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LB4-Section 5 Revised Structure

1. Sensing Device Operational System Requirements

The Sensing Device can operate either as a slave device to the Sensing Manager (i.e. it performs scans on instruction), or it can operate semi-autonomously (i.e. it manages a schedule of scans that it periodically synchronizes with the Sensing Manager), or completely autonomously (i.e. it performs a set of pre-configured scans and reports data to a pre-configured Data Consumer endpiont). This is defined by the particular mode of operation described in Annex D “Operating Modes”. The SD can have the capability to change between Operating Modes.

To enable the full set of functionalities, the following operational capabilities must be supported. Lightweight or simpler modes of operation would support a subset of these as required by their Operation Mode.

* SD Association: the SD shall have the capability to advertise itself to an SM to allow association with it, including secure authentication with the SM and setup of a secure transport layer method.
* Capabilities Advertisement: The SD shall have a system to itemize and expose its capabilities to the SM during the activation process, or when queried by the SM.
* Sensing Task Management: the SD shall be able to receive tasking instructions, and execute on them:
  + Task Scheduler: The SD shall have an onboard task scheduling capability to receive and make decisions about tasks, communicate if the tasks are accepted/rejected, provide status reports on tasks, and locally store its task schedule. The Task Scheduler is passed the key parameters of a sensing task as per the task parameter definitions in Annex B.1.3 through the Task Scheduler Service.
  + Sensing Task Execution: the SD shall have a capability to execute defined sensing tasks itemized in the scheduler, and be able to communicate the status of these tasks back to the SM. The Task Execution function is not defined in this standard as it is implementation specific.
* Data Distribution: the SD shall take sensing data, prepare it and transmit it to the SM for distribution to Data Consumer endpoints:
  + Data Packager: The SD shall have a capability to package sensed data with relevant metadata into a format suitable for transmission. The format of the data and metadata shall be as per the data exchange definition as defined in Annex B.1.3: Sensing Related Metadata specification. The Data Packager is not defined in this standard as it is implementation specific.
  + Data Transfer: The SD shall have a capability to transfer the data packages to the SM using the Data Distribution Service.
  1. SD Association Service
     1. SD Association Service Functions

The SD Association service shall use any suitable secure transport layer and authentication mechanism to establish identity and enter a trusted state to exchange messages with an SM. It shall store the association information as per the “SCOS Association Object”.

Should the SD require dis-association, it shall be able to send a disassociation message to allow the SM to remove its advertised capabilities from its resource inventory.

* + 1. SD Association Service: Interface Requirements

The authentication mechanism specification falls outside the scope of this standard as being implementation specific, but should allow for the exchange of messages as specified in Section 7.3.1 “SD-SM Association Messages”. Informative requirements for security mechanisms for authentication are given in appendix C: Security Systems C.2

Table 1 describes the sdAssociateRequest JSON object.

Table 1 - SD Association Request Object Definition

|  |  |  |
| --- | --- | --- |
| Parameter | R/O/C | Description |
| NAME: SDName DATA TYPE: string | Required | The name of the sensing device registered with SCOS operator.  The maximum length is 64 octets. |
| NAME: SCOSOperator DATA TYPE: string | Required | The name of the SCOS operator.  The maximum length is 64 octets. |
| NAME: SDType DATA TYPE: Integer | Required | The type of the sensing device. (1=SDFull, 2=SDProxy) |
| NAME: SDID DATA TYPE: string | Conditional | The unique ID assigned to the sensing device. If ID is not pre-assigned, this is left empty. The maximum length is 64 octets. |
| NAME: SDCertFile  DATA TYPE: String | Conditional | The path of the SD certificate file.  The maximum length of the ID string is 256 octets. |
| NAME: SDKeyFile  DATA TYPE: String | Conditional | The name of the SD certificate file.  The maximum length of the ID string is 256 octets. |
| NAME: SDCAFile  DATA TYPE: String | Conditional | The name of the trusted certificate authority.  The maximum length of the ID string is 256 octets. |

Table 2 describes the sdAssociateResponse JSON object.

