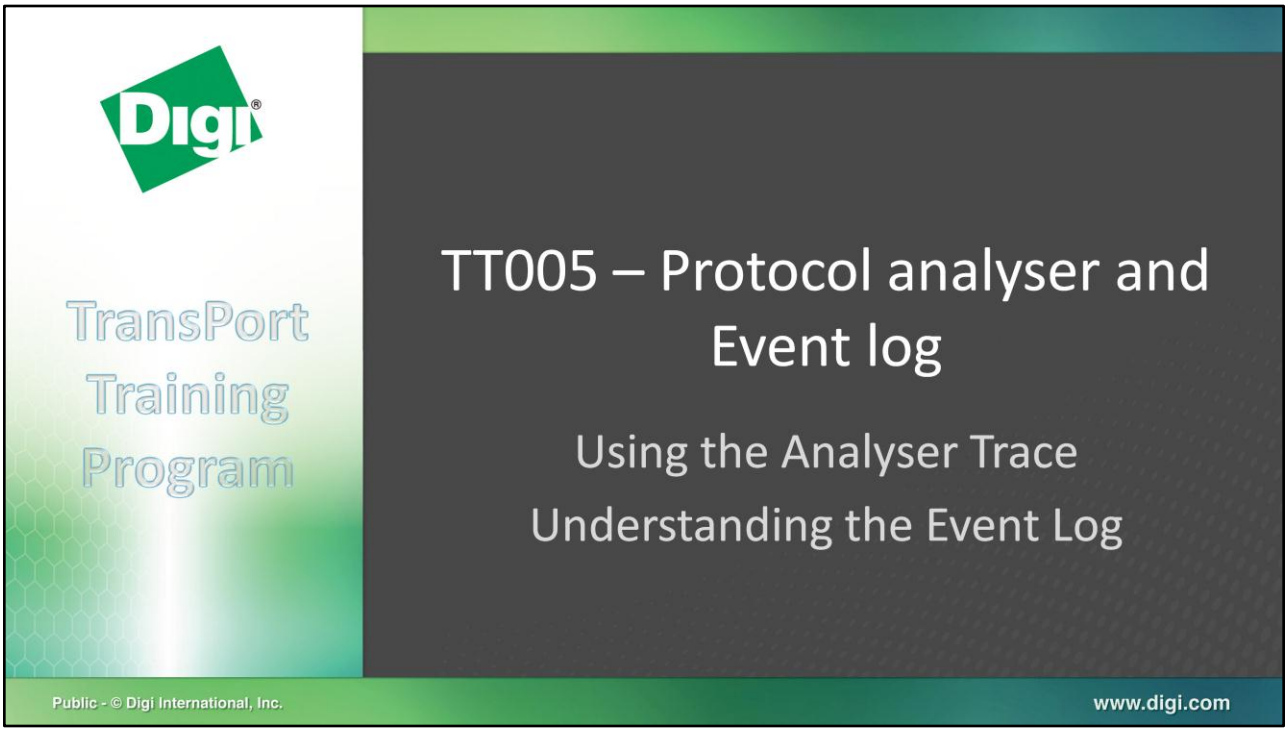

TransPort
Training
Program
TT005 – Protocol analyser and Event log
Using the Analyser Trace
Understanding the Event Log
Public - © Digi International, Inc.
www.digi.com

Analyser Trace

- TransPort routers have a built in protocol analyser
- Captures both transmitted and received data
- Is able to trace:

  Serial data, PPP negotiations & PPP frames,
  Ethernet frames, IP packets, DSL PVC cells,
  ISDN call setup (D channel), ISDN data (Bearer), X.25,
  IKE negotiations, IPSec traffic (ESP & IKE Float),
  Wi-Fi management & Wi-Fi data packets
- Filters can be applied to filter include or exclude specific:

  MAC addresses, TCP/UDP port numbers,
  IP protocols, IP addresses,
  discarded packets, loopback packets

Analyser Trace

- Trace data is presented in an easy to read format.
- Uses circular logging.
- Oldest trace data is at the top, most recent is at the bottom.

- Trace data can also be viewed and analysed with Wireshark Protocol Analyser©
  https://www.wireshark.org/

Trace data is compressed and stored in a virtual file named ana.txt, the contents of this file will be cleared if the power is removed from the router.

Analyser Trace

- To configure the Analyser Trace, browse to ***Management - Analyser > Settings***
- The options displayed will depend on the router hardware and firmware.
- The following slides will cover the most commonly used features.

The CLI configuration of the Analyser Trace uses a combination of:
'ana 0' commands
And physical or logical interface commands ETH/PPP/TUN/OVPN/Wi-Fi to enable tracing on the required interface.

