



Forschungsinstitut

umati Transformation Engine - API documentation

(Release Candidate, 2021-10-14)

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Chapter 1

Introduction

The [VDW-Forschungsinstitut e.V.](#) is currently working with partners and its members to create a specification of a TransformationEngine.

This documentation describes the interface between the umati Transformation Engine and its Data Clients.

Application Warning Notice

This DRAFT with date of issue 2021-10-01 is being submitted to the public for review and comment. Because the final API Specification may differ from this version, the application of this draft is subject to special agreement.

Comments are requested:

- preferably as a file by e-mail to g.goerisch@vdw.de
- or in paper form to VDW-Forschungsinstitut e.V., Lyoner Straße 18, 60528 Frankfurt

1.1 Recommended Reading

- Start with [Initialization of a data client plugin](#) to get an overview of the relation between transformation engine, shared library, data_client_plugin and data_client.
- Continue with the sections [Transformation Engine](#) and [Data Client](#) which contain the main components of the interface, namely [tek_sa_transformation_engine](#) and [tek_sa_data_client](#).

Chapter 2

Initialization of a data client plugin

Each data client shared library represents one plugin. One plugin may be responsible for multiple data client instances of (possibly) different type. Which type of data client is to be created is defined in the configuration. This configuration is passed to a call to [tek_sa_data_client_plugin::data_client_new](#).

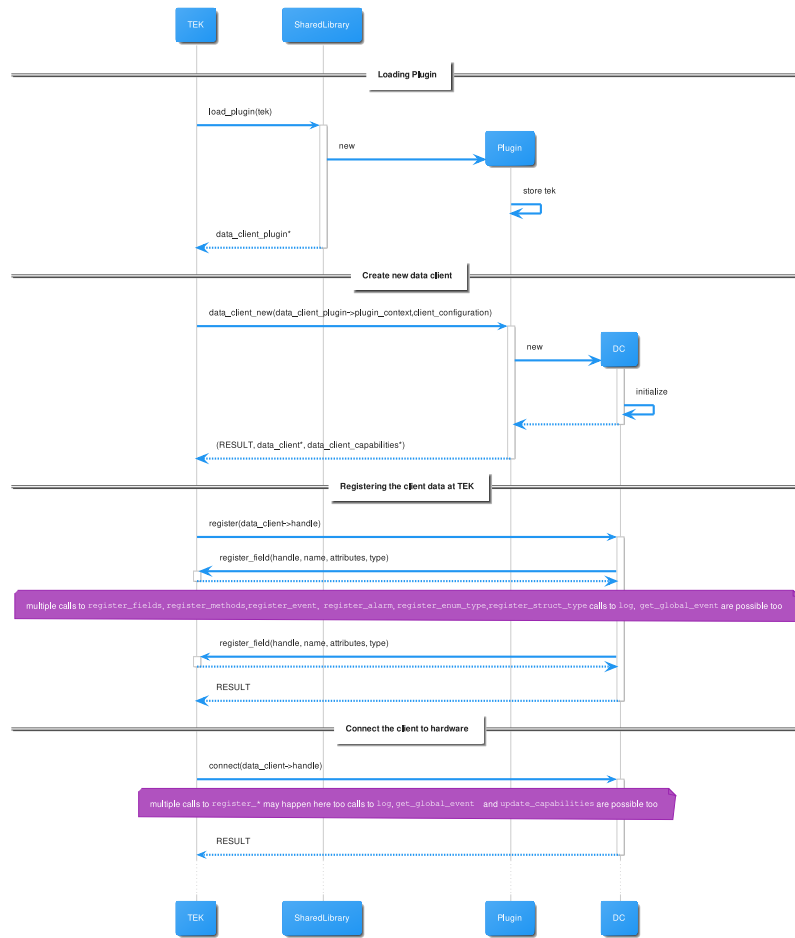
After loading the shared library the TEK calls the main initialization function with the fixed name `load_plugin` and a signature of [tek_sa_load_plugin_fn](#) . This function creates a new singleton instance of [tek_sa_data_client_plugin](#) and is expected to save the given TEK api struct.

Using the created [tek_sa_data_client_plugin](#), the TEK calls its [tek_sa_data_client_plugin::data_client_new](#) method for each configuration.

Each data client then is initialized with calls to [tek_sa_data_client::register_features](#) and [tek_sa_data_client::connect](#).

[tek_sa_data_client::register_features](#) should do all registration tasks which are possible without a connection to the hardware.

[tek_sa_data_client::connect](#) should connect to the hardware and register all new fields, types etc. Additionally it may happen that the capabilities of the data client change after connecting because more information about the hardware are known. Therefore it is expected that a call to [tek_sa_transformation_engine::update_capabilities](#) will happen.



Chapter 3

Known issues

3.1 API definition issues

This sections contains a list of yet unresolved issues concerning the definition of the API which do not relate directly to specific structs or functions.

Todo [D] A possibility to unregister fields, methods, events etc. is needed.

Todo [D] A possibility to define the sampling interval of subscribed fields is needed.

Todo [D, TEAM] We need a mechanism to transfer metadata from the controller/DC to the TEK see Teams/↔
Allgemein 15.9.2021

3.2 Documentation/Style issues

Todo [C, MIG] mkdocs/doxybook2 output can not handle union

Todo [C, MIG] mkdocs/doxybook2 output can not handle typedefs

Todo [C, MIG] mkdocs/doxybook2 output can not handle function pointers

Chapter 4

Todo List

Page **Known issues**

[D] A possibility to unregister fields, methods, events etc. is needed.

[D] A possibility to define the sampling interval of subscribed fields is needed.

[D, TEAM] We need a mechanism to transfer metadata from the controller/DC to the TEK see Teams/Allgemein 15.9.2021

[C, MIG] mkdocs/doxybook2 output can not handle union

[C, MIG] mkdocs/doxybook2 output can not handle typedefs

[C, MIG] mkdocs/doxybook2 output can not handle function pointers

Global **tek_sa_data_client::read_fields**)(tek_sa_data_client_handle dc, uint64_t request_id, const tek_sa↔_field_handle items_to_read[], uint32_t number_of_items, bool do_not_block)

[B, TEAM] define error values of read function

Global **tek_sa_data_client::subscribe**)(tek_sa_data_client_handle dc, const tek_sa_field_handle items_↔to_subscribe[], uint32_t number_of_items)

[D, TEAM] add sampling rate parameter

Global **tek_sa_data_client::write_fields**)(tek_sa_data_client_handle dc, uint64_t request_id, const struct tek_sa_field_write_request items_to_write[], uint32_t number_of_items, bool do_not_block)

[B, TEAM] should the data client call a progress function if the operation needs more time?

Global **tek_sa_transformation_engine::get_global_event**)(const char *name)

[C, TEAM] define the predefined events

[C, TEAM] define return value when event with given name does not exist?

Global **tek_sa_transformation_engine::read_progress**)(tek_sa_data_client_handle dc, uint64_t request_id, uint64_t progress)

[B, TEAM] when should a data client report progress?

[B, TEAM] when can the TEK stop the client (after progress was not reported)?

Global **tek_sa_transformation_engine::set_alarm**)(tek_sa_data_client_handle dc, const tek_sa_alarm_↔handle alarm)

[C, TEAM] called by data_client after connect, regardless of "acknowledge" calls during previous connection?

Chapter 5

Module Index

5.1 Modules

Here is a list of all modules:

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Chapter 6

Data Structure Index

6.1 Data Structures

Here are the data structures with brief descriptions:

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The interface of one instance of a data client	37
tek_sa_data_client_plugin	
Interface of the data client plugin	44
tek_sa_transformation_engine	
Interface of the Transformation Engine	46

Chapter 7

File Index

7.1 File List

Here is a list of all files with brief descriptions:

include/ south_api.h	Definition of the interface between Data Clients (DC) and the Transformation Engine (TEK) . . . 59
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Chapter 8

Module Documentation

8.1 Transformation Engine

Data Structures

- struct [tek_sa_transformation_engine](#)
Interface of the Transformation Engine.

8.1.1 Detailed Description

The module **Transformation Engine** contains the main API the transformation engine provides to data clients.

A client can interact the Transformation Engine API by accessing the *api* pointer which is given to the `load_plugin` function. (see the [tek_sa_load_plugin_fn](#) description)

Structs and definitions which are used in both the transformation engine and the data client API are described in the section [Common Definitions](#) .

8.2 Data Client

Data Structures

- struct [tek_sa_data_client_capabilities](#)
capabilities of the data client. These capabilities are applied to the complete data client as well as to each instance (device connection). [More...](#)
- struct [tek_sa_data_client](#)
The interface of one instance of a data client.
- struct [tek_sa_data_client_plugin](#)
Interface of the data client plugin.

Typedefs

- typedef void * [tek_sa_data_client_handle](#)
The type of the data client handle.
- typedef [TEK_SA_RESULT](#)(* [tek_sa_load_plugin_fn](#)) (struct [tek_sa_transformation_engine](#) *api, const struct [tek_sa_data_client_configuration](#) *plugin_configuration, struct [tek_sa_data_client_plugin](#) *plugin, struct [tek_sa_configuration](#) *tek_configuration)
Signature for the load plugin function.

Enumerations

- enum [tek_sa_threading_model](#) { [TEK_SA_THREADING_MODEL_SAME_THREAD](#) = 0x0 , [TEK_SA_THREADING_MODEL_SERIAL](#) = 0x1 , [TEK_SA_THREADING_MODEL_PARALLEL](#) = 0x2 }
- Describes the threading model of a data client instance of a data client plugin.*

8.2.1 Detailed Description

The module **Data Client** contains the API a data client has to implement. Optional parts of the interface are marked accordingly.

Structs and definitions which are used in both the transformation engine and the data client API are described in the section [Common Definitions](#) .

8.2.2 Data Structure Documentation

8.2.2.1 struct [tek_sa_data_client_capabilities](#)

capabilities of the data client. These capabilities are applied to the complete data client as well as to each instance (device connection).

Remarks

As these capabilities are extended in the specification process it may be necessary to split the capabilities of the data client and the instance into different structs.

Definition at line [1025](#) of file [south_api.h](#).

Data Fields

uint32_t	number_of_inflight_calls	<p>Number of uncompleted async api calls. Unlimited number of uncompleted calls are signaled using 0 A blocking client uses 1 to signal that the TEK must wait for each result before requesting the next operation.</p> <p>Remarks</p> <p>This information may be dependent on the physical device and therefore available only after the connection was established.</p>
enum tek_sa_threading_model	threading_model	<p>Requirements for the thread calling any communication function in the data client API.</p>

8.2.3 Typedef Documentation

8.2.3.1 tek_sa_data_client_handle

```
typedef void* tek_sa_data_client_handle
```

The type of the data client handle.

An opaque handle for data client plugins. Internal structure of the data_client implementation of a specific plugin is hidden behind this pointer.

Definition at line 235 of file [south_api.h](#).

8.2.3.2 tek_sa_load_plugin_fn

```
typedef TEK_SA_RESULT(* tek_sa_load_plugin_fn) (struct tek_sa_transformation_engine *api, const
struct tek_sa_data_client_configuration *plugin_configuration, struct tek_sa_data_client_plugin
*plugin, struct tek_sa_configuration *tek_configuration)
```

Signature for the load plugin function.

The shared library of the data client will export the function 'load_plugin' that fills a struct data_client_plugin.

Parameters

<i>api</i>	The TEK api.
<i>plugin_configuration</i>	Additional configuration files, e.g. licensing information, for the plugin itself.
<i>plugin</i>	The result of the initialized plugin.
<i>tek_configuration</i>	global configuration of properties used for data_clients

Returns

Success or failure code.

Definition at line 1840 of file [south_api.h](#).

8.2.4 Enumeration Type Documentation

8.2.4.1 tek_sa_threading_model

```
enum tek_sa_threading_model
```

Describes the threading model of a data client instance of a data client plugin.

Enumerator

TEK_SA_THREADING_MODEL_SAME_THREAD	The same thread must always be used to call the data client instance.
TEK_SA_THREADING_MODEL_SEQUENTIAL	Only one thread of a thread pool is doing a single call at a time at the data client instance.
TEK_SA_THREADING_MODEL_PARALLEL	DLL is thread safe, multiple parallel calls are allowed. Remarks If the number of parallel tasks in the data client is reached, the API call may return ASYNC_RESULT_RETRY_LATER.

Definition at line 995 of file [south_api.h](#).

8.3 Common Definitions

Data Structures

- struct [tek_sa_additional_file](#)
Configuration class which describes an additional file which is passed to the data client. [More...](#)
- struct [tek_sa_data_client_configuration](#)
Configuration object containing the contents of the configuration files for the [tek_sa_data_client_plugin](#) or [tek_sa_data_client](#) instances. [More...](#)
- struct [tek_sa_configuration](#)
Configuration struct that contains generic properties and settings for TEK instance. [More...](#)
- struct [tek_sa_guid](#)
The representation of a GUID when used as a field type. [More...](#)
- struct [tek_sa_byte_string](#)
The representation of a byte array with variable length when used as a field type. [More...](#)
- struct [tek_sa_string](#)
The representation of a string with variable length when used as a field type. [More...](#)
- struct [tek_sa_complex_data](#)
The representation of a field value which has a type which is not a predefined type. [More...](#)
- struct [tek_sa_complex_data_array_item](#)
The representation of the items of an array of complex data values with exactly one dimension. [More...](#)
- struct [tek_sa_complex_data_array](#)
The representation of an array of complex data with exactly one dimension. [More...](#)
- struct [tek_sa_complex_data_matrix](#)
The representation of array of complex data with more than one dimension. [More...](#)
- struct [tek_sa_variant_array](#)
The representation of a one dimensional array of the supported base types. [More...](#)
- struct [tek_sa_variant_matrix](#)
The representation of an array with more than one dimension of the supported base types. [More...](#)
- struct [tek_sa_variant](#)
The representation of a single value (which may be of array type too). [More...](#)
- struct [tek_sa_struct_field_type_definition](#)
The type definition of a record field in a user defined struct type. [More...](#)
- struct [tek_sa_struct_definition](#)

- The type definition of a user defined record type. [More...](#)*

 - struct [tek_sa_enum_item_definition](#)
- The definition of an enum item which is defined in a user defined enum type. [More...](#)*

 - struct [tek_sa_enum_definition](#)
- The type definition of a user defined enum type. [More...](#)*

 - struct [tek_sa_method_argument_description](#)
- The description of a method parameter. [More...](#)*

 - struct [tek_sa_field_write_request](#)
- Structure to encapsulate the parameters of a write field request. [More...](#)*

 - struct [tek_sa_write_result](#)
- Structure to encapsulate the result of a write field request. [More...](#)*

 - struct [tek_sa_read_result](#)
- Structure to encapsulate the result of a read operation of a single field. [More...](#)*

 - struct [tek_sa_event_parameter](#)
- Structure to encapsulate an event parameter. [More...](#)*

 - struct [tek_sa_dc_event](#)
- An event which may be sent from the data client to [tek_sa_transformation_engine::post_event](#). [More...](#)*

 - union [tek_sa_variant_array.data](#)
- The array values. [More...](#)*

 - union [tek_sa_variant.data](#)
- The value. [More...](#)*

Macros

- #define [TEK_SA_ERR_UNSPECIFIED](#) 1000
unspecified error to be used when no more specific error is available.