Table 2 - SD Associate Response Object Definition

|  |  |  |
| --- | --- | --- |
| Parameter | R/O/C | Description |
| NAME: SDName DATA TYPE: string | Required | The name of the sensing device registered with SCOS operator.  The maximum length is 64 octets. |
| NAME: associateResponseHash DATA TYPE: string | Required | The response code for association, unique per association (hash of SMID, SDID, Unix DateTime of request). |
| NAME: SDID DATA TYPE: string | Required | The unique ID assigned to the sensing device. The maximum length is 64 octets. |
| NAME: associateResponseCode DATA TYPE: string | Required | Association request response  - OK (association granted)  - Refused\_unknownSD (SM does not recognize SDID)  - Refused\_invalidcert (SM does not accept certificate)  - Refused\_unknown (unknown error) |
| NAME: heartbeatInterval DATA TYPE: Integer | Required | Heartbeat interval in seconds. |
| NAME: sdAssociationObject  DATA TYPE: JSON Object | Required | Object containing records of association as defined in Section 7, Table 15 – SD Association Object Definition |

If the SD is required to disconnect from its associated SM, it will transmit a disassociation message sxDissasociationRequest (e.g. if it is rebooting or about to go into an offline mode).

Table 3 describes the sdDisassociateRequest JSON object from SD to SM.

Table 3 - SD Disassociate Request Object

|  |  |  |
| --- | --- | --- |
| Parameter | R/O/C | Description |
| NAME: SDID  DATA TYPE: string | Required | The ID assigned to SD by the SCOS operator.  The maximum length is 64 octets. |
| NAME: SDName DATA TYPE: string | Required | The name of the sensing device registered with SCOS operator.  The maximum length is 64 octets. |
| NAME: associateResponse DATA TYPE: string | Required | The response code for association that was sent in initial associate request/response. |
| NAME: SCOSOperator DATA TYPE: string | Required | The name of the SCOS operator.  The maximum length is 64 octets. |

Table 4 describes the sdDisassociateResponse JSON object from SM to SD.

Table 4 - SD Disassociate Response Object

|  |  |  |
| --- | --- | --- |
| Parameter | R/O/C | Description |
| NAME: SDName  DATA TYPE: string | Required | The name of the SD registered with SCOS operator.  The maximum length is 64 octets. |
| NAME: SCOSOperator DATA TYPE: string | Required | The name of the SCOS operator.  The maximum length is 64 octets. |
| NAME: status  DATA TYPE: string | Required | The response code for dissociation request.  - OK (disassociation successful)  - NotAssociated (disassociation requested where no association exists) |
| NAME: oldSDID  DATA TYPE: string | Required | The SD ID that has been dissociated  The maximum length is 64 octets. |

* 1. SD Capabilities Advertisement Service
     1. SD Capabilities Advertisement Service: Functions

The SD shall advertise its capabilities to the SM when requested, both as part of the association and discovery process, and during regular resource update queries from the SM. This requires the SD to operate a data store which itemizes its capabilities as per the metadata specification in Annex B.

* + 1. SD Capabilities Advertisement Service: Interfaces

This interface shall exchange messages on association to SM (or association refresh) wherew the SD sends a capabilities inventory as a response to the sdAssociateResponse or sdAssociateRefresh.

Table 5 describes the sdCapabilityResponse JSON object sent by the SD to SM.

Table 5 - SD Capability Response Object Definition

|  |  |  |
| --- | --- | --- |
| Parameter | R/O/C | Description |
| NAME: SDID  DATA TYPE: string | Required | The name of the SD registered with SCOS operator.  The maximum length is 64 octets. |
| NAME: sdCapabilityInfo DATA TYPE: JSON Object | Conditional | Object describing SD capability (class B SD metadata) as described in Annex B. |

* 1. SD Task Scheduler Service
     1. SD Task Scheduler Service: Functions

The SD shall operate a task scheduler consisting of a local data store which itemizes currently scheduled tasks as per the objects defined in Sensing Scan Task Object Definition

* + 1. SD Task Scheduler Service: Interfaces

The Task Scheduler service shall be able to receive and process tasks as defined by the SD-SM Scan Message Exchange objects (Section 7.3.1.3), and insert them into its internal scheduler for execution by the Task Execution Service.

