# Software Design Specification

## Node Provisioning Information Type Registry (QR code, Z/IP Gateway, SmartStart)

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|---|---|
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| **Description:** | Provisioning Information Types to be specified in QR codes or delivered by provisioning applications. |
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|---|---|---|---|---|
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# REVISION RECORD

| Doc. Rev | Date | By | Pages affected | Brief description of changes |
|---|---|---|---|---|
| 1 | 20170509 | ABR | ALL | First revision |
| 2 | 20170531 | ABR | Some | Added Max Inclusion Request Interval |
| 3 | 20170622 | NOBRIOT | 3.1.1 and 3.1.2 | Added Information types form the Provisioning List Command Class and list of information Type formats<br>Added types 102 to 105 |
| 3 | 20170626 | ABR | Some | Changed representation of elective/critical flag from MS bit to LS bit |
| 3 | 20170628 | NOBRIOT | 3.1.1<br>3.1.2<br><br>3.1.2.7 | Re-formatted TLV Block format section<br>Updated the field description for the Type/Critical flags<br>Removed the table summary<br>Updated the Status type Passive value description |
| 4 | 20170927 | NOBRIOT | Table 1<br>3.1.2.7 | Updated the TLV list<br>Updated the Passive SmartStart inclusion setting description |
| 5 | 20180110 | NOBRIOT | <br>3.1.2.7 &<br>3.1.2.10<br>3.1.2.4 | Integrated approved content from Open Review 2017D:<br><ul><li>Split Status TLV into Network Status (previously NodeID) TLV and SmartStart inclusion setting TLV</li><li>Added a new UUID16 presentation value</li></ul> |
| 6 | 20180305 | BBR | All | Added Silicon Labs template |
| 7 | 20180502 | NOBRIOT | References | Cleaned-up the reference list |
| 8 | 20200101 | NOBRIOT | 1 | Added the TLV abbreviation |
| 9 | 20200701 | NOBRIOT | 3.1.2.5 & 3.1.2.6 | Relaxed the requirement saying that Name and Location MUST be together. |

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# 1 ABBREVIATIONS

| Abbreviation | Explanation |
|---|---|
| TLV | Type Length Value |

# 2 INTRODUCTION

This document specifies Smart Start Provisioning Information data types which may be pushed to a Smart Start gateway.

Data may be specified in a QR code during production or by a higher-layer application during provisioning of nodes.

These values are to be used with the Node Provisioning Command Class [2] or in SmartStart QR Codes [1].

## 2.1 Terms used in this document

The key words "MUST", "MUST NOT", "REQUIRED", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document MUST be interpreted as described in IETF RFC 2119 [3].

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# 3   REQUIREMENTS

## 3.1   Smart Start Provisioning Information Types

### 3.1.1   TLV Block Format

Each TLV (Type-Length-Value) block MUST be parsed according to the following format:

| 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|
| Type | | | | | | | Critical |
| Length | | | | | | | |
| Value 1 (Optional) | | | | | | | |
| … | | | | | | | |
| Value N (Optional) | | | | | | | |

**Type (7 bits)**

This field is used to advertise the type of the data contained in the corresponding TLV Block.

Values in the range 0..49 MAY be carried in a QR code by an actual product.
Values in the range 50..127 MUST NOT be carried in a QR code by an actual product

This field MUST comply with Table 1.

**Critical (1 bit)**

This field is used to advertise the criticality of the Information Type.

The value '0' MUST indicate that the value is Elective.
The value '1' MUST indicate that the value is Critical.

A receiving node MUST discard and ignore the entire provisioning list command if this flag is set to '1' and the Type field advertises a value that the receiving node does not support.

If this flag is set to '0' and the Type field advertises a value that the receiving node does not support, the actual Information Type MUST be ignored and left out the provisioning list entry.
A receiving node MUST continue processing the encapsulation command after a discarded Information Type.