Typedefs

- typedef int64_t [tek_sa_type_handle](#)
The type of a handle which is returned for user defined types.
- typedef int64_t [tek_sa_type_handle_or_type_enum](#)
The type for a reference handle which references either a user defined type (see [tek_sa_type_handle](#)) or a predefined type (See [tek_sa_variant_type](#).)
- typedef int64_t [tek_sa_datetime](#)
The type of date and time values wen used as a field type.
- typedef struct [tek_sa_variant tek_sa_field_value](#)
Type of data client field values.
- typedef uint32_t [tek_sa_field_handle](#)
Handle type for a field definition.
- typedef uint32_t [tek_sa_event_handle](#)
Handle type for an event definition.
- typedef uint32_t [tek_sa_alarm_handle](#)
Handle type for an alarm definition.
- typedef uint32_t [tek_sa_method_handle](#)
Handle type for a method definition.

Enumerations

- enum `tek_sa_variant_type` {
`TEK_SA_VARIANT_TYPE_NULL` = 0x0 , `TEK_SA_VARIANT_TYPE_BOOL` = 0x1 , `TEK_SA_VARIANT_TYPE_UINT8_T`
= 0x2 , `TEK_SA_VARIANT_TYPE_INT8_T` = 0x3 ,
`TEK_SA_VARIANT_TYPE_UINT16_T` = 0x4 , `TEK_SA_VARIANT_TYPE_INT16_T` = 0x5 , `TEK_SA_VARIANT_TYPE_UINT32_T`
= 0x6 , `TEK_SA_VARIANT_TYPE_INT32_T` = 0x7 ,
`TEK_SA_VARIANT_TYPE_UINT64_T` = 0x8 , `TEK_SA_VARIANT_TYPE_INT64_T` = 0x9 , `TEK_SA_VARIANT_TYPE_FLOAT`
= 0xa , `TEK_SA_VARIANT_TYPE_DOUBLE` = 0xb ,
`TEK_SA_VARIANT_TYPE_DATETIME` = 0xc , `TEK_SA_VARIANT_TYPE_STRING` = 0xd , `TEK_SA_VARIANT_TYPE_GUID`
= 0xe , `TEK_SA_VARIANT_TYPE_BYTE_STRING` = 0xf ,
`TEK_SA_VARIANT_TYPE_COMPLEX` = 0x20 , `TEK_SA_VARIANT_TYPE_FLAG_ARRAY` = 0x40 ,
`TEK_SA_VARIANT_TYPE_FLAG_MATRIX` = 0x80 }

The predefined types which can be processed in the TE.

- enum `tek_sa_field_attributes` { `TEK_SA_FIELD_ATTRIBUTES_WRITABLE` = 0x1 , `TEK_SA_FIELD_ATTRIBUTES_READABLE`
= 0x2 , `TEK_SA_FIELD_ATTRIBUTES_SUBSCRIBABLE` = 0x4 }

Flags type which contains the attributes of a data client field.

- enum `tek_sa_log_level_t` {
`TEK_SA_LOG_LEVEL_TRACE` = 0x0 , `TEK_SA_LOG_LEVEL_DEBUG` = 0x1 , `TEK_SA_LOG_LEVEL_INFO`
= 0x2 , `TEK_SA_LOG_LEVEL_WARNING` = 0x3 ,
`TEK_SA_LOG_LEVEL_ERROR` = 0x4 , `TEK_SA_LOG_LEVEL_CRITICAL` = 0x5 }

Definition of the possible logging levels which can be used in `tek_sa_transformation_engine::log`.

StatusCodes

- typedef int `TEK_SA_RESULT`
The return value type of all interface functions (which need to return information about success of the operation).
- #define `TEK_SA_ERR_SUCCESS` 0
An operation was completed successfully.
- #define `TEK_SA_ERR_NON_BLOCKING_IMPOSSIBLE` 10
A data client function was called in an asynchronous manner while the implementation can not use multiple threads.
- #define `TEK_SA_ERR_OUT_OF_MEMORY` 11
The data client or the Transformation Engine can not process a request because it has no more system resources.
- #define `TEK_SA_ERR_INVALID_PARAMETER` 12
The parameters passed to the function are invalid.
- #define `TEK_SA_ERR_RETRY_LATER` 0xffffffff
A data client function was called in an asynchronous manner while the number of inflight calls is already active.
- #define `TEK_SA_READ_RESULT_STATUS_OK` 0
A read operation completed successfully.
- #define `TEK_SA_READ_RESULT_STATUS_NOK` 1
A read operation failed.
- #define `TEK_SA_READ_RESULT_STATUS_TIMEOUT` 2
A read operation did not complete within the specified time limit.
- #define `TEK_SA_READ_RESULT_STATUS_INVALID_HANDLE` 3
The read operation failed because the passed field handle was invalid.
- #define `TEK_SA_BLOCK_TRANSFER_END_OF_FILE` 26
The read operation read until the end of file.
- #define `TEK_SA_BLOCK_TRANSFER_ABORT` 24
The block read or write operation should be stopped.

8.3.1 Detailed Description

The module **Common Definitions** contains functions, structs and typedefs which are used by the [Data Client](#) as well as the [Transformation Engine](#).

8.3.2 Data Structure Documentation

8.3.2.1 struct tek_sa_additional_file

Configuration class which describes an additional file which is passed to the data client.

Definition at line 245 of file [south_api.h](#).

Data Fields

char *	name	The name of the additional file as written in the configuration.
char *	content	The content of additional file.

8.3.2.2 struct tek_sa_data_client_configuration

Configuration object containing the contents of the configuration files for the [tek_sa_data_client_plugin](#) or [tek_sa_data_client](#) instances.

Definition at line 260 of file [south_api.h](#).

Data Fields

char *	config	The configuration file as UTF-8 encoded JSON string
struct tek_sa_additional_file *	additional_files	The additional files which are referenced in the configuration.
uint32_t	additional_files_count	The number of additional files

8.3.2.3 struct tek_sa_configuration

Configuration struct that contains generic properties and settings for TEK instance.

Definition at line 278 of file [south_api.h](#).

Data Fields

uint32_t	request_timeout_ms	generic definition for timeouts with linkage to communication to connected dataclients (e.g. requests), value is given in milli-seconds
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8.3.2.4 struct tek_sa_guid

The representation of a GUID when used as a field type.

built-in types (bool, (u)int_{8,16,32,64}_t, strings, guides, datetime; subset of <https://reference.opcfoundation.org/Core/docs/Part6/5.1.2/>

See also <https://reference.opcfoundation.org/v104/Core/docs/Part6/5.1.3/>

Definition at line 314 of file [south_api.h](#).

Data Fields

uint32_t	data1	The Data1 field.
uint16_t	data2	The Data2 field.
uint16_t	data3	The Data3 field.
uint8_t	data4[8]	The Data4 field.

8.3.2.5 struct tek_sa_byte_string

The representation of a byte array with variable length when used as a field type.

See <https://reference.opcfoundation.org/Core/docs/Part6/5.2.2/#5.2.2.7>

Definition at line 339 of file [south_api.h](#).

Data Fields

int32_t	length	The length of the byte string.
unsigned char *	data	The bytes of the byte string

8.3.2.6 struct tek_sa_string

The representation of a string with variable length when used as a field type.

See <https://reference.opcfoundation.org/Core/docs/Part6/5.2.2/#5.2.2.4>

Attention

The string encoding is always UTF-8.

Definition at line 357 of file [south_api.h](#).

Data Fields

int32_t	length	The length of the byte string.
unsigned char *	data	The UTF-8 encoded characters of the string.

8.3.2.7 struct tek_sa_complex_data

The representation of a field value which has a type which is not a predefined type.

A value with a complex data type which was registered at the tek by calling [tek_sa_transformation_engine::register_struct_type](#).

Definition at line 382 of file [south_api.h](#).

Data Fields

tek_sa_type_handle	type	The type handle of the registered data type.
uint32_t	data_length	The number of bytes in the <code>data</code> field. This is needed because the encoded length may differ for items of the same type.
unsigned char *	data	The bytes of the serialized value. The serialization is compatible with the binary OPC UA encoding of structures as described in https://reference.opcfoundation.org/v104/Core/docs/Part6/5.2.6/ .

8.3.2.8 struct tek_sa_complex_data_array_item

The representation of the items of an array of complex data values with exactly one dimension.

See also [tek_sa_complex_data_array](#)

Definition at line 412 of file [south_api.h](#).

Data Fields

uint32_t	data_length	The number of bytes in the <code>data</code> field. This is needed because the encoded length may differ for items of the same type.
unsigned char *	data	The bytes of the serialized value. See also tek_sa_complex_data::data

8.3.2.9 struct tek_sa_complex_data_array

The representation of an array of complex data with exactly one dimension.

A one-dimensional array of values which are of a complex data type.

Definition at line 438 of file [south_api.h](#).

Data Fields

tek_sa_type_handle	type	The type handle of the registered type of the array items.
uint32_t	number_of_items	The number of items in the array.
struct tek_sa_complex_data_array_item *	data	The array data, which consists of the concatenation of all serialized items.

8.3.2.10 struct tek_sa_complex_data_matrix

The representation of array of complex data with more than one dimension.

A multi-dimensional array of values which are of a complex data type.

Definition at line 460 of file [south_api.h](#).

Data Fields

tek_sa_type_handle	type	The type handle of the registered type of the array items.
uint32_t	dimension_length	<p>The number of dimensions in the array.</p> <p>Remarks</p> <p>As an explicit number of dimensions is always required, this value can not be less or equal to 0 (unlike the ValueRank in the OPC UA specification).</p>
uint32_t *	dimensions	<p>The array dimensions.</p> <p>Multi-dimensional arrays are encoded as a one-dimensional array and this field specifies the dimensions of the array. The original array can be reconstructed using this information. Higher rank dimensions are serialized first. For example, an array with dimensions [2,2,2] is written in this order: [0,0,0], [0,0,1], [0,1,0], [0,1,1], [1,0,0], [1,0,1], [1,1,0], [1,1,1]</p> <p>This is compatible with the encoding used by OPC UA array types: https://reference.opcfoundation.org/v104/Core/docs/Part6/5.2.2/#5.2.2.16</p>
struct tek_sa_complex_data_array_item *	data	The array data, which consists of the concatenation of all serialized items.

8.3.2.11 struct tek_sa_variant_array

The representation of a one dimensional array of the supported base types.

Definition at line 568 of file [south_api.h](#).

Data Fields

uint32_t	length	The number of elements in the array.
union tek_sa_variant_array.data	data	The array values.

8.3.2.12 struct tek_sa_variant_matrix

The representation of an array with more than one dimension of the supported base types.

Definition at line 596 of file [south_api.h](#).

Data Fields

uint32_t	dimension_length	The number of array dimensions.
uint32_t *	dimensions	The array dimensions. Multi-dimensional arrays are encoded as a one-dimensional array and this field specifies the dimensions of the array. The original array can be reconstructed using this information. Higher rank dimensions are serialized first. For example, an array with dimensions [2,2,2] is written in this order: [0,0,0], [0,0,1], [0,1,0], [0,1,1], [1,0,0], [1,0,1], [1,1,0], [1,1,1] This is compatible with the encoding used by OPC UA array types: https://reference.opcfoundation.org/v104/Core/docs/Part6/5.2.2/#5.2.2.16
struct tek_sa_variant_array	data	The array values.

8.3.2.13 struct tek_sa_variant

The representation of a single value (which may be of array type too).

Definition at line 623 of file [south_api.h](#).

Data Fields

uint8_t	type	The type of the value. Must be one of the values described in tek_sa_variant_type .
union tek_sa_variant.data	data	The value.

8.3.2.14 struct tek_sa_struct_field_type_definition

The type definition of a record field in a user defined struct type.

Definition at line 668 of file [south_api.h](#).

Data Fields

char *	name	The name of the data field.
tek_sa_type_handle_or_type_enum	type	The type of the field, represented as type_handle or type_enum.

8.3.2.15 struct tek_sa_struct_definition

The type definition of a user defined record type.

Definition at line 681 of file [south_api.h](#).

Data Fields

char *	name	The name of the type.
struct tek_sa_struct_field_type_definition *	items	The definition of the record fields.
uint32_t	item_count	The number of fields in the record type.

8.3.2.16 struct tek_sa_enum_item_definition

The definition of an enum item which is defined in a user defined enum type.

Definition at line 699 of file [south_api.h](#).

Data Fields

char *	name	The name of the enum item.
int32_t	value	The numeric value of the enum item.

8.3.2.17 struct tek_sa_enum_definition

The type definition of a user defined enum type.

Definition at line 712 of file [south_api.h](#).

Data Fields

char *	name	The name of the type.
struct tek_sa_enum_item_definition *	items	The defined enum values of this type.
uint32_t	item_count	The number of defined enum values.

8.3.2.18 struct tek_sa_method_argument_description

The description of a method parameter.

See [tek_sa_transformation_engine::register_method](#)

Definition at line 731 of file [south_api.h](#).

Data Fields

char const *	name	The name of the method parameter.
enum tek_sa_variant_type	type	The type of the method parameter.

8.3.2.19 struct tek_sa_field_write_request

Structure to encapsulate the parameters of a write field request.

Definition at line 858 of file [south_api.h](#).

Data Fields

tek_sa_field_handle	handle	The field handle as returned from tek_sa_transformation_engine::register_field .
tek_sa_field_value	value	The value to be written to the field.

8.3.2.20 struct tek_sa_write_result

Structure to encapsulate the result of a write field request.

Definition at line 870 of file [south_api.h](#).

Data Fields

TEK_SA_RESULT	status	The write operation result.
tek_sa_field_handle	handle	The handle of the field written.

