COP: From Knowledge Webs to Knowledge Portals

Denis Gouin[1], Alexandre Bergeron Guyard
Defence R&D Canada Valcartier
2459 Pie-XI North, Val-Bélair (Québec)
G3J 1X5, Canada
Tel: (418) 844 4000
Fax: (418) 844 4538
denis.gouin@drdc-rddc.gc.ca
alexandre.bergeron-guyard@drdc-rddc.gc.ca

Graham Estey
xwave
65 Iber Road, Stittsville, Ontario
K2S lE7, Canada
Tel: (613) 831-0888
graham.estey@xwave.com

10th International Command and Control Research and Technology Symposium
The Future of C2

Submitted for inclusion in the following track / topic area:

C4ISR/C2 Architecture

---

[1] Denis Gouin will act as the point of contact - denis.gouin@drdc-rddc.gc.ca

COP: From Knowledge Webs to Knowledge Portals

Denis Gouin, Alexandre Bergeron Guyard
Defence R&D Canada Valcartier
2459 Pie-XI North, Val-Bélair (Québec)
G3J 1X5, Canada
Tel: (418) 844 4000
Fax: (418) 844 4538
denis.gouin@drdc-rddc.gc.ca
alexandre.bergeron-guyard@drdc-rddc.gc.ca

Graham Estey
xwave
65 Iber Road, Stittsville, Ontario
K2S lE7, Canada
Tel: (613) 831-0888
graham.estey@xwave.com

Abstract

Over the last several years, the US DoD and its allies have been going through a major transformation, by implementing Net Centric Warfare (NCW). NCW provides the capability to share, access and protect information, and also collaborate in order to develop shared situation awareness. The Web has been a key enabler for NCW. Recent initiatives, such as the US K-Web and CA Command View, have caused the development of Knowledge Webs that easily connect organizations to information by exploiting Web technology.

Other recent initiatives have been the implementation of Net-Centric Enterprise Services (NCES) which not only allow sharing of information but also sharing of services. One approach to implement the NCES is the use of Enterprise Portal technology.

Over the last three years, Defence R&D Canada has been conducting the COP 21 Technology Demonstration project to explore and develop novel concepts for the Common Operational Picture (COP) of the future. COP 21 is referred to as a Situation Awareness Knowledge Portal. Some of its key concepts are the provision of portfolios to filter and categorize the information and the use of multiple portlets to view several items of information at the same time.

This paper reports on the COP 21 capabilities and describes the added value that Enterprise Portal and Knowledge Web technologies can bring to each other.

Introduction

Over the last several years, the US Department of Defense and its allies have been going through a major transformation which exploits all of the power of the Information Age. This transformation focuses on Information Superiority to implement Network Centric Warfare

(NCW). In NCW, according to Alberts [1], all elements of the force are robustly networked achieving secure and seamless connectivity and interoperability, providing the capability to share, access and protect information to a degree that it can establish and maintain an information advantage over an adversary, and providing the capability to collaboratively correlate, fuse and analyse the information in order to develop high quality shared awareness.

The term COP is widely used to refer to a product that supports shared understanding of the battlespace. A good definition for COP is "the integrated capability to receive, correlate and display heterogeneous sources of information in order to provide a consistent view of the battlespace". This definition focuses on the integration capability versus the end product. The end product is not simply a picture or a map with tracks but a series of well-organized views providing necessary knowledge for an understanding of the situation. Having access to common sets of information sources, each commander or staff officer is able to filter and customize his view based on his own needs or task.

Significant NCW initiatives aimed at providing a shared situation awareness or COP have been the development of Knowledge Webs that connect organizations to information by exploiting Web technology and client-server architectures. For instance, the US K-Web and CA Command View provide users with decision support displays connected to information through web links (urls) and allow them to post information to a server using simple template-based publication schemes.

Recent initiatives to implement NCW have been the implementation of Net-Centric Enterprise Services (NCES) which not only allow sharing of information but also sharing of services. Using the NCES, the US DoD organizations and Allied countries could interoperate using their own applications but adhering to the same sets of Information Technology standards and sharing common services.

One approach to implement the NCES is the use of Enterprise Portal technology, which bring added value to Knowledge Webs. A Portal refers to a collection of technologies and processes required to locate, retrieve, organize and publish structured and unstructured information in a secure manner. Portals also allow for the integration of an organization's applications and services, and support the collaboration of all configured on-line communities (ADGA, [2]).

Over the last three years, Defence R&D Canada has been conducting the COP 21 Technology Demonstration project to explore and develop novel concepts for the COP of the future. COP 21 is referred to as a Situation Awareness Knowledge Portal. It includes a number of capabilities and services that contribute to improving situation awareness.

This paper examines the capabilities provided by Knowledge Webs and Enterprise Portal technologies. It then describes the COP 21 Situation Awareness Knowledge Portal and finally discusses the evolution of Knowledge Webs into Knowledge Portals.
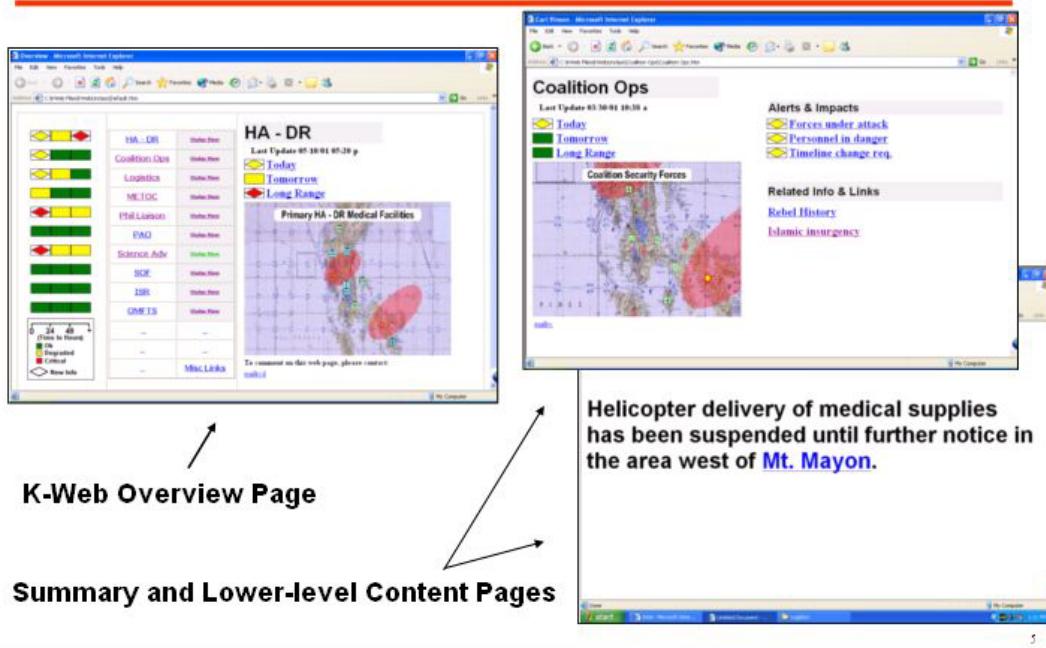
K-Web

Knowledge Web (K-Web) is a project sponsored by Office of Naval Research (ONR) and implemented by Space and Naval Warfare Systems Center, San Diego (SSC-SD), since 1999. The purpose is to support the sharing of knowledge in distributed, asynchronous, multi-echelon and coalition environments in order to facilitate collaboration and information sharing, enhance shared relevant knowledge, develop shared awareness and improve speed of command (Morrison et al., [3]; Morrison and Moore, [4]).