**Table 1, Provisioning List TLV Block:: Type encoding**

| Type Identifier (7 bits) | Type name | Criticality | Length | Default Value |
|---|---|---|---|---|
| 0x00 (0) | ProductType | 0 (Elective) | 4 bytes | N/A |
| 0x01 (1) | ProductId | 0 (Elective) | 8 bytes | N/A |
| 0x02 (2) | MaxInclusion RequestInterval | 0 (Elective) | 1 byte | N/A |
| 0x03 (3) | UUID16 | 0 (Elective) | 17 bytes | N/A |
| 0x04..0x31 (4..49) | *Reserved for QR code compatible provisioning information types* | | | |
| 0x32 (50) | Name | 0 (Elective) | 0..62 bytes | N/A |
| 0x33 (51) | Location | 0 (Elective) | 0..62 bytes | N/A |
| 0x34 (52) | SmartStart Inclusion Setting | 1 (Critical) | 1 byte | Pending |
| 0x35 (53) | Advanced Joining | 1 (Critical) | 1 byte | N/A |
| 0x36 (54) | Bootstrapping Mode | 1 (Critical) | 1 byte | Smart Start |
| 0x37 (55) | Network Status | 0 (Elective) | 2 bytes | N/A |

All other values are reserved and MUST NOT be used by a sending node. Reserved values MUST be ignored by a receiving node.

**Length (8 bits)**

This field MUST indicate the length of the corresponding Value field in bytes.
If used in a QR Code, this field MUST indicate the number of decimal digits used to advertise the corresponding value

**Value (N bytes)**

This field MUST indicate the value of the provisioning information type being advertised in the TLV block.

The length of this field (in bytes) MUST be according to the corresponding Length field value .This field MUST be omitted if the corresponding Length field is set to 0.

If carried on a QR Code, the number of decimal digits of this field MUST be according to the corresponding Length field value .This field MUST be omitted if the corresponding Length field is set to 0.

The encoding of this field MUST be interpreted based on Type field value as defined in 3.1.2 List of defined Provisioning Information Types.

### 3.1.2  List of defined Provisioning Information Types

### 3.1.2.1  ProductType Information Type

This Information Type is used to advertise the product type data of a supporting node.

| 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|
| Type = 0x00 (ProductType) | | | | | | | Critical=0 |
| Length = 0x04 | | | | | | | |
| Generic Device Class | | | | | | | |
| Specific Device Class | | | | | | | |
| Installer Icon Type 1 (MSB) | | | | | | | |
| Installer Icon Type 2 (LSB) | | | | | | | |

**Type (7 bits)**

The Type field set to 0x00 MUST indicate that the Information Type carries the product type information related to the node.

**Critical (1 bits)**

This field MUST be set to 0.

**Length (8 bits)**

This field MUST be set to 0x04.

**Generic Device Class and Specific Device Class (16 bits)**

These fields MUST carry the Generic Device Class and the Specific Device Class advertised in the node's NIF.

For a detailed description of all available Generic Device Classes, refer to [4] for Z-Wave nodes and [5] for Z-Wave Plus nodes.

**Installer Icon Type (16 bits)**

This field MUST carry the Specific Device Class advertised by the node's Root Device Z-Wave Plus Info Report Command.

Refer to [6] for the defined Icon Type.

### 3.1.2.2          ProductId Information Type

This Information Type is used to advertise the product identifying data of a supporting node.

| 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|
| Type = 0x01 (ProductID) | | | | | | | Critical=0 |
| Length = 0x08 | | | | | | | |
| Manufacturer ID 1 | | | | | | | |
| Manufacturer ID 2 | | | | | | | |
| Product Type 1 | | | | | | | |
| Product Type 2 | | | | | | | |
| Product ID 1 | | | | | | | |
| Product ID 2 | | | | | | | |
| Application Version | | | | | | | |
| Application Sub Version | | | | | | | |

**Type (7 bits)**

The Type field set to 0x01 MUST indicate that the Information Type carries the product ID information related to the node.

**Critical (1 bit)**

This field MUST be set to 0.

**Length (8 bits)**

This field MUST be set to 0x08.

**Manufacturer ID (16 bits)**

This field MUST carry the Manufacturer ID advertised by the node in the Manufacturer Specific Report Command (Manufacturer Specific Command Class).

Refer to [7] for the defined Manufacturer ID values.

**Product Type (16 bits)**

This field MUST carry the Product Type ID advertised by the node in the Manufacturer Specific Report Command (Manufacturer Specific Command Class).

**Product ID (16 bits)**

This field MUST carry the Product ID advertised by the node in the Manufacturer Specific Report Command (Manufacturer Specific Command Class).