8.3.2.21 struct tek_sa_read_result

Structure to encapsulate the result of a read operation of a single field.

Definition at line 882 of file [south_api.h](#).

Data Fields

TEK_SA_RESULT	status	The read operation result.
tek_sa_field_handle	handle	The handle of the read field.
tek_sa_field_value	value	The read value. Attention Must not be accessed if the <code>status</code> is not TEK_SA_ERR_SUCCESS

8.3.2.22 struct tek_sa_event_parameter

Structure to encapsulate an event parameter.

Definition at line 902 of file [south_api.h](#).

Data Fields

<code>char const *</code>	name	The name of the parameter.
tek_sa_field_value	value	The value of the event parameter.

8.3.2.23 struct tek_sa_dc_event

An event which may be sent from the data client to [tek_sa_transformation_engine::post_event](#).

Definition at line 914 of file [south_api.h](#).

Data Fields

tek_sa_datetime	timestamp	<p>The Timestamp of the event.</p> <p>Remarks</p> <p>This should be the a value as close as possible to the actual occurrence of the event.</p>
int16_t	severity	<p>The severity level of the event.</p> <p>The severity is defined as in https://reference.opcfoundation.org/v104/Core/docs/Part5/6.4.2/ which is cited here:</p> <p>Severity is an indication of the urgency of the Event. This is also commonly called “priority”. Values will range from 1 to 1 000, with 1 being the lowest severity and 1 000 being the highest. Typically, a severity of 1 would indicate an Event which is informational in nature, while a value of 1 000 would indicate an Event of catastrophic nature, which could potentially result in severe financial loss or loss of life.</p>
tek_sa_event_handle	event_type	<p>The event type handle as returned by the call to tek_sa_transformation_engine::register_event.</p> <p>Attention</p> <p>This field must not be TEK_SA_EVENT_HANDLE_INVALID</p>
tek_sa_field_handle	source	<p>The handle of the source of the event.</p> <p>The source of the event is a field in the data client. As not all events have a source, this field may be equal to TEK_SA_FIELD_HANDLE_INVALID.</p>
uint32_t	number_of_parameters	The number of event parameters.
struct tek_sa_event_parameter *	parameters	The event parameters.

8.3.2.24 union tek_sa_variant_array.data

The array values.

Definition at line 573 of file [south_api.h](#).

Data Fields

bool *	b	
--------	---	--

Data Fields

uint8_t *	ui8	
int8_t *	i8	
uint16_t *	ui16	
int16_t *	i16	
uint32_t *	ui32	
int32_t *	i32	
uint64_t *	ui64	
int64_t *	i64	
float *	f	
double *	d	
tek_sa_datetime *	dt	
struct tek_sa_string *	s	
struct tek_sa_guid *	guid	
struct tek_sa_byte_string *	bs	

8.3.2.25 union [tek_sa_variant.data](#)

The value.

Definition at line 632 of file [south_api.h](#).

Data Fields

bool	b	
uint8_t	ui8	
int8_t	i8	
uint16_t	ui16	
int16_t	i16	
uint32_t	ui32	
int32_t	i32	
uint64_t	ui64	
int64_t	i64	
float	f	
double	d	
tek_sa_datetime	dt	
struct tek_sa_string	s	
struct tek_sa_guid	guid	
struct tek_sa_byte_string	bs	
struct tek_sa_variant_array	array	
struct tek_sa_variant_matrix	matrix	
struct tek_sa_complex_data	complex	
struct tek_sa_complex_data_array	complex_array	
struct tek_sa_complex_data_matrix	complex_matrix	

8.3.3 Macro Definition Documentation

8.3.3.1 TEK_SA_ERR_SUCCESS

```
#define TEK_SA_ERR_SUCCESS 0
```

An operation was completed successfully.

Definition at line 783 of file [south_api.h](#).

8.3.3.2 TEK_SA_ERR_NON_BLOCKING_IMPOSSIBLE

```
#define TEK_SA_ERR_NON_BLOCKING_IMPOSSIBLE 10
```

A data client function was called in an asynchronous manner while the implementation can not use multiple threads.

The TEK will call the function in a synchronous manner again.

See [Asynchronous Data Client calls](#) and [tek_sa_data_client_capabilities](#)

Definition at line 794 of file [south_api.h](#).

8.3.3.3 TEK_SA_ERR_OUT_OF_MEMORY

```
#define TEK_SA_ERR_OUT_OF_MEMORY 11
```

The data client or the Transformation Engine can not process a request because it has no more system resources.

Definition at line 800 of file [south_api.h](#).

8.3.3.4 TEK_SA_ERR_INVALID_PARAMETER

```
#define TEK_SA_ERR_INVALID_PARAMETER 12
```

The parameters passed to the function are invalid.

Definition at line 803 of file [south_api.h](#).

8.3.3.5 TEK_SA_ERR_RETRY_LATER

```
#define TEK_SA_ERR_RETRY_LATER 0xffffffff
```

A data client function was called in an asynchronous manner while the number of inflight calls is already active.

The TEK will call the function again at a later time.

See [Asynchronous Data Client calls](#) and [tek_sa_data_client_capabilities](#)

Definition at line 815 of file [south_api.h](#).

8.3.3.6 TEK_SA_READ_RESULT_STATUS_OK

```
#define TEK_SA_READ_RESULT_STATUS_OK 0
```

A read operation completed successfully.

Definition at line 818 of file [south_api.h](#).

8.3.3.7 TEK_SA_READ_RESULT_STATUS_NOK

```
#define TEK_SA_READ_RESULT_STATUS_NOK 1
```

A read operation failed.

Definition at line 821 of file [south_api.h](#).

8.3.3.8 TEK_SA_READ_RESULT_STATUS_TIMEOUT

```
#define TEK_SA_READ_RESULT_STATUS_TIMEOUT 2
```

A read operation did not complete within the specified time limit.

Definition at line 824 of file [south_api.h](#).

8.3.3.9 TEK_SA_READ_RESULT_STATUS_INVALID_HANDLE

```
#define TEK_SA_READ_RESULT_STATUS_INVALID_HANDLE 3
```

The read operation failed because the passed field handle was invalid.

Definition at line 828 of file [south_api.h](#).

8.3.3.10 TEK_SA_BLOCK_TRANSFER_END_OF_FILE

```
#define TEK_SA_BLOCK_TRANSFER_END_OF_FILE 26
```

The read operation read until the end of file.

This result value applies to the [tek_sa_transformation_engine::block_read_data](#) callback.

Definition at line 836 of file [south_api.h](#).

8.3.3.11 TEK_SA_BLOCK_TRANSFER_ABORT

```
#define TEK_SA_BLOCK_TRANSFER_ABORT 24
```

The block read or write operation should be stopped.

This result value applies to the [tek_sa_transformation_engine::block_read_data](#) and the [tek_sa_transformation_engine::block_write_data](#) callback.

Definition at line 845 of file [south_api.h](#).

8.3.3.12 TEK_SA_ERR_UNSPECIFIED

```
#define TEK_SA_ERR_UNSPECIFIED 1000
```

unspecified error to be used when no more specific error is available.

Definition at line 851 of file [south_api.h](#).

8.3.4 Typedef Documentation

8.3.4.1 tek_sa_type_handle

```
typedef int64_t tek_sa_type_handle
```

The type of a handle which is returned for user defined types.

The TEK creates a unique type handle for every type registered with a call to [tek_sa_transformation_engine::register_struct_type](#) or [tek_sa_transformation_engine::register_enum_type](#). The TEK also ensures that the value range of these handles does not overlap with [tek_sa_variant_type](#).

Definition at line 298 of file [south_api.h](#).

8.3.4.2 tek_sa_type_handle_or_type_enum

```
typedef int64_t tek_sa_type_handle_or_type_enum
```

The type for a reference handle which references either a user defined type (see `tek_sa_type_handle`) or a predefined type (See `tek_sa_variant_type`.)

Definition at line 304 of file `south_api.h`.

8.3.4.3 tek_sa_datetime

```
typedef int64_t tek_sa_datetime
```

The type of date and time values wen used as a field type.

The definition is based on OPC UA DateTime (see <https://reference.opcfoundation.org/Core/docs/Part6/5.2.2/#5.2.2.5>)

Definition at line 373 of file `south_api.h`.

8.3.4.4 tek_sa_field_value

```
typedef struct tek_sa_variant tek_sa_field_value
```

Type of data client field values.

Definition at line 659 of file `south_api.h`.

8.3.4.5 tek_sa_field_handle

```
typedef uint32_t tek_sa_field_handle
```

Handle type for a field definition.

Definition at line 758 of file `south_api.h`.

8.3.4.6 tek_sa_event_handle

```
typedef uint32_t tek_sa_event_handle
```

Handle type for an event definition.

Definition at line 761 of file `south_api.h`.

8.3.4.7 tek_sa_alarm_handle

```
typedef uint32_t tek_sa_alarm_handle
```

Handle type for an alarm definition.

Definition at line 764 of file [south_api.h](#).

8.3.4.8 tek_sa_method_handle

```
typedef uint32_t tek_sa_method_handle
```

Handle type for a method definition.

Definition at line 767 of file [south_api.h](#).

8.3.4.9 TEK_SA_RESULT

```
typedef int TEK_SA_RESULT
```

The return value type of all interface functions (which need to return information about success of the operation).

Definition at line 780 of file [south_api.h](#).

8.3.5 Enumeration Type Documentation

8.3.5.1 tek_sa_variant_type

```
enum tek_sa_variant_type
```

The predefined types which can be processed in the TE.

This enum type is a composition of enum and flag values. Each enum value (the ones *not* starting with "TEK_SA_VARIANT_TYPE_FLAG") may be combined with zero or one flags (the ones starting with "TEK_SA_VARIANT_TYPE_FLAG").

Enumerator

TEK_SA_VARIANT_TYPE_NULL	The invalid type id.
TEK_SA_VARIANT_TYPE_BOOL	The type id of a bool value.
TEK_SA_VARIANT_TYPE_UINT8_T	The type id of an unsigned byte value.
TEK_SA_VARIANT_TYPE_INT8_T	The type id of a signed byte value.
TEK_SA_VARIANT_TYPE_UINT16_T	The type id of an unsigned short value.
TEK_SA_VARIANT_TYPE_INT16_T	The type id of a signed short value.

Enumerator

TEK_SA_VARIANT_TYPE_UINT32_T	The type id of an unsigned 32bit integer value.
TEK_SA_VARIANT_TYPE_INT32_T	The type id of a signed 32bit integer value value.
TEK_SA_VARIANT_TYPE_UINT64_T	The type id of an unsigned 64bit integer value.
TEK_SA_VARIANT_TYPE_INT64_T	The type id of a signed 64bit integer value.
TEK_SA_VARIANT_TYPE_FLOAT	The type id of a 32bit floating point value.
TEK_SA_VARIANT_TYPE_DOUBLE	The type id of a 64bit floating point value.
TEK_SA_VARIANT_TYPE_DATETIME	The type id of a date and time value. See tek_sa_datetime .
TEK_SA_VARIANT_TYPE_STRING	The type id of a string value. See tek_sa_string .
TEK_SA_VARIANT_TYPE_GUID	The type id of a GUID value. See tek_sa_guid .
TEK_SA_VARIANT_TYPE_BYTE_STRING	The type id of a byte string value. See tek_sa_byte_string .
TEK_SA_VARIANT_TYPE_COMPLEX	The type id of a value with a complex data type. See tek_sa_transformation_engine::register_struct_type .
TEK_SA_VARIANT_TYPE_FLAG_ARRAY	The flag which is set to declare an array with one dimension of the base type.
TEK_SA_VARIANT_TYPE_FLAG_MATRIX	The flag which is set to declare an array with more than one dimension of the base type.

Definition at line 504 of file [south_api.h](#).

8.3.5.2 tek_sa_field_attributes

```
enum tek_sa_field_attributes
```

Flags type which contains the attributes of a data client field.

Enumerator

TEK_SA_FIELD_ATTRIBUTES_WRITABLE	The attribute to mark a field as writeable.
TEK_SA_FIELD_ATTRIBUTES_READABLE	The attribute to mark a field as readable.
TEK_SA_FIELD_ATTRIBUTES_SUBSCRIBABLE	The attribute to mark a field which can be subscribed to.

Definition at line 746 of file [south_api.h](#).

8.3.5.3 tek_sa_log_level_t

```
enum tek_sa_log_level_t
```

Definition of the possible logging levels which can be used in [tek_sa_transformation_engine::log](#).

Enumerator

TEK_SA_LOG_LEVEL_TRACE	
TEK_SA_LOG_LEVEL_DEBUG	

Enumerator

TEK_SA_LOG_LEVEL_INFO	
TEK_SA_LOG_LEVEL_WARNING	
TEK_SA_LOG_LEVEL_ERROR	
TEK_SA_LOG_LEVEL_CRITICAL	

Definition at line 972 of file [south_api.h](#).

Chapter 9

Data Structure Documentation

9.1 tek_sa_data_client Struct Reference

The interface of one instance of a data client.

```
#include <south_api.h>
```

Data Fields

Lifecycle functions

- [TEK_SA_RESULT](#)(* [register_features](#))(tek_sa_data_client_handle dc)
Register all known features of the data client.
- [TEK_SA_RESULT](#)(* [connect](#))(tek_sa_data_client_handle dc)
Connect the data client to the data source.
- void(* [free](#))(tek_sa_data_client_handle dc)
Frees the data client and releases all its resources.

Data client functions

- [TEK_SA_RESULT](#)(* [read_fields](#))(tek_sa_data_client_handle dc, uint64_t request_id, const [tek_sa_field_handle](#) items_to_read[], uint32_t number_of_items, bool do_not_block)
Function to read one or more fields from the data client. The call may be executed in a synchronous or asynchronous manner (See parameter [do_not_block](#)).
- [TEK_SA_RESULT](#)(* [write_fields](#))(tek_sa_data_client_handle dc, uint64_t request_id, const struct [tek_sa_field_write_request](#) items_to_write[], uint32_t number_of_items, bool do_not_block)
Function to write values to data client fields.
- [TEK_SA_RESULT](#)(* [block_read](#))(const [tek_sa_data_client_handle](#) dc, uint64_t request_id, const char *filepath, uint64_t offset, int64_t length, bool do_not_block, int64_t *filesize)
Starts a block transfer from the client to the TEK.
- [TEK_SA_RESULT](#)(* [block_write](#))(const [tek_sa_data_client_handle](#) dc, uint64_t request_id, const char *filepath, uint64_t offset, int64_t length, bool do_not_block)
Start a block transfer from the TEK to the data client.
- [TEK_SA_RESULT](#)(* [subscribe](#))(tek_sa_data_client_handle dc, const [tek_sa_field_handle](#) items_to_subscribe[], uint32_t number_of_items)
Subscribe to changes of one ore more data client fields.
- [TEK_SA_RESULT](#)(* [unsubscribe](#))(tek_sa_data_client_handle dc, const [tek_sa_field_handle](#) items_to_unsubscribe[], uint32_t number_of_items)
Unsubscribe to changes of one ore more data client fields.

