IEC 61850 Client and Server Simulator

Introduction

61850 Client and Server simulators are very powerful tools for the development, but also for the testing and validation of IEC 61850 communication. The Xelas Energy Management (XEM) Product Portfolio contains these simulation tools to compliment the XEM development environments.

This datasheet will describe in more detail the features of the 61850 Client and Server Simulators.

Xelas Energy Management IEC 61850 Simulators

61850 Client and Server Simulators are very powerful tools for the development, but also for the testing and validation of IEC 61850 communication. Xelas Energy Management (XEM) contains these simulation tools to compliment the XEM Development Toolkits.

The XEM 61850 Simulators are available separately, for both client and server roles. They provide easy-to-use, comprehensive simulation over the IEC 61850 standard interfaces, including actual behavior. They can be used to test any commercial 61850 compliant product.

The simulators demonstrate the generic XEM architecture. This XEM architecture offers a very scalable approach. Multiple simulators can be started on a single system. Each simulator will use unique selectors but the same NSAP (IP Address). Each simulator instance can be configured to use different SCL files, and will be started in a self-contained directory structure. The simulators are integrated with the overall XEM process management and multi-platform configuration support features.
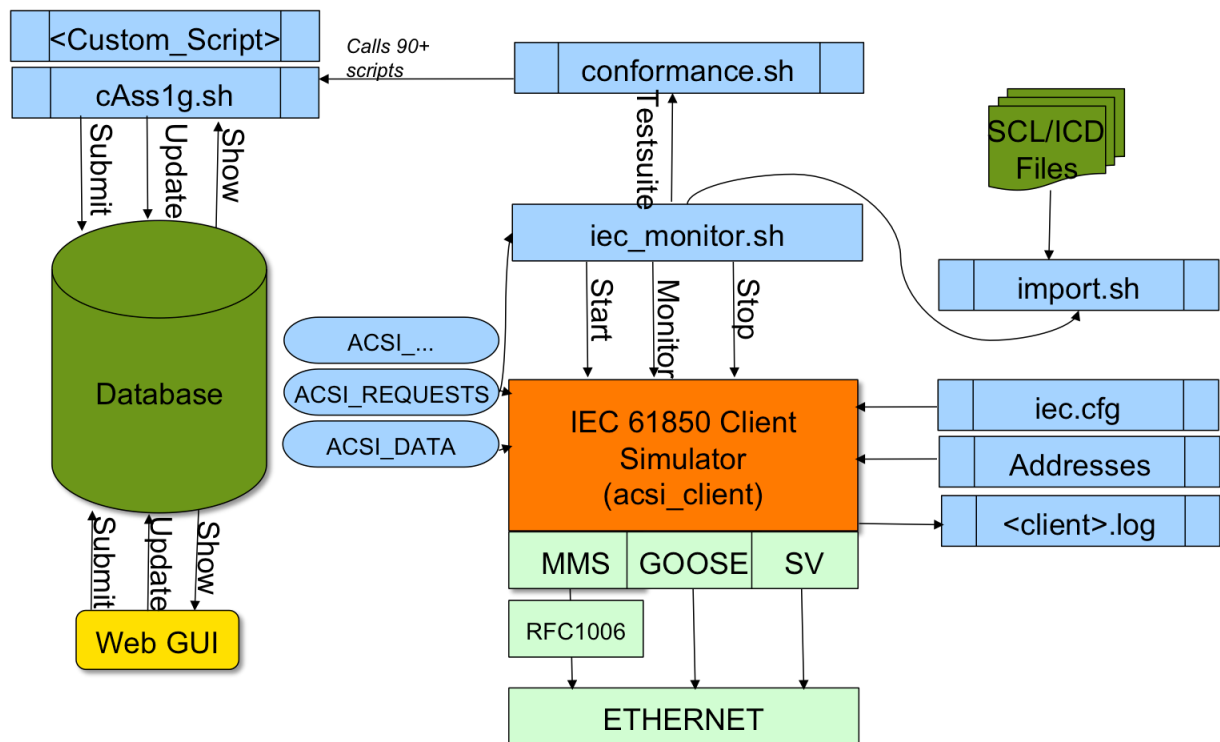
Figure 1. High Level Architecture of a 61850 Client Simulator

The XEM 61850 Simulators operate in the same interactive, script driven mode as all other XEM products. They can be operated in a command mode, but also using the

advanced XEM GUI. The XEM Simulators can model complex behaviors, including interactions with databases and prototyping GUIs. Simulators offer a complete implementation of the IEC 61850 server or client, supporting all the PICS as described in the user guide, without the need for a development API.

