Application Assurance — Application Identification and User-Defined Applications

In This Chapter

This section describes Application Assurance (AA) Application Identification and User-Defined Applications configurations.

Topics in this section include:

Applicability

This example is applicable to all 7750, 7450 and 7750-SRc chassis supporting Application Assurance and was tested on release 12.0.R4.

There are no specific pre-requisites for this example.

Overview

This chapter is intended for Application Assurance (AA) network architects and engineers. It provides best practice information to customize the AA policy and classify any type traffic to meet the service provider reporting, charging or control requirements.

In addition to the signatures built and supported by Alcatel-Lucent, service providers can create their own application signatures based on various criteria. This customization capability can be used to classify traffic hosted on the provider network (web portal, streaming service) or hosted on the Internet and not yet covered by the default AA signature set.

Basics and Terminology

The following main components are used for AA classification:

- **Application Filters —** App-filters are used to define applications based on Layer 3 to Layer 7 criteria. They provide a mapping between one or more protocol signatures or customized traffic patterns into an application of interest.
- **Application** — Such as BitTorrent®, Netflix®. Traffic is classified into applications using app-filters.
- **Application Group** — Such as peer-to-peer, multimedia streaming. For the purpose of reporting and control, applications of similar type/function can be grouped together in Application Groups (App-Group).
- **Charging Group** — Such as zero rating, default. For the purpose of charging or control, applications and app-group can be grouped together in charging groups.

The following table is a high level example to illustrate how app-filters are used to defined applications and show their logical grouping into app-group and charging group.

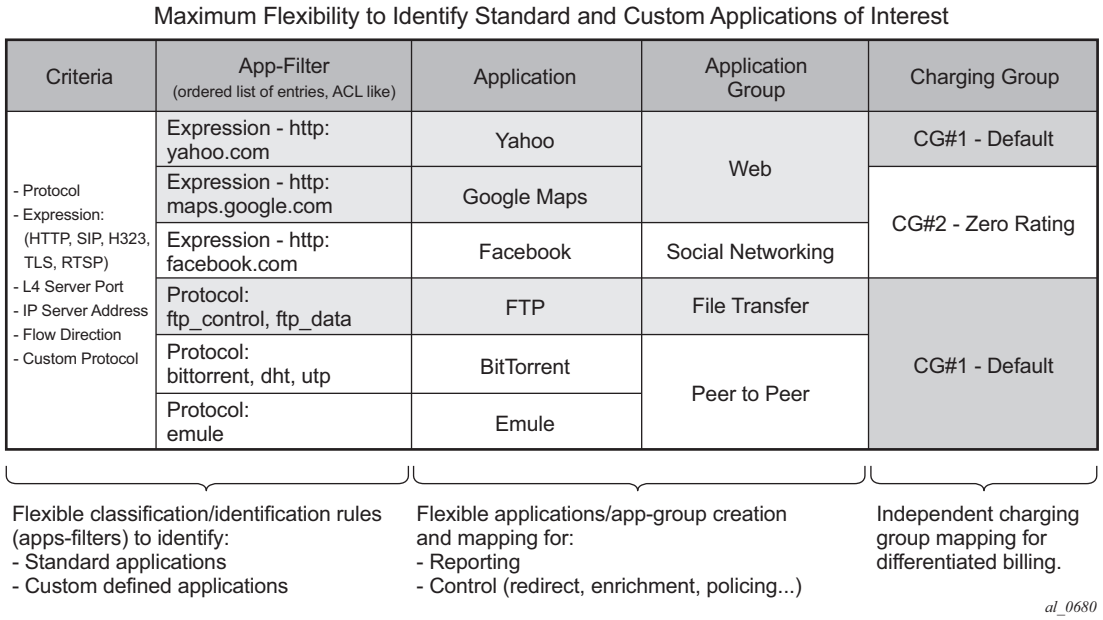


Figure 203: App-Filters/Applications/AppGroup

- BitTorrent® and Emule® applications are defined using their protocol signature and grouped in the P2P app-group.
- FTP application is defined using both ftp_data and ftp_control protocol signatures, the app is mapped in the file transfer app-group.
- Google Maps® and Yahoo® web sites are defined using http expression and grouped together in the Web app-group.

Configuration

Classification Criteria (App-Filter)

The operator can take full advantage of the flexible AA policy configuration to classify traffic from any application of interest using various criteria ranging from Layer 3 to Layer 7 expressions.

Expression match criteria allows to further refine traffic classification by identifying traffic from HTTP, HTTPS (SSL/TLS), SIP, H323, RTSP, Citrix protocol signatures.

The different app-filter match criteria are listed below:

- L7 Expression
  - HTTP: Host, URI, User Agent, Referer
  - SSL/TLS: Certificate Org Name, Common Name, SNI
  - H323: Product-ID
  - SIP: URI, User Agent, Media Type
  - RTSP: Host, URI, User Agent
  - Citrix: Application Published Name
  - RTMP: Page-host, page-uri, swf-host, swf-uri
- IP Protocol Number
- IP Server Address
- TCP/UDP Server Port
- Custom Protocol
- Protocol Signature

The following operators are supported to define expression based app-filters:

^ : Expression start with

$: Expression end with

*: Wildcard - anything before or after

\I: Forces case sensitivity

\d: Any single decimal digit [0-9]

\.: Any single character

*: Asterisk character

Examples of expression match combinations:

`^abcd*`: match ‘abcd’ at beginning, can end with anything

`*abcd*`: match ‘abcd’ anywhere

`*abcd$`: match ‘abcd’ at the end

`^abcd$`: exact expression match ‘abcd’

`^ab*cd$`: string starts with 'ab', ends with 'cd' (anything else in between)

`^ab\dcd$`: string starts with 'ab', followed by a decimal digit, ends with 'cd'

Note: It is possible to combine different criteria or expressions within the same filter in which case an implicit AND operation between the criteria within the same filter is done by the system.

