NETWORK ANALYSIS CENTRE

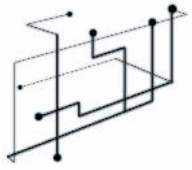
# Automated NOC Detection

[redacted], Head of GCHQ NAC

[redacted], Senior Network Analyst, CSEC NAC

# Challenge

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



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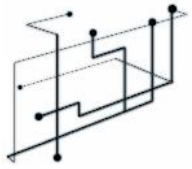
## Phase 1: Intelligent Router Configuration File Parsing

- 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.



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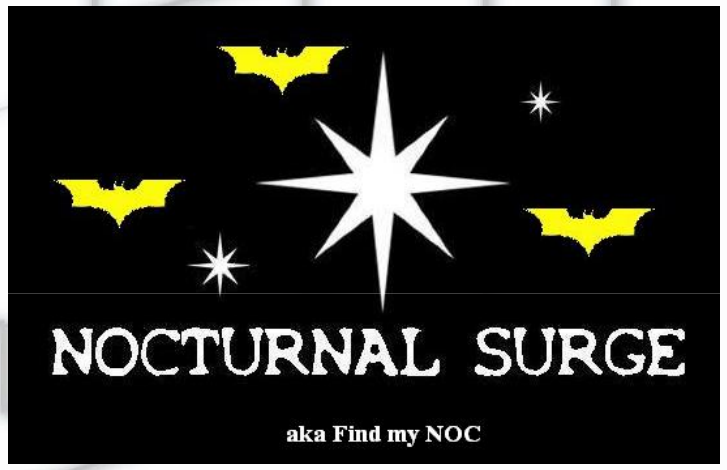
## NOCTURNAL SURGE

