Federal Emergency Management Agency (FEMA)

DMI-Services Concept of Operations
DM-Framework and DM-OPEN Enterprise Information Sharing Environment / Initial Operating Capability (IOC)

EADIS Work Order 22 / EADM PMO Business Assessment
Version 0.3 – DRAFT FOR REVIEW
February 12, 2008

Document Management History

Document Location

Location
File Path:

Revision History

Version Number	Version Date	Summary of Changes	Team/Author
0.1	1/5/09	Initial version	Neil Bourgeois, WO22/EADIS; Gary Ham, EADM PMO
0.2	1/8/09	Updated with Feedback from DM Stakeholder Review Meeting	Neil Bourgeois, WO22/EADIS
0.3	2/12/09	Updated with Feedback from DM PMO Review Meeting	Kirby Rice, EADM PMO

Approvals

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1   Introduction

1.1   General Description

Currently the Disaster Management Interoperability Services (DMIS) provides a basic incident management toolset allowing registered emergency management user groups to manage local emergency incidents securely and share information. Open Platform for Emergency Networks (DM-OPEN) is an interoperability service, coupled with shared messaging standards, enabling third party incident management software applications and devices to share information.

DMIS provides basic tools and a supporting infrastructure that allows first responders and emergency management communities to obtain and process information to prepare for and deal with all hazards, whether a man-made incident or other natural disaster.

The interfaces to DM-OPEN conform to open messaging standards as defined through the Emergency Management Technical Committee sponsored by the Organization for the Advancement of Structured Information Standards (OASIS) and through the National Information Exchange Model (NIEM). DM-OPEN provides a neutral, standards-based information sharing mechanism that can be used by heterogeneous systems to exchange needed messages supporting emergency management.

1.2   Functional Scope

The upgrades to the DM incident management toolset platform (DM-Framework) and DM-OPEN service will be loosely coupled separate systems so that the toolset and the interoperability service can independently evolve to meet the evolving mission requirements and technology changes. It is important these systems support National Incident Management Systems (NIMS) concept and principles.

The planned approach to accommodate this primary requirement involves implementation of a open, non-proprietary and extensible, scalable or expandable framework envisioned to provide emergency managers, disaster management related organizations and vendors with enterprise-wide reach and interoperability for existing systems. As visualized, the framework would serve as a preferred point of entry to disaster management information technology systems and a process and common operating environment that can provide the basis for development of an IT R&D roadmap for disaster management. The framework will promote greater coordination and collaboration between emergency management organizations and vendors, and maximize the value of existing and new systems used to share critical information in times of emergencies.

2   Background / Statement of Need

2.1   National National Research Council's Committee on Using Information Technology (IT) to Enhance Disaster Final Report

Section 214 of the E-Government Act of 2002 called on the Office of Management and Budget, in consultation with the Federal Emergency Management Agency (FEMA), to conduct a study on using information technology to enhance crisis preparedness, response, and consequence

management of natural and manmade disasters. The final report from the National Research Council's Committee on Using Information Technology (IT) to Enhance Disaster Management provides recommendations for enhancing disaster management through the use of IT.

The proposed DM-Framework and DM-OPEN Information Sharing Environment directly addresses several of the recommendations that the report provided.

- **Recommendation:** The federal government should develop and regularly update an IT R&D roadmap for disaster management with the involvement of a full range of stakeholders.
  - The report highlights the point that disaster management is a system-level problem and that no single system satisfies the requirements of all organizations.
  - Improvements in one technology area may have relatively little overall impact unless other interconnected technologies are able to leverage and utilize the improvements.
  - It is anticipated that the DM-Framework and interconnected DM-OPEN platforms will address these key issues.

- **Recommendation:** Federal, state, and local agencies should embrace a diversified acquisition strategy that includes increased use of commercial information technology and greater use of open source software and open standards development as a complement to more traditional acquisition approaches.
  - The report listed a number of challenges that organizations face in adopting IT.
  - Together DM-Framework and DM-OPEN will provide a flexible platform to facilitate development and deployment of many promising technologies that today are considered risky and costly given the limited opportunities presented by commercial markets for these technologies.

