# Application Note

## Z-Wave Multi Channel Basics

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| **Document No.:** | APL12955 |
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| **Description:** | Easy-reading introduction to Device Type and Command Class specification text on Multi Channel functionality<br><br>This doc introduces basic Multi Channel functionality. Association and Lifeline is introduced in APL12956. |
| **Written By:** | ABR;BBR |
| **Date:** | 2018-03-06 |
| **Reviewed By:** | ABR;JFR;NTJ;BBR;CRASMUSSEN;MKIDMOSE |
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| Approved by: | | | | |
|---|---|---|---|---|
| Date | CET | Initials | Name | Justification |
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SILICON LABS

## REVISION RECORD

| Doc. Rev | Date | By | Pages affected | Brief description of changes |
|---|---|---|---|---|
| 1 | 20140515 | ABR | ALL | First revision |
| 2 | 20141118 | ABR | Some | Simplified and clarified existing text.<br>Introduced Aggregated End Points.<br>Adjusted doc to reflect Multi Channel CC v4 |
| 3 | 20150625 | ABR | Some | Clarification that gateways do not need to advertise Multi Channel support<br>Clarification that controlling-only devices do not need End Point structuring |
| 4 | 20180306 | BBR | All | Added Silicon Labs template |

# Z-WAVE MULTI CHANNEL BASICS

Z-Wave enables a variety of monitoring and control applications. Sensors can send data to a gateway. Wall controllers may report button presses to a scene controller or control actuators directly. A Z-Wave node is conceptually an application resource in a plastic box communicating via a Z-Wave radio. Composite devices pack multiple application resources in the same plastic box, thus sharing the same Z-Wave radio. Application resources can always be addressed individually.
This is made possible by a range of Command Class and Device Type specifications.

Within a network, a Z-Wave node is identified by its NodeID. The NodeID essentially represents the plastic box and the radio.
Multi-resource devices are organized as Multi Channel Endpoints. Each application resource is identified by its own unique End Point. The plastic box itself is referred to as the Root Device.
Multi Channel Encapsulation allows a sending node to specify a source End Point and a destination End Point. Further, the destination End Point may be structured as a multicast mask, targeting up to 7 End Points by one command.

If a device implements no actuator functionality, it may not always be necessary to structure resources as Multi Channel End Points.
A multi-sensor with two distinct sensor types is one example. Another example is a remote control that sends Central Scene Notifications to a central gateway via the Lifeline association group. The remote control may advertise additional association groups, each representing a push button for direct actuator control. Without an icon type for each End Point, a graphical management tool has to render such input elements graphically based on the AGI Profile, e.g. Control:Key01.

Wall controllers, that only transmit commands, represent a gray zone. A remote control manufacturer may consider the wall controller to be just a remote control in a different form factor. This manufacturer sees no value in End Points.
A manufacturer of wall switches with built-in dimmers may consider the wall controller to be a downscaled wall switch where the load controlling hardware is omitted. This manufacturer may prefer to apply the same End Point structure to similar products for development and support reasons.

Multi Channel Encapsulation is used for transmission from one End Point to another, from an End Point to a Root Device as well as from a Root Device to an End Point.

In case of similar sensor types in the same device, End Points are needed to distinguish the sensor reports from the individual sensor resources. AGI allows the controller to determine the nature of the sensor, e.g. "Indoor temperature".
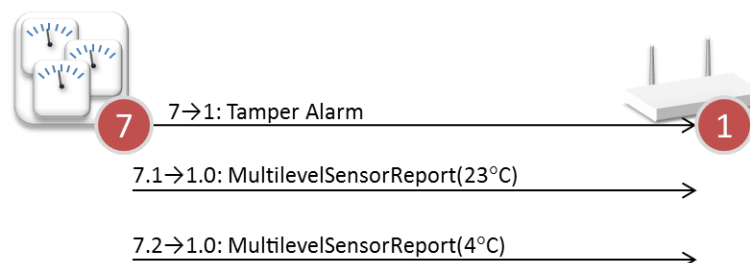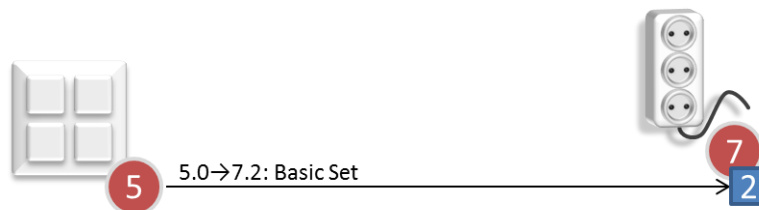