- `TEK_SA_RESULT(* invoke)(const tek_sa_data_client_handle dc, const tek_sa_method_handle method, uint64_t request_id, const tek_sa_field_value parameters[], const uint32_t number_of_parameters)`
Invoke a method on the data client.
- `TEK_SA_RESULT(* acknowledge_alarm)(tek_sa_data_client_handle dc, const tek_sa_alarm_handle alarm)`
Acknowledge an alarm in the data client.

Data fields

- `tek_sa_data_client_handle handle`
The handle that is passed as first parameter in all functions of this interface.

9.1.1 Detailed Description

The interface of one instance of a data client.

Definition at line 1051 of file `south_api.h`.

9.1.2 Field Documentation

9.1.2.1 register_features

```
TEK_SA_RESULT(* tek_sa_data_client::register_features) (tek_sa_data_client_handle dc)
```

Register all known features of the data client.

Parameters

<i>dc</i>	data client handle features are registered for
-----------	--

This method is called from the TEK after the data client was created and before is will be connected. See also [Initialization of a data client plugin](#)

A data client implementation should evaluate the configuration (passed to `tek_sa_data_client_plugin::data_client_new`) and register all known types fields, events, methods and alarms.

A connection to the controller must not be established.

Definition at line 1069 of file `south_api.h`.

9.1.2.2 connect

```
TEK_SA_RESULT(* tek_sa_data_client::connect) (tek_sa_data_client_handle dc)
```

Connect the data client to the data source.

This method is called from the TEK after the data client has registered its features. See also [Initialization of a data client plugin](#).

A data client implementation should connect to the data source and register additional features and capabilities.

If the data client can not connect to the data source it should keep trying to connect after the method call completed but it should not block.

Definition at line 1083 of file [south_api.h](#).

9.1.2.3 free

```
void(* tek_sa_data_client::free) (tek_sa_data_client_handle dc)
```

Frees the data client and releases all its resources.

Should be called by the TEK.

Definition at line 1090 of file [south_api.h](#).

9.1.2.4 read_fields

```
TEK_SA_RESULT(* tek_sa_data_client::read_fields) (tek_sa_data_client_handle dc, uint64_t request_id, const tek_sa_field_handle items_to_read[], uint32_t number_of_items, bool do_not_block)
```

Function to read one or more fields from the data client. The call may be executed in a synchronous or asynchronous manner (See parameter `do_not_block`).

The values of the requested fields are sent by calling the [tek_sa_transformation_engine::read_result](#) callback function. The data client must preserve the order of the fields in the results that are provided in [tek_sa_transformation_engine::read_result](#) callback.

If the time needed to retrieve the values is larger than half the global timeout value a data client must call the [vde_sa_tek_ap::read_progress](#) callback function.

Parameters

<i>dc</i>	The handle of the data client as returned from tek_sa_data_client_plugin::data_client_new .
<i>request_id</i>	A unique request identifier which is created by the TEK and must be passed to call to tek_sa_transformation_engine::read_result and tek_sa_transformation_engine::read_progress .
<i>items_to_read</i>	An array of field handles which describes the values the data client should read. See also function tek_sa_transformation_engine::register_field .
<i>number_of_items</i>	The number of handles in the parameter <code>items_to_read</code> .
<i>do_not_block</i>	A boolean flag that, when set to <i>true</i> , tells the data client that it should return immediately and return the read field values later in another thread.

Returns

TEK_SA_ERR_SUCCESS when the call succeeded.

TEK_SA_ERR_NON_BLOCKING_IMPOSSIBLE if `do_not_block` is set to `true` and the called data client is not able to do nonblocking calls. The TEK will retry with `do_not_block` set to `false`

TEK_SA_ERR_OUT_OF_MEMORY when the data client can not allocate the data structures and resources to read the fields.

any other error which applies to the read function

Todo [B, TEAM] define error values of read function

Attention

It is mandatory that the data client does not block when called with parameter `do_not_block` set to `true`.

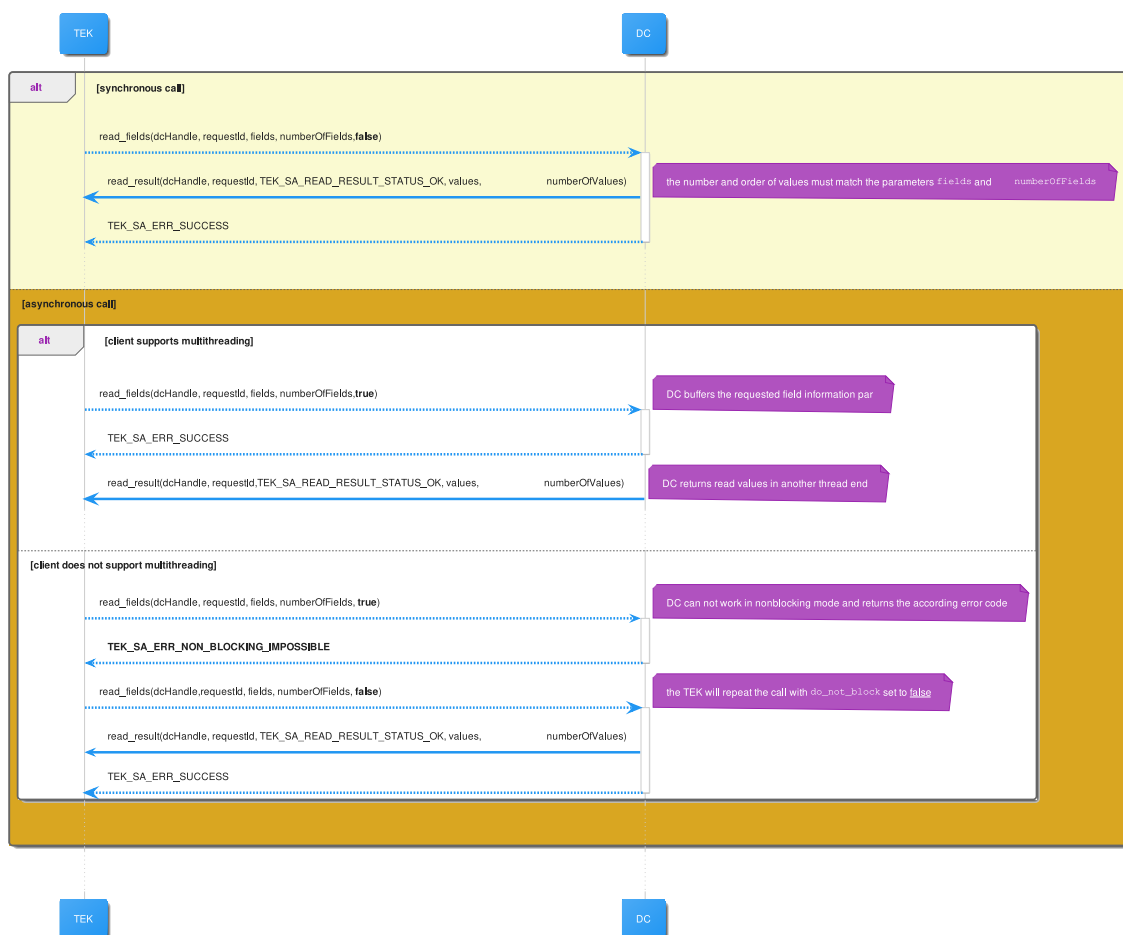
Usage of the Parameter `do_not_block`

Figure 9.1 Possible call sequences

Definition at line 1188 of file `south_api.h`.

9.1.2.5 write_fields

```
TEK_SA_RESULT(* tek_sa_data_client::write_fields) (tek_sa_data_client_handle dc, uint64_t request_id, const struct tek_sa_field_write_request items_to_write[], uint32_t number_of_items, bool do_not_block)
```

Function to write values to data client fields.

Parameters

<i>dc</i>	The handle of the data client as returned from tek_sa_data_client_plugin::data_client_new .
<i>request_id</i>	A unique request identifier which is created by the TEK and must be passed to call to tek_sa_transformation_engine::write_result .
<i>items_to_write</i>	An array of field handles and their values which describes the values the data client should write.
<i>number_of_items</i>	The number of handles in the parameter <i>items_to_write</i> .
<i>do_not_block</i>	A boolean flag that, when set to <i>true</i> , tells the data client that it should return immediately and write the values in the background. See also Usage in read_fields

Todo [B, TEAM] should the data client call a progress function if the operation needs more time?

Definition at line 1212 of file [south_api.h](#).

9.1.2.6 block_read

```
TEK_SA_RESULT(* tek_sa_data_client::block_read) (const tek_sa_data_client_handle dc, uint64_t request_id, const char *filepath, uint64_t offset, int64_t length, bool do_not_block, int64_t *filesize)
```

Starts a block transfer from the client to the TEK.

For example, read a file from the device.

Parameters

<i>dc</i>	The data client handle
<i>request_id</i>	The request id for the TEK API callbacks
<i>filepath</i>	The file or address of the block to be read. The format is data client specific. The pointer must be in utf-8.
<i>offset</i>	The offset in the data
<i>length</i>	A specific length, or -1 for the whole data
<i>do_not_block</i>	See Usage in read_fields
<i>filesize</i>	The file size will be written by the data client, or -1 if not known at the call

Returns

An information about the success or failure of the operation.

The data is not yet passed to this method directly but sent from the data client in chunks to the [tek_sa_transformation_engine::block_read_data](#) callback.

Definition at line 1239 of file [south_api.h](#).

9.1.2.7 block_write

```
TEK_SA_RESULT(* tek_sa_data_client::block_write) (const tek\_sa\_data\_client\_handle dc, uint64_t request_id, const char *filepath, uint64_t offset, int64_t length, bool do_not_block)
```

Start a block transfer from the TEK to the data client.

Parameters

<i>dc</i>	The handle of the data client as returned from tek_sa_data_client_plugin::data_client_new .
<i>request_id</i>	A unique request identifier which is created by the TEK and must be passed to call to tek_sa_transformation_engine::block_write_result and tek_sa_transformation_engine::block_write_data .
<i>offset</i>	The offset in the data
<i>length</i>	A specific length, or -1 for the whole data
<i>do_not_block</i>	See Usage in read_fields

Returns

An information about the success or failure of the operation.

The data is not yet passed to this method directly but requested from the data client in chunks from the [tek_sa_transformation_engine::block_write_data](#) callback.

Definition at line 1266 of file [south_api.h](#).

9.1.2.8 subscribe

```
TEK_SA_RESULT(* tek_sa_data_client::subscribe) (tek\_sa\_data\_client\_handle dc, const tek\_sa\_field\_handle items_to_subscribe[], uint32_t number_of_items)
```

Subscribe to changes of one ore more data client fields.

Parameters

<i>dc</i>	The handle of the data client as returned from tek_sa_data_client_plugin::data_client_new .
<i>items_to_subscribe</i>	The fields for which change events will be received.
<i>number_of_items</i>	The number of elements in the <i>items_to_subscribe</i> parameter.

Todo [D, TEAM] add sampling rate parameter

The subscription mechanism is very easy compared to that of the OPC UA specification. The TEK can subscribe to each field only once and all changes are signaled by a call to the `tek_sa_data_transformation_engine::notify_↔` change callback.

Definition at line 1290 of file `south_api.h`.

9.1.2.9 unsubscribe

```
TEK_SA_RESULT(* tek_sa_data_client::unsubscribe) (tek_sa_data_client_handle dc, const tek_sa_field_handle
items_to_unsubscribe[], uint32_t number_of_items)
```

Unsubscribe to changes of one ore more data client fields.

Parameters

<i>dc</i>	The handle of the data client as returned from tek_sa_data_client_plugin::data_client_new .
<i>items_to_unsubscribe</i>	The fields for which no more change events will be received.
<i>number_of_items</i>	The number of elements in the <code>items_to_unsubscribe</code> parameter.

Definition at line 1304 of file `south_api.h`.

9.1.2.10 invoke

```
TEK_SA_RESULT(* tek_sa_data_client::invoke) (const tek_sa_data_client_handle dc, const tek_sa_method_handle
method, uint64_t request_id, const tek_sa_field_value parameters[], const uint32_t number_of↔
_parameters)
```

Invoke a method on the data client.

Providing this function ins optional

Parameters

<i>dc</i>	The handle of the data client as returned from tek_sa_data_client_plugin::data_client_new .
<i>method</i>	The method handle which is returned from the <code>tek_sa_data_transformation_engine::register_method</code> method.
<i>request_id</i>	A unique request identifier which is created by the TEK and must be passed to call to tek_sa_transformation_engine::block_write_result and tek_sa_transformation_engine::block_write_data .
<i>parameters</i>	The parameters of the method. Number and type must match the method registration.
<i>number_of_parameters</i>	The number of parameters in the <code>parameters</code> array.

The outcome of the message call is returned in the [tek_sa_transformation_engine::call_method_result](#) callback.

Definition at line 1331 of file [south_api.h](#).

9.1.2.11 acknowledge_alarm

```
TEK_SA_RESULT(* tek_sa_data_client::acknowledge_alarm) (tek_sa_data_client_handle dc, const
tek_sa_alarm_handle alarm)
```

Acknowledge an alarm in the data client.

Parameters

<i>dc</i>	The handle of the data client as returned from tek_sa_data_client_plugin::data_client_new .
<i>alarm</i>	An alarm handle which is returned from the method tek_sa_transformation_engine::register_alarm .

Called by TEK to signal triggered alarm has acknowledged by TEK consumer. The alarm may or may not be raised before with a call to [tek_sa_transformation_engine::set_alarm](#). When the alarm condition is not true anymore, then the data client implementation has to reset the alarm and call [tek_sa_transformation_engine::reset_alarm](#)

Definition at line 1352 of file [south_api.h](#).

9.1.2.12 handle

```
tek_sa_data_client_handle tek_sa_data_client::handle
```

The handle that is passed as first parameter in all functions of this interface.

Definition at line 1363 of file [south_api.h](#).