Configuration from the GUI will automatically configure the interface settings as well as the analyser trace settings.

Analyser Trace – Configuration

- Maximum packet size (anything larger is truncated)
- Log size (180KB maximum)
- Protocol layers (only required for ISDN/X.25 tracing)
- IKE (IKE negotiations for IPsec VPNs)
- QMI (Qualcomm Management Interface)
- Serial Interfaces (Physical ASY & Virtual for W-WAN)
- Wi-Fi Management & Beacons
- Wi-Fi Data Packets

The maximum size of the pseudo file “ana.txt” that is used to store the captured data packets. Once the maximum size is reached, the oldest captured data packets are overwritten when new packets are captured.
The maximum value is 180Kb, but the data is compressed so more than 180Kb of trace data will be captured.

The checkboxes shown under this heading are used to select the serial interfaces over which packets will be captured and included in the analyser trace. The list of available interfaces will include the physical serial interfaces, internal virtual serial interfaces (if present) and interfaces used by built-in WWAN and/or PSTN modems.

Analyser Trace – Configuration

- Ethernet Interfaces = Layer 2 tracing on the specified interface
  Captures Ethernet frames with headers & shows VLAN tags

- PPP Interfaces = Layer 2 tracing of PPP negotiations & PPP data
  Can be used to understand why a PPP link fails to establish

- IP Sources = Layer 3 tracing on the specified interface
  Captures IP traffic and headers, shows addressing, port, higher layer protocol, checksums & sequence numbers to name a few.

Analyser Trace – Configuration

- Filters can be used to make the trace data very specific. On a busy router, the ana.txt file will fill up and overwrite old data very quickly.
- Filters can be used to specify MAC addresses, TCP/UDP port numbers, IP protocol numbers & IP addresses.
- To EXCLUDE traffic, enter the relevant text into the filter box.

  For example, to filter out HTTP traffic (port 80) using TCP/UDP Ports:

Analyser Trace – Configuration

- To INCLUDE traffic, enter the relevant text into the filter box prefixed with a tilde symbol ~
- Filtering in exclusively captures the specified traffic, filtering out all but the specified traffic.

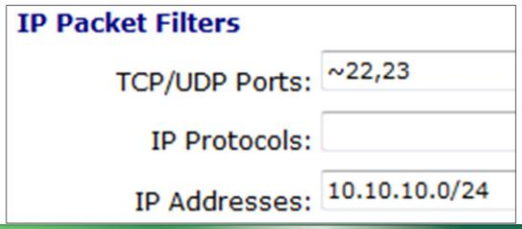
To filter in telnet traffic (port 23) and only see this traffic in the trace, using TCP/UDP Ports:

Analyser Trace – Configuration

Multiple values are comma separated, without spaces.

Multiple filters are cumulative.

To filter in telnet & SSH but exclude traffic from the 10.10.10.0/24 subnet:



Analyser Trace – Configuration

- MAC addresses are specified in HEX with OS specific separators (such as **:** or **-**) removed.

  00-05-9A-3C-7A-00 becomes 00059A3C7A00

- MAC addresses can be wild-carded by shortening the HEX

  To specify only network interface cards with the same OUI of 00059A

Analyser Trace – Configuration

Know the relevant commonly used Well Known Port Numbers:

20 FTP – Data
21 FTP – Control
22 SSH Remote Login Protocol
23 Telnet
25 Simple Mail Transfer Protocol (SMTP)
53 Domain Name System (DNS)
69 Trivial File Transfer Protocol (TFTP)
80 HTTP
123 Time service
110 POP3
161 SNMP
179 Border Gateway Protocol (BGP)
443 HTTPS

Analyser Trace – Configuration

Know the relevant commonly used Well Known Protocol Numbers:

1	ICMP
4	IPv4
6	TCP
17	UDP
47	GRE
50	ESP (IPsec)
51	AH (IPsec)
108	IP payload compression
112	VRRP
115	L2TP

Analyser Trace – Trace Output

- The trace data in text format is viewed from

  Management - Analyser > Trace

- Wireshark PCAP files are downloaded by clicking the hyperlinks shown in

  Management - Analyser > PCAP (e.g. Wireshark) traces

  The traces are IP, Ethernet, PPP & Wi-Fi

Tracing PPP Negotiations

Local to Remote

```
-----   19-8-2014  14:27:06.020   ------
FF 03 C0 21 01 00 00 12 01 04 05 DC 02 06 00 00     ...!............
00 00 07 02 08 02                                   ......

PPP 1 From LOC TO REM
FF 03          ADD/CTL
C0 21          Protocol:      LCP
01             Code:          CFG REQ
00             ID:            0
00 12          Len:           18
Options:
01             MRU            05 DC
02             ACCM           00 00 00 00
07             PFC
08             ACFC
----------
```