Application Definition Example

The example below provides a basic configuration example with the application FTP made of two protocol signatures ftp_control and ftp_data; the application is mapped into the application group file transfer:

Create the application group.

```
configure application-assurance group 1:1 policy
     app-group "File Transfer"
     exit
```

Create the application.

```
configure application-assurance group 1:1 policy
     application "FTP"
          app-group "File Transfer"
     exit
```

Create the app-filters.

```
configure application-assurance group 1:1 policy
     app-filter
          entry <1..65535> create
               protocol eq "ftp_data"
               application "FTP"
               no shutdown
          exit
          entry <1..65535> create
               protocol eq "ftp_control"
               application "FTP"
               no shutdown
     exit
```

Note: Once the application is created the operator is expected to configure the collection of statistics at the subscriber level for this new application (usually only for business VPNs).

User-Defined Applications

General Recommendations

In order to classify traffic properly it is recommended to follow the guidelines and best practices defined in this section before creating a new application:

- Analyze the application traffic
  - Identify what type traffic is used (Wireshark®).
  - Use the application the same way the end user would use it, the same application can create various flows.
- Configure the appropriate App-Filters
  - Following the analysis of the application done above, create the application.
  - Follow the App-Filter best practices chapter to understand in which range to add the filters.
  - More than one App-Filters can be required to identify a single application.

AppDB/Default AA Policy

The default AA policy called AppDB (Application Database) is provided by Alcatel-Lucent and should be used on most deployments. Contact your regional support organization for more details on how to obtain it.

This configuration includes applications and application-groups most Providers can use by default and is designed to allow the addition of any custom entries required by Service Providers to identify additional services/applications.

Before adding new entries to the template and customizing the configuration it is recommended to follow the next guidelines on app-filters and ranges. These guidelines are key to allow an easy upgrade path from the policy configuration provided by Alcatel-Lucent.

App-Filters

App-Filters are an ordered list of entries. It is important to keep the order of this list consistent with the classification objective.

For instance a common configuration mistake is to configure a filter rule for the HTTP protocol signature before HTTP expression filters. If that was the case then app-filters using HTTP expressions would not be used as the system would find an acceptable match with the protocol signature before walking the list of expressions configured. This mistake is described in the example below:

```
entry 100 create
  description "Default HTTP Protocol"
  protocol eq "http"
  application "HTTP"
  no shutdown
exit
entry 110 create
  description "Google"
  expression 1 http-host eq "*.google.com$"
  application "Google"
  no shutdown
exit
```

This is an incorrect AppFilter order. App-filter entry #100 will always match before the http expression entry #110.

Note: It is not necessary to specify a protocol when defining an expression filter, the protocol is implicit based on the type of expression match criteria used (for instance, http, sip, h323).

App-Filters Ranges

The App-Filter list is an ordered list, it is key to configure each app-filter in the right order and in the proper range.

The operator can customize the policy and create applications and app-filters by using the following ranges shown in Table 9 (other ranges are used by the Alcatel-Lucent default policy):

Table 9: Customer Reserved App-Filter Ranges

Range Name	Description	Start	End
Top range	Top range, matches before any other filters	1	1499
High priority	Matches before the other filters.	2000	3999
Expression range A	HTTP Host, Host+URI ; optionally with IP/ Port match	19000	22999

Table 9: Customer Reserved App-Filter Ranges (Continued)

Range Name	Description	Start	End
Expression range B	Other Expression Match ; optionally with IP/ Port match	33000	34999
Extended protocols	Protocol-signature + Port|IP|Dir. match	40000	41999
Custom protocols	Custom protocol signature match	61000	61499
Trusted/validate ports	1st packet validate, 1st packet trusted match	61500	61999

Ordering Basics:

- Layer 7 expressions based filters are located before their parent protocol signature (for example, expression matches on http are located before the http protocol app-filter; the same applies to TLS, SIP, H323, RTSP, Citrix).
- HTTP Host and URI are located before the HTTP referer for accounting accuracy (for example, YouTube® from within Facebook® is classified as YouTube®)
- App-filters combining protocol signatures with Layer 4 port, IP protocol, IP address or flow direction are always located before the protocol signature only filter range.

HTTP

Protocol

HTTP is a client/server protocol using TCP/IP at the transport layer to deliver resources such as HTML files, images, videos and more.

HTTP 1.1 enables HTTP clients to use a persistent connection to a server allowing them to reuse the same TCP session for multiple HTTP transactions. Text, images, video, scripts and other objects can be downloaded individually in different transactions through the same TCP session.