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

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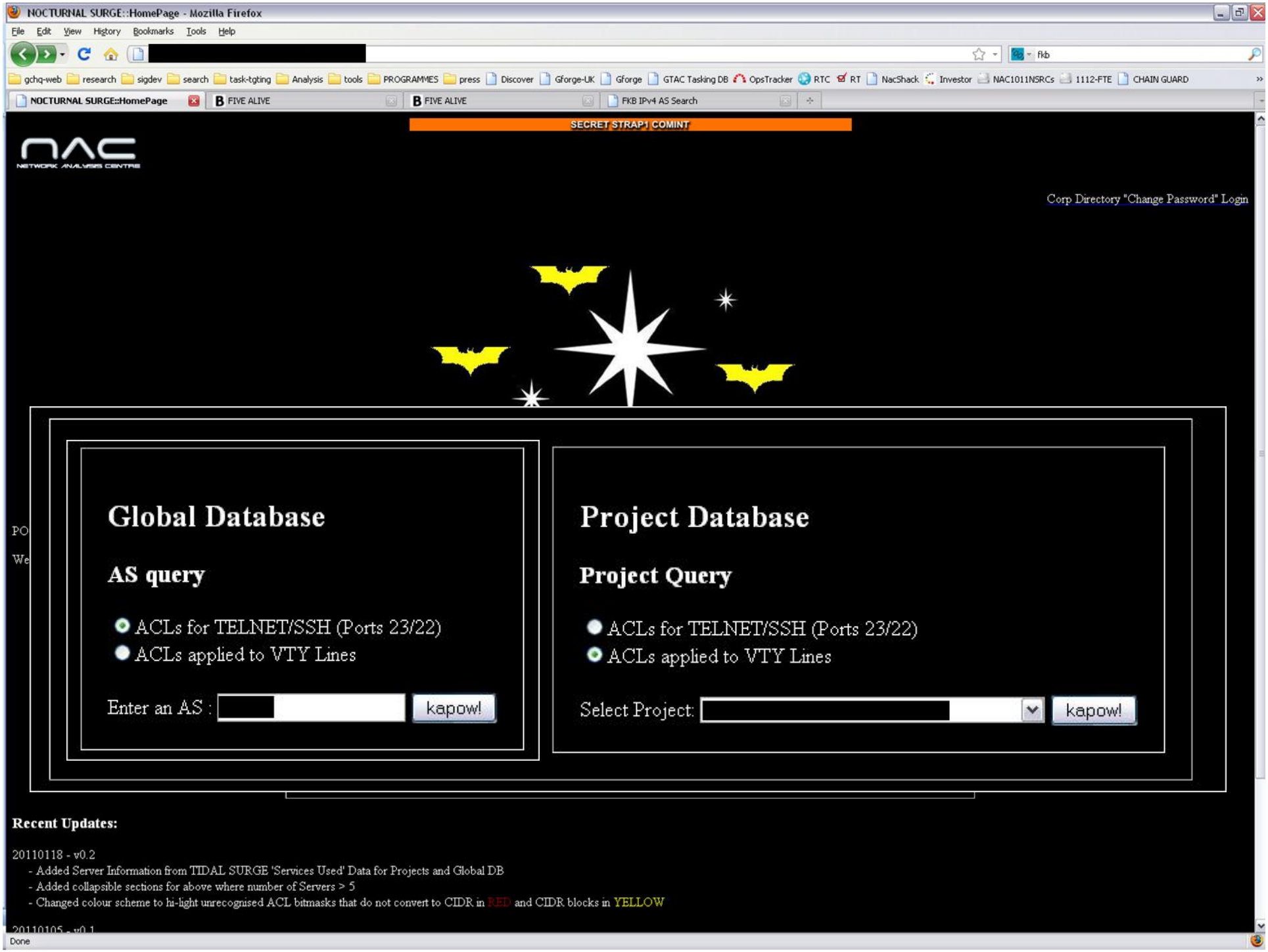
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NOCTURNAL SURGE::HomePage
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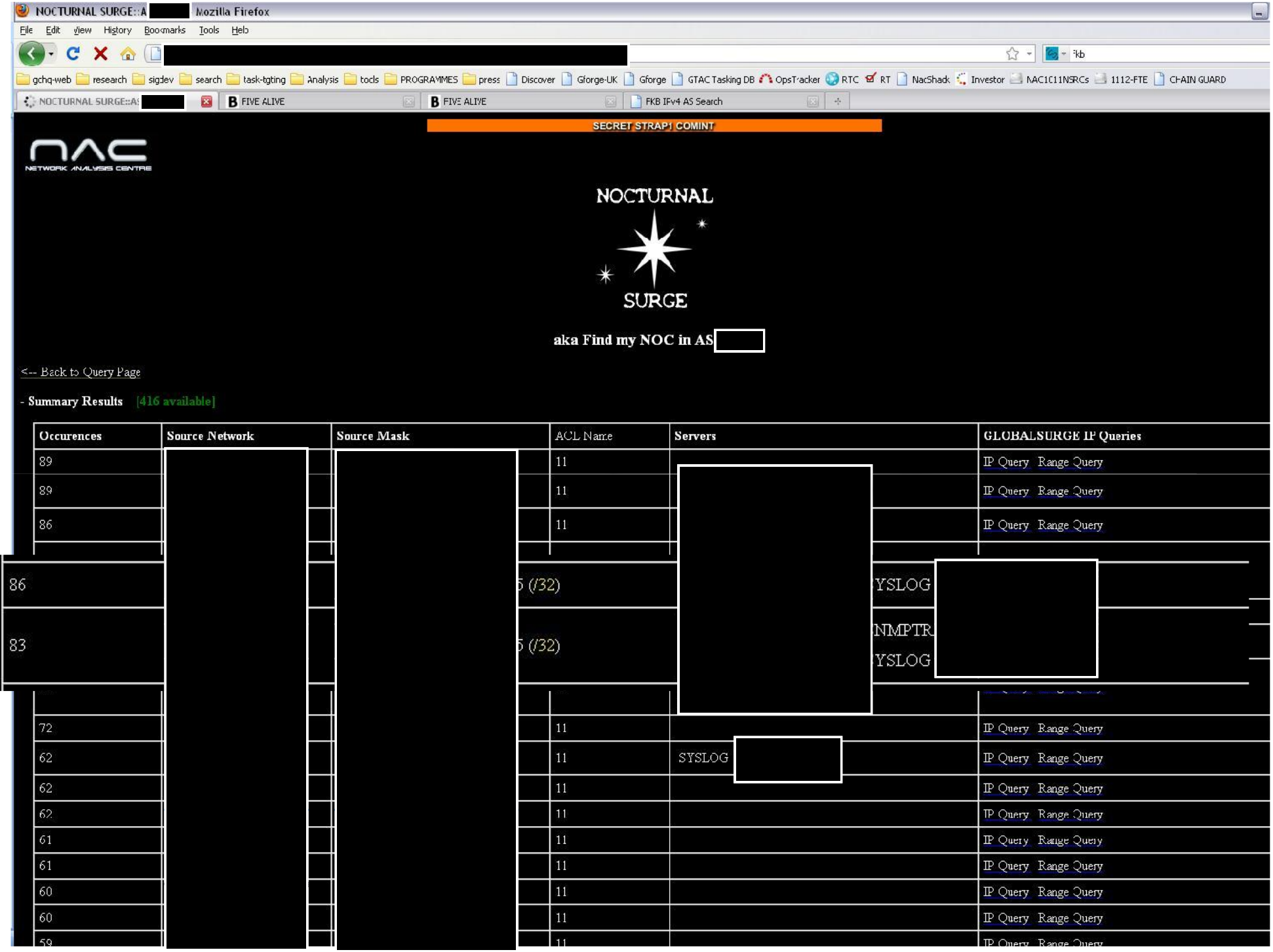
FIVE ALIVE
FKB IPv4 AS Search
SECRET STRAP1 COMINT
NETWORK ANALYSIS CENTRE
Corp Directory "Change Password" Login
Global Database
AS query
ACLs for TELNET/SSH (Ports 23/22)
ACLs applied to VTY Lines
Enter an AS :
kapow!
Project Database
Project Query
ACLs for TELNET/SSH (Ports 23/22)
ACLs applied to VTY Lines
Select Project:
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
Done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SECRET STRAP1 COMINT
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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 11 IP Query Range Query
89 11 IP Query Range Query
86 11 IP Query Range Query
86 5 (32) YSLOG