- **Recommendation:** Disaster management organizations should work closely with technology providers to define, shape, and integrate new technologies as a coherent part of their overall IT system.
  - The report points out that reliance on turn-key systems has meant that disaster management organizations have paid less attention to the underlying design issues that ultimately affect the functionality of their IT systems.
  - Often technologies have been acquired as stand-alone products with little consideration for how they integrate with other technologies already in use, even within their own organizations.
  - The DM-Framework and DM-OPEN platforms will promote integration with other technologies and facilitate interoperability among what are today considered stand-alone products.

- **Recommendation:** In the design, acquisition, and operation of IT systems, disaster management organizations should emphasize the incorporation of disaster response capabilities into the systems that support routine operations.
  - Unless experience is gained through routine use or regular training, the full benefits of investment in IT systems are unlikely to be realized.

- Moreover it is through routine use that the competence and confidence required to successfully use a technological capability, especially in the high-stress situation of disasters, are best developed. Also training large numbers of people to deal with infrequent events poses logistical challenges and is costly.

- The DM-Framework will provide collaborative features that will promote use on a day-to-day basis, as well as facilitate cost-effective enterprise-wide coordination for outreach, training, and exercise coordination.

2.2 Key DM-Framework Concepts

The DM-Framework along with DM-OPEN provides a federated platform that will allow for the loose coupling of different systems. This will also allow organizations to leverage existing solutions side-by-side and add additional products that can supplement and/or compliment their current systems. Other framework concepts include:

- The framework will provide enterprise-wide reach regardless of the Incident Management System (IMS) being used by an organization.

- The framework will host a wide range of service components. Each IT system that plugs into the framework will be defined as a service component regardless of whether it serves a single purpose or is a full blown Incident Management System (IMS).

- The framework will be entirely web based.

2.3 Key Framework Benefits

The DM-Framework along with DM-OPEN provides a building block solution that allows multiple products to be combined to build a disaster management system that meets all of an organization's requirements that includes:

- Providing a unified point for maintaining a disaster management focused R&D roadmap.

- Relieving an organization from the burden of having to sift through the myriad of products trying to find a mix of products that will meet their requirements without creating interoperability issues.

- Providing a platform on which vendors can show their unique capabilities and demonstrate interoperability at the same time. Allows an active and effective market to be built.

- Promoting community-driven development and adherence to standards.

- Promoting development of tools for everyday use that can be deployed within the framework.

- Exploiting redundancy and diversity to achieve resilience.

- Promoting the design of systems with flexibility, composability, and interoperability as core guiding principles.

2.4 Implementation Approach

In order to develop and implement upgraded platforms for DM-Framework and DM-OPEN as an independent data communication service: An open standard foundation will be employed using a Service Oriented Architecture (SOA) platform to build a flexible and scalable data-exchange

service platform. The data-exchange platform allows FEMA to promote reusable services; interconnect with a wide variety of systems and groups; and respond quickly and cost-effectively to changing needs.

This approach focuses on the needs of emergency responders, state and local officials to modernize emergency management interoperability services. To determine the best DM-Framework value solution for FEMA, a software evaluation effort (including costs and benefits) will be conducted. The scope of the evaluation shall include access to the following alternatives for implementation of the DM-Framework:

- Enhance an existing FEMA or Department of Homeland Security (DHS) application to support DM-Framework.

- Acquire and tailor COTS, Open Source, or other Federal Agencies (OFA) GOTS applications to support DM-Framework

The DM-Framework allows any number of combinations of the above, and also allows end-users to add their own member tools from robust Incident Management Systems to single function applications.

- Determine course of action for core DMIS capabilities that are not supported by implementation alternatives for the DM-Framework

- Establish core DM-Framework Initial Operating Capability (IOC) capabilities that include:

  – Incident Planning and Response

  – Shared Interactive Maps integrated with Incident Planning and Response

  – Reference Material for Operational Effectiveness

  – Resource Request and Tracking

  – Common Alerting Protocol (CAP) and Non-Weather Emergency Messages (NWEM) (National Weather Service (NWS) HazCollect) Alerts

  – National Map for Incidents and Alerts

  – Create and View EDXL-DE wrapped content

  – Weather Forecast Data, Doppler Radar, and Alerts

  – Secure Instant Messaging

  – Journal Recording

- Subsequent phases beyond IOC will incrementally add additional service components, capabilities and functionality.