Figure 204 describes a typical persistent HTTP connection between a web client and a server with multiple HTTP transactions within the same TCP session:

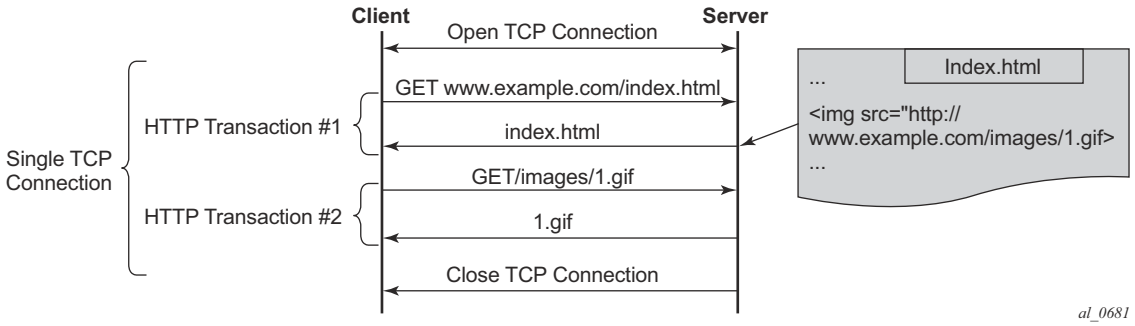


Figure 204: HTTP Persistent Connection

User-defined expression-based HTTP applications will use the first HTTP transaction to classify the flow (optionally this behavior can be modified).

HTTP Request

The example below shows the content of a typical HTTP request to wikipedia.org which includes the following header fields: HTTP Host, HTTP URI, HTTP User Agent and HTTP referer fields:

Web Browser URL: **http://en.wikipedia.org/wiki/Main_Page**

Host **URI**

HTTP Request Header
Host: en.wikipedia.org
URI: /wiki/Main_Page
User Agent: Mozilla/5.0(Windows NT 6.1; WOW64)
Referer: http://www.google.com/

- HTTP Host — Represents the domain name (does not include “http://”).
- HTTP URI — The URL trailer after the host domain name (begins with slash “/”).
- HTTP Referer — The address of the previous web page from which a link to the currently requested page was followed (in this example the referer is www.google.com which means the user clicked on a link from a Google search pointing to wikipedia.org).
- HTTP User Agent — This identifies the web browser or application making the HTTP request.

Configuration Examples

HTTP Host (Wikipedia)

Classifying HTTP traffic from this web site can be done using a single expression tail anchored on the HTTP host:

```
configure application-assurance group 1:1 policy app-filter
     entry <1..65535> create
          description "Wikipedia Web Access" expression 1 http-host eq "*.wikipedia.org$"
          application "Wikipedia"
          no shutdown
     exit
```

This can be confirmed using Wireshark®.

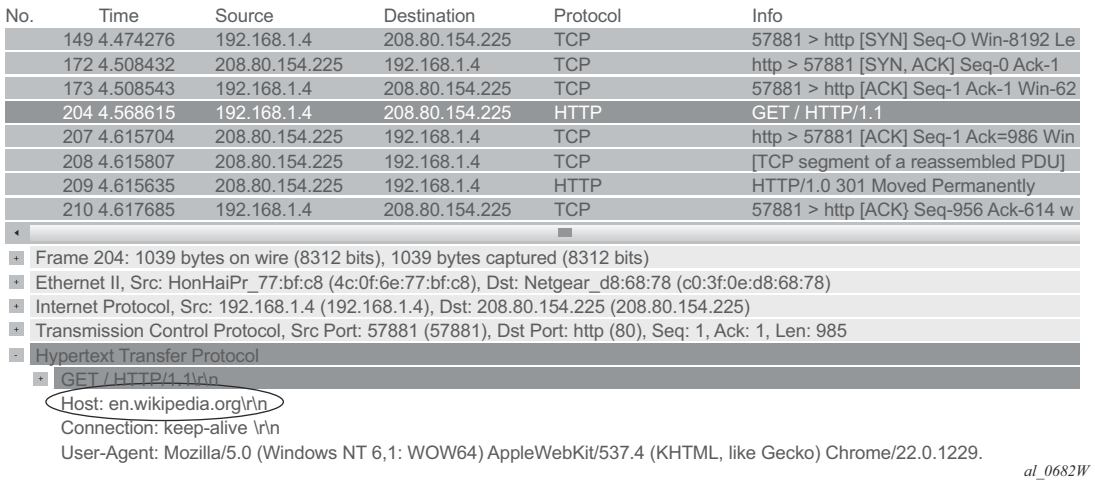


Figure 205: Wireshark® www.wikipedia.org

Classification per URI within the Same Host

Operators may need to apply different charging rules to different content located on the same HTTP domain (different URI, same HOST).

Table 10 displays an example of classification rules for the ISP ON-NET content services:

Table 10: Classification Rules for the ISP ON-NET Content Services

URL	Charging Rule	AA Application
www.ispdomain.com/video	Rule #1 – 0 Rating	ISP-Portal-Video
www.ispdomain.com/images	Rule #2 – Charge X	ISP-Portal-Images
www.ispdomain.com/*	Rule #3 – Charge Y	ISP-Portal-Default

HTTP 1.1 can reuse the same TCP connection for many transactions to the same server. Classifying each HTTP transaction to www.ispdomain.com independently requires a specific AA configuration.

Prior to SR OS 12.0.R1 the system can be configured to enable traffic classification for all http requests at the AA partition level only therefore affecting all HTTP flows within this partition. SR OS 12.0R1 allows to selectively enable “http-match-all-requests” in app-filters to improve the system performance and limit the HTTP analysis per domain.