**Example 1:** Two identical sensor resources distinguished via the Source End Point

The wall controller below implements one End Point for each button.
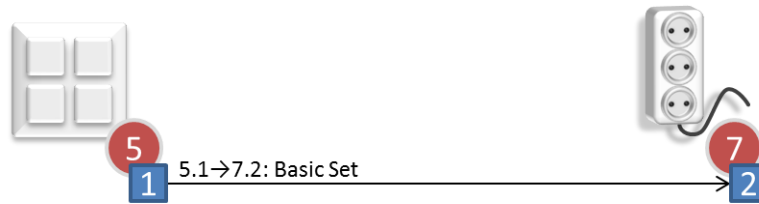
**Example 2:** End Point 1 of one node controlling End Point 2 of another node

The next wall controller implements no End Points. All association groups are provided by the Root Device.



**Example 3:** Root Device of one node controlling End Point 2 of another node

Note that while the wall controller in Example 3 implements no End Points itself, it still has to support Multi Channel communication in order to control actuator End Points in other devices.

Multi Channel Encapsulation is not used between Root Devices.
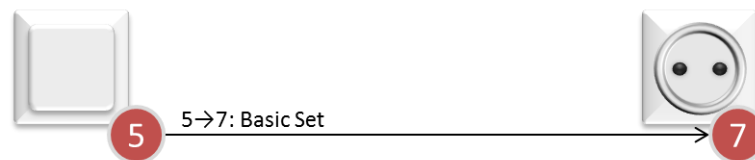


**Example 4:** Root Devices communicating without Multi Channel encapsulation

Historically, there could be only one application resource in one plastic box. In such a simple device, functionality relating to the plastic box, e.g. battery level, and application functionality, e.g. light control, are all accessed via the NodeID.
Thus, the application functionality of a simple device resides in the Root Device, while a  Multi Channel device has no application functionality in the Root Device.

Backwards compatibility is maintained in Multi Channel devices by the Root Device advertising application functionality, even though the functionality is actually provided by one or more End Points. End Point 1 implements the primary functionality of the device, but the product designer is free to mirror functionality of more End Points to the Root Device. As an example, the Root Device of a composite sensor may mirror the management function of two sensor End Points, causing both End Points to send sensor reports.
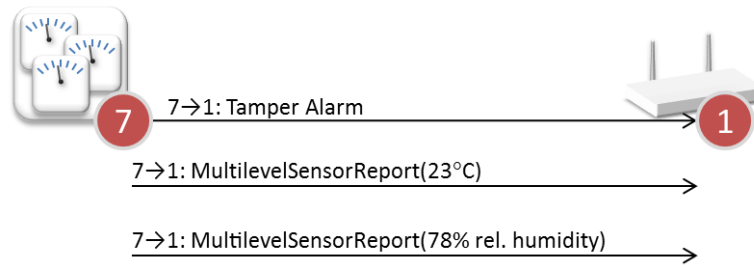
**Example 5:** Root Device mirrors two End Points in composite sensor

Mirroring multiple End Point sensor resources in the Root Device requires that the resources issue different commands. A receiving device has no way to distinguish identical reports.

In the same way, the Root Device of a power strip forwards commands to all three End Points of the device.
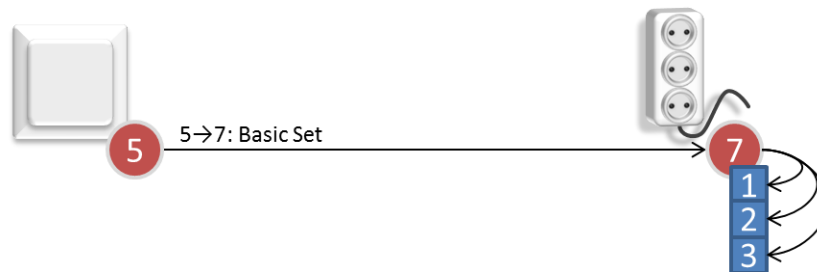


**Example 6:** Root Device mirrors three End Points in power strip

One cannot be sure that a command to the Root Device mirrors all End Points. The Multi Channel multicast feature may be used to send a Set command to the first 7 End Points. Alternatively, one may communicate to each individual End Point. This works for Set as well as Get commands.

