# Change of Address

Routing Issues of Transferred IPv4 Addresses
RIPE 70, Amsterdam

**Jim Cowie, Doug Madory**
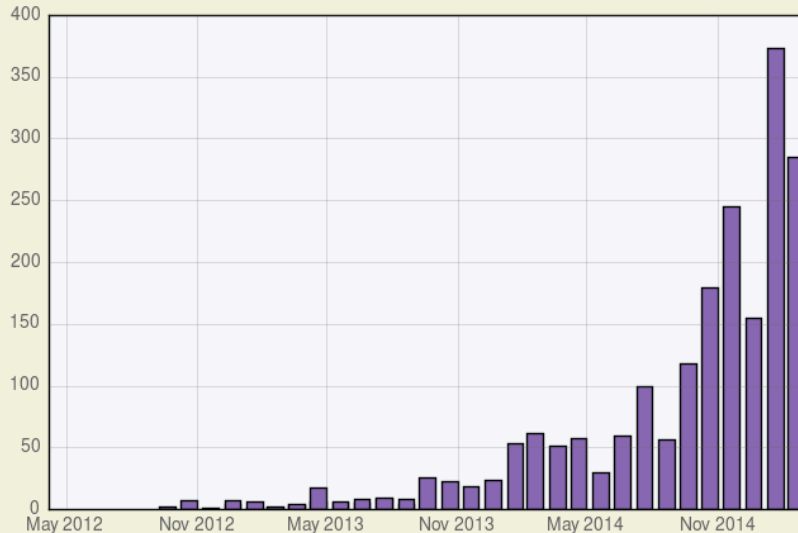May 12, 2015

# Increased rate of IPv4 transfer

**Transferred blocks of IPv4 address space by month**
Transferred PA IPv4 address space (RIPE)



Source: *RIPE IPv4 Transfer Data*

- The pace has greatly accelerated

- RIPE's table of IPv4 transfers continues to grow

- An increasing number of IPv4 brokers are facilitating the exchange of IPv4 address space
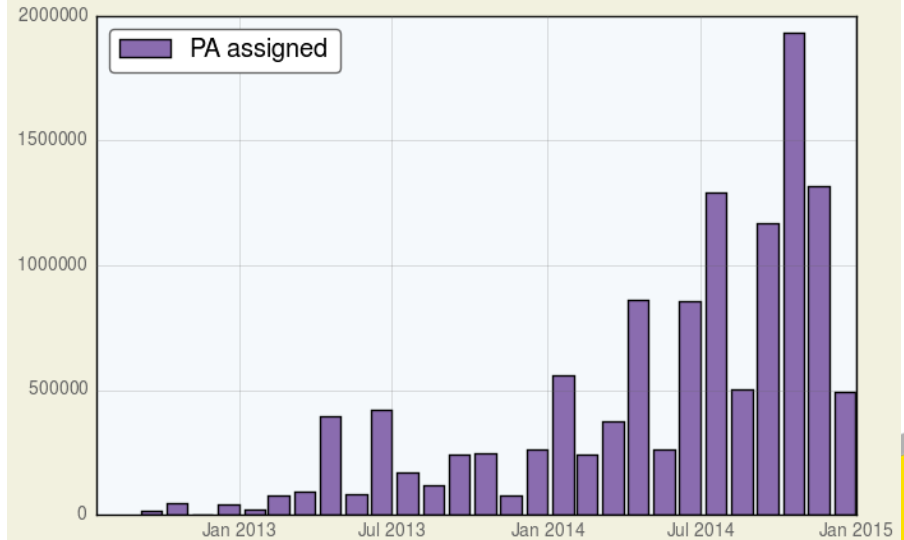
- Now it's a real market!

# These are the early days

- **The number of *blocks* transferred is growing smoothly**

- **The number of *addresses* transferred is still visibly variable**

- **Large-block transfers are still significant – like lumberjacks cutting and selling old-growth forests**



**Transferred IPv4 address space (RIPE)**
Total unique IPv4 addresses trasnferred by month

Source: *RIPE IPv4 Transfer Data*

# Romania is *visibly shrinking*

**Much IPv4 address space has been transferred (i.e. "sold") from Romania**

- 930 out of 1856 (50%) blocks transferred since January 2014 were from Romania

- 817 (44%) were from Jump Mgt (AS2541, jump.ro)