83 5 (32) NMPTR YSLOG
72 11 IP Query Range Query
62 11 SYSLOG IP Query Range Query
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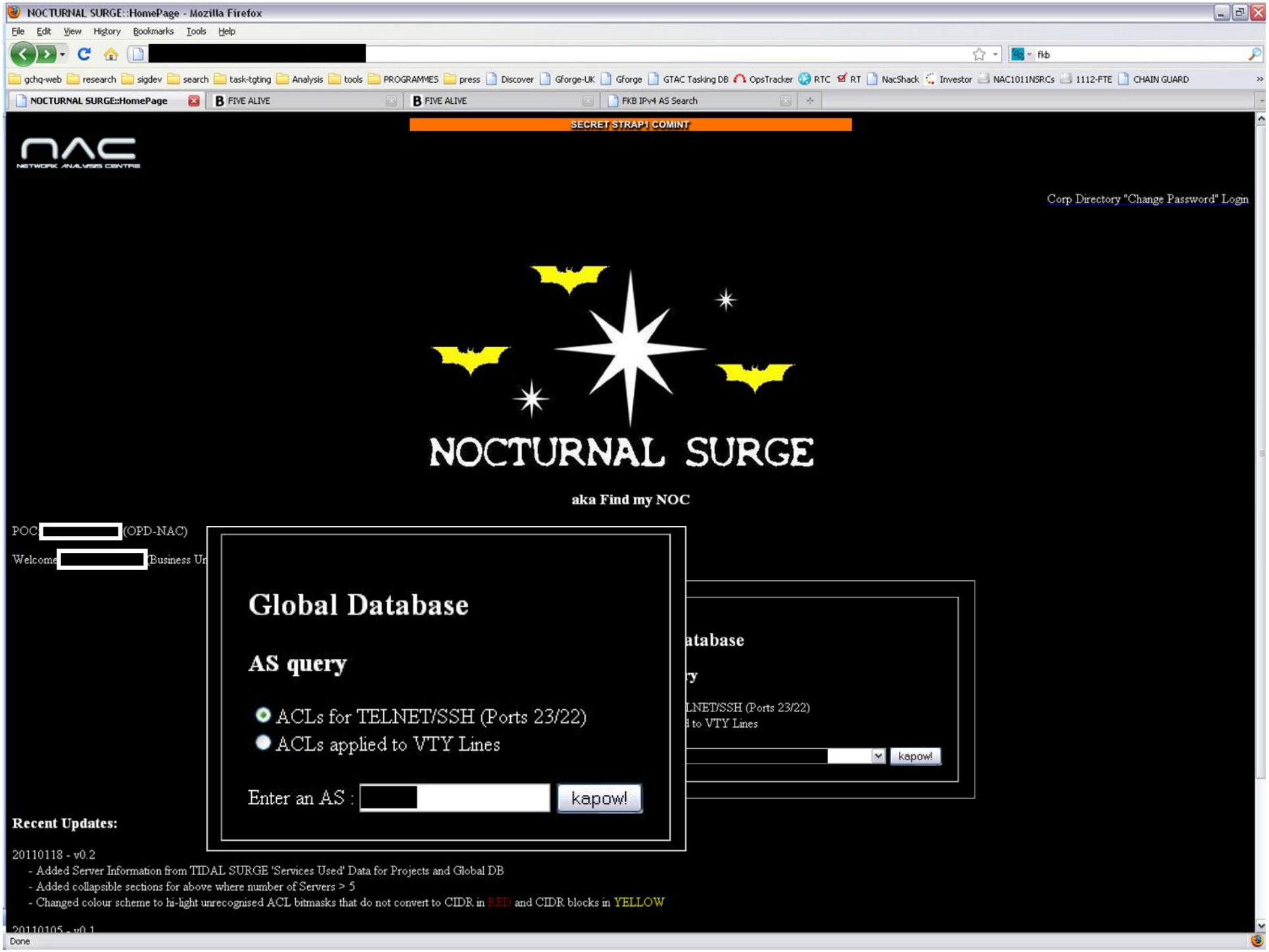
59 11 IP Query Range Query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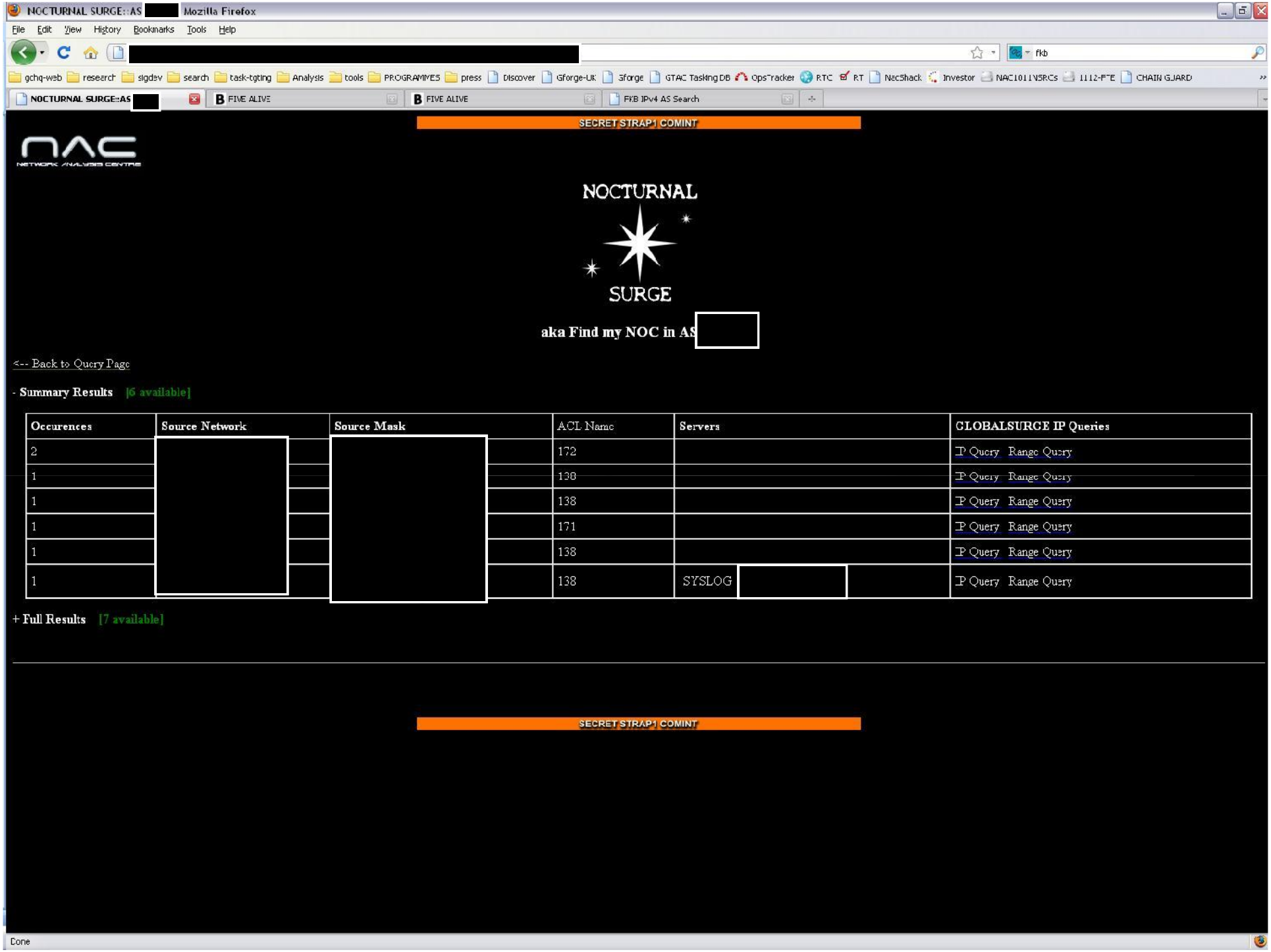
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fkb
gchq-web research sigdev search task-tgting Analysis tools PROGRAMMES press Discover GForge-UK GForge GTAC Tasking DB OpsTracker RTC RT NecShack Investor NAC1011N5RCs 1112-F5E CHAIN GJARD
NOCTURNAL SURGE::AS [redacted]
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SECRET STRAP1 COMINT
NETWORK ANALYSIS CENTRE
NOCTURNAL
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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
1 138 IP Query Range Query
1 138 IP Query Range Query
1 171 IP Query Range Query
1 138 IP Query Range Query
1 138 SYSLOG [redacted] IP Query Range Query
+ Full Results [7 available]
SECRET STRAP1 COMINT
Done