- Integrate emergency management data messaging standards, which will be supported by the following Web-Service interfaces for DM-OPEN IOC:

  – CAP 1.1 Alert

  – NWEM Alert (NWS HazCollect)

- EDXL-DE (Emergency Data Exchange Language - Distribution Element) (Note: All new emergency management data messaging standards will be implemented through the EDXL-DE interface. The EDXL-DE interface can also be leveraged to exchange NIEM (National Information Exchange Model) Information Exchange Packages.)
- Improved message retrieval capabilities by leveraging category data structures in the EDXL-DE data structure
- Hosting and providing access to type-lists for use in EDXL-DE messages.

The goal of the EDXL project in DM-OPEN is to facilitate emergency information sharing and data exchange across the local, state, tribal, national and non-governmental organizations of different professions that provide emergency response and management services. EDXL will accomplish this goal by focusing on the standardization of specific messages (messaging interfaces) to facilitate emergency communication and coordination particularly when more than one profession or governmental jurisdiction is involved.

Lessons learned from multiple incidents of national significance continue to indicate a need for a capability to rapidly share major/catastrophic/cataclysmic disaster situation information on a national scale.

3 Objectives

3.1 Stakeholder Objectives for Current Effort

- Focus on the needs of emergency response stakeholder community at local, state, tribal, national, and federal levels to modernize DMIS Incident Management System (IMS) and DM-OPEN interoperability services.

- Develop and implement upgraded platforms for DM-Framework and DM-OPEN as an independent data communication service, employing an open standard foundation using a SOA platform to build a flexible and scalable data-exchange service platform.

- Establish a data-exchange platform that will promote reusable services; interconnect with a wide variety of systems and groups; and respond quickly and cost-effectively to changing stakeholder needs.

3.2 Disaster Management (DM) Team Objectives for Current Effort

- Satisfy primary stakeholder objectives in the upgraded DM-Framework and DM-OPEN platform. IOC.

- Build a foundation for meeting longer range objectives in subsequent releases to DM-Framework and DM-OPEN.

- Leverage EDXL-DE to provide the foundation for improved delivery of messages via the DM-OPEN network through rule-based distribution. The EDXL-DE can be leveraged to provide the identification and categorization of content; the characterization of senders and recipients; and the targeting of recipients by geographic area of interest.

4 Programmatic Considerations

4.1 Functional

Historically, the development of DMIS Tools has been "from the bottom up." Emphasis has been on developing capabilities for the jurisdiction local to the incident. The capabilities of the DM-Framework and DM-OPEN platform will provide additional benefits at local, state, regional, and national levels.

The functionality described in this document involves a rather large set of overall requirements. Establishing an IOC target with planned releases will reduce risk and accelerate the transition to an improved DM-Framework and DM-OPEN capability.

4.2 Schedule

The capabilities described within the scope of this Concept of Operations (CONOPS) are earmarked for release in the Fall of 2009.

