DCN **22-18-0036-00-0003**

1. Sensing Device
   1. Sensing Device System Requirements

* SD Activation: the SD shall have the capability to advertise itself to an SM to allow association with it, including secure authentication with the SM.
* 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 Scheduler: The SD shall have an onboard task scheduling capability to receive and make decisions about tasks, and communicate if the tasks are accepted/rejected, and locally store this schedule. The Task Scheduler is passed the key parameters of a sensing task as per the task parameter definitions in Annex B.1.3.
* 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 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
* Data Transfer: The SD shall have a capability to transfer the data packages to the SM Data Distribution Service.
  + 1. SD Activation Service
       1. SD Activation Service Functions

The SD Activation service shall use any suitable authentication mechanism to establish identity and enter a trusted state to exchange messages through an association with an SM. It shall store the association information as per the objects in “SCOS Association Metadata”.

Table 2 enumerates sensing manager parameters toward associating with SCOS.

Table 2 SM Parameter 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 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. |

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 Activation 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 XXXX “SD-SM Association Messages”.

Table 3 describes the sdAssociateRequest JSON object.

Table 3 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: SDMode DATA TYPE: Integer | Required | The mode in which sensing device operates. (1=online, 2=offline) |
| 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 4 describes the sdAssociateResponse JSON object.

Table 4 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: response DATA TYPE: string | Required | The response code for association. |
| NAME: SDID DATA TYPE: string | Required | The unique ID assigned to the sensing device. The maximum length is 64 octets. |
| NAME: heartbeatInterval DATA TYPE: Integer | Required | Heartbeat interval in seconds. |

Disassociation shall happen on exchange of appropriate messages defined in SD-SM Disassociation Message Exchange ~~(current 5.4.1.5)~~.

Table 5 describes the sdDisassociateRequest JSON object from SD to SM.

Table 5 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: SCOSOperator DATA TYPE: string | Required | The name of the SCOS operator.  The maximum length is 64 octets. |

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

Table 6 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. |
| 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 query from SM by exchanging messages as defined in “SD-SM Capabilities Exchange Messages”.

Table 7 describes the sdCapabilityRequest JSON object sent by the SM to SD.

Table 7 SD Capability Request Object Definition

|  |  |  |
| --- | --- | --- |
| 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: sendBaseCapability DATA TYPE: boolean | Conditional | True or False. If false, base capability information is not required. |
| NAME: freqIntervals DATA TYPE: Array of freqInterval | Conditional | Array of freqInterval objects. Each freqInterval object denotes a frequency range as defined in Table 14. |
| NAME: timeIntervals DATA TYPE: Array of timeRange | Conditional | Array of timeInterval objects. Each timeInterval object denotes a time range as defined in Table 15 |
| NAME: scanPeriodicity DATA TYPE: Integer | Conditional | Supported scanPeriodicity interval. The periodicity interval is expressed in number of seconds. |

Table 8 describes the freqInterval JSON object sent by the SM to SD.

Table 8 SCOS Frequency Interval Object Definition

|  |  |  |
| --- | --- | --- |
| Parameter | R/O/C | Description |
| 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. |

Table 9 describes the timeInterval JSON object sent by the SM to SD.

Table 9 SCOS Time Interval Definition Object

|  |  |  |
| --- | --- | --- |
| Parameter | R/O/C | Description |
| NAME: startTime DATA TYPE: Time | Required | The start of a time interval. |
| NAME: endTime  DATA TYPE: Time | Required | The end of a time interval. |

Table 10 SCOS Time Datatype Definition Object

|  |  |  |
| --- | --- | --- |
| Parameter | R/O/C | Description |
| NAME: time  DATA TYPE: String | Required | UTC time expressed in the format YYYY-MM-DDThh:mm:ssZ as defined by [1] |

Table 11 describes the sdCapabilityResponse JSON object sent by the SD to SM.