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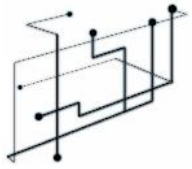
## GCHQ / CSEC NAC Joint tradecraft development

- 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



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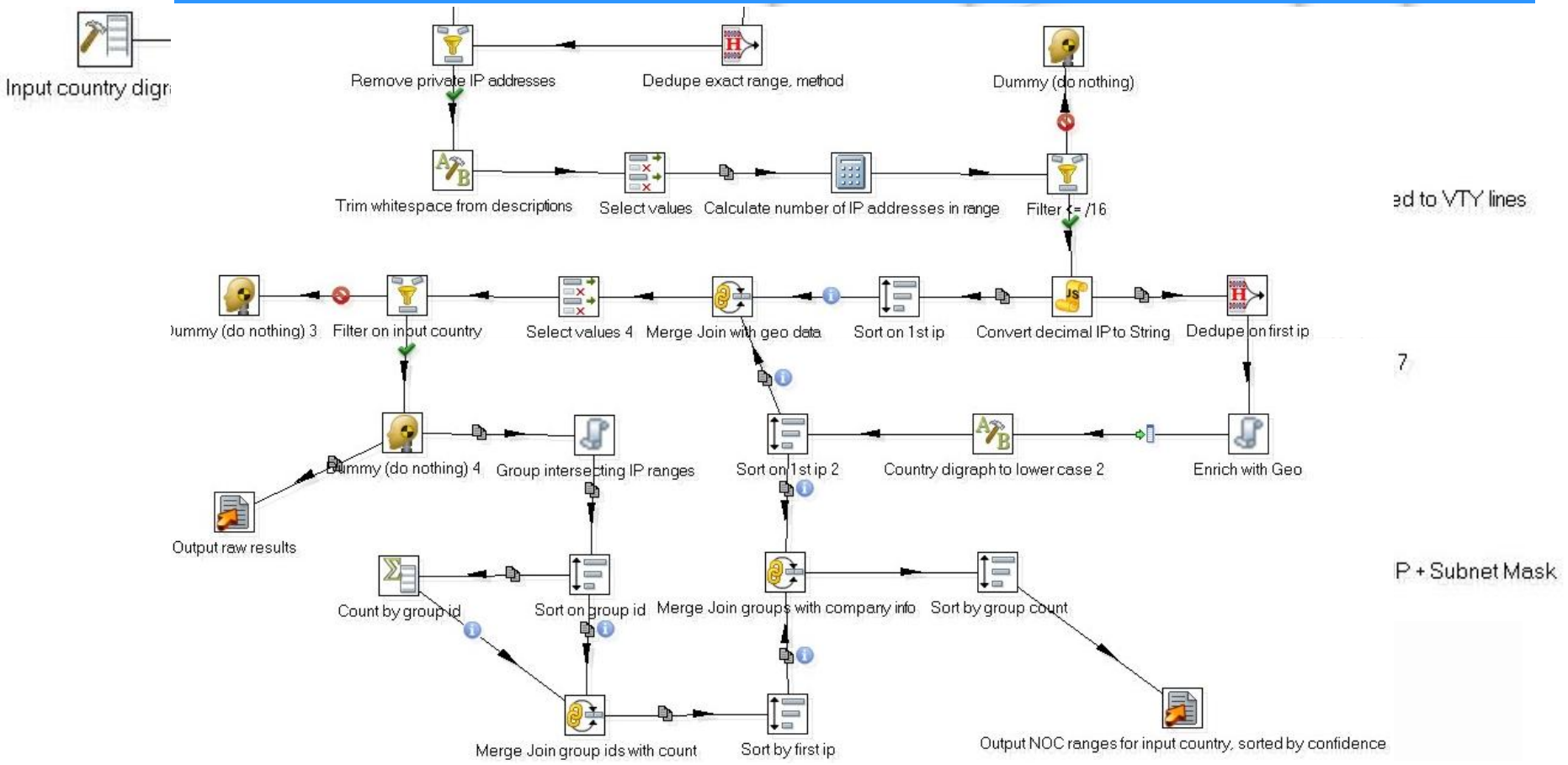
## Pentaho - NOC Auto Detection



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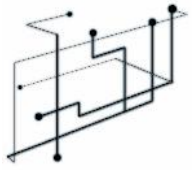
## Phase 2: Intelligent use of Metadata

- 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



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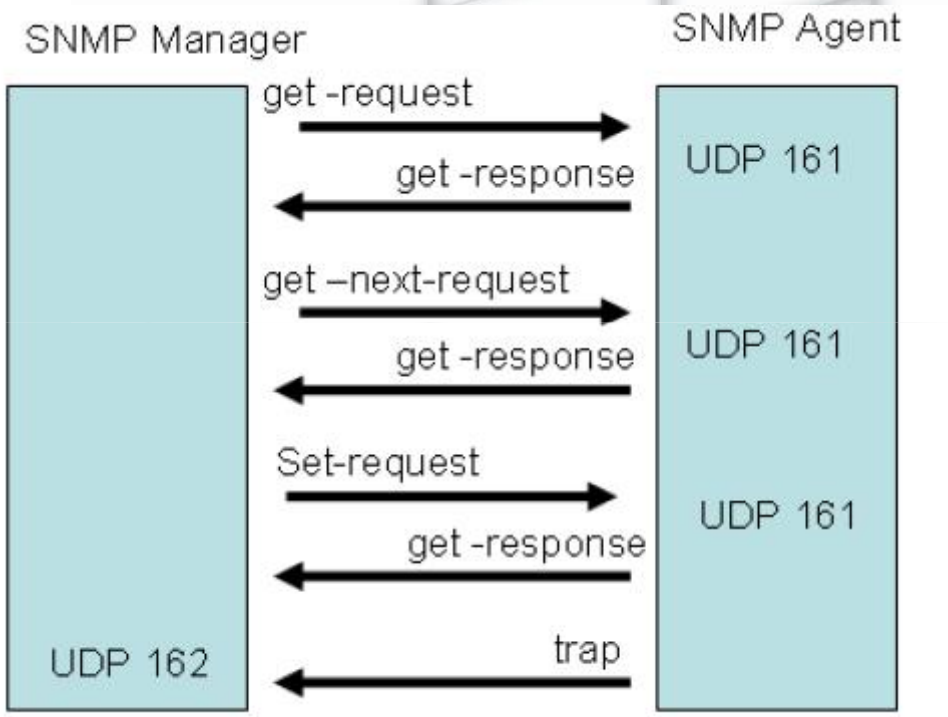
## SNMP Protocol