## Routed Romanian IPv4 address space
1 January 2014 - 5 April 2015

Source: *BGP Data*

# Analyzing the movement of IPv4

**Much of the Romanian address space is showing up in the Middle East**

- **33%** of the ~4500 prefixes originated in Saudi Arabia were Romanian a couple of months ago

- Iran, Syria, UAE are some other ME nations now using former Romanian IPv4 space

# As markets heat up, problems are inevitable
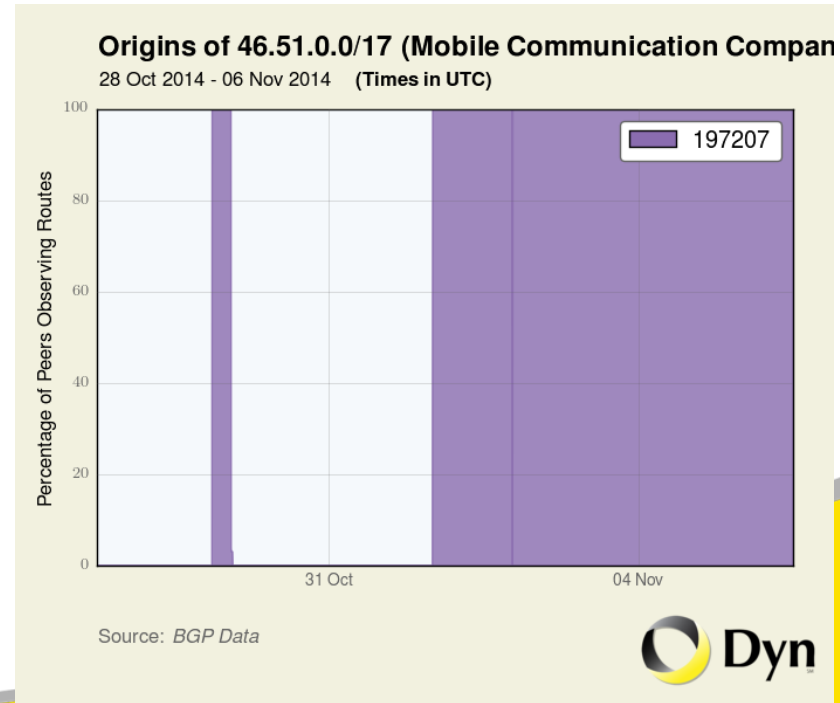


*Dacia 1300 in Morocco. Credit: Andrew Szabo*

Selling a block of addresses is not like selling a car.

Transfer of "title" and handing over the keys typically stops the seller from continuing to drive the car, get traffic tickets, etc.!

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# Example of the complexity of handover

- 27-Oct-2014: 46.51.0.0/17 was transferred from Netserv Consult SRL (RO) to Mobile Communication Company of Iran

- Mobile Communication Company of Iran (**AS197207**) began announcing the prefix immediately

- **Looks good, the keys have been handed over, the Iranian mobile provider is ready to drive!**



Origins of 46.51.0.0/17 (Mobile Communication Compan
28 Oct 2014 - 06 Nov 2014    (Times in UTC)

