



**Microsoft®**

## **Eagle**

Applying Microsoft's Citizen Safety Architecture using Groove® and SharePoint®.

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## INTRODUCTION

Microsoft, Geodan and ESRI have been working on an implementation of the Microsoft Citizen Safety Architecture to deliver a suite of applications and services that allow multiple agencies to collaborate seamlessly to increase responsiveness and realize a single Common Operational Picture (COP) to support fast and effective decision-making in a highly complex environment. This way, emergency services, governmental, non-governmental and rescue organizations are all connected and can collaborate effectively, helping to reduce disaster impact and measurably improve public safety.

This cooperation has resulted in the *Eagle* product suite where Microsoft Office Groove<sup>®</sup>, Microsoft Office SharePoint<sup>®</sup>, ESRI's ArcGIS and Geodan's Movida are integrated together into a disaster management information system winning the prominent Dutch Public Safety Award 2008 ([www.veiligheidaward.nl](http://www.veiligheidaward.nl)).



Figure 1. Flood Exercise

*Flevoland, in the center of the Netherlands, is completely reclaimed land with a mean surface level of 4 meter below sea level, protected by dykes. Without dykes or in case of a dyke failure it would be flooded immediately, which would be catastrophic for the 380,000 inhabitants.*

*In November 2008, Eagle was used in a week of large-scale live exercise scenarios, carried out by various agencies, including a simulation of a flood in Flevoland. There were more than 10 organizations present, providing fire engines, helicopters, ambulances, simulated casualties and stranded animals.*

*During scenarios where Eagle was deployed, all staff were issued with a GPS and a mobile tablet computer with Eagle Mobile installed. A command center was set up, which used Eagle applications both on desktops and projected on a wall mounted display. Geographical information, such as staff locations and flood boundaries, were exchanged automatically using Groove among the field staff and command center. Everyone involved could view the Common Operational Picture at any time. In the command center the different organizations were able take the necessary strategic decisions faster and more effectively using Eagle.*

## CHALLENGES IN DISASTER MANAGEMENT

In the case of managing a disaster, technology can help to provide, collect and store essential information, and share this information among people and organizations involved. There are a number of challenges, because the nature of a disaster management system is substantially different from a day-to-day information system. Some of these major challenges are listed below.

- **Situational awareness:** during a crisis it is very important that all organizations involved are aware of the situation on the ground in the disaster area (boundaries of the disaster area, location of specific incidents, etc). Nearly all the data collected or needed in a disaster management information system have an important spatial component. It is imperative that all staff have access to the same, actual geographic information, displayed in a Geographic Information System (GIS).
- **Real-time location awareness:** when trying to manage a disaster, it is especially important to know at any time the real-time locations of staff, citizens, victims, volunteers or response teams. Tracking and tracing of assets, people and equipment is essential. The ability to count casualties in affected areas is also extremely helpful.
- **Sharing data among different organizations:** when a disaster occurs, various organizations will respond instantly to manage and contain the impact of the disaster *in situ*. Other organizations provide information or knowledge, such as governmental or meteorological institutes, or utility companies. Those different organizations should work together and this requires management of communication and exchange of information. All data (spatial, textual, imagery) should be shared between all organizations involved, who have a need to know of such information.
- **Large data flows:** often there is a lot of data that needs to be made available. The data can be static like roadmaps, as well as dynamic like meteorological data and operational data. This information has to be aggregated and/or filtered depending on the type and scale of the disaster, and the amount and type of organizations involved.
- **Different networks:** organizations have often different physical networks. There are usually several LAN, WAN or mobile networks for emergency response teams, each with their own management and restrictions. Information should be shared across the boundaries of these networks. The organizations will already have networking equipment for their daily work and are generally reluctant to invest in completely new equipment for emergency response only.
- **Different levels:** organizations can be involved in different levels: strategic, tactical and operational levels, and each have specific requirements for information types (reports, maps, images, videos, etc.) and scope (generalized, detailed, subject).
- **Unreliable network connections:** in the case of a disaster, the network connections can be unreliable. The network can be overloaded because of large data flows and heavy use. The physical network can be severed. A disaster management information system must be able to deal with these situations by ensuring alternative access to data, ensuring a good backup strategy.