The documentation for this struct was generated from the following file:

- [include/south_api.h](#)

9.2 tek_sa_data_client_plugin Struct Reference

Interface of the data client plugin.

```
#include <south_api.h>
```

Data Fields

- void * [plugin_context](#)
The (private) plugin context. Must be freed using `free_context` on unloading the plugin.
- [TEK_SA_RESULT](#)(* [data_client_new](#))(void *[plugin_context](#), const struct [tek_sa_data_client_configuration](#) *[config](#), struct [tek_sa_data_client](#) *[created_client](#), struct [tek_sa_data_client_capabilities](#) *[capabilities](#))
Allocates and initializes the data client with a configuration. Prepare callbacks in `data_client`.
- void(* [free_context](#))(void *[plugin_context](#))
Frees the private context of the plugin.

9.2.1 Detailed Description

Interface of the data client plugin.

The data client plugin is created once as result of a call to the `load_plugin` method();

Definition at line 1387 of file [south_api.h](#).

9.2.2 Field Documentation

9.2.2.1 plugin_context

```
void* tek_sa_data_client_plugin::plugin_context
```

The (private) plugin context. Must be freed using `free_context` on unloading the plugin.

Definition at line 1392 of file [south_api.h](#).

9.2.2.2 data_client_new

```
TEK\_SA\_RESULT(* tek\_sa\_data\_client\_plugin::data\_client\_new) (void *plugin\_context, const struct tek\_sa\_data\_client\_configuration *config, struct tek\_sa\_data\_client *created\_client, struct tek\_sa\_data\_client\_capabilities *capabilities)
```

Allocates and initializes the data client with a configuration. Prepare callbacks in `data_client`.

Does not perform any actions like connecting to the data source or register information at the TEK.

Parameters

<i>plugin_context</i>	
<i>config</i>	
<i>created_client</i>	
<i>capabilities</i>	The data client capabilities (known before connect), e.g. the threading model of the data client. Capabilities can be updated by the client using the TEK API, if additional information are retrieved later in the lifecycle of the data client.

Returns

failure code or success

Definition at line 1410 of file [south_api.h](#).

9.2.2.3 free_context

```
void(* tek_sa_data_client_plugin::free_context) (void *plugin_context)
```

Frees the private context of the plugin.

Definition at line 1418 of file [south_api.h](#).

The documentation for this struct was generated from the following file:

- [include/south_api.h](#)

9.3 tek_sa_transformation_engine Struct Reference

Interface of the Transformation Engine.

```
#include <south_api.h>
```

Data Fields**Registration functions for data client operations and data fields**

- [TEK_SA_RESULT](#)(* [register_field](#))([tek_sa_data_client_handle](#) dc, const char *name, enum [tek_sa_field_attributes](#) attributes, enum [tek_sa_variant_type](#) type, [tek_sa_field_handle](#) *new_field_handle)
Registers a new field of a data client with a name inside the TEK.
- [TEK_SA_RESULT](#)(* [register_method](#))([tek_sa_data_client_handle](#) dc, const char *name, struct [tek_sa_method_argument_description](#) input_parameter[], uint32_t number_of_input_parameters, struct [tek_sa_method_argument_description](#) output_parameter[], uint32_t number_of_output_parameters, [tek_sa_method_handle](#) *new_method_handle)
Registers a new method at the TEK.
- [TEK_SA_RESULT](#)(* [register_event](#))([tek_sa_data_client_handle](#) dc, const char *name, [tek_sa_event_handle](#) *new_event_handle)
Registers a new Event that a data client might raise.
- [TEK_SA_RESULT](#)(* [register_alarm](#))([tek_sa_data_client_handle](#) dc, const char *name, const int16_t severity, const [tek_sa_field_handle](#) source, [tek_sa_alarm_handle](#) *new_alarm_handle)
Registers an alarm at the TEK.

Registration functions for extended types

- [TEK_SA_RESULT](#)(* [register_enum_type](#))([tek_sa_data_client_handle](#) dc, struct [tek_sa_enum_definition](#) const *type_definition, [tek_sa_type_handle](#) *new_type_handle)
Register a user defined enum type.
- [TEK_SA_RESULT](#)(* [register_struct_type](#))([tek_sa_data_client_handle](#) dc, struct [tek_sa_struct_definition](#) const *type_definition, [tek_sa_type_handle](#) *new_type_handle)

Register a user defined struct type.

Alarm and Event functions

- `TEK_SA_RESULT(* post_event)(tek_sa_data_client_handle dc, struct tek_sa_dc_event const *event)`
Post an event which was declared with a call to either [get_global_event](#) or [register_event](#).
- `TEK_SA_RESULT(* set_alarm)(tek_sa_data_client_handle dc, const tek_sa_alarm_handle alarm)`
Sets an alarm.
- `TEK_SA_RESULT(* reset_alarm)(tek_sa_data_client_handle dc, const tek_sa_alarm_handle alarm)`
Clears/resets an alarm.

Miscellaneous functions

- `TEK_SA_RESULT(* log)(tek_sa_data_client_handle source, enum tek_sa_log_level_t lvl, const char *format, va_list args)`
Logging function for data clients.
- `tek_sa_event_handle(* get_global_event)(const char *name)`
Get a handle of a globally defined event.
- `TEK_SA_RESULT(* update_capabilities)(tek_sa_data_client_handle dc, struct tek_sa_data_client_capabilities const *capabilities)`
Notifies the TEK of the change of the client's capabilities.

Data client callbacks

- `TEK_SA_RESULT(* read_progress)(tek_sa_data_client_handle dc, uint64_t request_id, uint64_t progress)`
Callback to signal progress of a read operation to the TEK.
- `TEK_SA_RESULT(* read_result)(tek_sa_data_client_handle dc, uint64_t request_id, TEK_SA_RESULT result, const struct tek_sa_read_result results[], uint32_t number_of_results)`
Callback of the data client read operation.
- `TEK_SA_RESULT(* notify_change)(tek_sa_data_client_handle dc, const struct tek_sa_read_result changes[], uint32_t number_of_changes)`
Callback to notify about a change of subscribed data fields.
- `TEK_SA_RESULT(* write_result)(tek_sa_data_client_handle dc, uint64_t request_id, TEK_SA_RESULT result, const struct tek_sa_write_result results[], uint32_t number_of_results)`
Callback of the data client write operation.
- `TEK_SA_RESULT(* call_method_result)(tek_sa_data_client_handle dc, uint64_t request_id, TEK_SA_RESULT result, const tek_sa_field_value results[], uint32_t number_of_results)`
Callback of a data client method call.
- `TEK_SA_RESULT(* block_read_data)(tek_sa_data_client_handle dc, uint64_t request_id, TEK_SA_RESULT result, unsigned char buffer[], uint32_t buffer_length)`
Callback from the data client to the TEK signaling the next data chunk of the block transfer.
- `TEK_SA_RESULT(* block_write_data)(tek_sa_data_client_handle dc, uint64_t request_id, unsigned char buffer[], uint32_t buffer_length, uint32_t *bytes_written)`
Callback from the data client to the TEK requesting another chunk to write to the data client.
- `TEK_SA_RESULT(* block_write_result)(tek_sa_data_client_handle dc, uint64_t request_id, TEK_SA_RESULT result)`
Callback from the data client to the TEK with the final result of the block transfer.

9.3.1 Detailed Description

Interface of the Transformation Engine.

Interface exported by the TEK, which is given a data client plugin (dll/so) to interact with the TEK.

Definition at line 1434 of file [south_api.h](#).

9.3.2 Field Documentation

9.3.2.1 register_field

```
TEK_SA_RESULT(* tek_sa_transformation_engine::register_field) (tek_sa_data_client_handle dc,
const char *name, enum tek_sa_field_attributes attributes, enum tek_sa_variant_type type,
tek_sa_field_handle *new_field_handle)
```

Registers a new field of a data client with a name inside the TEK.

Parameters

<i>dc</i>	The data client that registers at the TEK.
<i>name</i>	The name of the field. The data client decides the name.
<i>attributes</i>	The attributes of the field, e.g. is writeable.
<i>type</i>	The data type of the field.
<i>new_field_handle</i>	result of registration, only valid when method returns TEK_SA_ERR_SUCCESS.

Returns

TEK_SA_ERR_SUCCESS or error code when registration failed (e.g. duplicate registration, empty name...).

Definition at line 1452 of file [south_api.h](#).

9.3.2.2 register_method

```
TEK_SA_RESULT(* tek_sa_transformation_engine::register_method) (tek_sa_data_client_handle
dc, const char *name, struct tek_sa_method_argument_description input_parameter[], uint32_t
number_of_input_parameters, struct tek_sa_method_argument_description output_parameter[],
uint32_t number_of_output_parameters, tek_sa_method_handle *new_method_handle)
```

Registers a new method at the TEK.

Parameters

<i>dc</i>	The data client that registers at the TEK.
<i>name</i>	The name of the method.
tek_sa_method_argument_description	The description of the method input arguments.
<i>number_of_input_parameters</i>	The number of input parameters.
tek_sa_method_argument_description	The description of the method output arguments.
<i>number_of_output_parameters</i>	The number of output parameters.
<i>new_method_handle</i>	result of registration, only valid when method returns TEK_SA_ERR_SUCCESS.

Returns

TEK_SA_ERR_SUCCESS or error code when registration failed (e.g. duplicate registration, empty name...).

Definition at line 1475 of file [south_api.h](#).

9.3.2.3 register_event

```
TEK_SA_RESULT(* tek_sa_transformation_engine::register_event) (tek_sa_data_client_handle dc,  
const char *name, tek_sa_event_handle *new_event_handle)
```

Registers a new Event that a data client might raise.

Parameters

<i>dc</i>	The data client that registers at the TEK.
<i>name</i>	The name of the event. Must be unique within all events registered from this dc.
<i>new_event_handle</i>	result of registration, only valid when method returns TEK_SA_ERR_SUCCESS.

Returns

TEK_SA_ERR_SUCCESS or error code when registration failed (e.g. duplicate registration, empty name...).

The TEK ensures that the set of handles between the predefined events and the registered events are disjoint.

Definition at line 1498 of file [south_api.h](#).

9.3.2.4 register_alarm

```
TEK_SA_RESULT(* tek_sa_transformation_engine::register_alarm) (tek_sa_data_client_handle dc,  
const char *name, const int16_t severity, const tek_sa_field_handle source, tek_sa_alarm_handle  
*new_alarm_handle)
```

Registers an alarm at the TEK.

Parameters

<i>dc</i>	The data client that registers at the TEK.
<i>name</i>	The name of the new alarm, must be unique within all alarms registered for this data client.
<i>severity</i>	The alarm severity level.
<i>source</i>	field the alarm relates to, the same field can be used for multiple alarms.
<i>new_alarm_handle</i>	result of registration only valid when method returns TEK_SA_ERR_SUCCESS.

Returns

TEK_SA_ERR_SUCCESS or error code when registration failed (e.g. duplicate registration, empty name...).

Definition at line 1517 of file [south_api.h](#).

9.3.2.5 register_enum_type

```
TEK_SA_RESULT(* tek_sa_transformation_engine::register_enum_type) (tek_sa_data_client_handle  
dc, struct tek_sa_enum_definition const *type_definition, tek_sa_type_handle *new_type_handle)
```

Register a user defined enum type.

Parameters

<i>dc</i>	The data client that registers at the TEK.
tek_sa_enum_definition	The definition of the enumeration.
<i>result</i>	A tek_sa_type_handle associated to the registered enum.
<i>new_type_handle</i>	result of registration, only valid when method returns TEK_SA_ERR_SUCCESS.

Returns

TEK_SA_ERR_SUCCESS or error code when registration failed (e.g. duplicate registration, empty name...).

Definition at line 1541 of file [south_api.h](#).

9.3.2.6 register_struct_type

```
TEK_SA_RESULT(* tek_sa_transformation_engine::register_struct_type) (tek_sa_data_client_handle  
dc, struct tek_sa_struct_definition const *type_definition, tek_sa_type_handle *new_type_handle)
```

Register a user defined struct type.

Parameters

<i>dc</i>	The data client that registers at the TEK.
tek_sa_struct_definition	The definition of the struct.
<i>new_type_handle</i>	result of registration call when successful, only valid when method returns TEK_SA_ERR_SUCCESS.

Returns

indicator whether the type definition was successfully registered

Definition at line 1555 of file [south_api.h](#).

9.3.2.7 post_event

```
TEK_SA_RESULT(* tek_sa_transformation_engine::post_event) (tek_sa_data_client_handle dc, struct  
tek_sa_dc_event const *event)
```

Post an event which was declared with a call to either [get_global_event](#) or [register_event](#).

Parameters

<i>dc</i>	Handle of the data client which sends the event.
<i>event</i>	A event structure. See dc_event .

Returns

indicator whether the event was successfully posted or not

Definition at line [1575](#) of file [south_api.h](#).

9.3.2.8 set_alarm

```
TEK_SA_RESULT(* tek_sa_transformation_engine::set_alarm) (tek_sa_data_client_handle dc, const  
tek_sa_alarm_handle alarm)
```

Sets an alarm.

Parameters

<i>dc</i>	Handle of the data client that sets the alarm.
<i>alarm</i>	Handle of the alarm to be set.

Returns

indicator whether setting the alarm was successful or not

Todo [C, TEAM] called by data_client after connect, regardless of "acknowledge" calls during previous connection?

Definition at line [1588](#) of file [south_api.h](#).

9.3.2.9 reset_alarm

```
TEK_SA_RESULT(* tek_sa_transformation_engine::reset_alarm) (tek_sa_data_client_handle dc,  
const tek_sa_alarm_handle alarm)
```

Clears/resets an alarm.

Parameters

<i>dc</i>	Handle of the data client that clears/resets the alarm.
<i>alarm</i>	Handle of the alarm to be cleared/reset.

Returns

indicator whether resetting the alarm was successful or not

Definition at line 1598 of file [south_api.h](#).

9.3.2.10 log

```
TEK_SA_RESULT(* tek_sa_transformation_engine::log) (tek_sa_data_client_handle source, enum  
tek_sa_log_level_t lvl, const char *format, va_list args)
```

Logging function for data clients.

The TEK bundles the messages of all data clients.

The TEK must be aware of data clients running in different threads than the TEK itself and is responsible for handling multi-threaded access to the function.

Parameters

<i>data_client_handle</i>	The data client that logs a message.
<i>lvl</i>	The logging level.
<i>format</i>	The message format string. Format must be compatible to <code>printf</code> .
<i>args</i>	A <code>va_list</code> that contains all the arguments for the format string.

