealthy
  - Short-lived (< 1 day) routes to unannounced IP space + spam [Ramachandran:SIGCOMM'06] but…
  - …this does not necessarily imply hijacks [Vervier:ICC'14]
  - Anecdotal reports on mailing lists

- POTENTIAL EFFECTS
  - Misattribute attacks launched from hijacked networks due to hijackers stealing **IP identity**
  - Spam filters heavily rely on IP reputation as **a first layer** of defense

# Fly-by spammers :: Myth or reality?

# Your mission, should you accept it

- **Validate** or **invalidate** on a large scale the conjecture about fly-by spammers
- Assess the **prevalence** of this phenomenon

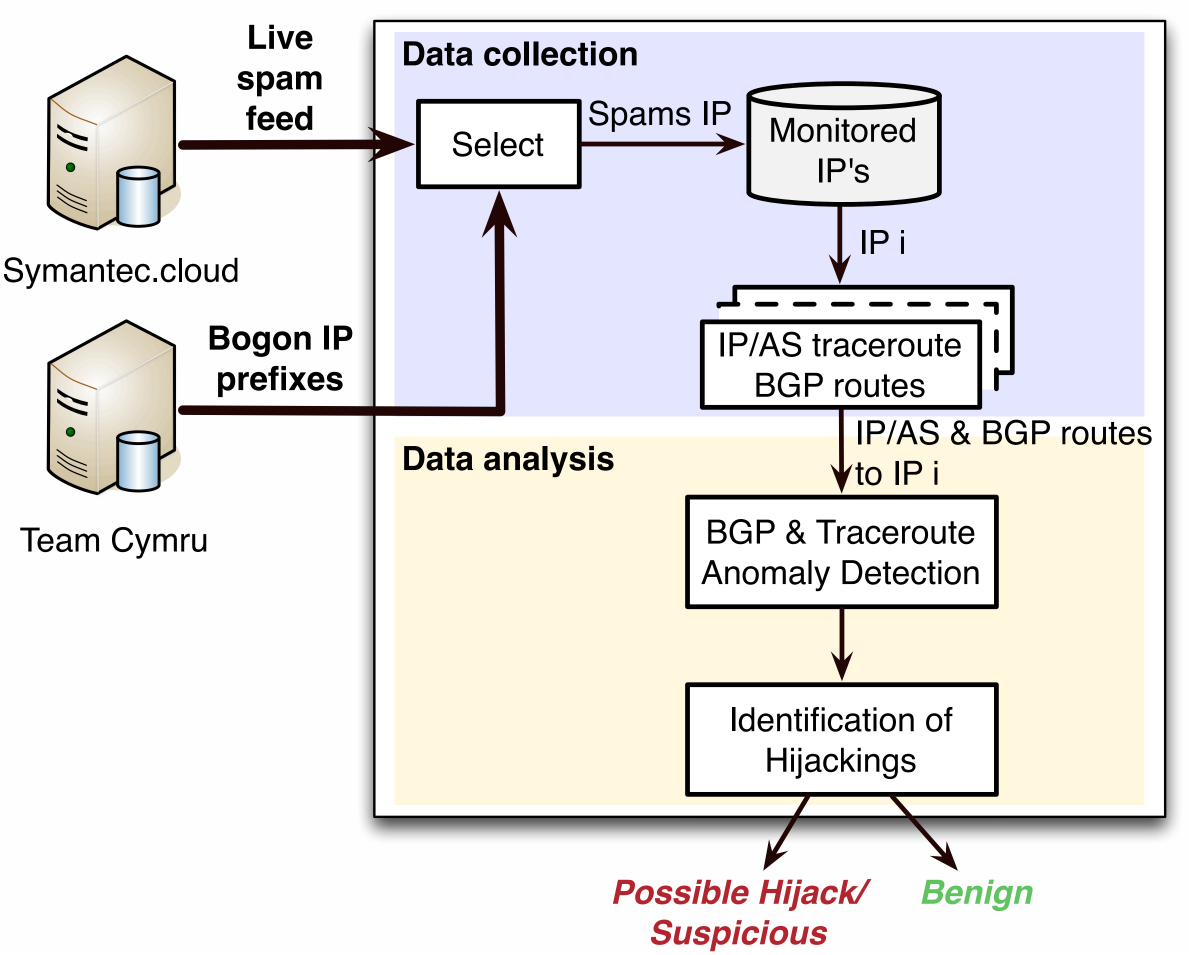


- **SpamTracer [Vervier:TMA'13]**
  - collect **routing** information about **spam** networks
  - extract abnormal routing behaviors to detect possible **BGP hijacks**

