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IBM Intelligent Operations Center for Smarter Cities

Acting effectively in today's world involves rapidly assimilating information from many sources, making decisions quickly, and acting in a maximally efficient manner. IBM® Intelligent Operations Center was created with precisely this model as its base. It is tailored to provide city and enterprise leaders with accessible operational and progress metrics and statuses. It integrates disparate and older systems into one engine that can simplify inputs, providing a complete overview of the enterprise or city and ensuring that the correct people are alerted to anything out of the ordinary, extreme, or important. It can kick off workflows and situation management, text you when you must know something, or provide real-time situational analysis and tracking as you work through day to day issues.

The flexibility of IBM Intelligent Operations Center means that you can integrate multiple systems into one interface, removing the need to view several interfaces at once and reducing the possibility of human error. The analytics engine that drives IBM Intelligent Operations Center means that all the information received is analyzed, processed, and stored so that insights are presented rather than volumes of data. You see what is important to you.

Under the current environment of economic uncertainty, it is imperative to work smarter and do more with less. This statement especially applies to cities where budgets are stretched thin and where a lack of the appropriate infrastructure can cost lives. IBM Smarter Cities® must use information, anticipate problems, and coordinate resources. IBM Intelligent Operations Center provides a unified view of city agencies and processes, where you can predict events that affect the city and to respond in a rapid and efficient manner.

This IBM Redpaper™ publication introduces the IBM Intelligent Operations Center and provides an introduction to its features, benefits, and architecture. This information is intended for city officials and IT architects that must understand the business value of IBM Intelligent Operations Center.

What a Smarter City is

Smarter Cities and enterprises are ones that drive sustainable economic growth by:

- ▶ Analyzing information across agencies and departments to make better decisions
- ▶ Anticipating problems to resolve them proactively and minimize the impact of disruptions
- ▶ Coordinating resources and processes to respond to issues rapidly and operate effectively

Cities generally have advanced systems for sanitation, utilities, land usage, housing, security, transportation, and more. As shown in Figure 1, a *Smarter City* is one that can balance its social, commercial, and environmental needs while it optimizes the resources it has available for the benefit of its citizens. Smarter Cities increase the value to the citizens they serve in a rapidly changing economic and urban world.

