

# Enabling Cross-organization Interoperability through Dynamic Directory Integration

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## ABSTRACT

Dynamic Team Management for Cross-organization Collaboration was developed by IBM, in cooperation with the U. S. Defense Information Systems Agency (DISA) and MITRE (a federally funded research and development organization), to support participating organizations in the U.S. Homeland Security/Homeland Defense Command and Control Advance Concept Technology Demonstration (HLS/D C2 ACTD). Dynamic Team Management includes finding and accessing information about resources (people) with whom you need to communicate and collaborate on a mission or task. Used in conjunction with collaboration tools and other applications, DTM supports constructing cross-organization teams of individuals to address particular missions or tasks, based on emerging needs. DTM demonstrates approaches to overcoming many of the challenges of building the best teams for each mission/task, accommodating information sharing preferences of participating organizations, directory integration automation, dynamically scaling to meet cross-organization communication and collaboration requirements, and achieving organizational interoperability.

## KEYWORDS

Interoperability, core services, directory integration, web services, communication, collaboration, dynamic teams

## INTRODUCTION

In an emergency situation it is imperative to rapidly assemble cross-organizational teams with the expertise required to respond to the emergency. These teams need to be able to work jointly, supported by collaboration tools and other applications, to coordinate and execute a response. The Dynamic Team Management (DTM) solution was developed with these requirements in mind. DTM provides the capability to assemble teams from different agencies, to locate, invite (alert), authenticate users, and collaborate to solve a problem. Specifically, DTM users are able to:

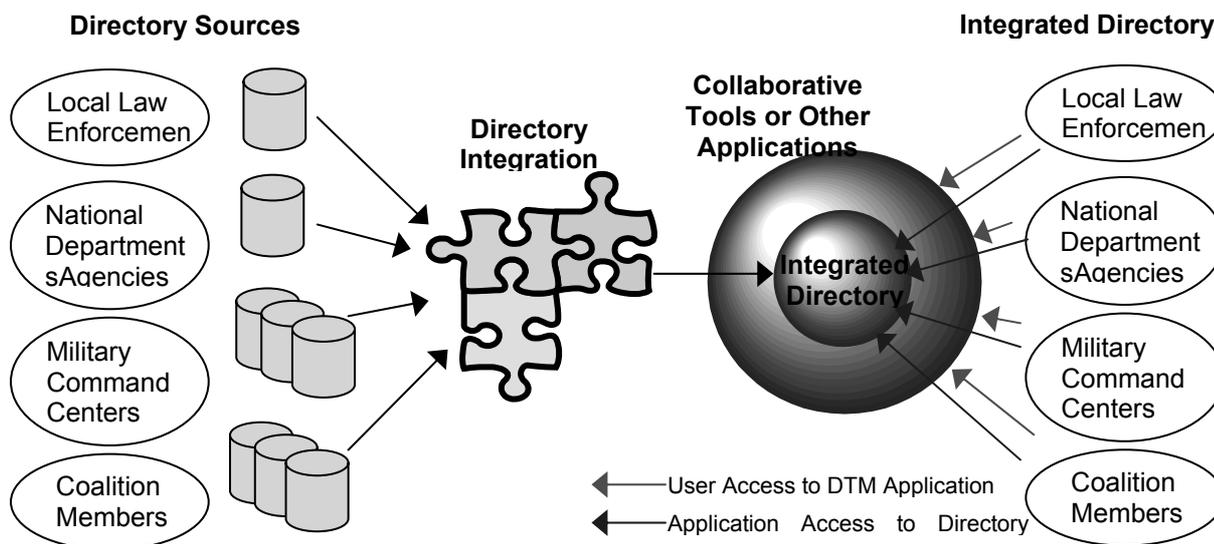
- Locate resources (usually individuals or roles). In preparation for, during, or in response to an event, find people based on a variety of factors (name, department, role, geography, skill etc).
- Invite. After locating the right resources, rapidly assemble a team, across agency boundaries, and invite them to collaborate.
- Authenticate. Using authentication information previously available or now provided, authenticate those individuals or roles.
- Collaborate. Work together, synchronously or asynchronously to solve a problem.