Capabilities included are:
- ➢ SCL files imported in the RDBM (for client simulators) or loading SCL file dynamically, to build a memory database (for server simulators)
- ➢ Various models can be defined in the SCL file such as:
  - o IEC 61850-7-2/3/4 (Substation Automation)
  - o IEC 61400 (Wind Power energy)
  - o IEC61850-Part 7-410 - Hydroelectric power plants (HYDRO)
  - o IEC61850-Part 7-420 - Distributed Energy Resources (DER)
- ➢ Capturing changes to data in the RDBM (client simulator) or in a text file dynamically (server simulator).
- ➢ Issue of and Responds to the IEC 61850 requests.
- ➢ Receive and Submits reports and update logs as configured in the SCL file.

The XEM Simulators support the IEC61850-10 Test Suite, with audit support for all IEC 61850 operations and key features such as:

- ➢ Easy coupling of third party client/servers to simulators.
- ➢ Validation and regression tests with third party client.
- ➢ IEC61850-10 conformance chapter specifies test cases for many test control blocks for both client and server certification.
- ➢ Possibility to maintain multiple test configurations with capability to specify customer details, client/server type (Xelas Energy Software or third party), disable/enable test control blocks and individual test cases.
- ➢ Both Web GUI and script interface can be used to start a conformance test or test suite for a specific configuration.
- ➢ After scheduling the request, the scripts will run requests between client and server conformant with IEC61850-10 and can be monitored in the GUI (logs, captures, results.)
- ➢ At the end of the test an HTML report is generated. The GUI will allow easy pinpointing of a problem with ability to review of logs and captures.
- ➢ The test suite is scripted and extensible.
- ➢ Regression tests can be run, allowing repeated execution of test suites between 61850 client and server components, capable of running millions of operations in fully automated fashion.

SCL support

The XEM Simulators offer an easy import of specifying SCL files of the client or server that needs to be tested. They include an installed sample agent.scl which works with the Xelas Energy Software client/server & test suite, containing all IEC 61850 elements such as:

➢ Logical Devices
➢ Logical Nodes
➢ Data objects and attributes
➢ Datasets
➢ Reporting Control block
➢ Log Control block

The last two features (Reporting Control Block and Log Control Block) enable the easy selection and grouping of the required test operations and simulation scenarios. Scenarios may be crafted and captured for repeatable formal testing.
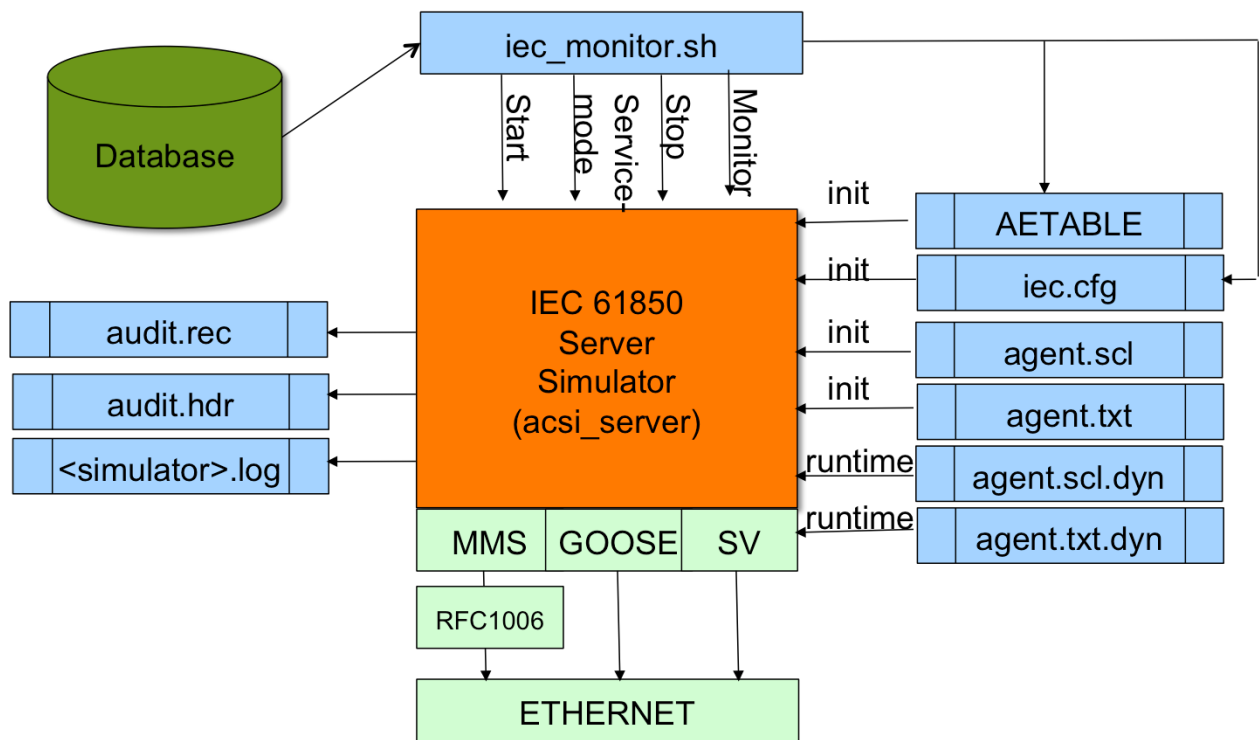