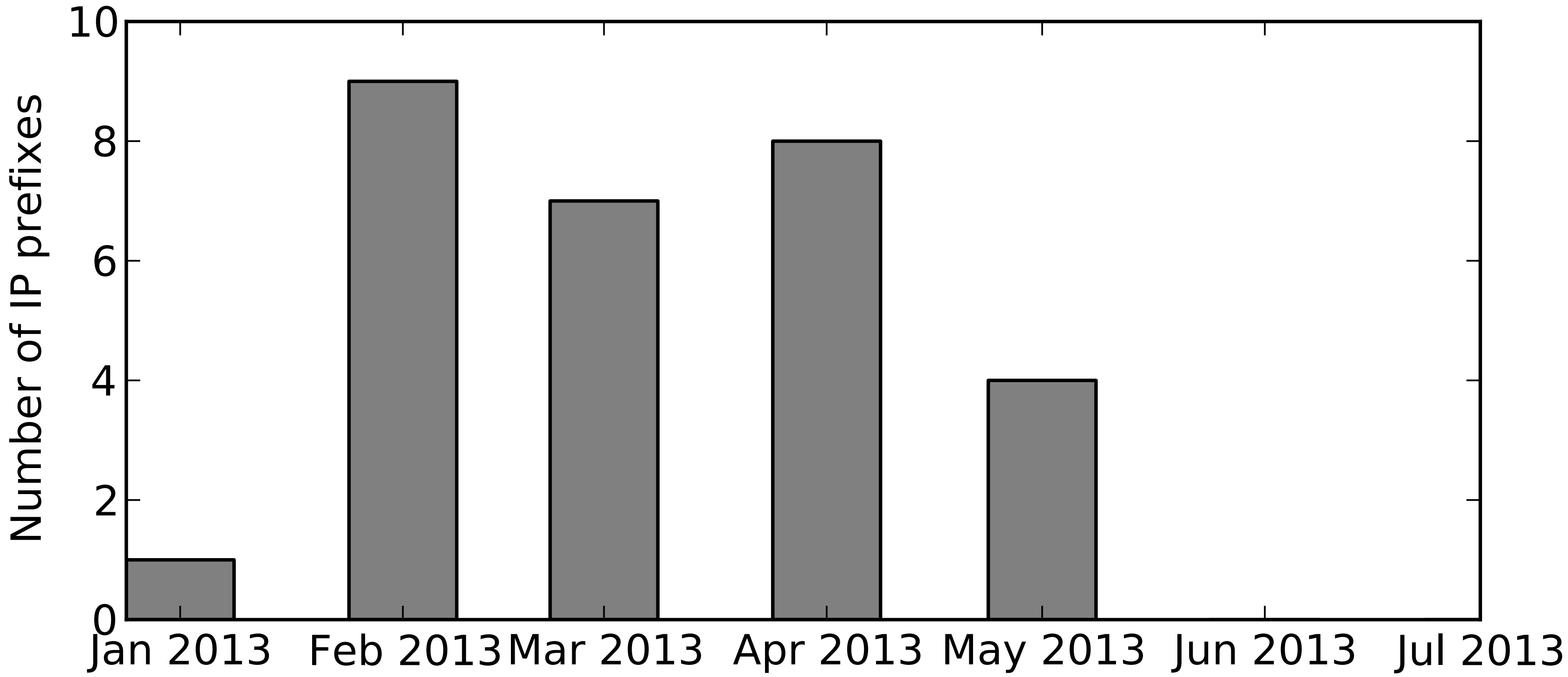
# SpamTracer :: Presentation

- ASSUMPTION
  - When an IP address block is hijacked for stealthy spamming, a **routing change** will be observed when the **block is released** by the spammer to remain stealthy
- METHOD
  - Collect **BGP routes** and **IP/AS traceroutes** to spamming networks just after spam is received and during several days
  - Look for a routing change from the **hijacked state** to the **normal state** of the network

# SPAMTRACER :: System architecture


Live spam feed
Symantec.cloud
Bogon IP prefixes
Team Cymru
Data collection
Select
Spams IP
Monitored IP's
IP i
IP/AS traceroute BGP routes
IP/AS & BGP routes to IP i
Data analysis
BGP & Traceroute Anomaly Detection
Identification of Hijackings
Possible Hijack/ Suspicious
Benign