Returns

log result status code; can be ignored normally or used for debugging.

Definition at line 1624 of file [south_api.h](#).

9.3.2.11 get_global_event

```
tek_sa_event_handle(* tek_sa_transformation_engine::get_global_event) (const char *name)
```

Get a handle of a globally defined event.

Parameters

<i>name</i>	name of globally defined event.
-------------	---------------------------------

Returns

handle to globally defined event

Todo [C, TEAM] define the predefined events

[C, TEAM] define return value when event with given name does not exist?

The TEK ensures that the set of handles between the predefined events and the registered events are disjoint.

Definition at line 1642 of file [south_api.h](#).

9.3.2.12 update_capabilities

```
TEK_SA_RESULT(* tek_sa_transformation_engine::update_capabilities) (tek_sa_data_client_handle
dc, struct tek_sa_data_client_capabilities const *capabilities)
```

Notifies the TEK of the change of the client's capabilities.

Parameters

<i>dc</i>	Handle of the data client that informs about the change of its capabilities.
<i>tek_sa_data_client_capabilities</i>	The updated client capabilities.

Returns

(void)

Definition at line 1651 of file [south_api.h](#).

9.3.2.13 read_progress

```
TEK_SA_RESULT(* tek_sa_transformation_engine::read_progress) (tek_sa_data_client_handle dc,
uint64_t request_id, uint64_t progress)
```

Callback to signal progress of a read operation to the TEK.

Parameters

<i>dc</i>	Handle of the data client that is the source of the call
<i>request_id</i>	id of request to data client which triggered the call back
<i>progress</i>	?? (percentage? why uint64?)

Todo [B, TEAM] when should a data client report progress?

Todo [B, TEAM] when can the TEK stop the client (after progress was not reported)?

Definition at line 1673 of file [south_api.h](#).

9.3.2.14 read_result

```
TEK_SA_RESULT(* tek_sa_transformation_engine::read_result) (tek_sa_data_client_handle dc,  
uint64_t request_id, TEK_SA_RESULT result, const struct tek_sa_read_result results[], uint32_t  
number_of_results)
```

Callback of the data client read operation.

Parameters

<i>dc</i>	Handle of the data client that is the source of the call
<i>request_id</i>	id of request to data client that triggered the call back
<i>result</i>	status code for read request
<i>results</i>	read values
<i>number_of_results</i>	length of results array

If the result is success, then the following constraints must hold:

The number of results MUST be equal to the number of fields requested in `read_fields`. The order of results MUST be the same as the order of fields in `read_fields`. The results array is only valid during the execution of the callback.

If the result is failure, the TEK MUST ignore the results and `number_of_results` parameters.

Definition at line 1698 of file [south_api.h](#).

9.3.2.15 notify_change

```
TEK_SA_RESULT(* tek_sa_transformation_engine::notify_change) (tek_sa_data_client_handle dc,  
const struct tek_sa_read_result changes[], uint32_t number_of_changes)
```

Callback to notify about a change of subscribed data fields.

Parameters

<i>dc</i>	Handle of the data client that is the source of the change
<i>changes</i>	changed field values
<i>number_of_changes</i>	length of changes array

Definition at line 1711 of file [south_api.h](#).

9.3.2.16 write_result

```
TEK_SA_RESULT(* tek_sa_transformation_engine::write_result) (tek_sa_data_client_handle dc,
uint64_t request_id, TEK_SA_RESULT result, const struct tek_sa_write_result results[], uint32_t number_of_results)
```

Callback of the data client write operation.

Parameters

<i>dc</i>	Handle of the data client data was written to
<i>request_id</i>	id of write request to data client that triggered the call back
<i>result</i>	overall result of write operation
<i>results</i>	write results for each written field
<i>number_of_results</i>	length of results array

Definition at line 1725 of file [south_api.h](#).

9.3.2.17 call_method_result

```
TEK_SA_RESULT(* tek_sa_transformation_engine::call_method_result) (tek_sa_data_client_handle dc,
uint64_t request_id, TEK_SA_RESULT result, const tek_sa_field_value results[], uint32_t number_of_results)
```

Callback of a data client method call.

Parameters

<i>dc</i>	Handle of the data client a method was called at
<i>request_id</i>	id of method call request to data client that triggered the call back
<i>result</i>	error/success indicator of method call
<i>results</i>	return values of method call, only valid for successful results
<i>number_of_results</i>	length of results array

Definition at line 1742 of file [south_api.h](#).

9.3.2.18 block_read_data

```
TEK_SA_RESULT(* tek_sa_transformation_engine::block_read_data) (tek_sa_data_client_handle dc,
uint64_t request_id, TEK_SA_RESULT result, unsigned char buffer[], uint32_t buffer_length)
```

Callback from the data client to the TEK signaling the next data chunk of the block transfer.

Parameters

<i>dc</i>	The data client handle.
-----------	-------------------------

Parameters

<i>request_id</i>	The request id of the block transfer.
<i>result</i>	The data client signals success, error, or end-of-file. Buffer may contain a last chunk when end-of-file is signalled. If an error is signalled, the data client has aborted the process and will not call this callback again for the request.
<i>buffer</i>	The current chunk of the file. The TEK must copy the data into it's own process.
<i>buffer_length</i>	The length of the chunk.

Returns

The TEK responds with success, or can abort the transfer.

Definition at line 1764 of file [south_api.h](#).

9.3.2.19 block_write_data

```
TEK_SA_RESULT(* tek_sa_transformation_engine::block_write_data) (tek_sa_data_client_handle dc,
uint64_t request_id, unsigned char buffer[], uint32_t buffer_length, uint32_t *bytes_written)
```

Callback from the data client to the TEK requesting another chunk to write to the data client.

Parameters

<i>dc</i>	The data client handle.
<i>request_id</i>	The request id of the block transfer.
<i>buffer</i>	The buffer to write the chunk of the file. The TEK must copy the data into the buffer provided by the data client.
<i>buffer_length</i>	The length of the buffer in the data client.
<i>bytes_written</i>	The number of bytes written in the buffer by the TEK.
<i>result</i>	Signals valid next chunk, end-of-file, abort or error.

Returns

Success or failure code.

Definition at line 1784 of file [south_api.h](#).

9.3.2.20 block_write_result

```
TEK_SA_RESULT(* tek_sa_transformation_engine::block_write_result) (tek_sa_data_client_handle
dc, uint64_t request_id, TEK_SA_RESULT result)
```

Callback from the data client to the TEK with the final result of the block transfer.

Parameters

<i>dc</i>	The data client handle.
<i>request↔ _id</i>	The request id of the block transfer.
<i>result</i>	The final result.

Definition at line 1798 of file [south_api.h](#).

The documentation for this struct was generated from the following file:

- include/[south_api.h](#)

Chapter 10

File Documentation

10.1 include/south_api.h File Reference

Definition of the interface between Data Clients (DC) and the Transformation Engine (TEK)

```
#include <stdarg.h>
#include <stdbool.h>
#include <stddef.h>
#include <stdint.h>
#include <stdlib.h>
```

Data Structures

- struct [tek_sa_additional_file](#)
Configuration class which describes an additional file which is passed to the data client. [More...](#)
- struct [tek_sa_data_client_configuration](#)
Configuration object containing the contents of the configuration files for the [tek_sa_data_client_plugin](#) or [tek_sa_data_client](#) instances. [More...](#)
- struct [tek_sa_configuration](#)
Configuration struct that contains generic properties and settings for TEK instance. [More...](#)
- struct [tek_sa_guid](#)
The representation of a GUID when used as a field type. [More...](#)
- struct [tek_sa_byte_string](#)
The representation of a byte array with variable length when used as a field type. [More...](#)
- struct [tek_sa_string](#)
The representation of a string with variable length when used as a field type. [More...](#)
- struct [tek_sa_complex_data](#)
The representation of a field value which has a type which is not a predefined type. [More...](#)
- struct [tek_sa_complex_data_array_item](#)
The representation of the items of an array of complex data values with exactly one dimension. [More...](#)
- struct [tek_sa_complex_data_array](#)
The representation of an array of complex data with exactly one dimension. [More...](#)
- struct [tek_sa_complex_data_matrix](#)
The representation of array of complex data with more than one dimension. [More...](#)
- struct [tek_sa_variant_array](#)

- The representation of a one dimensional array of the supported base types. [More...](#)*

 - struct [tek_sa_variant_matrix](#)
- The representation of an array with more than one dimension of the supported base types. [More...](#)*

 - struct [tek_sa_variant](#)
- The representation of a single value (which may be of array type too). [More...](#)*

 - struct [tek_sa_struct_field_type_definition](#)
- The type definition of a record field in a user defined struct type. [More...](#)*

 - struct [tek_sa_struct_definition](#)
- The type definition of a user defined record type. [More...](#)*

 - struct [tek_sa_enum_item_definition](#)
- The definition of an enum item which is defined in a user defined enum type. [More...](#)*

 - struct [tek_sa_enum_definition](#)
- The type definition of a user defined enum type. [More...](#)*

 - struct [tek_sa_method_argument_description](#)
- The description of a method parameter. [More...](#)*

 - struct [tek_sa_field_write_request](#)
- Structure to encapsulate the parameters of a write field request. [More...](#)*

 - struct [tek_sa_write_result](#)
- Structure to encapsulate the result of a write field request. [More...](#)*

 - struct [tek_sa_read_result](#)
- Structure to encapsulate the result of a read operation of a single field. [More...](#)*

 - struct [tek_sa_event_parameter](#)
- Structure to encapsulate an event parameter. [More...](#)*

 - struct [tek_sa_dc_event](#)
- An event which may be sent from the data client to [tek_sa_transformation_engine::post_event](#). [More...](#)*

 - struct [tek_sa_data_client_capabilities](#)
- capabilities of the data client. These capabilities are applied to the complete data client as well as to each instance (device connection). [More...](#)*

 - struct [tek_sa_data_client](#)
- The interface of one instance of a data client.*

 - struct [tek_sa_data_client_plugin](#)
- Interface of the data client plugin.*

 - struct [tek_sa_transformation_engine](#)
- Interface of the Transformation Engine.*

 - union [tek_sa_variant_array.data](#)
- The array values. [More...](#)*

 - union [tek_sa_variant.data](#)
- The value. [More...](#)*

Macros

- #define [TEK_SA_API_VERSION_MAJOR](#) 0
 - #define [TEK_SA_API_VERSION_MINOR](#) 1
 - #define [TEK_SA_API_VERSION_PATCH](#) 0
 - #define [TEK_SA_API_VERSION](#) "0.1.0"
 - #define [TEK_SA_ERR_UNSPECIFIED](#) 1000
- unspecified error to be used when no more specific error is available.*

Typedefs

- typedef void * [tek_sa_data_client_handle](#)
The type of the data client handle.
- typedef int64_t [tek_sa_type_handle](#)
The type of a handle which is returned for user defined types.
- typedef int64_t [tek_sa_type_handle_or_type_enum](#)
The type for a reference handle which references either a user defined type (see [tek_sa_type_handle](#)) or a predefined type (See [tek_sa_variant_type](#).)
- typedef int64_t [tek_sa_datetime](#)
The type of date and time values wen used as a field type.
- typedef struct [tek_sa_variant](#) [tek_sa_field_value](#)
Type of data client field values.
- typedef uint32_t [tek_sa_field_handle](#)
Handle type for a field definition.
- typedef uint32_t [tek_sa_event_handle](#)
Handle type for an event definition.
- typedef uint32_t [tek_sa_alarm_handle](#)
Handle type for an alarm definition.
- typedef uint32_t [tek_sa_method_handle](#)
Handle type for a method definition.
- typedef [TEK_SA_RESULT](#)(* [tek_sa_load_plugin_fn](#)) (struct [tek_sa_transformation_engine](#) *api, const struct [tek_sa_data_client_configuration](#) *plugin_configuration, struct [tek_sa_data_client_plugin](#) *plugin, struct [tek_sa_configuration](#) *tek_configuration)
Signature for the load plugin function.

Enumerations

- enum [tek_sa_variant_type](#) {
[TEK_SA_VARIANT_TYPE_NULL](#) = 0x0 , [TEK_SA_VARIANT_TYPE_BOOL](#) = 0x1 , [TEK_SA_VARIANT_TYPE_UINT8_T](#) = 0x2 , [TEK_SA_VARIANT_TYPE_INT8_T](#) = 0x3 ,
[TEK_SA_VARIANT_TYPE_UINT16_T](#) = 0x4 , [TEK_SA_VARIANT_TYPE_INT16_T](#) = 0x5 , [TEK_SA_VARIANT_TYPE_UINT32_T](#) = 0x6 , [TEK_SA_VARIANT_TYPE_INT32_T](#) = 0x7 ,
[TEK_SA_VARIANT_TYPE_UINT64_T](#) = 0x8 , [TEK_SA_VARIANT_TYPE_INT64_T](#) = 0x9 , [TEK_SA_VARIANT_TYPE_FLOAT](#) = 0xa , [TEK_SA_VARIANT_TYPE_DOUBLE](#) = 0xb ,
[TEK_SA_VARIANT_TYPE_DATETIME](#) = 0xc , [TEK_SA_VARIANT_TYPE_STRING](#) = 0xd , [TEK_SA_VARIANT_TYPE_GUID](#) = 0xe , [TEK_SA_VARIANT_TYPE_BYTE_STRING](#) = 0xf ,
[TEK_SA_VARIANT_TYPE_COMPLEX](#) = 0x20 , [TEK_SA_VARIANT_TYPE_FLAG_ARRAY](#) = 0x40 ,
[TEK_SA_VARIANT_TYPE_FLAG_MATRIX](#) = 0x80 }
The predefined types which can be processed in the TE.
- enum [tek_sa_field_attributes](#) { [TEK_SA_FIELD_ATTRIBUTES_WRITABLE](#) = 0x1 , [TEK_SA_FIELD_ATTRIBUTES_READABLE](#) = 0x2 , [TEK_SA_FIELD_ATTRIBUTES_SUBSCRIBABLE](#) = 0x4 }
Flags type which contains the attributes of a data client field.
- enum [tek_sa_log_level_t](#) {
[TEK_SA_LOG_LEVEL_TRACE](#) = 0x0 , [TEK_SA_LOG_LEVEL_DEBUG](#) = 0x1 , [TEK_SA_LOG_LEVEL_INFO](#) = 0x2 , [TEK_SA_LOG_LEVEL_WARNING](#) = 0x3 ,
[TEK_SA_LOG_LEVEL_ERROR](#) = 0x4 , [TEK_SA_LOG_LEVEL_CRITICAL](#) = 0x5 }
Definition of the possible logging levels which can be used in [tek_sa_transformation_engine::log](#).
- enum [tek_sa_threading_model](#) { [TEK_SA_THREADING_MODEL_SAME_THREAD](#) = 0x0 , [TEK_SA_THREADING_MODEL_S](#) = 0x1 , [TEK_SA_THREADING_MODEL_PARALLEL](#) = 0x2 }
Describes the threading model of a data client instance of a data client plugin.

