

# Development of Compact BeagleBone Black Interface Module for Supporting IEC 61850

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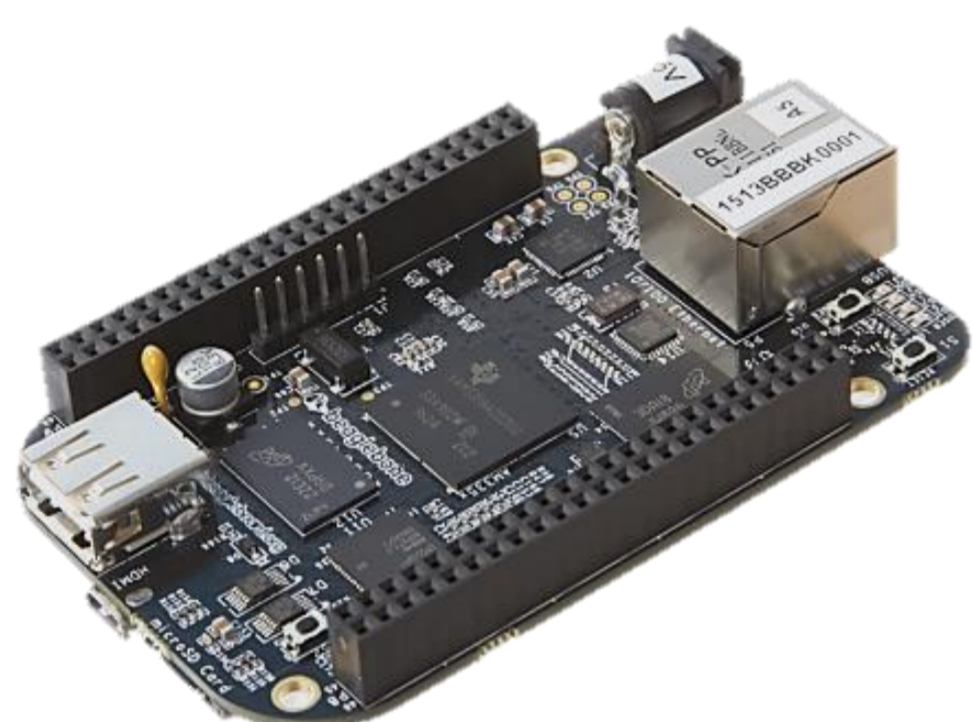
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## Introduction

- The standardized information description and the communication method are needed to provide the interoperability and the conformance of the distributed energy resources(DERs) from the various vendors
- IEC 61850 is expected to provide global standardized information exchange model to manage and control of DERs
- We propose compact BeagleBone Black interface module to provide a bridge between IEC 61850 system and DERs

## BeagleBone Black

- Main hardware of IEC 61850 interface module
- Credit card size(86.36mm\*53.34mm) commercial off-the-shelf embedded board(COTS)
- 1GHz ARM Cortex-A8 processor, 512MB DDR3 RAM, 4GB embedded MMC flash and various peripheral interfaces
- Reduction of initial development costs, time and the maintenance costs
- Compact size, good processing performance and large memory capacity compared to the other hardware of similar price