# 29 hijacked IP prefixes from Jan. to Jul. 2013

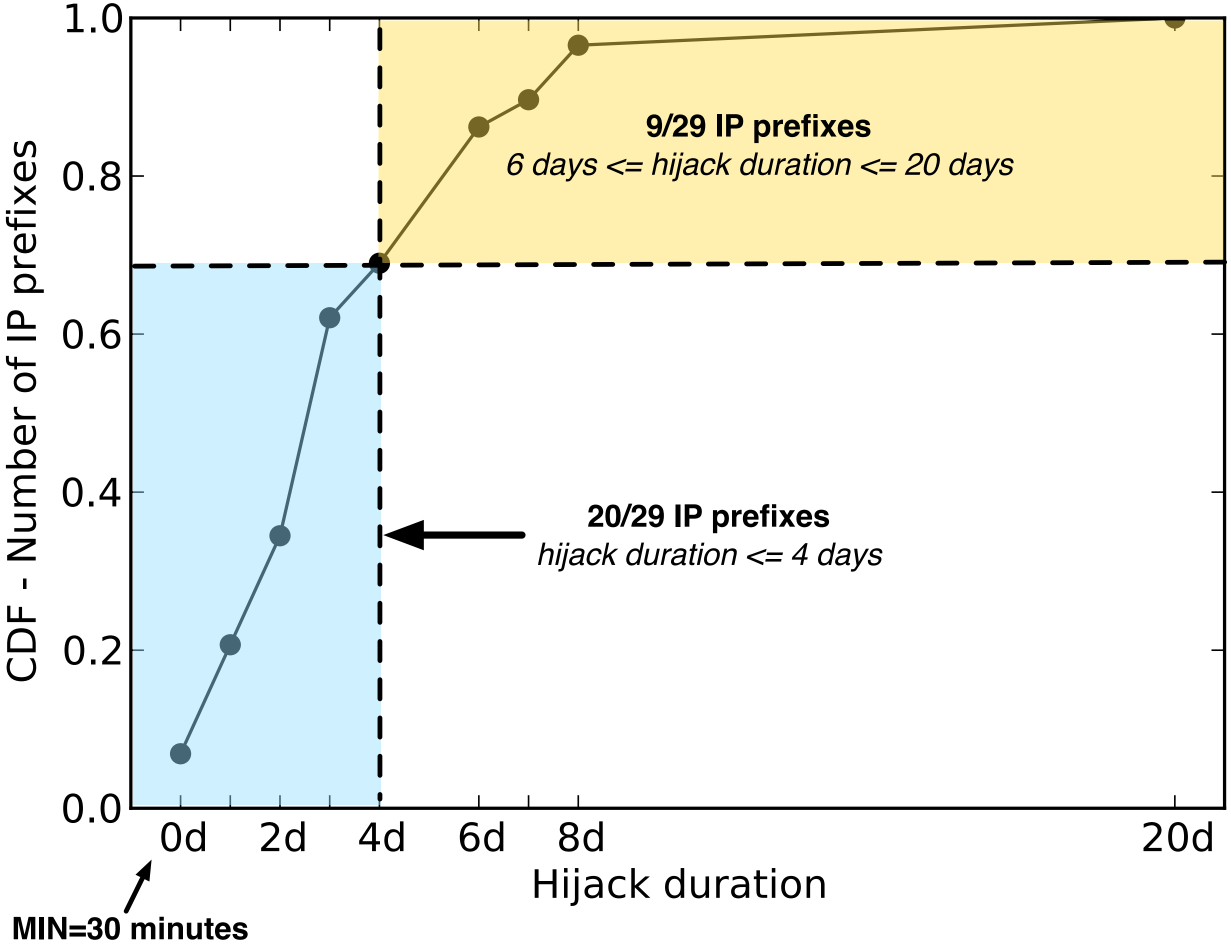


# Fly-by spammers :: Hijack signature

- Hijacked networks
  - were **dormant** IP address blocks, i.e., by the time the networks were hijacked they had been left **unadvertised** by their owner
  - advertised for a rather **short** period of time
  - advertised from an apparently **legitimate origin** AS but via a presumably **illegitimate upstream** AS
  - see [Huston:RIPE50]

