DCN 22-19-005-00-0003

LB4-Section 7 Revised Structure

1. Data Specification
   1. SCOS Messaging

The communication between each of the entities defined above can be grouped and defined within the main service categories, which are:

* SD Association to SM: Associate, Association Refresh, Disassociate, Capabilities Advertisement
* Task Scheduler: Task Insert, Task Query
* Data Distribution: Publish
* SCOS Control: SCOS Client Authenticate
  + 1. Message Encoding

SCOS messages are encoded in JavaScript Object Notation (JSON). JSON is a language-independent data-interchange format that is easy for humans to read and write. There are code and functions readily available in C, C++, C#, Java, JavaScript, MATLAB, Perl, and Python for parsing and generating JSON. It is a lightweight alternative to XML, commonly used to transmit data between server and browser application.

Each message begins with a header comprised of attribute-value pairs in ASCII characters.

If an attribute is not relevant to the sensor implementation, then the value is set to NaN or "NaN".

The following are specific formatting rules to be followed:

* All timestamps, i.e., t (defined above)and t1 (to be defined in Data message description) will be reported as seconds since 1/1/1970 midnight UTC in the UTC time zone (Unix Time).
* String values must only contain URL unreserved characters (i.e., uppercase and lowercase letters, decimal digits, hyphen, period, underscore, and tilde), and
* Field names cannot start with an underscore because that convention is reserved for internal implementation-specific uses.

Each message (in general) will begin with a header as shown in the following table.

Table 14 - SCOS Message Header Definition

|  |  |  |
| --- | --- | --- |
| Parameter | R/O/C | Description |
| NAME: version  DATA TYPE: String | Required | IEEE 802.22.3 SCOS protocol version.  The maximum length is 64 octets. |
| NAME: scosmode  DATA TYPE: Integer | Required | The mode for SCOS system, as defined in Annex E: SCOS Operational Modes. |
| NAME: scosmethod DATA TYPE: String | Required | The SCOS method in the context of the communication. The scaos methods are listed in the message descriptions.  The maximum length is 64 octets. |
| NAME: msgtype DATA TYPE: Integer | Required | The valid message types are request and response. (1=Request, 2=Response 3= Notification 4=AdminCmd 5=AdminCmdResponse) |
| NAME: timestamp  DATA TYPE: Time | Required | Timestamp associated with the communication.. |

The following are specific formatting rules to be followed to avoid problems when messages are ingested into MSOD: (1) All timestamps, i.e., t (defined above)and t1 (to be defined in Data message description) will be reported as seconds since 1/1/1970 midnight UTC in the UTC time zone. (2) String values must only contain URL unreserved characters (i.e., uppercase and lowercase letters, decimal digits, hyphen, period, underscore, and tilde), and (3) Field names cannot start with an underscore because that convention is reserved for MSOD internal use.

* + 1. Message Transport protocols

The SCOS standard is transport-agnostic. The standard defines requirements for the transport protocol. The implementers may choose appropriate transport protocol that meets these requirements and suits to the use-case.

* 1. Data Objects

Where complex data needs to be stored or exchanged within messages, it shall be structured in a Data Object.

* + 1. “SD Association Object”.

Table 15 – SD Association Object Definition enumerates parameters for an SD to associate with the SCOS system.

