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AMP Manager SQL Interface
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Abstract

This document describes a proposed public interface through which an application, such as a network management console, interacts with an Asynchronous Management Protocol (AMP) Manager via a database supporting the Structured Query Language (SQL). The use of SQL as an interfacing layer provides a natural way to describe interactions with an AMP Manager independent of a particular implementation of either the Manager or the application. Specifically, this document presents a database schema capturing how to send controls to a Manager and how to accept reports received by a Manager from one or more AMP Agents.

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1. Introduction

This document presents a public interface through which an application, such as a network management console, interacts with an Asynchronous Management Protocol ([\[I-D.birrane-dtn-amp\]](#)) Manager via a database supporting the Structured Query Language (SQL). Such an interface is useful as an implementation independent way of specifying how an application may interact with an AMP Manager to issue commands (such as through a custom graphical user interface) and to receive reports (as they are received by one or more AMP Agents).

1.1. Purpose

This document describes a database layout comprised of a series of names tables and the columns the comprise those tables. Where appropriate, primary and foreign key constraints are also discussed. This set of tables presents a data model through which all AMP Manager roles and responsibilities, as defined in the Asynchronous Management Architecture ([\[I-D.birrane-dtn-ama\]](#)), can be accomplished.

Application developers can use this specification to describe how to

populate a database with AMP-related information such that an AMP Manager implementation can read and use this data to effect AMP behavior. By reading and writing the tables in accordance with this specification, applications can claim conformance with the AMP Manager regardless of which AMP Manager implementation is used, so long as such a Manager is also in conformance with this specification.

AMP Manager developers use this specification to describe how AMP users input actions to the Manager and how to send received reports back to those users.

[1.2.](#) Scope

This document covers table names and the names, data types, default values, and comments associated with each column of each names table. These types should be appropriate for any database implementing a SQL interface and SHOULD NOT use any language or function specific to a particular SQL database vendor.

This document does not specify the setup, configuration, administration, or other function associated with a particular SQL database vendor. Further, this document does not specify how either the application or the AMP Manager log on to the database, or how database communications are verified and secured. Finally, this document does not discuss the architecture associated with incorporating a database between an application and an AMP Manager, as such architectures are likely tightly coupled to a network deployment.

[1.3.](#) Requirements Language

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in [RFC 2119](#) [[RFC2119](#)].

[2.](#) Database Overview

This specification assumes that all tables exist in a database called "amp_core", capturing the information necessary to capture core operations associated with the AMP Manager.

The schema contains tables capturing information about various areas of the AMP Manager interface. The following table types are defined.

- o Constants - These tables contain those constants defined in the AMP and AMA specifications as well as certain constants that are defined in this specification.
- o ADM Support - These tables capture all information that is solely defined in an ADM. Outside of adding support for a new ADM, the data in these tables should never be changed.
- o AMP Agent Support - These tables capture information about Agents in the system.
- o Compound Data Types Support- These tables capture information about TNVCs and expressions.

- o Operator Support- These tables capture the information that is needed to utilize operators.
- o ARI Information - These tables capture all information used to define Managed Identifiers (ARIs) for the Manager. This includes ARI definitions from ADMs custom definitions from users in the system. These tables also capture parameters, object identifiers, and ARI collections.
- o Outgoing Support - These tables capture information provided by an application to a Manager to be sent out to an AMP agent.
- o Incoming Support - These tables capture information provided by an Agent and incoming to the Manager to be passed along to the application.

The specification comprises tables, as in Figure 1.

+-----+-----+	
Table Name	Table Type
+-----+-----+	
data_type	Constants

incoming_state	Constants
outgoing_state	Constants
tnvc_set	Compound Data Type
tnvc	Compound Data Type
expression_set	Compound Data Type
expression	Compound Data Type
in_type_set	Operator Support
in_type	Operator Support
adm_nickname	ADM Support
adm	ADM Support
parmspec	ADM Support
parmspec_set	ADM Support
registered_agents	Agent Support
data	ARI Information
data_set	ARI Information
ac	ARI Information
ac_set	ARI Information
ari	ARI Information
ari_definition	ARI Information
outgoing_message_group	Outgoing Support
outgoing_message	Outgoing Support
incoming_message_group	Incoming Support
incoming_message	Incoming Support

Figure 1: amp_core tables

3. Constants

3.1. Data Types - data_types

Data types, as defined in the AMP, enumerate the types of information associated with collections of data, such as defined in ARI parameters, computed values, and report definitions.