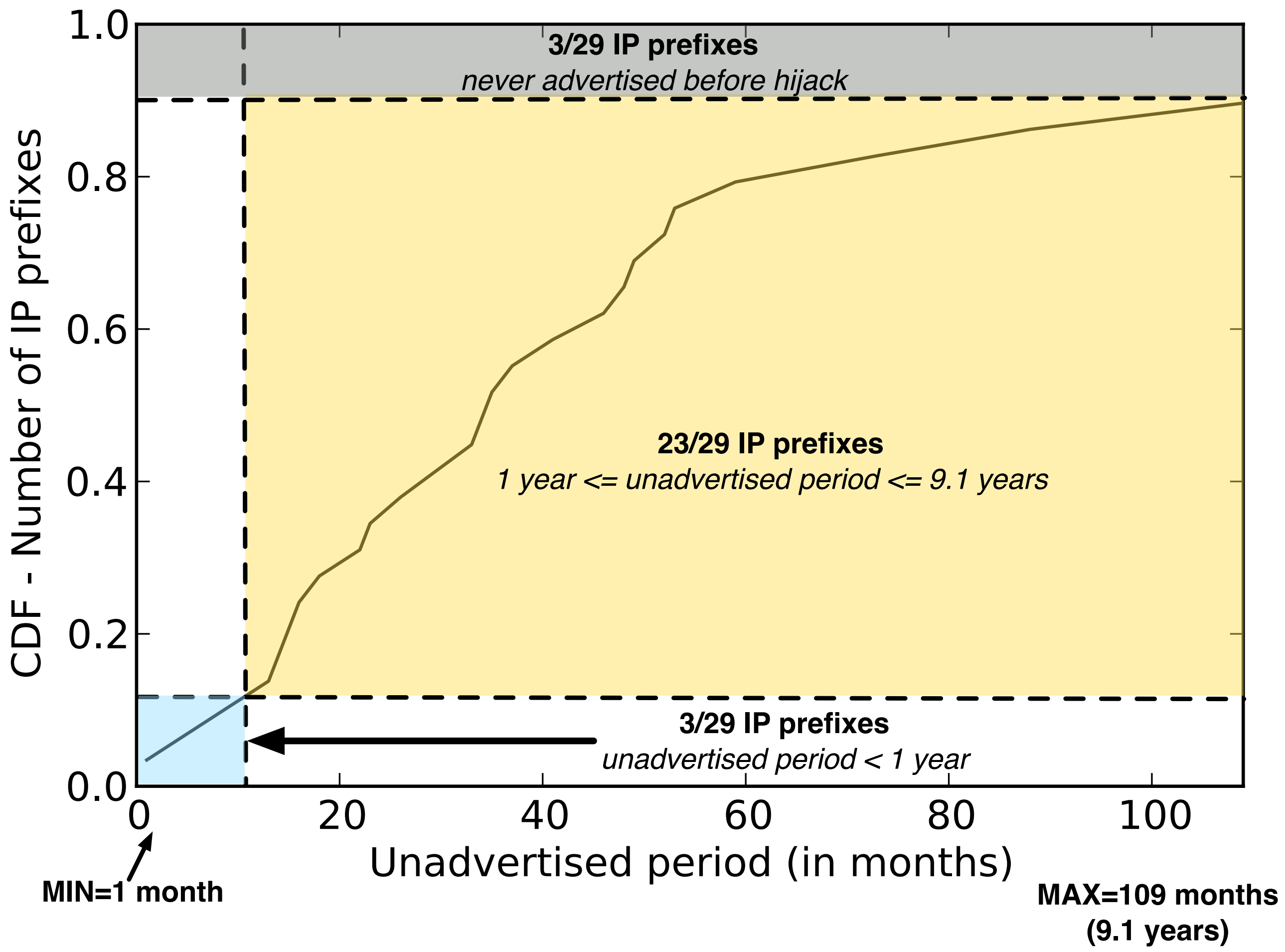
- In practice, we observed
  - hijack **durations** between 30 minutes and 20 days
  - **unadvertised** periods between 1 month and 9 years
  - **illegitimate upstream** ASes were hijacked too