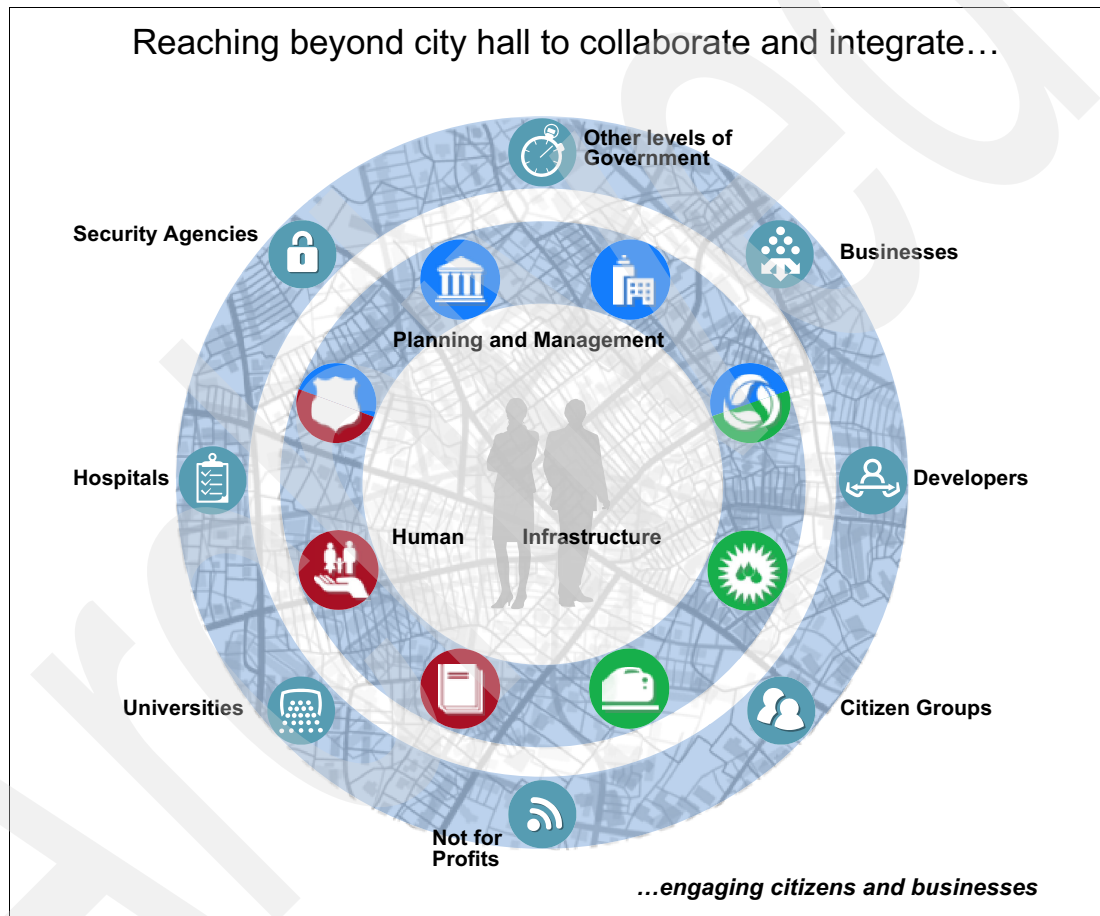


Figure 1 Components of a Smarter City

Challenges facing city leaders today

Cities around the globe are faced with the common challenges of aging infrastructures, shrinking budgets, shifting populations, and increasing threats. City executives, managers, and operators consistently report the following challenges:

- ▶ Today's cities are based on separate domains with no real ability to be managed as an entire entity.
- ▶ City managers have no single place to get real-time status or historical reports of city events.

- ▶ Older systems are domain-specific and are not concerned with the consequences on other domains.
- ▶ Daily operations of cities generate vast amounts of data from many different sources but cities often lack the ability to visualize and extract meaningful information.

IBM Intelligent Operations Center addresses these and many other challenging issues by providing insight, management, and oversight capabilities for any city or enterprise (as they both face many of the same issues).

What IBM Intelligent Operations Center is

The IBM Intelligent Operations Center solution integrates and uses data from multiple sources and makes sense of it on a single interface. It simplifies the disarray and multiplication of data sources that are necessary for understanding, yet that are too voluminous for easy consumption. IBM Intelligent Operations Center provides a single interface to all systems of an enterprise or city to make them usable without being overwhelming.

A flexible rules-based data flow directs large quantities of data into a structured format that can be used for reports and key performance indicators (KPIs). IBM Intelligent Operations Center brings events to the surface and alerts action when needed. It also provides a web-based, configurable interface that is specific to the user's role and needs so that everyone in the organization can see and collaborate on the same data in their own way. This ability to collaborate allows synchronization of effort, audit trails, collaboration, and group decision making. It also can help to synchronize and analyze efforts among sectors and agencies as they happen, giving decision makers consolidated information that helps them anticipate, rather than react, to problems.

IBM Intelligent Operations Center provides a unified view of city agencies or other complex infrastructures. It enables a city to monitor its services and operations to facilitate insightful decision-making. This approach helps provide effective event response management and coordination, from operational to critical events.

IBM Intelligent Operations Center processes data feeds and event information from individual departments to help improve the operational efficiency of a city or other complex infrastructures. It provides an executive dashboard to depict the overall status of a city's operations. The dashboard spans individual agency-specific solution areas and enables drill-down capability into each underlying agency or department. For example, water management, public safety, and traffic management.

Using the power of advanced analytics, asset management, and collaboration tools, IBM Intelligent Operations Center delivers the ability to gain insight into the environment through centralized information.

The IBM Intelligent Operations Center capabilities include:

- ▶ Incident reporting and tracking
- ▶ Situational awareness and reporting
- ▶ Support for creating and using standard operating procedures (SOPs)
- ▶ Real-time collaboration
- ▶ Resource and critical asset management
- ▶ Assessing and displaying KPIs

- ▶ The ability to open standard connection points to existing and future systems
- ▶ An easy-to-use interface that is designed with multiple types of users in mind, from senior managers to daily operators

City and government leaders and private enterprises around the world are using IBM Intelligent Operations Center to address a broad range of management and operations needs. These needs include airport management, city operations, emergency management, energy and emissions monitoring, parks and recreation maintenance, port security, stadium operations and security, transportation awareness and prediction, and water utilities monitoring and preventive maintenance.

Business value

IBM Intelligent Operations Center provides the following benefits:

- ▶ Helps city officials better monitor and manage city services by providing them insight into daily city operations through centralized management and data intelligence.
- ▶ Helps city agencies prepare for problems before they arise and to coordinate and manage problems when they do arise.
- ▶ Enables officials to communicate instantly and discuss and synchronize rescue efforts so they can send the correct people and equipment to the correct places at the correct times.
- ▶ Facilitates cross agency decision making, convergence of domains, coordination of events, communication, and collaboration, which improves the quality of services to the citizens and reduces expenses.
- ▶ Flags event conflicts automatically between city agencies.
- ▶ Optimizes planned and unplanned operations using a holistic reporting and monitoring approach.
- ▶ Helps operations executive or staff to adjust systems to achieve results that are based on the insights gained.