The format of the table is as follows.

Field	Type	Null	Key	Default	Extra
enumeration	int(10) unsigned	NO	PRI		
name	varchar(50)	NO	UNI		

description	varchar(255)	NO		""	
+	+	+	+	+	+

data_types

enumeration

The primary key for this table, and the enumerated value of the data type from the AMP specification.

Name

The name associated with this data type.

Description

The description associated with this data type.

An example of such a table is illustrated in [\[I-D.birrane-dtn-adm\]](#).

3.2. Incoming State - incoming_state

When reports are being received by a Manager from an Agent, they will be written into various Incoming Support table types. However, the application reviewing these incoming reports should not start to read them until the Manager has finished receiving and persisting them into the database.

The incoming_state table identifies three different wait states associated with receiving reports from Agents. The format of the table is defined as follows.

Field	Type	Null	Key	Default	Extra
state_id	tinyint(3) unsigned	NO	PRI		
name	varchar(50)	NO			
description	varchar(255)	NO			

incoming_state

state_id

The primary key for this table, and the enumerated value of the incoming state. Three states are defined in this specification, as follows.

0 - Initializing

This state signifies that a Manager is receiving a set of information and rows associated with this state should not be read by an application.

1 - Ready

This state signifies that a Manager has completed receiving reports and that rows associated with this state may be processed by an application.

2 - Processed

This state signifies that an application has completed processing reports and that either a Manager or an application can remove rows associated with this state at any time.

Name

The name associated with the incoming state (Initializing, Ready, Processed).

Description

The description associated with the incoming state.

An example of such a table is illustrated below.

ID	Name	Description
0	Initializing	Manager is receiving reports.
1	Ready	Manager has completed reception.
2	Processed	Application is done processing reports.

incoming_state example

3.3. Outgoing State - outgoing_state

When controls are being sent via a Manager to an Agent, they will be written into various Outgoing Support table types. However, the Manager receiving these outgoing controls should not start to read them until the application has finished writing them into the database.

The outgoing_state table identifies four different wait states associated with sending controls to Agents. The format of the table is defined as follows.

Field	Type	Null	Key	Default	Extra
state_id	tinyint(4)	NO	PRI		
name	varchar(50)	NO			
description	varchar(255)	NO			

outgoing_state

state_id

The primary key for this table, and the enumerated value of the outgoing state. Four states are defined in this specification, as follows.

0 - Initializing

This state signifies that an application is preparing a set of controls and rows associated with this state should not be read by a Manager.

1 - Ready

This state signifies that an application has completed preparing the controls and that rows associated with this state may be processed by the Manager for sending to one or more Agents.

2 - Processing

This state signifies that the Manager is in the process of sending associated controls to one or more Agents. Rows in this state should not be modified by an application as it could affect the controls sent by the Manager.

3 - Sent

This state signifies that the Manager has completed sending the set of controls and that either a Manager or an application can remove rows associated with this state at any time.

name

The name associated with the outgoing state (Initializing, Ready, Processing, Sent).

description

The description associated with the outgoing state.

An example of such a table is illustrated below.

state_id	name	description
0	Initializing	Application writing controls.
1	Ready	Ready for Sending to Agent.
2	Processing	Manager sending controls.
3	Sent	Manager send completed.

outgoing_state Example

4. ADM Support

4.1. ADM Nicknames - adm_nickname

The adm_nicknames table identifies all of the nicknames associated with supported ADMs. A Nickname is the compression of a shared portion of an ARI. Nickname enumerations MUST be unique. The format of the table is defined as follows.

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Field	Type	Null	Key	Default	Extra
adm_id	int(10) unsigned	NO	MUL		
nickname_enum	int(10) unsigned	NO			
label	varchar(255)	NO			

adm_nicknames

adm_id

The primary key for this table.

nickname_enum

The enumeration of the nickname.

label

This is the label of the nickname.

[4.2.](#) Supported ADMs - adm

The adm table identifies all of the ADMs supported by the AMP Manager and associated application. The format of the table is as follows.

Field	Type	Null	Key	Default	Extra
adm_id	int(10) unsigned	NO	PRI		auto_increment
name	varchar(255)	NO	UNI		
version	varchar(255)	NO			
description	varchar(255)	NO			
Organization	varchar(255)	NO			

adm

adm_id

The primary key for this table.

name

The name of the supported ADM.

version

The string representing the version of the ADM. A string is used to allow for a variety of version formats.

description

This is the description of the ADM.

