DLMS Overview

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Abbreviation List

- DLMS: Device Language Message Specification
- COSEM: Companion Specification for Energy Meter
- UA: User Association
- LLS: Low-Level Security
- HLS: High-Level Security
- LDN: Logical Device Name
- APDU: Application layer Protocol Data Unit
- HDLC: High-level Data Link Control

Preface

- Although DLMS is a multi-energy meter specification, this tutorial only mention about electricity metering
- This tutorial require reader be able to access DLMS User Association books
- After reading this tutorial, reader may get to know:
  - Why there's need for DLMS
  - What to refer to when developing DLMS implementation
  - Main concepts of DLMS/COSEM
  - What can Renesas DLMS Library help in developing

Agenda

1. Electricity Metering
2. Why DLMS?
3. Introduction DLMS/COSEM
4. How to get started with DLMS
5. DLMS/COSEM concepts
6. DLMS/COSEM Basic Structure
7. Conclusion for DLMS Overview

1. Electricity Metering (1/2)

Electromechanical Approach

Pros:
Been used for decades
Reliable, low price

Cons:
Need to read manually
Cannot read: electric parameters, usage profile

1. Electricity Metering (2/2)

Smart meter approach

- Can be read automatically from remote site
- Provide more information about electrical parameters
- Able to establish different time of use tariffs
- Able to provide different payment methods

Problem arise

Communication between meter and reader

How? **What?**

2. Why DLMS?

- Many standards for meter data exchange: FLAG, Euridis, MBUS, IEC 60870-5-102:1996, ANSI C12.18, C12.19, C12,21
- Main different points of DLMS:

Define Interface model: valid for electricity, gas, water, heat,…,
→ Separate user application layer and hardware operation

Standardize number of widely used meter functionality
→ Interoperability between manufacturers

Completely independent from the protocol layer, can be future expanded to new communication media

3. Introduction to DLMS/COSEM

1. What is DLMS?

→ **The word "DLMS"** used to **mention the "brand name"** of this protocol

2. What is COSEM?

→ **The word "COSEM"** used to **mention the specification** of DLMS protocol

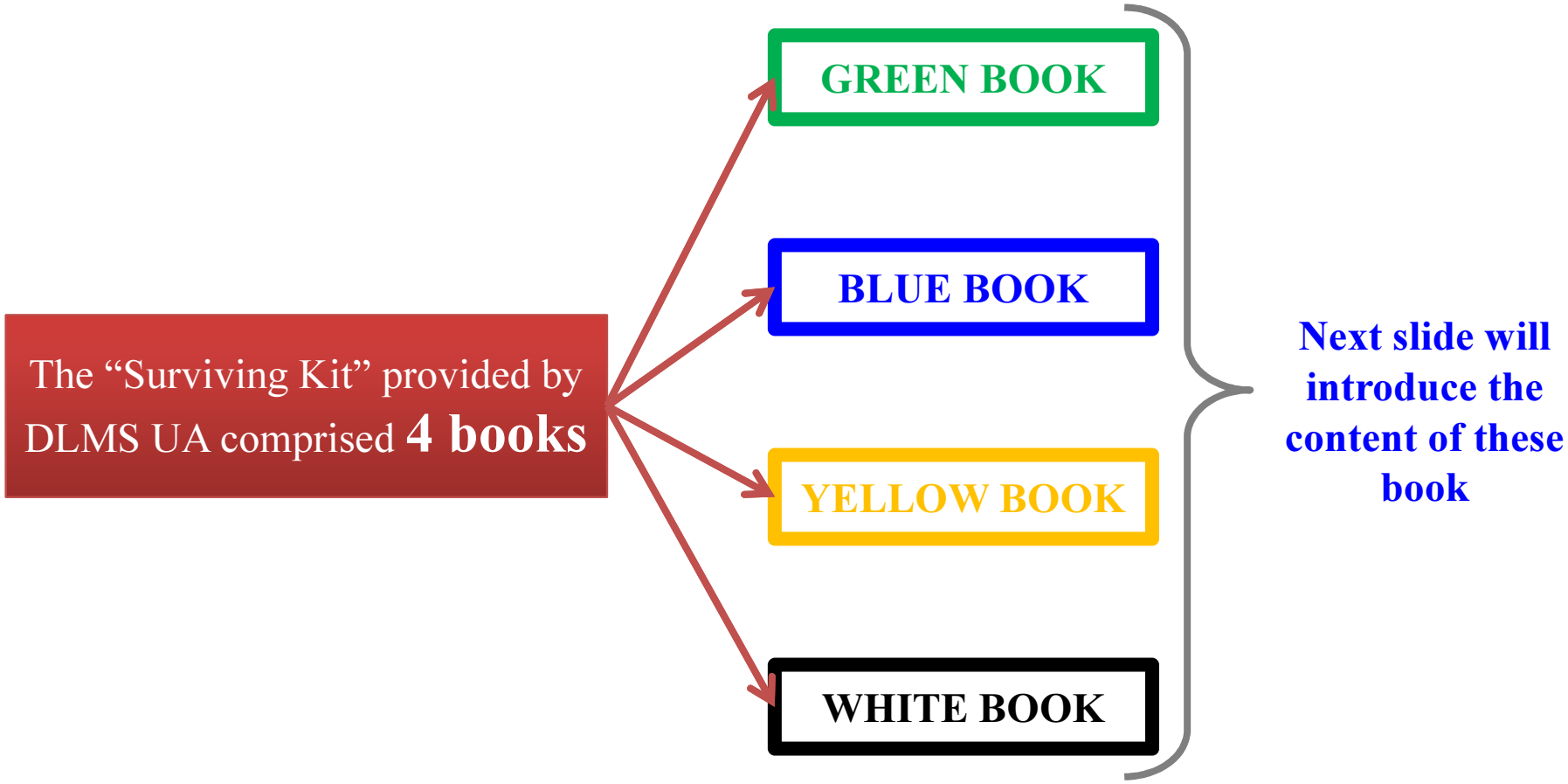
3. Who develop and maintain it?

