

LETSI Web Services for Learning Run-Time Communication

One of LETSI's first projects is the development of web services APIs to manage run-time communication between learning content and learning management systems (and/or other systems interacting with learners). Participating within the LETSI Web Services for Learning Run-Time Communication project are representatives of: Booz Allen Hamilton, BBN Technologies, the ADL Initiative, Rustici Software, and the Southwest Research Institute (SwRI).

The LETSI Web services project is intended to address a number of requirements not met by the existing standard, which is the "SCORM ECMAScript Interface for Content to Runtime Services Communication (IEEE 1484.11.2-2003)." The ECMAScript API is designed around browser-based learning delivery. Sophisticated learning methodologies, such as game-based learning and simulations, often are not browser-based and thus are difficult to integrate using the ECMAScript API. Moreover, the ECMAScript API may not be a good choice for high-stakes learning and assessment because of the history of security vulnerabilities associated with the ECMAScript API in browser-based learning delivery.

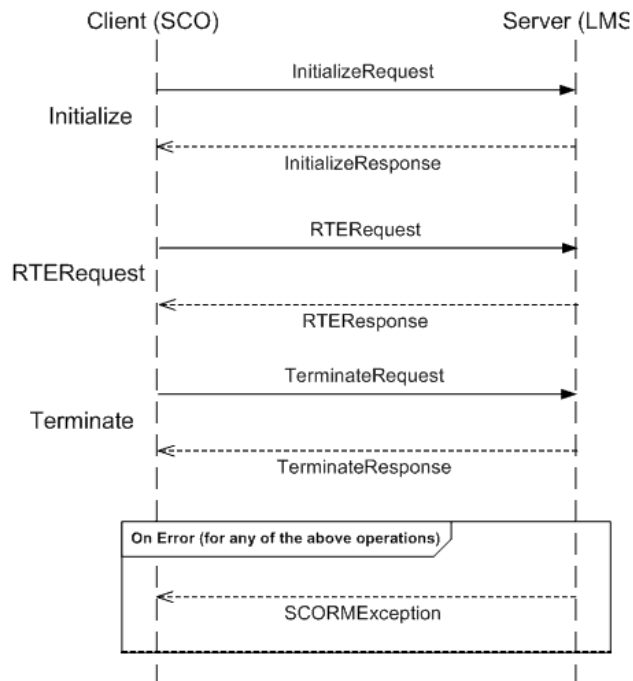
There are widely varying requirements associated with a range of different run-time communication use cases. Thus, the intent is not to define a "one-size-fits-all" web service binding, but a choice of service definitions and specific interfaces (SOAP and RESTful) that meet specific implementation requirements.

LETSI's web services API project has been divided into two phases.

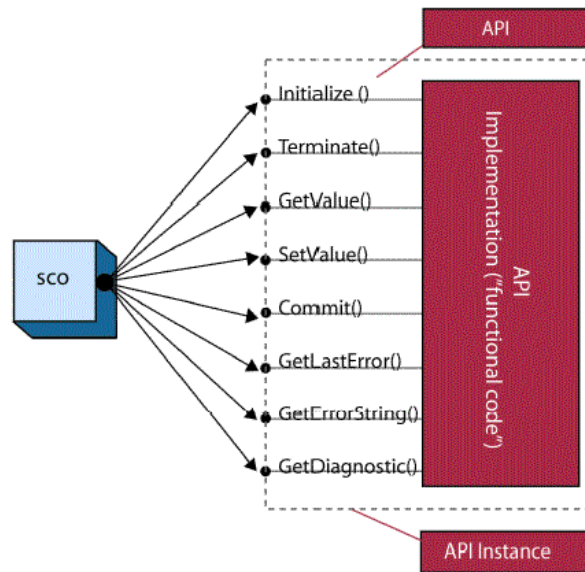
LETSI Learning Run-Time Communication Phase 1

The first phase is focused on maintaining a close correlation with the existing IEEE ECMAScript API. The Phase 1 design draws upon an early prototype offered by BBN Technologies (<https://letsy.org/bbn>). The Phase 1 web services definitions directly incorporate the IEEE XML binding of its data model for "Content Object Communication" (IEEE 1484.11.3-2005). An early proof-of-concept prototype built by Booz Allen Hamilton showed how web services built according to the LETSI web services definitions could even be implemented transparently as an adapter over an implementation of the existing ECMAScript API.

LETSI Web Services for Learning Run Time Communication Phase 1



ECMAScript API for Content to Runtime Services Communication



LETSI's Phase 1 web services are SOAP-based web services defined using web services definition language (WSDL). The SOAP-based web services developed for Phase 1 will use parts of the "WS-*" stack of technologies, including the WS-Security and WS-Reliable Messaging. Using these portions of the WS-* stack is important in meeting security and quality-of-service requirements associated with key use cases.

Example: Consider a multi-day, high-stakes simulation relating to homeland security or a similar sensitive topic. Such a simulation might involve dozens of people connecting from several different networks around the country or around the world.

For such a use case, WS-Security and WS-Reliable Messaging would provide the means to secure the communications of participants and to ensure that the integrity of the entire simulation would not be compromised by isolated and/or temporal network or communication errors.

Reliable messaging is critical for supporting mobile learning. The need for mobile applications to gracefully handle "occasional connectivity" is one of the key motivators driving reliable messaging in Web services.

Example: Consider a learner starting a learning session on a mobile phone during his or her morning commute on the train. The quality of communications may vary and is likely to drop completely when the train enters a tunnel or goes near structures that interfere with connectivity. Reliable messaging protocols could support applications that allow learners to pick-up where they left off after a temporary service disruption.

LETSI Learning Run-Time Communication Phase 2

Phase 2 of the LETSI project is not necessarily bound to either the existing IEEE data model, nor SOAP-based web services. RESTful web services bindings and a revised or alternative data models will be explored in Phase 2.

As part of an effort to advance a next-generation framework for learning run-time communication and to better support requirements for WSDL-based, RESTful, and other types of service interfaces, Phase 2 of the LETSI project will take a fresh look at the underlying data model. This work has not yet begun, but the diagram at the end of this paper is offered to illustrate such a model at a high level.

REST is an acronym standing for Representational State Transfer (<http://www.ics.uci.edu/~fielding/pubs/dissertation/top.htm>). At the heart of REST are named resources, which are identified using an URL. In learning run-time communications, among the key top-level resources to be managed are "Learning Session," "Learning Participant," and "Learning Session Report". These resources are not explicitly referenced within the IEEE Data Model for Content to Learning Management System Communication. There also are new fields that could be added to the existing IEEE data model that would enhance reporting from environments such as games, simulations, and virtual worlds.