Policy Management

Analytics Data Stream Reference

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About This Guide

This guide describes Policy Management product support for the Analytics Data Stream feature.

How This Guide is Organized

The information in this guide is presented in the following order:

- About This Guide contains general information about this guide, the organization of the guide, and how to get technical assistance.
- Overview provides an overview of the Analytics Data Stream feature.
- TLV Definitions provides a list of the TLV definitions suported by the Analytics Data Stream feature.

Scope and Audience

This guide is intended for service personnel who are responsible for managing Policy Management systems.

Related Publications

For information about additional publications related to this document, refer to the Oracle Help Center site. See Locate Product Documentation on the Oracle Help Center Site for more information on related product publications.

Locate Product Documentation on the Oracle Help Center Site

Oracle Communications customer documentation is available on the web at the Oracle Help Center (OHC) site, http://docs.oracle.com. You do not have to register to access these documents. Viewing these files requires Adobe Acrobat Reader, which can be downloaded at http://www.adobe.com.

1. Access the Oracle Help Center site at http://docs.oracle.com.
2. Click `Industries`.
3. Under the Oracle Communications subheading, click the `Oracle Communications documentation` link.

   The Communications Documentation page appears. Most products covered by these documentation sets will appear under the headings "Network Session Delivery and Control Infrastructure" or "Platforms."

4. Click on your Product and then the Release Number.

   A list of the entire documentation set for the selected product and release appears.

5. To download a file to your location, right-click the `PDF` link, select `Save target as` (or similar command based on your browser), and save to a local folder.

Customer Training

Oracle University offers training for service providers and enterprises. Visit our web site to view, and register for, Oracle Communications training:

http://education.oracle.com/communication

To obtain contact phone numbers for countries or regions, visit the Oracle University Education web site:

www.oracle.com/education/contacts

My Oracle Support

My Oracle Support (https://support.oracle.com) is your initial point of contact for all product support and training needs. A representative at Customer Access Support can assist you with My Oracle Support registration.

Call the Customer Access Support main number at 1-800-223-1711 (toll-free in the US), or call the Oracle Support hotline for your local country from the list at http://www.oracle.com/us/support/contact/index.html. When calling, make the selections in the sequence shown below on the Support telephone menu:

- For Technical issues such as creating a new Service Request (SR), select **1**.
- For Non-technical issues such as registration or assistance with My Oracle Support, select **2**.
- For Hardware, Networking and Solaris Operating System Support, select **3**.

You are connected to a live agent who can assist you with My Oracle Support registration and opening a support ticket.

My Oracle Support is available 24 hours a day, 7 days a week, 365 days a year.

Emergency Response

In the event of a critical service situation, emergency response is offered by the Customer Access Support main number at 1-800-223-1711 (toll-free in the US), or by calling the Oracle Support hotline for your local country from the list at http://www.oracle.com/us/support/contact/index.html. The emergency response provides immediate coverage, automatic escalation, and other features to ensure that the critical situation is resolved as rapidly as possible.

A critical situation is defined as a problem with the installed equipment that severely affects service, traffic, or maintenance capabilities, and requires immediate corrective action. Critical situations affect service and/or system operation resulting in one or several of these situations:

- A total system failure that results in loss of all transaction processing capability

- Significant reduction in system capacity or traffic handling capability
- Loss of the system's ability to perform automatic system reconfiguration
- Inability to restart a processor or the system
- Corruption of system databases that requires service affecting corrective actions
- Loss of access for maintenance or recovery operations
- Loss of the system ability to provide any required critical or major trouble notification

Any other problem severely affecting service, capacity/traffic, billing, and maintenance capabilities may be defined as critical by prior discussion and agreement with Oracle.

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1 Overview

This chapter provides an overview of Policy Management support for the Analytics Data Stream feature.

Analytics Data Stream

The Analytics Data Stream (ADS) feature implements an outbound analytics feed from the Multimedia Policy Engine (MPE) device. This feed provides real time analytics data about message processing in the MPE device and specific details about the policies that are being triggered by those messages.

The Analytics Data Stream feature is configured using the Configuration Management Platform (CMP) server. Refer to the *CMP Wireless User's Guide* for information on configuring the feature.