The basic concepts of K-Web are to capture the value-added information products (i.e., Knowledge) already being created by the command staff and by replacing the traditional 8-hour briefs with "anytime, anywhere, always available," mission-relevant information. The K-Web is a "dynamic status board" where you are trying to share the "best available" information at all times across the entire command. As shown in Figure 1, information producers asynchronously produce information products (e.g., briefings, reports, summaries, etc.) that can then be displayed on workstations called Knowledge Desks or a Knowledge Wall.
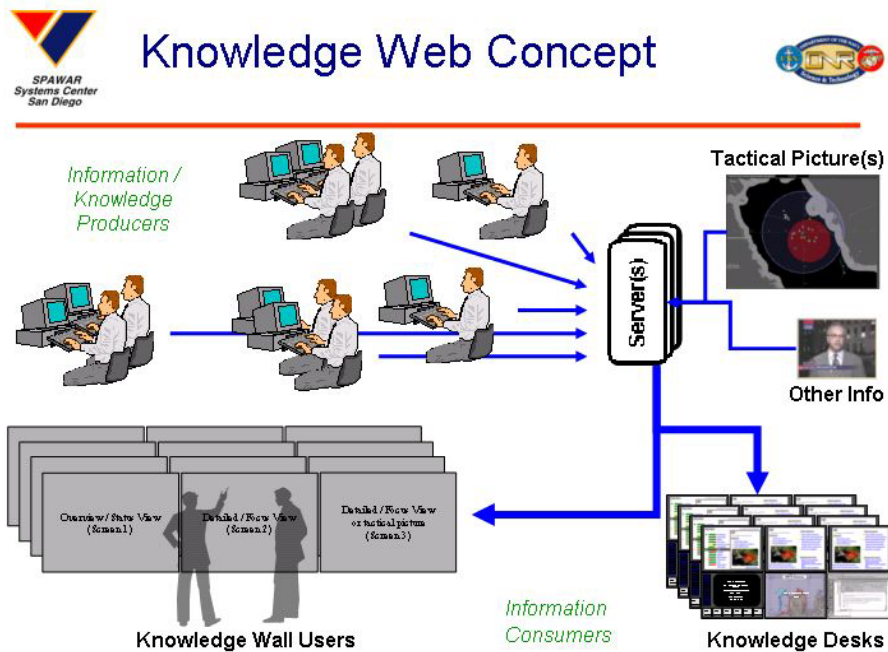
Figure 1 - The Knowledge Web Concept

Figure 2 represents a typical K-Web product (Morrison and Moore, [4]). In this example, the user can examine the current situation summary page of a Humanitarian Assistance / Disaster Relief mission, from various aspects such as the Coalition, Intel or METOC perspectives. By clicking on information links, the user gets access to more detailed information. Status indicators reflect time-based summaries for different slices of time (today, tomorrow, long range) and may be red, yellow, or green, indicating "show-stoppers," "caution," or "going as planned." A diamond indicates new or changed information.

Figure 2 - Typical K-Web Products

K-Web provides users with a template (Summary Maker) that supports the easy creation of basic HTML summary pages that can be rapidly published onto a Web and shared, with minimal impact on available bandwidth (Fig. 3). Textual and graphical information can be hyperlinked to more detailed information available within the Knowledge Web. Some of the information can be created by COTS/GOTS tools (Morrison, 2001, [5]).
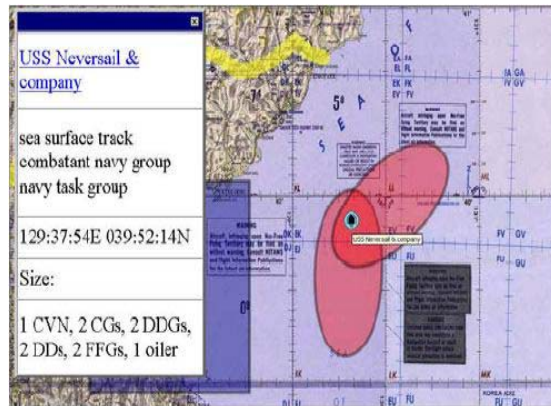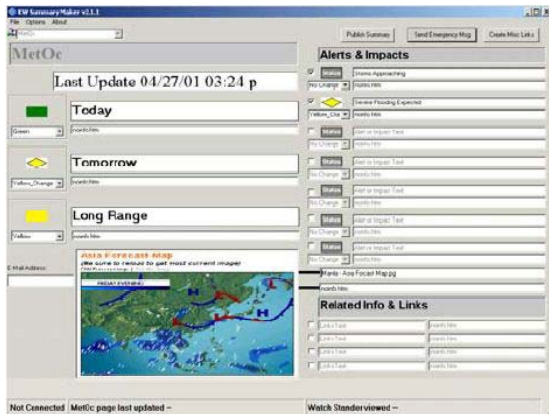

Figure 3 - Summary Page Authoring Tool   Figure 4 - TacGraph Authoring Tool

TacGraph (**Tac**tically-relevant **Graph**ics Authoring Tool) is designed as an easy-to-use graphical drawing tool to rapidly develop summarized, tactically relevant images and publish them as Web content (Fig. 4). It features imbedded National Geo-Intelligence Agency (NGA)

map data and a number of specialized drawing tools, along with 2525B symbol sets and produces both Web-standard HTML files and JPEG graphics files.

Command View

Command View is a Knowledge Web being developed in Canada's under the leadership of Director Joint Force Capability (DJFC). It is part of the C4ISR Campaign Plan / OPS Web Development. The Command View objective is to ensure that information is made available to the decision makers in an efficient and timely manner, by providing a single point of entry and by exploiting technology readily deployed onto the operational network. The development and deployment of CommandView is a success. It has forced operators and technical staff to work together to develop a web-based solution to disseminate and manage information between Canadian Forces organizations. A key design concept is the quick access to information (3 clicks or 7 seconds access). The facilitated access to information allows focusing on the decision making.