## COMMON OPERATIONAL PICTURE

Different organizations involved in a disaster should have easy access to the same actual information. They should see the same up-to-date map with the boundaries of a disaster, important locations such as fire locations or gas clouds, locations of ground staff, evacuees or possible casualties. This knowledge is described as situational awareness.

It is important that the information, both spatial and textual, is up-to-date and can be relied upon. The information should be synchronized among all organizations as soon as a change occurs. This shared actual view of a disaster is called the Common Operational Picture (COP).

A Common Operational Picture facilitates collaborative planning of operations and assists all staff levels to achieve situational awareness.

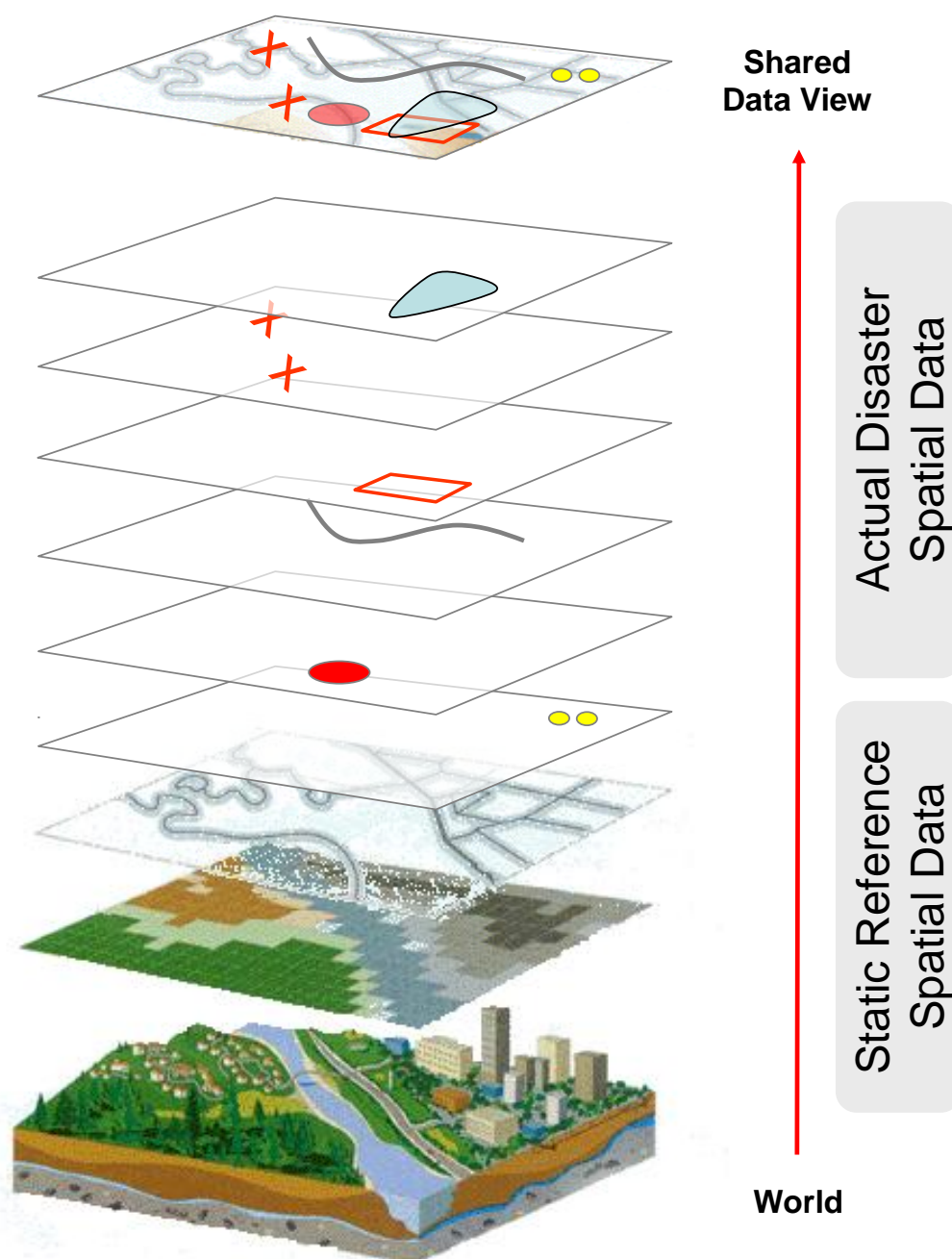


Figure 2. Shared data view

## THE NET-CENTRIC APPROACH

Peer-to-peer (P2P) technology is a net-centric approach that enables a system to be functional when no network connectivity is available, exchanging information as soon the connection to other clients is available, either through a WLAN or mobile network or using ad-hoc peer-to-peer networks with nearby clients. These clients are specific to the peer-to-peer solution. Strictly speaking, peer-to-peer networks do not distinguish between 'clients' and 'servers' and in this respect are not a 'client-server' architecture in which a relatively low number of servers provide info to other servers or applications. Instead, the notation of 'nodes' is largely adapted for the recourses in such networks. These nodes are linked via ad-hoc connections and allow for sharing of a large number of data including real-time data. While quite common in military command and control systems (C2), this technology is currently being more widely adapted in civil applications and especially in emergency response situations.