The Policy Event Record (PER) is the primary data type included in the data stream. The PER contains information related to executed policies, available subscriber tier and entitlements, and associated quota changes. For information on the other data types in the data stream, refer to Table 1-1.

Data is sent as a byte-encoded set of Type Length Values (TLV) over a client-initiated TCP connection. The analytics client implements a customized interface to read and process the data sent from the MPE device over the connection. TLVs represent different pieces of information about an event, which, when pieced together, make up an ADS message.

The Analytics Data Stream feature is implemented using a defined set of TLVs so that the data sent from the MPE device can be targeted at any third-party analytics client. Refer to TLV Definitions for a list of supported TLVs for the feature.

ADS Message Types

There are several types of Analytics Data Stream (ADS) messages that are sent between the MPE device and a connected analytics client. Each ADS and TLV message is preceded by a 2-byte Message Type field and a 32-bit little-endian length field. The length field is for the data portion of the message only, and does not include either the four bytes of the length field or two bytes of the message field.

Each ADS message contains a variable number of TLV records. Certain fields, such as policy IDs and user identifiers, can appear multiple times in an event.

The general structure of an ADS message, containing multiple TLVs is as follows:

```
     2 Bytes                     4 Bytes                          n Bytes
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
+-+
|   Message Type   |           data length              |    TLVs ...
+-------------------------------------------------------------------------------
--
```

The general structure of a TLV:

```
     2 Bytes                     4 Bytes                          n
Bytes
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
+-+-+-+-+
|   TLV Type       |         TLV data length           |    TLV
data...
+---------------------------------------------------------------------------
--------
```

Table 1-1 shows the messages types and their associated values. For information on the TLV values, refer to TLV Definitions.

Table 1-1 ADS Message Types

ADS Message Type	Message Description	Required TLVs
0x03 Keep Alive	Used as a NoOp for TCP connection maintenance. Keep alives are sent when ADS connections are idle. Identified by a TLV Message Type of KEEPALIVE	TLV 1: Version - ADS Interface Version.
0x04 Error	Errors are sent from the MPE device in response to various client requests and contain information about why the request was rejected or what caused the error.	TLV 1: Version - ADS Interface Version. TLV 10: Error Code - Code for type of error. TLV 9: Error - Error message details.
0x05 Version Request	A message sent from an analytics client to the MPE device as part of the version exchange. The version exchange is the first set of messages sent after establishing a connection. The client sends version(s) of ADS it would like to receive from.	TLV 1: Version - ADS Interface Version.
0x06 Version Acknowledgement	A response sent by the MPE device to a client Version Request, confirming the version of ADS content it will be sending.	TLV 1: Version - Analytics Data Stream Interface Version to be sent.

Table 1-1 (Cont.) ADS Message Types

ADS Message Type	Message Description	Required TLVs
0x07 Initiate Request	Client initiated request to signal the MPE device that the client is ready to receive data.	TLV 1: Version - ADS Interface Version. TLV 11: Analytics Client ID - Unique string identifier for that client. TLV 12: Channel Type - A placeholder in anticipation of future functionality. TLV 13: Request PRD (optional) - Provides a way for clients to request a copy of the current PRD data. TLV 14: Keep Alive Interval - Measured in MS. A value of 0 indicates no keep alive is necessary.
0x08 Stop Request	Stop receiving data on this client connection. This will flush any data remaining in the buffer to be sent before closing the connection.	TLV 1: Version - ADS Interface Version.
0x09 Stop Acknowledgement	Sent after flushing any buffered data to indicate nothing more remains and the connection can be closed.	TLV 1: Version - ADS Interface Version.
0x0A Reference Data Version Request	A client request to receive the current version of PRD data from the MPE device.	TLV 1: Version - ADS Interface Version.
0x0B Policy Event Record (PER)	Data processed by an analytics client. Contains information related to any executed policies, available subscriber Tier and Entitlements, and associated quota changes.	TLV 1: Version - ADS Interface Version. TLV 2: Event Type - Identifier for the type of event that triggered this PER. TLV 3: Reference Data Version - Relevant instance of PRD to de-reference PER data. TLV 6: Policy Event Serial Number - Unique serial numbers are applied to each message and can be used to reconstruct the original stream of PERs if the stream is load- balanced across multiple analytic client connections.
0x0C Policy Reference Data (PRD)	Provides details on the deployed policy library definitions so that data from the PERs can be de-referenced and interpreted in context.	TLV 1: Version - ADS Interface Version. TLV 2: Event Type - Identifier for the type of event that triggered this message. TLV 3: Reference Data Version - Relevant instance of PRD to de-reference PER data. TLV 6: Policy Event Serial Number - Unique serial numbers are applied to each message and can be used to reconstruct the original stream of PERs if it is load balanced across multiple analytic client connections.

