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1.1.1 Contextual User-Centric, Mission-Oriented Knowledge Portal:

1.1.2 Principles, Framework and Illustration

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Two possible topics:
Emerging Concepts of operations
or
Information Superiority

Contextual User-Centric, Mission-Oriented Knowledge Portal: Principles, Framework and Illustration

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Abstract

With the increased world-wide operational tempo, Commanders and their staffs need to rapidly develop shared understandings of the battlespace while ensuring each individual worker to be productive and concentrated in his/her assigned role and tasks. The Canadian National Defence Command Centre, responsible to monitor and direct strategic-level Operations, was selected as the candidate organization model. The vision is to provide each individual with a customized, mission and task oriented knowledge portal that gives access to the right information from any sources in context of the work and allows contribution to the collective "battlespace knowledge". An incremental approach is proposed to provide sophisticated knowledge management services. The target portal must allow a federated access to the variety of sources, allow arbitrary navigation and semantic connections on any sources and products, take into account user individual interests and group constraints within a dynamic and evolving task context and allow synchronous and asynchronous collaboration within the group. This paper presents the core principles and concepts that governed the structure of a high-level knowledge environment framework. Emphasis was put on the context, the linked ontologies and the portfolio concept. The framework is illustrated with a generic portal layout.

1. Introduction

Military Command and Control (C&C) internal and external environments have evolved dramatically over the past twenty years. At least four major drivers should be mentioned:

- Firstly, internal environments in World C&C Centres have witnessed a tremendous increase in information management requirements. The operational tempo, the number and diversity of information sources, the rate of message reception have all significantly increased. Operations are geographically dispersed and present an accrued diversity in nature.

- Secondly, the staff resources to perform C&C functions, i.e. to develop situational awareness and plan operations, have remained basically stable over the years, at least in Canada.
- Thirdly, the nature of operations, on one hand, and military and political alliances, on the other, increases the need for collaborative work between different forces and nations.
- Fourthly, the internetization of the society has two major implications for the military world: on the one hand, military workers possess an increasing level of information technology literacy, and on the other, the external environment continually adjusts to expanding information technology capabilities and, for the best or the worst, masters them.

Consequently a generalized pressing leitmotiv has developed from C&C Centres to expand capabilities centred on accessing and processing the right information, just on time. The dramatic events of September 11th, 2001 have put a renewed emphasis on the sense of urgency attached to providing military personal with enhanced Knowledge Management (KM) capabilities. This is particularly the case of the Canadian National Defence Center (NDCC), the Canadian Defence organization responsible to monitor and direct strategic level Defence operations, training and worldwide deployments[1]. Hence, over the last few years, information superiority has become the focus of many policies and military programs. However the means to achieve such superiority are just emerging.

Pressing requirements from users, technical innovation in component technologies and in application integration linking tasks and technology [Mack *et al*., 2001], user readiness and better understanding/overview of how military workers accomplish their tasks, offer convergent relevant conditions for development of a new type of environment to support them in achieving information superiority.

Concretely, the question is: How to improve military knowledge workers' efficiency, as individual workers, as communities and as groups, independently from their computer literacy level and without revolutionizing organisation values, business rules and work layouts. Although categorizing all military workers, as knowledge workers, might not be *acceptable*, all of them, as well as the lives they are protecting and defending, highly depend on proper information processing. What has been demonstrated in other research programs is that information superiority requires a drastic improvement in information management, exchanging and sharing information, and information assurance [Alberts and Garstka, 99][2].

In the C&C specific sphere, Commanders and their staff, from all levels of Command at any Service levels, need to rapidly develop shared understanding of the battlespace while ensuring the participation of all workers with productivity and focus to perform their assigned role and tasks. They demand a knowledge environment that will support the development, maintenance and sharing of the collective "battlespace knowledge".

Typically, such a wide and powerful initiative translates into a plethora of highly specialized research projects or programs. While technology plays a major role in this type of initiative, one cannot address the search for enhanced information processing capabilities by addressing

[1] From requirements capture sessions

[2] Many papers and presentations have been delivered on the issue. Alberts and Garstka present an interesting overview of the topics.

exclusively Information Technology (IT) components and capabilities issues. Organizational structure, management processes, individual skills and roles have for one part[3] [Allen and Scott Morton, 1991], and alignment between IT, organizational, internal and external dimensions for the other part, have to be considered [Henderson and Venkatraman, 1992]. The challenge to succeed resides in establishing the common conceptual denominator between all these fields, and in coordinating each and all related issues *that have to be addressed*.

Some major military knowledge management initiatives underway throughout the World and, notably, in USA, that are inscribed in the same trend should be mentioned. Among them,

- The CINC21 (Commander in Chief of the 21st Century) Advanced Concept and Technology Demonstration [Griffin] aims at providing a highly visual, dynamically updated capability that enables the CINC's staff to deal with complex multiple, simultaneous crises based on shared knowledge and collaboration across secure and optimized networks. The program concentrates on thrusts related to decision focused visualization, collaborative environments, information enterprise, and knowledge management.
- The Command Post of the Future (CPOF) [Harper, 1999] [CPOF] is a DARPA program whose objective is to provide an environment with tailored visualization, multi-modal human/computer interaction, and adaptive decision environment, in particular context tracking and dialog management.
- The Joint Battlespace Infosphere (JBI) [JBI Home page] is a combat information management system that provides users with specific information required to perform their functional responsibilities during crisis or conflict. The JBI integrates data from a wide variety of sources, aggregates this information, and distributes the information in the appropriate form and level of detail to users at all echelons. It makes use of publish and subscribe mechanisms to deliver information.
- SSC San Diego has developed improved decision support displays for command centers at the Commander, Joint Task Force (CJTF) level [Morrison, 2000]. The concepts and tools proposed include a knowledge wall and knowledge desks for liaison officers. The knowledge wall is composed of a series of windows incorporating decision support tools as well as summary information displays. The knowledge desk concept is an integrated desktop composed of several displays designed for: routine office tasks; providing the tactical situation picture tailored to the user's needs; monitoring the situation and facilitating information sharing by pushing information from the operator to a shared web site.