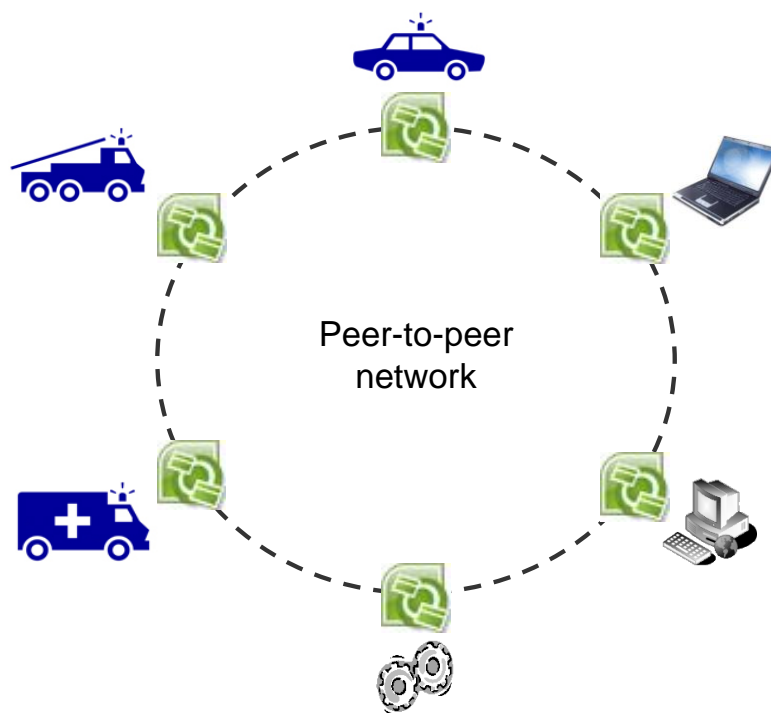


Figure 3. Net-centric approach

## EAGLE AT A GLANCE

The Eagle suite is a collection of applications enabling crisis teams, consisting of multiple organizations, to work effectively in a net-centric way, to share data and to realize a Common Operational Picture.

A huge advantage of the Eagle suite is its use of interactive maps showing actual geographical information that is part of the Common Operational Picture. Spatial data displayed on a map with the relevant context and background information is a huge asset in understanding the current situation, allowing all users to make faster, better decisions and react more swiftly to changes in the disaster situation.

**Eagle Command Center** enables the command center staff to share, add, edit and delete both geographical and textual data. This information is exchanged automatically between all users. The main entry is a map, showing the current geographical information. Eagle contains functionality to edit both spatial data, such as incident locations or the extent of a poisonous cloud, and textual data on a variety of relevant subjects. There are also functions for analysis of data, messaging, and issuing orders to ground staff.

**Eagle Mobile** gives ground staff, fighting the crisis *in situ*, an opportunity to add and edit geographical and textual data over a mobile data connection. As with *Eagle Command Center*, both textual and spatial information is exchanged automatically. Other relevant functionality is available depending on the type and level of ground staff.