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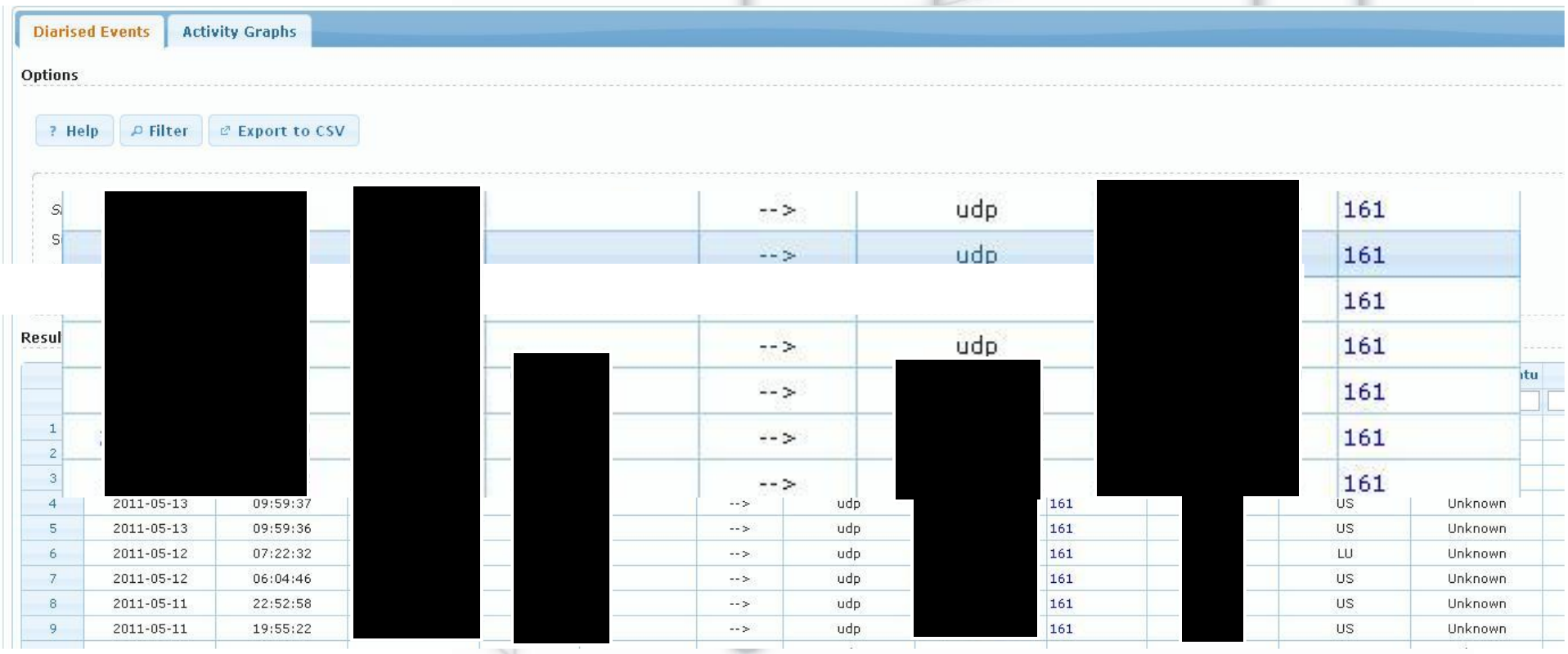
## SNMP Protocol in 5-Alive

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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 | | 17 | udp | | Trivial File Transfer Protocol TFTP | 52096 | 69 | 2011-05-13 | 10:00:00 | 2011-05-13 | 10:30:00 |
| 22 | | 17 | udp | | Trivial File Transfer Protocol TFTP | 58912 | 69 | 2011-05-13 | 10:00:00 | 2011-05-13 | 10:30:00 |
| 23 | | 17 | udp | | Trivial File Transfer Protocol TFTP | 53438 | 69 | 2011-05-13 | 10:00:00 | 2011-05-13 | 10:30:00 |
| 24 | | 17 | udp | | Network Time Protocol NTP | 52096 | 123 | 2011-05-13 | 10:00:00 | 2011-05-13 | 10:30:00 |
| 25 | | 17 | udp | | Network Time Protocol NTP | 58912 | 123 | 2011-05-13 | 10:00:00 | 2011-05-13 | 10:30:00 |
| 26 | | 17 | udp | | Network Time Protocol NTP | 53438 | 123 | 2011-05-13 | 10:00:00 | 2011-05-13 | 10:30:00 |
| 27 | | 17 | udp | | NetBIOS NetBIOS Datagram Service | 53438 | 138 | 2011-05-13 | 10:00:00 | 2011-05-13 | 10:30:00 |
| 28 | | 17 | udp | | NetBIOS NetBIOS Datagram Service | 58912 | 138 | 2011-05-13 | 10:15:00 | 2011-05-13 | 10:45:00 |
| 29 | | 17 | udp | | NetBIOS NetBIOS Datagram Service | 52096 | 138 | 2011-05-13 | 10:00:00 | 2011-05-13 | 10:30:00 |
| 30 | | 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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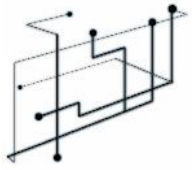
## Phase 3: Intelligent use of TELNET traffic