Table 6 describes the sxScanTaskInsert JSON object from SM to SD.

Table 6 – SD and SM Scan Task Insert Message Object

|  |  |  |
| --- | --- | --- |
| 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: sensingTaskObject DATA TYPE: JSON Object | Required | Object defining all necessary scan task parameters defined in Table 17 - Sensing Task Object Definition |

Table 7 describes the sxScanTaskInsertResponse JSON object from SD to SM.

Table 7 – SD and SM Scan Task Insert Response Message Object

|  |  |  |
| --- | --- | --- |
| Parameter | R/O/C | Description |
| NAME: SDID DATA TYPE: string | Required | The unique ID assigned to the sensing device. 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: taskInsertStatus DATA TYPE: String | Required | Status code for Task Insert Request  Accepted  RejectedInvalidParams – invalid scan definition  RejectedInvalidTime – invalid time requested  RejectedNoAvailability – Requested scan   exceeds available scan resources  RejectedNoCapability – Requested scan   exceeds available scan system capabilities |
| NAME: timestamp DATA TYPE: Time | Required | Timestamp of the associated status output. |

A scan task status request can be sent from the SM, based on a scheduled event or on a request from the SCOS Client to the SM. The SM would send a sdScanTaskQuery. The request from the SCOS Client to the SM would be the identical sxScanTaskQuery message.

Table 8 describes the sxScanTaskStatusQuery JSON object from SD to SM.

Table 8 – Scan Task Status Query Message Object

|  |  |  |
| --- | --- | --- |
| Parameter | R/O/C | Description |
| NAME: SDID DATA TYPE: string | Required | The unique ID assigned to the sensing device. 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: timestamp DATA TYPE: Time | Required | Timestamp of the originating query trigger (time of request by the SM, or time the sxScanTaskQuery was sent by the querying SCOS Client). |

Table 9 describes the sxScanTaskCompletionStatus JSON object from SD to SM.

Table 9 – Scan Task Completion Status Message Object

|  |  |  |
| --- | --- | --- |
| Parameter | R/O/C | Description |
| NAME: SDID DATA TYPE: string | Required | The unique ID assigned to the sensing device. 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: sensingTaskObject  DATA TYPE: JSON Object | Required | JSON object containing Sensing Task Object and Sensing Task Object Extended as defined in Table 17 and Table 18. |
| NAME: timestamp DATA TYPE: Time | Required | Timestamp of the associated status output. |

* 1. SD Data Distribution Service
     1. SD Data Distribution Service: Functions

The SD Data Distribution Service shall, on completion of a scan task (whether successful or not) transfer the available scan data plus associated metadata provided to it by the Data Packager service.

* + 1. SD Data Distribution Service: Interfaces

The SD Data Distribution service shall provide the packaged scan data according to the SD Publish Sensing Data Objects

Table 10 describes the sxPublishSensingData JSON object from SD to SM, and from SM to Data Consumer.

Table 10 - SD Publish Sensing Data Message

|  |  |  |
| --- | --- | --- |
| Parameter | R/O/C | Description |
| NAME: SDID DATA TYPE: string | Required | The unique ID assigned to the sensing device. 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: SCOSClientID  DATA TYPE: String | Required | Unique ID for the SCOSClient requesting the scan task.  The maximum length of the ID string is 64 octets. |
| NAME: publishTimestamp DATA TYPE: Time | Required | Timestamp of the time of data publish. |
| NAME: sensingTaskObject  DATA TYPE: JSON Object | Required | JSON object containing Sensing Task Object Extended as defined in Table 17 and Table 18. |
| NAME: sensingDataObject  DATA TYPE: JSON Object | Required | sensingData object of sensing measurements as per Table 21. |