Expanding the Dynamic Collaboration in Teams of Portal and Non-Portal Based Users Using Semantic Based Tools and Constructs

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Shon D. Vick

The Johns Hopkins University
APPLIED PHYSICS LABORATORY

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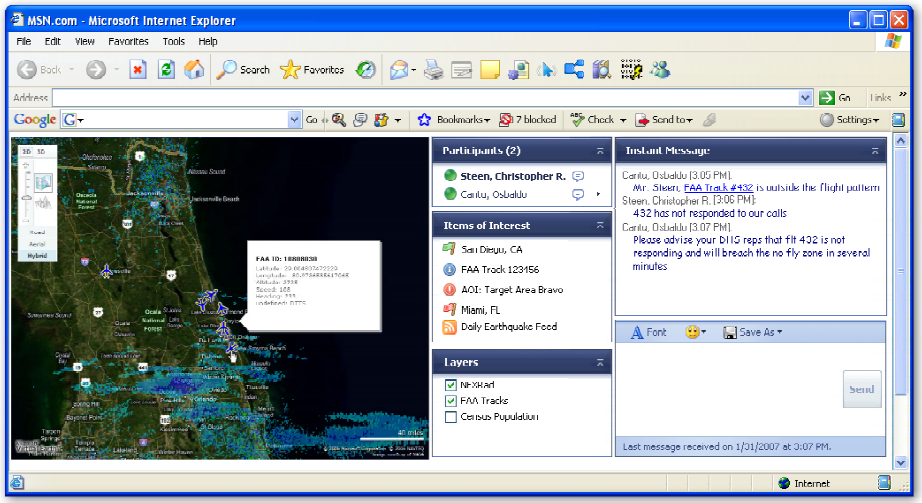
Introduction

- This talk is about several research efforts at The Johns Hopkins Applied Physics Laboratory (JHU/APL) to support collaboration for C2 and how they could be extended
- Research efforts
  - First effort developed a portal based prototype to evaluate the feasibility of an integrated capability that synchronizes text and geospatial displays using a limited form of semantic web technology
  - The second effort (non-portal based) examined an architecture that supports disadvantaged users (i.e. users with lower system capabilities).
- Extensions
  - While the prototypes yielded useful observations and results, fundamental limitations in the two architectures are present.
  - An selection of potential tools and technologies to be explored to enable more semantically rich representations for more effective C2 will be presented.

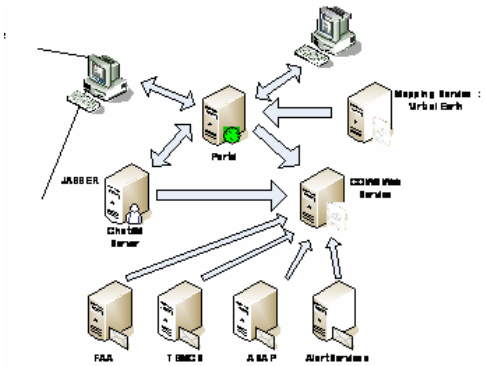
Portal Based System Effort

- User Defined Operational Picture (UDOP) -Users choose what/how data will be visualized
- Research to evaluate web portal environment that synchronizes text and geospatial displays using semantic web technology.
- Primary goals of the project were:
  - Integrate the geospatial display and chat clients into a single web application,
  - Interface chat with geospatial display based on semantic relationship



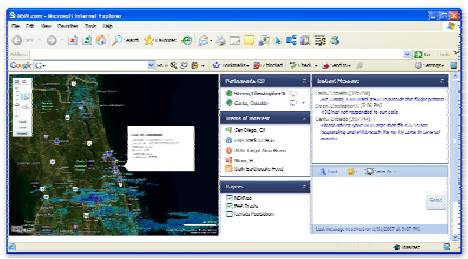
Portal Based Architectural Components

- ***Web application framework*** - EXT allows proper "piping" between each of the other frameworks and provided for the visualization capabilities.
- ***Chat framework:*** Two components were used to deploy the full chat capability.
  - On server-side, JABBER was used for the management, processing, and exchange of chat messages
  - On client side Microsoft instant messenger was used to view the chat text in the web browser on the client side.
- ***Geospatial framework***
  - Microsoft's Virtual Earth 5.0 APIs were used for the base-maps and navigation tools.
  - The framework included the ability to switch between various geospatial services
- ***Data services:*** Three different types of datasets and exchange standards were selected as test cases:
  - a web service that produced FAA tracks
  - the tiling service that produced Doppler radar of the entire US
  - GeoRSS feeds of events throughout