The SROS 12.0.R1 configuration example below allows traffic classification of different URIs of the same domain (www.ispdomain.com) independently therefore allowing differentiated charging and control:

- http-match-all-req is enabled on all host+uri app-filters to www.ispdomain.com
- default app-filter required to match any traffic to www.ispdomain.com

```
configure application-assurance group 1:1 policy
    app-filter
        entry <1..65535> create
            description "Zero rated content"
            expression 1 http-host eq "^www.ispdomain.com$"
            expression 2 http-uri eq "^/video*"
            http-match-all-req
            application "ISP Portal Video"
            no shutdown
        exit
        entry <1..65535> create
            description "Image charging"
            expression 1 http-host eq "^www.ispdomain.com$"
            expression 2 http-uri eq "^/images*"
            http-match-all-req
```

```
    application "ISP Portal Images"
    no shutdown
exit
entry <1..65535> create
    description "Default charging"
    expression 1 http-host eq "^www.ispdomain.com$"
    http-match-all-req
    application "ISP Portal Default"
    no shutdown
exit
```

SSL/TLS (HTTPs)

Protocol

HTTPS uses SSL/TLS to encrypt traffic between the client and the server. Since this communication is encrypted it is not possible to identify the HTTP Host or URI. However, AA can still identify the service requested by the subscriber by looking at the TLS certificate information or Server Name Indication exchanged in the clear before the TLS session is established.

Note: SSL/TLS expression based app-filters are not limited to HTTPS. HTTPS is not a protocol in itself, but is HTTP traffic-tunnelled encrypted into SSL/TLS on port 443.

SSL/TLS Certificates

The snapshot (Figure 206) from Wireshark shows the SSL/TLS certificate exchanged using the mobile application **whatsapp**®.

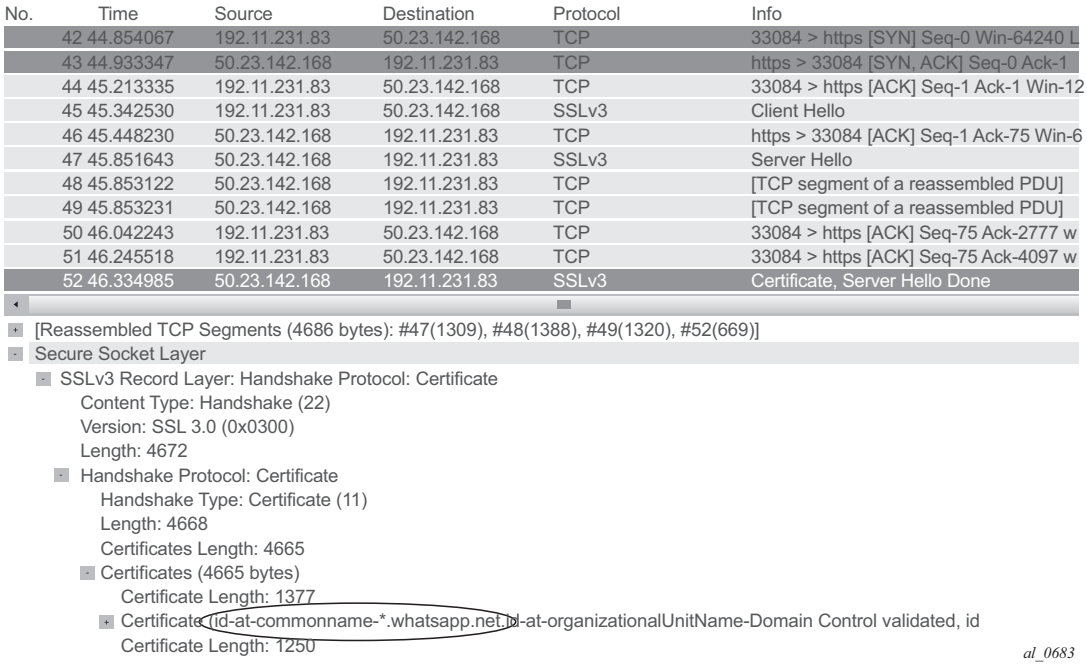


Figure 206: Wireshark® HTTPS www.whatsapp.com

The certificate information can be found in the Server Hello message sent by the server, capturing SSL/TLS (HTTPS) traffic from this application can be done using a single app-filter entry tail anchored on the TLS Common Name Certificate:

```
configure application-assurance group 1:1 policy
    app-filter
        entry <1..65535> create
            description "Whats App tls and image/voice/video traffic"
            expression 1 tls-cert-subj-common-name eq
                         "*.whatsapp.net$"
            application "Whats App"
            no shutdown
          exit
```

Server Name Indication

SSL/TLS traffic can optionally be identified using the Server Name Indication (SNI) which is an extension to the TLS protocol.

The SNI is found in the TLS Client Hello, the http-host expression in the app-filter is reused to classify this traffic:

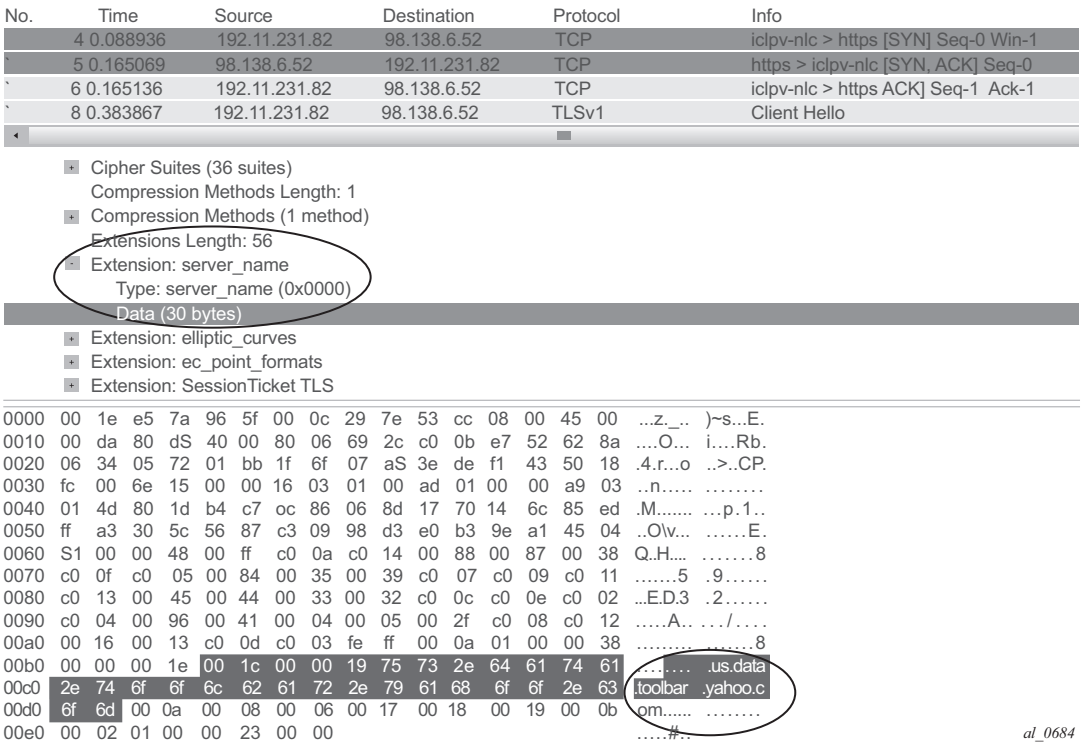


Figure 207: HTTPS SNI

```
configure application-assurance group 1:1 policy
    app-filter
        entry <1..65535> create
            description "Yahoo HTTP or TLS SNI"
            expression 1 http-host eq "*.yahoo.com$"
            application "Yahoo"
            no shutdown
          exit
```

SIP

Protocol

SIP is a signaling protocol used for controlling multimedia communication sessions such as voice and video over RTP. AA automatically monitors SIP control flows and associates RTP/RTCP media flows accordingly in the sip_rtp protocol signature.

The operator can use a SIP expression match criteria in app-filter to further refine traffic classification and identify any additional application on top of the default AA policy. This can be particularly useful in business VPNs to identify voice and telepresence applications.

AA supports SIP expression match criteria on SIP URI, SIP user agent and SIP media type. The snapshot below from Wireshark® shows a SIP control exchange using the voice-video application Vonage® followed by the RTP media audio flow; the expression fields that can be matched using AA app-filters are highlighted:

Figure 208: SIP Wireshark® Capture

Configuration Example

The configuration example below provides the configuration to classify Vonage® SIP/RTP desktop traffic using SIP URI expression:

```
configure application-assurance group 1:1 policy
    app-filter
        entry <1..65535> create
            description "Vonage"
            expression 1 sip-uri eq "*voncp.com*"
            application "Vonage"
            no shutdown
        exit
```

H323

Protocol

Similarly to SIP, H323 is a signaling protocol used for controlling multimedia communication sessions such as voice and video over RTP. AA automatically monitors H323 control flows and associates the RTP media flow accordingly in the h323_rtp protocol signature.

The operator can use an H323 expression match criteria app-filter to further refine traffic classification and identify any additional application on top of the default AA policy. This can be particularly useful in business VPNs to identify voice and telepresence applications.

AA supports H323 expression match criteria on the H323 Product ID. The snapshot below from Wireshark shows an H323 control exchange using the Telepresence application LifeSize® followed by the RTP media audio flow; the expression field that can be matched using AA app-filters is highlighted:

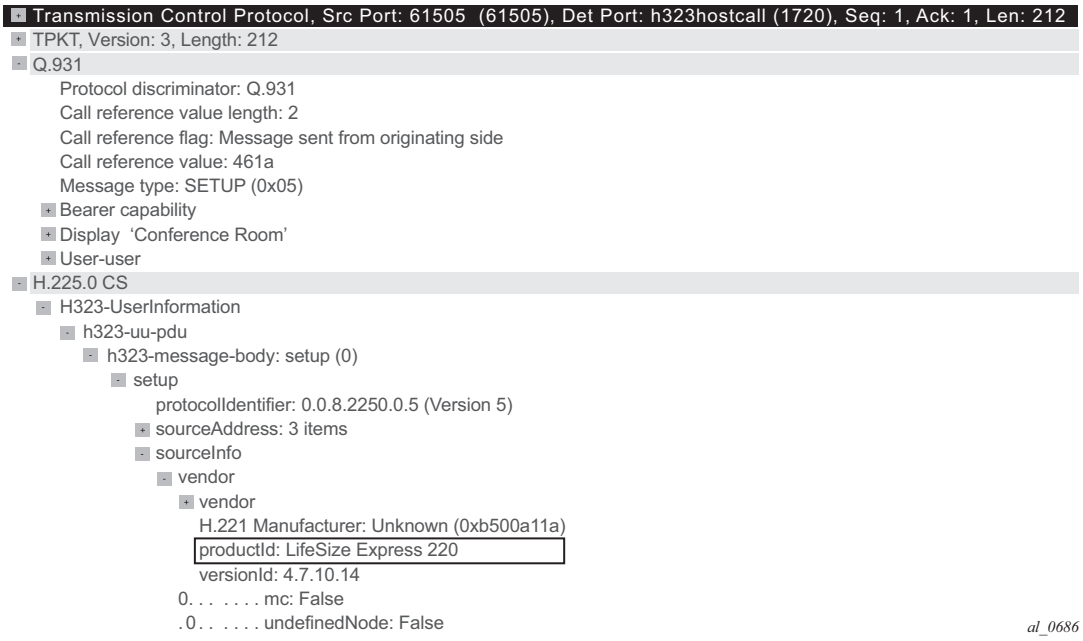


Figure 209: H323 Wireshark® Capture

Configuration Example

The configuration example below provides the configuration to classify LifeSize® H323/RTP traffic using the H323 product ID expression:

```
configure application-assurance group 1:1 policy
    app-filter
        entry <1..65535> create
            description "LifeSize H323 traffic"
            expression 1 h323-product-id eq "^LifeSize*"
            application "LifeSize"
            no shutdown
        exit
```