Another major benefit of IBM Intelligent Operations Center is that it aggregates several information feeds and makes sense of them in the context of the person that is viewing them. With this capability, city leaders can quickly assess the overall status of their city or enterprise. They can swiftly identify issues that require attention and coordinate resources to respond to issues rapidly and effectively.

IBM Intelligent Operations Center can recognize events as they arise, promoting them for instantaneous response by necessary parties. It supports creating and using standard operating procedures (SOPs) in response to these events, maintaining an overall transparency for interested parties to remain apprised of progress in handling events. Having this real-time information about events and SOP responses in place allows for efficient management.

Figure 2 shows an Operations page from IBM Intelligent Operations Center that pulls together relevant information from various sources into one meaningful view..

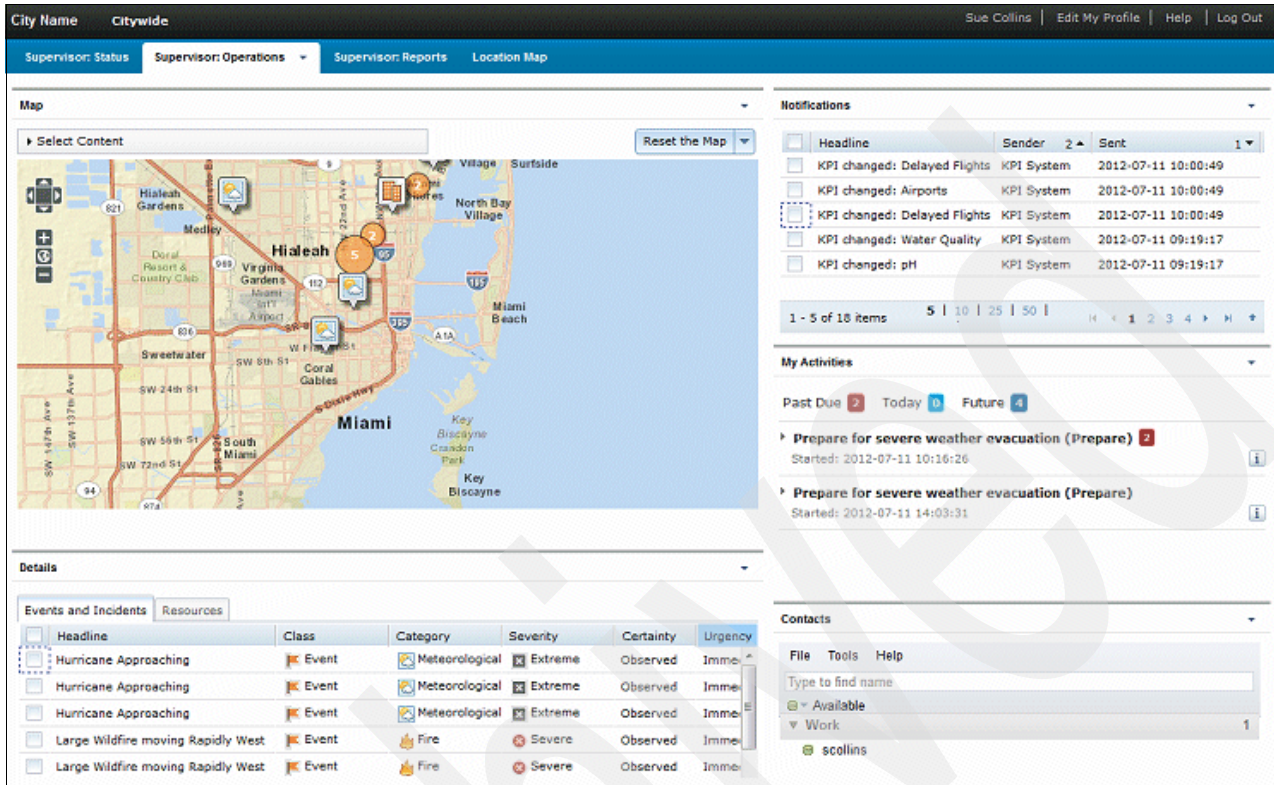


Figure 2 IBM Intelligent Operations Center operator dashboard

Key concepts

Before describing the functions provided by the IBM Intelligent Operations Center solution, it is important to explain some of the concepts that are mentioned in this section.

Events

An event is a significant occurrence or happening that is important and noteworthy to the IBM Intelligent Operations Center operations executive or staff. An event can be an occurrence at a single point in time, or it can have a duration that is associated with it. It can have a location that is associated with it, a severity, and other information about it, either collected when it was identified, or added later. Events are continually updated through time as they evolve and as more information is gathered about them and about the response to them.

Detection of events can be automated or manual. Events come into the IBM Intelligent Operations Center in different forms that are based on the nature of the operations and domains.