Dynamic Team Management (DTM) is a web-based solution that leverages collaboration components and an integrated directory to enable the creation of interoperable, cross-organization teams of skilled individuals to address an emerging problem. The Dynamic Team Management solution is built upon commercial off-the-shelf (COTS) software and provides the following benefits:

- build the best teams to address a specific mission/task
- accommodate the information sharing policies and procedures of contributing organizations
- automate directory discovery, integration, and synchronization
- scale to meet dynamic cross-organization collaboration requirements

## DIRECTORY INTEGRATION

Dynamic Team Management provides the foundational components, and functional tools necessary for true “cross agency collaboration” and agency interoperability. One of those key components is directory integration. The DTM Integrated Directory provides tools and procedures to integrate directory information (information about people) from existing sources. DTM provides pre-built, open-standard based connectors to a variety of file formats and schemas, which provide a means for rapid integration of directory information regardless of source. DTM is an excellent transformation toolset to assist emergency management organizations in building the knowledge-based information systems that are needed to assure proper information access to those who have a need to know regardless of threat level.



**Figure 1. Dynamic Team Management integrates organizational directory information from various organizations, in a variety of formats and schemas, and then makes the integrated directory available for use by the sharing organizations and their applications.**

DTM tools accommodate differing directory formats, schemas, and vocabulary. The solution flexibly addresses directory sharing requirements/restrictions of participating organizations. By regularly refreshing directory feeds, the solution maintains currency of directory information. Through the integrated directory, DTM provides components of the “core enterprise services” required for interoperability and enhanced decision making.

### Directory Integration COTS Software

The IBM Tivoli Directory Integrator product provides the enabling platform to easily develop mechanisms (referred to as assembly lines) to load and synchronize identity data from the source directories with the integrated directory. The consolidated identity information housed in the integrated directory can then be accessed by users via the DTM application, directly by any authorized Lightweight Directory Access Protocol (LDAP) compliant application, or via web services.

The two COTS software products that provide the DTM directory integration capability are the following:

- IBM Tivoli Directory Integrator (IDI) - provides built-in connectors to integrate a variety of identity data sources into the integrated directory. Changes in identity information on these data sources can also be synchronized with the integrated directory. For DTM, the product’s open architecture Java development environment enables customized loading of identity information from the data sources into the integrated directory. IDI assembly lines are the programs built with existing connectors to integrate the directory data for each information source.
- IBM Tivoli Directory Server - provides a powerful LDAP infrastructure that houses the integrated directory information. This information can be customized to provide the appropriate contact and search data. It is built upon DB2 Universal Database providing a high degree of scalability.

## LEVERAGING THE INTEGRATED DIRECTORY

The second component of the Dynamic Team Management solution is the application that leverages the integrated directory information. The DTM collaboration portal is simply one application that leverages the cross-organization integrated directory. As discussed above, the DTM integrated directory is exposed and made available for use by applications or direct query via LDAP or web services. Multiple applications/users may simultaneously leverage the integrated directory.

The Dynamic Team Management solution includes a collaboration portal to leverage the integrated directory. The DTM collaboration tools and services support users who want to search for individuals (by name or role) based on a variety of criteria (name, organization, department, expertise, geographic location, etc.). With the individuals found through the desired search, DTM users may chat, share documents or applications, conduct team meetings electronically, send alerts, etc. and do so securely.