Table 11 SD Capability Response Object Defiintion

|  |  |  |
| --- | --- | --- |
| 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: sdCapabilityInfo | Conditional | Object describing SD capability (class B SD metadata) as described in Annex B. |
| NAME: freqIntervals DATA TYPE: Array of freqInterval | Conditional | Array of freqInterval objects. Each freqInterval object denotes a frequency range as defined in Table 14. |
| NAME: timeIntervals DATA TYPE: Array of timeRange | Conditional | Array of timeInterval objects. Each timeInterval object denotes a time range as defined in Table 15 |
| NAME: scanPeriodicity DATA TYPE: Integer | Conditional | Supported scanPeriodicity interval. The periodicity interval is expressed in number of seconds. |

* + 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

Table 12 enumerates the parameter definition object for scanTask.

Table 12 Sensing Scan Task Object Definition

|  |  |  |
| --- | --- | --- |
| Parameter | R/O/C | Description |
| NAME: TaskID  DATA TYPE: String | Required | Unique ID for the Spectrum Scan.  The maximum length of the ID string is 64 octets. |
| NAME: TaskDuration  DATA TYPE: number | Required | Duration of scan in milliseconds. |
| NAME: TaskStartTime  DATA TYPE: Time | Required | 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.  The maximum length of the ID string is 64 octets. |
| NAME: TaskEndTime  DATA TYPE: Time | Conditional | The end time for the task. If repeatInterval and repeatCount are specified, TaskEndTime is not required. |
| NAME: TaskAttributes  DATA TYPE: Integer | Optional | Currently following task attributes can be specified.  0 = Exact time.  1 = Nearest time. |
| NAME: TaskOptions  DATA TYPE: Integer | Optional | Custom options. |

* + - 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 ~~(current 5.4.1.3~~), and insert them into its internal scheduler for execution by the Task Execution Service.

Table 13 describes the sdScanRequest JSON object from SM to SD.

Table 13 SD Scan Request 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: freqIntervals DATA TYPE: Array of freqInterval | Conditional | Array of freqInterval objects. Each freqInterval object denotes a frequency range as defined in Table 14. |
| NAME: scanResolution DATA TYPE: Integer | Conditional | The suggested frequency resolution for the scan. |
| NAME: TaskDuration  DATA TYPE: number | Required | Duration of scan in milliseconds. |
| NAME: TaskStartTime  DATA TYPE: Time | Required | 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 | Optional | The end time for the task. |

Table 14 describes the sdScanResponse JSON object from SD to SM.

Table 14 SD Scan 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: scanStatus DATA TYPE: Array of Integer | Required | Array provides scan output status code for each of the freqIntervals. The status code is one of the response codes from Table. The freqIntervals should match with the freqIntervals from the request message. |
| NAME: timestamp DATA TYPE: Time | Required | Timestamp with the associated scanning output. |
| NAME: scanData  DATA TYPE: Array of scanData objects | Required | Array of scanData objects. Each object represents SD measurements for the freqInterval. The scanData is defined in B.3.27.2 |
| NAME: envInfo DATA TYPE: environMetadata | Required | The environmental data including location, temperature, and humidity as described in B.3.8 |

Table 15 describes the scanData JSON object sent by the SM to SD.

Table 15 SD Scan Data Message Definition Object

|  |  |  |
| --- | --- | --- |
| 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. |

* + 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 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 16 describes the sdPublishRequest JSON object from SD to DM.

Table 16 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: scanStatus DATA TYPE: Array of Integer | Required | Array provides scan output status code for each of the freqIntervals. The status code is one of the response codes from Table. The freqIntervals should match with the freqIntervals from the request message. |
| NAME: timestamp DATA TYPE: Time | Required | Timestamp with the associated scanning output. |
| NAME: scanData  DATA TYPE: Array of scanData objects | Required | Array of scanData objects. Each object represents SD measurements for the freqInterval. The scanData is defined in B.3.27.2 |
| NAME: envInfo DATA TYPE: environMetadata | Required | The environmental data including location, temperature, and humidity as described in B.3.8 |

Table 17 describes the scanData JSON objects from SD to DM.

Table 17 SD ScanData 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. |

Table 18 describes the sdPublishResponse JSON object from SM to SD.

Table 18 SD Publish Sensing Data Response 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: status DATA TYPE: Array of Integer | Required | Each entry shows status for the publish request of the scanning data for each of the freqIntervals. |
| NAME: timestamp DATA TYPE: Time | Required | Timestamp for the associated scanning data that DM is acknowledging. |