# Hijack duration



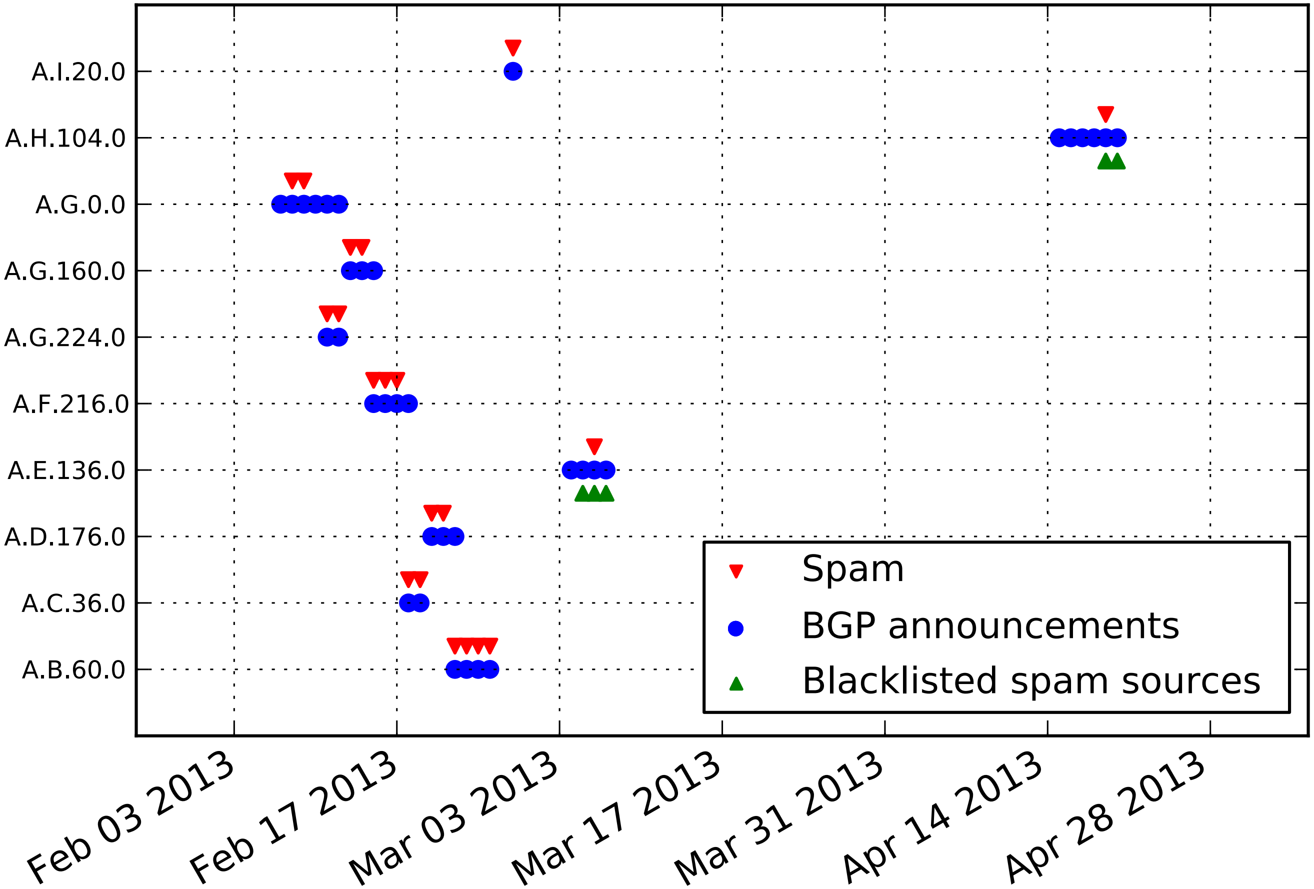
**Most hijacks were rather short-lived!**

# Durations of unadvertised period of IP prefixes



**Most hijacked IP prefixes were left unadvertised for a very long time!**

# Case studies ::
# IP prefix routing history & Spam & DNSBLs



- **IP prefixes have only been announced when spam was received!**
- **Few IP prefixes have spam sources blacklisted in Spamhaus SBL and DROP, Uceprotect or Manitu at the time of the BGP announcements!**

# Case studies ::
# IP prefix routing history & Spam & DNSBLs

- Strong temporal correlation between
  - BGP announcements of IP prefixes and
  - spam
- BGP announcements are quite short-lived!
- No identified spam bot!
- Scam web sites advertised in spam mails hosted in the hijacked networks