Here are some examples of the different types of events:

- ▶ *Triggers* are events that are generated by a real-world physical happening and usually require an action by the recipient. Examples of triggers include:
 - Fire or smoke alarms going off
 - Information technology systems going down
 - Intrusion detectors that are tripped
 - Natural events picked up by sensors, such as earth tremors

The importance of events can be filtered by the event engine so that lower-level indicators are only shown if they merit wider attention or if they represent a confluence or correlation of events in an area. For example, all fires might not be reported as events. However, a fire that involves multiple divisions of the fire service and environmental protection department, because of hazardous material, would merit an alert. Similarly, several fires in one area would be noteworthy. This correlation is performed automatically by IBM Intelligent Operations Center.

- ▶ *Threshold* events help you determine when the measurements obtained from a sensor or other source are moved outside the normal range. Basic threshold events are comparisons that compare two or more measures. They can also contribute to a trend. More sophisticated threshold events can compare measures against a threshold that is created by historical information. Examples of threshold events include:
 - Over and under temperature alarms
 - High and low water levels
 - Air quality and water purity that is breaching environmental standards
 - Excessive power consumption
 - High water levels in sewage pipes that identify potential combined sewer overflow
- ▶ *Manually entered* events complement IBM Intelligent Operations Center by augmenting the automated collection of incident and event notification and by paving the way from older reporting structures. Manual creation of events in IBM Intelligent Operations Center is a simple point and click exercise and allows creation of both emergent events that are received through a call center, planned events, and events reported through other means. This interaction with IBM Intelligent Operations Center by operators also allows the simple updating of events already in the system that is based on reported information, promotion of events to incidents, and the initiation of workflows to handle emergencies.
- ▶ *Complex* events are typically the result of a confluence of factors and possibly from a number of separate events whose occurrence at one time results in the generation of a new event. This situation underlines the flexibility of the event model in IBM Intelligent Operations Center. Events can range from simple events consumed whole from another system in the enterprise, all the way to complex derived events that represent rules-based creation of events that are based on other events.

Key performance indicators (KPIs)

A key performance indicator (KPI) is a quantifiable measure that is designed to track one of the critical success factors of a business process.

In the context of IBM Intelligent Operations Center, a KPI is a performance measurement that is used to evaluate conditions of a particular event or set of circumstances for an event.

KPIs figure prominently in the IBM Intelligent Operations Center, and are the most prominent feature on the dashboards that are typically configured for executives. They provide an at-a-glance overview of the health of an entire enterprise or city. KPIs are highly configurable, meaning that the executives that log in and see all green know that this state represents the level of health and operational stability they deem acceptable. A yellow or red status means that something occurred that is outside their comfort zone. A simple click on the unacceptable KPI provides a drill-down into the underlying conditions, which roll up into the top-level color. This way, executives can see at a glance that all is well or all is not well, how unwell (yellow versus red), and the cause for the out of norm condition.

Notifications

Notifications are items that are displayed on the IBM Intelligent Operations Center dashboard that help the operator to see what recent activity occurred. Examples of notifications include receiving new events and KPI changes.

Alerts

Alerts are notifications important enough to require operator attention. Alerts are notifications that are received when:

- ▶ Multiple events are happening in the same vicinity and at a similar time, thus indicating potential conflict or a need for coordination.
- ▶ A predefined KPI value change occurs, where the change is defined as an alert triggered by the administrator.

Common Alerting Protocol (CAP) message

IBM Intelligent Operations Center typically receives events in the Common Alerting Protocol (CAP) format. CAP is a standard protocol that was developed by OASIS for emergency management and communication. The CAP format is simple and straightforward, requiring only a few fields to be useful. The sender includes only relevant information about the event's location, severity, and any other important details.

The relative commonality and extreme extensibility of the CAP protocol make it a useful choice for interchange with the IBM Intelligent Operations Center. It is also simple to use the IBM Intelligent Operations Center enterprise service bus to map non-CAP messages into the CAP format.

Event rules

You can use the flexible event engine in IBM Intelligent Operations Center to create rules that guide the flow of data as it enters the IBM Intelligent Operations Center. Determinations about the nature of the event or data, whether it should be stored, and how it should be treated, are all part of the rules engine. These rules also can trigger SOPs, workflow, emails, and so on. Event rules can guide decisions and help achieve wanted and reasonable outcomes.

In IBM Intelligent Operations Center, one of the most common results of applying a rule to an event is to trigger an action, such as a notification. Rules and policies help make decisions about incoming and in-flight events. An example of a policy is to send an email to the city operator when a situation is detected outside the allowable KPI range.

Standard Operating Procedures (SOP)

A standard operating procedure (SOP) defines a sequence of activities that are triggered in response to an event whose parameters meet certain predefined conditions. In an SOP, each activity corresponds to either a manual or an automated task. A workflow can be assigned to an automated task.