→ DLMS User Association (DLMS UA)

dlms™
device
language
message
specification

More information can be found at *www.dlms.org*

4. How to get started with DLMS (1/2)



4. How to get started with DLMS (2/2)

GREEN BOOK → Specify the top DLMS/COSEM application layer and lower communication profile specific protocol

BLUE BOOK → Describe COSEM interface classes and the Object identification system (OBIS)

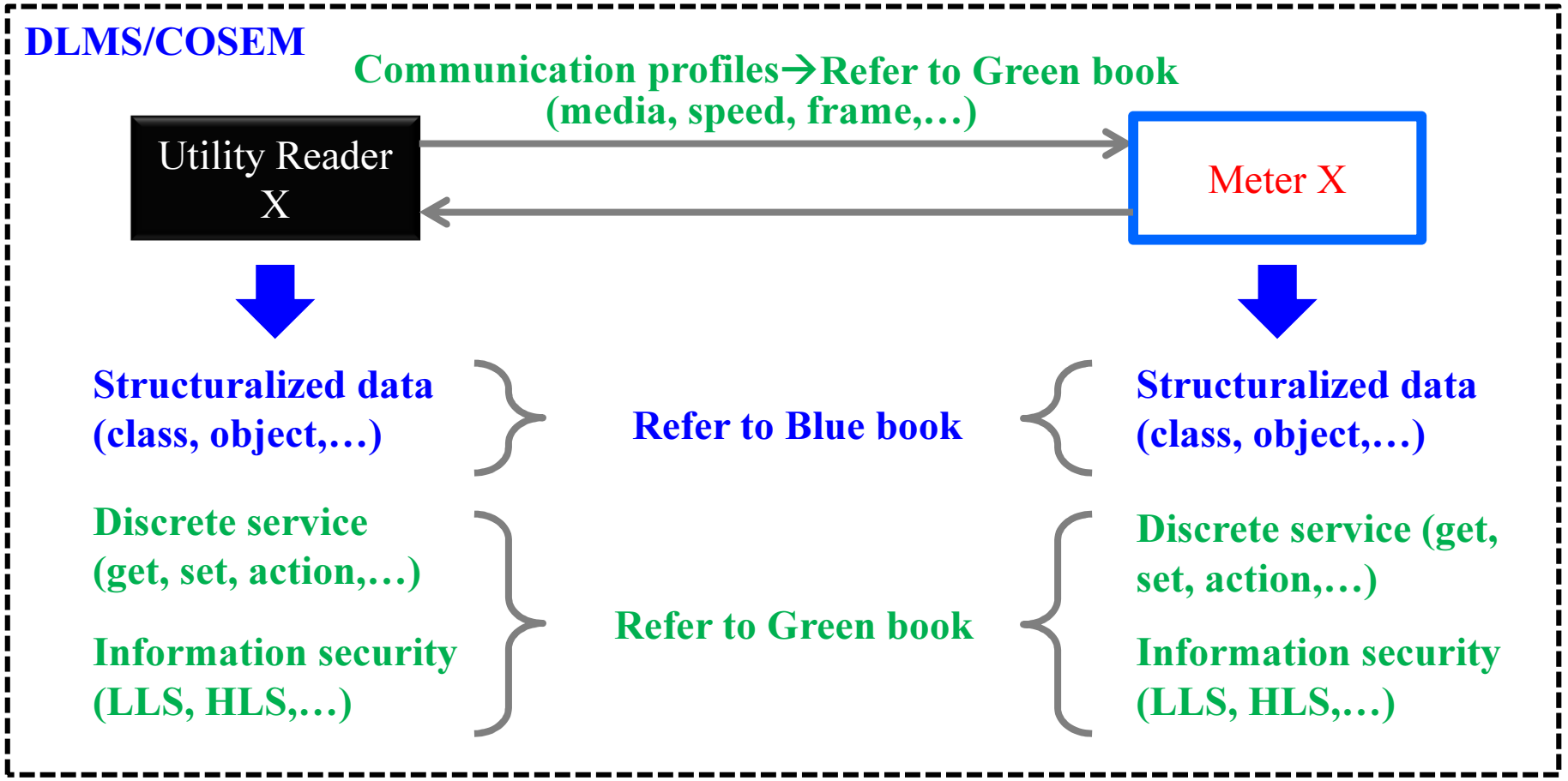
Two main books to consult when developing