# How effective is this spamming technique ?

- Out of 29 hijacked IP address blocks
  - 6 (21%) were listed in Uceprotect or Manitu
  - 13 (45%) were listed in Spamhaus SBL and DROP (Don't Route Or Peer)
    - DROP is supposed to list hijacked IP address blocks
    - but little is known about their listing policy
  - 29 (100%) were observed only once during the time period of the experiment
- **Fly-by spammers seem to manage to remain under the radar!**

# Which networks were targeted?

- All hijacked IP address blocks were **assigned** to a different organization (i.e., a different owner)
- Out of 29 organizations
  - 12 (41%) were found to be dissolved or very likely **out of business**
  - 17 (59%) were found to be **still in business** or no conclusive evidence of them being out of business could be found
- **Fly-by spammers seem to simply target dormant IP address blocks regardless of their owner still being in business or not!**

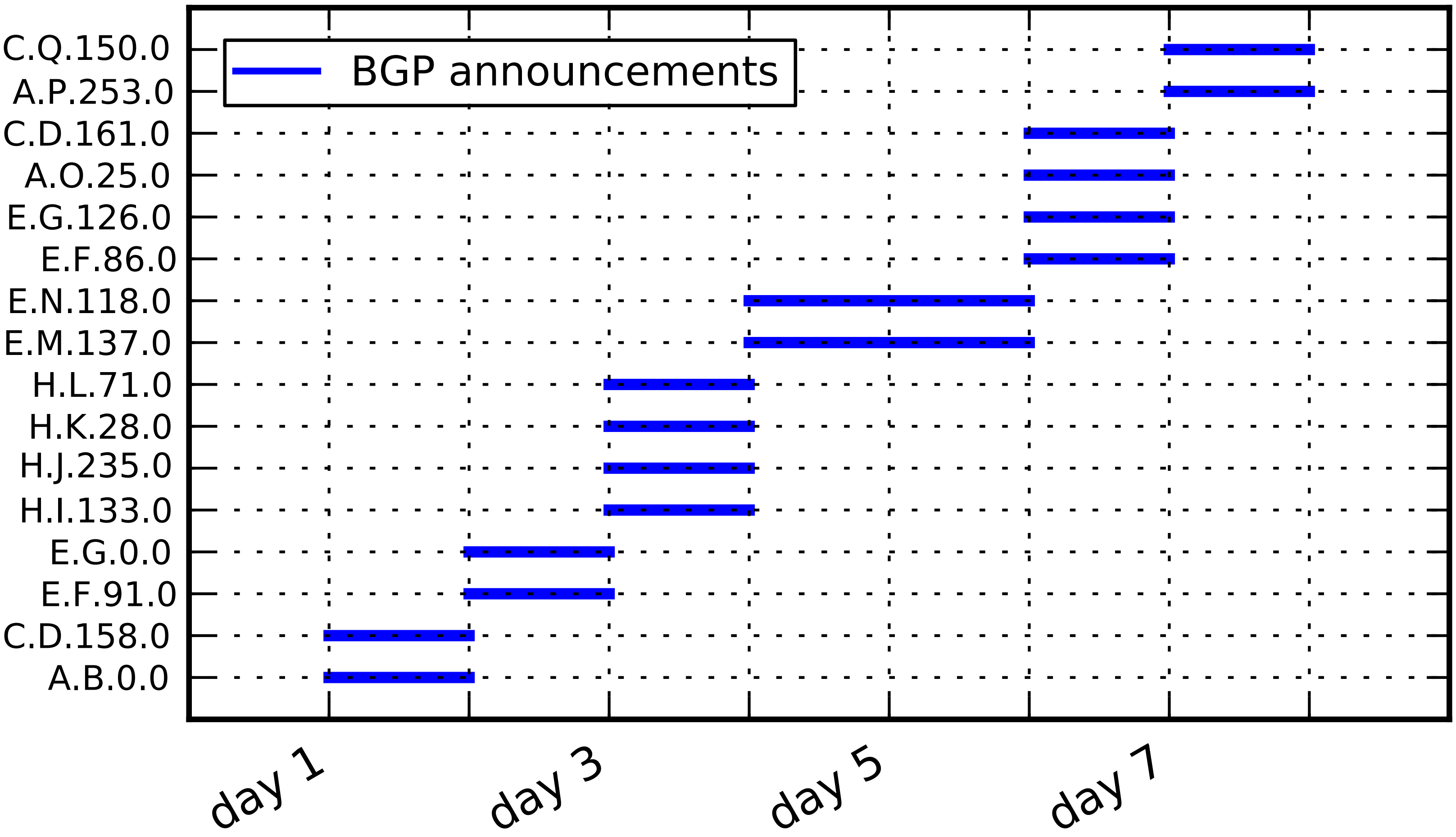
# One timeline to bind them

- Several hijacks were performed in **groups of 2 to 4**, all hijacks in a group starting and ending at the **same time**

- During several days there were always **at least two** IP prefixes hijacked

- This **temporal pattern** suggests a common root cause to those hijacks!