Remote to Local

```
-----   19-8-2014  14:27:06.690   ------
FF 03 C0 21 01 EF 00 13 01 04 05 D4 03 05 C2 23     ...!...........#
05 05 06 1C 64 F7 3D                                ....d.=

PPP 1 From REM TO LOC
FF 03          ADD/CTL
C0 21          Protocol:      LCP
01             Code:          CFG REQ
EF             ID:            239
00 13          Len:           19
Options:
01             MRU            05 D4
03             Authentication C2 23 05
05             Magic Number   1C 64 F7 3D
----------
```

Tracing PPP Negotiations

Local to Remote

```
-----   19-8-2014  14:27:06.690   ------
FF 03 C0 21 02 EF 00 13 01 04 05 D4 03 05 C2 23     ...!...........#
05 05 06 1C 64 F7 3D                                ....d.=

PPP 1 From LOC TO REM
FF 03          ADD/CTL
C0 21          Protocol:      LCP
02             Code:          CFG ACK
EF             ID:            239
00 13          Len:           19
Options:
01             MRU            05 D4
03             Authentication C2 23 05
05             Magic Number   1C 64 F7 3D
----------
```

Remote to Local

```
-----   19-8-2014  14:27:06.690   ------
FF 03 C0 21 04 00 00 0E 02 06 00 00 00 00 07 02     ...!............
08 02                                               ..

PPP 1 From REM TO LOC
FF 03          ADD/CTL
C0 21          Protocol:      LCP
04             Code:          CFG REJ
00             ID:            0
00 0E          Len:           14
Options:
02             ACCM           00 00 00 00
07             PFC
08             ACFC
----------
```

Tracing Ethernet Frames - ARP

Local to Remote

```
-----   19-8-2014  15:58:33.920   ------
FF FF FF FF FF FF 00 04 2D 04 87 CE 08 06 00 01     ........-.......
08 00 06 04 00 01 00 04 2D 04 87 CE C0 A8 00 04     ........-.......
00 00 00 00 00 00 C0 A8 00 01 00 00 00 00 00 00     ................
00 00 00 00 00 00 00 00 00 00 00 00                 ............

ETH From LOC TO REM           IFACE: ETH 0
FF FF FF FF FF FF  Dst. MAC
00 04 2D 04 87 CE  Src. MAC
08 06              Type:      ARP
ARP:
00 01              HW Type:   Ethernet (1)
08 00              Prot Type: IP (2048)
06                 HW Size:   6
04                 Prot Size: 4
00 01              Opcode:    Request (1)
00 04 2D 04 87 CE  Src. MAC
C0 A8 00 04        Src IP:    192.168.0.4
00 00 00 00 00 00  Dst. MAC
C0 A8 00 01        Dst IP:    192.168.0.1
----------
```

Remote to Local

```
-----   19-8-2014  15:58:33.920   ------
  00 04 2D 04 87 CE 00 1D 70 CE 81 F3 08 06 00 01     ..-.....p.......
  08 00 06 04 00 02 00 1D 70 CE 81 F3 C0 A8 00 01     ........p.......
  00 04 2D 04 87 CE C0 A8 00 04 00 00 00 00 00 00     ..-.............
  00 00 00 00 00 00 00 00 00 00 00 00                 ............

  ETH From REM TO LOC           IFACE: ETH 0
  00 04 2D 04 87 CE  Dst. MAC
  00 1D 70 CE 81 F3  Src. MAC
  08 06              Type:      ARP
  ARP:
  00 01              HW Type:   Ethernet (1)
  08 00              Prot Type: IP (2048)
  06                 HW Size:   6
  04                 Prot Size: 4
  00 02              Opcode:    Reply (2)
  00 1D 70 CE 81 F3  Src. MAC
  C0 A8 00 01        Src IP:    192.168.0.1
  00 04 2D 04 87 CE  Dst. MAC
  C0 A8 00 04        Dst IP:    192.168.0.4
  ----------
```