### Collaboration Portal COTS Software

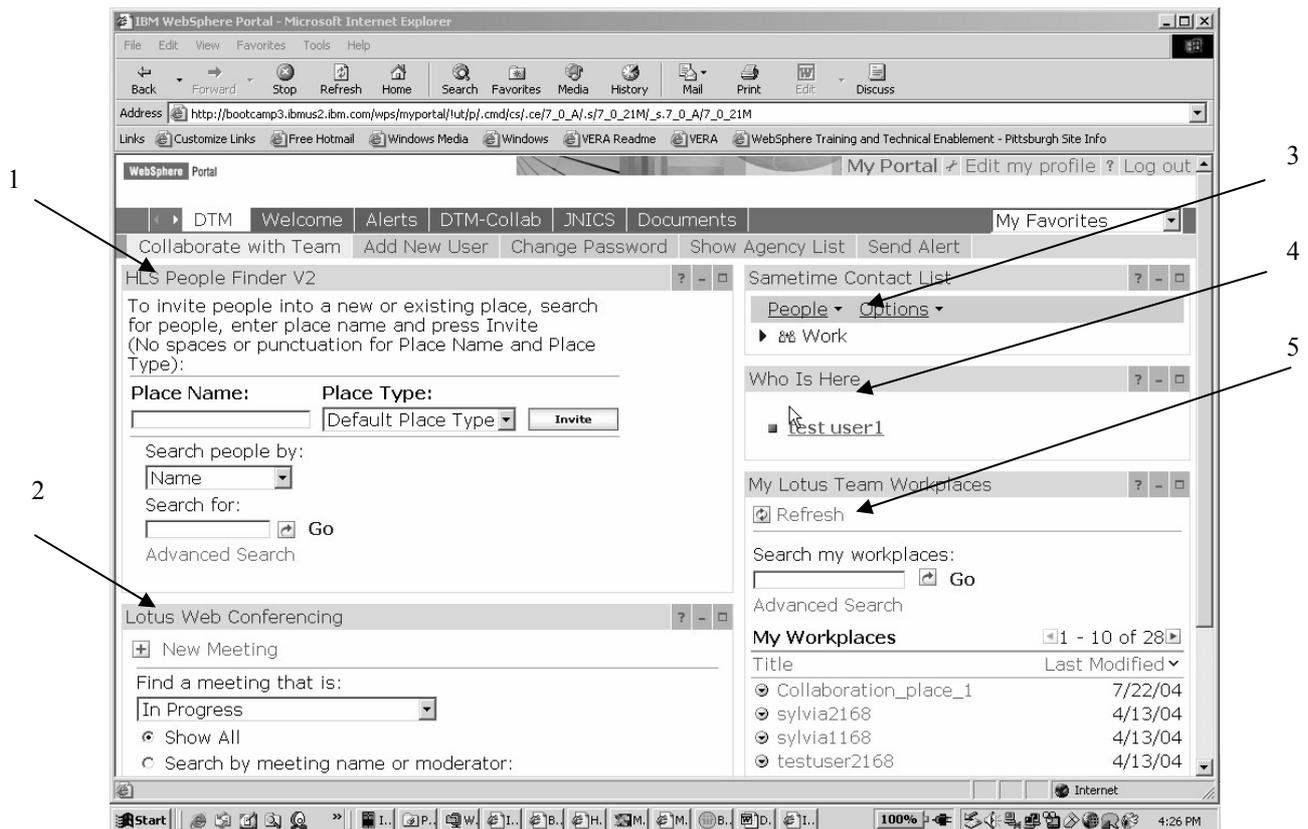
WebSphere Portal Server provides the entry into the Dynamic Team Management solution. It provides a single sign-on capability into portal as well as the chat, e-Meeting, and team workspace collaboration components. A set of ready-to-use collaborative portlets are fully integrated in WebSphere Portal and includes portlets for finding, connecting, and working with people. These portlets interface with the collaboration tools and operate on identity data stored in the DTM integrated directory. DTM collaboration tools include the following COTS software:

- IBM Lotus QuickPlace is a self-service asynchronous team collaboration solution where team members can create secure, central web-based workplaces. It enables teams to coordinate people, tasks, plans, and resources; collaborate by sharing and discussing ideas, resolving issues, co-authoring documents, exchanging files, and managing schedules; and communicate actions, decisions, key findings, and other knowledge by publishing them to the team place.
- IBM Lotus Sametime is real-time synchronous collaboration software, with online awareness, instant messaging, application sharing, and virtual e-Meetings. Online awareness means that you can determine in advance if a person is available to collaborate. Instant messaging allows users to exchange text, audio, and/or video in real time. Virtual meetings and application sharing are enabled via the web conferencing features.