Table 15 – SD Association Object Definition

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | R/O/C | Description | |
| NAME: SMID  DATA TYPE: String | Required | Unique ID for the Sensing Manager.  The maximum length of the ID string is 64 octets. | |
| NAME: SMSID  DATA TYPE: String | Required | Unique ID for the SMS.  The maximum length of the ID string is 64 octets. | |
| NAME: SCOSOperator  DATA TYPE: String | Required | The registered name of the SCOS operator.  The maximum length of the ID string is 64 octets. | |
| NAME: SMURL  DATA TYPE: String | Required | The URL for reaching the SM.  The maximum length of the ID string is 256 octets. | |
| NAME: SMCertFile  DATA TYPE: String | Required | The path of the SM certificate file.  The maximum length of the ID string is 256 octets. | |
| NAME: SMKeyFile  DATA TYPE: String | Required | The name of the SM certificate file.  The maximum length of the ID string is 256 octets. | |
| NAME: SMCAFile  DATA TYPE: String | Required | The name of the trusted certificate authority.  The maximum length of the ID string is 256 octets. | |
| Parameter | R/O/C | Description |
| NAME: SMID  DATA TYPE: String | Required | Unique ID for the Sensing Manager.  The maximum length of the ID string is 64 octets. |
| NAME: SDID  DATA TYPE: String | Required | Unique ID for the SD.  The maximum length of the ID string is 64 octets. |
| NAME: SCOSOperator  DATA TYPE: String | Required | The registered name of the SCOS operator.  The maximum length of the ID string is 64 octets. |
| NAME: SMURL  DATA TYPE: String | Required | The URL for reaching the SM.  The maximum length of the ID string is 256 octets. |
| NAME: SMCertFile  DATA TYPE: String | Required | The path of the SM certificate file.  The maximum length of the ID string is 256 octets. |
| NAME: SMKeyFile  DATA TYPE: String | Required | The name of the SM certificate file.  The maximum length of the ID string is 256 octets. |
| NAME: SMCAFile  DATA TYPE: String | Required | The name of the trusted certificate authority.  The maximum length of the ID string is 256 octets. |

* + 1. SM Identity Object

The following table enumerates sensing manager identity parameters to allow authentication and associating with the rest of the SCOS System entities.

Table 16 – SM Identity Object Definition

|  |  |  |
| --- | --- | --- |
| Parameter | R/O/C | Description |
| NAME: SMID  DATA TYPE: String | Required | Unique ID for the Sensing Manager.  The maximum length of the ID string is 64 octets. |
| NAME: SMSID  DATA TYPE: String | Required | Unique ID for the SM.  The maximum length of the ID string is 64 octets. |
| NAME: SCOSOperator  DATA TYPE: String | Required | The registered name of the SCOS operator.  The maximum length of the ID string is 64 octets. |
| NAME: SMURL  DATA TYPE: String | Required | The URL for reaching to the SM.  The maximum length of the ID string is 256 octets. |
| NAME: SMCertFile  DATA TYPE: String | Required | The path of the SM certificate file.  The maximum length of the ID string is 256 octets. |
| NAME: SMKeyFile  DATA TYPE: String | Required | The name of the SM certificate file.  The maximum length of the ID string is 256 octets. |
| NAME: SMCAFile  DATA TYPE: String | Required | The name of the trusted certificate authority.  The maximum length of the ID string is 256 octets. |

* + 1. Sensing Task Object

Table 17 - Sensing Task Object Definition enumerates the parameter definition object for scan task. The Sensing Scan Task Object is sent from the SM to the SD to be inserted into its task schedule, if accepted by the SD (that is, where the SD returns an “accepted” acknowledgement as per the sdScanTaskInsertResponse object. The Task Schedule Service must store all Sensing Scan Task Objects locally on the SD such that it can continue executing the task schedule even after system restarts. The Sensing Scan Task Object is stored on the SD as per the task request it receives and accepts, with the additional fields defined in Table 18, Sensing Scan Task Object Extended Definition, itemizing execution time and success parameters.

On completion of a task defined in the Scan Task Object, the Sensing Scan Task Extended Object fields are updated, and the object is stored locally on the SD. This object is only deleted on the SD after the SCOS Operator’s retention period elapses.

