NETWORK ANALYSIS CENTRE

Automated NOC Detection

[redacted], Head of GCHQ NAC

[redacted], Senior Network Analyst, CSEC NAC

NETWORK ANALYSIS CENTRE

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Challenge

- SDC 2009 – Challenged the Network Analysis community to automate the detection of Network Operations Centres

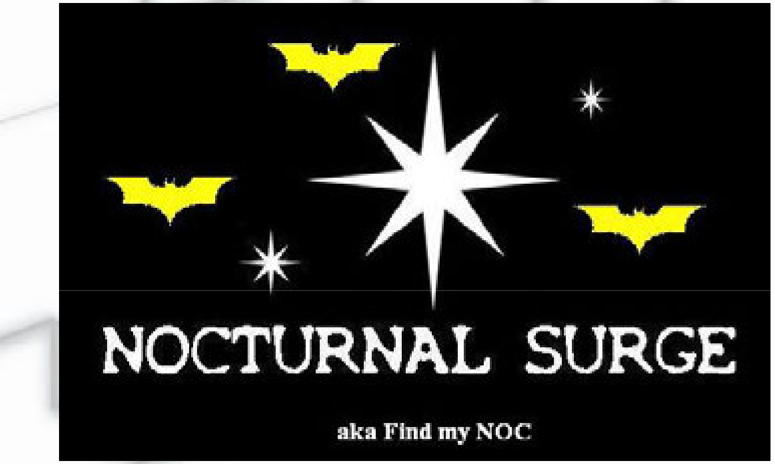
Phase 1: Intelligent Router Configuration File Parsing

- Routers have numerous services running on them that help identify the NOC IP ranges:
  - SSH
  - TELNET/VTY
  - SNMP
  - SYSLOG
  - DNS
  - TACACS
  - RADIUS
- Access to these services tends to be locked down by the use of Access Control Lists (ACLs)
- Configuration files provide details of how services are configured.

TOP SECRET STRAP 2

NOCTURNAL SURGE

- GCHQ response to challenge.
- Early Prototype that looks at only:
  - ACLs for SSH/TELNET
  - ACLs for VTY



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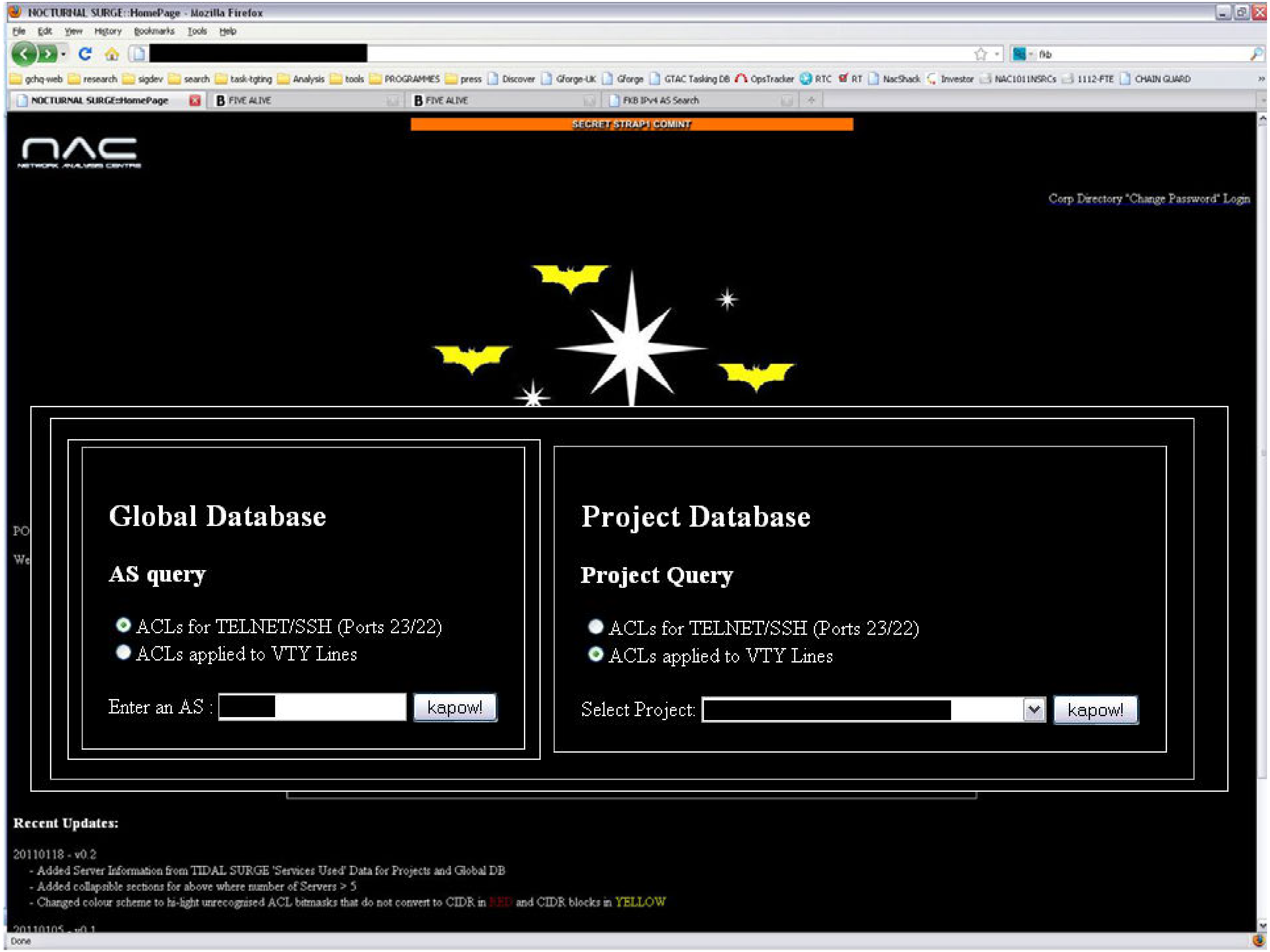
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NAC
NETWORK ANALYSIS CENTRE
Corp Directory "Change Password" Login
PO
We
Done

SECRET STRAP1 COMINT

Global Database

AS query

● ACLs for TELNET/SSH (Ports 23/22)
○ ACLs applied to VTY Lines

Enter an AS : [redacted] kapow!

Project Database

Project Query

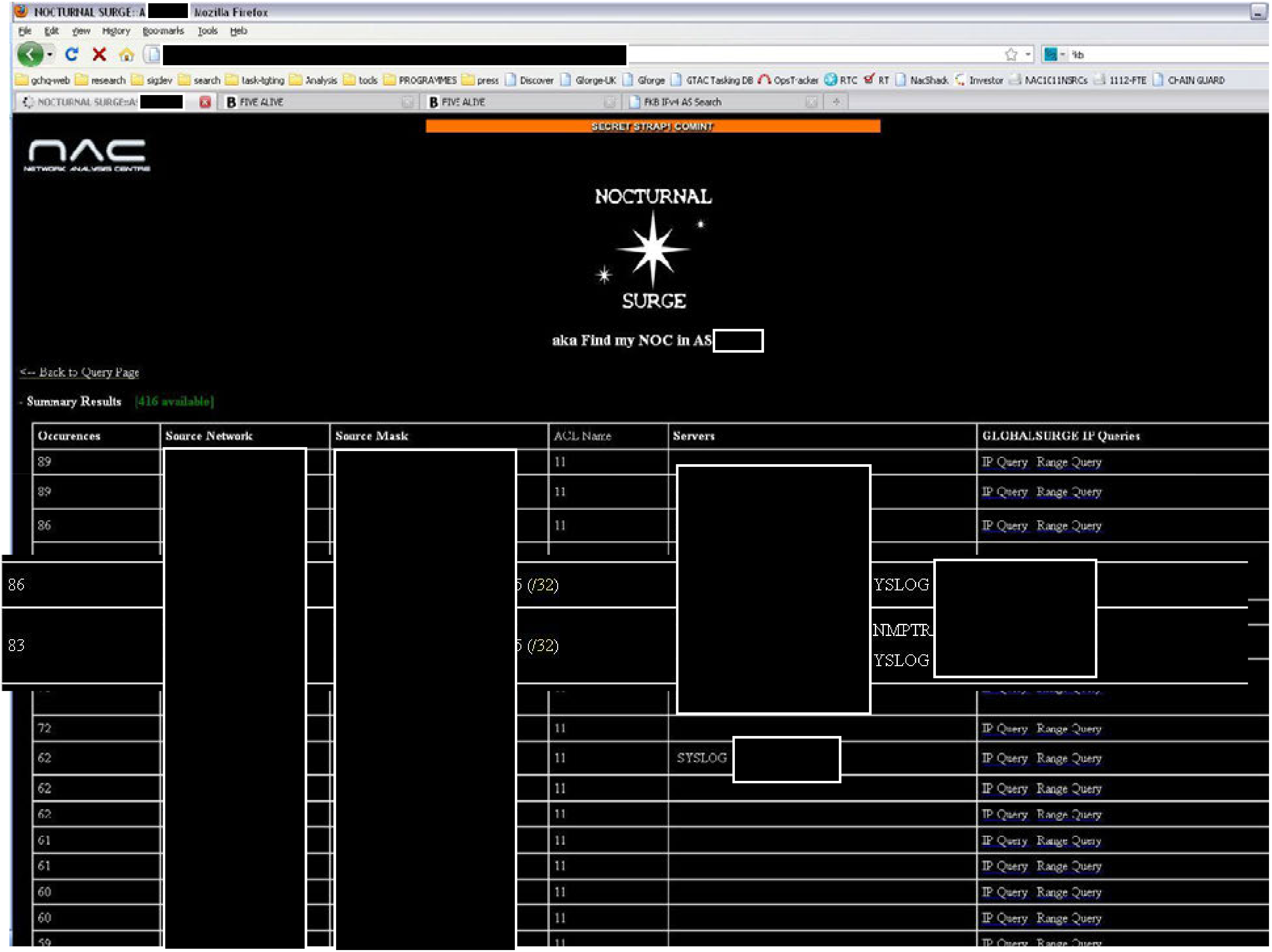
○ ACLs for TELNET/SSH (Ports 23/22)
● ACLs applied to VTY Lines