The Collaboration Manager

- Geospatial collaboration is effected by a Collaboration Messenger(CM) as a limited form of social software.
  - The term social software is often applied to a wide range of web-enabled applications for sharing a body of knowledge (BOK)
  - In a C2 setting such a BOK can be used to disseminate situational knowledge, tactics, and procedures and so on.
- Sharing Information
  - CM allows a user to communicate and share information with other users listed on a User Roster (UR). Information is exchanged through text and a construct called a Point of Interest (POI).
  - POIs may exist in a database or be defined by a user.
  - An entry in the UR is composed of username and email addresses but no other meta-data
- The Jabber protocol is used to exchange textual data and the POI between CMs.
  - There is no semantic information or meta-data in this exchange.
  - System cannot route text or POI to everyone on the UR or to a room with some interest or need to know or based on the interests



Simple Semantic Integration

- An interface between the chat and geospatial display based on a very simple semantic relationship was attempted.
- Limited semantic linkage was accomplished between chat data when FAA links were displayed.
  - If for example the chat text showed FAA Track #12z3, the user could click on the link and the map would reset and be represented in the geospatial display.
- A natural language application was used to implement a limited real-time parser that could identify chat messages related to geospatial features (e.g., cities).
- However semantically richer interaction between the geospatial display or even between two chat sessions was not accomplished.
- The issues involved in such semantic integration are discussed latter in this talk.

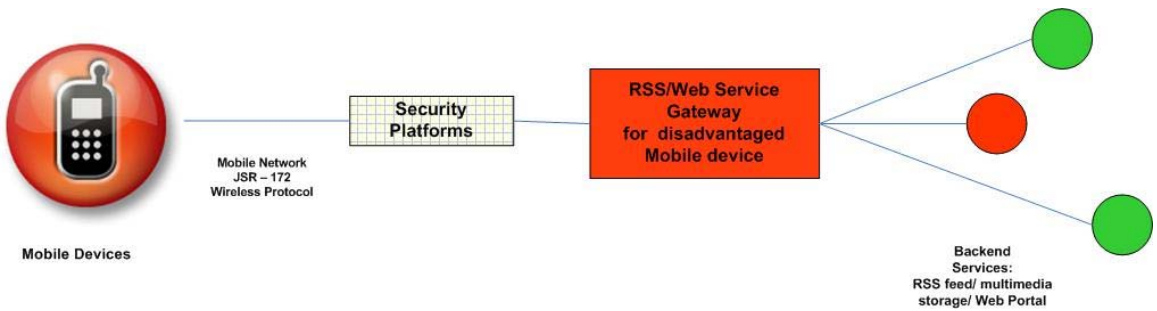
Dynamic Collaboration for Non-Portal Users

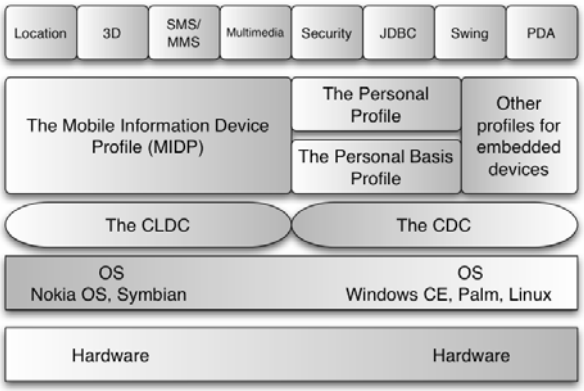
- Objectives
  - Build an RSS data server as well as a mobile RSS consumer/reader.
  - Allow mobile devices to consume web services with or without standard protocol.
  - Develop a method to allow a "disadvantaged" device to display data on a screen that was possibly meant for a portal user.