It is possible to specify the order in which some or all of the activities in an SOP are run. For example, the IBM Intelligent Operations Center operator can specify that a particular activity is not started until the previous activity is completed, skipped, or signed off by a manager.

Business intelligence, analytics, and reports

IBM Intelligent Operations Center supports the historical persistence of data and information around events. This situation provides the user with the opportunity to examine performance and conditions and apply business intelligence and analytics to this data. IBM Intelligent Operations Center users can identify patterns, measure the present against past performance, improve the present operation, and even predict future performance. The historical data can be easily extracted using IBM Intelligent Operations Center reporting functions.

Solution overview

IBM Intelligent Operations Center provides integrated data visualization, real-time collaboration, and deep analytics that can help leaders prepare for problems before they arise and to coordinate and manage problems as they occur, to improve the efficiency of city operations.

IBM Intelligent Operations Center delivers the following major functions:

- ▶ Visual workspace
- ▶ Events and incident management
- ▶ Resource, response, and activity management
- ▶ Status monitoring
- ▶ Collaboration, instant notification, and messaging
- ▶ Reports
- ▶ Semantic model

Usage scenarios: The IBM Intelligent Operations Center general functions that are described in this section apply to various industries and businesses, not just cities. For information about usage scenarios, see “Usage scenarios” on page 16.

The concepts and functions that are described in this section explain how the IBM Intelligent Operations Center solution makes supervision and coordination of complex organizations more effective. Organizations must bring together large amounts of information from multiple sources, filter and analyze the data, and develop insights to help them in decision-making. IBM Intelligent Operations Center helps you evaluate the effectiveness of the decisions and applied procedures and make improvements.

IBM Intelligent Operations Center helps organizations to:

- ▶ Handle events and alerts, in both emergencies and non-emergencies.
- ▶ Organize response teams, enabling fast and clear communications between team members.
- ▶ Define and provide standard operating procedures for handling the different situations that arise, with the correct assignments, which are based on legal requirements or historical experience.
- ▶ Track the progress of the performance of those procedures, including the results of the actions.
- ▶ Locate resources with the required capabilities to handle the events.
- ▶ Enable the continuous improvement of the organization’s services and responses.

Visual workspace

The IBM Intelligent Operations Center user interface is a dashboard that provides *insight* into data that is customized to a user's role and authority. This flexible view into the wealth of data that is flowing into, and stored in IBM Intelligent Operations Center, is at the heart of the solution. Its appearance is configurable and delivers exactly the data the user wants to see and is allowed to see.

The role-based context is necessary because IBM Intelligent Operations Center provides many avenues to data discovery. From the wealth of data that flows through it, IBM Intelligent Operations Center can customize and display only the information that the viewer needs and that is necessary for their role.

Figure 3 shows an executive dashboard in IBM Intelligent Operations Center. It is possible to use this visual workspace to work with other enterprise applications, either by having their user interfaces share the display or integrating their data into the data that is used by the Intelligent Operations Center.