Select Project: [redacted] kapow!

Recent Updates:

20110118 - v0.2
- Added Server Information from TIDAL SURGE 'Services Used' Data for Projects and Global DB
- Added collapsible sections for above where number of Servers > 5
- Changed colour scheme to hi-light unrecognised ACL bitmasks that do not convert to CIDR in RED and CIDR blocks in YELLOW

20110105 - v0.1



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FIVE ALIVE
FIVE ALIVE
FKB IPv4 AS Search
NAC
NETWORK ANALYSIS CENTRE

SECRET STRAP1 COMINT

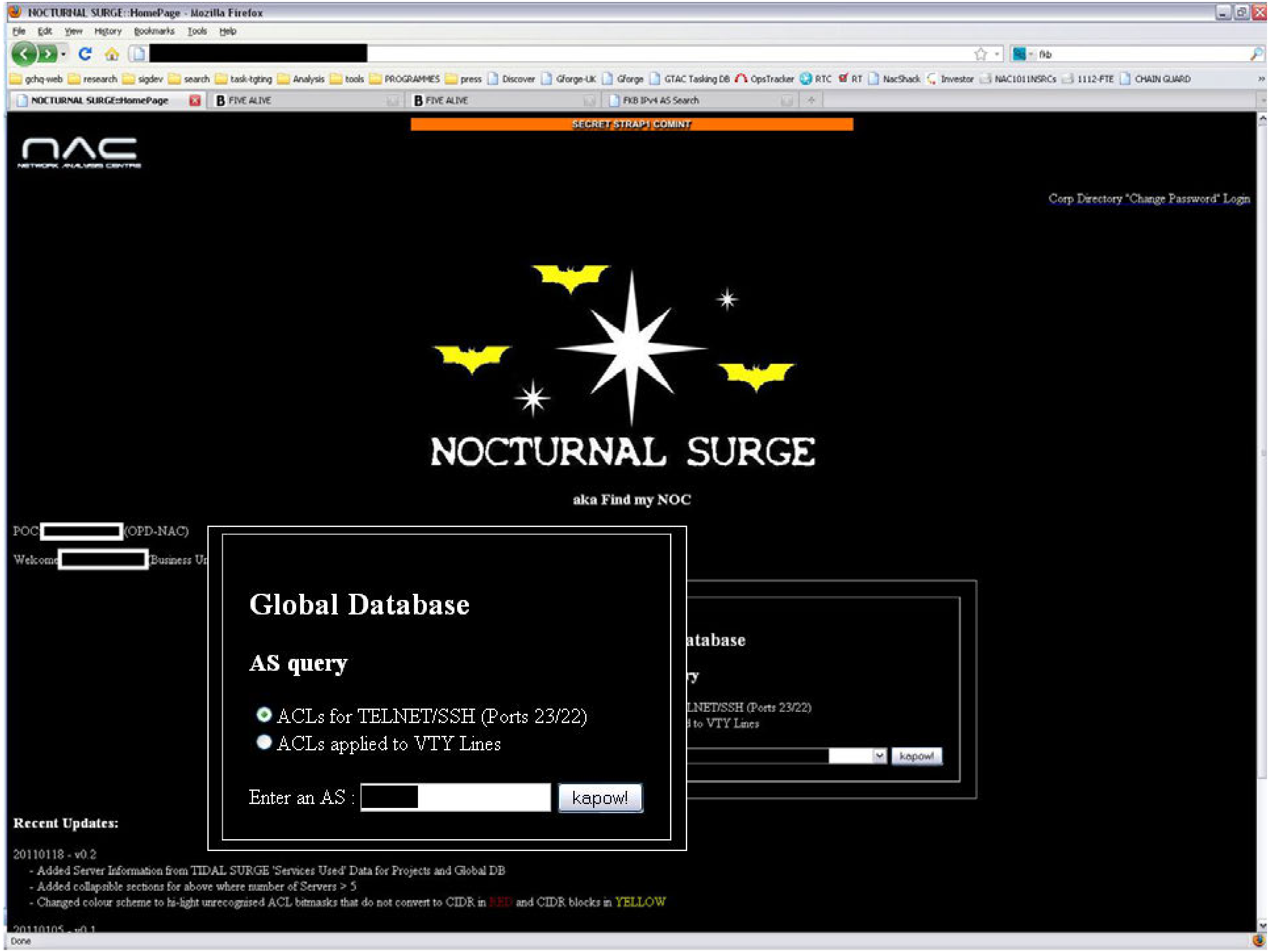
NOCTURNAL SURGE

aka Find my NOC in AS [redacted]

<-- Back to Query Page

- Summary Results [416 available]

Occurences	Source Network	Source Mask	ACL Name	Servers	GLOBALSURGE IP Queries
89	[redacted]	[redacted]	11		IP Query Range Query
89	[redacted]	[redacted]	11	[redacted]	IP Query Range Query
86	[redacted]	[redacted]	11	[redacted]	IP Query Range Query
86	[redacted]	[redacted]5 (/32)		[redacted] YSLOG [redacted]	
83	[redacted]	[redacted]5 (/32)		[redacted] NMPTR YSLOG [redacted]	
[illegible]	[redacted]	[redacted]	[illegible]	[redacted]	[illegible]
72	[redacted]	[redacted]	11		IP Query Range Query
62	[redacted]	[redacted]	11	SYSLOG [redacted]	IP Query Range Query
62	[redacted]	[redacted]	11		IP Query Range Query
62	[redacted]	[redacted]	11		IP Query Range Query
61	[redacted]	[redacted]	11		IP Query Range Query
61	[redacted]	[redacted]	11		IP Query Range Query
60	[redacted]	[redacted]	11		IP Query Range Query
60	[redacted]	[redacted]	11		IP Query Range Query
59	[redacted]	[redacted]	11		IP Query Range Query



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NOCTURNAL SURGE::HomePage | FIVE ALIVE | FIVE ALIVE | FKB IPv4 AS Search

SECRET STRAP1 COMINT

NAC
NETWORK ANALYSIS CENTRE

Corp Directory "Change Password" Login

NOCTURNAL SURGE

aka Find my NOC

POC [redacted] (OPD-NAC)

Welcome [redacted] (Business Un

Global Database

AS query

● ACLs for TELNET/SSH (Ports 23/22)

○ ACLs applied to VTY Lines

Enter an AS : [redacted] kapow!

atabase

ry

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kapow!