197207

Percentage of Peers Observing Routes

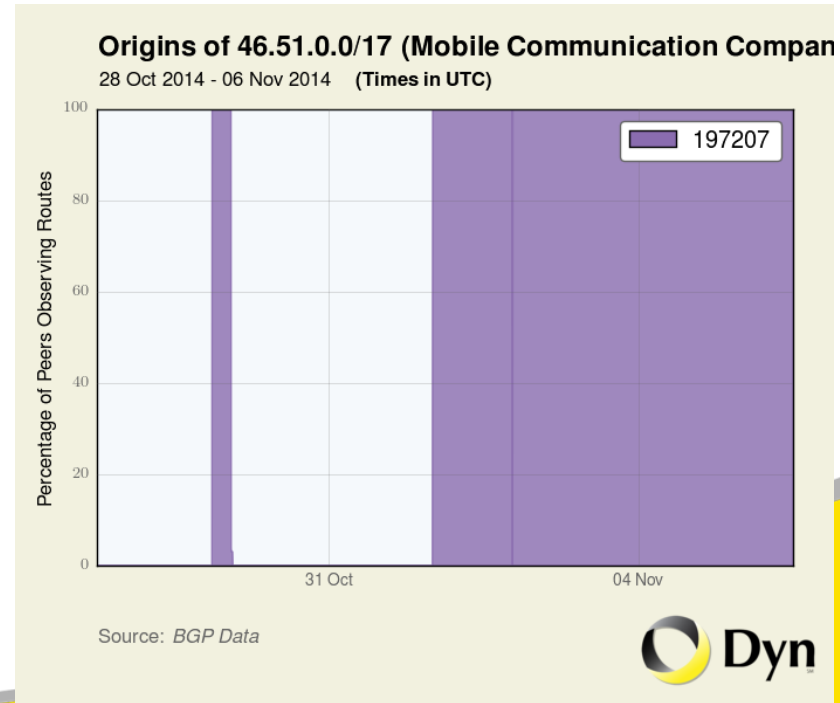31 Oct          04 Nov

Source: *BGP Data*

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**Not so fast…**

- Level 3 (AS3356) has announced more-specific prefixes within this range since early 2012:

  - **46.51.16.0/21, 46.51.24.0/21, 46.51.32.0/21 …**



Origins of 46.51.0.0/17 (Mobile Communication Compan[y])
28 Oct 2014 - 06 Nov 2014   (Times in UTC)

Source: *BGP Data*

# Time passes, impairment mysterious

From October transfer through early December, anyone trying to go to the more-specific /21s within the transferred /17 will end up blackholed (presumably in Romania)

!?

Iranian mobile users trying to use data services to reach content in the USA probably encounter real frustration

The embargo against Iranian users doesn't help clarify the situation – who's blocking them?!
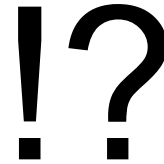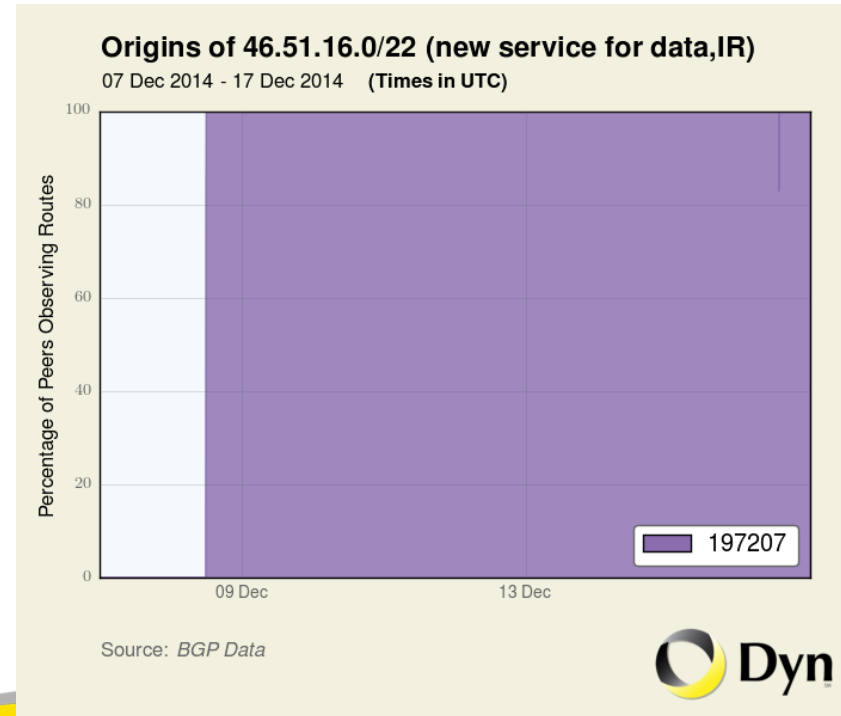
# Darwinian Competition: The New Normal?