5 User Encounter Description

5.1 DMIS and DM-OPEN Information Sharing Environment

The following diagram illustrates the enterprise-level information sharing environment for DM-Framework and DM-OPEN. This represents an unconstrained view to show the capability that could be incrementally implemented over time in a phased approach. The diagram is organized into three high-level vertical tiers from end-user to back end services.
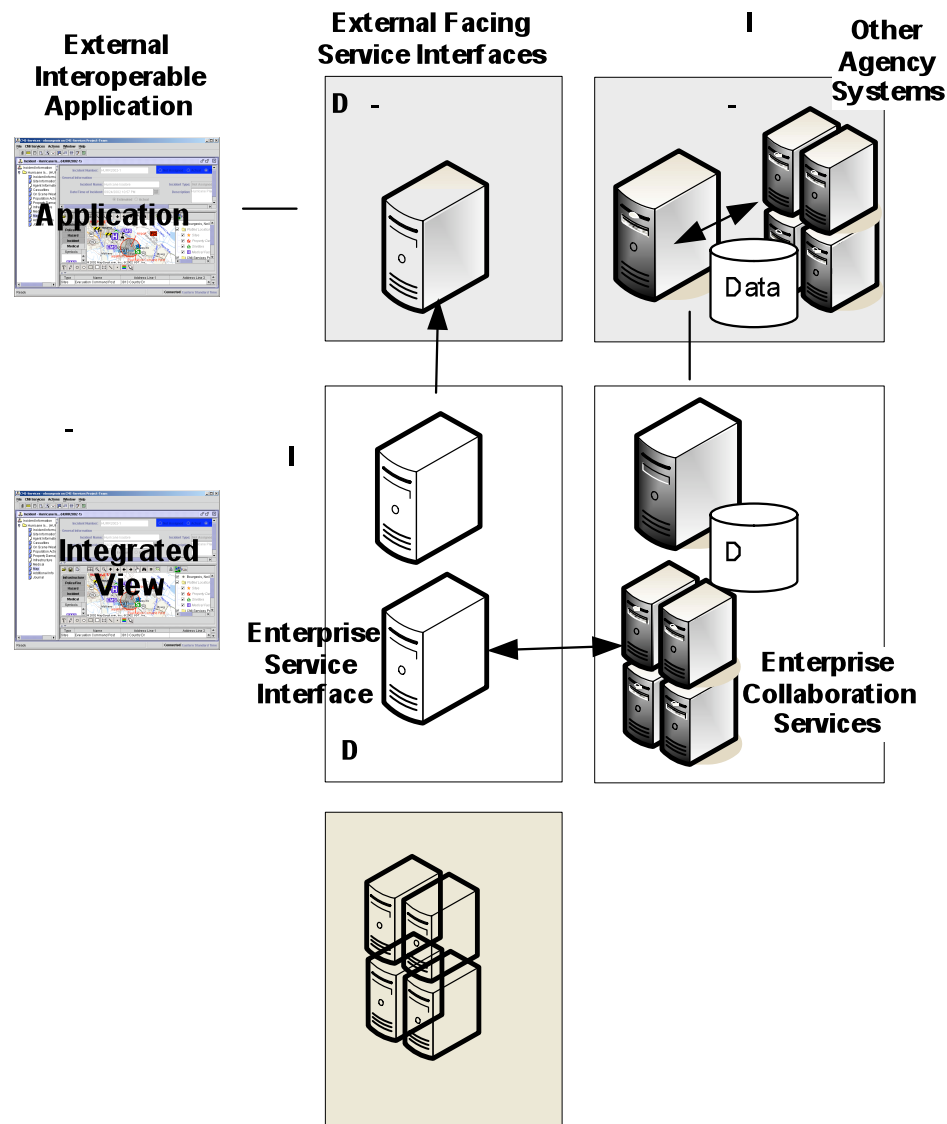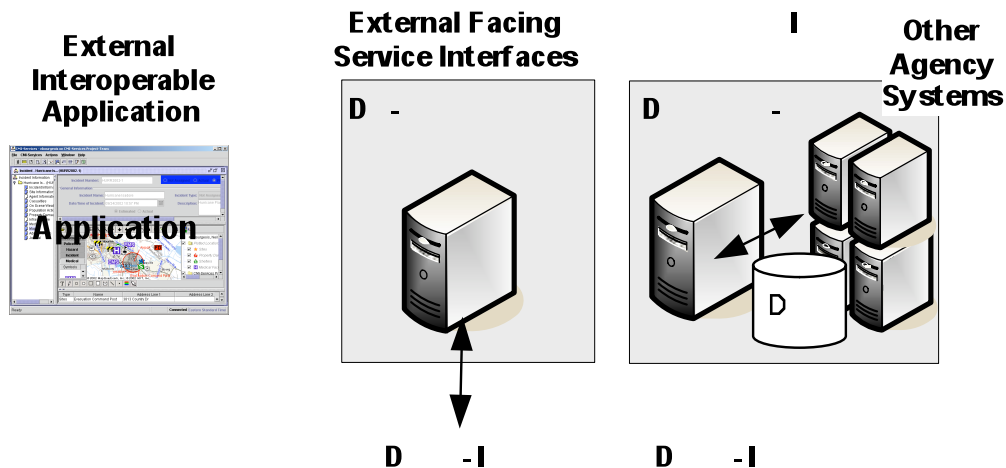

The diagram is also organized around the following three horizontal swim-lanes which are separately hosted and loosely coupled:

- DM-OPEN Layer
- DM-Framework Layer

- External Web Application Layer

5.1.1 DM-OPEN Layer

The first vertical tier in the DM-OPEN Layer includes External Interoperable Applications.