StatusCodes

- `#define TEK_SA_ERR_SUCCESS 0`
An operation was completed successfully.
- `#define TEK_SA_ERR_NON_BLOCKING_IMPOSSIBLE 10`
A data client function was called in an asynchronous manner while the implementation can not use multiple threads.
- `#define TEK_SA_ERR_OUT_OF_MEMORY 11`
The data client or the Transformation Engine can not process a request because it has no more system resources.
- `#define TEK_SA_ERR_INVALID_PARAMETER 12`
The parameters passed to the function are invalid.
- `#define TEK_SA_ERR_RETRY_LATER 0xffffffff`
A data client function was called in an asynchronous manner while the number of inflight calls is already active.
- `#define TEK_SA_READ_RESULT_STATUS_OK 0`
A read operation completed successfully.
- `#define TEK_SA_READ_RESULT_STATUS_NOK 1`
A read operation failed.
- `#define TEK_SA_READ_RESULT_STATUS_TIMEOUT 2`
A read operation did not complete within the specified time limit.
- `#define TEK_SA_READ_RESULT_STATUS_INVALID_HANDLE 3`
The read operation failed because the passed field handle was invalid.
- `#define TEK_SA_BLOCK_TRANSFER_END_OF_FILE 26`
The read operation read until the end of file.
- `#define TEK_SA_BLOCK_TRANSFER_ABORT 24`
The block read or write operation should be stopped.
- `typedef int TEK_SA_RESULT`
The return value type of all interface functions (which need to return information about success of the operation).

10.1.1 Detailed Description

Definition of the interface between Data Clients (DC) and the Transformation Engine (TEK)

This header file conforms to the following standards:

- ISO/IEC 9899:1990 (C90)
- ISO/IEC 14882:1998 (C++98)

To ensure binary compatibility of the interface between different compilers and different versions of the interface, the struct offset of each struct member is verified at compile time. This check is realized by the `TEK_SA_VERIFY↵_STRUCT_OFFSET` macro.

Definition in file [south_api.h](#).

10.1.2 Macro Definition Documentation

10.1.2.1 TEK_SA_API_VERSION_MAJOR

```
#define TEK_SA_API_VERSION_MAJOR 0
```

Definition at line 19 of file [south_api.h](#).

10.1.2.2 TEK_SA_API_VERSION_MINOR

```
#define TEK_SA_API_VERSION_MINOR 1
```

Definition at line 20 of file [south_api.h](#).

10.1.2.3 TEK_SA_API_VERSION_PATCH

```
#define TEK_SA_API_VERSION_PATCH 0
```

Definition at line 21 of file [south_api.h](#).

10.1.2.4 TEK_SA_API_VERSION

```
#define TEK_SA_API_VERSION "0.1.0"
```

Definition at line 22 of file [south_api.h](#).

10.2 south_api.h

[Go to the documentation of this file.](#)

```
00001 #ifndef TEK_SOUTH_API_H
00002 #define TEK_SOUTH_API_H
00003
00019 #define TEK_SA_API_VERSION_MAJOR 0
00020 #define TEK_SA_API_VERSION_MINOR 1
00021 #define TEK_SA_API_VERSION_PATCH 0
00022 #define TEK_SA_API_VERSION "0.1.0"
00023
00024 #include <stdarg.h>
00025 #include <stdbool.h>
00026 #include <stddef.h>
00027 #include <stdint.h>
00028 #include <stdlib.h>
00029
00030 #define TEK_SA_STRUCT_ALIGN_SELECT(O32, O64) (sizeof(void*) == 8 ? O64 : O32)
00031
00032 #if defined __STDC_VERSION__ && __STDC_VERSION__ >= 201112L
00033 #include <assert.h>
00034 #define TEK_SA_VERIFY_STRUCT_OFFSET(S, M, O32, O64)
00035 ;
00036 _Static_assert(offsetof(struct S, M) == TEK_SA_STRUCT_ALIGN_SELECT(O32, O64), \
00037 "struct offset of field " #M " in " #S " must be correct")
00038 #else
00039 #define TEK_SA_VERIFY_STRUCT_OFFSET(S, M, O32, O64)
00040 ;
00041 enum {
```

```

00042     S##_M##_offset =
00043     1 / (int) (offsetof(struct S, M) == TEK_SA_STRUCT_ALIGN_SELECT(032, 064)) \
00044     };
00045 #endif
00046
00047 #ifdef __cplusplus
00048 extern "C" {
00049 #endif
00050
00235 typedef void* tek_sa_data_client_handle;
00236
00237 /*****
00238  * Configuration structures
00239  *****/
00240
00245 struct tek_sa_additional_file {
00247     char* name;
00248
00250     char* content;
00251 };
00252
00253 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_additional_file, name, 0, 0);
00254 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_additional_file, content, 4, 8);
00255
00260 struct tek_sa_data_client_configuration {
00262     char* config;
00263
00265     struct tek_sa_additional_file* additional_files;
00266
00268     uint32_t additional_files_count;
00269 };
00270
00271 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_data_client_configuration, config, 0, 0);
00272 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_data_client_configuration, additional_files, 4, 8);
00273 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_data_client_configuration, additional_files_count, 8, 16);
00274
00278 struct tek_sa_configuration {
00281     uint32_t request_timeout_ms;
00282 };
00283
00284 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_configuration, request_timeout_ms, 0, 0);
00285
00286 /*****
00287  * Built-in type definitions and variant
00288  *****/
00289
00298 typedef int64_t tek_sa_type_handle;
00299
00304 typedef int64_t tek_sa_type_handle_or_type_enum;
00305
00314 struct tek_sa_guid {
00316     uint32_t data1;
00317
00319     uint16_t data2;
00320
00322     uint16_t data3;
00323
00325     uint8_t data4[8];
00326 };
00327 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_guid, data1, 0, 0);
00328 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_guid, data2, 4, 4);
00329 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_guid, data3, 6, 6);
00330 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_guid, data4, 8, 8);
00331
00339 struct tek_sa_byte_string {
00341     int32_t length;
00342
00344     unsigned char* data;
00345 };
00346 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_byte_string, length, 0, 0);
00347 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_byte_string, data, 4, 8);
00348
00357 struct tek_sa_string {
00359     int32_t length;
00360
00362     unsigned char* data;
00363 };
00364 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_string, length, 0, 0);
00365 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_string, data, 4, 8);
00366
00373 typedef int64_t tek_sa_datetime;
00374
00382 struct tek_sa_complex_data {
00384     tek_sa_type_handle type;
00385
00392     uint32_t data_length;
00393

```

```

00400 unsigned char* data;
00401 };
00402 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_complex_data, type, 0, 0);
00403 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_complex_data, data_length, 8, 8);
00404 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_complex_data, data, 12, 16);
00405
00412 struct tek_sa_complex_data_array_item {
00420     uint32_t data_length;
00421
00427     unsigned char* data;
00428 };
00429 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_complex_data_array_item, data_length, 0, 0);
00430 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_complex_data_array_item, data, 4, 8);
00431
00438 struct tek_sa_complex_data_array {
00440     tek_sa_type_handle type;
00441
00443     uint32_t number_of_items;
00444
00447     struct tek_sa_complex_data_array_item* data;
00448 };
00449
00450 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_complex_data_array, type, 0, 0);
00451 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_complex_data_array, number_of_items, 8, 8);
00452 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_complex_data_array, data, 12, 16);
00453
00460 struct tek_sa_complex_data_matrix {
00462     tek_sa_type_handle type;
00463
00470     uint32_t dimension_length;
00471
00486     uint32_t* dimensions;
00487
00490     struct tek_sa_complex_data_array_item* data;
00491 };
00492 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_complex_data_matrix, type, 0, 0);
00493 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_complex_data_matrix, dimension_length, 8, 8);
00494 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_complex_data_matrix, dimensions, 12, 16);
00495 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_complex_data_matrix, data, 16, 24);
00496
00504 enum tek_sa_variant_type {
00506     TEK_SA_VARIANT_TYPE_NULL = 0x0,
00507
00509     TEK_SA_VARIANT_TYPE_BOOL = 0x1,
00510
00512     TEK_SA_VARIANT_TYPE_UINT8_T = 0x2,
00513
00515     TEK_SA_VARIANT_TYPE_INT8_T = 0x3,
00516
00518     TEK_SA_VARIANT_TYPE_UINT16_T = 0x4,
00519
00521     TEK_SA_VARIANT_TYPE_INT16_T = 0x5,
00522
00524     TEK_SA_VARIANT_TYPE_UINT32_T = 0x6,
00525
00527     TEK_SA_VARIANT_TYPE_INT32_T = 0x7,
00528
00530     TEK_SA_VARIANT_TYPE_UINT64_T = 0x8,
00531
00533     TEK_SA_VARIANT_TYPE_INT64_T = 0x9,
00534
00536     TEK_SA_VARIANT_TYPE_FLOAT = 0xa,
00537
00539     TEK_SA_VARIANT_TYPE_DOUBLE = 0xb,
00540
00542     TEK_SA_VARIANT_TYPE_DATETIME = 0xc,
00543
00545     TEK_SA_VARIANT_TYPE_STRING = 0xd,
00546
00548     TEK_SA_VARIANT_TYPE_GUID = 0xe,
00549
00551     TEK_SA_VARIANT_TYPE_BYTE_STRING = 0xf,
00552
00555     TEK_SA_VARIANT_TYPE_COMPLEX = 0x20,
00556
00559     TEK_SA_VARIANT_TYPE_FLAG_ARRAY = 0x40,
00560
00563     TEK_SA_VARIANT_TYPE_FLAG_MATRIX = 0x80
00564 };
00565
00568 struct tek_sa_variant_array {
00570     uint32_t length;
00571
00573     union {
00574         bool* b;
00575         uint8_t* ui8;
00576         int8_t* i8;

```

```

00577     uint16_t* ui16;
00578     int16_t* i16;
00579     uint32_t* ui32;
00580     int32_t* i32;
00581     uint64_t* ui64;
00582     int64_t* i64;
00583     float* f;
00584     double* d;
00585     tek_sa_datetime* dt;
00586     struct tek_sa_string* s;
00587     struct tek_sa_guid* guid;
00588     struct tek_sa_byte_string* bs;
00589 } data;
00590 };
00591 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_variant_array, length, 0, 0);
00592 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_variant_array, data, 4, 8);
00593
00596 struct tek_sa_variant_matrix {
00597     uint32_t dimension_length;
00598
00599     uint32_t* dimensions;
00613
00616     struct tek_sa_variant_array data;
00617 };
00618 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_variant_matrix, dimension_length, 0, 0);
00619 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_variant_matrix, dimensions, 4, 8);
00620
00623 struct tek_sa_variant {
00629     uint8_t type;
00630
00632     union {
00633         bool b;
00634         uint8_t ui8;
00635         int8_t i8;
00636         uint16_t ui16;
00637         int16_t i16;
00638         uint32_t ui32;
00639         int32_t i32;
00640         uint64_t ui64;
00641         int64_t i64;
00642         float f;
00643         double d;
00644         tek_sa_datetime dt;
00645         struct tek_sa_string s;
00646         struct tek_sa_guid guid;
00647         struct tek_sa_byte_string bs;
00648         struct tek_sa_variant_array array;
00649         struct tek_sa_variant_matrix matrix;
00650         struct tek_sa_complex_data complex;
00651         struct tek_sa_complex_data_array complex_array;
00652         struct tek_sa_complex_data_matrix complex_matrix;
00653     } data;
00654 };
00655 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_variant, type, 0, 0);
00656 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_variant, data, 8, 8);
00657
00659 typedef struct tek_sa_variant tek_sa_field_value;
00660
00661 /*****
00662  * Type definitions from data client to TEK
00663  *****/
00664
00668 struct tek_sa_struct_field_type_definition {
00670     char* name;
00671
00673     tek_sa_type_handle_or_type_enum type;
00674 };
00675 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_struct_field_type_definition, name, 0, 0);
00676 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_struct_field_type_definition, type, 8, 8);
00677
00681 struct tek_sa_struct_definition {
00683     char* name;
00684
00686     struct tek_sa_struct_field_type_definition* items;
00687
00689     uint32_t item_count;
00690 };
00691 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_struct_definition, name, 0, 0);
00692 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_struct_definition, items, 4, 8);
00693 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_struct_definition, item_count, 8, 16);
00694
00699 struct tek_sa_enum_item_definition {
00701     char* name;
00702
00704     int32_t value;
00705 };
00706 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_enum_item_definition, name, 0, 0);