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Organization

This is the issuing organization of the ADM.

[4.3.](#) ARIs

ARIs identifying items such as Controls may accept parameters to customize their behavior. When defined in the context of an ADM, a parameterized ARI only includes the non-parameterized portion of the ARI followed by the expected data types for the parameterized portion of the ARI. This, essentially, acts as a template for populating a specific instance of the ARI with actual data.

This "template" is referred to as a ARI, as it is used to generate ARI instances. The instances of an ARI are called ARI definitions. The amp_core database schema identifies three tables used to capture ARI definitions from ADMs: parmspec, parmspec_set, ari, and ari_definition.

[4.3.1.](#) Individual ARI Parameter - parmspec

The parmspec table contains a row for each parameter associated with an ARI. All of the parameters for an ARI, together, are considered a "collection" of parameters. The format of the table is as follows.

Field	Type	Null	Key	Default	Extra
name	varchar(45)	NO			
parm_id	int(10) unsigned	YES	MUL	NULL	
parm_order	int(10) unsigned	NO	UNI	0	
type_id	int(10) unsigned	YES	MUL	NULL	

parmspec

name

The name of the parmspec collection.

parm_id

The id of the collection for this parameter. A parameter collection is the ordered set of parameters that describe an ARI. This is a foreign key that corresponds to the parm_id of the parmspec_set table.

parm_order

The 0-based ordering of this parameter within the collection.

type_id

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The type of this parameter. This must be one of the known AMP types and, as such, is a foreign key that corresponds to the enumeration of the data_type table.

[4.3.2.](#) ARI Parameter Collection - parmspec_set

The parmspec_set table represents the ordered set of parameters associated with an ARI. The format of the table is as follows.

Field	Type	Null	Key	Default	Extra
parm_id	int(10) unsigned	NO	PRI		auto_increment
comment	varchar(255)	NO			

parmspec_set

parm_id

The primary key for this table.

comment

This is the description of the parmspec set.

[4.3.3.](#) ARI - ari

The ari table captures the ARIs in the database. Some ARIs will be auto-populated from ADMs. Others will be added dynamically by users of the system. As per [AMP], an ARI without an identified Issuer field is assumed to be as defined in an ADM. The format of the table is defined as follows.

Field	Type	Null	Key	Default	Extra
curr_id	int(10) unsigned	NO	PRI		
name	varchar(50)	NO	UNI	Unnamed	
ari_id	int(10) unsigned	NO	MUL		
data_id	int(10) unsigned	NO	MUL		
description	varchar(255)	YES			

ari

curr_id

The primary key for this table.

name

The name of the ARI.

ari_id

This is the id of the ARI. This is a foreign key that corresponds to the ari_id in the ari_definition table.

data_id

This is a foreign key to the data_set table that corresponds with the data_id of the data_set table.

description

This is the description of the ari.

[4.3.4.](#) ARI - ari_definition

The ari_definition table stores the metadata of all known ARIs. The format of the table is as follows.

Field	Type	Null	Key	Default	Extra
ari_id	int(10) unsigned	NO	PRI		auto_inc
name	varchar(50)	NO	UNI	Unnamed	
type_id	int(10) unsigned	NO	MUL	NULL	
nn_id	int(10) unsigned	YES	MUL	NULL	
ari_bytestring	varchar(255)	NO			
parm_id	int(10) unsigned	YES	MUL	NULL	
issuer	bigint unsigned	YES		NULL	
tag	bigint unsigned	YES		NULL	
structure_id	varchar(255)	YES	MUL	NULL	
in_type_id	int(10) unsigned	YES	MUL	NULL	

ari_definition

ari_id

The primary key for this table.

nn_id

The nickname associated with this ARI, if applicable. This is a foreign key that corresponds to the id in the adm_nickname table.

parm_id

The parameter collection for this ARI. This is a foreign key that corresponds to the parm_id in the parm_set table.

issuer_flag

A binary value representing whether the ARI has an issuer field (value 1) or not (value 0).

tag_flag

A binary value representing whether the ARI has a tag field (value 1) or not (value 0).

type_id

The data type associated with this ARI. This is a foreign key that corresponds to the data_id in the data_types table.

name

A human-readable name for this ARI.

ari_bytestring

The enumeration of the ARI.

structure_id

This is the structure type of the ARI (EDD, VAR,etc.). This is a foreign key that corresponds to the data_id in the data_types table.

in_type_id

This is the in types that are needed to use a specific operator. This is a foreign key that corresponds to the in_type_id in the in_type_set table.