YELLOW BOOK → To get certificate from DLMS UA, the device must pass CTT, a test tool from DLMS UA. This book describe the process of this testing and certifying

WHITE BOOK → Explain all glossary terms used in DLMS publications

5. DLMS/COSEM concepts (1/2)

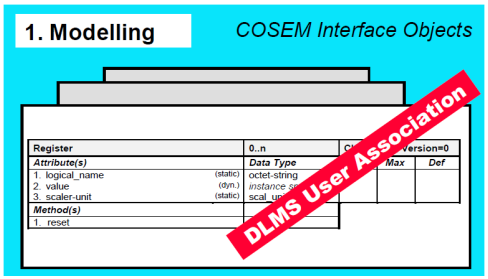
DLMS/COSEM not only a protocol, it's **a suite of specifications**!!



5. DLMS/COSEM concepts (2/2)

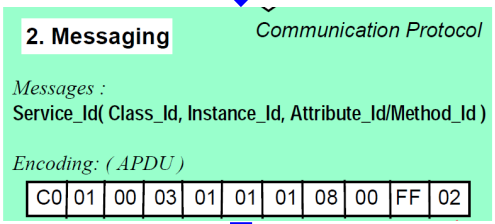
Define protocol in three main steps:

1. Modeling: transform all data and functions the meter can provide into attributes and methods

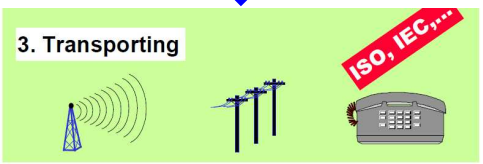


Refer to Blue book

2. Messaging: Define message format for different requests and responses



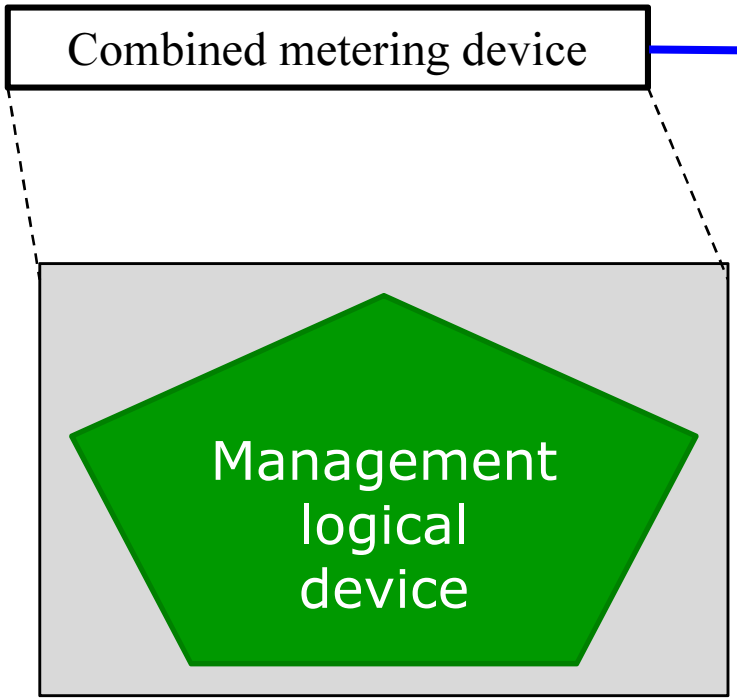
3. Transporting: Specification of the physical communication channel