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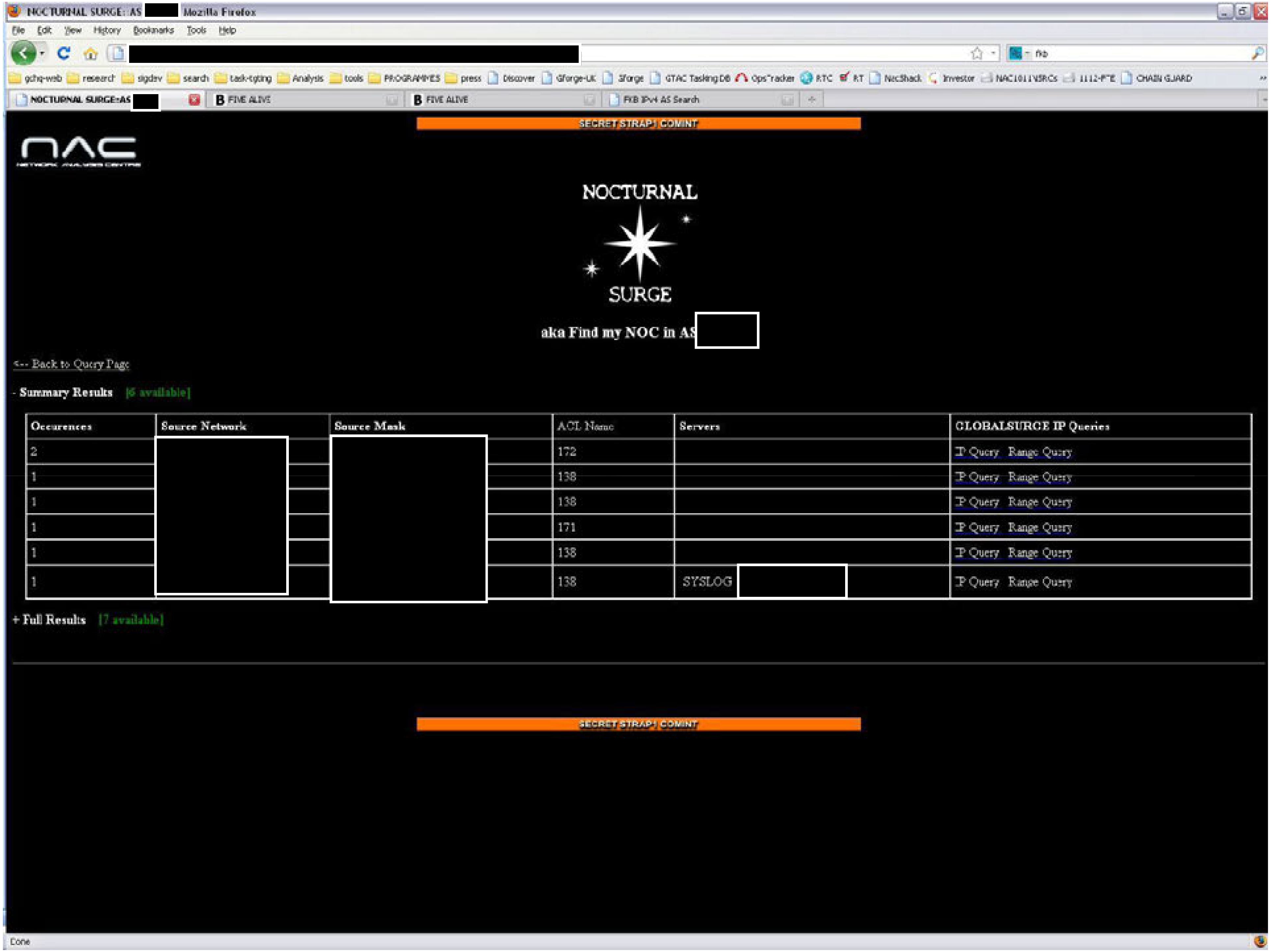

NOCTURNAL SURGE: AS [redacted] Mozilla Firefox
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NOCTURNAL SURGE:AS [redacted]
FIVE ALIVE
FIVE ALIVE
FKB IPv4 AS Search

SECRET STRAP1 COMINT

NOCTURNAL

SURGE

aka Find my NOC in AS [redacted]

<-- Back to Query Page

- **Summary Results** [6 available]

Occurences	Source Network	Source Mask	ACL Name	Servers	GLOBALSURGE IP Queries
2	[redacted]	[redacted]	172		IP Query Range Query
1	[redacted]	[redacted]	138		IP Query Range Query
1	[redacted]	[redacted]	138		IP Query Range Query
1	[redacted]	[redacted]	171		IP Query Range Query
1	[redacted]	[redacted]	138		IP Query Range Query
1	[redacted]	[redacted]	138	SYSLOG [redacted]	IP Query Range Query

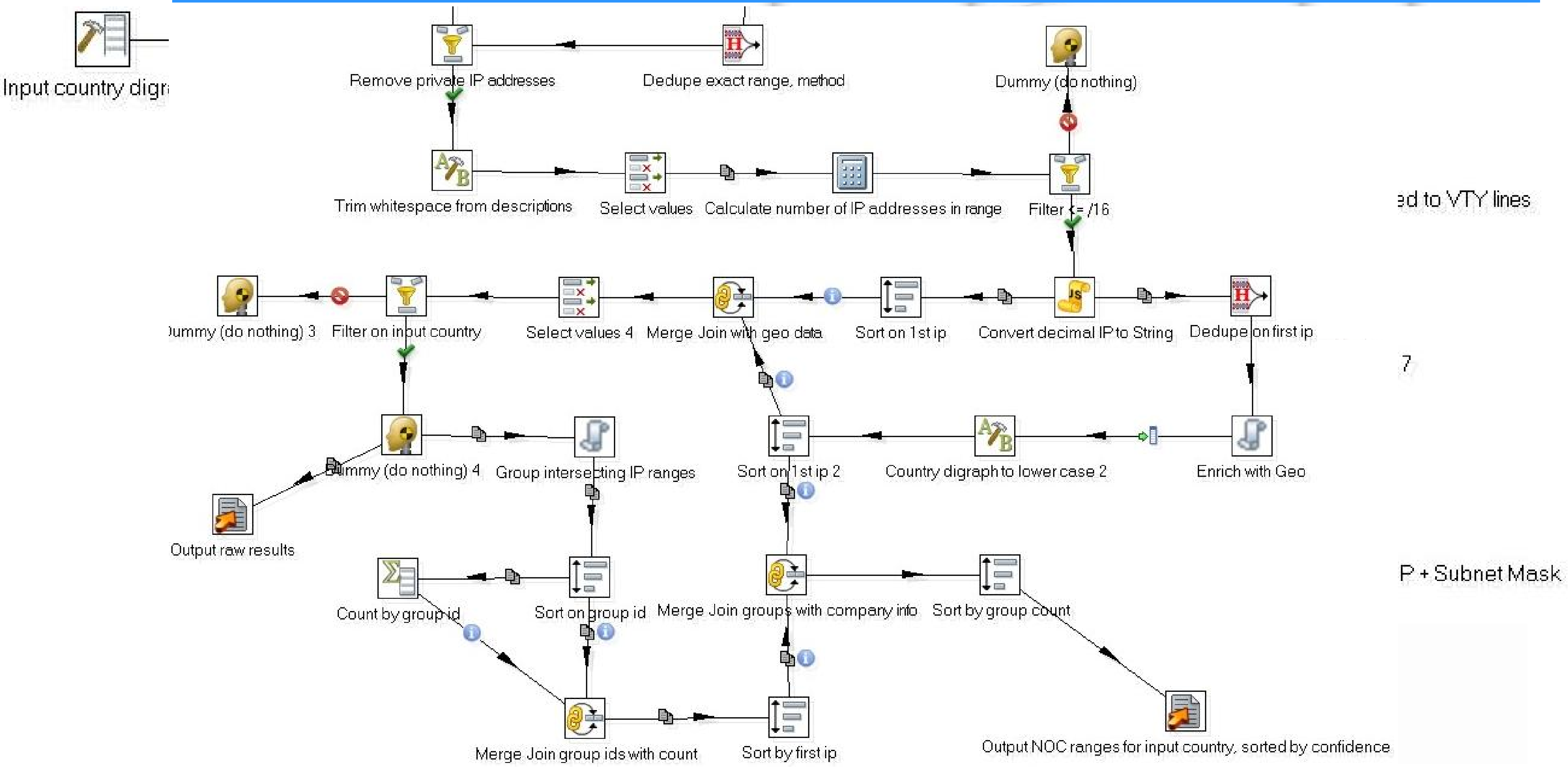
+ **Full Results** [7 available]