Figure 2. High Level Architecture of the 61850 Server Simulator

The dynamic update of the server simulator works according the following steps:

➢ When a file agent.scl.dyn is detected (for example by IEC 61850 file upload), it triggers reload of SCL information model in memory.

➤ ACSI Server Simulator binary will read the file. The file is used to specify:
- ○ Which data values are simulated
- ○ Any corresponding values
- ○ The format for the data reference must be ACSI compliant as described in IEC 61850-7-2 standard.
- ○ The services which are configured to be rejected

➤ Triggers changes to be propagated to the SCL object model (and may cause reports, logs or GOOSE events depending on the configuration of the SCL model)

The simulator acts completely like a real device! In the XEM development edition of the server simulator, it is also possible to extend types and behavior as needed and build a new acsi_server simulator binary.
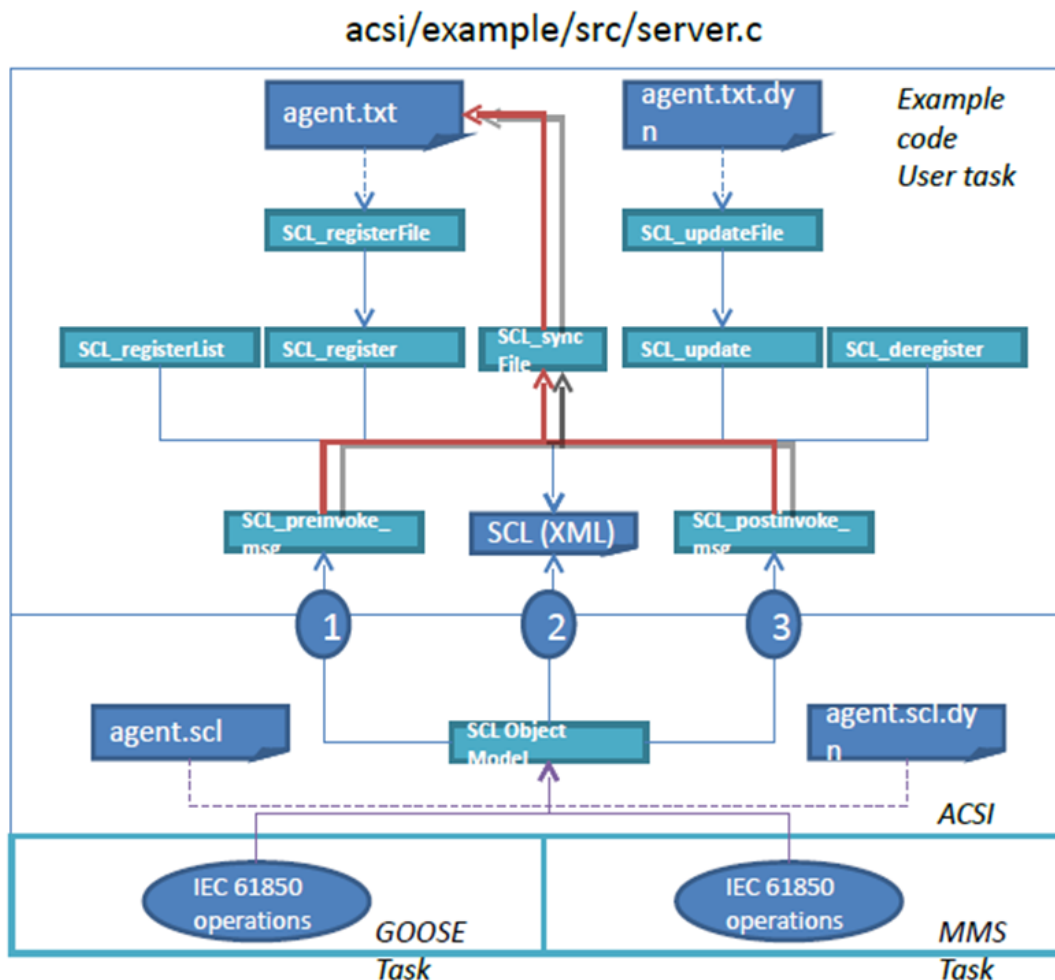
Figure 3. Information Flow Within the Simulator