So starting in early December, AS197207 started announcing all the even-more-specifics of AS3356's more-specifics to regain control over the space!
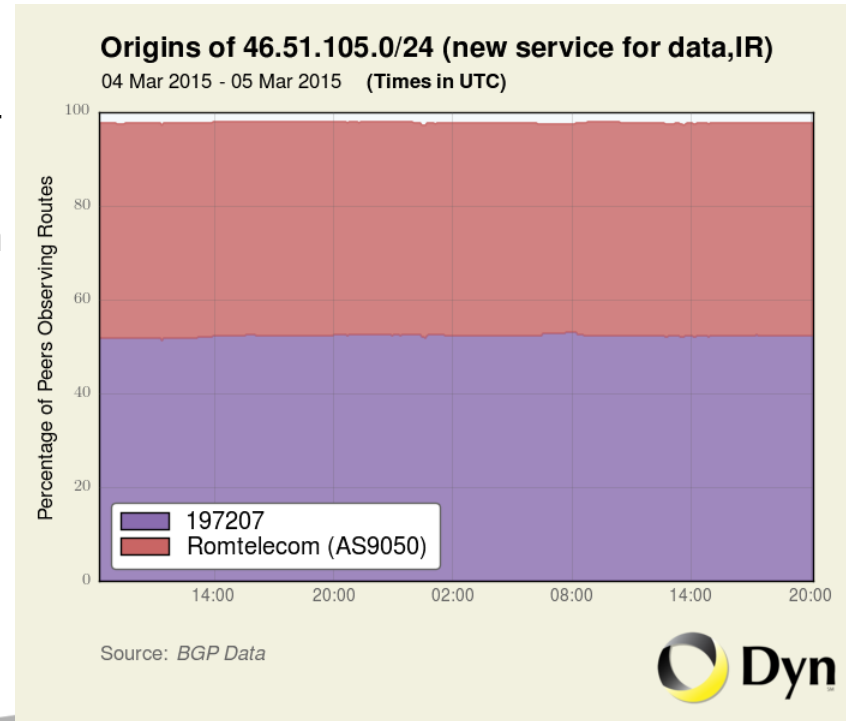
Had nothing to do with sanctions ..

Just a side effect of a market in which buyers close escrow without establishing clean routability (the seller's responsibility in future standard T&Cs?)

**Origins of 46.51.16.0/22 (new service for data,IR)**
07 Dec 2014 - 17 Dec 2014    (Times in UTC)



Source: *BGP Data*

# Oh, and it gets worse

- Today, 46.51.0.0/17 is routed by AS197207 out of Iran. Level 3 announces more-specifics of this route, however AS197207 announces more-specifics of those.

- Also, 46.51.108.0/22 has been announced from AS51656 out of Romania since 10-Nov-2010. However, AS197207 now announces the two more-specifics of the prefix (46.51.108.0/23 and 46.51.110.0/23)

- In addition, multiple prefixes in this range are announced by _both_ **Iranian** and **Romanian** entities. For example: 46.51.105.0/24 (pictured right)

**Origins of 46.51.105.0/24 (new service for data,IR)**
04 Mar 2015 - 05 Mar 2015    (Times in UTC)

Percentage of Peers Observing Routes

Legend:
- 197207
- Romtelecom (AS9050)

Source: *BGP Data*

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# Also Leads to Confusion in Geolocation

## GeoIP2 City Results

| IP Address | Country Code | Location | Postal Code | Coordinates | ISP | Organization | Domain | Metro Code |
|---|---|---|---|---|---|---|---|---|
| 46.51.24.1 | RO | Romania, Europe | | 46, 25 | Mobile Communication Company of Iran PLC | Mobile Communication Company of Iran PLC | netserv.ro | |

ISP and Organization data is included with the purchase of the GeoIP2 ISP database or with the purchase of the GeoIP2 Precision City or Insights services.
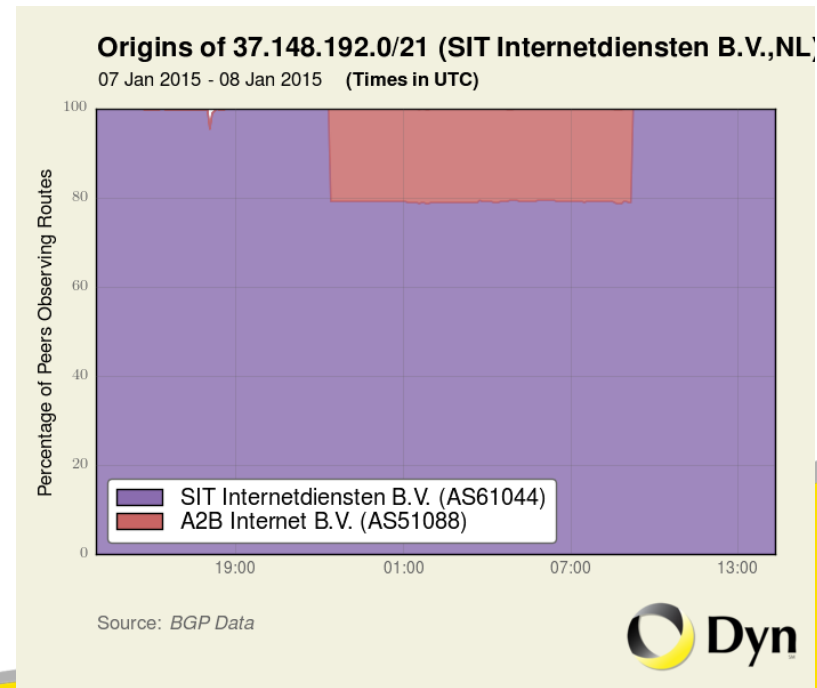
Domain data is included with the purchase of the GeoIP2 Domain Name database or with the purchase of the GeoIP2 Precision City or Insights services.