**Eagle Surface** enables tactical or strategic command to view the incident situation as a map on a Microsoft Surface™ table device, and can therefore be utilized as an easy-to-use conference tool. Using its touch screen interface, staff can navigate the map to view the current situation and issue commands by pressing their finger at a location on the map.

**Eagle Wall** provides a read-only view of the current status of the incident (the Common Operational Picture) shown on wall-mounted displays in the command center. It is updated automatically as status changes occur.

**Eagle Live** provides a subset of the Common Operational Picture that is publicly available, as a read-only view. Since this is a website containing both spatial and textual information, it can be seen by anyone online. *Eagle Live* shows up-to-date, screened incident information, including alerts posted by staff.

**Eagle Playback** is a user-friendly playback tool for the command center, with which the incident can be analyzed minute by minute for evaluation purposes, during and after the incident, to analyze what went right or wrong.

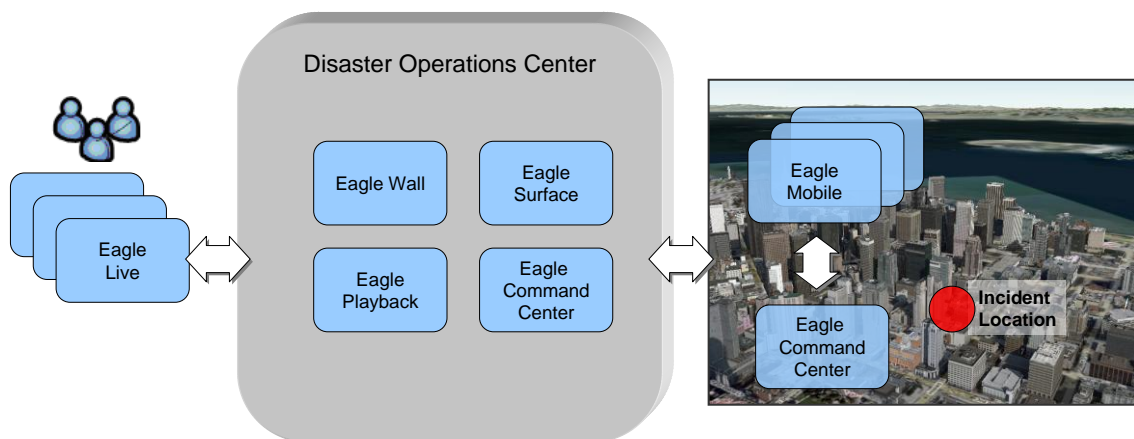


Figure 4. Eagle in action

## EAGLE AND MICROSOFT OFFICE GROOVE



Microsoft Office Groove, Microsoft’s collaboration product, perfectly fulfills the role of a peer-to-peer network in a complex crisis situation. Groove offers specific advantages for disaster management, including high security, utilization of several transport and application-layer protocols, efficient data exchange and the possibility to work both online and offline.

Groove is designed for situations where different organizations do not share a common security infrastructure and where offline access is important. Without user intervention Groove handles the available internet connection and begins synchronization when it detects a connection. When a connection is not available users can continue their work offline.

The Eagle suite is built on top of Groove. Eagle uses Groove to share the Common Operational Picture among the organizations involved. Groove consists of workspaces containing shared data. Everyone involved in the management of a particular disaster will have a notebook with Groove installed or use Groove ad hoc via a USB stick. For each incident a Groove workspace is created. The Regional Commander launches a predesigned Groove Workspace template that best suits the type of disaster.

These templates are pre-populated with elements of business logic, forms and documents relevant to the type of incident: fire, flood, road accident, plane crash, chemical incident, epidemic, etc. Whenever staff or organizations become involved in an incident, they will be invited to the incident workspace and automatically have access to all information. Everyone invited to that workspace shares the same information and so the Common Operational Picture is facilitated. Anyone authorized for editing can add such information, both spatial, textual or otherwise. Added locations or texts are then shared among everyone involved in the incident.

Nearly all information collected during an incident has a spatial component. Spatial information is stored natively as Well-Known Text (WKT), together with associated textual information. Well-Known Text is an OGC (Open Geospatial Consortium) standard describing geometries (point, line or shape) as textual data. Together with their associated textual attributes, they are stored in the right place inside the Groove workspace.