This paper focuses on core principles and concepts necessary to structure a high level framework that can support a knowledge based workspace environment. Although the proposed environment is generic and is applicable to any C&C centers or other organizations that are dealing with the monitoring, evaluation of situations and elaboration of proactive plans, the work was strongly based on the understanding of the challenging requirements of NDCC [COP 21 Arch, 2002] [CFCS, 2002] [CCOA Model, 2002]. The paper proposes avenues for further research projects.

[3] Reference is made to the MIT 90 framework.

2. **Positioning and Long-Term Vision**

This paper aims to establish a long-term vision to gradually provide users with a customized, mission and task oriented desktop that will give access to the right information from any sources in the context of the work, and will allow easy contribution to the collective battlespace knowledge. In short, the envisioned working environment must:

- provide basic document management and information exchange/distribution services;
- allow a federated access to multiple types of information from any media and from varying levels of abstraction;
- allow arbitrary navigation and semantic connections on any sources and products;
- take into account individual user interests and group constraints within a dynamic and evolving task context;
- allow synchronous and asynchronous collaboration within the group; and
- include a variety of services, such as personalization, contextual search, task-oriented, work-specific toolset, dashboard, multiple operations monitoring, briefing production and configuration.

This statement calls for portal concept in the wider definition of the concept. A portal [Morrisson, 2000] is an application that provides a personalized and adaptive interface enabling people to discover, track, and interact with other people, applications, and information relevant to their interests. Its distinguishing features are:

- Personalization for end users;
- Organization of the desktop;
- Resource division;
- Tracking of activities;
- Access and display of data stores;
- Location of important people and things.

The positioning of this work differs significantly depending on whether it is analyzed from a technology or from an organizational point of view.

2.1 ***From the technology perspective***

The vision is based on a 3 to 5 years technology horizon. Specifically, it has been positioned towards existing/commercialized portal solutions and collaborative tools. It is clearly inscribed in the trend of the last emerging generation of portals [Mack *et al.*, 2001], which will increasingly integrate context personalization, cascading portals, business processes, abstraction layers, federated search, person-to-person (P2P), web services, and knowledge management capabilities. In consequence, data mining, information aggregation, search and retrieval, alerting and visualization capabilities are core-targeted technologies.

From the beginning of 2002, major portals[4] solution providers have introduced the concept of « a unique desktop » into their implementation environments and they offer functionalities such as customized information access according to user profiling, basic collaborative tools, online application, wireless support, etc. However, these off-the-shelves solutions do not address all

[4] Such as Sharepoint, WebSphere or Plumbtree

previously stated requirements[5]. If some of the missing parts are conceptually well advanced and exist as a prototype or are even commercialized, none of the off-the-shelves integrated solutions that would address the totality could be found in the market.

As a result, from a technology perspective, the project vision takes into account architecture and bridges between numerous standalone applications, systems and networks. Ultimately, it will target development of the missing components, (hardware or software) considering current trends in fundamental research and concomitant technology demonstrator projects.

2.2 *From the organizational perspective*

Constituents to be considered in such approach are numerous. Sponsors, stakeholders and end-users belong to different services. End-users might be individuals of various ranks, fulfilling different responsibilities in different assignments; they might also be communities or groups. Tasks to perform are highly specialized and specific to each end-user. Task-related knowledge is often explicitly embedded in procedures whereas mission related knowledge remains tacit for a significant part. Business rules are not all formulated, and organisational culture and values are to be considered.

Minimizing change but rapidly securing gains [Kotter, 1996] from such an initiative has been identified as a major key success factor. While this paper does not provide a full insight into the client's organisational capability for acceptance of the present vision, the following key factors were considered when developing the vision and the solution:

- The approach has been driven so that it can fit current organizational structure and rules.
- Attention has been dedicated to the concepts of user/role/responsibility and to the requirements of shift management and of organizational work layouts.
- High-level principles allow for adequate security management.
- In order to comply with current practices and to facilitate acceptance by users, a high level of flexibility allows for possible human intervention in all automated processes.

Concretely, the proposed vision is based on a user-centric and generic approach, and is highly organizational structures/processes aware.

Hence, first of all, the vision developed takes into account issues such as the complexity of the environment, organisational structure and existing processes, task complexity, information overload, collaborative work, and it fulfils identified requirements. It aims at enhancing user capabilities and efficiency, while the resulting in user-friendly interface.

Secondly, because of the organizational culture and of the working layouts, uniformity of the feel and look of the environment has been identified as an important issue for buying into by decision makers, and ultimately for its rapid adoption. The solution has to be generic enough to address needs of users having to process situation awareness. It is based on a high level of abstraction supported by structured principles, and it allows for a superior degree of flexibility.