Command View's Main Page (Figure 5) displays the various Canadian military operations and provide an easy access to information on these operations, such as linking to a Domestic View Web Page (Figure 6). By exploiting Web technology, access is provided to information on key Joint Reports & Returns and on information and tools from the various Joint Organizations.
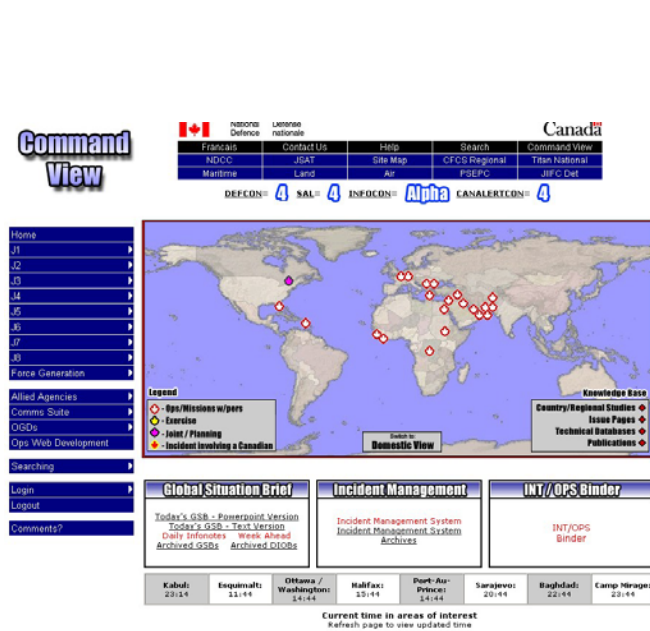

Figure 5 - Command View Main Page   Figure 6 - Domestic View Page

The existing functionality is the following:
- Users shape their own information environments by maintaining their own data closest to source.
- Users update/maintain the accuracy/timeliness and content of their own web pages.
- Command View links are available to remote web sites including the individual J-level homepages.
- Links throughout the page are used for quick access to other websites and documents.

- The "Operations Map" displays an international map or domestic maps showing operations/incidents using layered icons.
- The "Alert Level Bar" displays the CanAlertCon Level as well as other alert levels.
- The "Time zone Bar" displays time zones for specific locations.
- Provision of collaboration capabilities (e.g. chat).
- Some of the links are customizable by each user to suit his/her needs.
- A "What's New" section brings attention to newly added documents.

During Exercise Virtual Warrior III, all Operation Centers proved that they could input into their respective Domestic View Web Portals in the C-Net Domain. Efforts in Ex Virtual Warrior IV will push this capability into the DWAN for UNCLAS information and potentially to individual Canadian Force Units and Other Government Departments.

Improvements considered are the following:
- Standardize interfaces and enhance SOPs.
- How to better display information to support decision making.
- Provision of multiple data windows to allow users to browse multiple pieces of data simultaneously.
- Provision of an Intelligent Search Engine with dedicated servers and improved meta-tagging.

Enterprise Portal Technology

Information Portals have become an effective means of enabling organizations to access, share and manage information and knowledge pertinent to the organizations.

A portal can provide an organization with the following Web-based capabilities (ADGA, [2]):

Table 1. Portal Capabilities

| 1.	Personalized access	User can define what they want
2.	Role-based filtering of content	User retrieves information based on role or possibly rank
3.	User-friendly interaction	User can navigate instinctively (they understand what they see)
4.	Multi-system integration	Users directly access the systems they require to complete daily tasks
5.	Scalability	Users experience good online response time with lowest possible hardware investment
6.	Single sign-on	Users require only one password for all systems they use (with validation)
7.	Content management	Users require to find the documents and knowledge-sharing to be effective
8.	Security	Systems and content are accessed by appropriate personnel
9.	Community support	Employees and suppliers can collaborate online
10.	A general development framework	A technology tool kit that can aggregate various internal organizational software

"Seen from a technical point of view, portals are frameworks, which integrate various tools and applications together in a common framework" (RoweBots [6]). A single central place for this common framework is preferable, provided that the portal software performance is acceptable. All information can be cross-linked and stored once; updates can be assured and the intellectual capital of the organization protected. A portal like this can offer a complete environment for everyone in the organization to do his or her job, completely and seamlessly integrated with the desktop.

The overall benefits are (RoweBots, [6]):

- A single point of sharing and communication in the organization.
- Elimination of duplicate information.
- Reduction in information overload.
- Improved communication with all partners and customers.
- Access to a consistent set of applications with support and backups.
- International and multi-site collaboration without difficulties of shared drives and similar issues.
- Simple cross-functional cross organization communication.
- Creating norms of information sharing and knowledge creation for the organization.
- Communicating new reward systems, which emphasize knowledge sharing.

COP 21 Situation Awareness Knowledge Portal

Using Enterprise Portal technology, the COP 21 TD has implemented a Situation Awareness Knowledge portal (Gouin et al., [7] and [8]). Figure 7 is an illustration of the COP 21 Portal as it appears on a two-screen configuration.
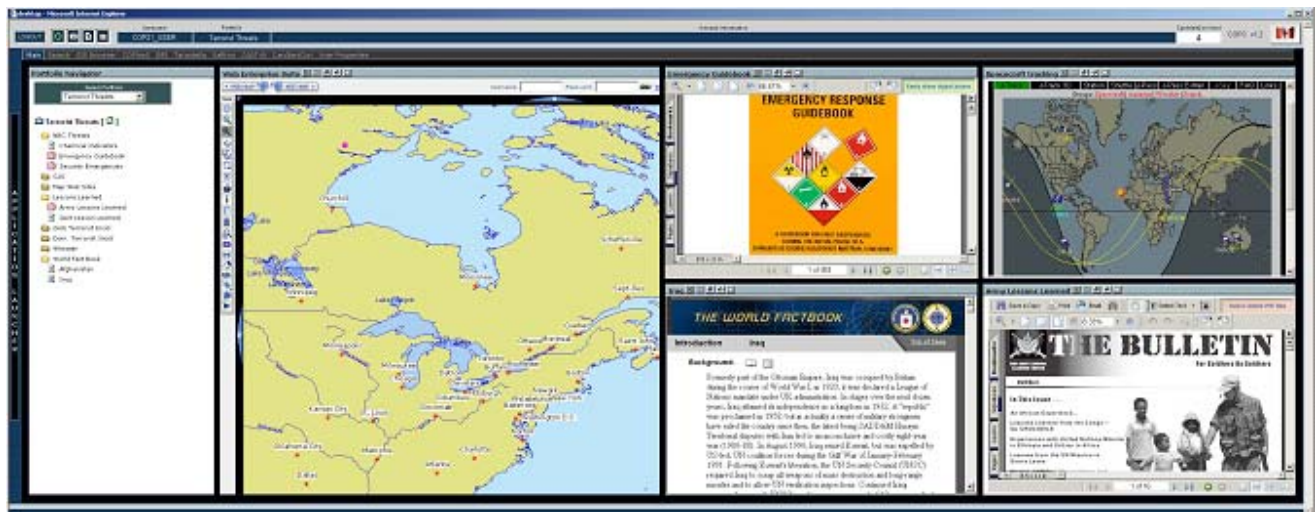
Figure 7 - The COP 21 Portal as Represented on a Two-Screen Configuration