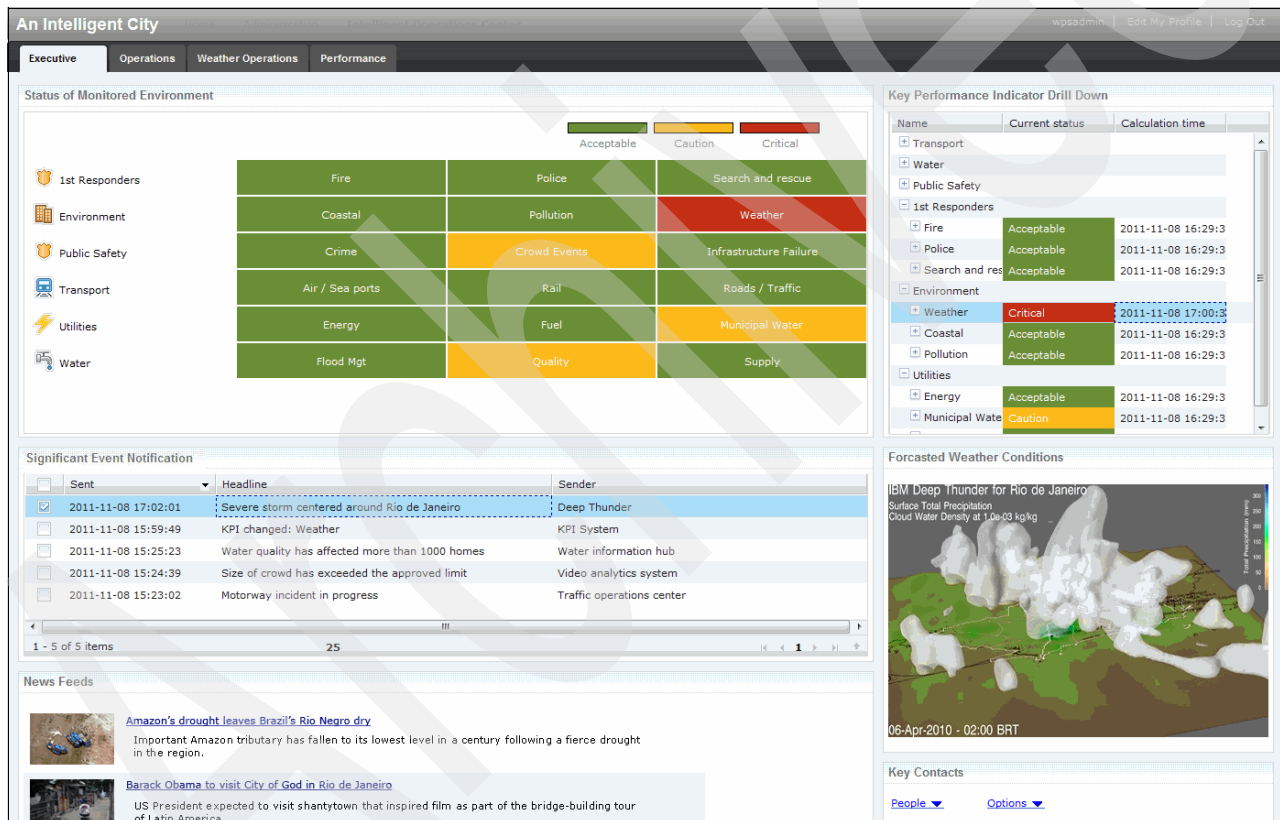


Figure 3 IBM Intelligent Operations Center visual workspace

Events and incident management

A major facet of IBM Intelligent Operations Center is its ability to use event information. Events represent occurrences of important happenings across the management domain that is represented by IBM Intelligent Operations Center. Events are presented appropriately to the user based on their role. Executives might view events as roll-ups or KPIs. Operators might see events in a list or on a map, and can respond to them based on their displayed urgency.

Events usually have temporal (point or span of time and physical (geospatial) location) attributes and a type. For example, a water main break at a particular street intersection qualifies as an event.

Events can also be things that you expect to happen in the future. Future events are useful for coordination purposes. For example, multiple city agencies might plan road work for the same section of a road at slightly different times. IBM Intelligent Operations Center can correlate the events and enable collaboration so the city tears up the road only once instead of multiple times.

IBM Intelligent Operations Center provides an event reporting and tracking mechanism to enable identification and understanding across underlying domains. You can manage predicted events, planned events, and current events as they evolve. For example, replacing pipes that run under a road is a planned event or work order that involves both water and traffic operations and possibly other operations such as cable or electric. Inclement weather due to arrive in the next 24 hours is a predicted event. A traffic jam is a current event that is affected by both the road work and weather. By managing all these types of events in one place, it is possible to improve response, reduce extra work, prepare more efficiently, and maintain a fully informed perspective of the current and future state of the enterprise.

An integrated geographic information system (GIS) or location plan maps events visually so that you can perform visual correlation, see patterns, and gauge the impact of events through interactive mapping and scenario analysis.

Figure 4 shows a geospatial mapping of events and an events list with detailed information about the events.