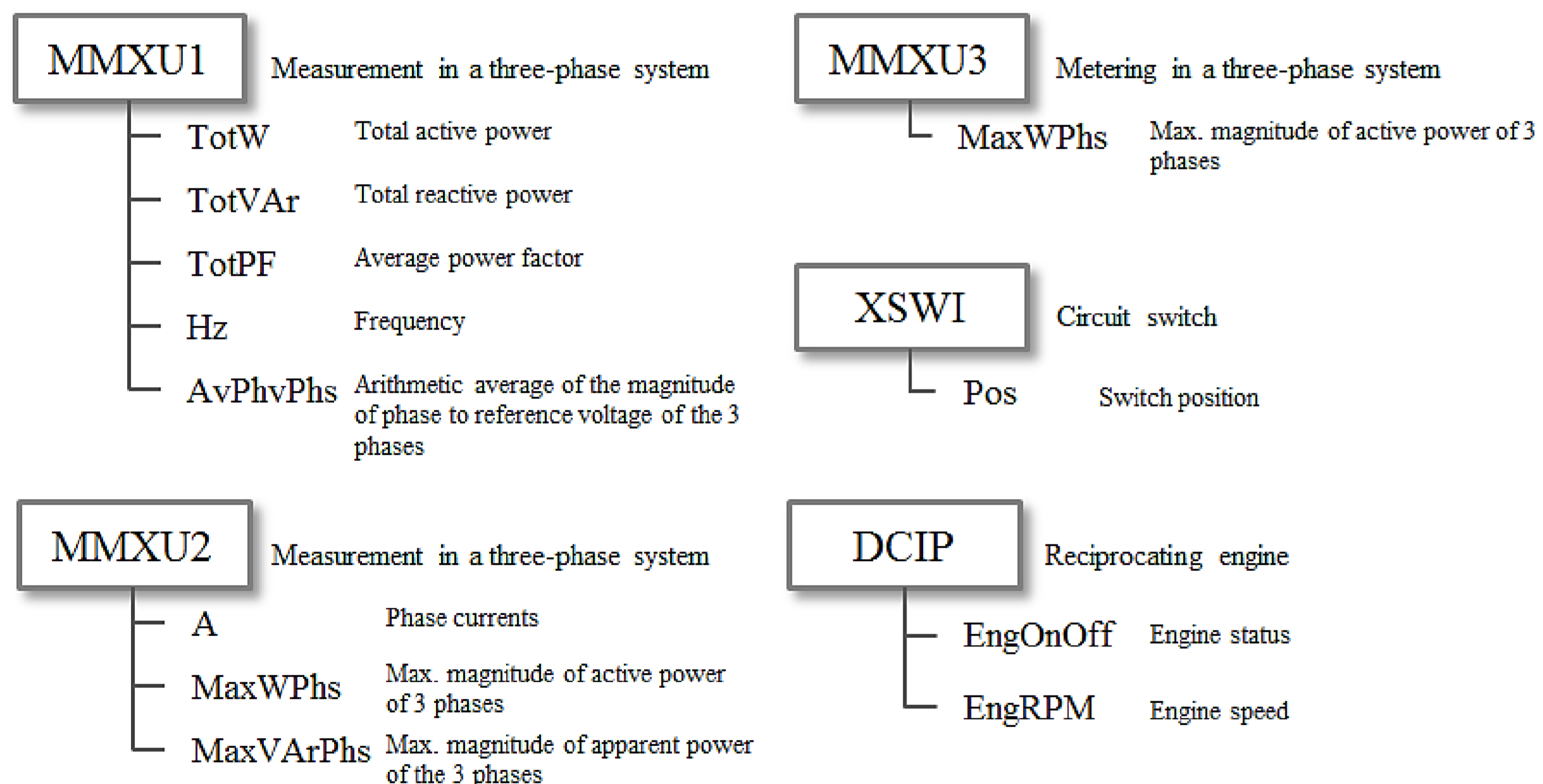
BeagleBone Black



IEC 61850 Interface Module

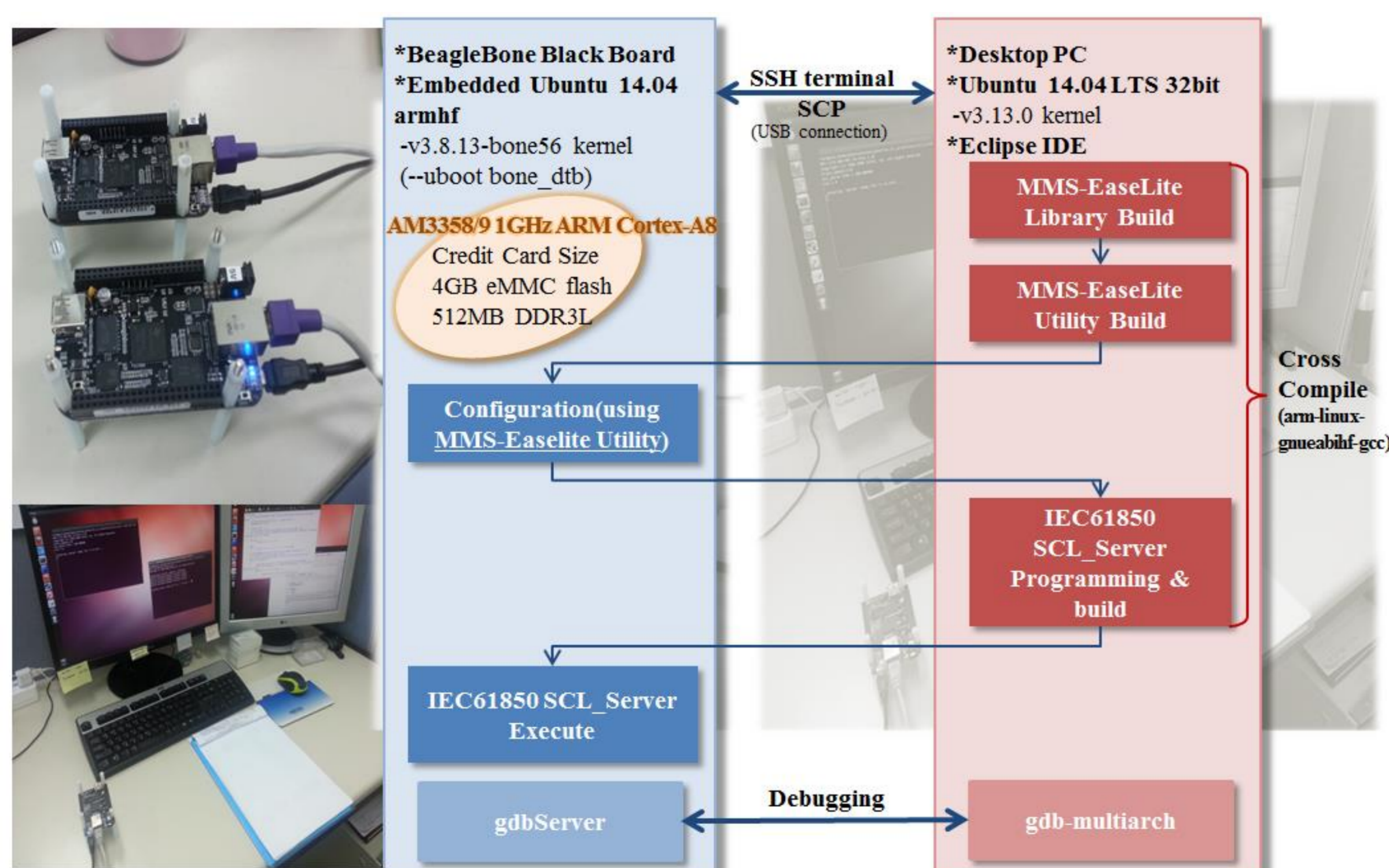
## Information Model Design

- SCL(Substation configuration language) file
  - Description of device functions and communication services according to the IEC 61850 standard
- Information model design of photovoltaic generators, a wind turbine, diesel generators and a BESS
- Example of designed information model of the diesel generator