SECRET STRAP1 COMINT

GCHQ / CSEC NAC Joint tradecraft development

- During March 2011 GCHQ Analysts visited CSEC to look at the using PENTAHO for tradecraft modelling working with CSEC NAC and CSEC/H3 software developers to see if could model NOCTURNAL SURGE in PENTAHO and then implement in OLYMPIA.
- Only possible to attempt because:
  - GCHQ NAC use PENTAHO
  - CSEC NAC/H3 use PENTAHO
  - CSEC NAC have implemented GCHQ NAC TIDAL SURGE Database Schema (DSD also have this..)
- GCHQ approach based on AS
- CSEC approach based on Country

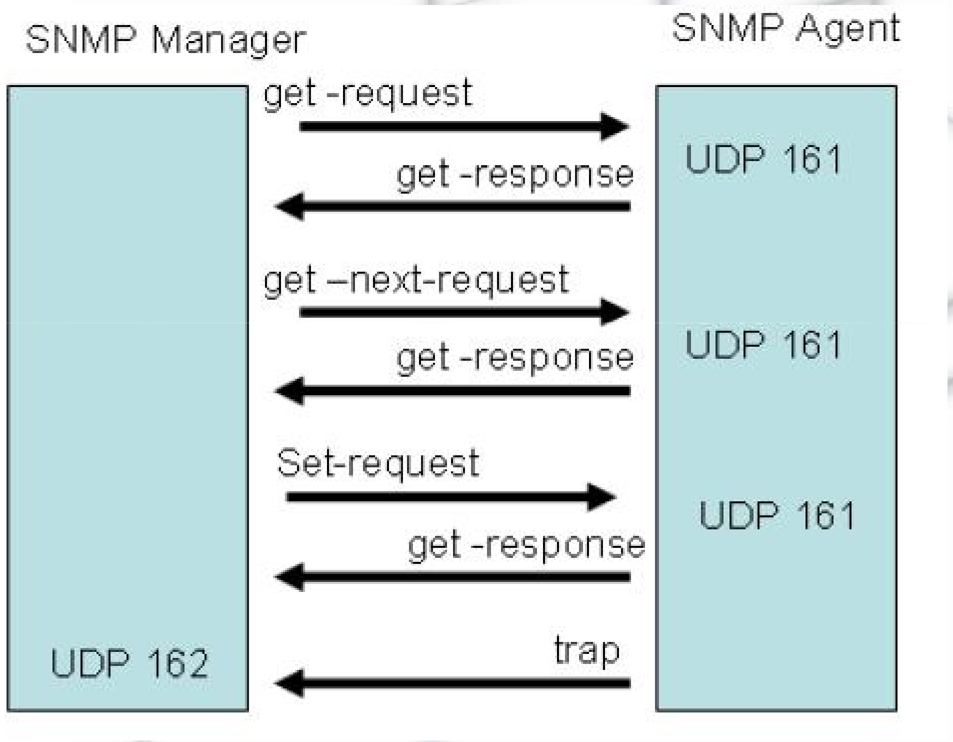
Pentaho - NOC Auto Detection



Phase 2: Intelligent use of Metadata

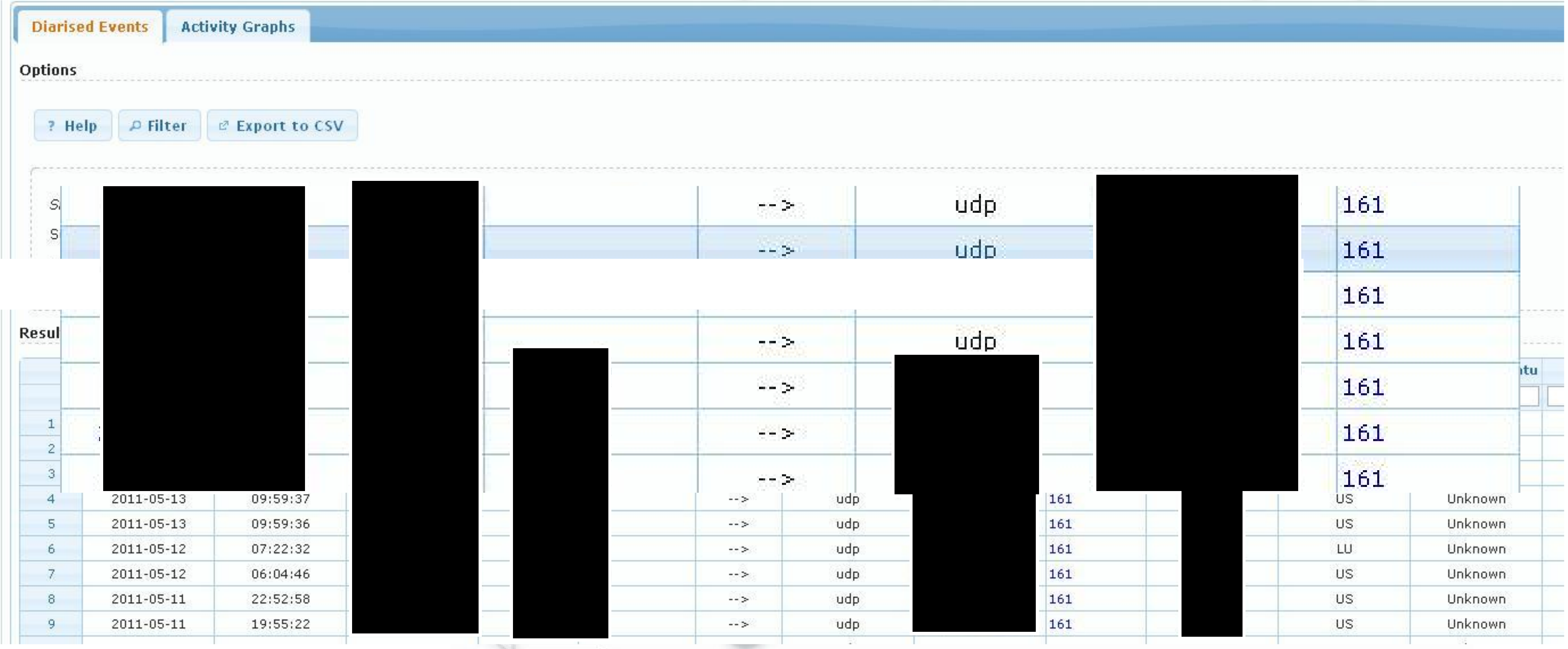
- We do not always get full configuration files to parse.
- Services between routers and NOCs run on IP/TCP/UDP
- We do create 5-TUPLE metadata from our collection
  - GCHQ have prototype database – 5-Alive
  - CSEC have database - HYPERION

SNMP Protocol



TOP SECRET STRAP 2

SNMP Protocol in 5-Alive



[redacted]	[redacted]	-->	udp	[redacted]	161
[redacted]	[redacted]	-->	udp	[redacted]	161
[redacted]	[redacted]			[redacted]	161
[redacted]	[redacted]	-->	udp	[redacted]	161
[redacted]	[redacted]	-->	[redacted]	[redacted]	161
[redacted]	[redacted]	-->	[redacted]	[redacted]	161
[redacted]	[redacted]	-->	[redacted]	[redacted]	161

4	2011-05-13	09:59:37	[redacted]	[redacted]	-->	udp	[redacted]	161	[redacted]	US	Unknown
5	2011-05-13	09:59:36	[redacted]	[redacted]	-->	udp	[redacted]	161	[redacted]	US	Unknown
6	2011-05-12	07:22:32	[redacted]	[redacted]	-->	udp	[redacted]	161	[redacted]	LU	Unknown
7	2011-05-12	06:04:46	[redacted]	[redacted]	-->	udp	[redacted]	161	[redacted]	US	Unknown
8	2011-05-11	22:52:58	[redacted]	[redacted]	-->	udp	[redacted]	161	[redacted]	US	Unknown
9	2011-05-11	19:55:22	[redacted]	[redacted]	-->	udp	[redacted]	161	[redacted]	US	Unknown

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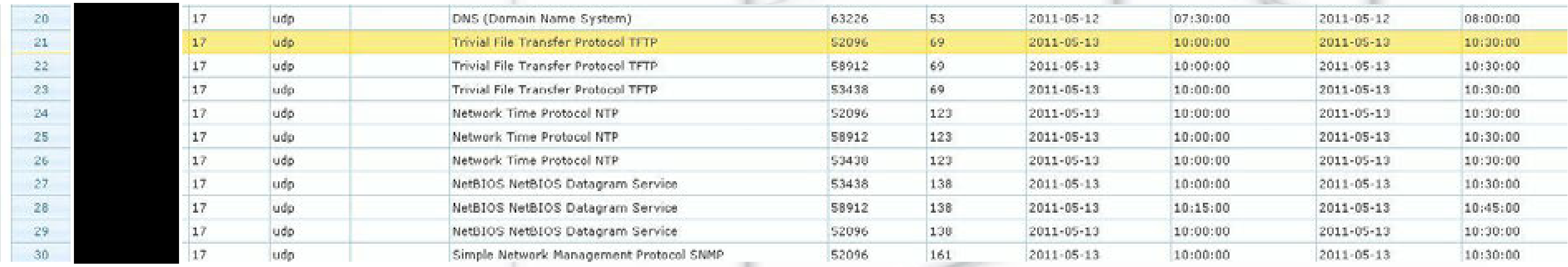
Further drill down on activity for identified IP