Thirdly, although the implementation of the vision might imply the re-engineering of some organizational processes, its development is not driven by such an approach. Rather, it considers existing conditions but is not limited by them.

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[5] Typically: 10% out of the box, 90% to be developed or highly customized

3. The Guiding Principles for Modelling the Knowledge Environment Concept

3.1 *Guiding Principles*

As this work aims at establishing a long-term federating vision, it calls for a well-founded conceptual approach that will guide future project developments towards the shared objective of information superiority. A series of functional principles have been established and they lead to the definition of a model and framework from which a contextual user-centric knowledge portal can be developed. The established guiding principles can be grouped in three broad categories according to their focus:

- Principles resulting from the user-centric focus: being generic and providing optimal flexibility for users.
- Principles resulting from the search for a significant contribution to information superiority: presenting an integrated environment, supporting knowledge management and being tool-based oriented.
- Principles contributing to the use of a contextual working space.

Principles resulting from user-centric focus

Two main considerations result from the user-centric focus. Some related aspects of these considerations have been mentioned in the previous sections since they constitute success factors. The first is to establish a framework applicable and acceptable to all users, independently of hierarchical levels, roles, responsibilities and the parent organization they belong to. The second is that the framework applies to single users and communities or groups of users.

These considerations have considerable implications. They translate into the following principles for the model and framework development, and subsequently into the proposed illustration:

- No predominance has been given to specific roles or organizations.
- User parameterization by the system administrator predominates over personalization options. It determines features and sources available to users.
- Ultimately, the interface resulting from the model and the framework should be independent of the type of display device that supports it.
- Despite the fact the proposed solution is based on the single/integrated interface, malleability of the interface is primordial.
- In performing their responsibilities, users refer to their own body of knowledge constructed through years of experience. They have their own way of undertaking their tasks. They have developed specific approaches, strategies, and working habits. Tapping on their experience, they implicitly know what to expect from such sources or from collaboration with such individuals, how long it will take to produce a briefing, what level of detail is expected from them in certain situations, etc. In addition to formalized procedures, a significant part of their work is intuitive and refers to tacit components. Users should be provided with the ability to deactivate some features if they are irrelevant to them or counterproductive, given the way they are used to work. This will enable users with the ability to choose the relevant paths to perform their tasks/work.

Principles contributing to information superiority achievement

Three additional considerations need to be acknowledged to assure that the framework contributes significantly to information superiority: an integrated access to sources, knowledge management built-in capabilities, and a strong tool/service development orientation [Harrisson, 2001]. The framework should be tool-based and services oriented. Major issues/requirements that have to be addressed are related to information overload and information assurance, collaboration, and "physical work layout". Implications in order to addresses most of the current requirements translate into the following:

- Presenting to users an integrated workspace environment that is driven by knowledge management focussing on the capturing, (re)using and creating individual and organisational knowledge.
- Developing tools to increase the relevance of the information users have to manipulate, to categorize appropriately all types of documents in circulation, including messages, and to dispatch messages and documents according to their content.
- Favouring geospatial resources/tools and other visualisation capabilities that play a fundamental role in understanding and communicating information.
- Making readily/easily available to users relevant task support tools according to the task they are performing, and according to preferred ways of working, competence profiles and community of expertise.
- Taking into account the five dimensions [Capt J. K. Burton, 2001] of information assurance: information integrity, confidentiality, authentication, availability and non-repudiation.
- Exchanging and sharing information should be inherently promoted within the knowledge portal. With the emergence of the concept of networked war, it becomes more and more essential to be able to share relevant information in order to gain information superiority. Information must be distributed efficiently and understood by participants who are often geographically dispersed. The aim is to enable the creation of shared awareness and knowledge of the situation.

Principles resulting from the use of contextual working space

Two additional considerations are necessary to ensure that users are working efficiently and are staying concentrated on their tasks: to allow them to perform all "related work" in a delimited working space, called *portfolio* and to provide assistance and services in *context* of this "related work". The question is how to qualify the "related work". Depending on users, "related work" could take different meanings. For some, it could designate all the tasks to be performed in relation to a specific operation. For others, it could be related to a very complex continuous task (e.g. planning) that could apply on a set of similar operations sharing analogous problematical issues. For senior users, who are responsible to give daily interpretation on the worldwide crises, the "related work" could apply on the entirety of the operations but with a very focused work-minded (e.g. situation assessment). Figure 1 illustrates the mapping of portfolios against two dimensions: ***A*** and ***I***. ***A*** corresponds to the set of long-term delivery activities that are usually task-oriented; an element of this set could either be a very well defined military task (e.g. developing courses of action) or be a broader fuzzy activity, such as assessing situations. ***I*** (for *intervention*) corresponds to the set of world-wide or domestic operations/crises, where Canada

has to intervene or monitor in some ways, including the union subsets of these elements (e.g. all operations in North Africa).