- 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



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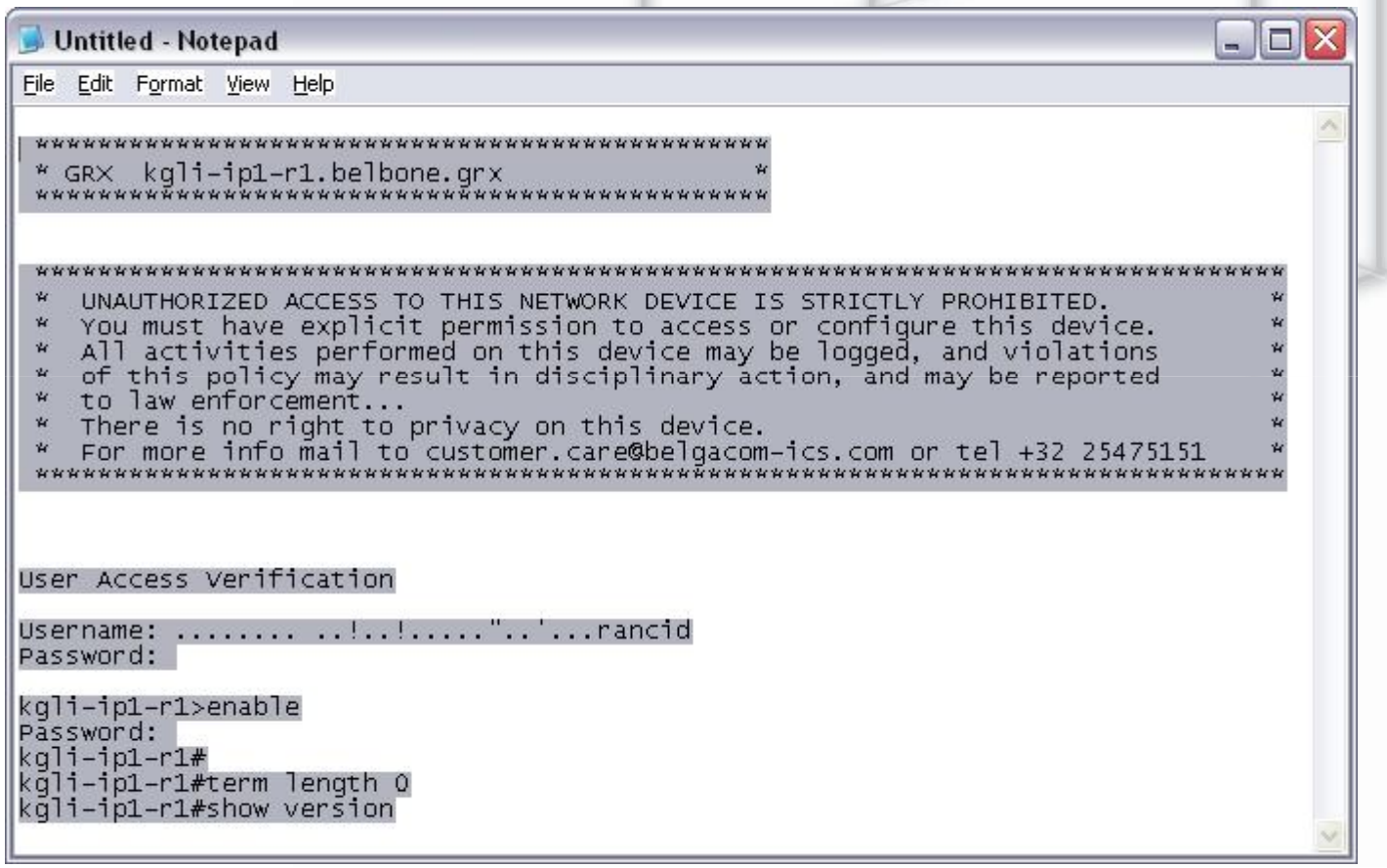
## From TCP Port 23 (Echo)

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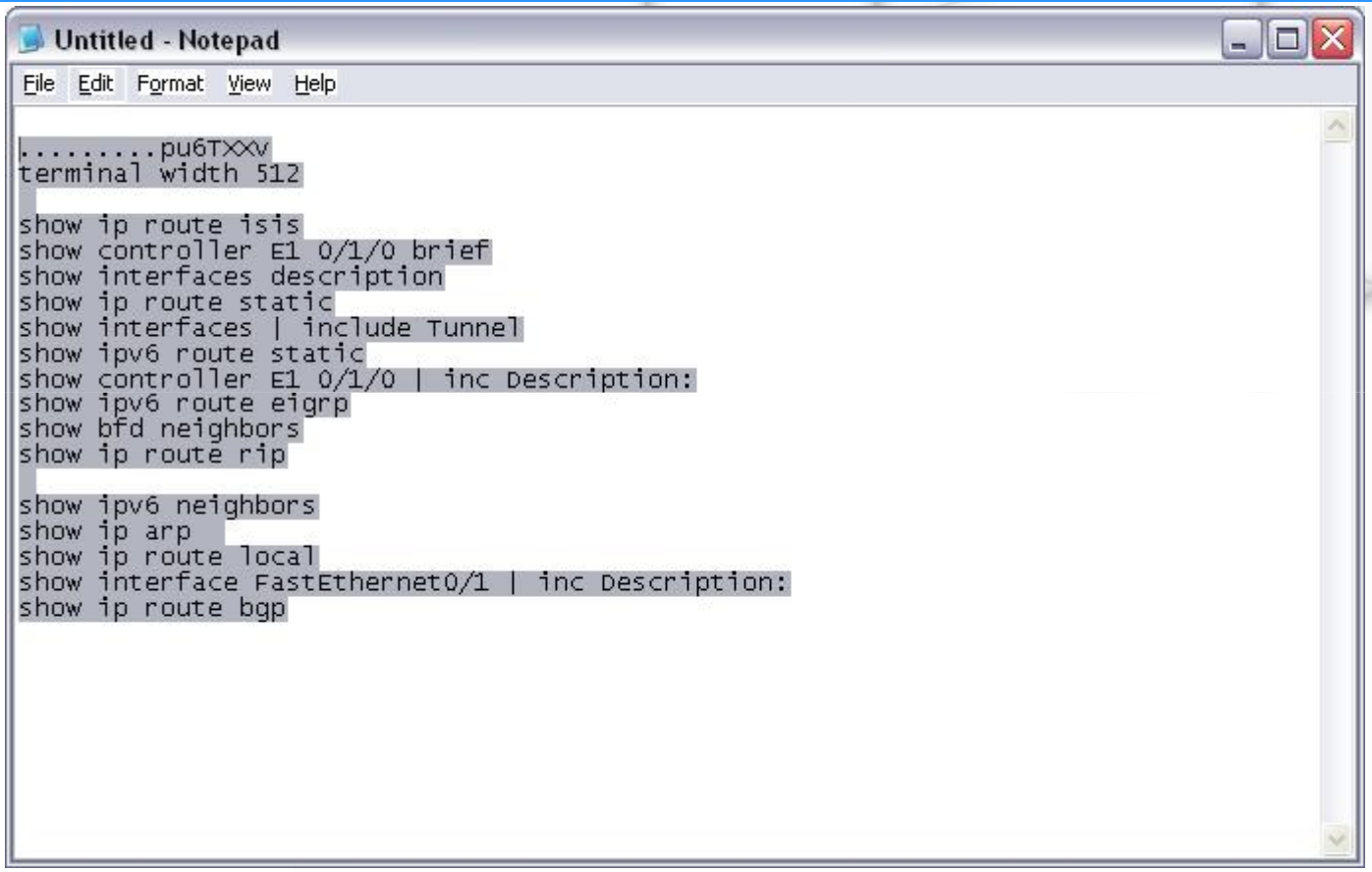
## To TCP Port 23



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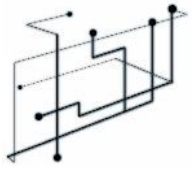
## Intelligent analysis of TELNET traffic

- 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 ?)