The COP 21 Portal is a Situation Awareness Knowledge Portal, in line with NCES. It provides a number of COP capabilities that contribute to improve situation awareness as follows:

- Single point of access to multiple information sources
- Filtering and categorizing information using Portfolio views
- Dissemination of information using Portfolios
- View of several documents together
- Contextual search services
- Web-Based Geographic Information System
- Integration of application services in the portal

COP 21 was exercised during JWID 04. As a general assessment: "The warfighters strongly endorsed the trials' technology as a whole and were impressed with the range and depth of functionality that was demonstrated. The warfighters also provided many positive comments and constructive suggestions about how to improve functionality. The warfighters provided particularly positive feedback about the flexibility and utility of the portfolio, portal, and search functions. The integration of applications and their ease of access were also greatly appreciated" (JWID 04, [9]).

Each of the main COP 21 Portal capabilities is described hereafter.

a. Single Point of Access to Multiple Information Sources

As a portal, COP 21 is an integration platform. It does not replace existing applications. Rather, implemented using Enterprise Portal technology (BEA Web Logic, [10]) it allows a user to access a variety of sources of information and a variety of services from a single workstation. The user no longer has to move from one workstation to another or from one application environment to another to consult information and interact with applications. Through the use of a standard based portal/web service architecture users are able to access data from web-enabled applications and view them in one concise task-oriented view. Standardized data fetches allow many types of data sources to be mined on an interactive or timed basis. This allows the system to alert the user when new task relevant data is added to any of the data sources. One benefit of this standards' based approach is that fetches to new sources of information and the integration of new applications or Web Services can be easily implemented. See Figure 8 to demonstrate the large variety of applications and data sources that were be integrated into the COP 21 portal Architecture during the Joint Warrior Interoperability Demonstration 04 (JWID 04).

Since the COP21 uses standards' based web services to expose access to its core services it is possible for other applications or portals that are not part of the COP21 Core to access and update the information in COP21 Portfolios. This allows portals to be customized to meet the requirements of the specific user community without the need to duplicate services and data. Also, it is possible to add data to a portfolio via these web services and COP21 has plug-ins for MS Exchange 2000 Web client and Microsoft SharePoint 2003 Documents libraries. These plug-ins allow you to add emails and documents from these systems into the COP21 portfolios.

At the moment, COP 21 supports access to data sources on one network. During JWID 04 however, data diode technology was used to bring information from a lower classification domain. In the future, enterprise portal technology should be able to leverage on advances in multi-level security and other network security technologies.

Comments from the JWID 04 experimentation are the following:

"COP21 is ideal for loading a large amount of data from multiple sources, as proved by the scenarios run."

"Being able to access all pertinent info from one workstation has increased my efficiency 10 fold!"
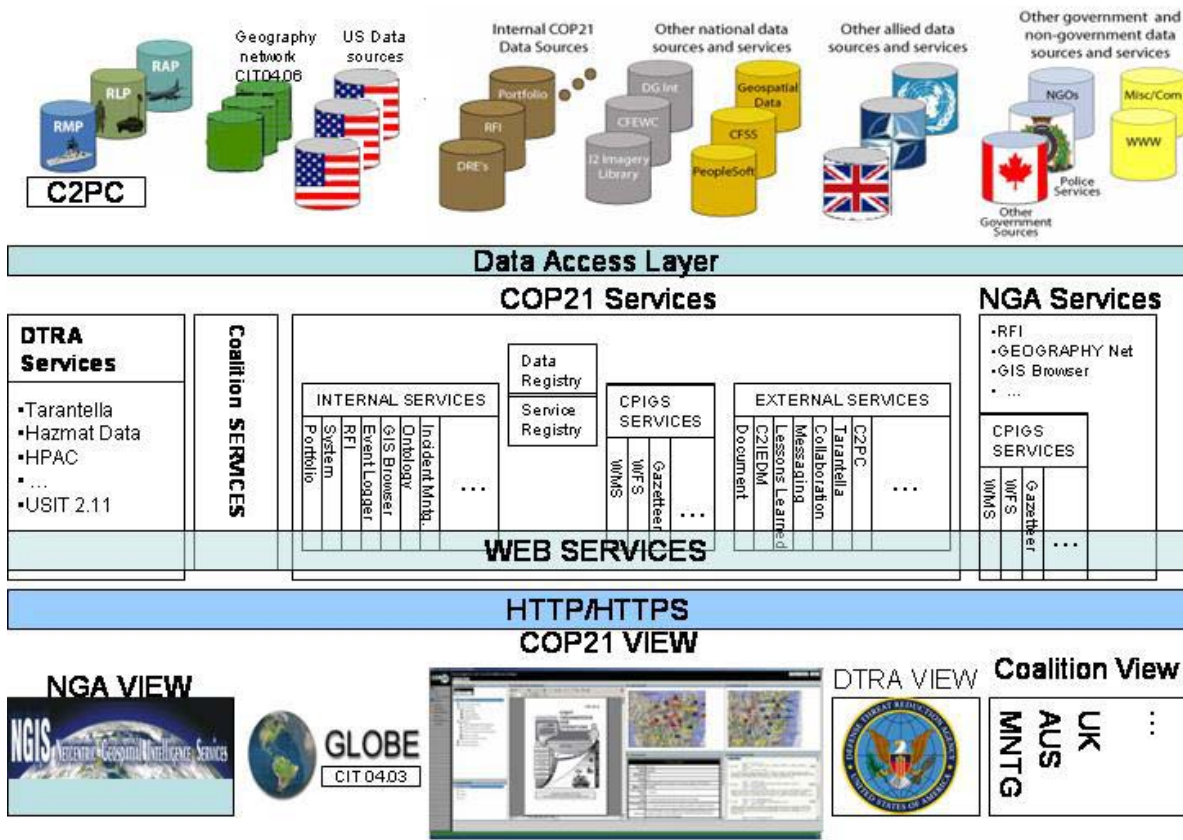

Figure 8 – COP 21 Portal Architecture at JWID 2004

b. Filtering and Categorizing Information using Portfolio Views

One particular concept of COP 21 is the provision of portfolios where the user can filter and categorize the information based on the interventions (e.g., military operations) and his tasks (e.g. monitoring, planning). Only the information and the tools a user needs to access are held in a portfolio. These portfolios can hold any format of information, including web pages, text documents, spreadsheets, messages, maps and video clips. In fact, similar to the Knowledge Web concepts, the links to information are stored in the portfolios rather than the information itself. Each authenticated user has access to a number of portfolios, depending on their roles. Portfolios can be shared amongst users and as portfolios point to information, there is no duplication of information or version control issues. In fact it is possible that the same document exists in several portfolios where the relevance to the task is different. This relevance is captured in the metadata used in the COP21 System.