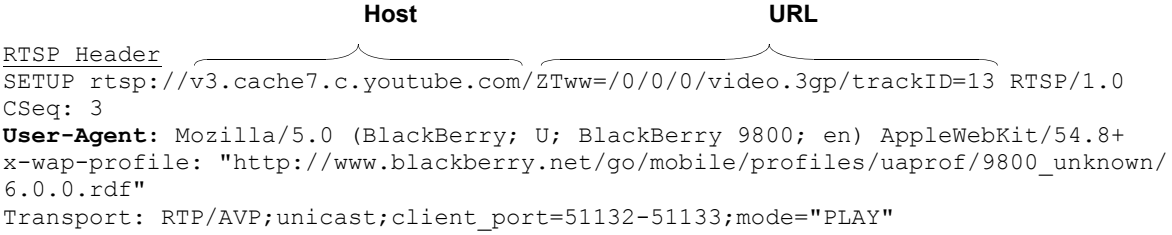
RTSP

Protocol

RTSP is a signaling protocol used for controlling media streaming content such as audio and video over RTP/RDT. AA automatically monitors the RTSP control flows and associates its RTP/RDT media flow with the rtp_rtsp protocol signature.

The operator can use an RTSP expression match criteria app-filter to further refine traffic classification and identify any additional application on top of the default AA policy. This can be particularly useful to identify specific streaming applications.

AA supports RTSP expression match criteria on the RTSP Host, URI, UserAgent. The snapshot below from Wireshark® shows an RTSP setup request to YouTube® followed by the RTP media audio flow; the expression fields that can be matched in RTSP SETUP request using AA app-filters are highlighted:



Configuration Example

The configuration example below provides the configuration to classify YouTube® RTSP/RTP traffic using RTSP Host expression:

```
configure application-assurance group 1:1 policy
    app-filter
        entry <1..65535> create
            description "YouTube RTSP/RTP Video"
            expression 1 rtsp-host eq "*.youtube.com$"
            application "YouTube"
            no shutdown
        exit
```

Citrix

Protocol

Independent Computing Architecture (ICA) is a Citrix Systems® protocol used in Citrix's WinFrame, Citrix XenApp (formerly called MetaFrame/Presentation Server), and Citrix XenDesktop products.

Citrix makes it possible to run applications remotely on large servers, thus making better use of server resources while at the same time allowing people using other platforms to use the applications, for example, run Microsoft® Word on a UNIX workstation.

Citrix_ica protocol signature will detect any remote application using Citrix (the protocol needs to be unencrypted and configured to non-seamless). The Citrix ICA session is started from a client and can be anything from Remote Desktop, SAP to Microsoft® Word.

The Citrix expression match app-filter is used to classify traffic based on the Citrix-published application. This published application is configured on the server and in the example above can be for instance RDP, SAP, Word, XLS or Microsoft® Word depending how the server is configured.

Configuration Example

```
configure application-assurance group 1:1 policy
    app-filter
        entry <1..65535> create
            description "Citrix SAP Application"
            expression 1 citrix-app eq "SAP"
            application "Citrix SAP"
            no shutdown
        exit
```

IP Address and TCP/UDP Port

Traffic from specific server(s) can be classified using IPv4/v6 server-address app-filter rules. It is used usually to identify traffic from an internal (on-net) server as opposed to an Internet (off-net) server.

The server-address app-filter automatically detects the client from the server by identifying which side opens the connection. It implicitly classifies traffic based on the server IP address or Port number. For example, if A initiates a TCP connection to B, then flows A->B and B<-A can be classified with a match on server-address = B. Similarly a flow initiated from B to A would be classified using a match on server-address = A.

Server Address

The configuration example below uses a server-address app-filter to classify traffic from server 10.1.1.1 in the application called Application-1:

```
configure application-assurance group 1:1 policy
    app-filter
        entry <1..65535> create
            description "Server #1 10.0.0.1"
            server-address eq 10.0.0.1/32
            application "Application-1"
            no shutdown
        exit
```

Server-Address + Server Port

The configuration example below uses server-address and server-port app-filters to classify traffic from server 10.0.0.2 on port 1234 in the application called Application-2. It is particularly useful when the same server is used to provide different services that need to be classified separately:

```
configure application-assurance group 1:1 policy
        entry <1..65535> create
            description "Server #2 10.0.0.2 port 1234 Only"
            server-address eq 10.0.0.2/32
            server-port eq 1234
            application "Application-2"
            no shutdown
        exit
```

Server Port and Protocol Signature

It is possible to combine a protocol signature with a port number in the same app-filter, this is typically done in business VPNs for specific internal applications not detected using existing AA protocol signatures.

The configuration below classifies a business VPN application running on TCP port 4000 and not detected by any other signatures. It combines the protocol signature unknown_tcp with the desired port number. This allows keeping the classification untouched for the rest of the protocols/ applications and is the recommended approach:

```
configure application-assurance group 1:1 policy
    app-filter
        entry <1..65535> create
            description "Business VPN Application X Port 4000"
            server-port eq 4000
            protocol eq unknown_tcp
            application "Busines VPN Application X"
            no shutdown
        exit
```

Note: It is important to follow the app-filter range recommendations for a proper classification of traffic using IP address or port number.

