

Med-e-Tel 2006, April, 6th 2006, Luxembourg

Seamlessly and Securely sharing health care data with Triple Space Communication

Authors: E. Della Valle, D. Cerri, A. Ghioni and D. Cerizza
Speaker: A. Castelli



Semantic Web Activities
CEFRIEL - Politecnico di Milano
email: swa@cefriel.it
web: <http://swa.cefriel.it>

→ The eHealth

- is a scenario in which the integration problem is amplified by
 - the intensive use of knowledge,
 - the need of accurately handling citizens' privacy, and
 - *live or death implications*.
- has been seeking for *semantic interoperability* since late '90s,
 - e.g.
 - Reference Information Model in HI7 v3
 - Archetypes of openEHR

→ Securely sharing health data among healthcare organizations remains an open challenge.

- e.g. realizing a multilanguage interoperable *European patient summary*
- e.g. realizing a Personal Health Record

→ Triple Space Communication

- is a new paradigm for developing an highly scalable, semantically enhanced communication infrastructure
- is *funded by several projects* at European and National level
 - e.g., TripCom - IST-FP6-STREP starting in April 2006
- might prove the right technology for sharing health care data respecting healthcare organizations' autonomy and citizens' privacy

HL7 (Health Level Seven) a non-profit, ANSI accredited Standards Developing Organization, founded in 1987, that provides standards for the exchange, management and integration of data to support patient clinical care and the management, delivery and evaluation of health care services;
<http://www.hl7.org/>

GEHR/openEHR, an initiative that foster EHR interoperability started in 1992 as the “Good European Health Record” EU research project that is currently maintained by the openEHR Foundation;
<http://www.openehr.org/>

CEN/TC 251, the technical committee on Health Informatics of the European Committee for Standardization, that, since 1998, is standardizing CEN EN 13606 / *EHRcom*; and
<http://www.centc251.org/>

IHE (Integrating the Healthcare Enterprise) [6], a not-for-profit initiative founded in 1998 that does not develop standards as such, but selects and recommends appropriate standards for specific use cases.
<http://www.ihe.net/>

1987 HL7 v1.x - it never got adopted

1995 HL7 v2.x - large adoption especially in USA

1999 CEN/TC 251 - the first to introduce, with CEN ENV 13606 / EHRcom, an **information model** and a **methodological approach** for deriving concrete *interoperable messages*

2002 GEHR/openEHR - proposal of the *archetype* concept and of a **two-level methodology**

2004 HL7 v.3 - definition of an Information Model (*RIM*) that is the ultimate **source** from which all **HL7 v3 protocol** specification standards draw their **information related content**.

Attempt for **specifying** the format of each of the **message** that can be exchanged among any pair of systems...

Attempt for **specifying** an **information model** and deriving all **messages** and **protocol specification** from such information model and formal terminologies (e.g. LOINC, SNOMED, etc.)

The proposals for standardizing an application protocol for the health care sector are all **similar** in concept and capabilities.

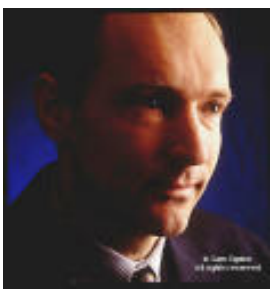
They try to address the **interoperability** problem by

- **introducing a shared conceptual model** (i.e., an ontology),
- **deriving message structure from such conceptual model** so that semantics is encoded in the definition of each element of data including its relationship with other elements,
- **defining the information**, which can be carried by each message, using **standard medical terminologies** (e.g., LOINC, SNOMED, INN, ICD, etc.)
- **binding the resulting messages to “*the technology of the day*”**, meaning EDI in the '90, XML and Web Services today, who-knows-what tomorrow

This idea is very **similar to the Semantic Web Services approach** in which “semantic interoperability” is achieved by modeling, at a conceptual level, Web Services and the domain they are deployed in.