The portfolio manager component provides authenticated users with the ability to create, modify and delete 'portfolios', 'folders' and 'entries' through a user interface. The portfolio navigator component also provides users with the ability to browse and view the portfolio data through a user interface. Users may select a working portfolio, expand or collapse folders within that portfolio and select entries to display from portfolios/folders. Users are also able to view a portfolio summary as well as the metadata corresponding to each data entry. Users are also able to set expiry dates for portfolios, folders and entries which indicate when the data is expected to be no longer relevant. Expired items appear in red in the navigator window. The system also allows you to assign a standard access permissions (read, write and full control) to user roles for 'portfolios', 'folders' and 'entries'. Figure 9 shows a view of some folders and entries contained in a portfolio.

Figure 9 - Portfolio Navigator showing Portfolio Folders and Entries

Comments from the JWID 04 experimentation are the following:

"It's an effective way to share, file and organize info."

"Having all the apps in one place – not needing to know where documents are stored – just that they are related to a portfolio is a bonus."

c. Disseminating Information using Portfolios and Notification Services

Portfolios can be shared amongst users and as portfolios point to information, there is no duplication of information or version control issues. As new information is added or updated in a portfolio, the information becomes available to all users registered to that portfolio. Users are automatically notified of the new information through the scrolling of a message at the bottom of their screen using Elvin/Sticker, an event notification tool with a 'ticker-tape' interface. Via the Alert Icon, the user is also warned of the portfolio entries that have changed. It is also possible as a result of the Web Services based architecture for other applications or portals outside to the portal to access the portfolio services.

Comments from the JWID 04 experimentation are the following:

> "Posting to portfolios is an appropriate and effective means of info dissemination".

> "The portfolio method to disseminate information is certainly better than trying to guess who to send info to – i.e. need to know who needs to know by email. It is partially a push and partially a pull environment."

> "I liked the fact that the sticker automatically informed others that I had changed anything in the portfolio."

d. Multiple Collated Windows to View Several Documents Together

In the COP 21 portal, the information available in a portfolio can be displayed in a number of windows, called portlets. Rather than seeing one piece of information at a time, the user is able to consult several documents. For instance, a user can simultaneously view the Commander's intent, the Blue and Red (Friendly and Enemy) forces situation map, Orders of Battle and Weather Reports. COP 21 has implemented a 'state maintenance' with the ability to refresh portlets individually, so that the user can easily switch from one portfolio to another, presenting the information as last viewed.

The user is able to run the COP 21 portal on a single or multiple displays. A single-screen implementation provides three portlets whereas a two-screen configuration allows five portlets. Figure 7 is an example of five COP 21 portlets spanned across a two-screen configuration.

Comments from the JWID 04 experimentation are the following:

> "I like the 5 windows that gave us the opportunity to see more info at the same time (e.g. incident report with the map showing the exact grid."

> "With the 5 screens in full operation you get a better picture of what's going on in any of the portfolios you have open. It also remembers what you had open."

e. Contextual Search Services

COP 21 provides contextual search capabilities, see Figure 10. Using Autonomy [11], a second-generation search engine, searches can be made in a document repository, portfolios, e-mails, websites, network file shares, chat sessions, and databases. The query allows users to find documents via a natural language or keyword centric specification. However, the searches are performed based on concepts, taking into account frequency of keywords and associations between these keywords.

Users can view the contents of any document returned from a search, in the results in original format, in the source text (which is stored in the search engine database), highlighted text or as a conceptual summary. Users may also request to add any document from the result set to a portfolio or to refine their query manually or via the 'suggest similar' option. Persistent queries in the form of agents can be pre-configured to automatically find documents relating to a particular concept of interest. The system also allows the user to submit searches based on the metadata for task subfolders.
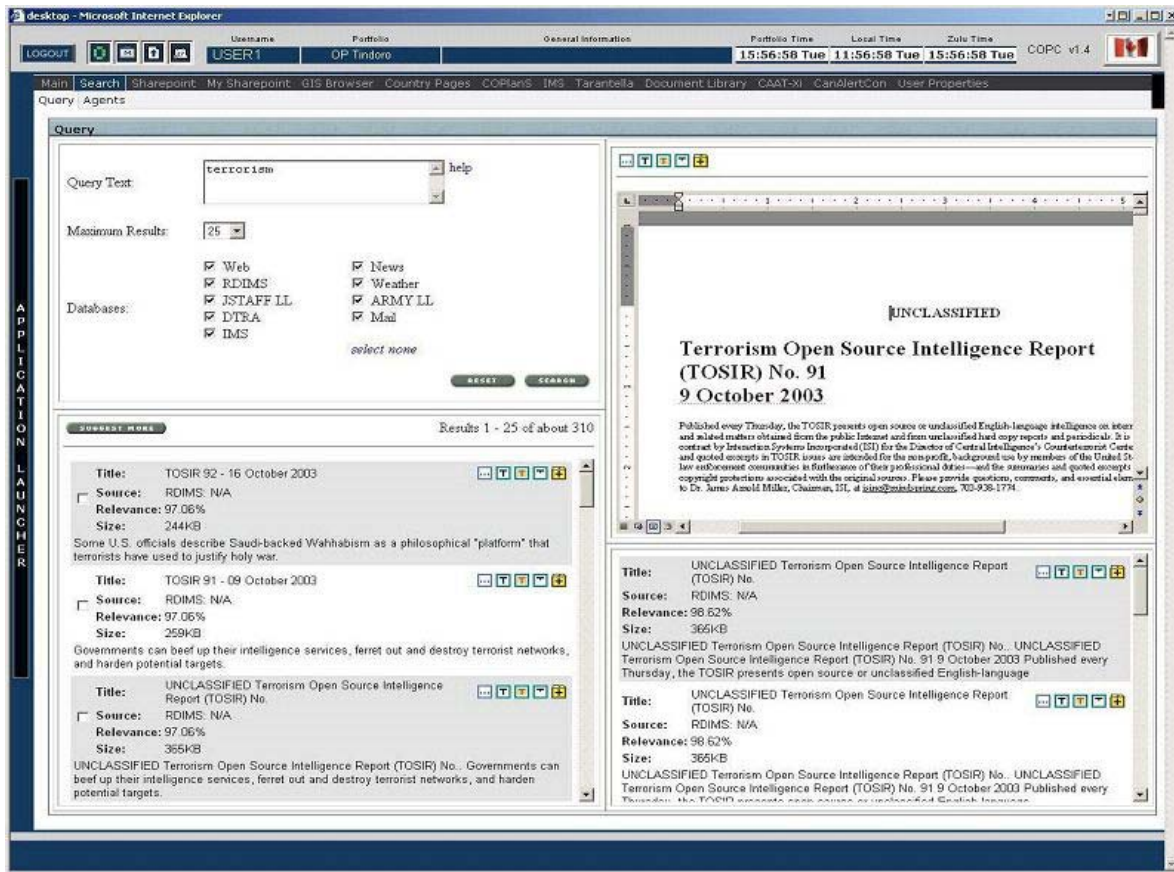
Figure 10 - Example of the Results of a Contextual Search