[5.](#) Agent Support

[5.1.](#) Registered Agents - registered_agents

The registered_agents table lists the network identifiers for each Agent known in the network. The format of the table is defined as follows.

Field	Type	Null	Key	Default	Extra
registry_id	int(10) unsigned	NO	PRI		auto_increment
agent_id	varchar(128)	NO		ipn:0.0	

registered_agents

registry_id

The primary key for this table.

agent_id

This is the identifier for the Agent, suitable for passing into a network send call. A string representation is selected to best capture the identifier format for a

particular network.

[6.](#) ARI Information

[6.1.](#) Data Collections

Data collection tables capture the Data Collection (DC) data type as defined in [[I-D.birrane-dtn-amp](#)]. Similar to the parmspec and parmspec_set tables, Data Collections are represented as an ordered collection of individual data items, with one table representing the collection itself, and another table holding the ordered data within the collection.

[6.1.1.](#) Data Collection Entry - data_value

The data_value table holds data collection entries, one per row. The format of the table is defined as follows.

Field	Type	Null	Key	Default	Extra
data_id	int(10) unsigned	NO	MUL		
data_order	int(10) unsigned	NO	UNI	0	
data_type	int(10) unsigned	NO	MUL		
ari_id	blob	YES	MUL	NULL	
byte	longblob	YES		NULL	
tnvc_id	int(10) unsigned	NO	MUL		
ac_id	int(10) unsigned	NO	MUL		
vast	bigint	YES		NULL	
uvast	bigint unsigned	YES		NULL	
real	longblob	YES		NULL	
str	varchar(255)	YES		NULL	
bool	boolean	YES		NULL	
ts	datetime	YES		NULL	

data_value

data_id

The id of the data collection. This is a foreign key that corresponds with the data_id of the data_set table.

data_order

The 0-based order of this entry in the encapsulating collection.

data_type

The type of this data collection. This is a foreign key that corresponds to the enumeration in the data_types table.

tnvc_id

This is a foreign key that corresponds to the tnav_id of the tnav_set table.

ac_id

This is a foreign key that corresponds to the ac_id of the ac_set table.

byte

The byte value shows the value of the data (if the piece of data is a byte). If the data is not a byte, this field MUST be NULL.

vast

The vast value shows the value of the data (if the piece of data is of type int or vast). If the data is not an int or vast, this field MUST be NULL.

uvast

The uvast value shows the value of the data (if the piece of data is of type uint or vast). If the data is not an uint or uvast, this field MUST be NULL.

real

The real value shows the value of the data (if the piece of data is of type real32 or real64). If the data is not a real32 or real64, this field MUST be NULL.

Str

The str field shows the value of the data (if the piece of data is of type string). If the data is not a string, this field MUST be NULL.

Bool

The bool field shows the value of the data (if the piece of data is of type boolean). If the data is not a boolean, this field MUST be NULL.

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The ts field shows the value of the data (if the piece of data is of type timestamp). If the data is not a timestamp, this field MUST be NULL.

[6.1.2.](#) Data Collection - data_set

The data_collection_set table holds information for a particular collection of data entries (from data_value). The format of the table is defined as follows.

Field	Type	Null	Key	Default	Extra
data_id	int(10) unsigned	NO	PRI		auto_increment
comment	varchar(255)	NO			

data_set

data_id

The Data Collection identifier. This is a primary key.

comment

This is a description of the data set.

[6.2.](#) ARI Collections

A ARI Collection is an ordered set of ARI values, similar to a Data Collection, which is an ordered set of Data values. One table is used to represent the ARI Collection, and another table is used to capture the ordered ARIs in the collection.

[6.2.1.](#) ARI Collection Entry - ac

The ac table holds ARI collection entries, one per row. The format of the table is defined as follows.

Field	Type	Null	Key	Default	Extra
-------	------	------	-----	---------	-------

ac_id	int(10) unsigned	NO	MUL		
ac_order	int(10) unsigned	NO		0	
ari_id	int(10) unsigned	NO	MUL		
+-----+	+-----+	+-----+	+-----+	+-----+	+-----+

ac

ac_id

The ARI Collection to which this entry belongs. This is a foreign key that corresponds with the ac_id of the ac_set table.

ari_id

The identifier for this ARI. This is a foreign key that corresponds to the ari_id in the ari_definition table.

ac_order

The 0-based order of this entry in the encapsulating collection.