# 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.



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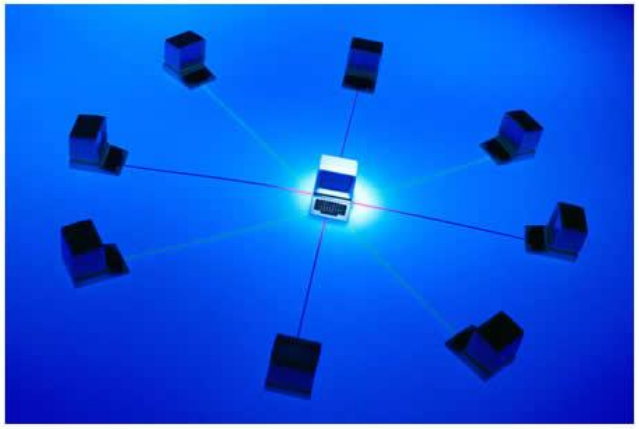
## Fusion of sources

- 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.



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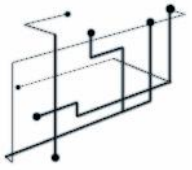
## And then….enabling CNE on NOCs

- 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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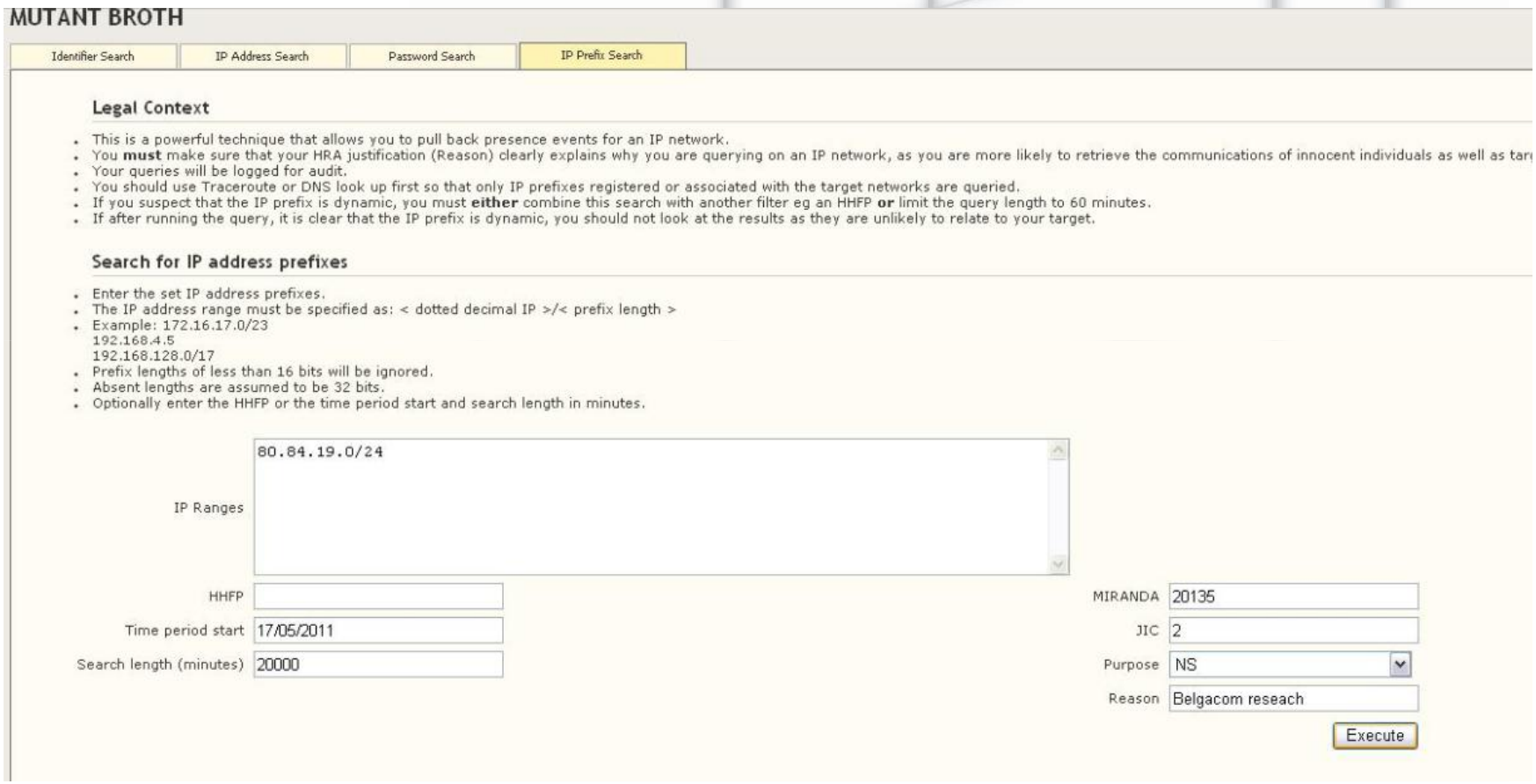
## NOC IP range search in MUTANT BROTH

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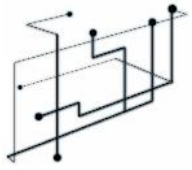
## NOC IP range – Target identifiers for QUANTUM INSERT