Tracing IP Packets – Telnet setup

```
-----   19-8-2014  16:07:01.700   ------
  45 00 00 34 07 0C 40 00 80 06 72 5E C0 A8 00 05    E..4..@...r^....
  C0 A8 00 04 EF 10 00 17 18 A2 72 BA 00 00 00 00    ..........r.....
  80 02 20 00 53 38 00 00 02 04 05 B4 01 03 03 02    .. .S8..........
  01 01 04 02                                        ....

  IP (In) From REM TO LOC       IFACE: ETH 0
  45              IP Ver:       4
                  Hdr Len:      20
  00              TOS:          Routine
                  Delay:        Normal
                  Throughput:   Normal
                  Reliability:  Normal
  00 34           Length:       52
  07 0C           ID:           1804
  40 00           Frag Offset:  0
                  Congestion:   Normal
                                Don't Fragment
                                Last Fragment
  80              TTL:          128
  06              Proto:        TCP
  72 5E           Checksum:     29278
  C0 A8 00 05     Src IP:       192.168.0.5
  C0 A8 00 04     Dst IP:       192.168.0.4
  TCP:
  EF 10           SRC Port:     ??? (61200)
  00 17           DST Port:     TELNET (23)
  18 A2 72 BA     SEQ Number:   413299386
  00 00 00 00     ACK Number:   0
  80 02           Flags
                  Data Offset   32
                                SYN
  20 00           Window:       8192
  53 38           Checksum:     21304
  00 00           URG Ptr:      0
  02              TCP_OPT:      MSS (1460)
  01              TCP_OPT:      NOOP
  03              TCP_OPT:      ??? (3)
  01              TCP_OPT:      NOOP
  01              TCP_OPT:      NOOP
  04              TCP_OPT:      ??? (4)
  ----------
```

Remote to Local

```
-----   19-8-2014  16:07:01.700   ------
45 00 00 2C 08 8C 00 00 FA 06 36 E6 C0 A8 00 04    E..,......6.....
C0 A8 00 05 00 17 EF 10 04 8F BE 81 18 A2 72 BB    ..............r.
60 12 20 00 B9 62 00 00 02 04 05 78                `. ..b.....x

IP (Final) From LOC TO REM    IFACE: ETH 0
45              IP Ver:       4
                Hdr Len:      20
00              TOS:          Routine
                Delay:        Normal
                Throughput:   Normal
                Reliability:  Normal
00 2C           Length:       44
08 8C           ID:           2188
00 00           Frag Offset:  0
                Congestion:   Normal
                              May Fragment
                              Last Fragment
FA              TTL:          250
06              Proto:        TCP
36 E6           Checksum:     14054
C0 A8 00 04     Src IP:       192.168.0.4
C0 A8 00 05     Dst IP:       192.168.0.5
TCP:
00 17           SRC Port:     TELNET (23)
EF 10           DST Port:     ??? (61200)
04 8F BE 81     SEQ Number:   76529281
18 A2 72 BB     ACK Number:   413299387
60 12           Flags
                Data Offset   24
                              SYN
                              ACK
20 00           Window:       8192
B9 62           Checksum:     47458
00 00           URG Ptr:      0
02              TCP_OPT:      MSS (1400)
----------
```

Local to Remote

Tracing IP Packets – Telnet, TCP 3 Way Handshake

```
-----   19-8-2014  16:07:01.700   ------
  45 00 00 28 07 0D 40 00 80 06 72 69 C0 A8 00 05     E..(..@...ri....
  C0 A8 00 04 EF 10 00 17 18 A2 72 BB 04 8F BE 82     ..........r.....
  50 10 FB 90 F5 52 00 00 00 00 00 00 00 00           P....R........

  IP (In) From REM TO LOC       IFACE: ETH 0
  45              IP Ver:       4
                  Hdr Len:      20
  00              TOS:          Routine
                  Delay:        Normal
                  Throughput:   Normal
                  Reliability:  Normal
  00 28           Length:       40
  07 0D           ID:           1805
  40 00           Frag Offset:  0
                  Congestion:   Normal
                                Don't Fragment
                                Last Fragment
  80              TTL:          128
  06              Proto:        TCP
  72 69           Checksum:     29289
  C0 A8 00 05     Src IP:       192.168.0.5
  C0 A8 00 04     Dst IP:       192.168.0.4
  TCP:
  EF 10           SRC Port:     ??? (61200)
  00 17           DST Port:     TELNET (23)
  18 A2 72 BB     SEQ Number:   413299387
  04 8F BE 82     ACK Number:   76529282
  50 10           Flags
                  Data Offset   20
                                ACK
  FB 90           Window:       64400
  F5 52           Checksum:     62802
  00 00           URG Ptr:      0
  ----------
```