20	[redacted]	17	udp		DNS (Domain Name System)	63226	53	2011-05-12	07:30:00	2011-05-12	08:00:00
21	[redacted]	17	udp		Trivial File Transfer Protocol TFTP	52096	69	2011-05-13	10:00:00	2011-05-13	10:30:00
22	[redacted]	17	udp		Trivial File Transfer Protocol TFTP	58912	69	2011-05-13	10:00:00	2011-05-13	10:30:00
23	[redacted]	17	udp		Trivial File Transfer Protocol TFTP	53438	69	2011-05-13	10:00:00	2011-05-13	10:30:00
24	[redacted]	17	udp		Network Time Protocol NTP	52096	123	2011-05-13	10:00:00	2011-05-13	10:30:00
25	[redacted]	17	udp		Network Time Protocol NTP	58912	123	2011-05-13	10:00:00	2011-05-13	10:30:00
26	[redacted]	17	udp		Network Time Protocol NTP	53438	123	2011-05-13	10:00:00	2011-05-13	10:30:00
27	[redacted]	17	udp		NetBIOS NetBIOS Datagram Service	53438	138	2011-05-13	10:00:00	2011-05-13	10:30:00
28	[redacted]	17	udp		NetBIOS NetBIOS Datagram Service	58912	138	2011-05-13	10:15:00	2011-05-13	10:45:00
29	[redacted]	17	udp		NetBIOS NetBIOS Datagram Service	52096	138	2011-05-13	10:00:00	2011-05-13	10:30:00
30	[redacted]	17	udp		Simple Network Management Protocol SNMP	52096	161	2011-05-13	10:00:00	2011-05-13	10:30:00

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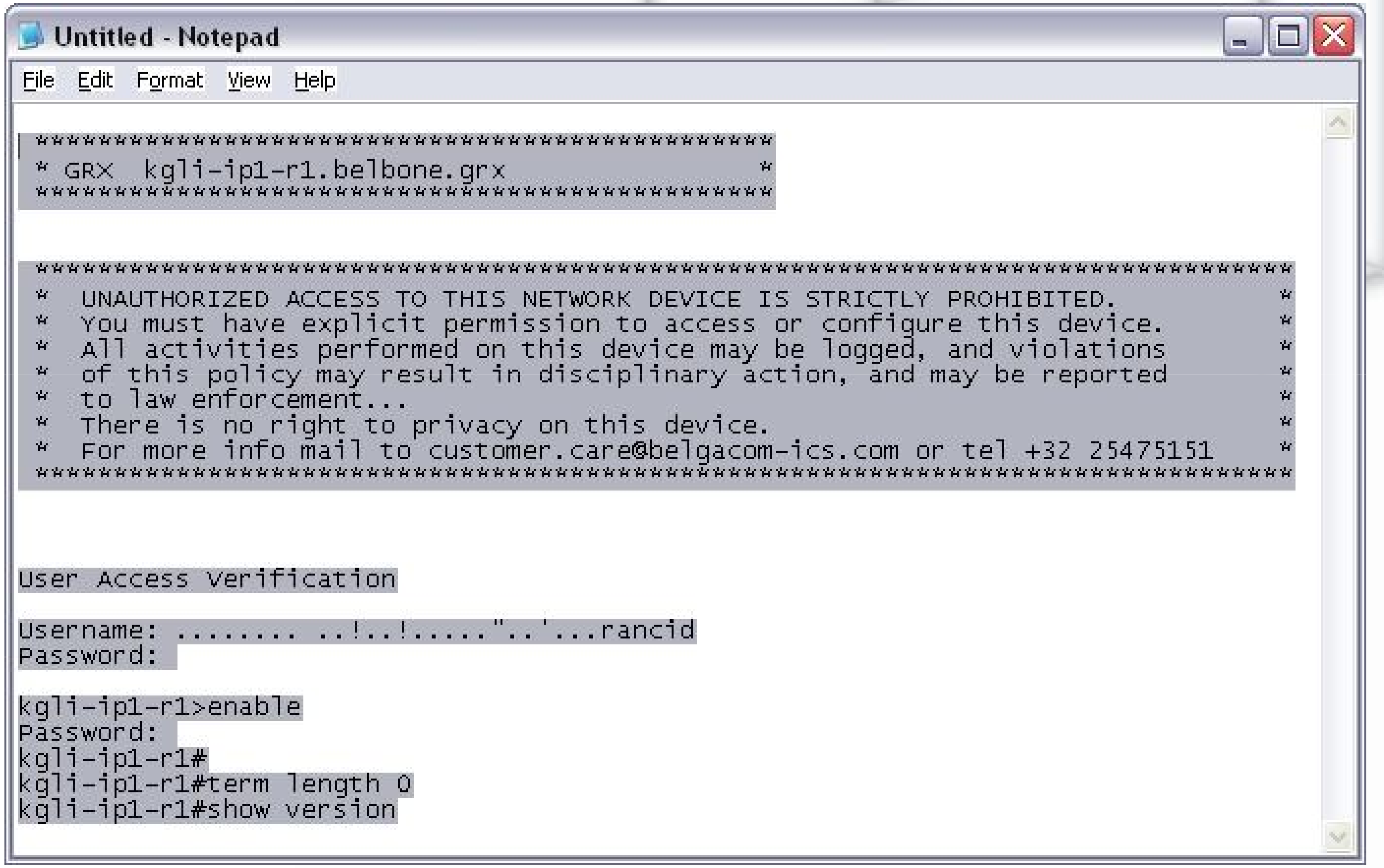
Phase 3: Intelligent use of TELNET traffic

- Again we do not always get full configuration files. Phase 1 is based on full (or as near to full) configuration files
- GCHQ NAC collect TELNET Sessions into TERMINAL SURGE
  - Collection based on TCP Port 23 (TELNET)
  - Other protocols use TCP Port 23 (YMSG)
- Interaction with Routers over TCP Port 23 maybe nefarious:
  - Scanning
  - Password guessing
- Need to separate legitimate use from nefarious activity
- Look for signs of legitimate use.
  - Successful login
  - Follow on commands

TOP SECRET STRAP 2

From TCP Port 23 (Echo)



```
 ***********************************************
 * GRX  kgli-ip1-r1.belbone.grx                *
 ***********************************************


 ********************************************************************************
 *  UNAUTHORIZED ACCESS TO THIS NETWORK DEVICE IS STRICTLY PROHIBITED.          *
 *  You must have explicit permission to access or configure this device.      *
 *  All activities performed on this device may be logged, and violations      *
 *  of this policy may result in disciplinary action, and may be reported      *
 *  to law enforcement...                                                       *
 *  There is no right to privacy on this device.                               *
 *  For more info mail to customer.care@belgacom-ics.com or tel +32 25475151   *
 ********************************************************************************



User Access Verification

Username: ........ ..!..!....."..'...rancid
Password: 

kgli-ip1-r1>enable
Password: 
kgli-ip1-r1#
kgli-ip1-r1#term length 0
kgli-ip1-r1#show version
```