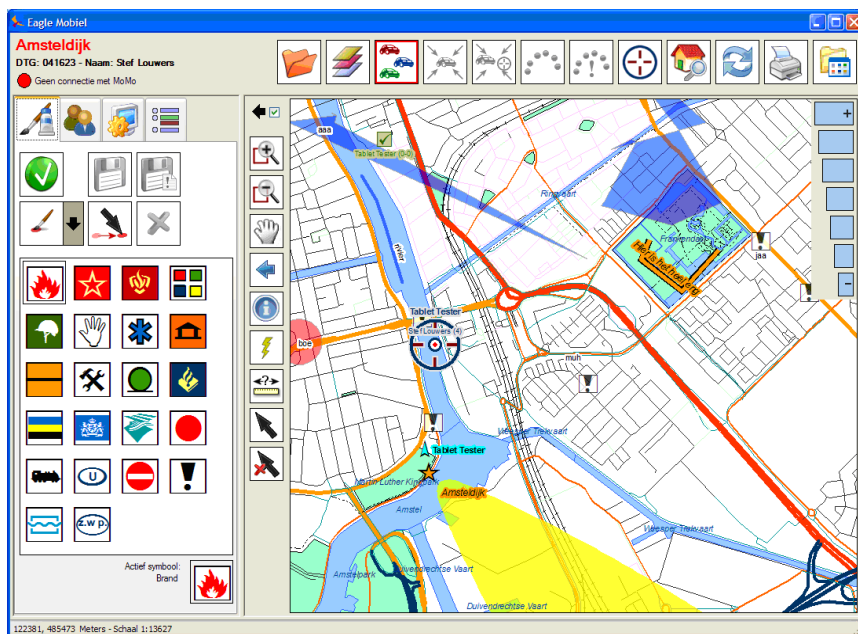


Figure 5. Eagle Mobile

Because the Eagle suite uses ESRI's ArcGIS, which, like many Geographic Information Systems, can read and write WKT geometries, the Eagle suite can easily parse and display WKT information on top of the background layers in its map views.

Keeping track of history is essential during crisis management. It is important to know who edited what, when the edits took place, and the sequence of edits. This historical information should be available immediately, so when new information is appearing on someone's map, it should be known who added this information as this can raise or lower its importance. Groove adds this piece of information automatically, tagging each line of data with the author, creation date, or edit date.

## EAGLE AND MICROSOFT SHAREPOINT

Microsoft SharePoint is another essential technical piece in the crisis management puzzle, providing a suite of features for storing documents, information, contacts and task lists. Because it has a web-based front-end it is easy to make its content available to anyone in the Command Center or anywhere on the Internet if there is network connectivity.

Groove Workspace templates are stored in SharePoint. When a Groove Workspace is created, at the start of an incident, the template of that workspace is selected from a menu of templates within

SharePoint. As these templates launch, Groove Web Services (GWS) checks with Microsoft SharePoint Server to see if the business logic rules and/or supporting files are correct.

SharePoint and Groove can synchronize with each other. Groove workspace information can be stored into SharePoint and it is possible to put SharePoint information into a Groove workspace. This two-way synchronization provides shared information and facilitates the Common Operational Picture.