**Application Version and Application Sub Version (16 bits)**

These fields MUST carry the Application Version (Firmware 0 Version) and Application Sub Version (Firmware 0 Sub Version) advertised by the node in the Version Report Command (Version Command Class).

### 3.1.2.3 MaxInclusion RequestInterval Information Type

This Information Type is used to advertise if a power constrained Smart Start node will issue inclusion request at a higher interval value than the default 512 seconds.

| 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|
| Type = 0x02 (MaxInclusion RequestInterval) | | | | | | | Critical=0 |
| Length = 0x01 | | | | | | | |
| Interval | | | | | | | |

**Type (7 bits)**

The Type field set to 0x02 MUST indicate that the Information Type carries the Smart Start inclusion request interval used by the node.

**Critical (1 bit)**

This field MUST be set to 0.

**Length (8 bits)**

This field MUST be set to 0x01.

**Interval (8 bits)**

This field is used to advertise the Smart Start inclusion request interval used by the node.

The value MUST be represented in the unit of 128 seconds.
The value MUST be encoded as an unsigned integer in the range 5..99; corresponding to a range of 640..12672 seconds.

### 3.1.2.4          UUID16 Information Type

#### 3.1.2.4.1          Interoperability considerations

Z Wave SmartStart node provisioning information may include a UUID field, carrying 16 bytes of manufacturer-defined information; unique for a given product. The field reflects the UUID information stored physically in the NVR memory of the product's Z-Wave chip.

Z-Wave UUIDs are not limited to the UUID format defined by RFC4122 but may also be presented as ASCII characters and a relevant prefix.

This Information Type is used to advertise a product's unique identity.

| 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|
| Type = 0x03 (UUID16) | | | | | | | Critical=0 |
| Length = 0x11 | | | | | | | |
| Presentation Format | | | | | | | |
| UUID16 1 | | | | | | | |
| ... | | | | | | | |
| UUID16 16 | | | | | | | |

**Type (7 bits)**

The Type field set to 0x03 MUST indicate that the Information Type carries the UUID assigned to the node.

**Critical (1 bit)**

This field MUST be set to 0.

**Length (8 bits)**

This field MUST be set to 0x11.

**Presentation Format (8 bits)**

This field is used to specify the format that a UI MUST use for presenting the node's UUID.

**Table 2, UUID Presentation Format encoding**

| Value | Description |
|-------|-------------|
| 0 | 32 hex digits, no delimiters |
| 1 | 16 ASCII chars, no delimiters |
| 2 | "sn:" followed by 32 hex digits, no delimiters. |
| 3 | "sn:" followed by 16 ASCII chars, no delimiters |
| 4 | "UUID:" followed by 32 hex digits, no delimiters. |
| 5 | "UUID:" followed by 16 ASCII chars, no delimiters |
| 6 | RFC4122 compliant presentation<br>(e.g. "58D5E212-165B-4CA0-909B-C86B9CEE0111") |

All other values are reserved and MUST NOT be used by a sending node. Values reserved for future use MUST be in the range 0..99.

A UI MUST map reserved encoding identifiers to identifier 0 (32 hex digits).

### UUID16 (16 bytes)

This field is used to advertise the UUID assigned to the node.

This field SHOULD carry an UUID as defined by IETF RFC 4122. For device identification purposes, a controller MUST evaluate the combination of the Product ID field and this field to ensure a unique identification.

### 3.1.2.5          Name Information Type

This Information Type is used to advertise the name assigned to a supporting node.

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| 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|
| Type = 0x32 (Name) | | | | | | | Critical=0 |
| Length | | | | | | | |
| Name 1 | | | | | | | |
| … | | | | | | | |
| Name N | | | | | | | |

**Type (7 bits)**

The Type field set to 0x32 MUST indicate that the Information Type carries the name assigned to the node.

**Critical (1 bit)**

This field MUST be set to 0.

**Length (8 bits)**

This field MUST indicate the length of the Name field in bytes.
This field MUST be in the range 0..62. The combined Name and Location strings MUST NOT be longer than 62 bytes.

**Name (N bytes)**

This field is used to advertise the name assigned to the node.

This field MUST be encoded according to the Name field of the Z/IP Name and Location Command Class, version 1.