Return on Investment

The Xelas Energy Software Simulators offer all features that support a project through the entire software lifecycle:

- ➢ DESIGN - simulate both client and server to validate the information model and prototype the user interface
- ➢ DEVELOPMENT - generate customized example application code for use with XEM client and server development products
- ➢ UNIT TESTING - interactive mode for unit testing of real application against simulation
- ➢ QUALITY ASSURANCE - develop scripted scenarios for formal regression testing
- ➢ MAINTENANCE - interactive mode for recreation of problem scenarios

The result of using XEM Simulators is higher quality application code, reduced development cost and faster time to market for your application or equipment.

In a case study, the original project plan estimated:

- ➢ 6 man-months for information model development
- ➢ 10 man-months for a prototype of the graphical user interface
- ➢ 10 man-months for the development of simulations to validate the complete application

With the aid of the XEM 61850 Simulators:

- ➢ the information modeling effort was reduced to 4 man-months
- ➢ the GUI prototype to 3 man-months
- ➢ the simulation development to 4 man-months

A savings of nearly 60%

In a project related to the case study, the development effort for a IEC Client included 22K lines of manager code and 14K lines of server code just for testing purposes. The development of test code represented 40% of their development effort. With XEM Simulators, the development of test modules can be reduced by as much as 80%, since scenarios are developed using reusable scripts with the support of a graphical user interface.

XEM Simulators expedite the development phase as well, both in the use of the Simulator GUI for interactive unit testing, as well as the new code generation feature.

Xelas Energy Management (XEM) Product portfolio

The Xelas Energy Management (XEM) Product Portfolio offers all the necessary building blocks to implement an IEC 61805 standard based communication network.

Protocols for all Essential Layers of the IEC 61850 Standard

- ➢ Protocols are delivered with toolkits to implement customer solutions.
- ➢ Manufacturing Message Specification (MMS) Protocol Stack including OSI Protocols
- ➢ RFC-1006 OSI Protocol stack
- ➢ GOOSE and Sample Values

IEC 61850 Client Toolkit

- ➢ 61850 Edition 1 and 2 fully supported
- ➢ Native MMS, GOOSE/SV Support
- ➢ Built on top of Java J2EE Framework. C and C++ APIs also available.
- ➢ Persistent storage of all data, multiple database support, though ODBC/JDBC
- ➢ Multiple Information modules supported such as 61850-7-420 and 61400
- ➢ Multi-threaded scalable architecture
- ➢ Ported on various platforms: Linux, Windows, UNIX

IEC 61850 Server Toolkit

- ➢ 61850 Edition 1 and 2 fully supported
- ➢ Native MMS, GOOSE and SV support
- ➢ C Development environment for greater portability and performance
- ➢ Architecture optimized for embedded RTOS
- ➢ Ported to VxWorks, pSOS, Embedded Linux
- ➢ Both binary as well as source code available

IEC 61850 Dynamic Integration Platform

- ➢ Integrate various Protocols and Information Models
- ➢ Dynamic reconfigurable with Java script Off the shelf adaptors: IEC 61850, SCADA 5-104, OPC, XML, SNMP, ASCII
- ➢ Platforms: Linux, Solaris, HPUX, Windows
- ➢ Off the shelf Adaptations for various Information Models:
  - o IEC 61850-7-2/3/4 – Substation Automation
  - o IEC 61400 – Windpower
  - o IEC61850-Part 7-410 – Hydro-electric Power Plants (HYDRO)
  - o IEC61850-Part 7-420 – Distributed Energy Resource (DER)

Check www.xelasenergy.com for more product Information.

About Xelas Energy Software

Xelas Energy Software is a dedicated division within Xelas Software. The energy products and solutions are based on twenty five years of experience of implementing complex network management solutions. There are multiple products, originally built for telecom network management that are applicable to IEC 61850 management as well.

Xelas Software established its market role through intense participation in industry collaboration, and developed standard software components now widely used by market leaders such as Alcatel-Lucent, Nokia Solutions Networks (NSN), Motorola, Ericsson, IBM, NTT, NEC, Samsung, Huawai and Telefonica. Xelas Software products are made to fit energy, telecom, messaging and aviation network management markets.

Xelas Software is a privately owned company, which acquired the software licenses and intellectual property of Vertel Corporation and Retix. Xelas Energy Software, a division of Xelas Software, with development offices in the U.S. and Europe, is one of the few software vendors worldwide to have implemented in-house the IEC 61850 standards, including MMS protocol, GOOSE, SV and OSI Protocols (RFC1006).

Xelas Energy Software

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