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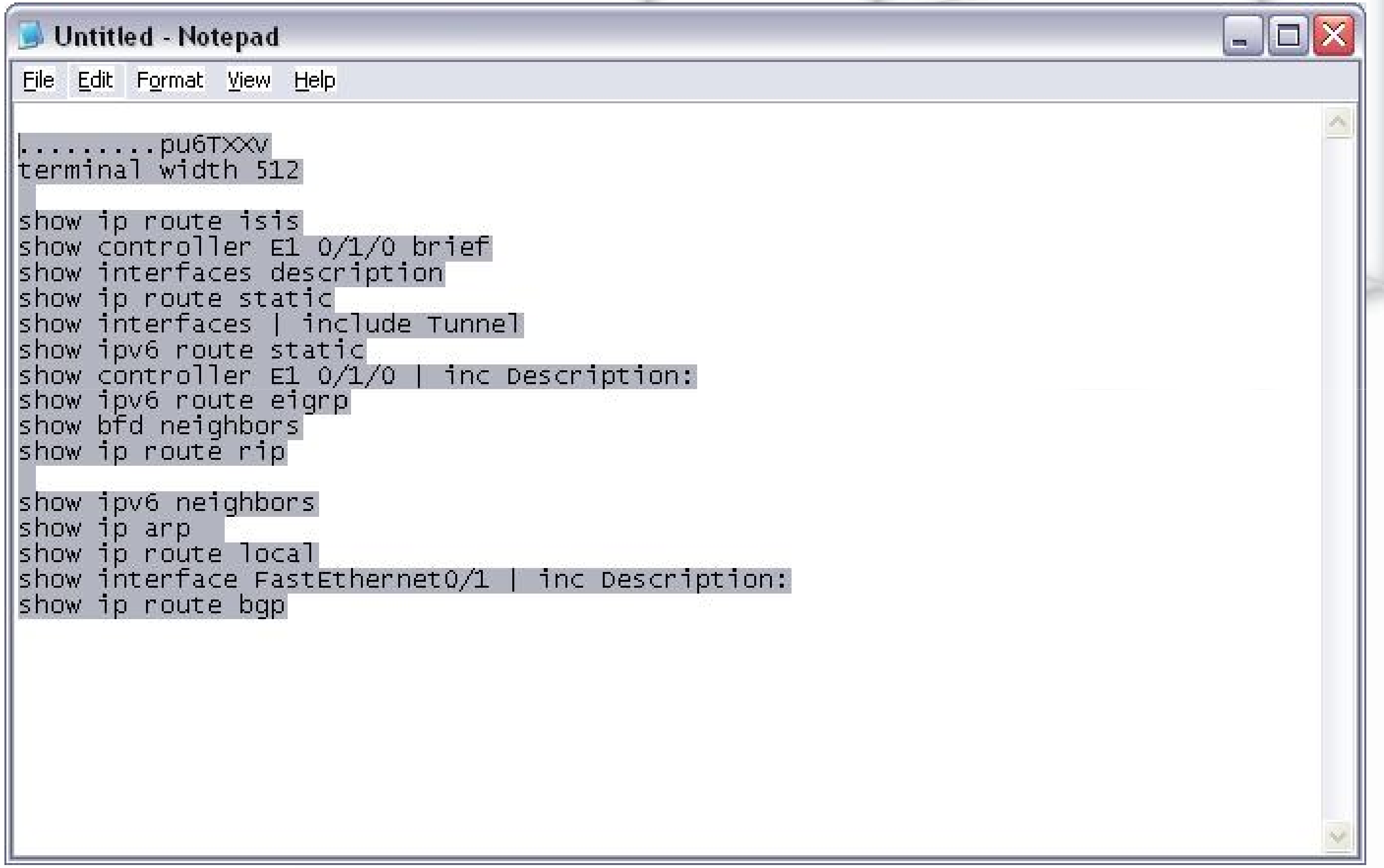
To TCP Port 23



```
.........pu6Txxv
terminal width 512

show ip route isis
show controller E1 0/1/0 brief
show interfaces description
show ip route static
show interfaces | include Tunnel
show ipv6 route static
show controller E1 0/1/0 | inc Description:
show ipv6 route eigrp
show bfd neighbors
show ip route rip

show ipv6 neighbors
show ip arp
show ip route local
show interface FastEthernet0/1 | inc Description:
show ip route bgp
```

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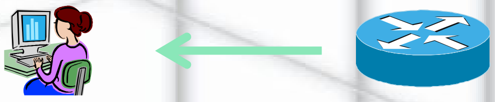
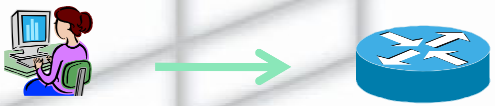
Intelligent analysis of TELNET traffic

- The fact that login was successful for both examples means the following:
  - From TCP Port 23
    - To IP address is Network Management Terminal (in the NOC ?)



  - To TCP Port 23
    - From IP address is Network Management Terminal (in the NOC ?)



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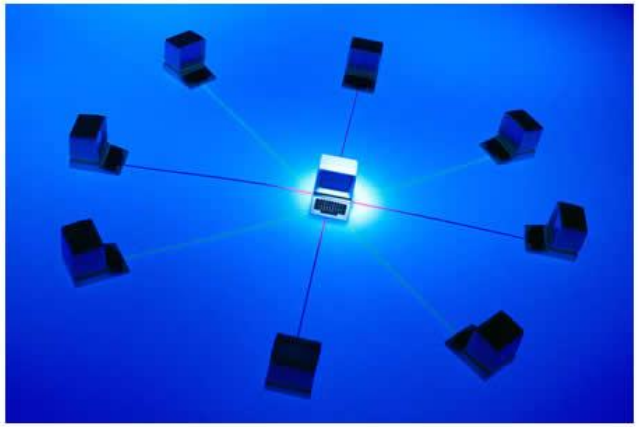
Phase 4: Bulk Port Scanning

- We know the key services/servers running in the NOC
- Utilise HACIENDA, GCHQ’s bulk port scanning capability to identify what IPs have these service ports open – additional logic to build up confidence required.

Fusion of sources

- Aim is to bring all sources that help identify NOC IP ranges together with associated confidence.
- Different techniques provide different results due to the nature of passive access (international v's in-country for instance)
- Different techniques have different levels of reliability – therefore looking to develop aggregation with overlay of smart intelligence.
- Solution can work on not just ISP NOCs but also Mobile OMCs.



And then….enabling CNE on NOCs

- We now have IP ranges – need selectors of NOC Staff to enable QUANTUM INSERT attack against them.
- Use of GCHQ TDI capability to identify selectors coming out of IP ranges and/or identification of proxy/NAT within NOC range.

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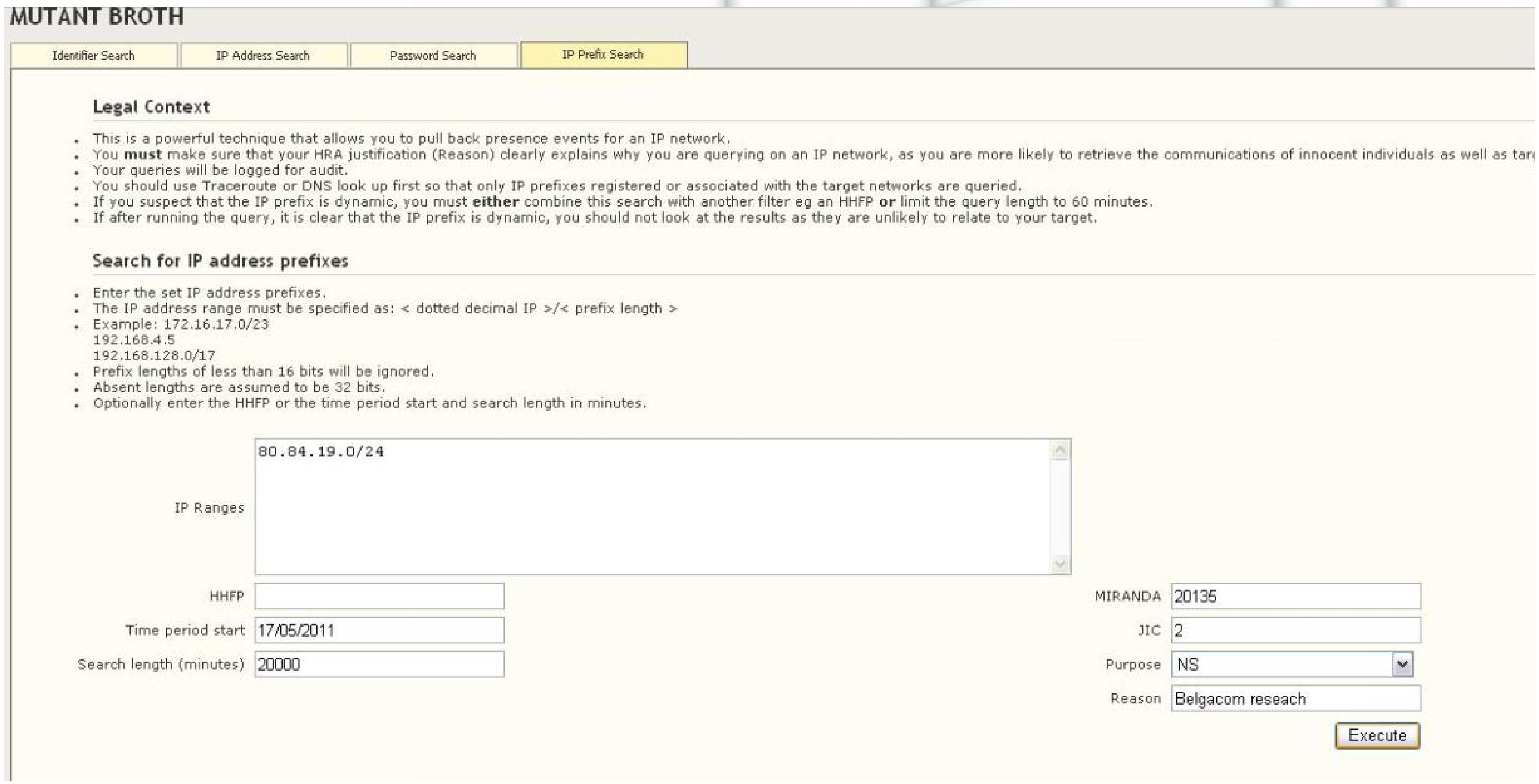
NOC IP range search in MUTANT BROTH