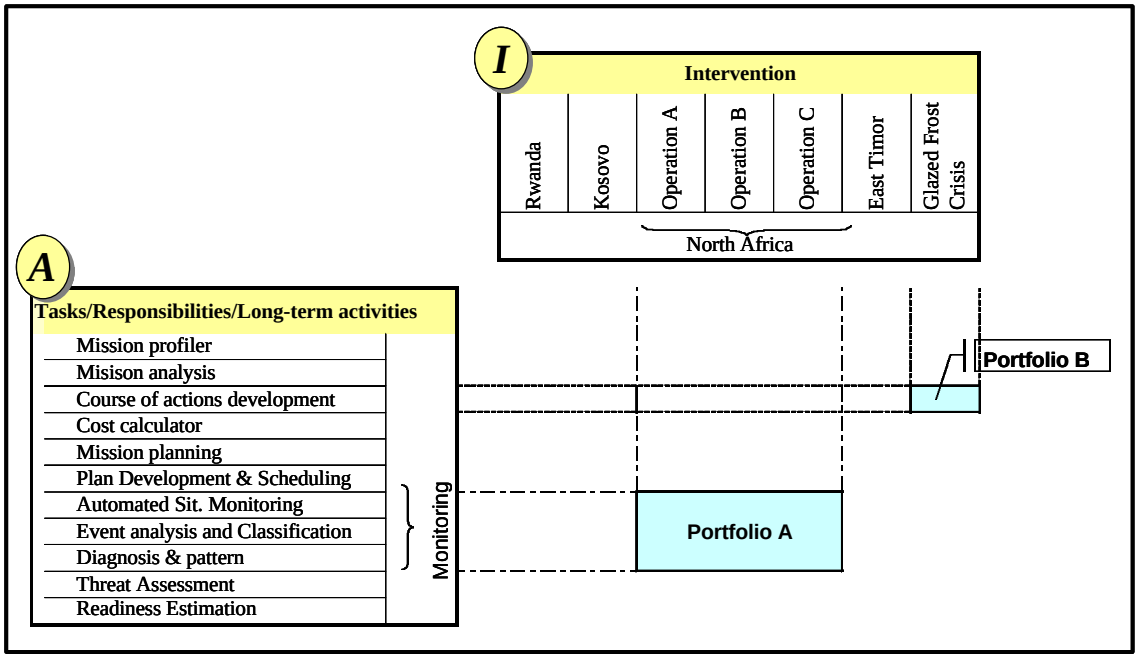

Figure 1. Examples of two portfolios with different purposes: (A) to monitor North Africa operations and (B) to develop courses of action in regards to the Canadian Glazed Frost Crises

A third dimension also applies: the ownership (***O***). In most cases, portfolios will be assigned to individuals to allow privacy in their work while still allowing exchanging and publishing of the information. Moreover, portfolios could be shared by groups of users. In this case, the ownership will belong to the group and each user will contribute into the same portfolio, allowing the support of shift management or simultaneous work. Figure 2 illustrates the scope of portfolios in relation to the three dimensions: ***A***, ***I*** and ***O***.

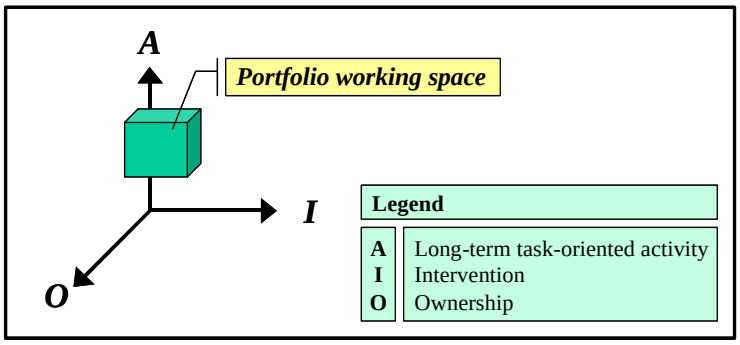

Figure 2. Scope of portfolios

The delimitation of the work into well-scoped portfolios allows, to a certain extent, to *confine* or *grasp* the knowledge handled within them as well as the know-how. The exploitation of that

knowledge and know-how, by the means of appropriate *ontologies*, is then feasible and brings powerful possibilities, such as providing contextual assistance in various ways to the work performed within portfolios. The relationship between the portfolio, its contextual counterpart and the linked ontologies are discussed in detailed in the next subsection.
These considerations (portfolio and contextual assistance) have implications on the development of the knowledge environment. They translate into the following principles:

- Delimiting the portfolio against three dimensions: long-term task-oriented activities, *intervention*, and ownership will ensure flexibility in the organization of the work and allow individual or group customization of the environment.
- The scope of each portfolio needs to be preferably predefined and managed at a higher hierarchical level to ensure control and certain uniformity that will ease collaboration between users.

Contextual assistance will impact the whole universe of a portfolio (internal or external to it), such as the set of available sources, the access and behavior of tools, the set of task-oriented services, etc.

3.2 ***The Model Supporting the Knowledge Environment Concept***

The guiding principles provide elements to structure a model supporting the Knowledge Environment. The model is composed of ten entities or concepts that are meaningful by themselves.

The first set comprises three entities that refer to the organizational knowledge into which users will tap in a straightforward manner to perform their work. Within this set:

- *Tools* consist of the user functions and built-in capabilities that are necessary, to a user, to carry out his/her tasks and activities.
- *Task Knowledge* consists of the know-how and knowledge that are derived from experience, established work methods and their sequence.
- *Sources* consist of the raw information, external elements and systems that are made available to the environment.

The second set of four entities refers to the organizational structure and management processes. Within this set:

- *Organization* is defined as an administrative or functional structure and includes the definition of roles, responsibilities and long-term activities of users and groups.
- *Intervention* refers to a worldwide or domestic operations/crisis/situations where monitoring, intervention or assessment is required.
- *Users* refer to individuals or groups who have responsibilities and need to interact with the environment.
- *Administration* refers to the management and configuration of the knowledge environment.