The External Interoperable Applications use standards based web-services to establish interfaces to DM-OPEN. These applications can include other COTS and GOTS incident management systems as well as other alert and message distribution systems. Also these applications can be stand-alone or accessed from the DM-Framework Layer.

The second vertical tier includes the External Facing Service interface that provides the entry point for all interoperable system interactions. These interactions are handled by the following Web-services Application Programming Interfaces (APIs):

- CAP 1.1 *(IOC)*

- EDXL-DE *(IOC with Incremental retrieval improvements, and more inclusive Publish/Subscribe features supported in release following IOC)*

- Non-Weather Emergency Message (NWEM) *(IOC)*

- Hospital Availability Exchange (HAVE)*(IOC via EDXL-DE)*

- Resource Management *(IOC via EDXL-DE)*

- Situational Reporting (SITREP)*(IOC via EDXL-DE)*

- National Information Exchange Model (NIEM) Information Exchange Package Document (IEPD) *(IOC via EDXL-DE)*

From the third Internal Services tier the DM-OPEN Enterprise Service Bus (ESB) platform exposes services to the DM-OPEN External Service Interface and then back to external systems via web-services. This internal platform can also communicate internally to other agency systems via Web-Services or other database and application interfaces. Currently DM-OPEN

communicates internally to the NWS HazCollect system to submit an NWEM for broadcast over National Oceanic and Atmospheric Administration (NOAA) Weather Radio. This will facilitate the delivery of new and evolving information products from federal agencies to the DM Community.

An ESB can be viewed as an enterprise messaging system which allows integration between different architectures without the need for writing code through the use of interface adapters and data transformation services. ESB technology is used to support the implementation of a Service Oriented Architecture (SOA). SOA describes an IT infrastructure which allows different applications to exchange data with one another as they participate in business processes. The objective of an SOA is to deliver business processes to end-users and other systems. It is planned that an SOA solution will be used in the implementation of DM-Framework and DM-OPEN.

5.1.2 DM-Framework Layer

The first vertical tier in the DM-Framework Layer includes the DM-Framework Web Interface, where End-Users interact via a browser in a composite web-page comprised of configurable portlets. These portlets can provide access to a wide range of applications of benefit to DM stakeholders.
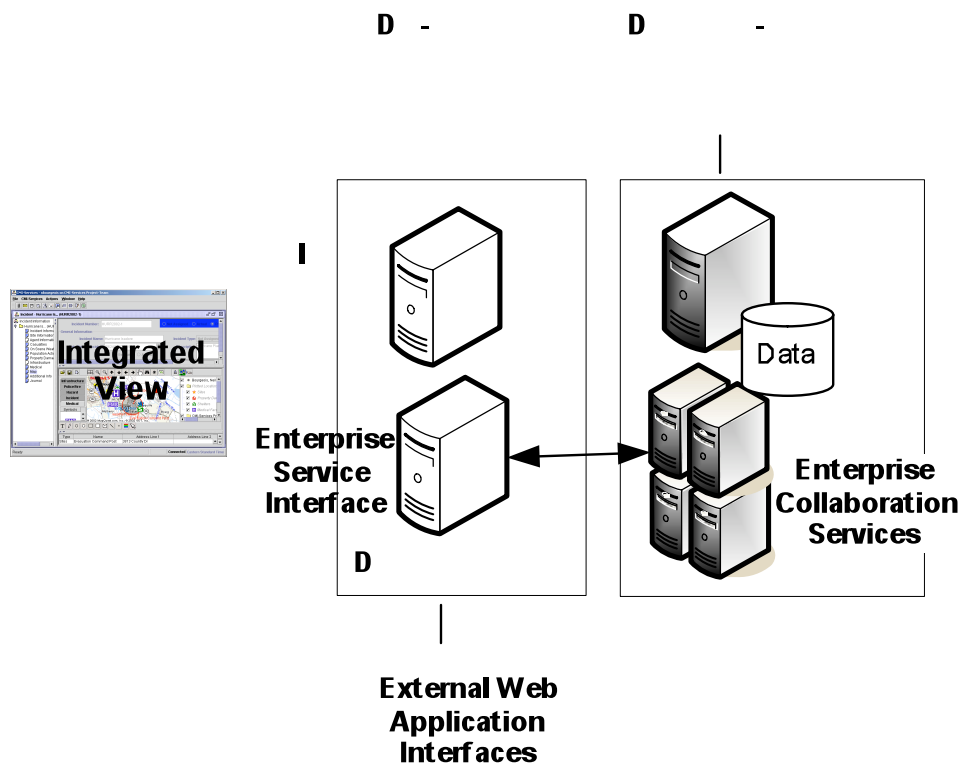
In the second vertical DM-Framework tier the Web interfaces are grouped together in two categories, the IMS Service Interface and the Enterprise Service Interface.