The system uses this contextual search service to alert users when new data relevant to the portfolio they are working is added to one of the data repositories. New documents added to the portal are automatically indexed by Autonomy.

f. Web-Based Geographic Information System

COP 21 integrates OGC-based (Open GIS Consortium) geospatial services allowing the user to access remote geospatial datasets. The GIS Browser provides capabilities to display standard raster and vector products, along with STANAG 2525B symbols and emergency mapping symbology (FGDC, [12]). GIS also allows for customization of the map and saving of contextual views in COP 21 portfolios. This allows analysts to develop detailed maps and add them to a portfolio, which individual users can modify to meet their immediate needs.

g. Integration of Application Services in the Portal

Various applications can be accessed through the COP 21 Portal allowing users not only to connect to information sources but also to execute applications on their COP 21 workstations. The COP 21 portal not only integrates various sources of information but also integrates a variety of services such as an Incident Management System, a Request for Information service and a number of information visualization and decision support applications. These applications have been integrated into the portal in a loosely coupled or tightly coupled manner. Figure 11

shows the COP 21 Portal with Integrated Web-based applications such as a GIS browser, an incident management system and a BattleRhythm editor/viewer.
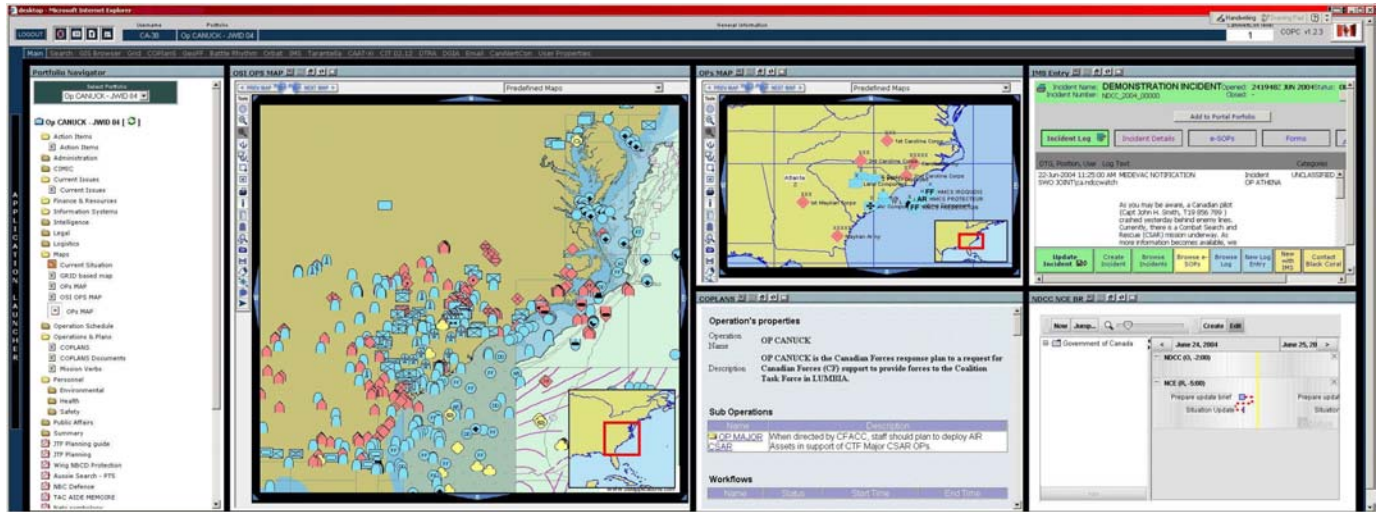
Figure 11 - COP 21 Portal with Integrated Web -based Applications

The loosely coupled applications are those accessed through the COP 21 Application Launcher. In this case, the applications simply run over the Portal or within portlet with limited interaction with it. Tightly integrated applications are applications which have been modified to interact with the portal. This could include the ability to submit items or application state to a portfolio or to modify how the application runs based on the uses session state in the portal. These applications are usually accessed either via application tabs or entries in the portfolios. Tighter integration has allowed running applications within the COP 21 portal, through one of the Application Tabs. Some of these applications have also been configured to run within a portlet and upload or display information into/from portfolios.

Towards a Knowledge Portal

K-Web, Command View and the COP 21 Portal are complementary. They all provide easy sharing of information in order to improve situation awareness and support decision-making. However, each application has some unique concepts and a 'best of bread' solution is worth examining. As part of the COP 21 project, a goal has been to consider how Command View could evolve from a Knowledge Web to a Knowledge Portal. A number of key concepts are considered:
- Exploitation of Enterprise Portal Technology
- Global View and Portfolio Views
- Managing Information
- Contextual Support
- Improved Search Capabilities and Classification
- Linked Views
- Collaboration services
- Decision Boards and Decision Support Applications
- Briefing Aids
- Knowledge Walls

a.   Exploitation of Enterprise Portal Technology

In fact K-Web and Command View are portals but not implemented using Enterprise Portal technology. Whereas it is easy to develop a portal that links to information sources using hyperlinks (urls), Enterprise Portal technology also allows for easy development of links to other types of information sources, e.g., fetches into databases, other applications, e-mail exchange servers.

Also, a simple Web Portal can launch Web-based applications, through the use of hyperlinks pointing to these applications. However, Enterprise Portal technology allows to better integrate these applications and to support the dynamic setup and registry of these applications. Moreover, in the context of Net-Centric Enterprise Services, portal services can be shared with other organizations and coalition partners.

b.   Global View and Portfolio Views

Command View's Home Page provides an interesting concept of the Global View which allows for an overview of the various current military operations. It also provides a one-click access to the home pages of the various Joint Staff and eventually Other Government Department (OGD) organizations. This Home Page provides one-stop shopping for information.

Portfolios implemented in COP 21 are complementary to this concept. Information relevant to any military operation can be hyperlinked into these portfolios. This allows staff officers to easily assemble the information needed to carry out the tasks related to that portfolio. For instance, one portfolio could store bookmarks of the maps of the theatre of operations (at the proper map scale and with proper thematic and tactical layers), aerial photographs, hyperlinks to Reports & Returns (e.g. Commander's Intent, OpOrders), information on the socio-political situation (e.g. Country pages, CIA Fact Book) and doctrinal documents corresponding to the mission.

