accordingly. The 'Return' button deletes the 'current holder' field of the subsequently scanned item (in the data base and on the NFC chip). 'Manipulate item' allows a database entry to be displayed and modified when the corresponding item is scanned. Thus, items can also be added or deleted here. With a 'More' click, additional information and a search function are displayed.

Evaluation

After the NFC-based inventory system was introduced, problems with using this approach in a practical environment soon became apparent. These problems were caused by the poor response of NFC tags, when any metal object was in their vicinity. As even some smartphones have metal cases, this resulted in a poor NFC communication reception. Thus, the evaluation recommends that smartphones with metal case are not used with an NFC-based inventory system. All following evaluations were performed with non-metallic smartphones.

The project identified a smartphone with a good NFC reception, a non-metallic case, and it was also expected to find suitable 'metal-compatible' NFC tags. In particular, explicit metal-shielded tags are expected to work on any surface. The tests utilized metal-shielded tags ranging in price from a few cents to a few dollars. The cheap metal shielded tags performed as poorly as non-shielded tags, whilst the more expensive ones generally performed better than the low-cost tags. However, the evaluations have shown that even the most expensive and metal-shielded tags failed to work on a large set of metallic items.

Conclusions and Future Steps

Due to these problems with using the NFC system at metal objects, it was decided that an NFC tag-based approach was unacceptably unreliable, and the human-readable label system was reinstantiated. However, the smartphone app developed is still in use and determines a step forward in the entire inventory process, as it not only allows for an active identification of items – originally planned for by scanning their NFC tag –, but also allows for entering an identifier and all device-related information in a mobile manner, without the need for a Web-based inventory interface.

As very many metallic items were identified as difficult to read, even with current metal-shielded tags, the technology progress of new metal-shielded tags will be tracked in the near future for a possible return to the NFC technology. Once metal-cased devices work well with a new type of metal-shielded tags, the inventory system will be switched back to an NFC-based inventory system. In conclusion, when planning an introduction of an NFC-based system, it is important to ensure that NFC tags on metallic items can be used by verifying NFC tags operations on metallic items.

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TrakChain Estimates Costs for Track and Trace in the Internet of (many) Things

by Miguel L. Pardal and José Alves Marques

The TrakChain assessment tools take a description of a physical supply chain – relevant locations, how many goods are received, how often, etc. – and estimate the performance of track and trace queries in a modelled traceability system, providing predictions of how much processing and storage will be required for the working system. The tools were developed at Instituto Superior Técnico, Universidade de Lisboa, Portugal and were evaluated using a Pharmaceuticals supply chain case study.

The Internet of Things (IoT) promises benefits from a deeper connection between the virtual and physical worlds. One specific application area is logistics. The global economy depends on a wide range of supply chains that transfer goods from producers to consumers. The combined use of Enterprise Resources Planning (ERP) and Supply Chain Management (SCM) information systems has greatly improved the overall operational efficiency of supply chains. However, to achieve further improvements, more up-to-date and precise information about the supply chain is required.

RFID is an IoT technology that allows detailed and automated data capture in the supply chain, as specified by the EPCglobal standards [2]. Tags are attached to the objects of interest and readers placed along the supply chain locations generate event data, as illustrated in Figure 1.

A practical RFID traceability system should perform adequately for the large number of physical objects flowing in the supply chain [1]; and it should protect the sensitive business data from unauthorized access providing the desired data visibility [2]. The TrakChain project was proposed to evaluate both these aspects. It provides

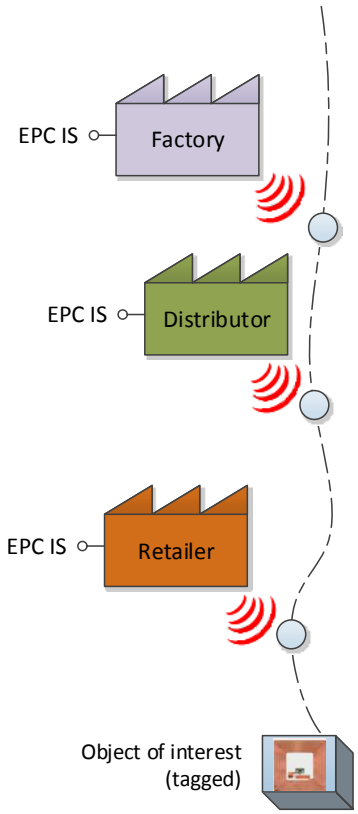

Figure 1: Data about a physical object of interest, tagged with RFID, is captured along the supply chain. EPC IS is a standard for capturing and sharing event data.

tools to estimate and measure the computational and communicational costs; and also security tools. The project was developed at Instituto Superior Técnico, Universidade de Lisboa, Portugal; in collaboration with researchers from the University of Cambridge, UK; and the Massachusetts Institute of Technology, USA; and was aligned with normalization efforts by GS1 for 'RFID data discovery services' and 'event-based traceability'.

Traceability Cost Models

The cost models can compare traceability systems for different supply chains, so that the best architecture for a given setting can be found. It helps to find answers for questions such as: Should the system be centralized or decentralized? Should data be copied to specific locations or referenced?

The data flow of the assessment tool is illustrated in Figure 2: given a supply chain characterization and system workflow specifications, the cost model can estimate processing times and data storage needs. The tool was validated with a case study in the Pharmaceuticals industry that compared solutions being proposed to ensure the authenticity of drugs [2].

Traceability Data Access Control

The supply chain participants need to trust that the traceability system will manage their data properly and enforce data access control, otherwise they will not share their data [3].

TrakChain implemented visibility restriction mechanisms that can be used to define and enforce access control policies using RDF and SPARQL. The policies can be converted to a standard format, XACML, to reuse existing enforcement infrastructures with certified management and audit tools.

The expressiveness of the policies was evaluated against a set of requirements for a real-world pharmaceutical traceability system, and it was shown to be expressive enough to satisfy the business requirements. For example, it can specify dynamic conditions to allow the sharing of data with business partners downstream in the supply chain that are not known in advance.

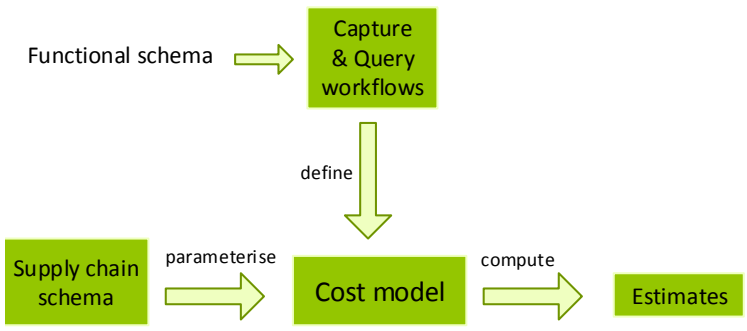

Figure 2: Data flow of the TrakChain cost assessment tool.

Future Work

More data attributes, such as expiry dates and temperature readings, can also be made available and controlled by the traceability system. The increase in the safety and quality of products is a good example of how the Internet of Things can help change the world for the better.

Link:
http://trakchain.net

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