2
TLV Definitions

This chapter describes and lists the TLV definitions.

TLV Definitions Overview

This chapter describes the individual pieces of a TLV message and lists the TLV definitions.

Type Length Values (TLV) represent individual pieces of data that make up the ADS message content. A TLV consists of a Type definition, data length measured in bytes (which does not include the Type or Length), and the data value.

Type: 2 bytes

Length: 4 bytes

Value: String {variable} | 1 byte | Short {2 bytes} | Integer {4 bytes} | Long {8 bytes} | TLVs {variable}

In addition, TLVs can contain other TLVs. In those cases the Length of the parent TLV includes the combined length of all sub TLVs.

TLV 1: Version

TLV 1 indicates the version of the Analytics Data Stream.

- Allowed Occurrences - 1
- Value: String value representing the Analytics Data Stream interface version.

TLV 2: Event Type

TLV 2 identifies the type of operation that triggered the policy event.

- Allowed Occurrences - 1
- Value - Short (2 bytes)
- Event Types:
  - 0x01: CREATE
  - 0x02: MODIFY
  - 0x03: DELETE
  - 0x04: CLEANUP
  - 0x05: ACK
  - 0x06: DELETEACK
  - 0x07: CLEANUPACK
  - 0x08: CREATEERR

- 0x09: MODIFYERR
- 0x0A: DELETEERR
- 0x0B: CLEANUPERR
- 0x0C: REPORT
- 0x0D: REAUTH
- 0x0E: REAUTHERR
- 0x0F: REAUTHACK
- 0x10: ABORT
- 0x11: ABORTERR
- 0x12: ABORTACK
- 0x13: PRD
- 0x14: ERROR

TLV 3: Reference Data Version

TLV 3 indicates the policy version used to map policy identifiers in the PER message to policy definitions sent with the policy reference data.

- Allowed Occurrences - 1
- Value - String - Policy Reference Data Version

TLV 4: Policy Entry Timestamp

TLV 4 indicates the time that the policy engine started processing the event.

The Policy Entry Timestamp is obtained using the Java System.currentTimeMillis(), which is the number of milliseconds since January 1, 1970. For example, a value of 1309440504000 represents June 30, 2011 at 09:28:24.

- Allowed Occurrences - 1
- Value - Long (8 bytes)

TLV 5: Policy Exit Timestamp

TLV 5 indicates the time that the policy engine stopped processing this event. Processing time, in milliseconds, for the event can be calculated by subtracting the value of the Policy Exit Timestamp field with the value of the Policy Entry Timestamp field.

The Policy Exit Timestamp is obtained using the Java System.currentTimeMillis(), which is the number of milliseconds since January 1, 1970. For example, a value of 1309440504000 represents June 30, 2011 at 09:28:24.

- Allowed Occurrences - 1
- Value - Long (8 bytes)

TLV 6: Policy Event Serial Number

TLV 6 is used to identify the order in which a policy event occurred.

When the MPE device generates events that send ADS messages to multiple ADS consumers, the serial number can be used by the consumers to reconstruct the original event stream. For example, if there are two active ADS streams and the messages are evenly load balanced across those two streams, stream A will receive messages for events 1, 3, 5, etc. and stream B will receive messages for events 2, 4, 6, etc.

- Allowed Occurrences - 1
- Value - Long (8 bytes), range 0-0xFFFFFFFF

TLV 9: Error Message

TLV 9 indicates an error message.