Table 17 - Sensing Task Object Definition

|  |  |  |
| --- | --- | --- |
| Parameter | R/O/C | Description |
| NAME: SCOSClientID DATA TYPE: string | Required | The unique ID assigned to the SCOS Client requesting task insertion.  The maximum length is 64 octets. |
| NAME: SDID DATA TYPE: string | Conditional | The unique ID assigned to the sensing device. The SDID field is only populated after the SM has accepted the task insert request from the SCOS Client and allocatred against the appropriate SD. The maximum length is 64 octets. |
| NAME: TaskID  DATA TYPE: String | Required | Unique ID for the Spectrum Scan.  The maximum length of the ID string is 64 octets. |
| NAME: lowFreq DATA TYPE: Integer | Required | The low frequency of a frequency interval. |
| NAME: highFreq  DATA TYPE: Integer | Required | The high frequency of a frequency interval. |
| NAME: scanResolution DATA TYPE: Integer | Conditional | The requested frequency resolution for the scan. |
| NAME: TaskDuration  DATA TYPE: Number | Conditional | Duration of scan in milliseconds, if not defined or 0, task duration determined by SD scanning subsystem. |
| NAME: TaskStartTime  DATA TYPE: Time | Optional | The start time for the task. |
| NAME: TaskRepeatInterval  DATA TYPE: Number | Optional | The interval in seconds after which the task needs to be repeated. |
| NAME: TaskRepeatCount  DATA TYPE: Number | Optional | The number of times the task needs to be repeated. |
| NAME: TaskEndTime  DATA TYPE: Time | Conditional | The end time for the task. If repeatInterval and repeatCount are specified, TaskEndTime is not required. |
| NAME: TaskStartTimeAttribute  DATA TYPE: Integer | Optional | Currently following task attributes can be specified.  0 = Exact time.  1 = Nearest time. |
| NAME: SDDetectionAlgorithm  DATA TYPE: String | Required | Specifies the algorithm to be used in Task, as described in . |
| NAME: TaskOptions  DATA TYPE: Integer | Optional | Custom options. This would typically include parameters for Custom Scan Algorithm |

Table 18 - Sensing Task Object Extended Definition

|  |  |  |
| --- | --- | --- |
| NAME: TaskExecuteTimeStart  DATA TYPE: Time | Required | Specifies the datetime a task was started on the SD |
| NAME: TaskExecuteTimeEnd  DATA TYPE: Time | Required | Specifies the datetime a task was ended on the SD (whether completed or not). In the case of repeated tasks, gives the most recent task completion end time. In the case of tasks still in progress, time of status request. |
| NAME: TaskEndStatus  DATA TYPE: String | Required | Provides the task completion status code  CompNoErr: Complete, no errors  CompWErr: Complete, with errors (non-fatal)  IncompNoErr: Incomplete, no error code  IncompWError: Incomplete, with error code (error code appended without space as per Scan Task Status Code in Table 19) |
|  |  |  |

Table 19 - Scan Task Status Code Definition

|  |  |  |
| --- | --- | --- |
| NAME: TaskStatusCode  DATA TYPE: String | Conditional | Completion status error code for tasks  • InProgress (task still in progress)  • Aborted (abort instruction sent)  • ScanTimeout (internal timeout)  • ScanInvalidParameters (internal error)  • SystemFail (SD power fail, etc) |

The following algorithms can be specified. At least once algorithm model needs to be supported by SD. Support for GenericEnergyDetection is normative. The standard allows development of advanced algorithms.

Table 20 - SD Detection Algorithm Options

|  |  |
| --- | --- |
| **Scan Algorithm** | **Description** |
| GenericEnergyDetection | Normative |
| CyclicFeatureDetection | Optional |
| CustomScanAlgorithm | Optional |

It is the responsibility of the SCOS Administrator to publish algorithm definitions externally. The implementation does not need to be publicly accessible. Where these algorithms are non-proprietary, the metadata should include explicit links to repositories providing algorithm details, sample code and definition, on open access sites such as GitHub.

* + 1. Sensing Data Object

Table 21 describes the sensingData JSON object created by the SD after executing a scan (whether successful or not) and trasnitting to the SM, and from the SM to Data Consumer via the Data Distribution Services.

Table 21 - Sensing Data Object Definition

|  |  |  |
| --- | --- | --- |
| Parameter | R/O/C | Description |
| NAME: dataFormat DATA TYPE: Integer | Required | The format of the output data as specified in B.3.27.2. |
| NAME: sizeData  DATA TYPE: Integer | Required | The number of measurements. |
| NAME: measData  DATA TYPE: Array of Complex | Required | The complex measurement values. The size of the array is defined by sizeData. |
| NAME: envInfo DATA TYPE: JSON Object | Required | A JSON object containing the environmental data including location, temperature, and humidity as described in B.3.8 |