Flow Setup Direction

Traffic can be classified based on flow-setup-direction app-filter. The flow setup direction can be either subscriber-to-network or network-to-subscriber.

Network side and subscriber side is AA terminology related to where AA is enabled:

- In broadband and mobile networks, AA is enabled per subscriber. This means the subscriber side represents the ESM/mobile/transit subscriber while the network side represents Internet or other subscribers.
- In business VPNs, AA is enabled on a VPN SAP/spoke SDP and the subscriber side represents the local VPN site (SAP/spoke/transit).

The example below shows the configuration to classify http traffic hosted by AA subscribers (for example, broadband subscribers running a web server):

```
configure application-assurance group 1:1 policy
    app-filter
        entry <1..65535> create
            description "HTTP Server on the subscriber side"
            flow-setup-direction network-to-subscriber
            protocol eq http
            application "HTTP Server"
            no shutdown
        exit
```

IP Protocol

Traffic can be classified using an IP protocol number for non TCP/UDP traffic.

The example below example provides the configuration to classify ICMP IPv4/v6 traffic:

```
configure application-assurance group 1:1 policy
    app-filter
        entry <1..65535> create
            description "ICMP v4"
            protocol eq "non_tcp_udp"
            ip-protocol-num eq icmp
            application "ICMP"
            no shutdown
        exit
        entry <1..65535> create
            description " ICMP v6"
            protocol eq "non_tcp_udp"
            ip-protocol-num eq ipv6-icmp
            application "ICMP"
            no shutdown
        exit
```

Custom Protocol

Custom protocols can be used to classify TCP/UDP applications using hexadecimal string matching (up to 16 hex octets) at a configurable payload offset in the data payload. The expression string length and offset must not exceed 128 bytes.

To illustrate this feature the Solaris® application GoGlobal is used. It provides remote access to a server (similar to VNC®). The snapshot below (Figure 208) from Wireshark® shows a TCP SYN/ACK session establishment followed by the first data exchange:

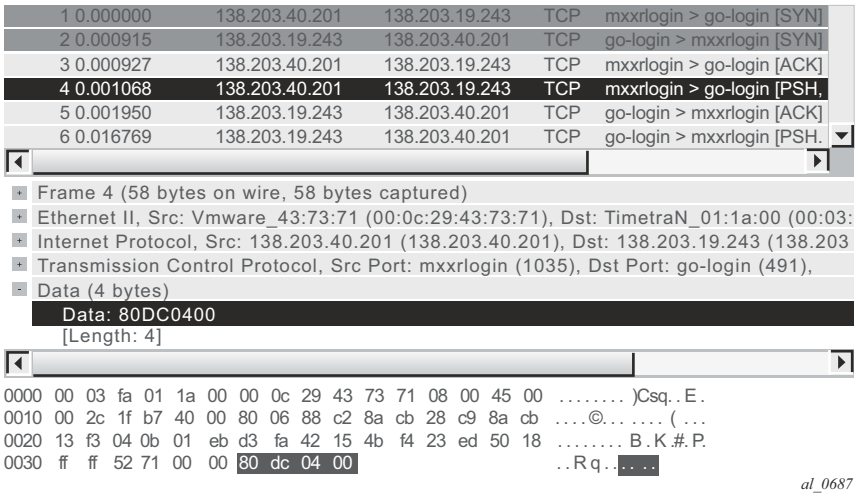


Figure 210: Wireshark® GoGlobal

Wireshark® shows that each TCP session payload starts with 80DC0400 (no offset) after the three-way TCP handshake, as a result the configuration required to classify this traffic is described below:

```
configure application-assurance group 1:1 policy
    custom-protocol 1 ip-protocol-num tcp create
        description "goglobal tcp"
        expression 1 eq "\x80\xdc\x04\x00" offset 0 direction client-to-server
        no shutdown
    exit
    app-filter
        entry <1..65535> create
            description "GoGlobal "
            protocol eq "custom_01"
            application "GoGlobal"
            no shutdown
        exit
```

Typical Configuration Mistakes

An operator creating new user-defined applications can make a few typical mistakes which are listed below:

- App-filters in shutdown state — The default app-filter state is shutdown. A n**o shutdown** command must be executed in order for it to be enabled.
- App-filters with no match criteria — This is a more troublesome mistake as it will catch all the traffic entering the filter in a particular application.

Troubleshooting Application Identification

Show Commands

Router/Partition Statistics

Partition level statistics are not updated in real time. Instead, statistics for a particular flow are updated either at flow closure or every five minutes. The fiveminute sliding window interval is a common interval for all flows in a given ISA MDA. Different ISA MDAs will have a different five minute windows as this interval is set at the MDA boot time.

The following command can be used to view the statistics for all applications configured in the ISA Group 1, Partition 1:

```
show application-assurance group 1:1 application count
```

Alternatively it is possible to sort the display by octets, packets, flows:

```
show application-assurance group 1:1 application count top [octets|packets|flows] [max-count <max-count>]
```

The operator can also identify which app-filters are being hit by the AA policy per partition (this command is not available per subscriber), it is particularly useful to identify which filters are used and optionally prune unnecessary app-filters from user-defined applications:

```
show application-assurance group 1:1 policy app-filter
```

Note: The app-filter policy is usually relatively large, in which case additional 7x50 SR CLI functionality can be used to filter out the output and only show the relevant information. The example below was created for the application FTP:

```
A:PE# show application-assurance group 1:1 policy app-filter | match "application \"FTP\""
                                pre-lines 3 post-lines 2
                    exit
                    entry 44300 create (2 flows, 1205 B)
                        protocol eq "ftp_control"
                        application "FTP"
                        no shutdown
                    exit
                    entry 44301 create (2 flows, 1401 B)
                        protocol eq "ftp_data"
                        application "FTP"
                        no shutdown
                    exit
```

Because partition level statistics are not updated in real time it is recommended for troubleshooting purposes to use subscriber statistics or sub-study statistics.

