Chapter 10: Information Technology (IT)

IT innovations for e-Customs

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Abstract: The ITAIDE project shows that a complex set of external drivers influences the modernization strategies of Customs agencies. Rapid advances in technology available to Customs agencies push investments to replace antiquated systems with more sophisticated tools and processes, and to introduce radical procedure redesigns supported by advanced technologies in order to help Customs simultaneously balance and optimize the twin goals of trade facilitation and border integrity. Three main technologies have been used as cornerstones in the ITAIDE Living Labs: container security devices, Service-Oriented Architecture (SOA), and information sharing standards and services. In this chapter we provide an overview of these technological cornerstones of the ITAIDE innovations.

Key words: IT innovation, container security device, SOA, EPCIS, information sharing

1 Container security devices

In its Container Security Initiative Strategic Plan for 2006-2011, the US Customs and Borders Protection (US CBP) states that “the use of electronic seals and the development of container technology that can track and report on the integrity of a shipment will provide supply chain stakeholders with a real time picture of the location and status of shipments and give carriers better control of equipment. These technologies significantly impact domestic and foreign cargo handling and trade facilitation” (U.S. CBP, 2006, p. 18).

Container security devices thus support a number of functional requirements, e.g., (1) they act as electronic container seals, (2) they enable tracking of containers and of shipments (location information), (3) they report on the integrity of shipments (status information), (4) they are accessible to multiple supply chain stakeholders and (5) they provide real time information.
1.1 How Smart is a smart seal?

Container security devices – also referred to as electronic seals or smart seals – with varying degrees of sophistication exist in the market, ranging from simple mechanical devices to lock container doors to devices that utilize Radio Frequency Identification (RFID) technology, satellite technology for container tracking, security-related sensors (e.g., illumination inside the container) and logistics-related sensors (e.g., temperature, shock) and means of communication (e.g., GSM, Wi-Fi) to detect and report attempts of tampering with container integrity or undesired changes in the state of the goods. The ITAIDE Living Labs deployed advanced electronic seals to explore the maximum potential of these technologies. We present the capabilities of high-end smart seals by using the example of Tamper-Resistant Embedded Controller (TREC) devices, which have been used in the Beer Living Lab and Asset Tracking (AT) technology in the Drug Living Lab.

1.2 TREC devices and the secure trade lane

A TREC device is a container mounted device consisting of a GPS receiver, a number of environmental sensors and communication modules, as well as power supply. Its GPS receiver tracks the container’s precise location (on regular intervals, upon deviation from expected route and upon arriving at specified locations), while its sensors continuously monitor the physical state the container is in (temperature, humidity, illumination, potentially poisonous gases) and its state (door opening, tampering attempts, movement, acceleration, shock). A TREC device can securely store and periodically transmit this status information to a database where it can be accessed by authorized parties. It can also be configured to raise real-time alerts whenever a predefined event takes place (expressed as a business rule that is violated).

TRECs are part of IBM’s Secure Trade Lane (STL) Solution of which the STL Backend is the other major component. STL is an example of a Service–Oriented Architecture (SOA) that can be used to exchange information between the businesses in the supply chain and the government agencies involved in cross-border control procedures of the supply chain. STL uses open standards and IBM technologies to deliver highly secure status updates on cargo containers as well as real-time, wireless global access to their content-status and location (IBM, 2006). The STL Backend application provides several services, the most important of which are:

- Container tracking: A ‘container tracking and security device’, in this case an IBM TREC (see Figure 1 below), is utilized to pass on data about the precise location (GPS coordinates) of a container at regular intervals. It is configured to signal events (e.g., when the container enters or leaves a predefined location, particularly the warehouses and ports of departure and destination) and to detect the loading and unloading of the container onto or from a vessel.
- Shipment monitoring: Shipment monitoring services (SMS) are used to configure a TREC with a particular route, defining relevant geo zones (geo-