- Allowed Occurrences - 0..1
- Value - String

TLV 10: Error Code

- Allowed Occurrences - 0..1
- Value - Short (2 bytes)
  - ▪ 0x00: MESSAGE_OUT_OF_SEQUENCE
  - ▪ 0x01: INVALID_TLV_IN_MESSAGE
  - ▪ 0x02: MISSING_REQUIRED_TLV
  - ▪ 0x03: NO_VALID_ADS_VERSION
  - ▪ 0x0A: STARTING_TIMEOUT
  - ▪ 0x0B: INITIATING_TIMEOUT

TLV 11: Analytics Client ID

- Allowed Occurrences - 1
- Value - String

TLV 12: Channel Type

- Allowed Occurrences - 1
- Value - String

TLV 13: Request PRD

TLV 13 indicates a request for PRD data.

If a version is requested that matches the 'current' version of PRD data (TLV 3: Reference Data Version), then the PRD will not be sent. Otherwise, the current version of PRD data is sent to the client when TLV 13 is included.

- Allowed Occurrences - 0..1
- Value - String

TLV 14: Keep Alive Interval

- Allowed Occurrences - 0..1
- Value - Integer (4 bytes) value representing the keep alive interval in ms.

TLV 101: RAT Type

- Allowed Occurrences - 0..1
- Value - Short (2 bytes)
- RAT types:
  - 0x00: [UNKNOWN] RAT-type unknown or not specified
  - 0x01: [CDMA2000_1X] CDMA 1xRTT data service
  - 0x02: [EVDO_REL0] CDMA EV-DO Release 0
  - 0x03: [HRPD] CDMA High Rate Packet Data
  - 0x04: [WLAN] IEEE 802.11 Wireless LAN
  - 0x05: [3GPP_UTRAN] GSM UMTS Terrestrial Radio Access Network
  - 0x06: [3GPP_GERAN] GSM EDGE Radio Access Network
  - 0x07: [3GPP_UMA_GAN] 3GPP Unlicensed Mobile Access / General Access Network
  - 0x08: [3GPP_HSPA_EVOLUTION] 3GPP High Speed Packet Access Evolution Radio Access Network
  - 0x09: [UMB] Ultra Mobile Broadband Radio Access Network
  - 0x0A: [3GPP_EUTRAN] 3GPP evolved UTRAN

TLV 102: IP-CAN-Type

TLV 102 indicates the type of Connectivity Access Network in which the user is connected.

- Allowed Occurrences - 0..1
- Value - Short (2 bytes)

- IP-CAN Types:
  - 0x00: UNKNOWN
  - 0x01: THREEGPP_GPRS
  - 0x02: DOCSIS
  - 0x03: XDSL
  - 0x04: WIMAX
  - 0x05: THREEGPP2
  - 0x06: THREEGPP_EPS
  - 0x07: NON_THREEGPP_EPS
  - 0x4D: WIRELINE_ACCESS

TLV 105: Session Id

- Allowed Occurrences - 0..1
- Value - String

TLV 106: Application Id

TLV 106 indicates the Diameter application ID of the request causing this policy event.

- Allowed Occurrences - 0..1
- Value - Integer (4 bytes)
- Application Ids (not an exhaustive list):
  - 16777238: 3GPP Gx
  - 16777266: 3GPP Gxx
  - 16777235: 3GPP Rx

TLV 107: Peer Identity

TLV 107 indicates the identity of the attached peer (for example, GGSN).

- Allowed Occurrences - 0..1
- Value - String

TLV 108: SGSN IP Address

TLV 108 indicates the IP address of the SGSN.

- Allowed Occurrences - 0..1
- Value - IP address string

TLV 109: SGSN MCC-MNC

TLV 109 indicates the MCC-MNC of the SGSN.

- Allowed Occurrences - 0..1
- Value - MCC-MNC string

TLV 110: AF Application ID

TLV 110 indicates the application ID passed in an AF request, if present.

- Allowed Occurrences - 0..1
- Value - String

TLV 111: Subscriber ID

TLV 111 identifies the subscriber associated with the event.

A subscriber ID is represented as an encoded string, where:

- The first part of the string is a unique tag that describes the identifier value that follows. Currently defined identifier types are:
  - NAI
  - E164
  - IMSI
  - IP
  - SESSID
  - NAME
  - SIP
  - PRIVATE
  - UNKNOWN
- The unique tag is followed by a delimiter character (currently ":").
- The delimiter is followed by the actual identifier value.
- Allowed Occurrences - 0..*
- Value - String

TLV 112: User Equipment Information

TLV 112 identifies the user equipment identifier associated with the event.