- Achieving these objectives required significant research to gain an understanding of the current capabilities of key technologies.
- Meeting these objectives yielded a prototype capability that demonstrates a "disadvantaged" user (perhaps a disaster relief responder) interacting with a collaborative team operating in a portal environment.

Non-Portal Technologies

- RSS parsing library JSR 172 compliant protocols
- Java 2 Micro Edition (J2ME) software development kit
  - J2ME is a framework on which a J2ME "configuration" targets a range of devices with a specific set of capabilities, e.g. mobile phones.
  - A "profile" selects a configuration and a range of APIs that facilitate the development of a range of applications targeted at a range of similar devices, depending on the configuration specified.





Non Portal Functionality

- Disadvantaged user has access to RSS feeds on low-end devices
- System based on flexible system that allows for easy augmentation
- Little semantic integration
  - No mash-up of feeds
  - No interpretation of feeds
  - There is no way to reason about a feed's context or intended use

Limiting Semantics Limits Effective Collaboration

- Semantic Web as model
  - RDF , OWL, Ontologies
  - Other Technologies
- Exchanging Data <u>and</u> Semantics
  - Existing informal or semiformal structures like hyperlinks or simple unadorned protocols like JABER need to be augmented by machine-readable formal descriptions ("metadata") or tags
- Incorporating stronger semantics into Social Software

Semantic Wikis

- In CM tool, for example, knowledge about a POI or other significant knowledge could be shared through a Wiki by augmenting a BOK contained in the Wiki with additional information and context.
- In the chat context that knowledge may not persist easily.
- A Wiki is just a website or similar online resource which allows users to add and edit content collectively sharing a BOK.
- A Wiki without Socially Enabled Semantics (SES) supports an online collaboration model and related set of tools that allows any user to edit some content within the BOK quickly
- A more powerful system would allow meta tagging of concepts for enhanced search