Current trends

II Semantic Web



T. Berners-Lee

THE SEMANTIC WEB

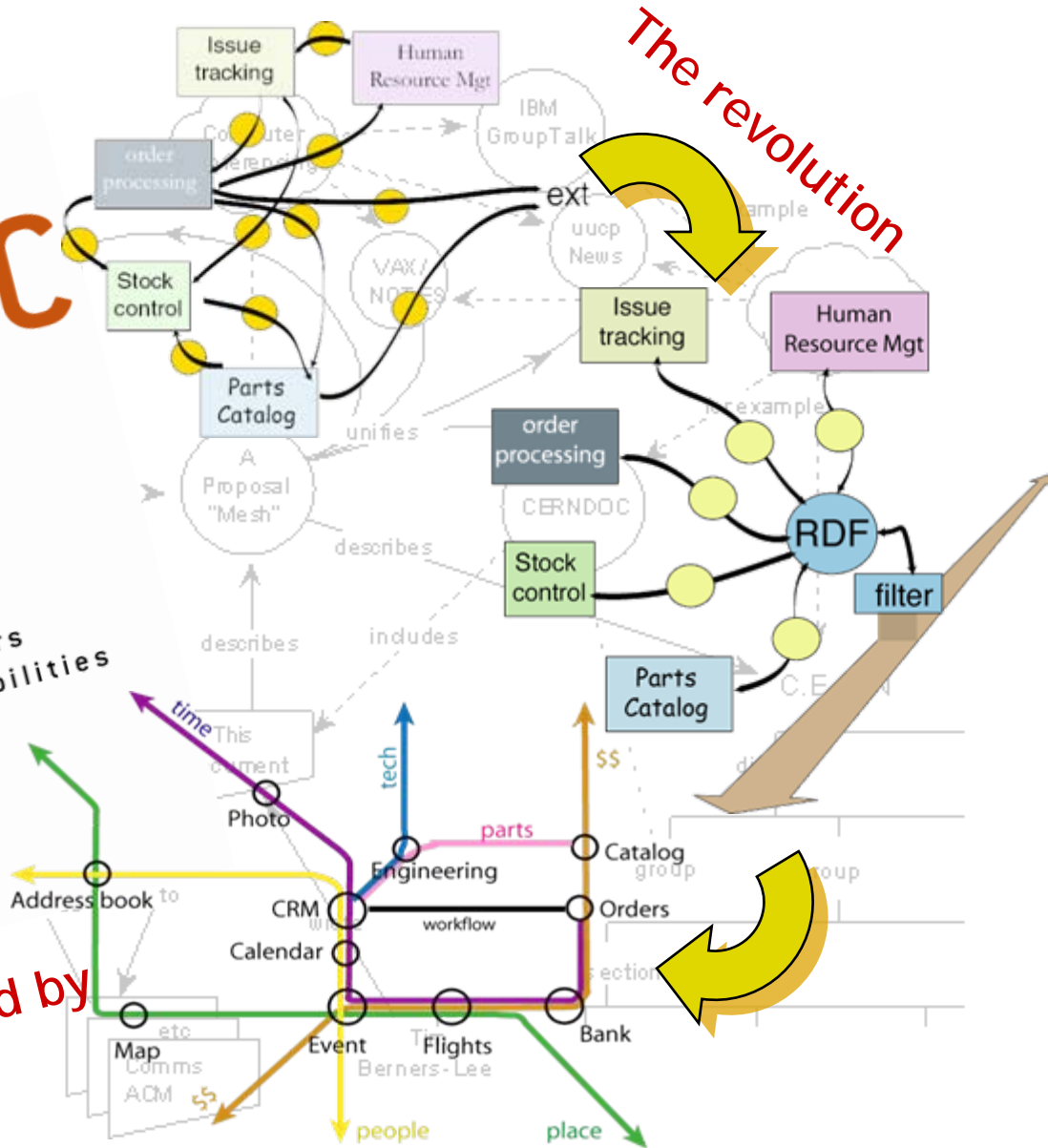
A new form of Web content that is meaningful to computers will unleash a revolution of new abilities