# "Hey, is that my car?!"

A2B Internet B.V. (AS51088) mistakenly re-announced address space that they had previously sold
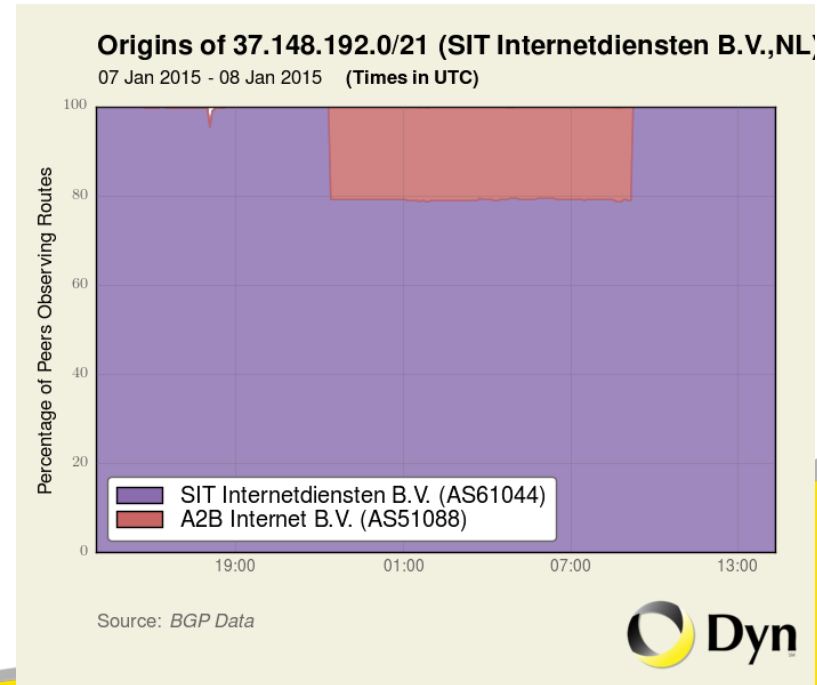
- 37.148.192.0/21 was announced by AS51088 for 12hrs

- This prefix is normally announced by AS61044 (SIT Internetdiensten BV)



Origins of 37.148.192.0/21 (SIT Internetdiensten B.V.,NL)
07 Jan 2015 - 08 Jan 2015    (Times in UTC)

SIT Internetdiensten B.V. (AS61044)
A2B Internet B.V. (AS51088)

Source: BGP Data

# "Hey, is that my car?!"

**Original owners can mistakenly reannounce sold space:**

- **46.244.81.0/24 was announced by A2B for 59hrs**

  - More-specific of 46.244.80.0/23 normally announced by AS51407 (Mada, Palestinian Territories)

- **Due to the nature of the routing, each hijack incident created a MITM routing scenario.**

  - I.e. traffic destined for Mada in Gaza was redirected first through AS51088 before finally reaching AS51407



Origins of 37.148.192.0/21 (SIT Internetdiensten B.V.,NL)
07 Jan 2015 - 08 Jan 2015    (Times in UTC)

SIT Internetdiensten B.V. (AS61044)
A2B Internet B.V. (AS51088)

Source: *BGP Data*

# Summary: IPv4 Buyer Beware

- Carefully research the historical routing of the prefix for sale and its more specifics

- Don't forget DNS: Are any FQDNs still pointing to your new prefix? Could bring you unwanted (nasty) traffic.

- Configure aggressive routing alarms on any purchased prefix via a 3rd party service

- Establish strong technical contacts within the seller's organization

- Brokers may want to explore 'clean routing' assertions at close of escrow (maybe even clawbacks) as a part of standard T&Cs

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