Refer to Green book

6. DLMS/COSEM Basic Structure (1/5)

1. Modeling: (at server side)



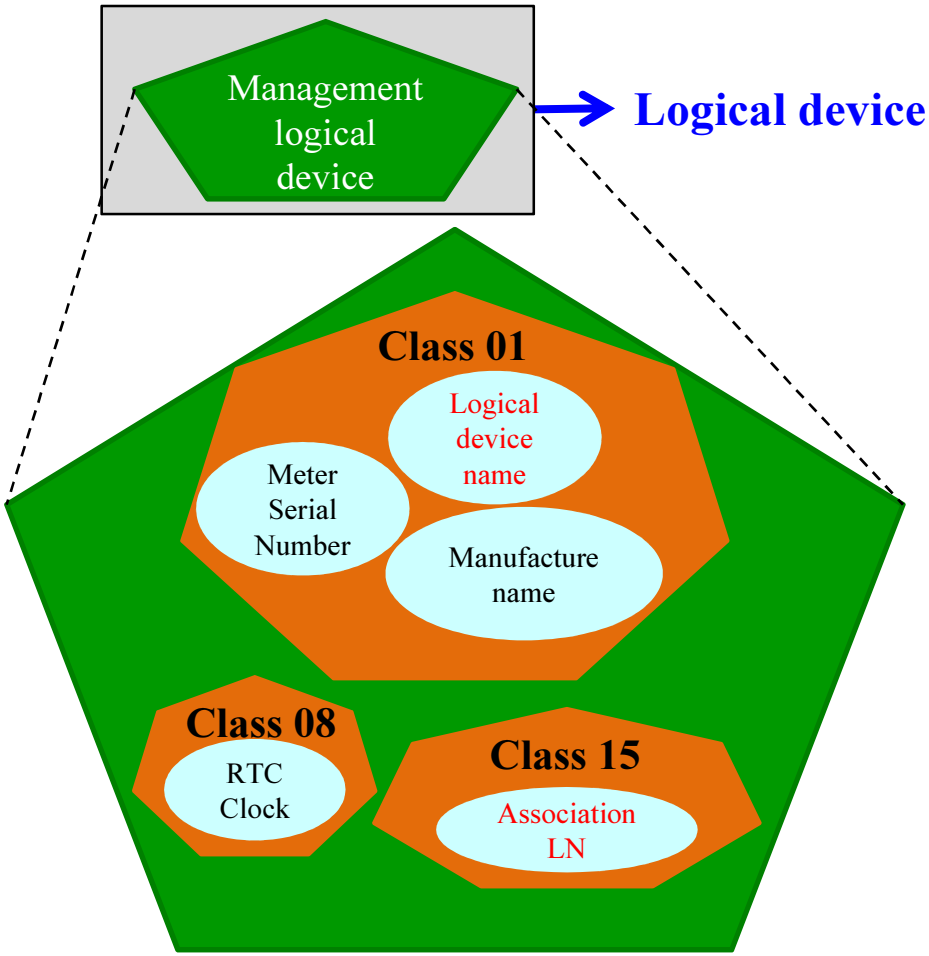
Physical device (hardware)

+ Contain 1 or more logical device (software)
+ Each physical device **MUST** contain a logical device named: **Management logical device**
→ Same structure with other logical devices and has one object describe all logical device inside physical device

→ The structural of server can be refer to Chapter 4, DLMS Green Book 7th ed. or Renesas provided framework for detail

6. DLMS/COSEM Basic Structure (2/5)

1. Modeling: (at server side)

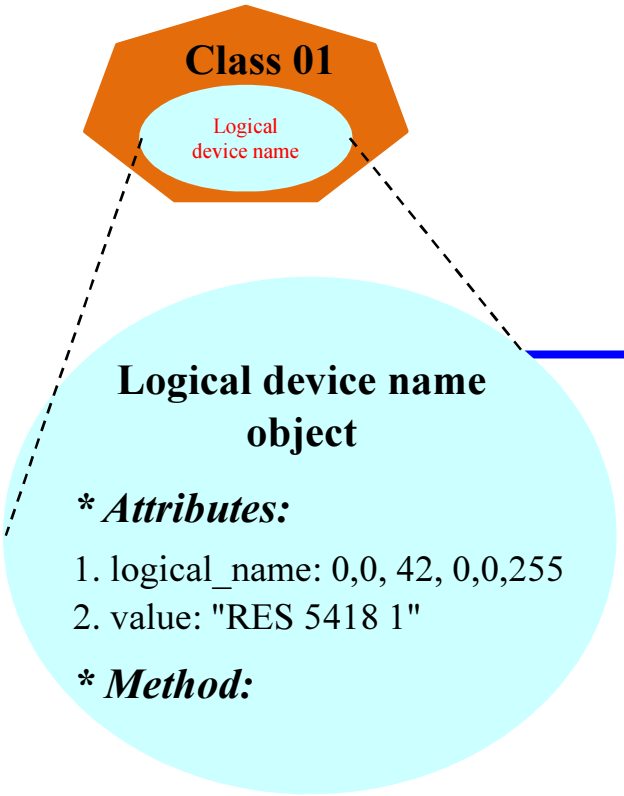


The address of data in your application
+ Contain 1 or many objects
+ Objects **share the same structure** is **belong to a class**
+ Each logical device **MUST** contain at least **two** objects:
  - Logical device name and
  - Association LN or Association SN