Management tools may have a need to present expanded views of Multi Channel devices, e.g. in the floor plan view of a smart home deployment. Such tools hide Root Device application functionality to compensate for the backwards compatibility mirroring of End Point functionality to the Root Device. This way, the power strip can be presented the way it really works.
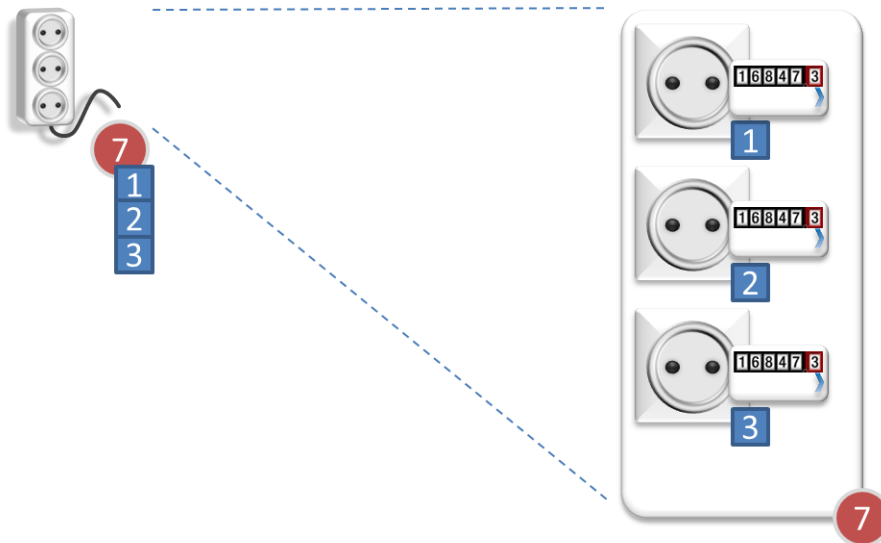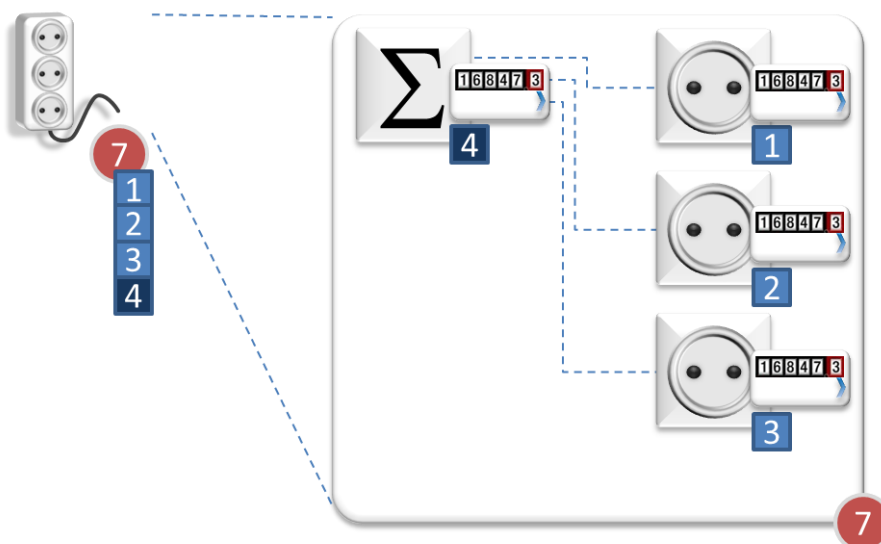
**Example 7:** Expanded representation of power strip

An Aggregated End Point allows a Multi Channel device to implement functionality relating to multiple End Points.

Aggregated End Points are used for reporting the accumulated consumption of physical resources via Meter and Multilevel Sensor Command Classes. Examples include Electrical power, water and gas.

Aggregated End Points are not intended for control. End Points are controlled via multicast or individual End Point addressing.

The example below shows a power strip with aggregated metering.



**Example 8:** Expanded representation of power strip with aggregated metering

The power strip reports the total power consumption in response to a request to the Aggregated End Point.
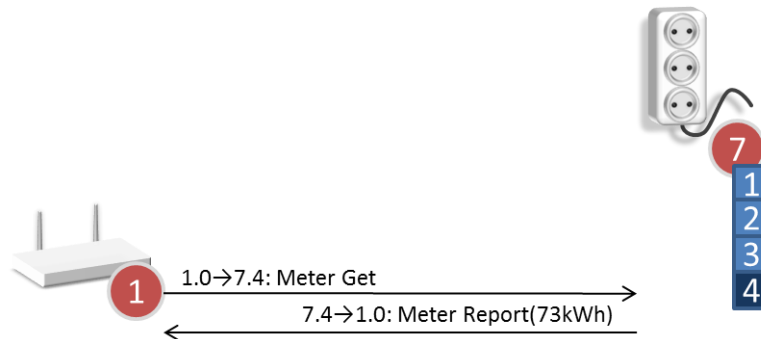