[6.2.2.](#) ARI Collection - ac_set

The ac_set table holds information for a particular collection of ARIs (from the ac table). The format of the table is defined as follows.

+-----+	+-----+	+-----+	+-----+	+-----+	+-----+
Field	Type	Null	Key	Default	Extra
+-----+	+-----+	+-----+	+-----+	+-----+	+-----+
ac_id	int(10) unsigned	NO	PRI		auto_increment
comment	varchar(255)	NO			
+-----+	+-----+	+-----+	+-----+	+-----+	+-----+

ac_set

ac_id

The ARI Collection identifier.

[7.](#) Operator Support

[7.1.](#) In Type Set - in_type_set

The `in_type_set` table holds information for a particular collection of operator in types (from the `in_types` table). The format of the table is defined as follows.

Field	Type	Null	Key	Default	Extra
<code>in_type_id</code>	<code>int(10) unsigned</code>	NO	PRI		<code>auto_increment</code>
<code>comment</code>	<code>varchar(255)</code>	NO			

`in_type_set`

`in_type_id`

The `in_type` set identifier.

`comment`

The description of the `in_type` set.

7.2. In Type - `in_type`

The `in_type` table holds information about operator in types. The format of the table is defined as follows.

Field	Type	Null	Key	Default	Extra
<code>in_type_id</code>	<code>int(10) unsigned</code>	NO	PRI		<code>auto_increment</code>
<code>name</code>	<code>varchar(255)</code>	NO			
<code>order</code>	<code>int(10) unsigned</code>	NO			
<code>type id</code>	<code>int(10) unsigned</code>	NO	MUL		

`in_type_set`

`in_type_id`

The `in_type` set identifier. This is a foreign key that corresponds to the `in_type_id` of the `in_type_set` table.

`name`

The name of the operator in type.

order

The order of the operator in type in the set.

type id

This is the type of the operator in_type. This is a foreign key that corresponds to the enumeration in the data_types table.

[8.](#) Outgoing Message Support

Outgoing messages are those that are written into the database by an application and read by an AMP Manager, formatted, and sent to one or more AMP Agents.

The database represents outgoing messages in two tables. One table holds information for the entire outgoing message group, and another table captures each individual outgoing message. An individual outgoing message is simply a ARI collection of the ARIs to be run on the Agent.

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[8.1.](#) Outgoing Messages - outgoing_message

The outgoing_message table captures a single ARI Collection holding the set of Control ARIs to be sent to an Agent as part of a Message Group. The format of the table is defined as follows.

Field	Type	Null	Key	Default	Extra
message_id	int(10) unsigned	NO	PRI		auto_increment
group_id	int(10) unsigned	NO	MUL		
start_ts	datetime	NO		0	
ac_id	int(10) unsigned	NO	MUL		

outgoing_message

message_id

The primary key for this table.

group_id

The outgoing message group to which this outgoing message belongs. This is a foreign key that corresponds to the id in the outgoing_message_group table.

start_ts

The time at which the controls in the ARI Collection should be run. This may be an absolute or relative time, as defined in [\[I-D.birrane-dtn-amp\]](#).

ac_id

The ARI Collection comprising this outgoing message. This is a foreign key that corresponds to the ac_id of the ac_set table.

[8.2.](#) Outgoing Message Groups - outgoing_message_group

The outgoing_message_group table captures an outgoing message group, which is one or more outgoing messages. The format of the table is defined as follows.

Field	Type	Null	Key	Default	Extra
group_id	int(10) unsigned	NO	PRI		auto_increment
created_ts	datetime	YES		NULL	
modified_ts	datetime	YES		NULL	
state	tinyint(4)	NO	MUL		
agent_id	int(10) unsigned	NO	MUL		

outgoing_message_group

`group_id`
The primary key for this table.

`created_ts`
The time at which the outgoing message group was created.

`modified_ts`
The last time at which the message group was modified.

`state`
The current state of the outgoing message group. This state provides a contention-avoidance mechanism between an application and an AMP Manager. This is a foreign key that corresponds to the `state_id` of the `outgoing_state` table.

`agent_id`
The identifier of the Agent receiving this message group. Currently, a message group is only sent to one Agent. Sending to multiple Agents is accomplished with multiple entries in this table. This is a foreign key that corresponds to the `registry_id` in the `registered_agents` table.

