REAL-TIME OPERATIONAL SYSTEMS

A LOOK AT EXAMPLES OF CLOSE INTEGRATION OF SPATIAL TECHNOLOGY WITH REAL-TIME OPERATIONAL SYSTEMS AND HOW THIS IS TRANSFORMING DECISION SUPPORT FOR MAJOR EVENT SECURITY AND CRITICAL INFRASTRUCTURE PROTECTION IN THE CONTEXT OF 2012.

The use of standalone GIS for hotspot analysis, plume modelling and 3D visualisation are well documented for emergency planning, but far less has been written on the more demanding area of real-time operational systems.

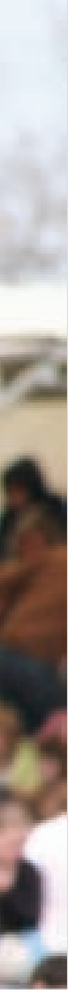
Inquiries into major incidents spanning the tragic fire in Enschede in the Netherlands, Hurricane Katrina and 9/11, have all highlighted the fundamental importance of providing timely access to information to support decision making and having the ability to share information and coordinate across the spectrum of organisations involved in major incidents. It is often shown that the data necessary to inform critical decisions existed, but were not made available in a timely manner or in a form that could be used. A key reason for this is the problem of how to associate the location and effects of incidents with the operational systems and data of multiple response organisations in real time.

Common Operational Picture (COP)

Spatial technology can help overcome some of the most challenging aspects of managing major events whether major sporting events like the Olympic Games, protection of critical infrastructure or responding to major natural disasters. Using a spatial framework provides the means to associate the myriad of different information sources. This is critical to building a clear picture of the situation on the ground and for coordinating response and communications across the bewildering range of organisation and geographically dispersed locations.

While superficially similar to a conventional GIS, real-time operational systems are implemented within much broader and far more demanding IT environments. Key distinguishing factors include:

- Full integration and interoperability with communications infrastructures (e.g., public telephony, emergency services radio and military messaging);
- The ability to support operational procedures, rules, profiles and security;
- Extremely high degrees of resilience and availability (in the order of ~99.9999%);
- Integration with real-time data feeds and other operational systems.
- At the heart of all such systems is what is often referred to as the Common Operational Picture (COP). By referencing data to



a common spatial framework, the COP provides a comprehensive, up-to-the-minute view of the situation on the ground and fuses static mapping and real time data feeds, often from multiple agencies and organisations. Although commonly associated with command and control, Intergraph's platform has been used around the globe to support critical operations ranging from the Turin Winter Olympics and 2007 Pan-American Games, to national border security and transport infrastructure protection for international airports and mass transit systems.

Clearly, real-time data feeds are essential in order to keep the COP up-to-date. The first examples were developed to keep operators informed of the location and status of mobile resources. However, the proliferation of mobile communications and intelligent devices has given rise to an explosion in the volume and types of information that can be integrated in the COP, both from static and mobile sources. These can include anything from security devices (e.g., access control systems, perimeter detection, radar, 'intelligent' and geo-referenced video) to environmental data and personal tracking - the 2005 US presidential inauguration combined personal mobile devices given to VIPs with conventional tracking of security units to provide a clear picture at all times.

Too much data can also be a bad thing and data need to be presented in a clear, useable form when they are needed. A common flaw of conventional security systems; numerous studies have shown the efficacy of operators plummets after less than 15 minutes staring at CCTV monitors. 'Intelligent' security systems like the one being implemented for New York Metropolitan Transport Authority, change the role of the operator. Instead of continuously swapping operators' attention from one camera to the next in the hope of spotting anomalies, intelligent systems constantly monitor all devices and sensors and highlight any exceptions for verification the instant they occur. Monitored sources may include access control systems, intelligent CCTV, perimeter intrusion detection systems and CBRNE sensors. The assessment may use human verification or use pre-processing to filter the information and only flag exceptions to pre-defined operational conditions such as in the case of 'intelligent' CCTV.

The spatial framework also helps the operator understand situations more quickly by showing the context of the alert with clear links to supplementary information that can help them determine whether action is required. For example, when an alarm is raised by an access control system the operator may be shown its location, CCTV that covers the area in question and the location and status of nearby personnel. Video footage 10 seconds either side of the alarm can be accessed by clicking a camera location, similarly a patrol can be dispatched to investigate or called by clicking on its location.

The COP also enables spatial analysis techniques to be applied to real time data to automate and streamline simple, yet time consuming operational procedures. Caller location services like EISEC provide a location reference for calls connecting with emergency response centres. This location is used to pre-prepare basic essential information for the call taker (such as a map display showing the locations of the caller and the nearest available response units) even before the call has been answered. This approach gains valuable seconds for critical responses such as ambulance dispatch, but its real power is in breaking bottlenecks associated with the mobilisation phase of major events. Due to their organisational complexity, these can be significant and ultimately costly. To give some idea of the potential complexity, the TOPOFF 3 preparedness exercise in North America in 2005 involved 27 federal agencies and more than 200 government and private sector organisations.

Applications and benefits

The potential benefits can be illustrated perfectly by an example of a mobilisation systems deployed by a European national rail operator. The system applies the logic of their existing manual operational procedure to information captured by the operator (classifying the location, nature and scale of the incident) to identify the organisations needed to support the response and the most appropriate contact centres and personnel. It then automatically communicates with the team identified through combinations of telephone, SMS, radio and email and track responses. Removing the manual look-up and call-out cut mobilisation times from around 45 minutes to three. This is a critical saving as early intervention in emergencies dramatically improves outcomes.

While highly effective, the analysis used in the rail mobilisation case is relatively simple and more complex modelling is also used in operational systems. Hotspot analysis has long been used to identify clusters in the locations of crime and how these vary over time. The same functionality when integrated with the COP is used to improve response times for emergency units, such as ambulances. Service areas are calculated for each vehicle using their AVL positions and models of the road network. The service areas are constantly compared with spatial models showing predicted demand for calls (generated by analysing historic call-out data) to identify how to position the units to give the best coverage. The models run in real time so units can be re-positioned when others are assigned to calls and to reflect changes in the distribution of predicted demand at different times of day.

Modelling for decision support is continuing to advance through its integration with the COP. For example, real time data feeds from chemical sensors and meteorological are used to trigger models and set their starting parameters, while current research by the Centre of Geospatial Science at Nottingham University is investigating the application of agent models to the COP and operational procedures to identify potential cordon boundaries and staging and marshalling sites for major incident management.

A final key area of integration is the use of 3D virtual environments to visualise scenarios and plan operations. Testing is a vital element of emergency management, but the cost and disruption associated with enacting scenarios for major events means levels of training are below what they should be. The cost of the TOPOFF 3 exercise in 2005 was estimated to be $16 million. A collaboration in the United States between the federal Warfighter Protection Laboratory, SAIC and Intergraph established a multi-agency training environment that linked existing operation models (developed for battlefield training) with Intergraph's I/CAD system. The simulation environment enables major scenarios to be tested more often and analysed in more detail using metrics that are automatically collected during the tests.

Conclusion

Major events of the scale of the London 2012 Olympic Games are unparalleled in their organisational and operational complexity. Their safe and effective management requires timely and well-informed decision making coupled with the ability to communicate with and coordinate a bewildering range of organisations across diverse and geographically dispersed locations. Real-time operational systems are one of the most successful examples of the application spatial technology demonstrating clear and tangible benefits. Their ability to integrate information to form the COP and coordinate and communicate responses has makes them a perquisite for major sporting events the world over.

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