Figure 12 is an early example of a mock-up of some of the Command View concepts implemented within a COP 21 Framework. Starting with a map of the world, the user can select a military operation of interest and load the related portfolio and information.
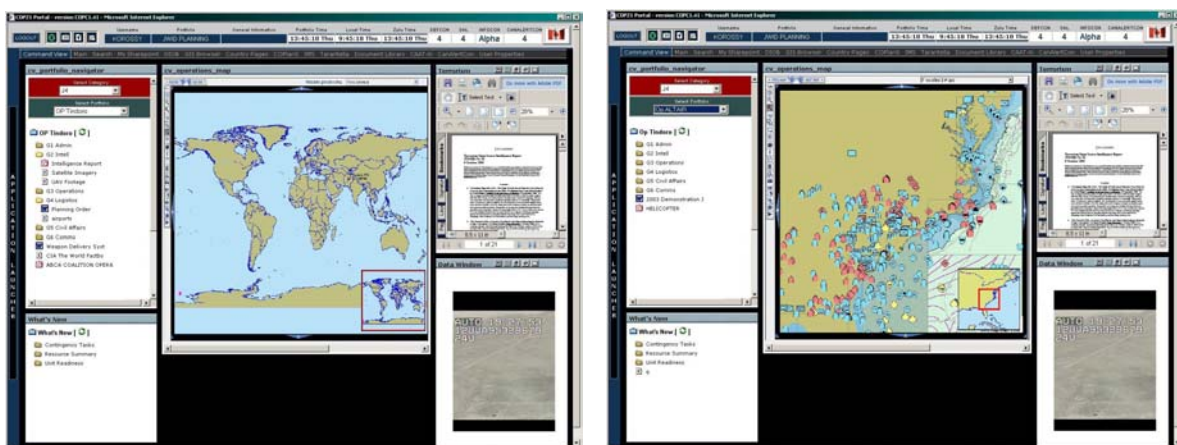

Figure 12 - Early Mock-ups of Command View within a COP 21 Framework

c. Managing Information

Considering the vast amount of information provided by Net-Centric Warfare, good information management is necessary. In the context of a Command View Portal and portfolios, the supporting approaches are both technological and organizational (some of these have been implemented in COP 21):

- Information ownership along with access privileges (read, write, delete) have been associated with portfolios, folders and information entries.
- Information aging attributes have been associated with the information entries, together with capabilities to automatically archive outdated information.
- Automated information management capabilities have been developed to look for the duplication of information.
- Standard Operating Procedures (SOPs) should be defined for managing the information in Portfolios. This includes specifying Portfolio templates (table of contents) with default folders.
- An Information Manager should be appointed to overlook the use of the Portal and enforce SOPs.

d. Contextual Support

COP 21 has put together a comprehensive vision of a user-centric, mission-oriented knowledge portal (Gauvin et al., [13] and [14]). The approach is built on three intertwined fundamental concepts, namely Context, Ontology and Portfolio defined as:

- Portfolio: A user's (or group's) working space to perform the work related to long-term task-oriented activities in relation to a domain of interest (operations, interventions, exercises).
- Context: The set of all elements (internal or external) surrounding the work performed in a portfolio that contributes to bring light on its meaning and its value.
- Ontology: An organized and shared set of definitions of the elements pertaining to organizational domains and portal universes.

The delimitation of the work into well-scoped working spaces (portfolios), allows to a certain extent, the user to confine and to grasp the knowledge and know-how that is handled. The use of knowledge content and structure, using appropriate domain ontologies, could be used to define the information of interest for different military mission types (e.g. peace support operations, anti-terrorism) and to automatically generate a portfolio template. The domain ontologies could also provide contextual assistance in offering the right tools and giving access to the right sources of information.

e. Improved Search Capabilities and Classification

Although COP 21 already provides interesting search capabilities, these could be improved by exploiting the latest information technology trends. Firstly, interactive search capabilities could be provided to guide the user through the process. The search capabilities could exploit structures such as semantic networks, ontologies, and more comprehensive meta-data to establish links between domain models and information sources, and help users find relevant information. Secondly, automated document classification and knowledge-object capture techniques could be provided to efficiently support situation analysis. These capabilities would allow the user to

examine document content and derive the Who, What, When and Where. Finally, the search capabilities would be multi-lingual, exploiting translation services.

f. Linked Views

One of the advantages of the COP 21 Portal is that multiple pieces of information can be viewed at a time. However, currently these pieces of information are only visually linked. Linking them programmatically and having data aware applications would improve Situation Awareness. For instance, selecting information in one application running in one portlet would select the same objects in applications running in other portlets. Drag and drop operations would be possible to move information from one portlet to another. When doing so, the information would be represented in the proper format: for example, unit symbols on a map-based portlet would be represented showing the unit fields in a spreadsheet portlet.

g. Collaboration Services

In order to develop shared situation awareness, collaboration services are necessary. These services can be synchronous or asynchronous. Within a Knowledge Portal synchronous services such as chat, and white boarding should allow users interacting with each others and with the information. Collaboration sessions should be stored and should be 'searchable'. Asynchronous collaboration can take the form of change notification (special icon such as in K-Web and COP 21) and alerting mechanisms (e.g. event notification such as in COP 21). The Enterprise Portal environment can be beneficial to tie the collaboration services to the other applications.

h. Decision Boards and Decision Support Applications

Decision-makers need to balance their decision-making criteria and perform option analyses before making their final choices. Although time might constraint the analytical process in favour of more naturalistic or ad hoc action selection, the Knowledge Portal may provide some Decision Boards and Decision Support Applications.

As already described, K-Web provides some interesting Decision Boards where an assessment of the situation is done from different perspectives and reflects different slices in time (Fig. 2). K-Web has also been examining the concept of Story Boards where staff officers will be provided with templates to assess a situation (Morrison and Moore, [3]; Oonk et al., [15]) (Figs. 13 - 14).