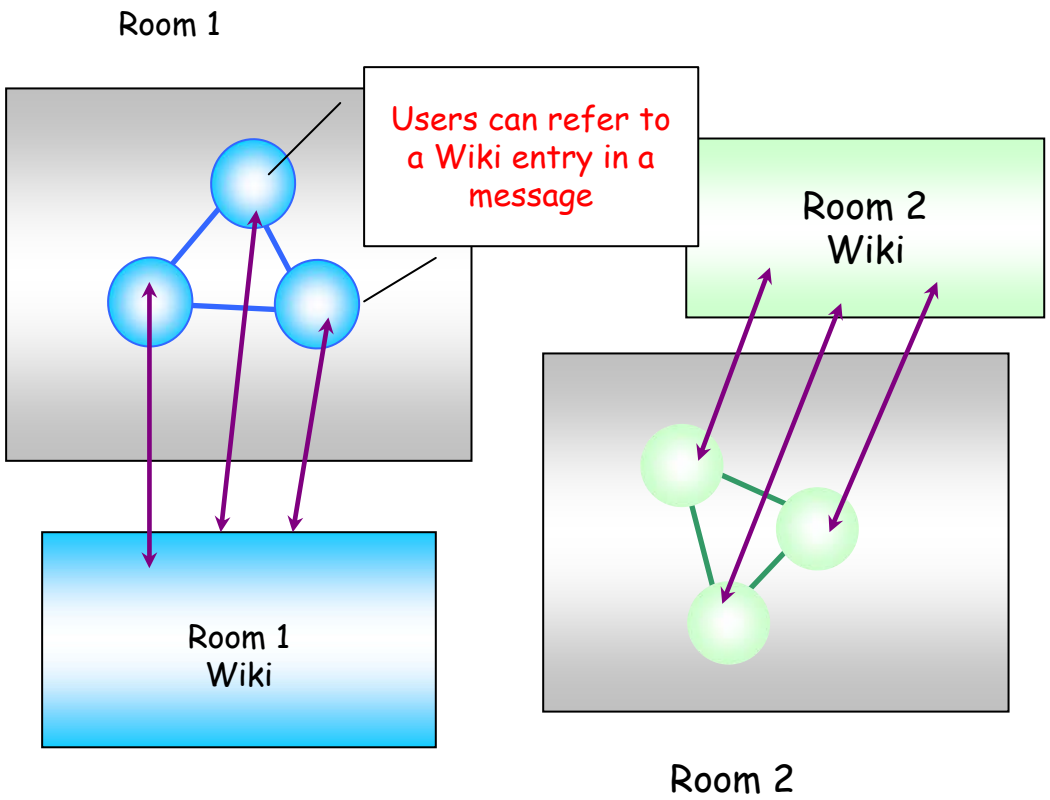
SweetWiki

- Early semantic supported Wiki markup language (i.e. WikiML or its variants). Among other features mark-up facilities allowed for simple remote edition and storage facilities. SweetWiki abandons WikiML in favor of a tool that is built around RDF, RDFS, OWL, and SPARQL.

- A SweetWiki approach that relates semantic content associated with POIs, tagged or un-tagged textual information or UR with entries in a Wiki would be a powerful mechanism to share semantics in a dynamic way.

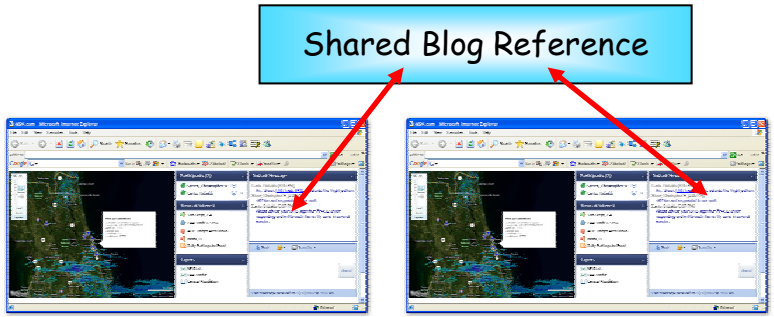
- A simple topology for the use of a Wiki in conjunction with the CM would have all users within a room share a Wiki. Messages exchanged between users in a room could have content that is tagged to refer to content in the Wiki.
- Several other semantic Wikis systems exist to date these include WikSAR, Semantic Wiki, IkeWiki and Semper Wiki.