by TIM BERNERS-LEE, JAMES HENDLER and ORA LASSILA

Application interconnected by concepts



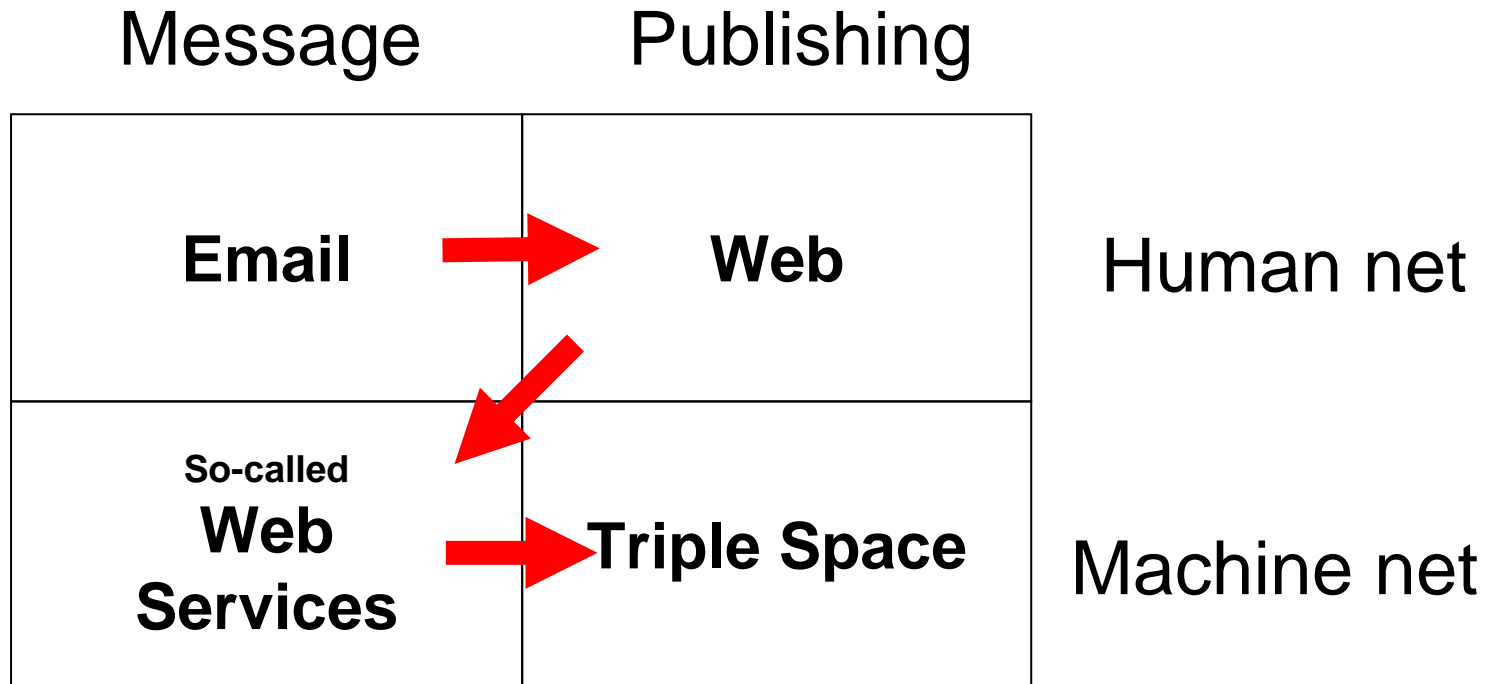
J. Hendler



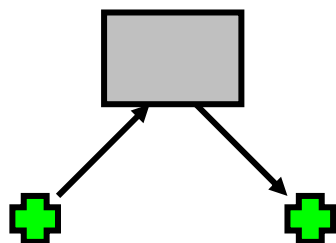


D. Fensel

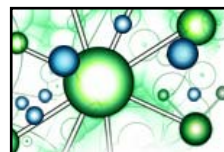
"Triple Space Communication will change the Internet usage through computers just as the Web revolutionized the Internet usage through humans"



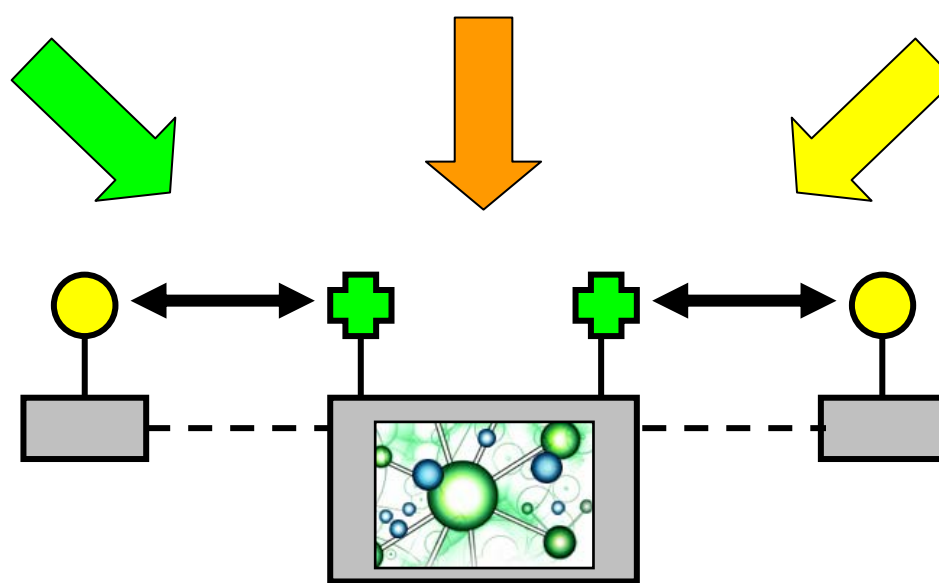
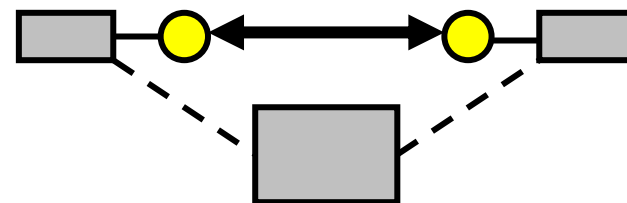
Tuple Space Technology