Remote to Local

```
-----   19-8-2014  16:07:01.710   ------
45 00 00 4A 08 8E 00 00 FA 06 36 C6 C0 A8 00 04     E..J......6.....
C0 A8 00 05 00 17 EF 10 04 8F BE 93 18 A2 72 BB     ..............r.
50 18 20 00 6B 5A 00 00 0D 0A 52 65 6D 6F 74 65     P. .kZ....Remote
20 43 6F 6E 6E 65 63 74 69 6F 6E 2E 0D 0A 0D 0A      Connection.....
55 73 65 72 6E 61 6D 65 3A 20                       Username:

IP (Final) From LOC TO REM    IFACE: ETH 0
45              IP Ver:       4
                Hdr Len:      20
00              TOS:          Routine
                Delay:        Normal
                Throughput:   Normal
                Reliability:  Normal
00 4A           Length:       74
08 8E           ID:           2190
00 00           Frag Offset:  0
                Congestion:   Normal
                              May Fragment
                              Last Fragment
FA              TTL:          250
06              Proto:        TCP
36 C6           Checksum:     14022
C0 A8 00 04     Src IP:        192.168.0.4
C0 A8 00 05     Dst IP:        192.168.0.5
TCP:
00 17           SRC Port:      TELNET (23)
EF 10           DST Port:      ??? (61200)
04 8F BE 93     SEQ Number:   76529299
18 A2 72 BB     ACK Number:   413299387
50 18           Flags
                Data Offset   20
                              PSH
                              ACK
20 00           Window:       8192
6B 5A           Checksum:     27482
00 00           URG Ptr:      0
----------
```

Local to Remote

Extended logging

- The Analyser Trace can be written to a USB flash drive for capturing data over an extended time frame.
- A secondary log file is created on U:
- CLI based configuration only:

```
ana 0 logdrive u
ana 0 logfile big_ana.txt
ana 0 logsizek 102400
```

Hands-On Practical Session - Analyser

- Using the Analyser Trace…
- Enable the Analyser Trace, set the capture log size to its maximum value.
- Enable IP tracing on the Ethernet interface connected to the LAN and the PPP WAN interface.
- Send some data through the router, browse a web page & review the trace data.
- Try and find the DNS lookups.

Hands-On Practical Session - Analyser

- Configure the trace so it only captures DNS lookups. We need to capture the request from the PC to router and router to DNS server along with the reply packets.

- Do a DNS lookup from your PC using the router as the DNS server.

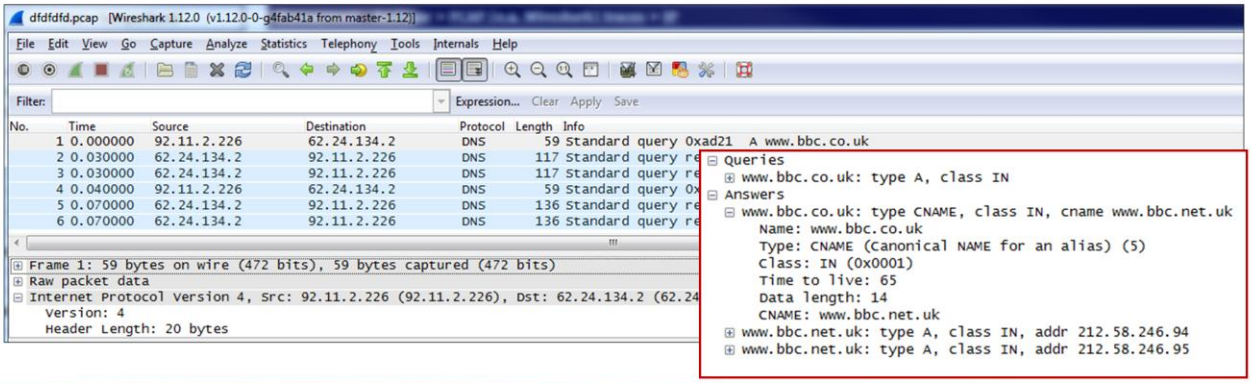
  You can use the Windows 'nslookup' command