i. Briefing Aids
Staff Officers spend considerable time in preparing briefings, often using Microsoft PowerPoint. With the advent of Knowledge Webs and Knowledge Portals, staff officers should focus on problem solving rather than on preparing and reviewing PowerPoint briefs. Knowledge Web technology now allows for automatic generation of a large portion of the briefs. Also, staff officers should be able to brief directly from the portal. Tools should be provided to prepare a script that would sequence the interaction with the different pieces of information. The user should be able to allow for the loading of new information at the time of the briefing.
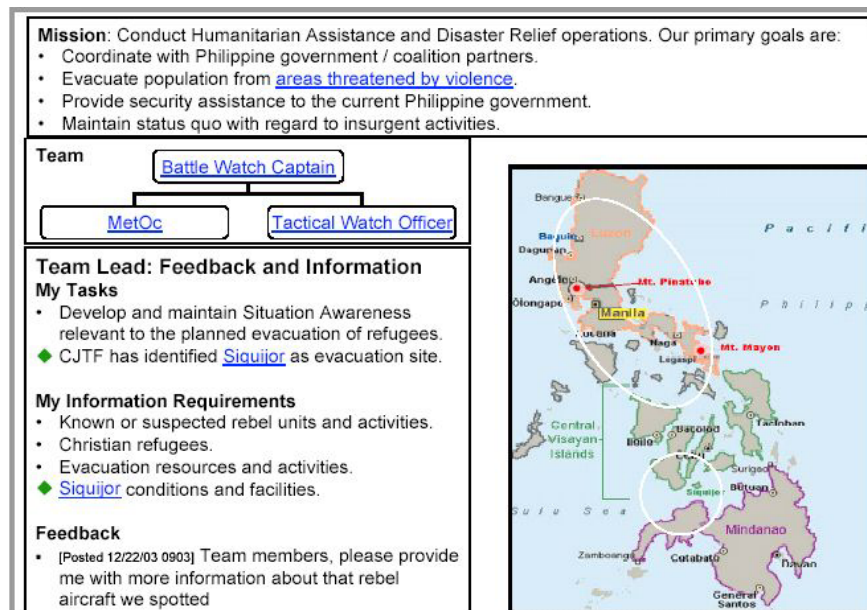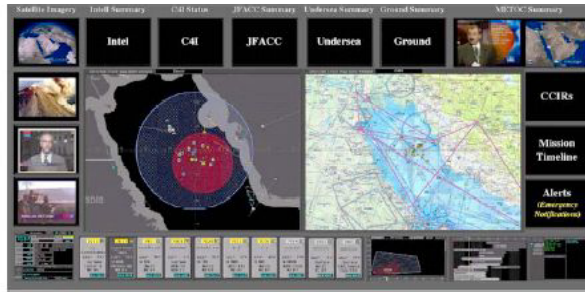
Figure 13 - Mock-up of a Story Board Template in K-Web

Figure 14 – Mock-up of a Notional Situation Context Display in K-Web

j. Knowledge Walls

K-Web provides a good example of a Knowledge Wall, where information from the K-Web displays can be combined with other applications to provide share situation awareness and to support briefing. An interesting aspect is that the Summary Pages all have a similar layout and are viewable from a good distance. Figure 15 shows various iterations of the Command 21 Knowledge Wall (Morrison and Moore, [3]. These pages can be shown onto the small displays but can easily be switched onto the two larger ones.

Figure 15 - Examples of Knowledge Walls Designs and Implementations in Command 21 / K-Web

In terms of a Knowledge Portal, staff officers should be able to display any of the windows/portlets from the portal, either showing global views or specific information from various portfolios. They should be able to dynamically select various portlets to be displayed on any the Knowledge Wall displays and interact with the applications.

Conclusion

In the age of Information Warfare, the warfighters and staff officers can easily be overwhelmed with information and lack proper situation awareness. Network Centric Warfare and Network Centric Enterprise Services have been proposed as a way ahead for the command and control systems of the future. Knowledge Webs and Enterprise Portal Technology constitute an effective means of enabling organizations to access, share and manage information and knowledge of pertinence and therefore a good foundation to implement Network Centric Enterprise Services.

The US Office of Naval Research (ONR) and Space and Naval Warfare Systems Center, San Diego (SSC-SD) have been leading an interesting Knowledge Web initiative known as K-Web that has helped staff officers to easily produce and share information and knowledge. CA Director Joint Force Capability (DJFC) has undertaken a similar initiative. In parallel to this, CA Defence R&D Canada has developed a Situation Awareness Knowledge Portal that complements the concepts put forward in these two initiatives.

This paper has described the key concepts provided by the three initiatives and suggested how these concepts could be combined into a comprehensive Knowledge Portal that would even further exploit the advances in Enterprise Portal and Information Technologies.

References

[1]   Alberts, D.S., "Understanding Information Age Warfare", Washington, DC: CCRP Publication Series, August 2001

[2]   ADGA, "Report on Strategic Portal Study for the Department of National Defence", 30 June 2003

[3]   Morrison, J.G., Moore, R., Averett, G. and Oonk, H., "Knowledge Web (K-Web) - Increasing Speed of Command Using Web-Enabled Technologies", http://www-tadmus.spawar.navy.mil/K-Web%20Brief%20JGM%208-03.pdf

[4]   Morrison, J. G., and Moore, R., "Knowledge Web (K-Web): Use by CARGRU THREE aboard the USS Carl Vinson During Operation Enduring Freedom", http://www.pacific-science.com/kmds/K-Web%20Use%20and%20Impact%20During%20Operation%20Enduring%20Freedom_files/frame.htm

[5]   Morrison, J. G., "Command 21 K-Web Tools Handout", SSC San Diego. San Diego, 2001, CA, http://www.pacific-science.com/kmds/Command21Tools_R3.pdf

[6]   RoweBots Inc, " Portals and Their Evolution – An Analysis of Portals with Communities of Practice", Contract Report W7714-030777/001/ZG, March 2004

[7]   Gouin, D., Gauvin, M. and Woodliffe, E., "COP 21 TD - Towards a Situational Awareness Knowledge Portal", Proceedings of SPIE 2003 - Aerosense/Defence Sensing, Simulation and Controls, Orlando, 21-25 April 2003

[8]   Gouin, D. and Bergeron Guyard, A., "Novel Concepts of the Future, NATO Workshop IST-043/RWS-006: Visualisation and the Common Operating Picture (COP) ", 14-17 September 2004, Canadian Forces College Toronto, Canada

[9]   JWID 2004, "Joint Warrior Interoperability Demonstration 2004 Final Report", CIT 04.05 – Portal to Portal Interoperability Trial, https://www.cwid.js.mil/public/cwid05fr/htmlfiles/c405war.html

[10] BEA WebLogic, http://www.bea.com

[11] Autonomy, http://www.autonomy.com

[12] FGDC, "Homeland Security Working Group Symbology Reference", http://www.fgdc.gov/HSWG/ref_pages/SymbologyBackground_ref.htm

[13] Gauvin, M., Boury-Brisset, A.-C. and Auger, A. "Context, Ontology, Portfolio: Key Concepts for a Situation Awareness Knowledge Portal", Proceedings of the 37th Hawaii International Conference on Systems Sciences (HICSS '04), Hawaii, January 2004

[14] Gauvin, M., Boury-Brisset, A.-C. and Garnier-Waddell, F., "Contextual User-Centric, Mission-Oriented Knowledge Portal: Principles, Framework and Illustration", 7th International Command and Control Research Technology Symposium, Quebec City, 16-20 September 2002

[15] Oonk, H., Moore, R. and Morrison, J.G., "Communication of Context in Multi-Echelon Information Exchange Environments", www.dodccrp.org/events/2004/CCRTS_San_Diego/CD/presentations/085.pdf