Semantic Web (Triple + Ontologies)

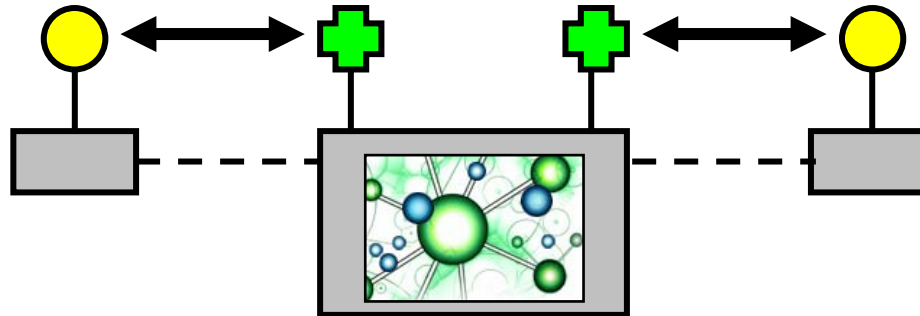


Web Service Technology



Triple Space Computing

Triple Space Computing



Pushing the state-of-the-art in the direction of

→ time autonomy

→ providers of data can publish data at any point in time

→ location autonomy

→ once published the data becomes independent of providers internal storage (thus available even if the providers are not on-line)

→ reference autonomy

→ providers are independent of the knowledge about potential readers

→ schema autonomy

→ the data is represented independently for any provider internal data schema

Message-based communication

- has proven efficient and effective for certain activities in this area (i.e., hospital administration), but
- has shown some problems to effectively and seamlessly collecting and integrating data from electronic health records.

When addressing the problem of collecting and integrating data from electronic health records, at least two are the possible solutions:

- **building centralized databases that would**
 - contain all the medical records on every patient.
 - incorporate all of the different access rules and policies regarding different users and different levels of access.
- **exchanging messages only when needed**
 - In this way no central repository is required and the ownership of the data seems respected,

- the *cost* of building the infrastructure and collecting the data is enormous,
- the centralized repository approach creates *competitive and security issues* about who controls and has access to the information on a specific patient,
- the *difficulty in maintaining up-to-date* a repository originating from a large number of independently evolving systems, and
- last but not least a message once sent (especially in an asynchronous scenario) gives the owner a *sense of disengagement instead of* strengthening the sense of *ownership*.

- each recipient must *know in advance where to look for information*,
- each recipient must *know in advance the terminology* (e.g., SNOMED, LOINC) *to use* when asking for a specific record content,
- each recipient ends up maintaining *a specific interface for each system* it has to interact with, and
- *mining* (for disease prevention, early diagnosis, pharmaceutical research, enhancement of patient safety) *becomes almost impossible* due to the large amount of messages to be exchanged

- **it is a realistic solution for the data ownership problem** because healthcare organizations will not lose their control over resources and they will be able to share information only with those that are authorized,
- **it provides a simple way to guarantee consistency** because health data won't be neither transmitted or copied but simple used,
- **it supplies a straight forward way to deal with integrity** because data won't be transmitted and it should be impossible for anybody, but the owner, to modify the data, and
- **finally, it is a cost-effective solution** because additional storage resources (and related management cost) are drastically reduced.

Like the Web changed the networking of humans from email exchange to persistent publication, **Triple Space Computing will revolutionize the networking of machines.**

eHealth will benefit in binding to Triple Space Communication in terms of

→ Interoperability:

→ the distributed infrastructure of Triple Space Communication will enable maximum decoupling (i.e. in time, space, information schema and terminologies) between eHealth services, hence exchanging information without regards to time, space and the standard they implement becomes possible

→ Information security and trust:

→ Triple Space Communication will enable the enforcement of Authentication and Authorization rules in a distribute way, in which every eHealth service is responsible for keeping the ownership of the data, but the health of citizens depends on the ability to trustworthy sharing data.

Thank you very much for your attention

Any question?

Contact

Semantic Web Activities
CEFRIEL - Politecnico di Milano

email: swa@cefriel.it

Web: <http://swa.cefriel.it>

Tel: 02 23954-324



This work is partially funded by the European Commission under the projects TRIPCOM (IST-4-027324-STP), COCOON (FP6 IST-507126) and by Italian government under the ITEA project Nomadic Media.