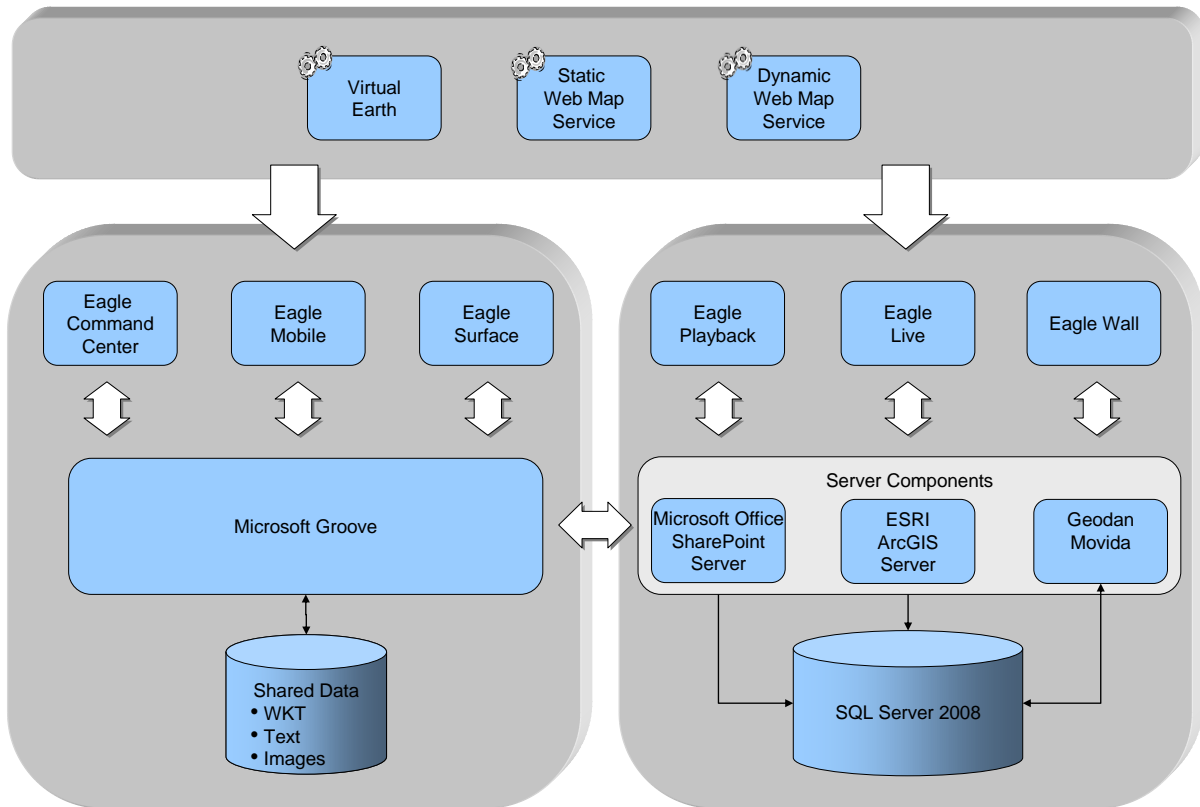


Figure 6. Eagle Architecture

After the incident has been concluded, the Groove Workspaces are simply archived to provide a set of backup records which capture the minute-by-minute information and actions of the response teams. By storing these archives in SharePoint with some descriptive meta-data they become indexed and searchable throughout the organization, and they can be made visible using various applications, such as *Eagle Playback*.

## EAGLE AND MICROSOFT SQL SERVER®

SharePoint data can be stored within a SQL Server database. This is especially useful if there is a large volume of data. A variety of data can be stored in SQL Server 2008, anywhere and anytime, from structured, semi-structured to unstructured documents such as geometries, images and rich media, directly within the database. SQL Server 2008 delivers a rich set of integrated services enabling queries, searches, synchronizations, reports, and analysis.

SharePoint data stored in a SQL Server database has advantages on performance, availability, security and resource management.

As SQL Server 2008 supports geometry data types and algorithms, and is able to import and export them as Well-Known Text, it fits perfectly into the Eagle architecture. Groove workspaces are stored indirectly via Microsoft SharePoint into a SQL Server 2008 database. All harvested and dynamically created operational data is then available for querying, searching, reports and analyses.



Figure 7. Rescuing people from flooded houses (exercise)

## EAGLE AND ESRI ARCGIS

The Eagle applications contain a substantial amount of geographical information and spatially enabled components. Using the interactive maps, users can zoom, pan, select objects, add and edit spatial data, or change symbolization. For all this functionality a variety of ESRI's ArcGIS products are used as the mapping engine, displaying all geographical information on various map backgrounds such as aerial photographs.

ArcGIS is an integrated collection of Geographical Information System (GIS) software products that provide a standards-based platform for spatial analysis, data management, and mapping. ArcGIS is scalable and can be integrated with other enterprise systems such as work order management, business intelligence, and executive dashboards. ArcGIS products and tools are available for desktop-based, web-based, or mobile field solutions.

