A secure client/server interface protocol for the electricity prepayment vending industry

by Kennedy Pregarsen Subramoney and Prof Gerhard Hancke

Electricity prepayment systems have been successfully implemented by South Africa's national electricity utility (Eskom) and local municipalities for more than 17 years. The prepayment vending subsystem is a critical component of prepayment systems, as it provides convenient locations for customers to purchase electricity. It predominantly operates in an "offline" mode. However, electricity utilities are now opting for systems that operate in an "online" mode.

→ *Customers purchasing prepaid electricity from the first XMLVend 2.1-enabled point of sale in Vereeniging (Sharpville).*

The online mode of operation or online vending is when a prepayment token is requested from a centralised server that is remote from the client at the actual point of sale (POS). The token is only generated by the server and transferred to the POS client once the transaction, the POS client and the payment mechanism have been authenticated and authorised. The connection between the POS client and the server is a standard computer network channel (like Internet, direct dial-up link, X.25 or general packet radio service (GPRS).

Research concluded in the Department of Electrical, Electronic and Computer Engineering identified the lack of online vending system standardisation as a matter of concern, as it posed a significant risk for utilities, which faced the problem of being locked into proprietary online vending systems. Thus, the South African prepayment industry (led by Eskom) initiated a project to develop industry specifications for online vending systems.

The first critical task in this project was to conduct a current state analysis of the South African prepayment industry, technology and specifications. The prepayment industry is built around the standard transfer specification (STS). This has become the de facto industry standard to securely transfer electricity credit from a POS to the prepaid meter. STS is supported by several offline vending system specifications.

The current state analysis was followed by a requirements analysis phase. The requirements analysis confirmed the need for a standard interface protocol specification, rather than a full systems specification. The interface specification focused on the protocol between a vending client and vending server, and did not specify the client and server application layer functionality and performance requirements. This approach encouraged innovation and competitiveness among client and server suppliers, while ensuring

interoperability between these systems.

The online vending protocol design was implemented using the web services framework, and was therefore appropriately named XMLVend. The protocol development phase was an iterative process with two major releases, XMLVend 1.22 and XMLVend 2.1. XMLVend 2.1 is the current version of the protocol. XMLVend 2.1 addressed the shortcomings identified in XMLVend 1.22, updated the existing use cases and added several new use cases. It was also modelled as a unified modelling language (UML) interface or contract for prepayment vending services. Therefore, clients using the XMLVend interface are able to request services from any service provider (server) that implements the XMLVend interface. The UML-modelled interface and use case message pairs were mapped to Web Service Definition Language (WSDL) and schema (XSD) definitions respectively.

XMLVend 2.1 is a secure and open web service-based protocol that facilitates prepayment vending functionality between a single logical vending server and n number of clients. It has become a key enabler for utilities to implement standardised, secure, interoperable and flexible online vending systems. ☻

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→ *Successful commissioning of the first XMLVend 2.1-enabled point of sale.*