Subscriber Statistics

Subscriber level statistics can be updated in real time. AA is usually configured by the Operator to collect subscriber level statistics for all application groups in residential and Wifi, while business VPNs typically collect Application group and all applications for each site with AA enabled.

The commands below can be used to view per subscriber statistics for all app-groups or applications configured in ISA Group 1, Partition 1 for the ESM subscriber "Bob" or business VPN SAP 1/1/1:10:

```
show application-assurance group 1:1 aa-sub esm "bob" app-group count
show application-assurance group 1:1 aa-sub sap 1/1/1:10 application count
```

In case only app-group statistics are collected per subscriber, the aa-sub-study feature can be used to collect per application level statistics for selected subscribers, see configuration example below:

```
A:PE# configure application-assurance group 1:1 statistics aa-sub-study application
A:PE>config>app-assure>group>statistics>aa-sub-study# aa-sub esm "bob"
```

Once done, the system will show all application level statistics for this subscriber:

```
show application-assurance group 1:1 aa-sub-study esm "bob" application count
```

Similarly to partition level statistics, aa-sub and aa-sub-study statistics can be sorted by octets, packets, flows:

```
show application-assurance group 1:1 aa-sub-study esm "bob" application count top
[octets|packets|flows] [max-count <max-count>]
```

Note: When the number of flows per ISA card reaches a threshold then per subscriber statistics are not available in real time anymore and only the snapshot command can be used to display the statistics recorded in the previous 5 minute interval window:

```
show application-assurance group 1:1 aa-sub-study esm "bob" snapshot application count
```

AppFilterMiss

The default policy configuration provides a failsafe application at the very end of the app-filter list to classify any remaining traffic in the AppFilterMiss application. There should never be any traffic in this application. This failsafe filter is used as a debug to make sure that there are no major issues in the configuration.

Note: Traffic can typically be classified as AppFilterMiss when not all protocol signatures are mapped to a particular application. This could happen when upgrading to a new ISA software and enabling new protocol signature detection while not ensuring first that the correct application was provisioned. See the 7x50 SR Release Note upgrade section for more details on AA signature upgrade.

Tools

Flow-Record-Search

Traditional show commands may not provide enough information when troubleshooting flow identification and the operator can use the ISA flow-record-search tool to dump the ISA flow table for more information. This feature comes with a large number of filtering options documented in the user guide.

Each flow gives visibility into: Flow ID, Sub-Type, Sub-Name, Initiator, Direction, Source IP, Dest. IP, IP Protocol, Source Port, Dest. Port, FC, DSCP, Classified, Protocol, Application, App-Group, Charging Group, Packets tx, Bytes Tx, Packets-discarded, Bytes-discarded etc.

See below for the most commonly used commands.

To show all the flows in a given ISA card per ISA group:partition (can be a very long output, up to 3M entries):

```
tools dump application-assurance group 1:1 flow-record-search isa 1/2
```

To show all the flows per AA subscriber in a given group:partition:

```
tools dump application-assurance group 1:1 flow-record-search aa-sub esm "bob"
```

To show all the active flows per AA subscriber in a given group:partition:

```
tools dump application-assurance group 1:1 flow-record-search aa-sub esm "bob" flow- sta-
tus active
```

The flow-record-search command is also available with additional details by adding search-type detail at the end of the command line. Note that due to the length of the output it is recommended to paste the CLI output content in a notepad file.

HTTP Host Recorder

SR OS 11.0.R1 introduced the comprehensive cflowd feature which allows AA to export the HTTP domain extracted from HTTP flows to the 5670 RAM reporting solution. As such, it is the preferred functionality to understand which HTTP Hosts are visible in the network.

Prior to SR OS 11.0.R1, the HTTP host recorder is a tool function available in the 7750 to record HTTP Hosts seen by AA. See the 7750 SR OS Multi-Service Integrated Services Adapter Guide for more details.

```
A:PE# show debug
debug
    application-assurance
        group 1:1
            http-host-recorder
                filter
                    default-filter-action record
                    record http-host-app-filter-candidates
                exit
                rate 100
                no shutdown
            exit
        exit
    exit
exit

A:PE# tools dump application-assurance group 1:1 http-host-recorder top bytes
```

Port Recorder

This function is particularly useful in business VPN (it can also be used in residential networks). The port-recorder AA tool function is similar to the http-recorder. It allows the operator to record which ports are used on selected applications.

It is most commonly used with the applications Unidentified TCP and Unidentified UDP but it can be configured to record any other applications:

```
A:PE# show debug
debug
    application-assurance
        group 1:1
            port-recorder
                application "Unidentified TCP"
                application "Unidentified UDP"
                rate 100
                shutdown
            exit
        exit
    exit
exit

A:PE# tools dump application-assurance group 1:1 port-recorder top bytes
```

Conclusion

This example, which is intended for Application Assurance (AA) network architects and engineers, provides the information required to modify an existing AA policy following AA best practices and guidelines, and provides the necessary troubleshooting information to better understand application classification using Application Assurance.