**Example 9: Aggregated End Point of Power strip reports accumulated value**

The presence of Multi Channel End Points is discovered by the Root Device advertising support for the Multi Channel Command Class. The gateway does not implement End Points. Therefore, it does not advertise support for the Multi Channel Command Class even though it can talk to End Points.
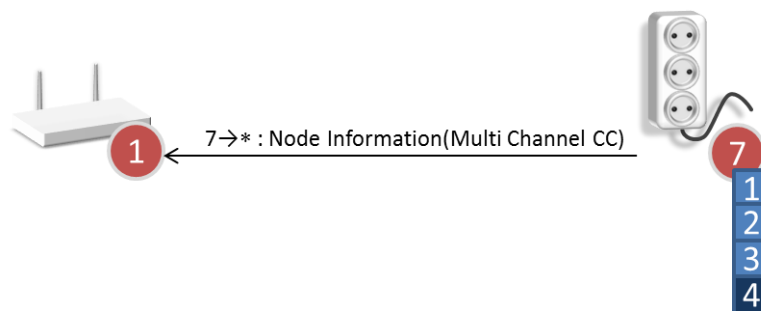


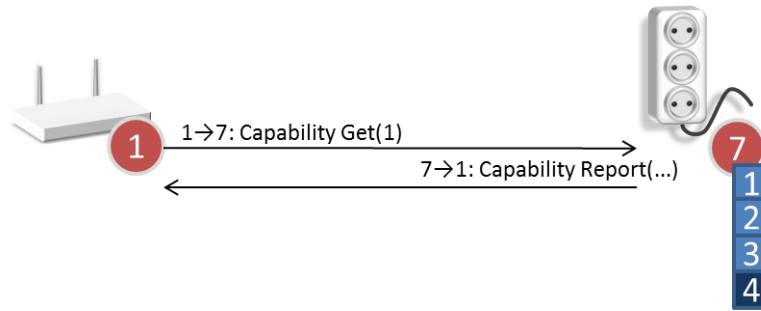**Example 10: Power strip advertises that it implements End Points**

Next step is to query the available End Points.
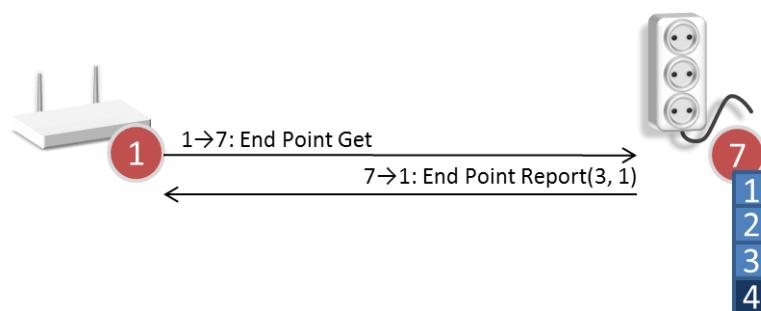


**Example 11: Power strip advertises available End Points**

The power strip advertises that three individual End Points implement application functionality. Further, one Aggregated End Point is advertised.
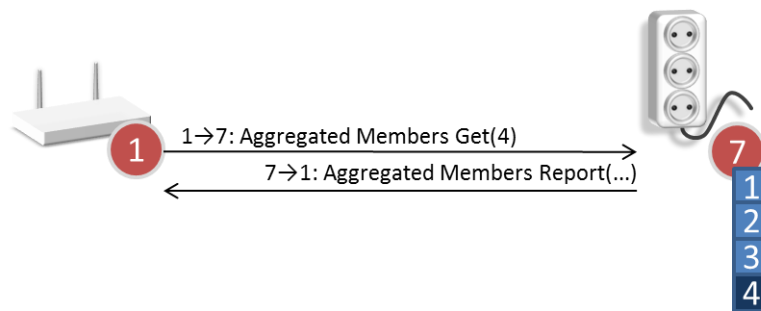
Each of the End Points are queried for supported Command Classes.

**Example 12: Power strip advertises End Point capabilities**

The same Capability Get command is used for individual End Points and for Aggregated End Points.

One may query which individual End Points are members of an Aggregated End Point.