Legal Context

- This is a powerful technique that allows you to pull back presence events for an IP network.
- You **must** make sure that your HRA justification (Reason) clearly explains why you are querying on an IP network, as you are more likely to retrieve the communications of innocent individuals as well as tar
- Your queries will be logged for audit.
- You should use Traceroute or DNS look up first so that only IP prefixes registered or associated with the target networks are queried.
- If you suspect that the IP prefix is dynamic, you must **either** combine this search with another filter eg an HHFP **or** limit the query length to 60 minutes.
- If after running the query, it is clear that the IP prefix is dynamic, you should not look at the results as they are unlikely to relate to your target.

Search for IP address prefixes

- Enter the set IP address prefixes.
- The IP address range must be specified as: < dotted decimal IP >/< prefix length >
- Example: 172.16.17.0/23
  192.168.4.5
  192.168.128.0/17
- Prefix lengths of less than 16 bits will be ignored.
- Absent lengths are assumed to be 32 bits.
- Optionally enter the HHFP or the time period start and search length in minutes.

IP Ranges: 80.84.19.0/24

HHFP:

Time period start: 17/05/2011

Search length (minutes): 20000

MIRANDA: 20135

JIC: 2

Purpose: NS

Reason: Belgacom reseach

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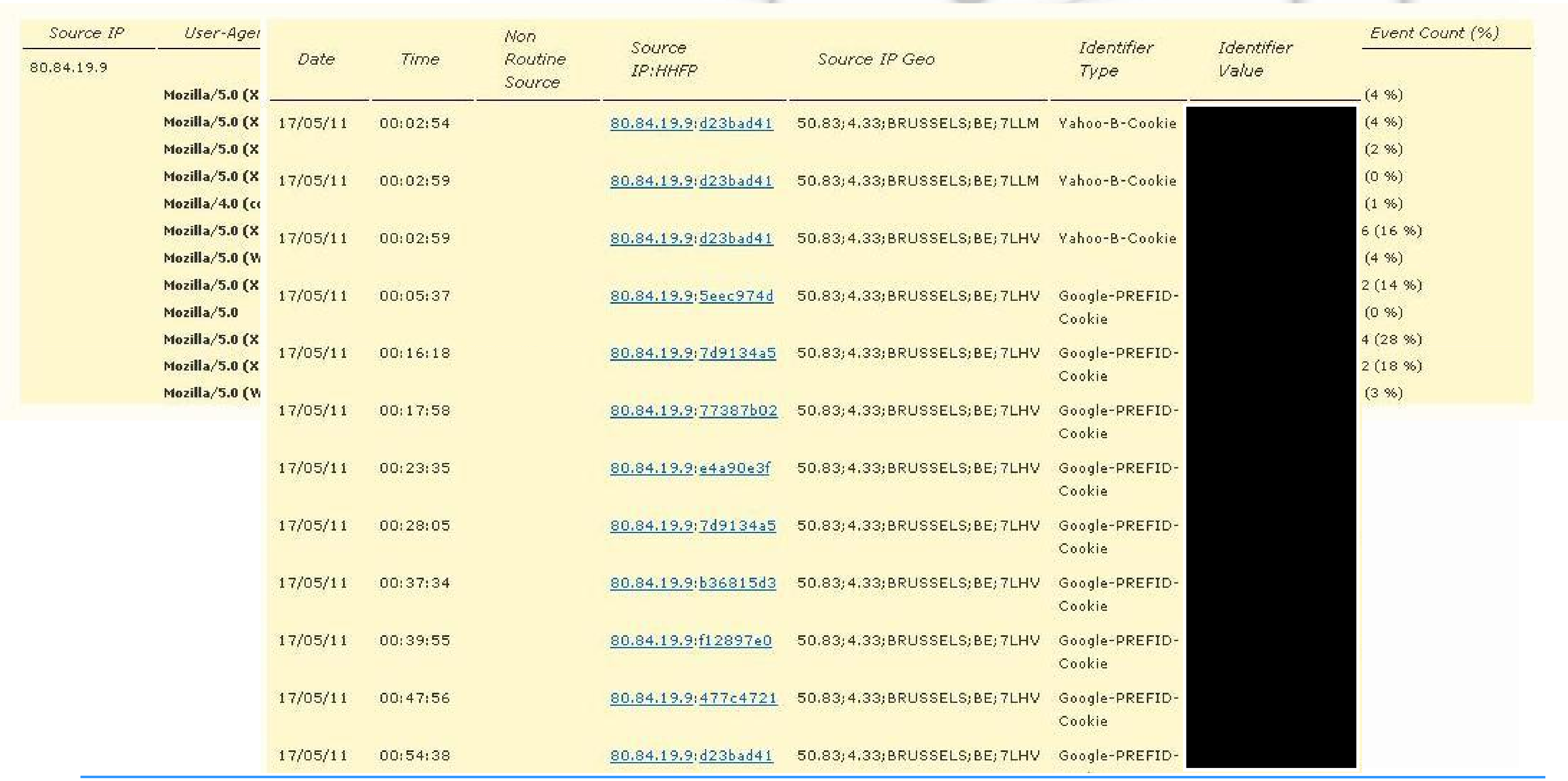
TOP SECRET STRAP 2