- **IMS Service Interface**: The IMS Service Interface provides access to the DM-Framework hosted IMS application or potentially other external COTS/GOTS IMS products that have

been configured to operate on the DM-Framework platform. This provides DM-Operators the flexibility to use the IMS product of their choosing.

- **Enterprise Service Interface**: Enterprise Service Interface provides access to a potentially wide range of capabilities such as:

    – Single Sign-on access to IMS, Enterprise Services and other DM integrated applications.

    – Web-Map-Service (WMS) interfaces to Geographic Information System (GIS) repositories.

    – Web-Service interfaces to other external Web applications and the DM-OPEN-ESB platform.

    – Real Time Collaboration and Data Sharing:

        • Document Management

        • Communities of Interest / Team-Rooms

        • Instant Messaging

        • Presence Awareness

        • Web Conferencing

    – Email and Application Integration

    – Personalization and Web-content Management

    – Social Networking

An IMS or other product that interfaces with OPEN can be operated independently or from the DM-Framework Platform and communicate via DM-OPEN External Service Interfaces.

In the third vertical tier are Internal Services that include application and data layer services that support the delivery of IMS and enterprise service functionality as well as communication to internal DM-OPEN-ESB and other agency services. Currently DMIS and DM-OPEN communicate internally to the NWS HazCollect system to submit an NWEM that can be broadcast over NOAA Weather Radio. In the future the DM-Framework and DM-OPEN can be leveraged to support emerging alert networks such as the IPAWS.

5.1.3   External Web Application Layer

The DM-Framework could also have interfaces to the External Web-Application Layer. The Enterprise Service Interface portlets could provide access to other Web-Applications external to the DM-Framework such as:

- WMS mapping services

- Weather forecast services

- Other local resources important to incident management

The configurations for interfaces to external Web-Applications can be managed centrally at program level or locally by DM Operators.

5.2 IOC Capabilities

5.2.1 (IOC) DM-Framework IMS Service and External Interoperable Application Data Sharing

Because the DM-Framework IMS Service will be hosted and accessible on the same internal network, access is possible to the *Internal DM-OPEN-ESB Services*. All interactions from the *External Interoperable Application* across the Internet are executed using the DM-OPEN APIs on the *External Facing DM-OPEN Service Interface*.

It is anticipated that emergency management functionality such as Incident Reporting/Tracking, Situation Reporting, Resource Management, and Alerting will be provided by the selected DM-Framework IMS Service. The DM-Framework IMS Service, in the same manner as other *External Interoperable Applications*, will share information via DM-OPEN APIs.

Through the use of *Internal DM-OPEN-ESB Services* adapters, a new dimension for sharing information can be leveraged. The DM-Framework IMS Service data structures can be accessed for use in *Enterprise Service Interface* enterprise level status boards, incident and alert maps, and in consolidated information views with other incident and disaster management tools. This allows users of the DM-Framework IMS to publish information on the DM-Framework outside of the IMS.

5.2.2 (IOC-Candidates) Enterprise Service Interface

As discussed previously, the use of *Internal DM-OPEN-ESB Services* adapters opens the door for extended interactions among those systems hosted on the same internal network. New integrated enterprise services can be built from available interoperable applications. Due to the characteristics of today's SOA platforms, these integrated services can be established and implemented incrementally. The specifics for the IOC implementation of these enterprise services are dependent in part upon the final selection for the DM-Framework SOA platform.