→ Identify logical device and general information of all object inside

6. DLMS/COSEM Basic Structure (3/5)

1. Modeling: (at server side)



COSEM Object

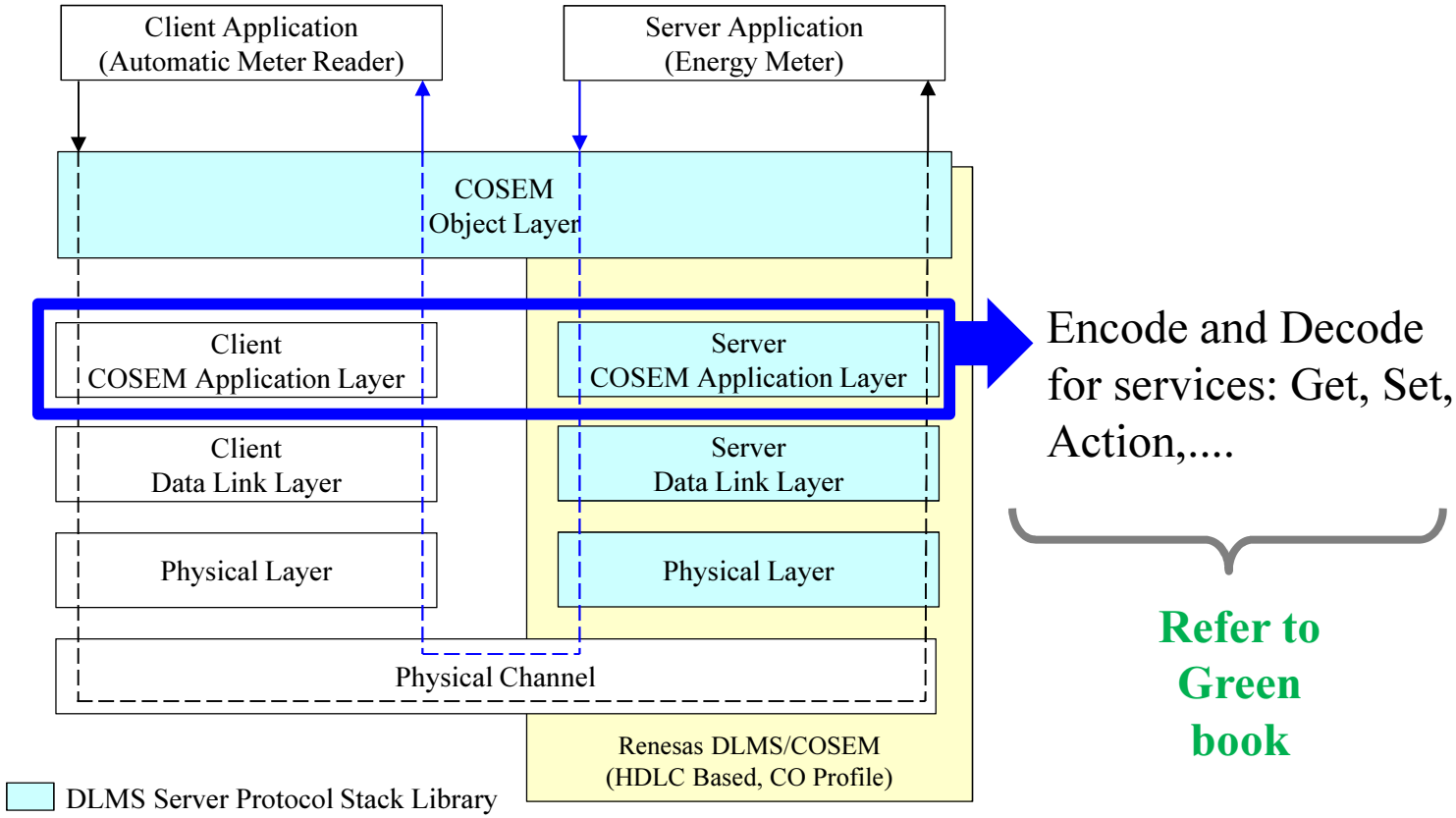
+ Contain attribute(s) and method(s)
+ logical_name attributes is always the first attribute

→ Objects is highly structuralize. See more at:

- Chapter 4, “COSEM Interface Class” Blue Book 10th ed.
- For implementation: Renesas provided template