**3.1.2.6        Location Information Type**

This Information Type is used to advertise the location assigned to a supporting node.

| 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|
| | | Type = 0x33 (Location) | | | | | Critical=0 |
| | | | Length | | | | |
| | | | Location 1 | | | | |
| | | | … | | | | |
| | | | Location N | | | | |

**Type (7 bits)**

The Type field set to 0x33 MUST indicate that the Information Type carries the location assigned to the node.

**Critical (1 bit)**

This field MUST be set to 0.

**Length (8 bits)**

This field MUST indicate the length of the Location field in bytes.
This field MUST be in the range 0..62. The combined Name and Location strings MUST NOT be longer than 62 bytes.

**Location (N bytes)**

This field is used to advertise the location assigned to the node.

This field MUST be encoded according to the Location field of the Z/IP Name and Location Command Class, version 1.

### 3.1.2.7 SmartStart Inclusion Setting Information Type

This Information Type is used to advertise the SmartStart Inclusion Setting of the Provisioning List entry.

| 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|
| Type = 0x34 (SmartStart Inclusion Setting) | | | | | | | Critical=1 |
| Length = 0x01 | | | | | | | |
| SmartStart Inclusion Setting | | | | | | | |

**Type (7 bits)**

The Type field set to 0x34 MUST indicate that the Information Type carries the Provisioning List entry SmartStart Inclusion Setting.

**Critical (1 bit)**

This field MUST be set to 1.

**Length (8 bits)**

This field MUST be set to 0x01.

**SmartStart Inclusion Setting (8 bits)**

This field MUST indicate the Inclusion Setting of the Provisioning List entry. It is used by a controller to decide if it must listen and/or include a node in a network when receiving SmartStart Inclusion Requests. This field MUST comply with Table 3.

**Table 3, Provisioning List SmartStart Inclusion Setting Information Type::SmartStart Inclusion Setting encoding**

| Value | SmartStart Inclusion Setting | Description |
|-------|------------------------------|-------------|
| 0x00 | Pending | The node will be added in the network when it issues SmartStart inclusion requests. |
| 0x02 | Passive | The node is in the Provisioning List but it has been decided by the supporting or controlling node that the node is unlikely to issue SmartStart inclusion requests in the near future. <br><br> SmartStart Inclusion requests will be ignored by the Z/IP Gateway. <br><br> All entries with this status MUST be updated to the "Pending" status when a Provisioning List Iteration Get Command is received. |
| 0x03 | Ignored | SmartStart inclusion requests sent by the node in the Provisioning List entry will be ignored until the status is changed again by a Z/IP Client or controlling node. |

All other values are reserved and MUST NOT be used by a sending node. Reserved values MUST be ignored by a receiving node.

### 3.1.2.8 Advanced Joining Information Type

This Information Type is used to advertise the Security keys to grant during S2 bootstrapping to a SmartStart node in the Provisioning List.

If this Information Type is used the joining node MUST NOT be granted other keys than specified in Granted Keys at the next Security bootstrapping attempt following a SmartStart inclusion.

This TLV MUST NOT be used if the joining node is included with classic inclusion and MUST be used only for SmartStart inclusions.

| 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|
| Type = 0x35 (Advanced Joining) | | | | | | | Critical=1 |
| Length = 0x01 | | | | | | | |
| Keys to be granted | | | | | | | |

**Type (7 bits)**

The Type field set to 0x35 MUST indicate that the Information Type carries the Security keys to grant during S2 bootstrapping to the Provisioning List entry.

**Critical (1 bit)**

This field MUST be set to 1.

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**Length (8 bits)**

This field MUST be set to 0x01.

**Keys to be granted (8 bits)**

This field is used to indicate which network keys MUST be granted during bootstrapping.
This field MUST be treated as a bitmask and comply with Table 4

**Table 4, Provisioning List Advanced Joining Information::Keys to be granted encoding**

| Bit | Description |
|-----|-------------|
| 0 | Indicates the Unauthenticated Security Class Key |
| 1 | Indicates the Authenticated Security Class Key |
| 2 | Indicates the Access Control Security Class Key |
| 7 | Indicates the Security 0 Network Key |

All other values are reserved and MUST NOT be used by a sending node. Reserved values MUST be ignored by a receiving node.
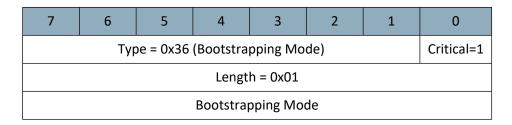
A bit is set to '1' MUST indicate that the corresponding Security key MUST be granted.
A bit is set to '0' MUST indicate that the corresponding Security key MUST NOT be granted.

