A Model and Archetype Based Interoperability Framework for Near Real-Time Surveillance Systems

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OBJECTIVE

The pilot near real time surveillance system ASTER, which currently monitors the French Forces in Djibouti and French Guiana [1], has been especially designed for inter-allied interoperability. This paper briefly describes the rationale of this system's interoperability framework and components, and its results from a 4 years long experience.

BACKGROUND

Surveillance for health threats within allied deployed forces raises several operational constraints related to geographical spread of health-care data sources, nation-dependent information management and organization, data military classification, patient privacy, information accuracy and timeliness. These constraints advocate against a central data warehousing, and uphold a solution where data stay in-situ and where surveillance is done using real-time convenient queries against the data sources.

METHODS

The ASTER system adopts a lightweight interoperability approach using a logical model of epidemiological events [2] with the OpenEHR archetypes paradigm [3] and the CEN/TC251 prEN13606 standard. This approach is a "plug-and-play" semantic interoperability build upon a specific knowledge representation that avoids the rigidities of message-based standards, as HL7 or Edifact.

The logical model, which underlies the approach, is a typed first-order logic language tailored for the representation and reasoning about epidemic spread. It allows the formal definition of epidemiological events under surveillance and the systematic structuring of queries. It considers an epidemiologic event (a case) as a tuple: event = <eventId, population, location, time>, with some specific characteristics for time, location and population. Clinical features of the case are event attributes. From this model, archetypes are used for defining the epidemiological events against data sources and writing portable queries without reference to the underlying information model of each source, using an ontology of recorded information. The CEN prEN13606 normalizes the transfer of information and the security characteristics. Finally, information exchange is organised into web services using the logical model.

RESULTS

Thanks to the methods described above, we have written modelling tools for authoring OpenEHR archetypes and templates, and for linking them to existing data sources without the need they comply with a common schema. Queries for epidemiological events for surveillance and investigation purposes are collected into libraries of requests that can be addressed to data sources via web services. During the surveillance process, information can be used without data privacy disrupting or central consolidation. During the 4 years long experience of ASTER, this interoperability framework has been used with several data source models and their evolutions, with very lost costs of development or adaptation. It has been used with success during a NATO inter-allied disease surveillance experiment, and will support a NATO surveillance exercise this year. As a result of the previous experiments, an initial NATO Near Real Time Disease Surveillance Capability for allied deployments is planned using this system.

CONCLUSIONS

Automated acquisition of health-care data using ASTER's interoperability approach for near-real time surveillance: (1) Avoids the need for a central data warehousing, steering clear of lag associated with importing periodicity, privacy and data classification concerns, and a global data structure implementation. (2) Is not message-based, with no need for a Reference Information Model and the uniform implementation of messages specifications in all datasources. (3) Makes "plug-and-play" semantic interoperability possible. (4) Allows resources savings. (5) Gives a logical basis for further surveillance processes.

REFERENCES

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