The user equipment field is represented as an encoded string, where:

- The first part of the string is a unique tag that describes the identifier value that follows. Currently defined identifier types are:
  - IMEISV

  - MAC
  - EU164
  - MODIFIED_EU164
  - ESN
  - MEID
- The unique tag is followed by a delimiter character (currently ":").
- The delimiter is followed by the actual identifier value.
- Allowed Occurrences - 0..1
- Value - String

TLV 118: Called Station Identifier

TLV 118 indicates the address the user is connected to.

- Allowed Occurrences - 0..1
- Value - String

TLV 119: Mobility Protocol

- Allowed Occurrences - 0..1
- Value - 1 byte
- Mobility Protocol Values:
  - 0x00: Unknown
  - 0x01: GTP
  - 0x02: PMIP
  - 0x03: DSMIP

TLV 120: Billing Day

TTLV 120 indicates the day of the month on which the user's quota values are reset. A value of 1-31 indicates the day, and a value of 0 indicates that the quota values are not automatically reset.

- Allowed Occurrences - 0..1
- Value - 1 byte

TLV 121: Entitlement

TLV 121 contains a single entitlement enabled for the user. The meaning of the value in the entitlements field is defined by the operator. A separate TLV 121 is generated for each entitlement associated with the subscriber.

- Allowed Occurrences - 0..*
- Value - String

TLV 122: Tier

TLV 122 indicates the name of the tier associated with the user.

- Allowed Occurrences - 0..1
- Value - String

TLV 123: Event triggers mask

TLV 123 indicates the bit mask of all event triggers received from the PCEF/BBERF.

- Allowed Occurrences - 0..1
- Value - Long (8 bytes) mask
- Event Trigger Bit Definitions:
  - 0x00000000: NO_TRIGGER
  - 0x00000001: PCF_CHANGE
  - 0x00000002: QOS_CHANGE
  - 0x00000004: RAT_CHANGE
  - 0x00000008: TFT_CHANGE
  - 0x00000010: PLMN_CHANGE
  - 0x00000020: LOSS_OF_FLOW
  - 0x00000040: RECOVERY_OF_FLOW
  - 0x00000080: IP_CAN_CHANGE
  - 0x00000100: PCC_RULE_FAILURE
  - 0x00000200: ACCESS_NETWORK_PHYSICAL_ACCESS_ID_CHANGE
  - 0x00000400: SGSN_CHANGE
  - 0x00000800: GW_PCEF_MALFUNCTION
  - 0x00001000: RESOURCES_LIMITATION
  - 0x00002000: MAX_NR_BEARERS_REACHED
  - 0x00004000: QOS_CHANGE_EXCEEDING_AUTHORIZATION
  - 0x00008000: RAI_CHANGE
  - 0x00010000: USER_LOCATION_CHANGE
  - 0x00020000: NO_EVENT_TRIGGERS
  - 0x00040000: AGW_MALFUNCTION
  - 0x00080000: OUT_OF_CREDIT
  - 0x00100000: REALLOCATION_OF_CREDIT
  - 0x00200000: REVALIDATION_TIMEOUT
  - 0x00400000: UE_IP_ADDRESS_ALLOCATE
  - 0x00800000: UE_IP_ADDRESS_RELEASE

- 0x01000000: DEFAULT_EPS_BEARER_QOS_CHANGE
- 0x02000000: AN_GW_CHANGE
- 0x04000000: SUCCESSFUL_RESOURCE_ALLOCATION
- 0x08000000: USAGE_THRESHOLD_REACHED
- 0x10000000: CELL_CONGESTED
- 0x20000000: CELL_CLEAR
- 0x40000000: SERVICE_FLOW_DETECTION
- 0x80000000: USAGE_REPORT
- 0x100000000: UE_TIME_ZONE_CHANGE
- 0x200000000: RESOURCE_MODIFICATION_REQUEST
- 0x400000000: TAI_CHANGE
- 0x800000000: ECGI_CHANGE
- 0x4000000000: APPLICATION_START
- 0x8000000000: APPLICATION_STOP
- 0x10000000000: ADC_REVALIDATION_TIMEOUT
- 0x20000000000: USER_CSG_INFORMATION_CHANGE
- 0x40000000000: DEFAULT_EPS_BEARER_QOS_MODIFICATION_FAILURE
- 0x80000000000: USER_CSG_HYBRID_SUBSCRIBED_INFORMATION_CHANGE
- 0x100000000000: USER_CSG_HYBRID_UNSUBSCRIBED_INFORMATION_CHANGE
- 0x200000000000: APN_AMBR_MODIFICATION_FAILURE