If some keys to be granted are not requested by a joining node, a supporting node SHOULD grant the intersection between the keys specified in this field and the actual requested keys.

A supporting node SHOULD ignore this field if there is no intersection between the keys to be granted indicated in this field and the keys requested by the joining node. In this case, the supporting node SHOULD grant the all requested keys to the joining node.

### 3.1.2.9      Bootstrapping Mode Information Type

This Information Type is used to advertise the bootstrapping mode to use when including the node advertised in Provisioning List entry.

| 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|
| Type = 0x36 (Bootstrapping Mode) | | | | | | | Critical=1 |
| Length = 0x01 | | | | | | | |
| Bootstrapping Mode | | | | | | | |

**Type (7 bits)**

The Type field set to 0x36 MUST indicate that the Information Type carries the bootstrapping mode to use when including the node advertised in Provisioning List entry.

**Critical (1 bit)**

This field MUST be set to 1.

**Length (8 bits)**

This field MUST be set to 0x01.

**Bootstrapping Mode (8 bits)**

This field is used to indicate which bootstrapping mode MUST be used when including the node advertised in the current Provisioning List Entry.

This field MUST comply with Table 5.

<p align="center"><strong>Table 5, Bootstrapping Mode Information Type::Bootstrapping mode encoding</strong></p>

| Value | Bootstrapping Mode | Description |
|---|---|---|
| 0x00 | Security 2 | The node MUST manually be set to Learn Mode and follow the S2 bootstrapping instructions (if any). |
| 0x01 | Smart Start | The node will be included and S2 bootstrapped automatically using the Smart Start functionality. |

All other values are reserved and MUST NOT be used by a sending node. Reserved values MUST be ignored by a receiving node.

### 3.1.2.10      Network Status Information Type

This Information Type is used to advertise if the Provisioning List entry is in the network and its assigned NodeID.

| 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|
| Type = 0x37 (Network status) | | | | | | | Critical=0 |
| Length = 0x02 | | | | | | | |
| Assigned NodeID | | | | | | | |
| Network status | | | | | | | |

**Type (7 bits)**

The Type field set to 0x37 MUST indicate that the Information Type carries the Provisioning List entry Network status and assigned NodeID.

**Critical (1 bit)**

This field MUST be set to 0.

**Length (8 bits)**

This field MUST be set to 0x02.

**Assigned NodeID (8 bits)**

This field MUST indicate the NodeID that has been granted or reserved to the Provisioning List entry during network inclusion.
The value 0 MUST indicate that the NodeID is not assigned or unknown.

A controlling node should be aware that this information MAY be inaccurate if e.g. a node has subsequently been removed by another controller or using classic remove operation where the removed node could not be identified.

**Network Status (8 bits)**

This field MUST indicate the network status of the Provisioning List entry. This field MUST comply with Table 6.

**Table 6, Provisioning List Network Status Information Type::Network Status encoding**

| Value | Network Status | Description |
|-------|----------------|-------------|
| 0x00 | Not in network | The node in the Provisioning List is not currently included in the network. |
| 0x01 | Included | The node in the Provisioning List is included in the network and is functional. |
| 0x02 | Failing | The node in the Provisioning List has been included in the Z-Wave network but is now marked as failing. (e.g. communication fails or it has not woken up for longer than expected.) |

All other values are reserved and MUST NOT be used by a sending node. Reserved values MUST be ignored by a receiving node.

# REFERENCES

[1]     Silicon Labs, SDS13937, Node Provisioning QR Code Format (S2, Smart Start)

[2]     Silicon Labs, SDS13784, Z-Wave Network-Protocol Command Class Specification.

[3]     IETF RFC 2119, Key words for use in RFCs to Indicate Requirement Levels, http://tools.ietf.org/pdf/rfc2119.pdf

[4]     Silicon Labs, SDS10242, Z-Wave Device Class Specification.

[5]     Silicon Labs, SDS11847, Z-Wave Plus Device Types Specification.

[6]     Silicon Labs, SDS13738, Z-Wave Plus Assigned Icon Types.

[7]     Silicon Labs, SDS13425. Z-Wave Plus Assigned Manufacturer IDs.