```



```

00707 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_enum_item_definition, value, 4, 8);
00708
00712 struct tek_sa_enum_definition {
00714     char* name;
00715
00717     struct tek_sa_enum_item_definition* items;
00718
00720     uint32_t item_count;
00721 };
00722 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_enum_definition, name, 0, 0);
00723 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_enum_definition, items, 4, 8);
00724 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_enum_definition, item_count, 8, 16);
00725
00731 struct tek_sa_method_argument_description {
00733     char const* name;
00734
00736     enum tek_sa_variant_type type;
00737 };
00738 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_method_argument_description, name, 0, 0);
00739 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_method_argument_description, type, 4, 8);
00740
00741 /*****
00742  * Handles and structures for data exchange
00743  *****/
00744
00746 enum tek_sa_field_attributes {
00748     TEK_SA_FIELD_ATTRIBUTES_WRITABLE = 0x1,
00749
00751     TEK_SA_FIELD_ATTRIBUTES_READABLE = 0x2,
00752
00754     TEK_SA_FIELD_ATTRIBUTES_SUBSCRIBABLE = 0x4,
00755 };
00756
00758 typedef uint32_t tek_sa_field_handle;
00759
00761 typedef uint32_t tek_sa_event_handle;
00762
00764 typedef uint32_t tek_sa_alarm_handle;
00765
00767 typedef uint32_t tek_sa_method_handle;
00768
00780 typedef int TEK_SA_RESULT;
00781
00783 #define TEK_SA_ERR_SUCCESS 0
00784
00794 #define TEK_SA_ERR_NON_BLOCKING_IMPOSSIBLE 10
00795
00800 #define TEK_SA_ERR_OUT_OF_MEMORY 11
00801
00803 #define TEK_SA_ERR_INVALID_PARAMETER 12
00804
00815 #define TEK_SA_ERR_RETRY_LATER 0xffffffff
00816
00818 #define TEK_SA_READ_RESULT_STATUS_OK 0
00819
00821 #define TEK_SA_READ_RESULT_STATUS_NOK 1
00822
00824 #define TEK_SA_READ_RESULT_STATUS_TIMEOUT 2
00825
00828 #define TEK_SA_READ_RESULT_STATUS_INVALID_HANDLE 3
00829
00836 #define TEK_SA_BLOCK_TRANSFER_END_OF_FILE 26
00837
00845 #define TEK_SA_BLOCK_TRANSFER_ABORT 24
00851 #define TEK_SA_ERR_UNSPECIFIED 1000
00852
00853 /*****
00854  * Request and response structures
00855  *****/
00856
00858 struct tek_sa_field_write_request {
00861     tek_sa_field_handle handle;
00862
00864     tek_sa_field_value value;
00865 };
00866 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_field_write_request, handle, 0, 0);
00867 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_field_write_request, value, 8, 8);
00868
00870 struct tek_sa_write_result {
00872     TEK_SA_RESULT status;
00873
00875     tek_sa_field_handle handle;
00876 };
00877 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_write_result, status, 0, 0);
00878 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_write_result, handle, 4, 4);
00879
00882 struct tek_sa_read_result {

```

```

00884     TEK_SA_RESULT status;
00885
00887     tek_sa_field_handle handle;
00888
00895     tek_sa_field_value value;
00896 };
00897 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_read_result, status, 0, 0);
00898 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_read_result, handle, 4, 4);
00899 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_read_result, value, 8, 8);
00900
00902 struct tek_sa_event_parameter {
00904     char const* name;
00905
00907     tek_sa_field_value value;
00908 };
00909 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_event_parameter, name, 0, 0);
00910 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_event_parameter, value, 8, 8);
00911
00914 struct tek_sa_dc_event {
00921     tek_sa_datetime timestamp;
00922
00937     int16_t severity;
00938
00945     tek_sa_event_handle event_type;
00946
00953     tek_sa_field_handle source;
00954
00956     uint32_t number_of_parameters;
00957
00959     struct tek_sa_event_parameter* parameters;
00960 };
00961 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_dc_event, timestamp, 0, 0);
00962 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_dc_event, severity, 8, 8);
00963 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_dc_event, event_type, 12, 12);
00964 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_dc_event, source, 16, 16);
00965 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_dc_event, number_of_parameters, 20, 20);
00966 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_dc_event, parameters, 24, 24);
00967
00972 enum tek_sa_log_level_t {
00973     TEK_SA_LOG_LEVEL_TRACE = 0x0,
00974     TEK_SA_LOG_LEVEL_DEBUG = 0x1,
00975     TEK_SA_LOG_LEVEL_INFO = 0x2,
00976     TEK_SA_LOG_LEVEL_WARNING = 0x3,
00977     TEK_SA_LOG_LEVEL_ERROR = 0x4,
00978     TEK_SA_LOG_LEVEL_CRITICAL = 0x5,
00979 };
00980
00987 /*****
00988  * Data client capabilities
00989  *****/
00990
00995 enum tek_sa_threading_model {
01000     TEK_SA_THREADING_MODEL_SAME_THREAD = 0x0,
01001
01006     TEK_SA_THREADING_MODEL_SEQUENTIAL = 0x1,
01007
01014     TEK_SA_THREADING_MODEL_PARALLEL = 0x2,
01015 };
01016
01025 struct tek_sa_data_client_capabilities {
01035     uint32_t number_of_inflight_calls;
01036
01041     enum tek_sa_threading_model threading_model;
01042 };
01043 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_data_client_capabilities, number_of_inflight_calls, 0, 0);
01044 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_data_client_capabilities, threading_model, 4, 4);
01045
01051 struct tek_sa_data_client {
01069     TEK_SA_RESULT (*register_features)(tek_sa_data_client_handle dc);
01070
01083     TEK_SA_RESULT (*connect)(tek_sa_data_client_handle dc);
01084
01090     void (*free)(tek_sa_data_client_handle dc);
01091
01188     TEK_SA_RESULT (*read_fields)(tek_sa_data_client_handle dc,
01189                                 uint64_t request_id,
01190                                 const tek_sa_field_handle items_to_read[],
01191                                 uint32_t number_of_items,
01192                                 bool do_not_block);
01193
01212     TEK_SA_RESULT (*write_fields)(tek_sa_data_client_handle dc,
01213                                   uint64_t request_id,
01214                                   const struct tek_sa_field_write_request items_to_write[],
01215                                   uint32_t number_of_items,
01216                                   bool do_not_block);
01217
01239     TEK_SA_RESULT (*block_read)(const tek_sa_data_client_handle dc,

```

```

01240         uint64_t request_id,
01241         const char* filepath,
01242         uint64_t offset,
01243         int64_t length,
01244         bool do_not_block,
01245         int64_t* filesize);
01246
01266 TEK_SA_RESULT (*block_write)(const tek_sa_data_client_handle dc,
01267                               uint64_t request_id,
01268                               const char* filepath,
01269                               uint64_t offset,
01270                               int64_t length,
01271                               bool do_not_block);
01272
01290 TEK_SA_RESULT (*subscribe)(tek_sa_data_client_handle dc,
01291                             const tek_sa_field_handle items_to_subscribe[],
01292                             uint32_t number_of_items);
01293
01304 TEK_SA_RESULT (*unsubscribe)(tek_sa_data_client_handle dc,
01305                              const tek_sa_field_handle items_to_unsubscribe[],
01306                              uint32_t number_of_items);
01307
01331 TEK_SA_RESULT (*invoke)(const tek_sa_data_client_handle dc,
01332                          const tek_sa_method_handle method,
01333                          uint64_t request_id,
01334                          const tek_sa_field_value parameters[],
01335                          const uint32_t number_of_parameters);
01336
01352 TEK_SA_RESULT (*acknowledge_alarm)(tek_sa_data_client_handle dc, const tek_sa_alarm_handle alarm);
01353
01363 tek_sa_data_client_handle handle;
01364
01366 };
01367 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_data_client, register_features, 0, 0);
01368 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_data_client, connect, 4, 8);
01369 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_data_client, free, 8, 16);
01370 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_data_client, read_fields, 12, 24);
01371 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_data_client, write_fields, 16, 32);
01372 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_data_client, block_read, 20, 40);
01373 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_data_client, block_write, 24, 48);
01374 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_data_client, subscribe, 28, 56);
01375 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_data_client, unsubscribe, 32, 64);
01376 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_data_client, invoke, 36, 72);
01377 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_data_client, acknowledge_alarm, 40, 80);
01378 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_data_client, handle, 44, 88);
01379
01387 struct tek_sa_data_client_plugin {
01392     void* plugin_context;
01393
01410     TEK_SA_RESULT (*data_client_new)(void* plugin_context,
01411                                      const struct tek_sa_data_client_configuration* config,
01412                                      struct tek_sa_data_client* created_client,
01413                                      struct tek_sa_data_client_capabilities* capabilities);
01414
01418     void (*free_context)(void* plugin_context);
01419 };
01420 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_data_client_plugin, plugin_context, 0, 0);
01421 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_data_client_plugin, data_client_new, 4, 8);
01422 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_data_client_plugin, free_context, 8, 16);
01423
01434 struct tek_sa_transformation_engine {
01452     TEK_SA_RESULT (*register_field)(tek_sa_data_client_handle dc,
01453                                    const char* name,
01454                                    enum tek_sa_field_attributes attributes,
01455                                    enum tek_sa_variant_type type,
01456                                    tek_sa_field_handle* new_field_handle);
01457
01475     TEK_SA_RESULT (*register_method)(tek_sa_data_client_handle dc,
01476                                     const char* name,
01477                                     struct tek_sa_method_argument_description input_parameter[],
01478                                     uint32_t number_of_input_parameters,
01479                                     struct tek_sa_method_argument_description output_parameter[],
01480                                     uint32_t number_of_output_parameters,
01481                                     tek_sa_method_handle* new_method_handle);
01482
01498     TEK_SA_RESULT (*register_event)(tek_sa_data_client_handle dc,
01499                                    const char* name,
01500                                    tek_sa_event_handle* new_event_handle);
01501
01517     TEK_SA_RESULT (*register_alarm)(tek_sa_data_client_handle dc,
01518                                    const char* name,
01519                                    const int16_t severity,
01520                                    const tek_sa_field_handle source,
01521                                    tek_sa_alarm_handle* new_alarm_handle);
01522
01541     TEK_SA_RESULT (*register_enum_type)(tek_sa_data_client_handle dc,
01542                                         struct tek_sa_enum_definition const* type_definition,

```

```

01543         tek_sa_type_handle* new_type_handle);
01544
01555     TEK_SA_RESULT (*register_struct_type)(tek_sa_data_client_handle dc,
01556         struct tek_sa_struct_definition const* type_definition,
01557         tek_sa_type_handle* new_type_handle);
01558
01575     TEK_SA_RESULT (*post_event)(tek_sa_data_client_handle dc, struct tek_sa_dc_event const* event);
01576
01588     TEK_SA_RESULT (*set_alarm)(tek_sa_data_client_handle dc, const tek_sa_alarm_handle alarm);
01589
01598     TEK_SA_RESULT (*reset_alarm)(tek_sa_data_client_handle dc, const tek_sa_alarm_handle alarm);
01599
01624     TEK_SA_RESULT (*log)(tek_sa_data_client_handle source,
01625         enum tek_sa_log_level_t lvl,
01626         const char* format,
01627         va_list args);
01628
01642     tek_sa_event_handle (*get_global_event)(const char* name);
01643
01651     TEK_SA_RESULT (*update_capabilities)(tek_sa_data_client_handle dc,
01652         struct tek_sa_data_client_capabilities const* capabilities);
01653
01673     TEK_SA_RESULT (*read_progress)(tek_sa_data_client_handle dc,
01674         uint64_t request_id,
01675         uint64_t progress);
01676
01698     TEK_SA_RESULT (*read_result)(tek_sa_data_client_handle dc,
01699         uint64_t request_id,
01700         TEK_SA_RESULT result,
01701         const struct tek_sa_read_result results[],
01702         uint32_t number_of_results);
01703
01711     TEK_SA_RESULT (*notify_change)(tek_sa_data_client_handle dc,
01712         const struct tek_sa_read_result changes[],
01713         uint32_t number_of_changes);
01714
01725     TEK_SA_RESULT (*write_result)(tek_sa_data_client_handle dc,
01726         uint64_t request_id,
01727         TEK_SA_RESULT result,
01728         const struct tek_sa_write_result results[],
01729         uint32_t number_of_results);
01730
01742     TEK_SA_RESULT (*call_method_result)(tek_sa_data_client_handle dc,
01743         uint64_t request_id,
01744         TEK_SA_RESULT result,
01745         const tek_sa_field_value results[],
01746         uint32_t number_of_results);
01747
01764     TEK_SA_RESULT (*block_read_data)(tek_sa_data_client_handle dc,
01765         uint64_t request_id,
01766         TEK_SA_RESULT result,
01767         unsigned char buffer[],
01768         uint32_t buffer_length);
01769
01784     TEK_SA_RESULT (*block_write_data)(tek_sa_data_client_handle dc,
01785         uint64_t request_id,
01786         unsigned char buffer[],
01787         uint32_t buffer_length,
01788         uint32_t* bytes_written);
01789
01798     TEK_SA_RESULT (*block_write_result)(tek_sa_data_client_handle dc,
01799         uint64_t request_id,
01800         TEK_SA_RESULT result);
01801
01803 };
01804 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_transformation_engine, register_field, 0, 0);
01805 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_transformation_engine, register_method, 4, 8);
01806 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_transformation_engine, register_event, 8, 16);
01807 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_transformation_engine, register_alarm, 12, 24);
01808 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_transformation_engine, register_enum_type, 16, 32);
01809 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_transformation_engine, register_struct_type, 20, 40);
01810 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_transformation_engine, post_event, 24, 48);
01811 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_transformation_engine, set_alarm, 28, 56);
01812 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_transformation_engine, reset_alarm, 32, 64);
01813 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_transformation_engine, log, 36, 72);
01814 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_transformation_engine, get_global_event, 40, 80);
01815 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_transformation_engine, update_capabilities, 44, 88);
01816 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_transformation_engine, read_progress, 48, 96);
01817 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_transformation_engine, read_result, 52, 104);
01818 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_transformation_engine, notify_change, 56, 112);
01819 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_transformation_engine, write_result, 60, 120);
01820 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_transformation_engine, call_method_result, 64, 128);
01821 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_transformation_engine, block_read_data, 68, 136);
01822 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_transformation_engine, block_write_data, 72, 144);
01823 TEK_SA_VERIFY_STRUCT_OFFSET(tek_sa_transformation_engine, block_write_result, 76, 152);
01824
01840 typedef TEK_SA_RESULT (*tek_sa_load_plugin_fn) (

```

```
01841     struct tek_sa_transformation_engine* api,
01842     const struct tek_sa_data_client_configuration* plugin_configuration,
01843     struct tek_sa_data_client_plugin* plugin,
01844     struct tek_sa_configuration* tek_configuration);
01845
01846 #ifdef TEK_SA_DATA_CLIENT_IMPL
01847
01848 #ifdef _WIN32
01849 #define TEK_SA_API_EXPORT __declspec(dllexport) __stdcall
01850 #else
01851 #define TEK_SA_API_EXPORT __attribute__((__visibility__("default")))
01852 #endif
01853
01854 TEK_SA_RESULT TEK_SA_API_EXPORT
01855 load_plugin(struct tek_sa_transformation_engine* api,
01856            const struct tek_sa_data_client_configuration* plugin_configuration,
01857            struct tek_sa_data_client_plugin* plugin,
01858            struct tek_sa_configuration* tek_configuration);
01859
01860 #endif
01861
01862 #ifdef __cplusplus
01863 }
01864 #endif
01865
01866 #undef TEK_SA_STRUCT_ALIGN_SELECT
01867 #undef TEK_SA_VERIFY_STRUCT_OFFSET
01868
01869 #endif /* TEK_SOUTH_API_H */
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