TLV 124: Location Area Code

- Allowed Occurrences - 0..1
- Value - String

TLV 125: Cell Identifier

Version 1 of the PER will not generate this TLV, in favor of the fully qualified TLV 126 (Cell Global Identifier), which includes the cell identifier.

- Allowed Occurrences - 0..1
- Value - String

TLV 126: Cell Global Identifier

TLV 126 is generated only when the Geographic Location Type is 0 (CGI). This TLV is generated in preference to TLV 124 and TLV 125.

- Allowed Occurrences - 0..1

- Value - String
  The Cell Global Identifier is built by creating an array of values from the 3GPP-User-Location-Info AVP:
  - MCC
  - MNC
  - Location Area Code
  - Cell Identity

TLV 127: EUTRAN Cell Identifier

- Allowed Occurrences - 0..1
- Value - String

TLV 128: MCCMNC

- Allowed Occurrences - 0..1
- Value - String

TLV 129: Service Area Code

- Allowed Occurrences - 0..1
- Value - String

TLV 130: Routing Area Code

- Allowed Occurrences - 0..1
- Value - String

TLV 131: Tracking Area Code

- Allowed Occurrences - 0..1
- Value - String

TLV 137: Origin Host

- Allowed Occurrences - 0..1
- Value - String

TLV 138: Framed IP Address

- Allowed Occurrences - 0..1
- Value - String

TLV 140: Quota Usage

TLV 140 reports the current amount of usage for the subscriber for the given quota.

When reporting bulk (unclassified) usage, the quota string will be a single byte with a value of 0x00. The usage value is the number of bytes used in the current billing cycle.

- Allowed Occurrences - 0..*
- Value - TLV 144 Usage Value, TLV145 Quota Limit Type, TLV 146 Quota Limit, TLV 142 Quota Name, TLV 143 Monitoring Key

TLV 141: Usage Update

TLV 141 reports any usage updates that were reported by the CCR associated with the event.

If the Monitoring Key is 0 length, no monitoring key was sent with this usage update.

- Allowed Occurrences - 0..1
- Value - TLV 144 Usage Value, TLV 145 Quota Limit Type, TLV 142 Quota Name, TLV 143 Monitoring Key

TLV 142: Quota Name

- Allowed Occurrences - 0..*
- Value - String

TLV 143: Monitoring Key

- Allowed Occurrences - 0..*
- Value - String

TLV 144: Usage Value

- Allowed Occurrences - 0..*
- Value - Long (8 bytes)

TLV 145: Quota Limit Type

- Allowed Occurrences - 0..*
- Value - 1 byte
- Quota Limit Types:
  - Time=0
  - Total Volume=1
  - Input (upstream) Volume=2
  - Output (downstream) Volume=3
  - Service Specific=4

TLV 146: Quota Limit Value

- Allowed Occurrences - 0..*
- Value - Long (8 bytes)

TLV 500: Policy

TLV 500 provides a list of all policy groups deployed to the associated MPE.

- Allowed Occurrences - 0..*
- Value - TLV 501, TLV 502, TLV 503, TLV 504, TLV 510
  A policy consists of a Name, ID, associations with policy tables, mandatory action, and zero or more optional actions.

TLV 501: Policy Name

TLV 501 indicates the name of the policy.

- Allowed Occurrences - 1
- Value - String

TLV 502: Policy ID

TLV 502 indicates the value provided in the PRD policy definitions. This value is used as reference data.

One Policy ID TLV is included in the PER for each policy that is matched for the event. During policy execution, a policy can execute more than one time, so the policy identifier may be included in the policy list multiple times.