The third set consists of the three entities that distinguish the proposed model and the subsequent framework, from the usual IT environment: *ontology, portfolio and context.*

- *Ontology* is an explicit specification of a shared conceptualization [Gruber, 93] defined by concepts, attributes, properties, constraints, axioms and relations between

the concepts. It constitutes a foundation for the communication between human and machine agents.

- *Portfolio* is the virtual container of the user's work material.
- *Context* is the intelligent background entity that provides the contextual assistance.

The model is expressed in two layers as illustrated in figure 3. The first layer is composed of the nine entities conveying tangible concepts (i.e. where objects of the concept could be named). All entities are interlinked in various ways with the others. The central entity is the portfolio with its three dimensions (Ownership, Activities and Intervention) that found respective instantiation in the User, Organization and Intervention entities. The superimposed layer is composed of one entity, the context, which is solidly linked to the central entity (the portfolio) but impacts on all other ones.

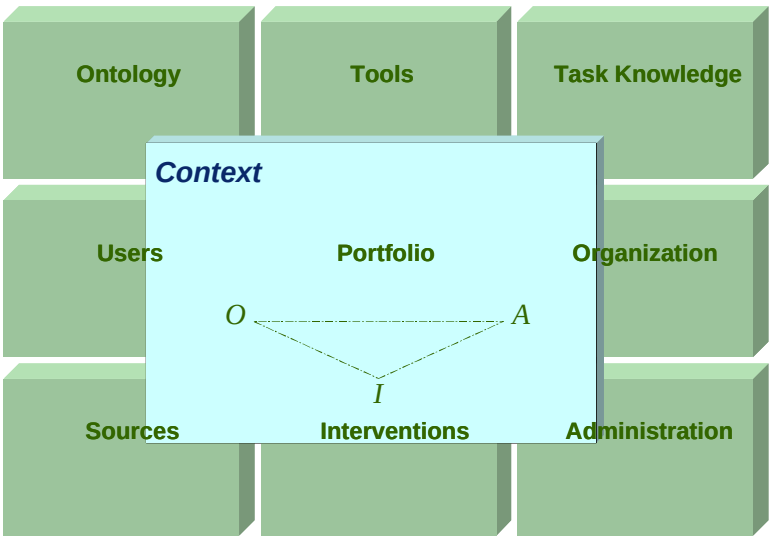

Figure 3. The Knowledge Environment Model

The key concepts of the model are detailed below.

Ontology

The ontology is the foundation of communication among users and between human and machines. Sharing and reusing knowledge is considered a major competitive advantage by all types of organizations. However many barriers prevent it from being achieved easily. Culture, value or even leadership of the organization are invoked. Amongst the well-known barriers is communication in all dimensions. As mentioned in *The Working Knowledge* [Davenport and Prusak, 98], "people can't share knowledge if they do not speak a common language". Common language contributes to common understanding, enables information and knowledge sharing and reuse without misunderstanding. It is the foundation for a wide interoperability.

The prime motivation for an ontology is to enable communication between computer systems in a way that is independent of the individual system technologies, information architectures and application domain. In other words, an ontology includes rich relationships between terms. Ontology will be transparent to users and not imposed on them as additional constraints. Each

specific knowledge domain and organisation will structure its own ontology. These ontologies will be organized into mapped ontologies [Jasper and Uschold, 1999]. Context, portfolio and all task-specific tools, including a thesaurus viewer, will refer and use implemented ontology. Inherently, development of ontologies can only be incremental. Their maintenance has to be carefully addressed.

Portfolio

The portfolio constitutes a user's (or group's) working space to perform a long-term task-oriented activity within a particular domain of intervention. The elements defining the scope were discussed in the previous subsection. The portfolio contains all the representative material needed to perform the work (e.g. documents, annotated maps, preferences, emails, queries, work-tracking history, personal comments, etc.) as well as all the links to the required external elements such as the list of relevant sources, reference documents, groups of experts, subscriptions, task-oriented tools, specialized applications, thesaurus views, organizational work layouts, etc. Users may have as many portfolios as they need and can share portfolios with others. In this case, the ownership of the portfolio belongs to the group. For efficiency of the work environment, portfolio may need to be predefined at a hierarchical level but the flexibility to create portfolios remains necessary for users and groups. Ideally, for manageable considerations, the number of portfolios per user should be limited.

Context

The context operates in background on the portfolio as a transparent agent. It monitors the parameters of the portfolio and keeps track of their evolution as actions are performed within the portfolio. To a certain extent, it can be seen as a set of evolving parameters, or the intersection of them, that characterize the working situation [Pomerol and Brézillon P, 2001] [Klemke, 2000]. Henceforth, parameterization of the portfolio has a direct impact on the context itself.

From a functional point of view, the context determines what information is relevant. It is user dependent. When working within the portfolio, the user has access to numerous tools and information from various sources to help manage his/her work. With an active context, all of these tools will be available with optimal settings in a manner that he/she is familiar in function of the tasks to be performed. The information will be made available according to the domain of knowledge, his/her official assignment and security privileges. The context circumscribes and reinforces the meaning of the information, strengthens its understanding and its processing by providing the right tools to do so; it facilitates knowledge creation, acquisition and sharing. "It allows for more direct transferal of knowledge from the domain of learning to the domain of application, by avoiding needless generalization out of context." [Jasper and Uschold, 1999]. Furthermore, the context provides access to the background/default information for further inferences and searches. It constrains possible intermediate inferences and consequently, allows the reach of useful inferences. It suggests appropriate concept approximation to help formulate meaningful queries. It allows for the efficient representation of information and knowledge to enhance their comprehension and exploitation.