  `nslookup <host> <DNS_server>`

  `nslookup www.bbc.co.uk 192.168.1.1`

Hands-On Practical Session - Analyser

- Download the relevant Wireshark PCAP file
- Review the trace data in WireShark



End of Hands-On Practical Session

The Event Log

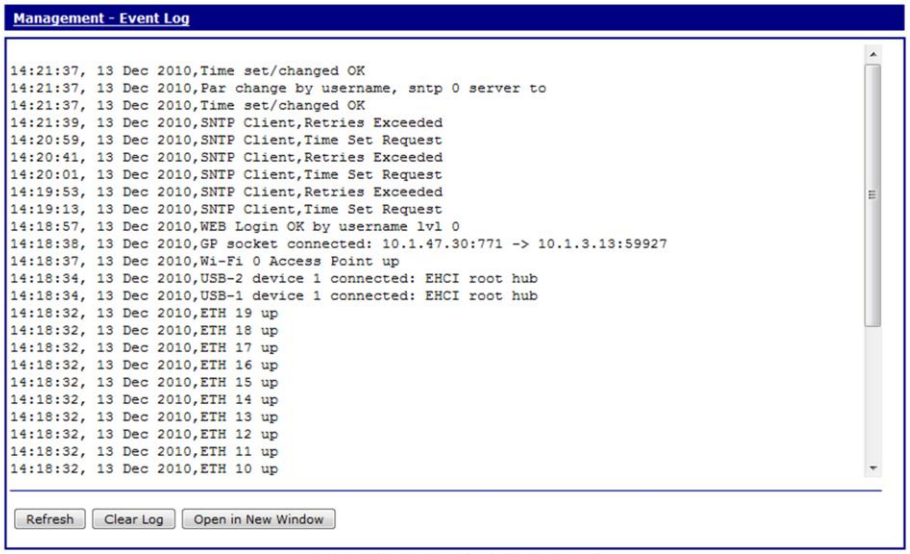
- The **event log** (eventlog.txt) is a file containing system events.
- Uses circular logging.
- Newest events are at the top, oldest at the bottom.
- Is stored in battery backed RAM and retained if power is removed.

- WR21 has no NVRAM so clears the event log if the power is disconnected but retains the information if rebooted.

The Event Log

- Each line in the event log contains:
  - Time of the event based on system time
  - Date of the event based on system date
  - Brief description of the event
- Extra information for some events may also include:
  - The interface that generated the event
  - The protocol that generated the event
  - Source and destination IP address
  - The user who triggered the event
  - A phone number (ISDN, PSTN, SMS)

The Event Log

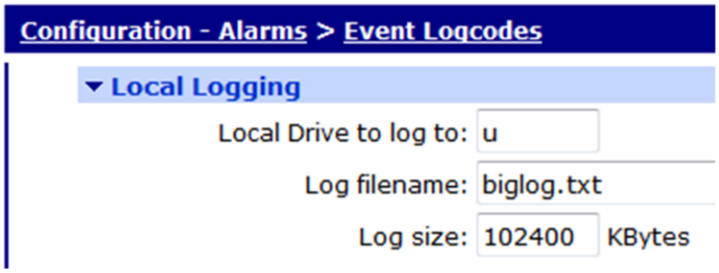


The Event Log

- The event log can be obtained in various ways:
- GUI: Management - Event Log
- CLI: type eventlog.txt
- FTP: download the eventlog.txt from the router
- Debug.txt: The event log is part of the debug.txt file.

Extended logging

- The event log can be written to a USB flash drive for logging events over an extended time frame.
- A secondary log file is created on U:



CLI based configuration:

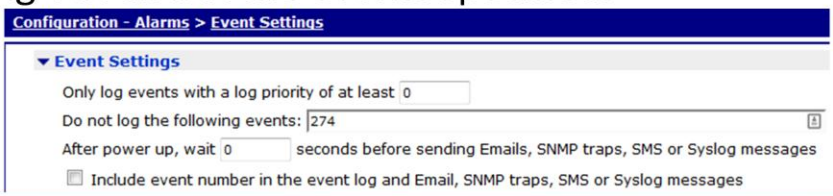
```
event 0 logdrive u
event 0 logfile biglog.txt
event 0 logsizek 102400
```

Event Triggered Alerting

- Events can be used to trigger alerts.
- Alerts can be one of or a combination of:
  - Email notification
  - SNMP trap
  - SMS
  - Syslog message
- Alerts can be restricted to a specific Entity/Number
- Email alerts can have the event log and/or analyser trace attached. Other files from the router can be specified too.

The Event Log Configuration

- Configured from ***Configuration - Alarms > Event Settings***
- Unwanted events can be filtered out.
- To INCLUDE events, enter the relevant text into the filter box prefixed with a tilde symbol ~
- Filtering in exclusively captures the specified events, filtering out all but the events specified.



Log priority:
0 = show all events
1 – 9 = 1 most important, 9 least important.
Entering 5 would display events with priority 0-5

The event filtered out here is:
274Wi-Fi client %a probing %c

A delay can be added so if the router reboots, it will wait until connectivity is established before sending an alert.

Including event numbers can be included in the event log view, but in the majority of cases these are not required.

