Testing Energy Meter compliance for Protocol & Performance as per standards

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Need for Open Protocol in Energy Metering

- IT in the form of, Intelligent Meters (IM), has already pervaded the Indian power sector.
- These meters provide information needed for billing, accounting, load survey, demand monitoring, power quality etc.
- These meters are being read automatically or remotely by various techniques.
- These meters have become a part of SCADA systems which are put together by the manufacturers and system integrators in some utilities.
Need for Open Protocol in Energy Metering

- The choice of communication medium is equally important as it along with protocol which assures seamless connectivity in the chosen distribution network and ensure successful implementation of the application.

- The application software at either end aided by a common open protocol can exchange required information as and when needed.
The goal of IT empowerment in distribution would require Interoperability, Data collection and Data Management.

Interoperability could be defined as “The ability of a system or a product to work with other systems or products without special effort on the part of the customer”

- Any system can read any meter
- No special involvement of vendors
METERING SUBSYSTEMS

HOST

CONNECTIVITY PROTOCOL

HT

DTr

LT

M1

M2

M3

M4

Mn

HT-Mn
Need for Open Protocol in Energy Metering

- IEC 62056 is already being adopted by many countries and is now finding place in many tenders floated by utilities in India as well.

- IEC 62056 is the only open standard which can be tested using a Conformance Test Tool (CTT) maintained by DLMS UA.
Present situation in India

- Indian metering industry is a heterogeneous one with multiple communication protocols.
- Even optical ports are not uniform complying to any standards.
- Another issue is the difficulties in integration of different make of meters at the field level.
- Difficulties in implementation of AMR (Automatic Meter Reading) in India.
IEC 62056 (dlms) FEATURES

OBJECT MODELLING - Companion Specification for Energy Metering [COSEM]
DATA IDENTIFICATION – Object Identification System [OBIS]
MESSAGING
TRANSPORT

MEASUREMENT ➔ COMPUTATION ➔ COMMUNICATION

METER

MANDATORY OBJECTS
ADDITIONAL OBJECTS

INSTANTANEOUS VALUES
PROFILES
TARIFF READINGS
POWER QUALITY PARAMETERS
AND OTHERS
<table>
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<th>IEC Part Number</th>
<th>Title</th>
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<tr>
<td>IEC 62056-42-2002</td>
<td>Electricity Metering – Data Exchange for meter reading, tariff and load control: Physical layer services and procedures for connection oriented asynchronous data exchange</td>
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<tr>
<td>IEC 62056-46-2002</td>
<td>Electricity Metering – Data Exchange for meter reading, tariff and load control: Data link layer using HDLC protocol</td>
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<td>IEC 62056-53-2002</td>
<td>Electricity Metering – Data Exchange for meter reading, tariff and load control: COSEM Application Layer</td>
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<td>IEC 62056-61-2002</td>
<td>Electricity Metering – Data Exchange for meter reading, tariff and load control: OBIS Object identification system</td>
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<td>IEC 62056-62-2002</td>
<td>Electricity Metering – Data Exchange for meter reading, tariff and load control: Interface Classes</td>
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<tr>
<td>IEC 62056-47-2006</td>
<td>Electricity Metering – Data Exchange for meter reading, tariff and load control: COSEM transport layers for IPv4 networks</td>
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DLMS UA provides a conformance testing process.

The main elements of the process are:
- Conformance test tool;
- DLMS Certification;
- Listing of compliant equipment;
- Conformance test maintenance process.

The process is based on self-testing, using the Conformance Test Tool.
Testing for protocol compliance

Test Setup

Conformance Test Tool

Device under Test
CTT is an application that automatically performs predefined test cases on devices implementing the COSEM object model and the DLMS/COSEM 3-layer, connection-oriented, HDLC based communication profile or the TCP-UDP/IP based communication profile.

The purpose of the CTT is to verify that the device implementation conforms to the standard, and, if not, to show which parts of the standard are not correctly implemented.
CTT takes as input a text file called the Conformance Test Information file (CTI file) that describes the relevant device parameters used during the test. The CTI is provided by the manufacturer in the prescribed format.

At the end of a test run, the CTT generates a test report showing which test cases passed and which failed. The test report is a digitally signed text file.
A CTI file may/must contain the Mandatory/Optional elements.

The following are Mandatory Elements:

- Manufacturer
  - Name
  - ThreeLettersId
- PhysicalDevice
  - Ident
  - SerialNr
- CommunicationProfilesSupported
- ApplicationContextsSupported
- SecurityLevelsSupported
- LogicalDevice [ ]
  - ServerSAP
    - Association [ ]
      - ClientSAP
        - ContextName
        - MechanismName
  - Conformance
    - DLmsVersionNumber
    - ServerMaxReceivePduSize
- HDLCProfile
  - PhysicalLayer
    - EchoingPort
    - OpeningMode
- DataLinkLayer
  - InactivityTimeout
  - InterFrameTimeout
  - ResponseTimeout
  - DISCToNDMTimeout
  - AddressingSchemes
- TCPProfile
  - ServerTCPPort
  - ConnectTimeout
  - ResponseTimeout
- ClassExtraInfo
  - Version
  - AttributeId
  - AttributeExtraInfo
As a Third Party Testing Laboratory, we test the device using CTT and the reports are forwarded to DLMS UA for verification & publishing the certificates.

Conformance test reports are filed by the DLMS UA, but they are not published. Copies should be available from the vendor.
Is the conformance test be enhanced continuously?

The DLMS UA regularly maintains the conformance test specifications and the conformance test tool to allow testing new features and to increase the depth of testing. The process is described on the DLMS UA conformance testing web-site.
How should products be labeled after passing the conformance test?

Upon acceptance of the test report, the DLMS UA recommends that the manufacturer displays the “DLMS/COSEM compliant” mark on its product and product literature.

The “DLMS/COSEM compliant mark can be found on the DLMS UA conformance testing web-site.
Enhancements to the product after it has passed conformance test, is it needed to re-test the product for conformance?

The DLMS/COSEM test certificate is valid for the product identified in the test certificate. The features of the product having passed the test are listed in the PICS and PIXIT / CTI files, which are part of the test report. The list of objects can be identified by browsing through the COSEM object list test part of the test report.
If during a product enhancement new features are added which were not tested earlier, the product must be re-tested so that compliance can be claimed.
Product configurations, do they need to be re-tested?

It is recommended that conformance testing is made on a few different configurations, characteristic for the implementation.

It is recommended that the DUT is configured for the tests in such a way, that all features implemented and available in any valid configuration are tested.
Testing for protocol compliance

- CPRI has the Conformance Test Tool to test meters with DLMS compliance, and has successfully tested:
  - 12 devices from 3 Indian manufacturers
  - 18 devices from 4 overseas manufacturers
  - Server stack for an Indian Company.
- CPRI is the only laboratory to test highest number of devices for DLMS compliance in the world (www.dlms.com)
- Manyquires are being received for testing devices for DLMS compliance.