NOC IP range – Target identifiers for QUANTUM INSERT

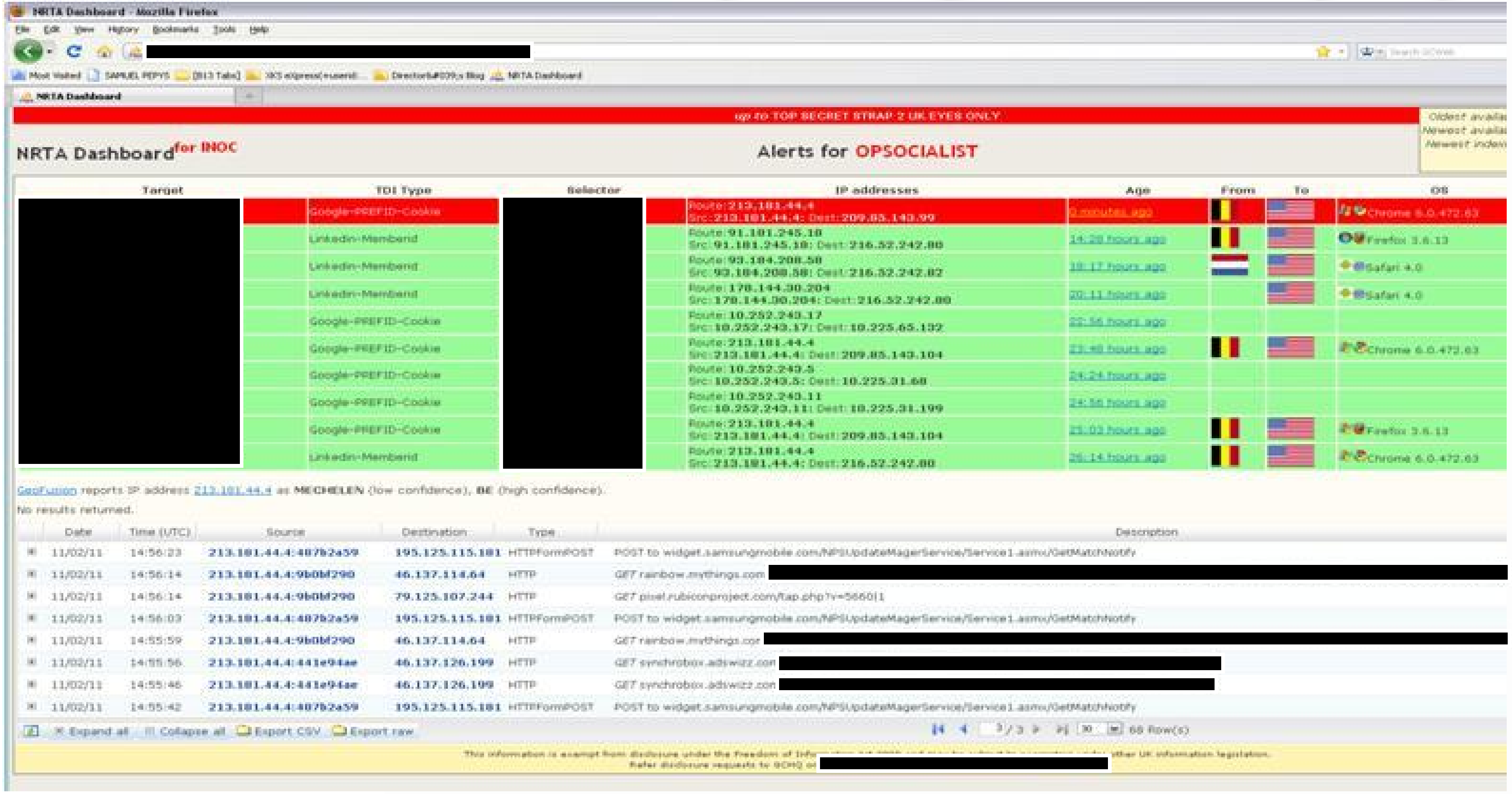


Source IP	User-Age	Event Count (%)
80.84.19.9		
	Mozilla/5.0 (X	(4 %)
	Mozilla/5.0 (X	(4 %)
	Mozilla/5.0 (X	(2 %)
	Mozilla/5.0 (X	(0 %)
	Mozilla/4.0 (c	(1 %)
	Mozilla/5.0 (X	6 (16 %)
	Mozilla/5.0 (W	(4 %)
	Mozilla/5.0 (X	2 (14 %)
	Mozilla/5.0	(0 %)
	Mozilla/5.0 (X	4 (28 %)
	Mozilla/5.0 (X	2 (18 %)
	Mozilla/5.0 (W	(3 %)

Date	Time	Non Routine Source	Source IP:HHFP	Source IP Geo	Identifier Type	Identifier Value
17/05/11	00:02:54		80.84.19.9:d23bad41	50.83;4.33;BRUSSELS;BE;7LLM	Yahoo-B-Cookie	[redacted]
17/05/11	00:02:59		80.84.19.9:d23bad41	50.83;4.33;BRUSSELS;BE;7LLM	Yahoo-B-Cookie	[redacted]
17/05/11	00:02:59		80.84.19.9:d23bad41	50.83;4.33;BRUSSELS;BE;7LHV	Yahoo-B-Cookie	[redacted]
17/05/11	00:05:37		80.84.19.9:5eec974d	50.83;4.33;BRUSSELS;BE;7LHV	Google-PREFID-Cookie	[redacted]
17/05/11	00:16:18		80.84.19.9:7d9134a5	50.83;4.33;BRUSSELS;BE;7LHV	Google-PREFID-Cookie	[redacted]
17/05/11	00:17:58		80.84.19.9:77387b02	50.83;4.33;BRUSSELS;BE;7LHV	Google-PREFID-Cookie	[redacted]
17/05/11	00:23:35		80.84.19.9:e4a90e3f	50.83;4.33;BRUSSELS;BE;7LHV	Google-PREFID-Cookie	[redacted]
17/05/11	00:28:05		80.84.19.9:7d9134a5	50.83;4.33;BRUSSELS;BE;7LHV	Google-PREFID-Cookie	[redacted]
17/05/11	00:37:34		80.84.19.9:b36815d3	50.83;4.33;BRUSSELS;BE;7LHV	Google-PREFID-Cookie	[redacted]
17/05/11	00:39:55		80.84.19.9:f12897e0	50.83;4.33;BRUSSELS;BE;7LHV	Google-PREFID-Cookie	[redacted]
17/05/11	00:47:56		80.84.19.9:477c4721	50.83;4.33;BRUSSELS;BE;7LHV	Google-PREFID-Cookie	[redacted]
17/05/11	00:54:38		80.84.19.9:d23bad41	50.83;4.33;BRUSSELS;BE;7LHV	Google-PREFID-	[redacted]

TOP SECRET STRAP 2

Real-time picture of QI



NRTA Dashboard - Mozilla Firefox

[redacted]

up to TOP SECRET STRAP 2 UK EYES ONLY

Oldest availa
Newest availa
Newest index

NRTA Dashboard for INOC

Alerts for OPSOCIALIST

Target	TDI Type	Selector	IP addresses	Age	From	To	OS
[redacted]	Google-PREFID-Cookie	[redacted]	Route:213.181.44.4 Src:213.181.44.4: Dest:209.85.143.99	0 minutes ago	🇧🇪	🇺🇸	Chrome 6.0.472.63
	Linkedin-Memberid		Route:91.181.245.18 Src:91.181.245.18: Dest:216.52.242.80	14:20 hours ago	🇧🇪	🇺🇸	Firefox 3.6.13
	Linkedin-Memberid		Route:93.184.208.58 Src:93.184.208.58: Dest:216.52.242.82	18:17 hours ago	🇳🇱	🇺🇸	Safari 4.0
	Linkedin-Memberid		Route:178.144.30.204 Src:178.144.30.204: Dest:216.52.242.80	20:11 hours ago		🇺🇸	Safari 4.0
	Google-PREFID-Cookie		Route:10.252.243.17 Src:10.252.243.17: Dest:10.225.65.132	22:56 hours ago			
	Google-PREFID-Cookie		Route:213.181.44.4 Src:213.181.44.4: Dest:209.85.143.104	23:40 hours ago	🇧🇪	🇺🇸	Chrome 6.0.472.63
	Google-PREFID-Cookie		Route:10.252.243.5 Src:10.252.243.5: Dest:10.225.31.68	24:24 hours ago			
	Google-PREFID-Cookie		Route:10.252.243.11 Src:10.252.243.11: Dest:10.225.31.199	24:56 hours ago			
	Google-PREFID-Cookie		Route:213.181.44.4 Src:213.181.44.4: Dest:209.85.143.104	25:03 hours ago	🇧🇪	🇺🇸	Firefox 3.6.13
	Linkedin-Memberid		Route:213.181.44.4 Src:213.181.44.4: Dest:216.52.242.80	26:14 hours ago	🇧🇪	🇺🇸	Chrome 6.0.472.63

GeoFusion reports IP address 213.181.44.4 as MECHELEN (low confidence), BE (high confidence).

No results returned.

	Date	Time (UTC)	Source	Destination	Type	Description
⊞	11/02/11	14:56:23	213.181.44.4:487b2a59	195.125.115.181	HTTPFormPOST	POST to widget.samsungmobile.com/NPSUpdateMagerService/Service1.asmx/GetMatchNotify
⊞	11/02/11	14:56:14	213.181.44.4:9b0bf290	46.137.114.64	HTTP	GET rainbow.mythings.com [redacted]
⊞	11/02/11	14:56:14	213.181.44.4:9b0bf290	79.125.107.244	HTTP	GET pixel.rubiconproject.com/tap.php?v=566011
⊞	11/02/11	14:56:03	213.181.44.4:487b2a59	195.125.115.181	HTTPFormPOST	POST to widget.samsungmobile.com/NPSUpdateMagerService/Service1.asmx/GetMatchNotify
⊞	11/02/11	14:55:59	213.181.44.4:9b0bf290	46.137.114.64	HTTP	GET rainbow.mythings.cor [redacted]
⊞	11/02/11	14:55:56	213.181.44.4:441e94ae	46.137.126.199	HTTP	GET synchrobox.adswizz.con [redacted]
⊞	11/02/11	14:55:46	213.181.44.4:441e94ae	46.137.126.199	HTTP	GET synchrobox.adswizz.con [redacted]
⊞	11/02/11	14:55:42	213.181.44.4:487b2a59	195.125.115.181	HTTPFormPOST	POST to widget.samsungmobile.com/NPSUpdateMagerService/Service1.asmx/GetMatchNotify

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Refer disclosure requests to GCHQ on

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Questions ?

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