Information Model of the Diesel Generator

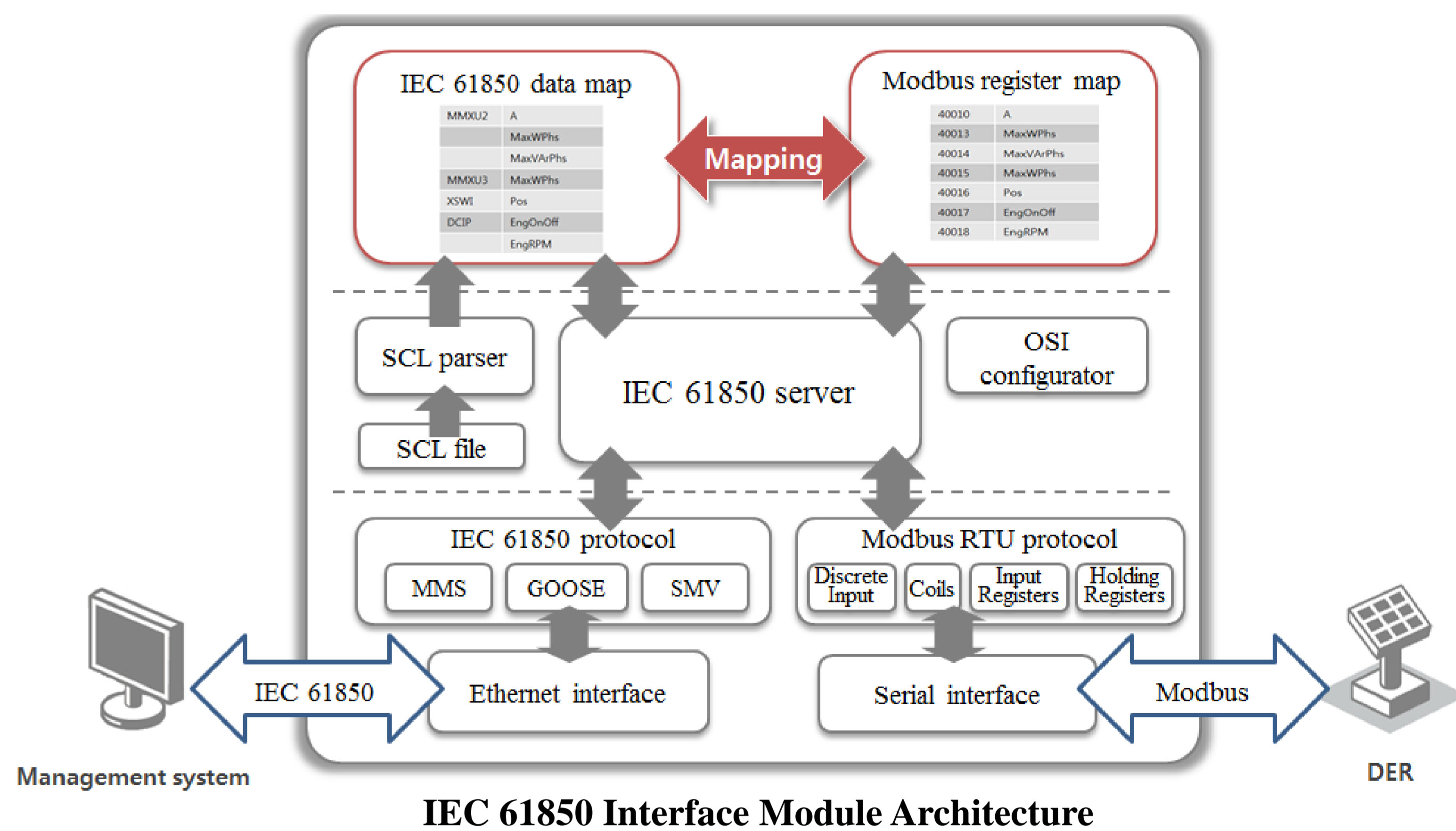
## Development Environment



IEC 61850 Interface Module Development Environment

## Interface Module Architecture

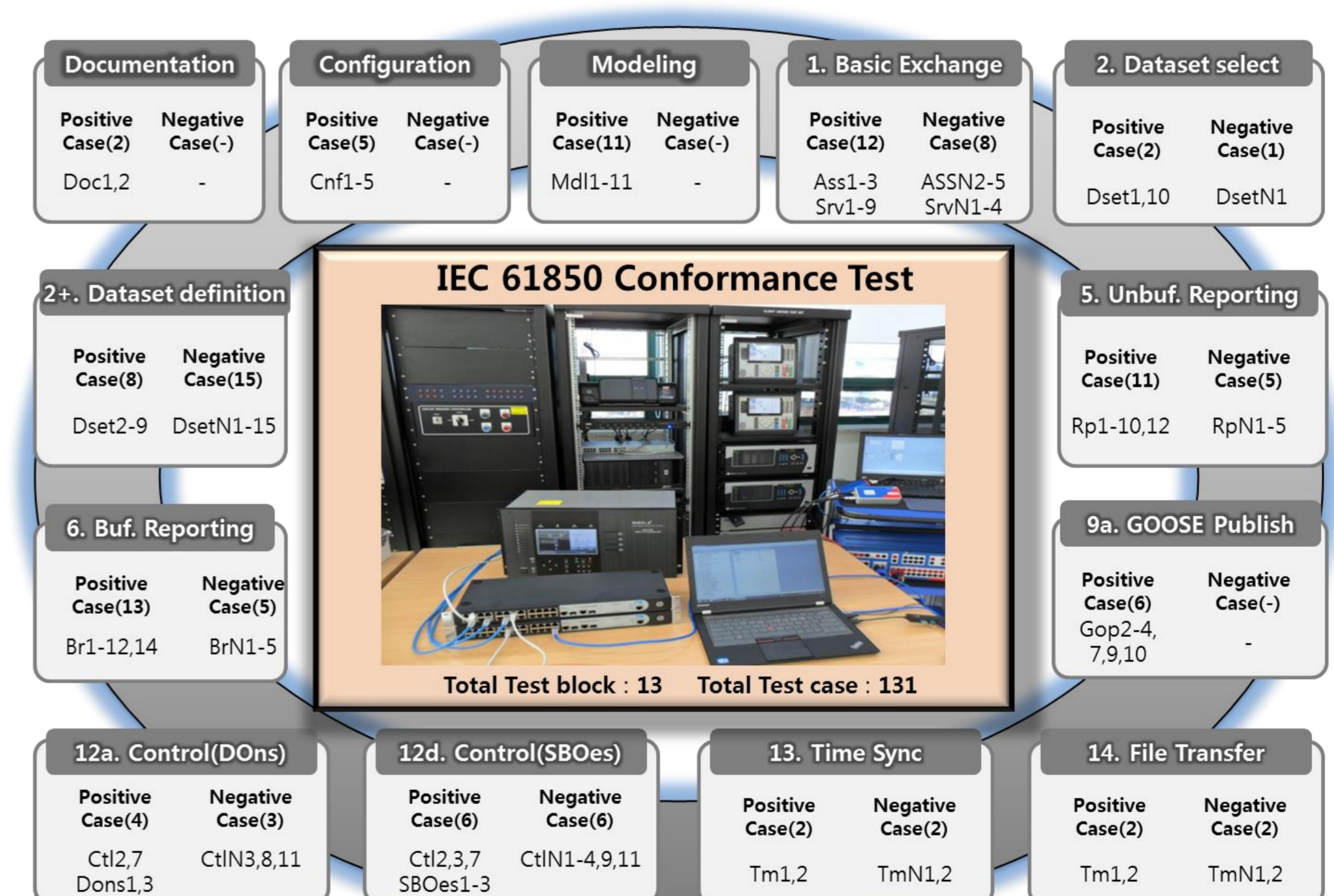
- Commercial IEC 61850 protocol stack(MMS-EASE Lite) porting
- SCL parser
  - SCL file parsing
  - Creation of IEC 61850 data map on the memory
- OSI configurator
  - Communication setting
- IEC 61850 server application
  - Processing of IEC 61850-based service requests from the clients or other servers
  - Protocol conversion between the IEC 61850 protocol and the protocol of the DER after mapping the IEC 61850 data memory onto the Modbus register memory of DER



IEC 61850 Interface Module Architecture

## Conformance Test

- IEC 61850 server conformance test of the interface module by level A IEC 61850 certification test laboratory
- Certification with 13 conformance blocks and 131 test cases
- Three test phases to pass all the cases
  - First phase : 45% of all test cases pass(mostly the basic functions)
  - Second phase : 61% of all test cases pass(detailed function, exception handling)
  - Final phase : all the test cases clear(remaining functions)



Conformance Test Blocks and Cases