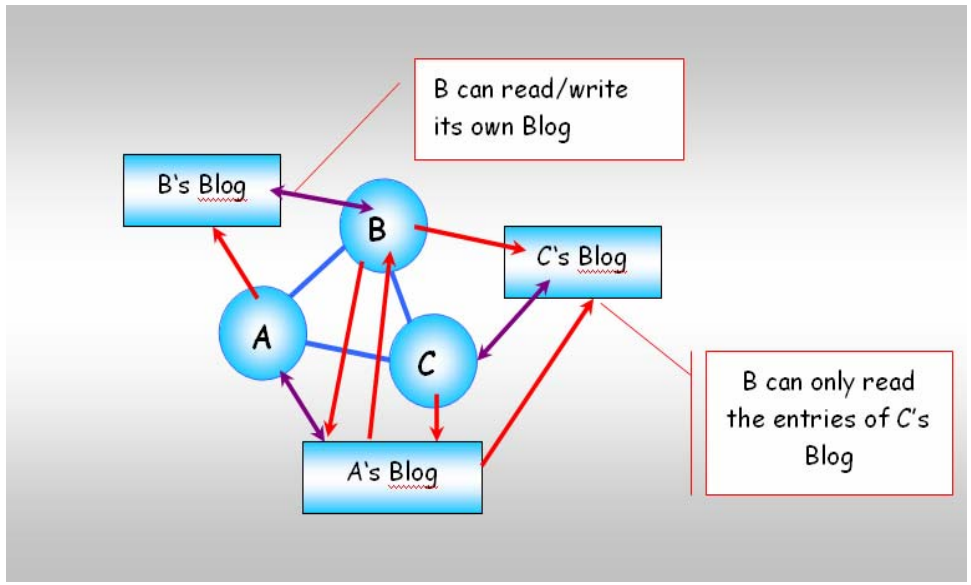
Alternate Topologies for Sharing a BOK



Semantic Blogging

- CM could use blogging and allow the mark-up of blog content to augment semantics
- A mapping of such content to concepts and relationships which are formally described using an ontology could be made by the creator of a blog
- A semantics of phrase used in a CM dialog could be resolved using terms labeled in the semantic blog
- Semantic labeling could also be used to restrict access and create classes of other users.



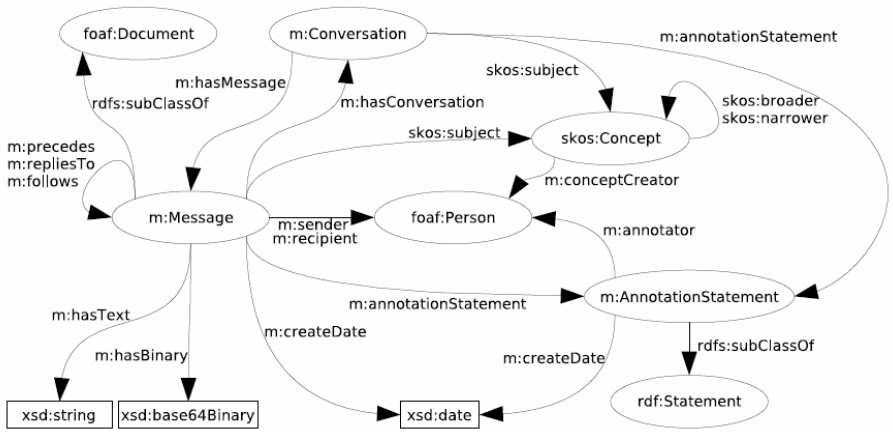


Semantic Instant Messenger

- **The Observation** - CM has weak message classification
  - No facilities to search for messages on a particular subject for example or from a user with particular characteristics
  - Looking at messages by their subject line can give misleading results because often the subject line has little to do with the actual discourse.
- **The Problem**
  - Instant messages (IM) typically are missing context are rather short, and informal – need context to understand
  - Topic switching and interleaving messages are particularities of IM conversation
  - Searching for something specific may entail processing something general or even something irreverent
  - IM messages usually lack semantics
  - Current IM clients do not identify message properties, e.g. the creation date, or sender of a message. Consequently, relations between them cannot be exploited.
- **The solution**
  - Semantics Aware Instant Messaging (SAM)
    - Addresses the weaknesses in message classifications by allowing a user-definable taxonomy that is used to add semantics to messages by annotating them with entries from the taxonomy.
    - Users can tag a message for classification.

Classifying Messages

- A drawback of this message classification is that the user may have to make some effort to annotate messages appropriately.
  - May be lowered by semi-automatic annotation exchange between conversation partners. Additionally an intelligently designed user interface could mitigate this problem.
- Ontological meta-model provides semantics for IM entities



Conclusion

- In this talk we looked at two C2 internal research efforts at The Johns Hopkins Applied Physics Laboratory (JHU/APL) to support collaboration for C2 and how they could be extended
- Research efforts
  - First effort developed a portal based prototype to evaluate the feasibility of an integrated capability that synchronizes text and geospatial displays using a limited form of semantic web technology
  - The second effort (non-portal based) examined an architecture that supports disadvantaged users (i.e. users with lower system capabilities).
- Results – The technologies for the basic systems are mature
- Extensions
  - While the prototypes yielded useful observations and results, fundamental limitations in the two architectures are present.
  - A selection of potential tools and technologies to be explored to enable more semantically rich representations for more effective C2 was presented: semantic blogs, semantic Wikis, and semantic instant messengers all could be integrated into the CM. Everywhere possible when data is exchanged it should be tagged and processed by a tool that processes the tag.