**Example 13: Power strip advertises Aggregated End Point members**

The power strip advertises that Aggregated End Point 4 relates to the individual End Points 1, 2 and 3.
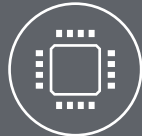
## REFERENCES

[1]     SDS12657 Z-Wave Command Class Specification, A-M
[2]     SDS12652 Z-Wave Command Class Specification, N-Z
[3]     SDS11847 Z-Wave Plus Device Types Specification
[4]     SDS11846 Z-Wave Plus Role Types Specification
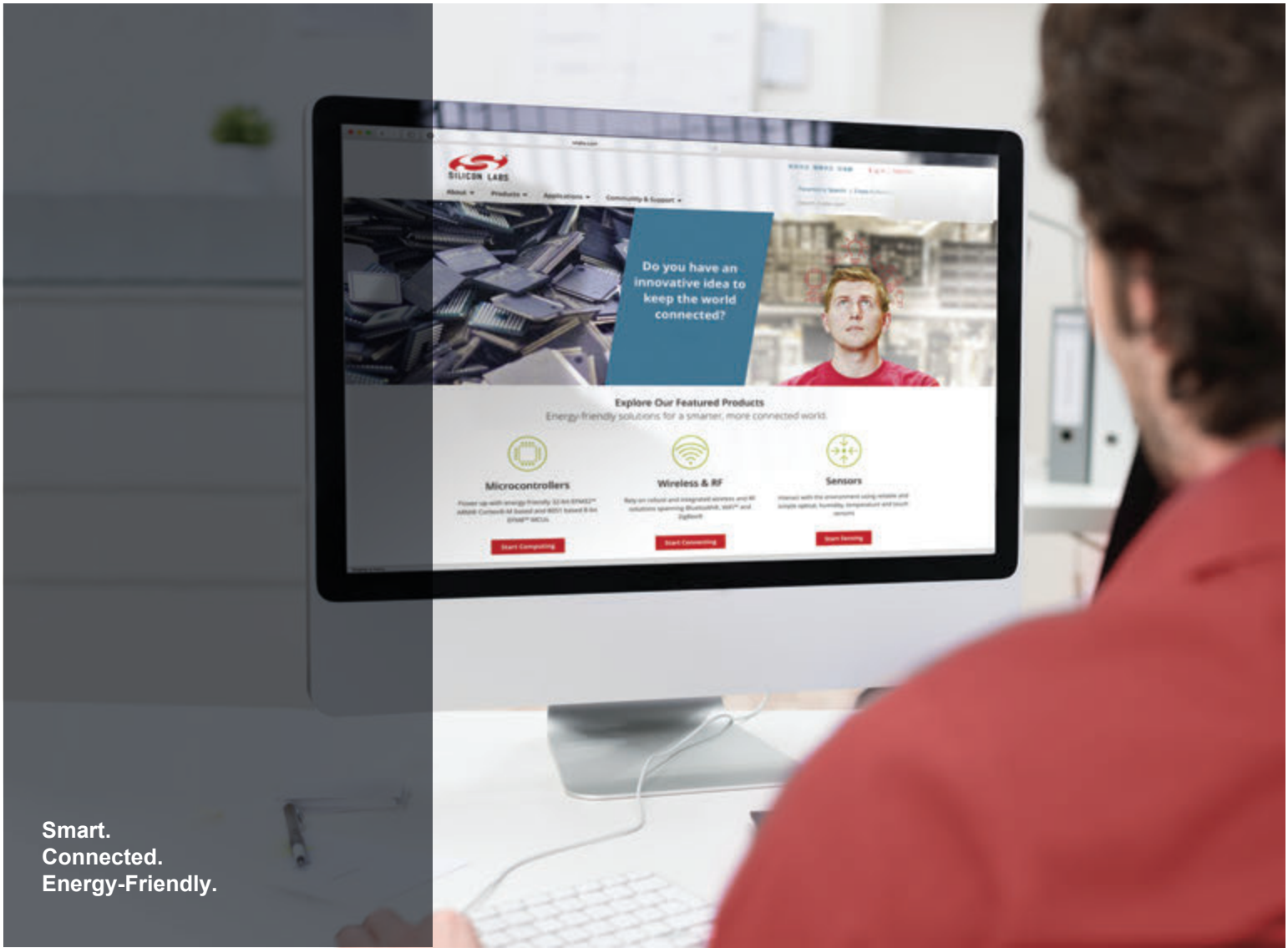
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**Silicon Laboratories Inc.**
**400 West Cesar Chavez**
**Austin, TX 78701**
**USA**

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