Today's SOA platforms facilitate the implementation of a range of collaboration services that will enhance an emergency manager's capability in all phases of Disaster Management. Whether a DM Operator uses the DM-Framework IMS Service or another IMS product configured to be accessible via the DM-Framework IMS Service Interface they will benefit from using their selected IMS in the DM-Framework environment. Logging onto the DM-Framework platform will provide an operator with enterprise-reach to collaborate with others in the DM community.

An example of a potential enterprise service will be described in the following section. The current DMIS application incorporates a version of these capabilities that could be carried forward and enhanced on the DM-Framework with a robust SOA platform.

5.2.3 CONOPS Example: Real-Time/Historical Incident/Alert Trend Analysis

In this example we are looking at a capability to provide situational awareness and support trend analysis of incidents and alerts. An Enterprise Service Interface could be hosted using an existing COTS/GOTS Web-application that displays all active and/or historical incidents and alerts plotted on a world-wide map.

- Data could be retrieved from alerts and situational reports submitted via DM-OPEN along with supporting information provided from other agency systems via interface adapters on the Internal DM-OPEN-ESB service platform.

- Incidents and Alerts could be represented by icons based on type and status for quicker visual appraisal.

- Icon selection could provide drill down to incident and alert details.

Other information could potentially be combined with the incident and alert data to support trend and other analysis. For example, "impacted" populations could be examined for certain incident types and this information used to prioritize mitigation plans and actions. A similar analysis could be done with "impacted" critical infrastructure. These supporting information products could come from interfaces to other agency systems, which serve as the authoritative information source. Potentially this analysis could be accomplished at various levels from enterprise-level to local level based on geographic area of interest, or limited to a specific COG. A COG may want to analyze only its own incidents and alerts.

Operators could then leverage other collaboration tools (e.g. web-conferencing) to organize online interactive sessions to review trends, walk-through reports or discuss incident and alert details.

The current DMIS application has the capability to display a world-wide map and plot incidents recorded in DMIS tools and alerts posted from either DMIS Tools or posted through DM-OPEN. With the implementation of SITREP, using EDXL-DE, it will be possible for the DM-Framework to display incidents posted through DM-OPEN.

Other capabilities could be established to view incident and alert trends as well as providing situational awareness on an enterprise-level.

5.2.4   External Web Applications

The current DMIS application leverages several external web applications, including:

- Access to Weather Forecast data

- Access to GIS repositories using open standards such as Open Geospatial Consortium (OGC) WMS. This facilitates map overlays for Ortho-Imagery, flood hazard maps, and other geospatial information.

The DM-Framework can be easily configured to provide access to these and additional external web applications.

6   References

The capabilities described in this Concept of Operations (CONOPS) are extrapolations from current DMIS Tools and DM-OPEN capabilities. Additional capabilities have been derived from existing and emerging OASIS and NIEM emergency messaging standards.

7   Future Considerations

As part of the DM-OPEN initiative, development and technical guidance is made available to third party developers to implement Web-Service interfaces to DM-OPEN as part of their product offerings. Similar development and technical guidance needs to be made available for the DM-Framework.

8 Appendix A: Acronyms

8.1 Acronyms

Acronym	Explanation
API	Application Programming Interfaces
CAP	Common Alerting Protocol Common Action Plan
COG	Collaborative Operating Group
CONOPS	Concept of Operations
COTS	Commercial Off The Shelf
DHS	Department of Homeland Security
DM	Disaster Management
DMIS	Disaster Management Interoperability Services
EDXL-DE	Emergency Data Exchange Language - Distribution Element
EM	Emergency Manager
ESB	Enterprise Service Bus
FEMA	Federal Emergency Management Agency
GIS	Geographic Information System
GOTS	Government Off The Shelf
HAVE	Hospital Availability Exchange
IMS	Incident Management System
IEPD	Information Exchange Package Document
IOC	Initial Operating Capability
IPAWS	Integrated Public Alert and Warning System
NIEM	National Information Exchange Model
NIMS	National Incident Management Systems
NOAA	National Oceanic and Atmospheric Administration
NWEM	Non-Weather Emergency Messages
NWS	National Weather Service
OASIS	Organization for the Advancement of Structured Information Standards
OGC	Open Geospatial Consortium
OPEN / DM-OPEN	Open Platform for Emergency Networks
OTA	Other Federal Agencies
SITREP	Situational Reporting
SOA	Service Oriented Architecture
WMS	Web-Map Services