In an advanced vision of the working environment, the context could have a more proactive role. It could become a visible asset for the user, instead of being solely transparent. The user could control it, activate or deactivate it, drag it from portfolios to others, modify its impact on some

specific areas and parameters, and visualize it to comprehend at a glance its value-added and its action. One concrete example of this is to allow users to select the context that could provide assistance in a specific framework of decision/action, or to let the context recognize which other context could help, according to the situations that are representative of a particular class of problems [Killion, 2000].

To conclude, recent research indicates a strong impact of context on the usefulness of information during the searches. Information seeking in context improves considerably the relevance of query results. Information processing (search, retrieval, analysis, summarizing, fusing etc.) is more efficient when a context filters or guides the process. These results might be extrapolated to other activities or tasks users have to perform. The context, in combination with the portfolio, allows users to benefit from having information, knowledge and tools at reach out of a single click. The context appears to be a powerful sealing and operational agent between all elements of the model.

4. **The Knowledge Environment Framework**

The Knowledge Environment Framework defines a set of tools and services for supporting the knowledge management environment. The diagram (figure 4) and text below briefly describes the 3-tier framework structured in user, business, and data tier.

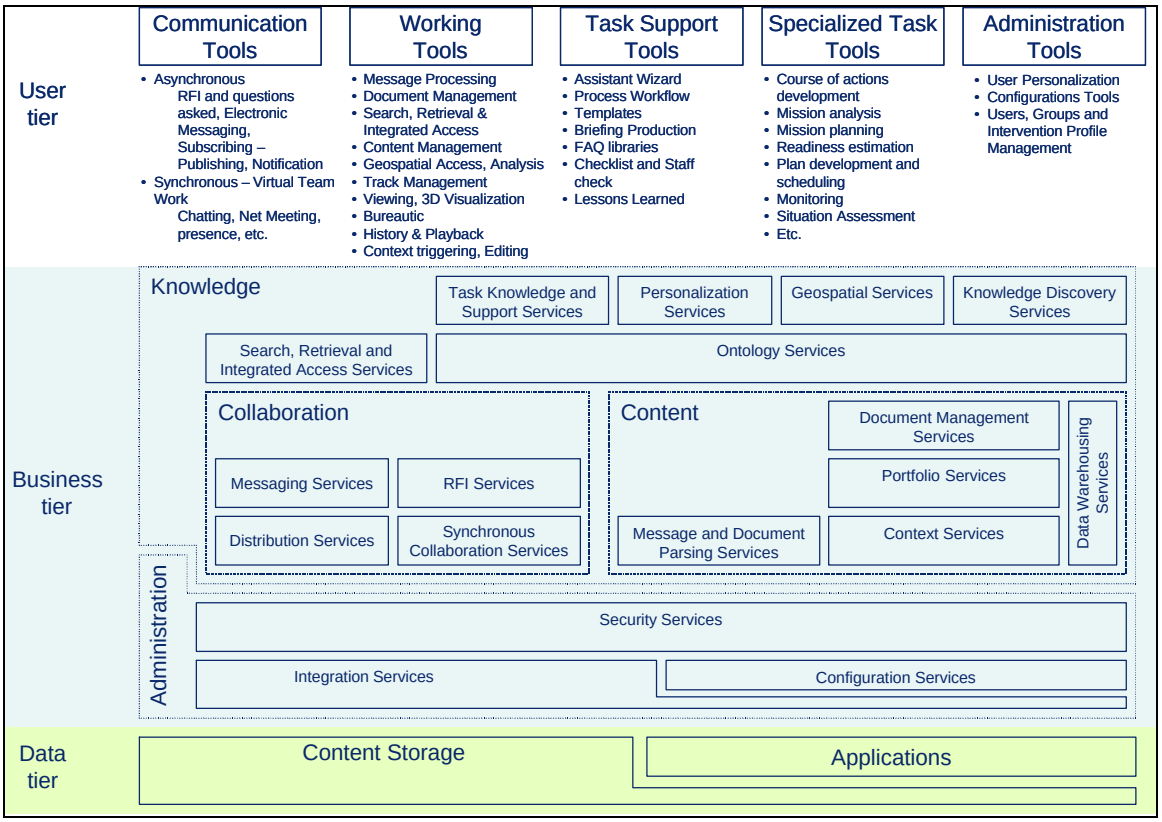

Figure 4. The Knowledge Environment Framework

4.1 ***User Tier***

The user tier section of the framework is structured around five main tools families: communication tools, working tools, task-support tools, specialized task tools and administration tools. In order to be supported by the environment, these tools imply in turn, the structuring of services in the Business tier.

4.2 ***Business Tier***

The business tier contains the business rules and logic. Aiming at delivering an integrated access to information and tools required to perform various tasks within the broad situation assessment process, the system should provide a reference platform for the development of interoperable services across a wide range of environments. These services share business/military logic, data and processes through a programmatic interface across networks. They should allow military organisations to communicate data without intimate knowledge of each other's IT systems behind firewalls. The complexity of connections required might not have control over both ends of the connection. Thus these services must be seen as loosely coupled.