| Source IP | User-Agent | Date | Time | Non Routine Source | Source IP:HHFP | Source IP Geo | Identifier Type | Identifier Value | Event Count (%) |
|---|---|---|---|---|---|---|---|---|---|
| 80.84.19.9 | | | | | | | | | |
| | Mozilla/5.0 (X | | | | | | | | (4 %) |
| | Mozilla/5.0 (X | 17/05/11 | 00:02:54 | | 80.84.19.9:d23bad41 | 50.83;4.33;BRUSSELS;BE;7LLM | Yahoo-B-Cookie | [redacted] | (4 %) |
| | Mozilla/5.0 (X | | | | | | | | (2 %) |
| | Mozilla/5.0 (X | 17/05/11 | 00:02:59 | | 80.84.19.9:d23bad41 | 50.83;4.33;BRUSSELS;BE;7LLM | Yahoo-B-Cookie | | (0 %) |
| | Mozilla/4.0 (c | | | | | | | | (1 %) |
| | Mozilla/5.0 (X | 17/05/11 | 00:02:59 | | 80.84.19.9:d23bad41 | 50.83;4.33;BRUSSELS;BE;7LHV | Yahoo-B-Cookie | | 6 (16 %) |
| | Mozilla/5.0 (W | | | | | | | | (4 %) |
| | Mozilla/5.0 (X | 17/05/11 | 00:05:37 | | 80.84.19.9:5eec974d | 50.83;4.33;BRUSSELS;BE;7LHV | Google-PREFID-Cookie | | 2 (14 %) |
| | Mozilla/5.0 | | | | | | | | (0 %) |
| | Mozilla/5.0 (X | 17/05/11 | 00:16:18 | | 80.84.19.9:7d9134a5 | 50.83;4.33;BRUSSELS;BE;7LHV | Google-PREFID-Cookie | | 4 (28 %) |
| | Mozilla/5.0 (X | | | | | | | | 2 (18 %) |
| | Mozilla/5.0 (W | 17/05/11 | 00:17:58 | | 80.84.19.9:77387b02 | 50.83;4.33;BRUSSELS;BE;7LHV | Google-PREFID-Cookie | | (3 %) |
| | | 17/05/11 | 00:23:35 | | 80.84.19.9:e4a90e3f | 50.83;4.33;BRUSSELS;BE;7LHV | Google-PREFID-Cookie | | |
| | | 17/05/11 | 00:28:05 | | 80.84.19.9:7d9134a5 | 50.83;4.33;BRUSSELS;BE;7LHV | Google-PREFID-Cookie | | |
| | | 17/05/11 | 00:37:34 | | 80.84.19.9:b36815d3 | 50.83;4.33;BRUSSELS;BE;7LHV | Google-PREFID-Cookie | | |
| | | 17/05/11 | 00:39:55 | | 80.84.19.9:f12897e0 | 50.83;4.33;BRUSSELS;BE;7LHV | Google-PREFID-Cookie | | |
| | | 17/05/11 | 00:47:56 | | 80.84.19.9:477c4721 | 50.83;4.33;BRUSSELS;BE;7LHV | Google-PREFID-Cookie | | |
| | | 17/05/11 | 00:54:38 | | 80.84.19.9:d23bad41 | 50.83;4.33;BRUSSELS;BE;7LHV | Google-PREFID- | | |



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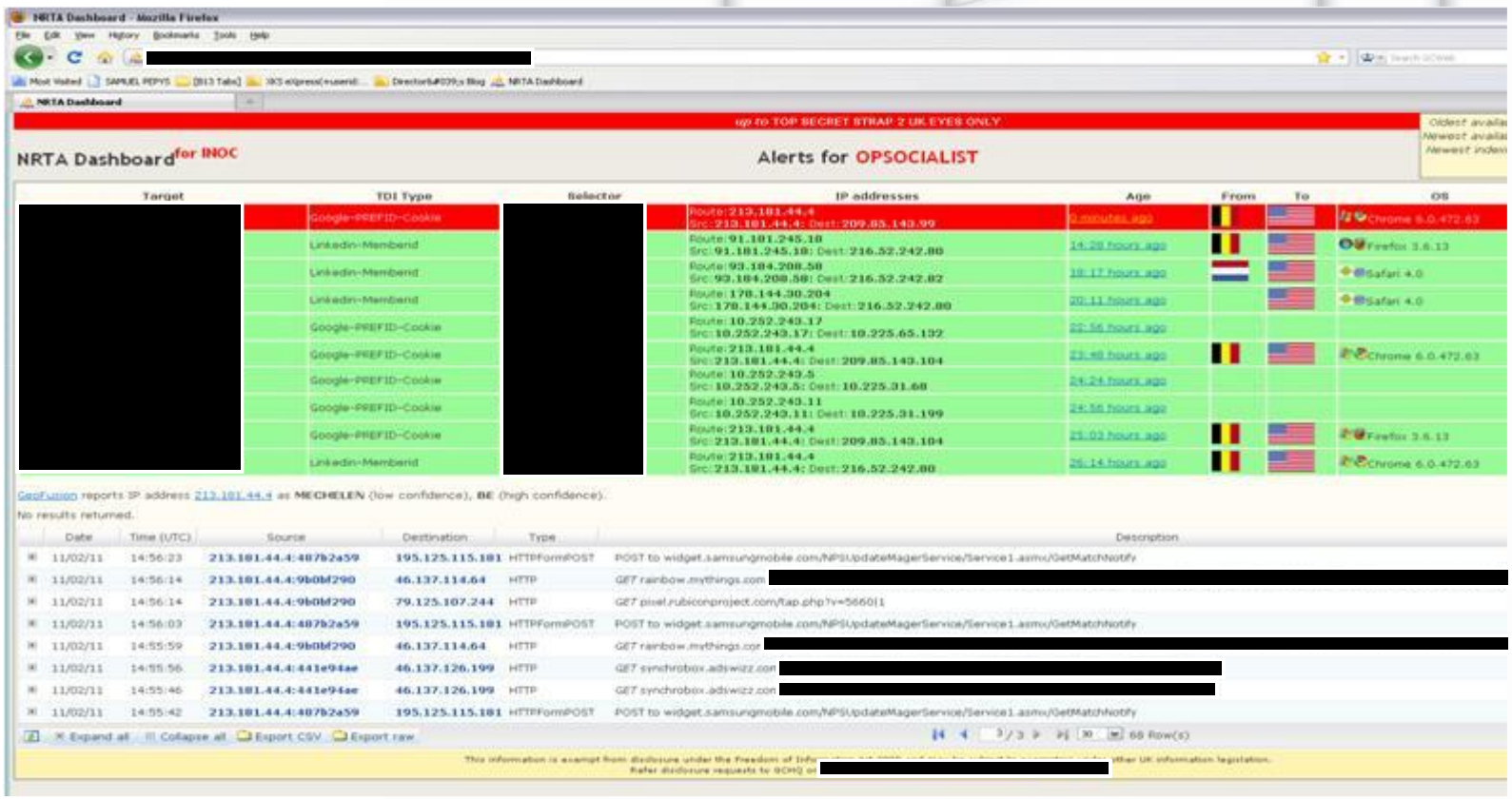
## Real-time picture of QI

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## Questions ?


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