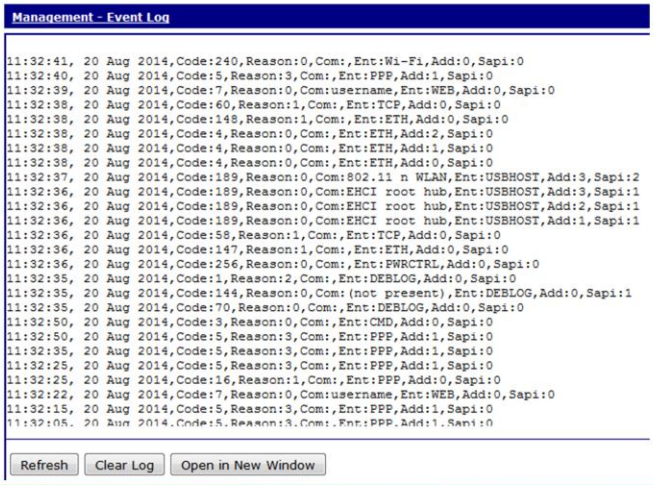
Logcodes.txt

- The event log relies on the presence of the logcodes.txt to make the output readable and easy to understand.
- Contains a list of:
  - Event numbers, descriptive text and associated variables
  - Reason numbers, descriptive text and associated variables
  - Event priority numbers and reason priority number, where applicable. 0 – 9 where 0 is most important and 9 is least important.

```
[EVENTS]
01,0,Power-up[%c]
[REASONS]
1,,Reboot command
2,,Reboot command via web
```

Logcodes.txt

- Without the logcodes.txt, the event log looks like this:



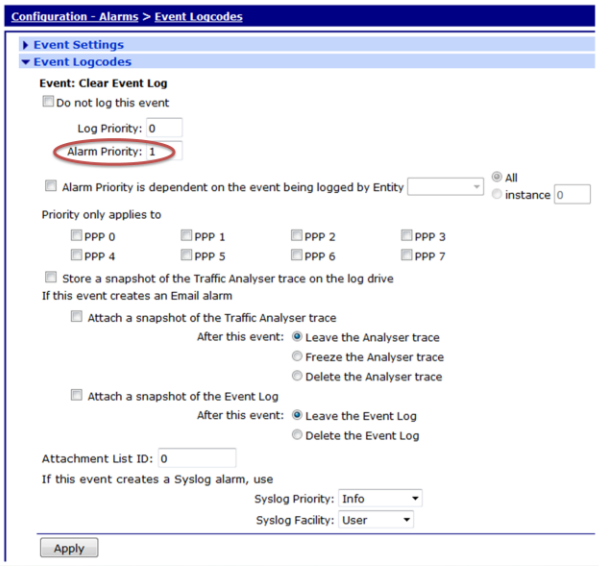
Modifying Logcodes.txt

- Browse to ***Configuration - Alarms > Event Logcodes***

Review the information on the slide and point out the:
Event Number
Event Description
Event Priority
Reason Number
Reason Description
Reason Priority column (configured reason priorities will show here)
The Filter column will display ‘On’ if the event is filtered out. Shown in next slide.

Modifying Logcodes.txt

- Click on the 'Event' or 'Reason' to modify.
- The 'Alarm Priority' is used for alerting.
- The 'Log Priority' is used to include or exclude events from the event log.



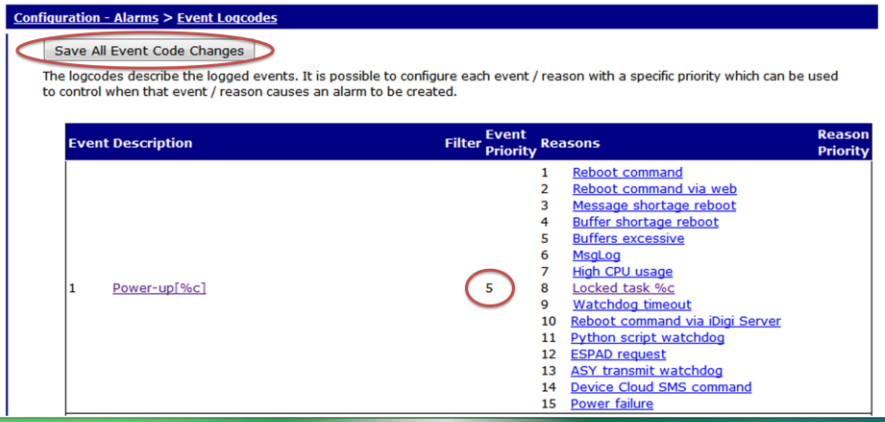
It's the alarm priority that is the important one.
The alarm priority is used in conjunction with (for example) "Send an email notification when the event priority is at least".

The Log priority allows you to include or exclude events from the event log and is rarely if ever changed from default.
The log priority is used in conjunction with *Configuration - Alarms > Event Settings > Email Notifications > Only log events with a log priority of at least xx*.
The default value of 0 means all events will be included (or logged) in the event log.

Draw attention to the options to attach the event log and analyser trace.
Mention the Attachment List ID and to specify the file list at the bottom of the previous page (main logcodes window). File names are comma separated.

