Application Note

Z-Wave Development Basics

Document No.:	APL13475
Version:	5
Description:	Easy-reading introduction to Z-Wave development. This doc introduces the Z-Wave Specifications and how they are to be used. Refer to the other application nodes in the "Basics" series for more networking and application specific topics.
Written By:	NOBRIOT;ABR;BBR
Date:	2018-03-05
Reviewed By:	JFR;ABR;NOBRIOT
Restrictions:	Public

Approved by:

Date	CET	Initials	Name	Justification
2018-03-05	14:38:40	NTJ	Niels Thybo Johansen	

REVISION RECORD

Doc. Rev	Date	By	Pages affected	Brief description of changes
1	20151228	NOBRIOT	ALL	First revision
2	20160525	NOBRIOT	1.2.4 1.2.8	Added explanations about the SDK and sample apps Changed Certification form with Certification Portal
3	20161215	NOBRIOT	1.2.1	Adapted document to the new Command Class specification format
4	20180305	BBR	All	Added Silicon Labs template

1 Z-WAVE DEVELOPER BASICS

1.1 Training

Before looking into any documentation and getting started with Z-Wave development, it is recommended to take the training available on the ZTS website:

http://zts.sigmadesigns.com/z-wave-online-training

1.2 Z-Wave Documentation

There are several specification documents defining how nodes must be implemented in a Z-Wave network. The documents' constellation is depicted in Figure 1. The blue color indicates Z-Wave Plus specific documents.

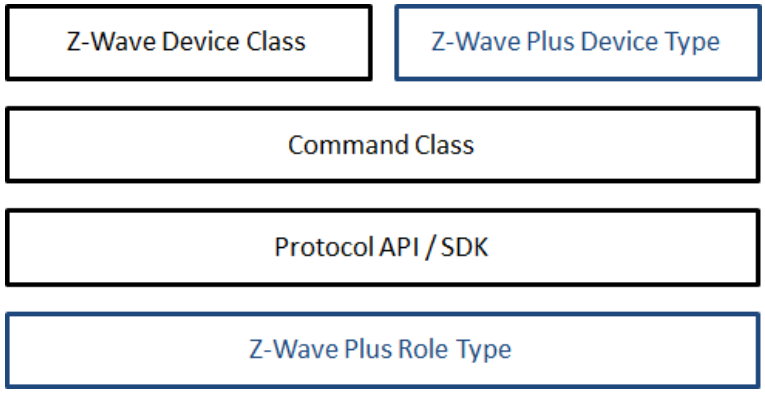


Figure 1, Z-Wave Specifications overview

1.2.1 Command Class Specification

Commands Classes are used for example to switch devices on or off, to monitor the battery status or convey sensor measurements. They cover a broad range of applications.

The Command Class Specification is composed of four documents separating Command Classes into different logical layers.

- Z-Wave Application Command Classes [16]
  This document specifies commands classes providing application level functionalities, which can typically be supported by any node, regardless of its Device or Role Type. This document is intended to be the “getting started” document and also describes Command Class rules, such as fields, versioning or the Node Information Frame.

- Z-Wave Management Command Classes [17]
  This document specifies commands classes providing functionalities to support nodes’ administration and management. Those Command Classes are often mandated by the Z-Wave Plus Role Type and/or Device Type and provide functionalities like battery support, firmware update or associations.

- Z-Wave Transport-Encapsulation Command Classes [18]
  This document specifies command classes used for encapsulating other command classes.

- Z-Wave Network-Protocol Command Classes [19]
  This document specifies command classes providing functionalities related to RF or Z-Wave/IP networks. Controllers’ specific command classes are also listed in this document.

A device typically implements a small subset of Command Classes depending on the application and Device Type requirements. It is therefore not recommended to read the Command Class specification in whole. It should only be referred to when implementing a Command Class.

1.2.2 Z-Wave Device Class Specification

The Z-Wave Device Class Specification [3] has been superseded by the Z-Wave Plus Device Type Specification for Z-Wave Plus compliant devices. The Z-Wave Device Class Specification defines Generic and Specific Device Classes used by legacy Z-Wave devices. Device Classes are used for defining the minimum set of Command Classes that a given product must implement to ensure interoperability between devices. Device Classes are forward compatible with Device Types.

For example, a switch that can only be switched on or off will have the Generic Device Class: Binary Switch. From this Generic Device Class, it can take one of several Specific Device Classes depending on the nature of the device: power switch, scene switch, etc.

Device Classes serve as guidance to the developer and also define the requirements that a device must comply with. A device can implement additional Command Classes.

1.2.3 Z-Wave Plus Device Type and Role Type Specifications

The Device Type [4] and Role Type [5] specifications specify Z-Wave Plus framework requirements that a Z-Wave Plus node has to comply with. Some Device Types are backwards compatible with Generic and Specific Device Classes from the Device Class Specifications.