Deployment of this framework represents and involves a fairly fundamental shift in modelling the architecture and in designing Defence applications. The concept of services should be understood as:

- a set of standards including application-to-application communication and interoperability standards that describe a service-oriented, component-based application architecture; and
- a set of components used in various processes and distributed widely throughout the knowledge environment.

The Business Tier consists of four groups of services that are aligned on the main principles described in the first section of this paper:

- The *Knowledge Services* group is a central place where structured knowledge is kept and maintained. It is divided into numerous services such as: ontology, task knowledge and support, search, retrieval and integrated access, personalization, geospatial and knowledge discovery services.
- The *Collaboration Services* group consists of services to support synchronous (virtual teamwork) and asynchronous communication between users, such as electronic messaging, distribution, and Request for Information (RFI).
- The *Content Management Services* group is used to manage the content from a knowledge repository focus. Typically, these services consist of document management, message and document parsing, portfolio, context, and data warehousing services. More specifically, portfolio services provide assistance in managing resources, activities, and schedules related to long-term task-oriented activities. Context services will comprise a series of intelligent agents, including a context mapper, a content indexer, an activity recognizer, an event tracking and tools to edit, to enable/disable or to handle contexts.
- The *Administration Services* group typically comprises Security, Configuration and Integration Services, which provide the means to bring data or functions from one application program to others.

4.3 *Data Tier*

The data tier actually consists of the applications and content storage. The later refers to a collection of data organized so that it can be easily access, managed and updated.

5. **Illustration**

The philosophy that has driven the knowledge portal interface design resulting from the guiding principles and the framework is to provide the user with optimally relevant information and tools without altering the clarity of the interface, henceforth leveraging the *context* concept as much as possible.

The knowledge portal layout, illustrated in figure 5, consists of seven different zones where most of them can be minimized or maximized.

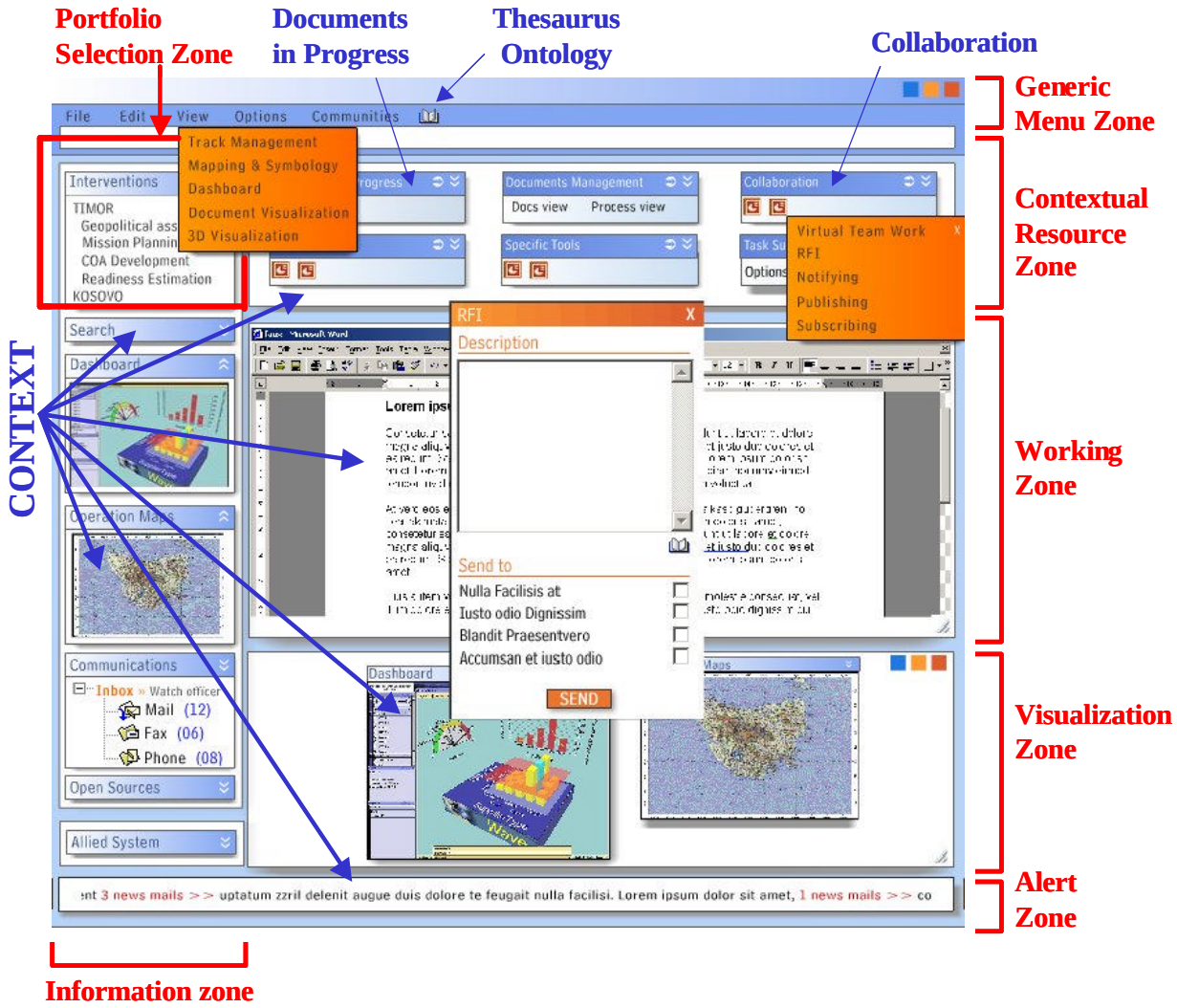

Figure 5. The Knowledge Portal

Among these zones, five are impacted by the context that is associated to the portfolio, which was selected by the user within his/her assignment, responsibility and security parameters:

- The *information zone* presents an integrated but contextual access to all information sources available to the user, whether these are open or specific to the work, such as geospatial information. The zone contains an advanced contextual search engine and allows the user to work in dashboard mode to assess a situation in progress.
- The *contextual resource zone* is to display, manage or produce documents related to user's assignment and responsibility. It allows the user to tap on task specific tools (templates, wizards, lessons learned, etc.), to work with others, in synchronous or asynchronous mode, to access specific specialized tools such as systems or applications (e.g. planning application), and to keep track of all documents and actions taken when assuming his/her duty. All boxes in this zone present a button to disable the context if needed. Using this functionality, the user will be able to display documents or to work with the tools that were filtered by the context, to have access to the universe of elements that belong to the organisational/corporate level, and to work with all tools in their default behaviour mode.
- The *working zone* is where instance of documents are opened. On selecting a document from the «Document in progress» box, the associated application is instantiated. More than one layer/instantiation of the application can be displayed. The user can perform other tasks without leaving the knowledge portal. The working area is expandable but cannot be minimized.
- The *visualization zone* allows for display of documents or applications dragged from the information zone. Functionalities offer cascade or mosaics display capabilities according to the user preferences. Within this zone, maps, dashboard and screens from other systems can be displayed. The visualization zone is expandable but cannot be minimized. Arbitrary navigation from and between any fields within geospatial products and documents of the working zone is possible.
- The *alert zone* is located at the bottom of the screen. It comprises a ticker that displays general non-contextual and contextual information. Alerts related to new message arrivals will be displayed in the ticker.

To conclude, operationalization of the context makes it possible to considerably enhance the relevance of the information brought to the user while ultimately addressing the information overload issue. As such the proposed portal interface complies with fundamental rules of clarity and simplicity thereby optimizing its chance of easy acceptance by users.

6. **Change Management issues**

6.1 ***Technology and Security Issues***

Technology and security issues are highly intertwined as security issues have driven, and still do often drive technological choices. The focus of the present paper is not to provide a detailed review of technological and security issues related to development of the framework. Further work will need to assess exhaustively the magnitude of technological and security constraints

required. However number of key factors that have implications on technology feasibility of the solution, have been considered as the framework was developed, notably:

- the high level of complexity of the technological environment;
- the systems legacy;
- the exclusive interface of most applications/systems, as many applications/systems were developed by their own and in isolation;
- the diversity of parallel and independent networks in use;
- the vacuum to be preserved for security issues;
- the fundamentals of access rights to sources; and
- the possibility of human intervention requested on all/any fully automated processes.

What appeared from positioning this initiative towards commercialized portal solutions is that the main technology-based challenge resides in integration of existing or prototyped components to provide users with a single integrative and effective interface.

6.2 *Organizational Issues*

Attention has been paid to the magnitude of changes brought by the framework because it is usually proportional to the efforts to be deployed for acceptance [Turner and Crawford, 1998]. Although this paper does not provide a full insight into the organisational capability for acceptance of such a framework, key factors were considered. An approach excluding drastic Business Process Reengineering (BPR) is favourable to minimize the impact on business rules, work layout and user work habits.

Furthermore, the real challenge for organizations seeking important changes is to validate and enhance the vision, while providing the analytical justification and internal support to effectively position it with the key stakeholders. A key success factor in achieving this is to gain cross-departmental understanding and buy-in of the vision. This is endorsed by helping them understand how new business processes will effect their services while, at the same time, benefit the strategic direction of the organization as a whole.

In addition, further involvement of end-users will be necessary for refining the vision, to assess if all requirements are properly addressed and to fine tune the proposed interface. End-users' involvement is essential to further testing and promoting the concepts of the portfolio and context. It will definitely facilitate organizational and user acceptance.

6.3 *Incremental Strategy*

Given the number of stakeholders, the dimensions to be considered and the diversity of current projects, development and implementation of this knowledge portal initiative can only be incremental. At this stage it is too early to define exhaustively a priority list. As previously mentioned, technology issues (including both architecture, hardware and software issues) are numerous and complex. Organizational capacity to adopt and receive this initiative has not been fully assessed as yet.

However, many components of the proposed knowledge portal are already available, and action should be taken to ensure that developments prioritize the implementation of the portfolio

concept. Gradual implementation of other key components, such as the context, will be possible as the structuring of ontologies and of processes modeling develop.

6.4 *Conclusion and Research Perspectives*

As user centric and non-BPR approaches have been adopted, C&C requirements have been addressed and minimal impact on user's work habits have been taken care of, the authors believe that acceptance of the knowledge portal is realistic and promising. Henceforth, the knowledge environment framework constitutes a beneficial approach to the information superiority issue.

To a certain extent the paper presents a common high-level framework for C&C strategic-level organizations. It also maps research requested to deliver incremental development and implementation of the concept. As such the paper constitutes in itself a research program. It provides a research framework to guide the development of advanced knowledge management services for the years to come.

7. **References**

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