### Portal Interface

Figure 2 illustrates the DTM collaboration portal user interface. The DTM collaboration portlets use the underlying directory schema of the integrated directory to provide search and collaboration capabilities. The portlets on this page include:

1. **HLS People Finder Portlet** - This portlet assists in finding people by name, agency, expertise, and other qualifiers. It supports both a basic search and advanced search capability. The portlet allows the user to select people from the search results and add them to a new or pre-existing team workplace (QuickPlace). Users are notified by e-mail when invited to a team workplace. When creating a new workplace, the user can provide the place type which defines the workplace template, including information relevant to the event or team task.
2. **Lotus Web Conferencing Portlet** – provides integrated tools for managing on-line meetings. From within the portlet, people can join existing e-Meeting, see active meetings they need to join, or schedule new meetings.
3. **Sametime Contact List Portlet** – This portlet enables Sametime instant messaging. The user can initiate chat sessions with other users, add/remove people to/from the contact list, add/remove personal groups to/from the contact list, change on-line status, list only on-line users or all users, and rename personal groups.
4. **Who is Here Portlet** - This portlet lists the currently active (on-line, in the collaboration portal) users.
5. **My Lotus Team Workplaces Portlet** – This portlet lists the Lotus QuickPlace workplaces in which the user is a member. The portlet allows the user to search across all of the workplaces, join a workplace, or create a new workplace.



**Figure 2. The Dynamic Team Management Collaboration Portal leverages the integrated directory to facilitate cross-organizational team communication and collaboration.**

## CONCEPT OF OPERATIONS

*“On the first of February 2003, the space shuttle falls out of the sky. Within 90 minutes, we had to set up a critical information exchange environment with 15 organizations that we had not even so much as made a phone call to. What elements of planning can you do when you don't even know who your partners are on an event-driven basis? You have to figure out how to dynamically create trusted information exchange environments, dynamically manage them, and have them go away when no longer required.”<sup>1</sup>*

The DTM directory integration and collaboration portal software components enable the desired cross-organization connectivity, communication, and collaboration among people responding to emerging events. Far more challenging in achieving cross-organizational interoperability and coordination is a concept of operations and standard operating procedures that ensure the application of the technology to meet mission objectives. Used effectively, the DTM solution can be a part of the day-to-day mission performance of an evolving and changing organization. DTM improves situation awareness of the participating organizations and helps locate responder capabilities and expertise that can be applied to solving complex and critical problems through effective collaboration and teaming.

Multiple information domains exist today across a coalition operation to include inter-agency needs. Today's operational information sharing requires flexible, faster, and secure means to electronically connect these domains. DTM focuses on people connectivity across domains. The goal of DTM is to simplify the often complex task of managing heterogeneous, cross-organizational, and distributed directories.

While the software listed in the preceding sections of this paper provides the technology to implement the DTM solution, a commitment by organizations to share directory information to support communication, collaboration, and interoperability is essential. The following processes are a recommended minimum to support effective teaming using DTM:

1. Design the Integrated Directory schema to support mission needs and mission applications.
2. Discover the need to communicate and collaborate with organization(s) not currently in the Integrated Directory.

3. Contact the organization(s) to be added. Agree to share directory information.
4. Document information sharing agreements (Memoranda of Understanding (MOUs)), specifying the information to be shared (entire directory or a subset) and the conditions under which it will be shared.
5. Build and test the Directory Integrator (IDI) assembly lines for each source directory. IDI automates directory schema discovery, data mapping, assembly line construction, and directory synchronization.
6. Adapt applications to leverage the Integrated Directory services by using LDAP or web services.
7. Include Dynamic Team Management processes and procedures in organizational Standard Operating Procedures (SOPs).
8. Train personnel and exercise DTM processes and procedures. This means familiarizing personnel with the new ability to reach out and find cross-organizational and extra-organizational resources (people) that improve mission performance in a dynamic environment. The end-users of DTM are the users of software applications (e.g., incident management systems) and communications devices (e.g., computers, phones, PDAs, radios) that leverage the information in the integrated directory schema.
9. Continually refine concepts of operation and SOPs based upon operational experience.

Dynamic Team Management facilitates cross-organizational connectivity among organizations through the integrated directory. Following the nine-step process above, an organization will build a set of information sharing agreements and implement those agreements by building and applying Directory Integrator assembly lines. It is not the intent of the DTM integrated directory to capture and retain an ever expanding set of information about across a diverse set of organizations. When the situation that warrants directory integration (conditions explicitly stated in the information sharing agreements), then the IDI assembly lines are “turned on”. When the event that prompted the need to share is over, the IDI assembly lines are “turned off”. The organizations(s) providing the directory sources always retain control of the directory information shared.