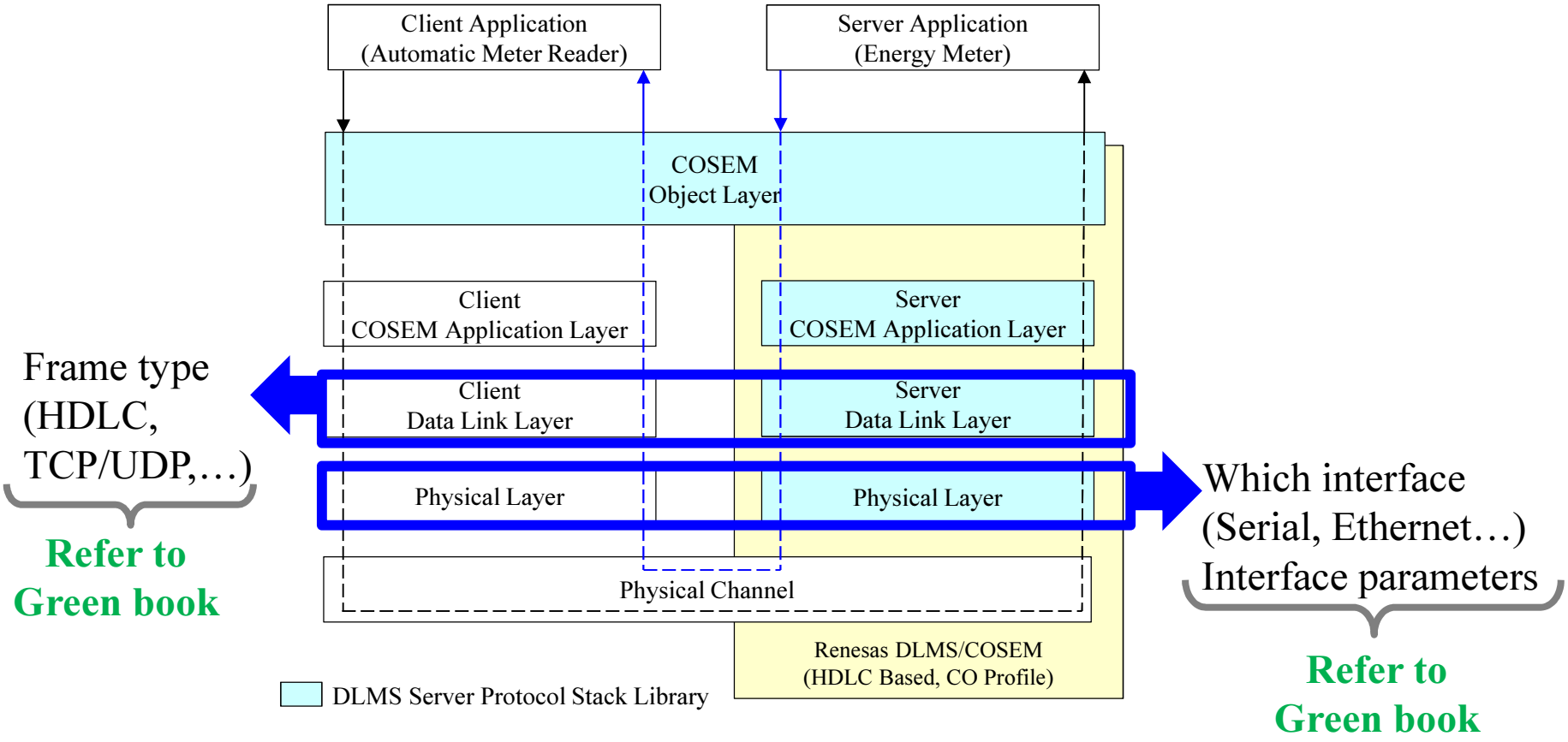
6. DLMS/COSEM Basic Structure (4/5)