Saving Log Codes Changes

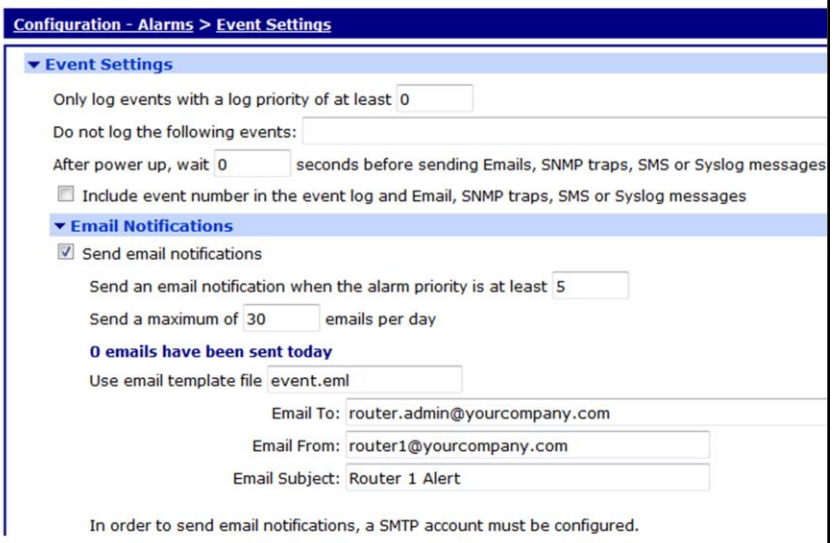
- After making a change, click Apply, then 'Save All Event Code Changes'.
- Changes are saved to the file **logcodes.dif**



At boot up the logcodes.txt and logcodes.dif are merged to create the modified view of the log codes.

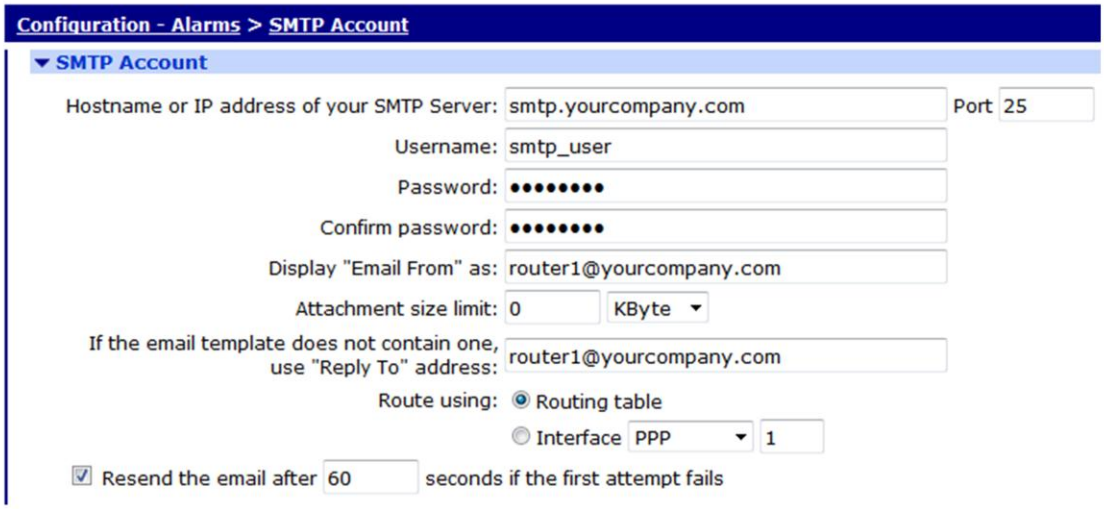
Sending Email Alerts

- Email alerts can be sent, but extra configuration is required.
- See ‘QN01 - Configure a Sarian or Digi Transport router to send an automatic email on a specific event’ more information.



Also see:
QN34: Configuring Syslog alerting on a TransPort router
QN35: Configuring SMS Alerts on a Transport Router
QN36: Configuring SNMP Traps on a Transport Router

Sending Email Alerts



Hands-On Practical Session – Event Log

- View the logcodes.txt from the CLI
- Experiment with the filtering options to include and exclude events from the Event Log.
- Modify an Event Logcode in the GUI, save the change and review the file logcodes.dif
- If time allows, configure Email, Syslog or SMS alerting

Also see:
QN34: Configuring Syslog alerting on a TransPort router
QN35: Configuring SMS Alerts on a Transport Router
QN36: Configuring SNMP Traps on a Transport Router

End of Hands-On Practical Session