### Escalating Directory Integration in Response to Events

Directory Integrator assembly lines are built and turned on or off as events dictate. Although assembly lines are not difficult to build and can be built quickly once agreements to share information have been reached, the existence of pre-built assembly lines speeds the integration of organizational directory information when quick response may minimize damage or save lives. Table 1 displays different situations in which assembly lines are likely to be pre-built, or to be built as needed.

Situation	Description of Organizations Involved	IBM/Tivoli Directory Integrator Assembly Lines	
		Pre-Built?	ON or OFF?
Core Partners	Organizations that regularly communicate and collaborate to accomplish collective mission.	Yes	Always ON to synchronize directories
Event-Driven Collaboration with Anticipated Partners	Organizations with which you may anticipate a need to communicate and collaborate only in certain situations (e.g., specific event types, event locations).	Yes	Turn ON when dictated by the event; turn OFF when the event is over.
Event-Driven Collaboration with Unanticipated Partners	Organizations with which you suddenly have a need to communicate and collaborate as driven by an event, but not organizations that you could have anticipated.	No – Build as the need is discovered	Turn ON when dictated by the event; turn OFF when the event is over.

**Table 1. Pre-built assembly lines, when feasible, speed directory integration in emergency situations**

## EMPLOYMENT

Dynamic Team Management has been used to support cross-organization communication and collaboration in a number of situations. One example is participation in the relief effort for the December 2004 Indian Ocean tsunami, in which multiple external directories were integrated and the DTM collaborative capabilities were extended to remote, diverse responders via browser.

Another example was the June 2004 Joint Warrior Interoperability Demonstration (JWID 04) and its successor CWID 05 (planned for June). JWID/CWID is an annual event that enables the U.S. combatant commands and international community to investigate command, control, communications, computers, intelligence, surveillance, and reconnaissance (C4ISR) solutions that focus on relevant and timely objectives for enhancing coalition interoperability. DTM will support the CWID HLD/HLS scenarios in addition to traditional coalition operations, conducted in a simulated operational environment. DTM user experiences in JWID 04 are documented in the September 2004 report Network Centric Operations and event-driven, cross-agency task forces. Among the reports conclusions were the following<sup>2</sup>:

- The use of DTM during JWID 04 fostered many discussions on the “real problems” related to creating a trusted information exchange environment.
- DTM enables broad, procedure-free collaboration.
- The way DTM was deployed is consistent with the NCO principle “build a little, test a little, field a little, and learn a lot”.

## CONCLUSION

Dynamic Team Management solves some of the issues and challenges faced by planners and responders who need to perform complex tasks that require collaboration across widely dispersed and diverse organizations.

- Accommodating differing directory formats, schemas, and vocabulary
- Flexibly address directory sharing requirements/restrictions
- Maintaining currency of directory information
- Scaling collaboration as the situation evolves
- Locating the proper individuals/roles (expertise, responsibility) when team building
- Communicating/collaborating with organizations with whom you may have never previously worked
- Avoiding one focal/choke point within an organization (single point of failure)
- Communicating via roles as well as individuals
- Capturing organizational reporting relationships
- Enable applications to leverage integrated directory information

The Integrated Directory Services provided by the DTM Solution are in alignment with the core services components of Network Centric Warfare. DTM integrates directory information across organizations that need to collaborate on a mission/task. Once organizations agree to share directory information and assembly lines have been built, there is minimal impact on the established directory management procedures of participating organizations. DTM supports an information environment that is integrated, scalable, and a fully distributed information processing and transport infrastructure, based on commercial technologies. Most of all, the integrated directory, as a core information service, can be leveraged by mission applications, without re-writing the applications.

## REFERENCES

1. Quotes from Major General Meyerrose, US Northern Command (NORTHCOM) to the JWID Final Planning Conference (FPC) in Chesapeake, VA on Tuesday 30 March 2004.
2. Bubbers, Lex (2004) Network Centric Operations and event-driven, cross-agency task forces, A NCO case study sponsored by IBM.
3. Renner, Scott (2004) How Do We Build Information Systems That Support Network-Centric Warfare? The Edge, Information Interoperability Issue, Vol. 8, No. 1.