2. Messaging:

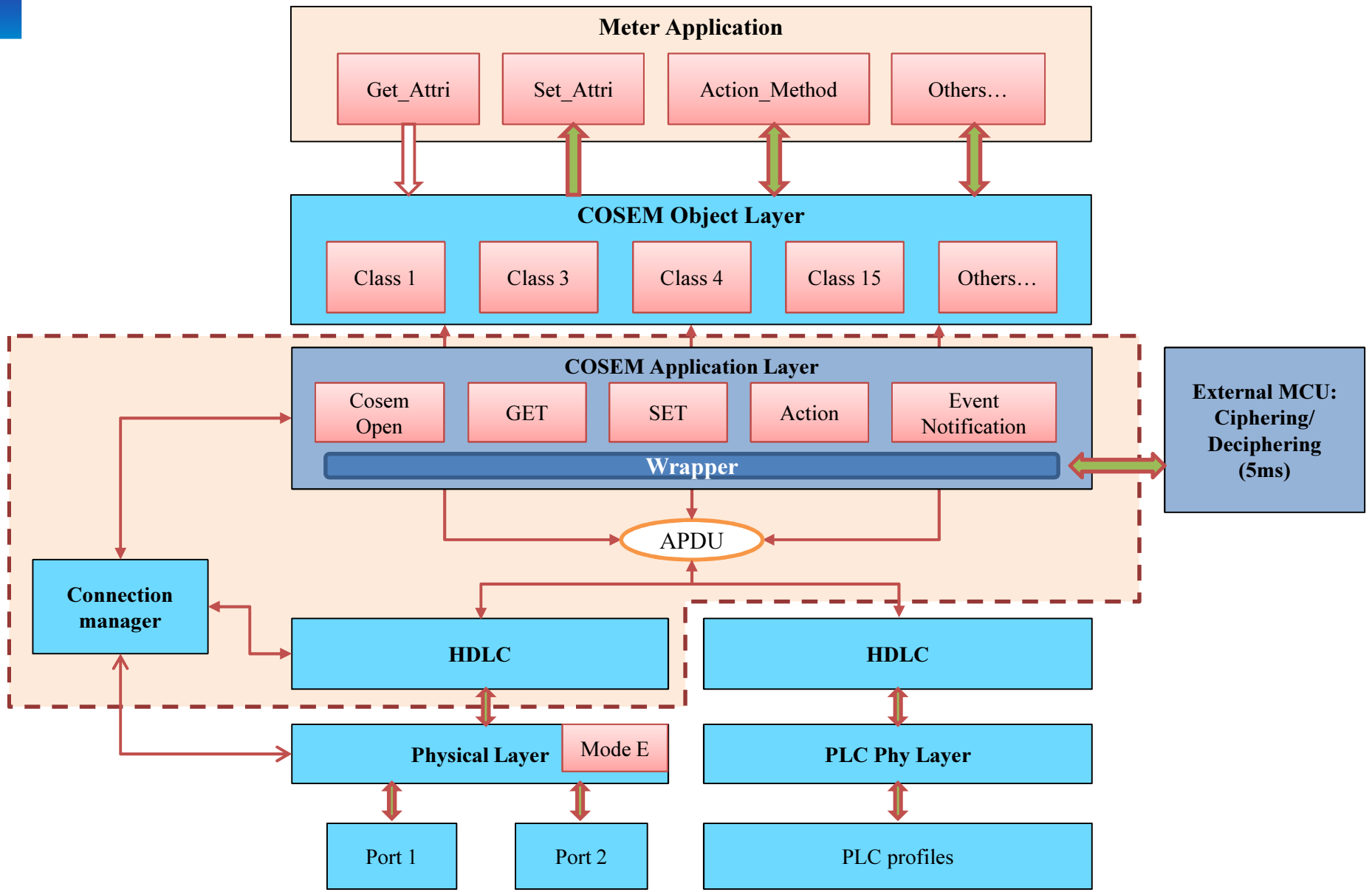


6. DLMS/COSEM Basic Structure (5/5)

3. Transporting:



7. Renesas stack overview



7.Current supported classes

```
#define USED_CLASS_01     (1) /* Data */
#define USED_CLASS_03     (1) /* Register */
#define USED_CLASS_04     (1) /* Extended Register */
#define USED_CLASS_05     (0) /* Demand Register */
#define USED_CLASS_06     (0) /* Register activation */
#define USED_CLASS_07     (1) /* Profile generic */
#define USED_CLASS_08     (1) /* Clock */
#define USED_CLASS_09     (1) /* Script table */
#define USED_CLASS_10     (0) /* Schedule */
#define USED_CLASS_11     (0) /* Special days table */
#define USED_CLASS_15     (1) /* Association LN */
#define USED_CLASS_17     (0) /* SAP assignment */
#define USED_CLASS_18     (0) /* Image transfer */
#define USED_CLASS_19     (0) /* IEC local port setup */
#define USED_CLASS_20     (0) /* Activity calendar */
#define USED_CLASS_21     (0) /* Register monitor */
#define USED_CLASS_22     (1) /* Single action schedule */
#define USED_CLASS_23     (0) /* IEC HDLC setup */
#define USED_CLASS_24     (0) /* IEC twisted pair */
#define USED_CLASS_26     (0) /* Utility tables */
#define USED_CLASS_27     (0) /* Modem configuration */
#define USED_CLASS_28     (0) /* Auto answer */
#define USED_CLASS_29     (0) /* Auto connect */
#define USED_CLASS_61     (0) /* Register table */
#define USED_CLASS_63     (0) /* Status mapping */
#define USED_CLASS_64     (0) /* Security setup */
#define USED_CLASS_70     (0) /* Disconnect control */
#define USED_CLASS_71     (0) /* Limiter */
```

7.Supported functionality

- **Version 0.5 or Version 0.51**
  - SET-NORMAL
  - GET-NORMAL
  - BLOCK-TRANSFER-WITH-SET
  - BLOCK-TRANSFER-WITH-GET
  - ATTRIBUTE0-SUPPORTED-WITH-GET
  - ATTRIBUTE0-SUPPORTED-WITH-SET
  - GET-WITH-LIST
  - SET-WITH-LIST
  - SELECTIVE-ACCESS
  - Lowest level security (No security)
  - Low level security (LLS)
- **Version 0.8**
  - Multiple channels
  - Mode E
  - Action-normal
  - High Level Security (HLS)
- **Version 1.0**
  - Event Notification service
  - Ciphering and Deciphering