When creating a Z-Wave Plus product, the developer must choose a Z-Wave Plus Device Type depending on the intended application. The chosen Device Type must reflect Z-Wave functionalities and not the physical product appearance. For example if the intended product is a gateway built into a TV,

the Device Type must be Gateway and not TV. If several Device Types seem to match the product needs, the Device Type must be selected based on the best match. Additional Command Classes may be added to meet the application needs.

The developer must also choose a Z-Wave Plus Role Type that matches the nature of the product. The Role Types Specification [5] defines the networking and battery requirements for a device. Based on the Role Type, nodes can be either Controllers or Slaves.

- Controllers must be capable of setting up and performing maintenance operations in a Z-Wave network.
- Slaves do not offer any network management functions. Slave can only be added or removed from a network by a controller. Slaves can nevertheless send commands to other nodes and "control" others at the application level.

1.2.4 Protocol API/SDK

The protocol API and the Software Developer's Kit (SDK) is a software implementation running on Silicon Labs chips. It enables developers to use the Z-Wave protocol with API functions and therefore build applications in a fast and cost effective manner.

The SDK contains among others:

- Z-Wave API libraries (both for controllers and slaves)
- Z-Wave Plus sample applications
- PC sample applications
- Tools

Programming boards and chips are provided with the SDK.

The SDK implementation is compliant with RF and protocol requirements mandated by both Z-Wave and Z-Wave Plus specifications. The implementation and sample application intends to show development best practices. For more details about the SDK, visit http://zts.sigmadesigns.com/embedded-software-development-kits and refer to [15]

There is also a Z-Wave Controller development kit, which aims at creating controlling applications for Smart TVs, PCs, tablets and smart phones. It contains a Z/IP Gateway application, libraries and apps. For more information, visit http://zts.sigmadesigns.com/controller-software-development-kit.

1.2.5 Application Notes: Basics Documents

The intended use and best practices for certain Command Classes may not be obvious when reading the Command Class Specifications. The Basic series documents provide examples of how to use and implement Command Classes in specific applications. It is recommended to consult the Basic series ([8] … [14]) before getting started with an implementation.

1.2.6 Application Framework

The Z-Wave Application Framework relieves end product developers from the burden of implementing Command Classes. The framework implements a generic Command Class parser structure and a range of Command Classes.

Product sample applications in the SDK are built using the application framework. For more details, refer to [7].

1.2.7 Z-Wave over IP (Z/IP)

The Z/IP architecture allows Z-Wave nodes to be represented as IP hosts, which can be discovered via mDNS, the standard LAN Service Discovery mechanism, and can exchange Z-Wave application commands via the standard Z-Wave UDP port assigned by the IANA.

The Z/IP Gateway may operate as a native IPv6 router, presenting the Z-Wave network as an IPv6 subnet, or it may operate in compatibility mode in existing IPv4 infrastructures, requesting an IPv4 LAN address for each Z-Wave node.

Thus, a Z/IP client sends IP packets to the IP address of a Z-Wave light dimmer just as IP packets are sent to a network printer. In the same way, a Z/IP Client discovers a Z-Wave light dimmer just as it discovers a network printer.

1.2.8 Certification

When a product is getting ready, the Certification portal [6] is used to fill a list of functionalities that the device implements. This list is then used to ensure that the product complies with all requirements from the Device Class/Device Type, Role Type and additional Command Classes.

A Compliance Test Tool (CTT), made available by Silicon Labs, can be used together with the ZTS resources. The CTT allows developers to perform automated test on their product before submitting for certification. It is not mandatory to use the CTT, but experience shows that companies who have used the CTT are more likely to pass certification. The CTT is available at the following address: http://zts.sigmadesigns.com/compliance-test-tool-ctt

For further proofing, other certification resources can be found on ZTS: http://zts.sigmadesigns.com/z-wave-certification-program.