# One timeline to bind them



# What about long-lived hijacks?

- We looked specifically for short-lived hijacks
  - each spam network was monitored for 1 week after spam was received
- But what about long-lived ones
  - it happens also, e.g., LinkTelecom hijack lasted 5 months [NanogML'11, Symantec:ISTR'12, Schlamp:CCR'13]
  - but they are less straightforward to detect
  - and it seems to defeat the assumed purpose of evading blacklisting
- We are working on updating our framework to better detect these cases

# How to prevent fly-by spammers?

- In the observed hijack cases, spammers
  - did **not** tamper with the origin of the IP address blocks
  - but advertised the IP address blocks via **illegitimate** upstream ASes

- The RPKI is currently the most promising architecture for securing BGP
  - both **Route Origination** and **Route Propagation** must be secured to prevent fly-by spammers
  - secured Route Origination via ROAs is being more and more deployed
  - but secured Route Propagation with BGPsec is still at a too early stage

- The solution for now is thus to
  - return and help RIRs reclaim **dormant** IP space, and
  - use **detection systems** to mitigate the effects of these attacks, e.g., by feeding IP-based reputation systems with hijacked IP address blocks

# Conclusion

- The observed fly-by spammer cases show that this phenomenon is happening though it does **not currently** seem to be a very **prevalent** technique to send **spam**, e.g., compared to botnets

- However, it is important to detect those attacks because hijacking IP address blocks **hinder traceability** of attackers and can lead to **misattributing** attacks when responding with possibly legal actions!

# Perspectives

- Provide an **interface** for network operators to query identified hijacks
- Collaborate with **RIRs** and **ISPs** to help mitigate hijacks
- Ongoing **collaboration** with Institut Eurécom (FRA) and TU München (GER) to build a comprehensive system for the detection and investigation of malicious BGP hijacks

# Thank you!

Time for Q&A!

# Some references

**[Ramachandran:SIGCOMM'06]** A. Ramachandran and N. Feamster. *Understanding the network-level behavior of spammers.* In SIGCOMM, pages 291-302, 2006.

**[Pilosov:Defcon'08]** A. Pilosov and T. Kapela. *Stealing the Internet: An Internet-Scale Man In The Middle Attack.* Defcon 16, Las Vegas, NV, August 2008.

**[Huston:RIPE50]** G. Huston. *Auto-Detecting Hijacked Prefixes?* RIPE 50, May 2005.

**[NanogML'11]** *Prefix hijacking by Michael Lindsay via Internap*, http://mailman.nanog.org/pipermail/nanog/2011-August/039381.html, August 2011.

**[Symantec:ISTR'12]** Symantec Internet Security Threat Report: *Future Spam Trends: BGP Hijacking. Case Study - Beware of "Fly-by Spammers".* http://www.symantec.com/threatreport/, April 2012.

**[Vervier:TMA'13]** P.-A. Vervier and O. Thonnard. *Spamtracer: How Stealthy Are Spammers?* In IEEE International TMA Workshop, pages 453-458, 2013.

**[Schlamp:CCR'13]** J. Schlamp, G. Carle, and E. W. Biersack. *A Forensic Case Study on AS Hijacking: The Attacker's Perspective. ACM CCR*, pages 5-12, 2013.

**[Vervier:ICC'14]** P.-A. Vervier, Q. Jacquemart, J. Schlamp, O. Thonnard, G. Carle, G. Urvoy-Keller, E. Biersack and M. Dacier. *Malicious BGP Hijacks: Appearences Can Be Deceiving.* To appear in IEEE ICC, 2014.

Spamhaus DNSBLs, http://www.spamhaus.org/

Uceprotect DNSBL, http://www.uceprotect.net/

Manitu DNSBL, http://www.dnsbl.manitu.net/