In version 1.0, only matched policies are included in the PER, so a PER can be generated without including any Policy Id TLVs.

Policy Group Tracing

Some policies may contain an action that instructs the policy engine to execute a policy group. A policy in a group may also execute another group, increasing the nesting level. A policy can belong to zero or more groups. When tracking which group a policy belongs to, only use the current (i.e., most deeply nested) group. The PER parser must track the current group level. The policy reference data indicates which policies execute groups and which policies exit a group to facilitate tracking the current group and nesting level. When a policy group is exited and there is no matching policy with an action that indicates this, the PER includes a policy ID of zero, to indicate that the group nesting level has been exited.

- Allowed Occurrences - 1
- Value - Policy Identifier, Long (8 bytes)

TLV 503: Policy Mandatory Action

- Allowed Occurrences - 1
- Value - TLV 505, TLV 506
  There is only one of these actions ("accept", "reject", "continue processing", etc).

TLV 504: Policy Optional Action

TLV 504 indicates the list of optional actions that are executed when the policy's condition is passed.

- Allowed Occurrences - 0..*
- Value - TLV 505, TLV 506

TLV 505: Policy Action ID

TLV 505 indicates the action.

- Allowed Occurrences - 1
- Value - String

TLV 506: Policy Action Replacement

TLV 506 indicates user-configured data in the policy action.

- Allowed Occurrences - 0..*
- Value - TLV 507, TLV 508

TLV 507: Policy Action Replacement Sequence

TLV 507 indicates the field in the policy action that contains the value that will be replaced by the value in TLV 508.

- Allowed Occurrences - 0..*
- Value - Integer (4 bytes)

TLV 508: Policy Action Replacement Value

TLV 508 indicates the actual value that is used as a replacement for the fields in the policy action.

- Allowed Occurrences - 0..*
- Value - String

TLV 509: Policy Table ID

TLV 509 indicates a table that can be referenced within a policy.

Table-driven policies allow variables, such as rule names, to be referenced from a table instead of being hard-coded in the policy. Table-driven policies require a table to be sent as part of reference data.

- Allowed Occurrences - 0..*
- Value - Long (8 bytes)

TLV 510: Policy Table Association

TLV 510 is included with a policy TLV to indicate that the table is associated with the policy.

- Allowed Occurrences - 0..*
- Value - TLV 509, TLV 511

TLV 511: Policy Table Alias

TLV 511 indicates the alias used to identify the table within replacement values.

- Allowed Occurrences - 1
- Value - String

TLV 512: Policy Table

TLV 512 provides the PRD data that defines a policy table.

- Allowed Occurrences - 0..*
- Value - TLV 509, TLV 513

TLV 513: Policy Table Row

TLV 513 indicates a row in a policy table.

A single row defined in the CMP can translate to multiple rows in the table. Therefore, the policy table rows do not correspond directly to the CMP rows.

- Allowed Occurrences - 1..*

- Value - TLV 514, TLV 515

TLV 514: Policy Table Row Number

TLV 514 indicates a number for a row in the policy table. This number is unique within the table.

- Allowed Occurrences - 1
- Value - Integer (4 bytes)

TLV 515: Policy Table Cell

TLV 515 indicates the contents of a cell in the policy table.

- Allowed Occurrences - 1..*
- Value - TLV 516, TLV 517

TLV 516: Policy Table Column Name

TLV 516 indicates the name of a column in the policy table.

- Allowed Occurrences - 1
- Value - String

TLV 517: Policy Table Cell Value

TLV 517 indicates the value in the table cell.

- Allowed Occurrences - 1
- Value - String

TLV 518: Matched Table Row

TLV 518 indicates a grouping that identifies a specific row and table matched during policy execution.

- Allowed Occurrences - 1..*
- Value - TLV 509, TLV 514

TLV 519: Matched Table Driven Policy

TLV 519 indicates a grouping of a policy ID and associated tables matched during policy execution.

The TLV 519 information is sent in a PER to signify that the policy and the associated table and specific row were executed by the MPE device. This information is included in place of TLV 502 when table driven policies are executed.

- Allowed Occurrences - 0..*
- Value - TLV 502, TLV 518