[9.](#) Incoming Message Support

Incoming messages are those that are written into the database by an AMP Manager and read by an application wishing to understand the status of an AMP Agent.

The database represents incoming messages in two tables. One table holds information for the entire incoming message group, and another table captures each individual incoming message.

[9.1.](#) Incoming Messages – `incoming_messages`

The `incoming_messages` table captures information returned from an AMP Agent. The format of the table is defined as follows.

Field	Type	Null	Key	Default	Extra
message_id	int(10) unsigned	NO	PRI	NULL	auto_increment
group_id	int(10) unsigned	NO	MUL	NULL	
ac_id	int(10) unsigned	YES	MUL	NULL	

incoming_messages

message_id

The primary key for this table.

group_id

The incoming message group to which this incoming message belongs. This is a foreign key that corresponds with the group_id in the incoming_message_group table.

ac_id

This is a foreign key that corresponds to the id in the ac_set table.

9.2. Incoming Message Groups - incoming_message_group

The incoming_message_group table captures an incoming message group, which is one or more incoming messages. The format of the table is defined as follows.

Field	Type	Null	Key	Default	Extra
group_id	int(10) unsigned	NO	PRI		auto_incr
recieved_ts	datetime	YES		NULL	
generated_ts	datetime	YES		NULL	
state	tinyint(3) unsigned	NO	MUL		
agent_id	int(10) unsigned	NO	MUL		

incoming_message_group

group_id

The primary key for this table.

recieved_ts

The time at which the incoming message group was received by the AMP Manager.

generated_ts

The time at which the incoming message group was generated by the sending AMP Agent.

state

The current state of the incoming message group. This state provides a contention-avoidance mechanism between an application and an AMP Manager. This is a foreign key that corresponds to the data_id in the data_types table.

agent_id

The identifier of the Agent sending this incoming message group. This is a foreign key that corresponds to the registry_id in the registered_agents table.

[10.](#) Compound Data Types

[10.1.](#) TNVC Support

[10.1.1.](#) Type Name Value Collection - tnvc

The tnvc table is a group of tnvc collections.

Field	Type	Null	Key	Default	Extra
tnvc_id	int(10) unsigned	NO	PRI		auto_incr
order	int(10) unsigned	NO	UNI		
name	int(10) unsigned	YES			
value	int(10) unsigned	NO	MUL		

tnvc

tnvc_id

The identifier of the TNV collection. This is a foreign key that corresponds to the tnvc_id in the tnvc_set table.

order

The order of the tnvc in the set.

name

The name of the tnvc.

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value

The value of the tnvc. This is a foreign key that corresponds to the data_id in the data_set table.

[10.1.2.](#) Type Name Value Collection Set - tnvc_set

The tnvc_set table provides the information of a TNV (Type-Name-Value) collection that describes data values in the AMM.

Field	Type	Null	Key	Default	Extra
tnvc_id	int(10) unsigned	NO	PRI	NULL	auto_incr
comment	varchar(255)	NO			

tnv_collection

tnvc_id

The identifier of the TNV collection. This is a primary key.

comment

This is the description of the tnvc set.

[10.2.](#) Expression Support

[10.2.1.](#) Expression Set - expression_set

The expression_set table shows the id of the expression as well as whether it is true or false. This table is a collection of expressions.

Field	Type	Null	Key	Default	Extra
expr_id	int(10) unsigned	NO	PRI	NULL	auto_incr
comment	varchar(255)	NO			

expression_set

expr_id

The identifier of the expression. This is a primary key.

comment

This is the description of the expression.

[10.2.2.](#) Individual Expression - expression

An expression is an AC in which a series of items are ordered so as to produce a valid post-fix mathematical expression. This table contains all of the information that are included in each expression.

Field	Type	Null	Key	Default	Extra
expr_id	int(10) unsigned	NO	PRI	NULL	auto_incr
order_num	int(10) unsigned	NO	UNI	NULL	
ari_id	int(10) unsigned	NO	MUL	NULL	

expression

expr_id

The identifier of the expression. This is a foreign key that corresponds to the expr_id in the expression_set table.

order_num

The 0-based order of this entry in the encapsulating collection.

ari_id

This is the ari id. This is a foreign key that corresponds to the ari_id in the ari_definition table.

[11.](#) IANA Considerations

At this time, this schema definition has no fields registered by IANA.

[12.](#) Security Considerations

Security considerations are outside of the scope of this document.

[13.](#) References

[13.1.](#) Informative References

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[Appendix A.](#) Acknowledgements

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