The ArcGIS Server APIs for Microsoft Virtual Earth™ and Silverlight™ integrate ESRI's server solution, ArcGIS Server, with Microsoft Virtual Earth services and capabilities in a rich interactive application. With ArcGIS API for Microsoft Silverlight, it is possible to use geographic resources, such as maps, locators, and geoprocessing models, and Silverlight components, including grids, tree views, and charts in custom-built applications.

## EAGLE AND MICROSOFT VIRTUAL EARTH



Microsoft Virtual Earth contains high resolution spatial data of the earth and can display these, 2D or 3D, within a browser. The Eagle Suite contains several applications, such as *Eagle Wall* and *Eagle Live*, which can use the Virtual Earth platform combined with ESRI's Virtual Earth API to display the geographical incident data as custom layers on the Virtual Earth background. This gives users rich functionality for panning, zooming, analysis, 3D view and birds eye view, with all incident data being displayed within its spatial context and selectable by space, time, and textual characteristics.

## EAGLE AND MICROSOFT SILVERLIGHT™



Microsoft Silverlight is a programmable web browser plug-in that enables features such as animation, vector graphics and audio-video playback that characterize rich internet applications.

Microsoft Silverlight is used in *Eagle Wall* and *Eagle Playback*. Its functionality is used to display incident data with an attractive and useful user interface, enabling fast responses and "Deep Zoom" capabilities. ESRI's Silverlight API is used to play back changes in geographic information minute-by-minute and to provide rich spatial analysis, displayed on the Virtual Earth map background.

## EAGLE AND MICROSOFT SURFACE



The Microsoft Surface multi-touch table product allows multiple users to manipulate images and maps using fingers, hands or specific pointing devices. Multiple people can simultaneously gather around and interact with the table, which thus takes the role of a conference table. With this innovative new technology, tactical and strategic command can get an overview of the disaster on a table-wide interactive display.

*Eagle Surface* uses Microsoft Surface, in combination with Geodan's multi-touch mapping engine, Virtual Earth backgrounds, and spatial data synchronized from the Groove incident workspace to compose a perfect overview in a virtual command center.

## EAGLE AND GEODAN MOVIDA



Geodan Movida is Geodan's tracking-and-tracing system, tracing people and assets such as vehicles and people. Tracing of staff in the field is essential during a crisis. In case of large amounts of staff, it is

not feasible to trace all staff all the time because the network load would be too high. Therefore Geodan Movida allows selection of the tracking rate, and filtering by covered distance or by individual. Geodan Movida enables alerts based on people entering or exiting certain areas such as the extent of a poisonous gas cloud, or within a certain distance of each other. It is possible to see and store those alerts in either Groove or a SQL Server database. All these data are then available on demand in *Eagle Playback* or for real-time analysis.

## CONCLUSION

When a disaster occurs, it is extremely important that the staff of different rescue and emergency organizations share the same actual information, be it spatial information, textual information or otherwise. This shared information is known as the Common Operational Picture. The Common Operational Picture can enhance operations, assist in faster and more effective decision making, and control and minimize damage and possibly even save human lives.

The Eagle suite for Disaster Management, built on top of Microsoft Groove and SharePoint, and using ESRI's ArcGIS and Geodan Movida, synchronizes and exchanges geographical and textual information, thus realizing the Common Operational Picture.

The Eagle suite won the Dutch Public Safety Award 2008, with the connotation: "It is an important contribution in the complete renewal and modernization of the information supply for disaster management in the Netherlands".

### **Additional Information**

For more information on Eagle contact: [pubsafe@microsoft.com](mailto:pubsafe@microsoft.com)

Geodan: [www.geodan.com](http://www.geodan.com)

ESRI: [www.esri.nl](http://www.esri.nl)

Microsoft Office Groove: <http://office.microsoft.com/en-us/groove/default.aspx>

Microsoft Office Sharepoint: <http://www.microsoft.com/sharepoint/default.msp>

Microsoft SQL Server: <http://www.microsoft.com/sqlserver/2008/en/us/default.aspx>

Microsoft Virtual Earth: <http://www.microsoft.com/virtualearth/default.aspx>

Dutch Public Safety Award 2008: <http://www.veiligheidaward.nl>