7. Conclusion for DLMS Overview (1/3)

- DLMS is a set of specification for communication between Energy Meter and Utility Reader
- DLMS/COSEM provide overall structural specification, but not cover implementation-specific issue
- DLMS/COSEM define three steps in separating layers
  - Modeling
  - Messaging
  - Transporting

7. Conclusion for DLMS Overview (2/3)

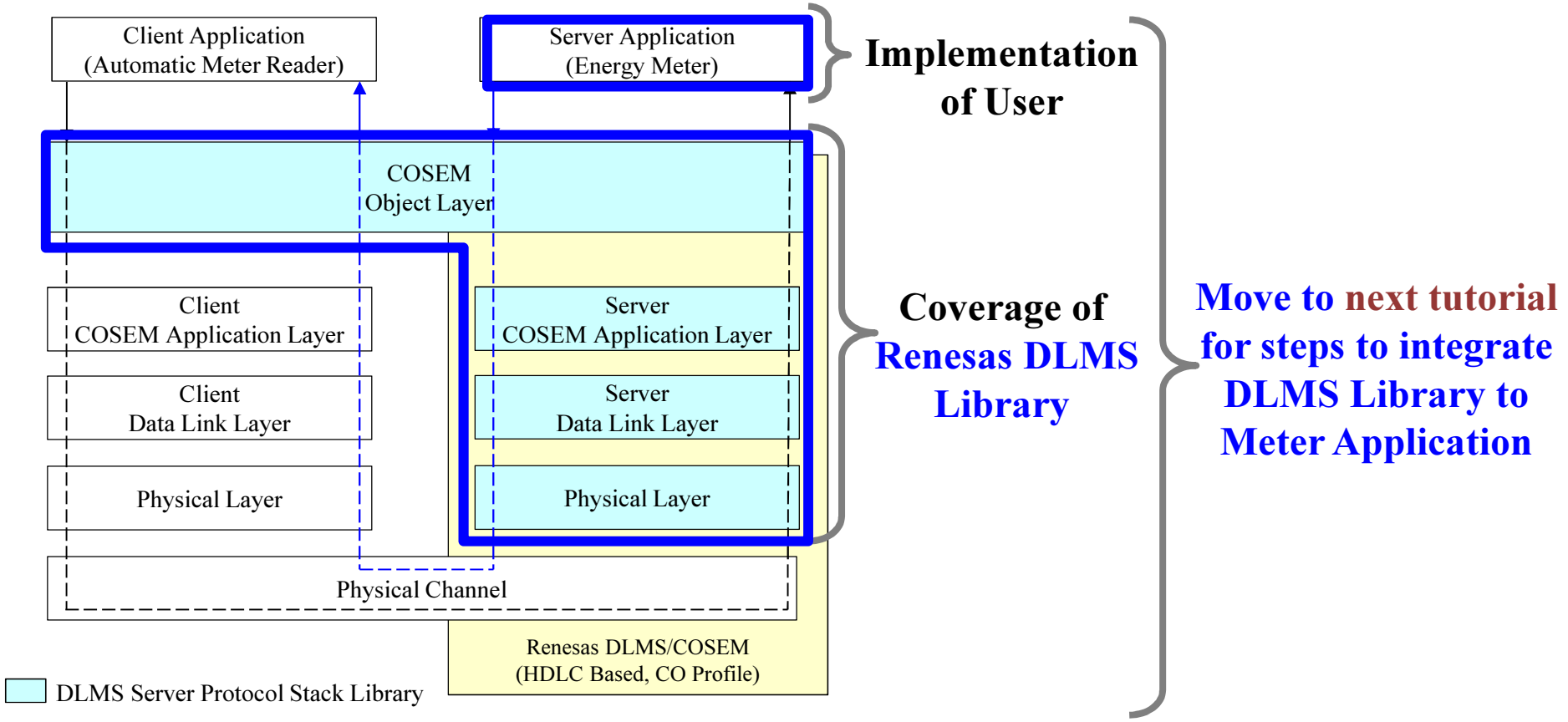
- Renesas provide **DLMS Library** and **framework** of meter application written in pure C
- Currently, DLMS Library support RS232 media and HDLC (with mode E) communication profile

→ Reduce work load and maintainability of software.

What to do	User Detail Work	
	With Renesas DLMS Lib	Without any library
Define new object	Refer framework + Blue book	Self-thinking object structure + Refer Blue book
Program flow	Refer framework	Self-written
Send, receive data	Append driver functions to wrapper	Self-determine place to put driver function
Encode, decode data frame	Put data and function to service APIs → Just read Green Book and Blue book for information	Refer Green Book and Blue book for: + Writing HDLC data encode + decode + Writing service APIs + Writing distribution function for each class

7. Conclusion for DLMS Overview (3/3)

Structural relationship between Renesas DLMS Library and User Application



Thank you for reading

Renesas Design Vietnam Co., Ltd.