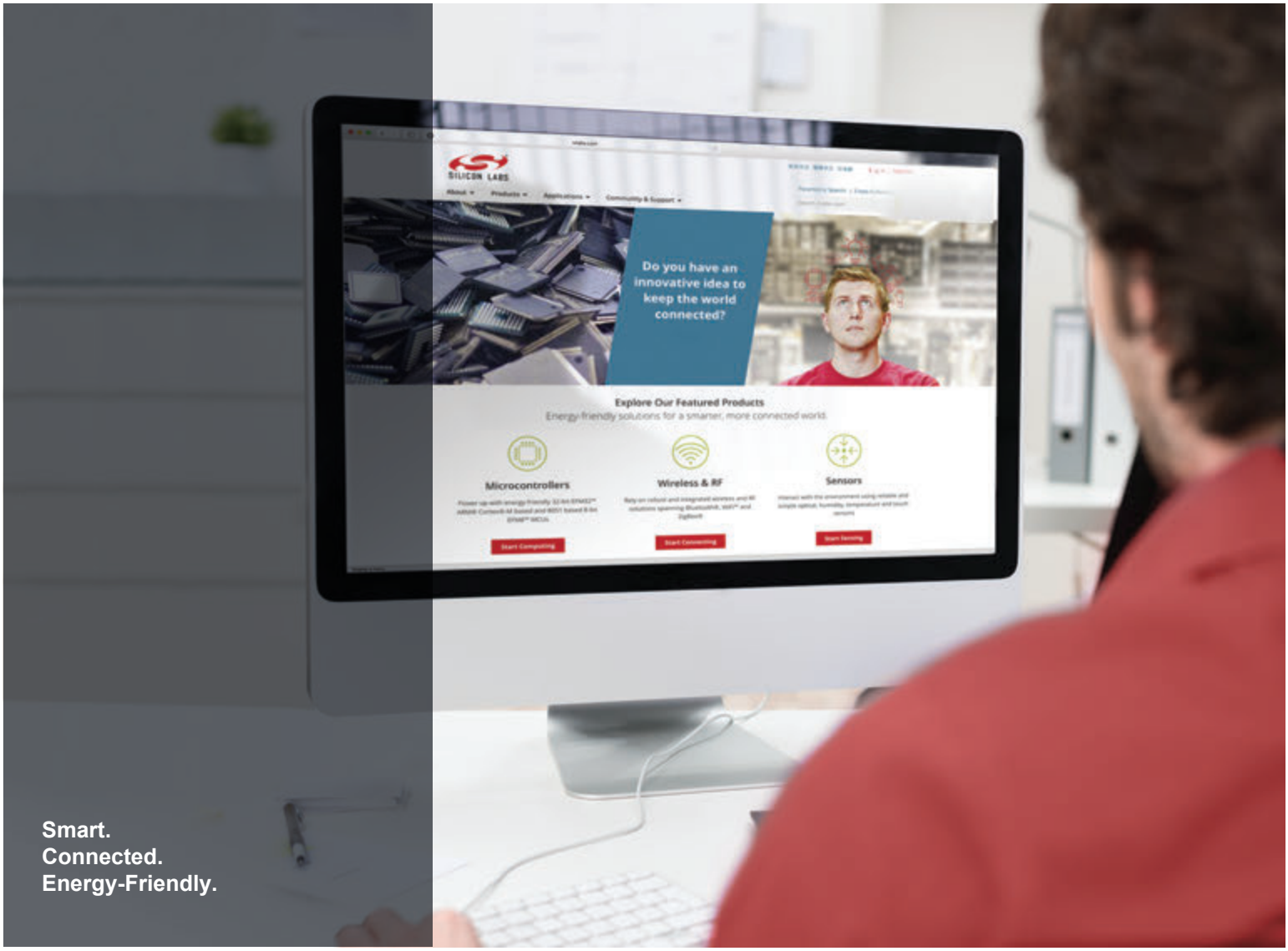
1.3 Programming resources

To get started with programming, useful resources can be found on ZTS:

http://zts.sigmadesigns.com/getting-started-z-wave

REFERENCES

[1] Silicon Labs, SDS12657 Z-Wave Command Class Specification, A-M
[2] Silicon Labs, SDS12652 Z-Wave Command Class Specification, N-Z
[3] Silicon Labs, SDS10242 Z-Wave Device Class Specification
[4] Silicon Labs, SDS11847 Z-Wave Plus Device Types Specification
[5] Silicon Labs, SDS11846 Z-Wave Plus Role Types Specification
[6] Silicon Labs, Z-Wave Plus Certification Portal, http://z-wavecertification.sigmadesigns.com
[7] Silicon Labs, SDS12804, Z-Wave Plus Application Framework v6.51.0x
[8] Silicon Labs, APL13031, Z-Wave Networking Basics
[9] Silicon Labs, APL12955, Z-Wave Multi Channel Basics
[10] Silicon Labs, APL13298, Z-Wave Device Configuration Basics
[11] Silicon Labs, APL12956, Z-Wave Association Basics
[12] Silicon Labs, APL12957, Z-Wave Battery Support Basics
[13] Silicon Labs, APL13128, Z-Wave Time and Date Basics
[14] Silicon Labs, APL13084, Z-Wave Control Application Basics
[15] Silicon Labs, SNR12428, Z-Wave 500 Series SDK v6.51.06
[16] Silicon Labs, SDS13781: Z-Wave Application Command Class Specification
[17] Silicon Labs, SDS13782: Z-Wave Management Command Class Specification
[18] Silicon Labs, SDS13783: Z-Wave Transport-Encapsulation Command Class Specification
[19] Silicon Labs, SDS13784: Z-Wave Network-Protocol Command Class Specification



Products
www.silabs.com/products

Quality
www.silabs.com/quality

Support and Community
community.silabs.com

SILICON LABS®

Silicon Laboratories Inc.
400 West Cesar Chavez
Austin, TX 78701
USA

http://www.silabs.com