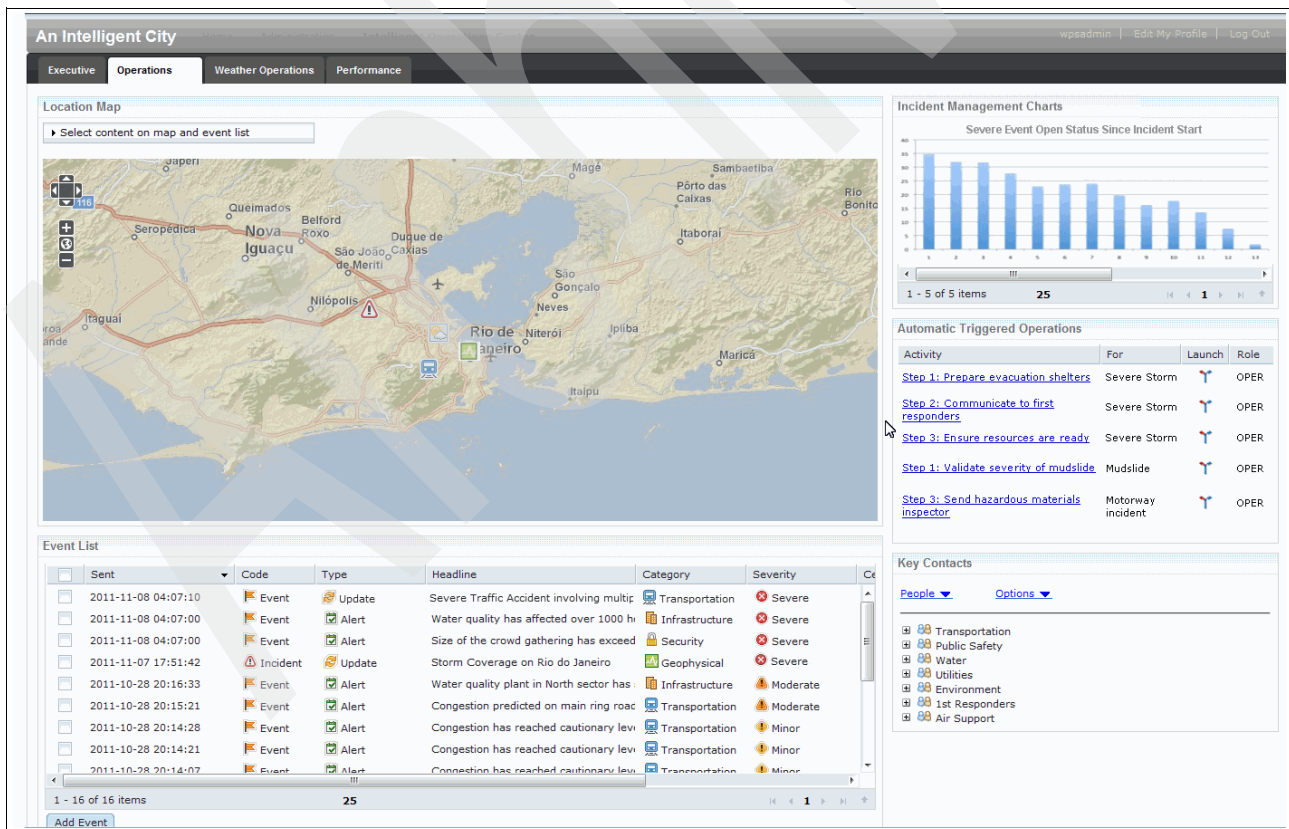


Figure 4 Geospatial and detailed representation of events

Resource, response, and activity management

IBM Intelligent Operations Center provides a system for storing appropriate procedures and workflows that are based on activities that are associated with events.

After IBM Intelligent Operations Center recognizes an event, it can choose several different actions to mediate or manage the event. Typically, a first action involves escalating the event to an *incident*. The operator might first consult SOPs and communicate with local teams through IBM Intelligent Operations Center's collaboration tools.

SOPs are predefined instructions for dealing with events or situation that a city can anticipate and plan for. SOPs can be reduced programmatically to a series of steps and actions. Some SOPs can be automated, and some require a human to make a decision.

An incident is flagged as something that requires special attention and handling. After an event is escalated to an incident, a workflow or other predefined series of actions is kicked off in accordance with an SOP.

You can track the progress of workflows and monitor or update the status of activities that are assigned to you. Information about a range of available resources can be highlighted on a map. The information is easy to access when and where you need it.

Figure 5 shows the list of events in the operator's dashboard and the actions that are associated with the event. For example, you can view the SOPs, find the nearby resources and their capabilities, and escalate the event to an incident.

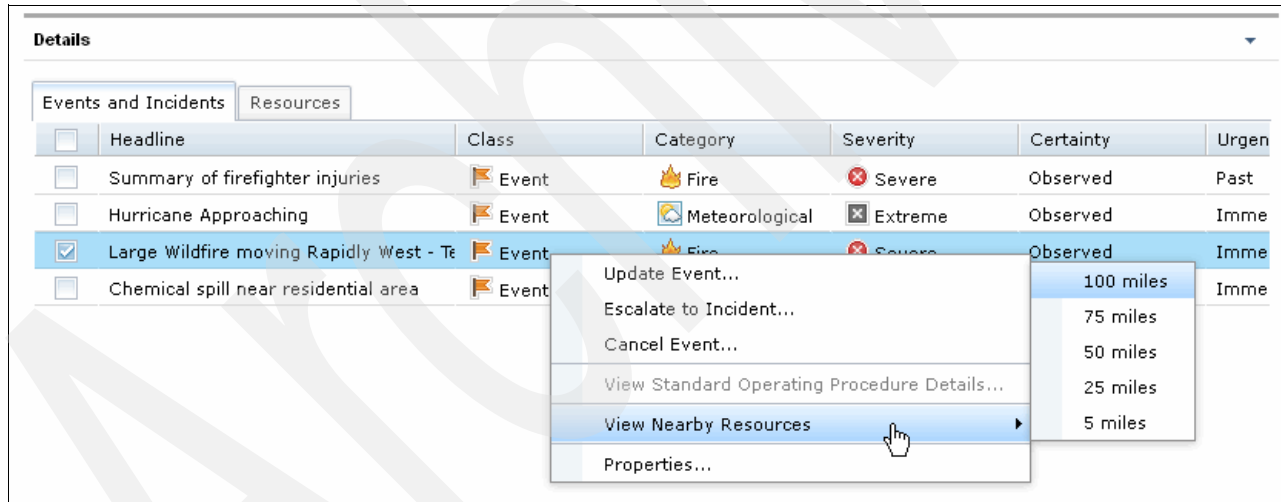


Figure 5 Event details and operator actions

Status monitoring

You can use IBM Intelligent Operations Center to tailor and define KPIs. KPIs are updated as underlying data changes. Through this function, users of IBM Intelligent Operations Center can:

- ▶ Summarize executive-level status for a single domain or across domains
- ▶ Highlight issues and identify problems
- ▶ Investigate further by drilling down into the KPI details

KPIs are used to measure nearly anything of importance to city leaders, from the number of traffic accidents this calendar quarter to the on-time performance of the public transportation system. IBM Intelligent Operations Center receives raw or computed metrics and uses them to compute the actual KPIs.

For example, for bus performance, the metrics might indicate, for each bus, whether it is ahead of schedule, on time, or behind schedule. After this information is rolled up with all the other bus information, IBM Intelligent Operations Center might create a single metric that indicates if, on average, the buses are on schedule. City bus administrators can rest easy if they see, at one glance, that the average bus arrival is green. This situation probably means that, on average, buses are arriving at approximately their scheduled times. If this KPI turns yellow or red, the administrator can determine the cause and act appropriately.

Because of the hierarchical nature of KPIs, users of IBM Intelligent Operations Center can uncover and act upon the underlying cause of the KPI change. IBM Intelligent Operations Center provides the simplicity of an overarching and comprehensive dashboard, and the necessary underlying detail to determine a cause and enact appropriate remediation.

Collaboration, instant notification, and messaging

IBM Intelligent Operations Center provides a workspace where users can maintain alerts for matters that need their attention. They can use this workspace to monitor news and events, especially when other portlets that announce news are not in view.

An integrated collaboration and communication tool is also provided for messaging and communication among users where and when it is needed.

Reports

IBM Intelligent Operations Center has an integrated reporting facility to set up and run reports with the events and KPIs supplied by the solution. This facility collects and presents the most useful information on an up-to-the-minute and regular basis. This facility provides all the advantages of tailored summaries and graphical presentation.

IBM Intelligent Operations Center comes with a reports page that can display up to six reports. Administrators can also create a reports page manually and customize the portlet layout. The reporting subsystem uses an analytic data model. Reports can be created based on historical data that is exposed by business intelligence and analytics. Users can create *ad hoc* reports and reusable reports. Reusable reports can be easily assembled using drag-and-drop technology. They can be created as components that can be visually displayed in the IBM Intelligent Operations Center dashboard.

Figure 6 shows examples of reports that are built with the IBM Intelligent Operations Center reporting facility.



Figure 6 Reports and data analysis

Semantic model

IBM Intelligent Operations Center incorporates a hidden jewel that is known as the *model manager*. This component allows for the complex modeling of relationships in a city or enterprise between its devices, equipment, buildings, and their relationship to each other and to less palpable items, such as maintenance records, failure history, composition, and cost. This modeling and association between all the parts of a city and its processes allows for complex analysis and optimization at reduced cost and with greater ease.

As complexity increases in cities and enterprises overall, as companies acquire other companies, as utilities bring in more data sources, the need for an overarching model that can federate databases and create a single point of reference becomes essential. The reference semantic model capability that is built into IBM Intelligent Operations Center enables increasingly complex organizations to create overarching models that simplify processes, analysis, and access to relevant data.

Typical flow

The following steps describe typical flows of a message through the IBM Intelligent Operations Center solution infrastructure:

1. After IBM Intelligent Operations Center receives the CAP alert, it examines the alert and determines whether it is a *KPI* metric.
 - a. If it is a KPI metric, IBM Intelligent Operations Center forwards it to its KPI processing engine, where it evaluates the metric and updates the appropriate visual representation of the KPI.
 - b. It also sends a notification to the IBM Intelligent Operations Center user interface to notify the user about the change in the status.
2. If IBM Intelligent Operations Center recognizes a CAP alert as an *event*, it performs several actions to mediate or manage the event. Some of the actions include:
 - a. Display the event as an item in the event list.
 - b. Add an entry in the geospatial database and show the event location on the Map portlet on the operator dashboard.
 - c. Escalate the event to an incident, if appropriate.
 - d. Check the characteristics of the event against the SOP matrix, which maps event characteristics to specific procedures.
 - e. If the event matches one of the defined SOPs, a new standard operating procedure workflow is initiated and is visible in the IBM Intelligent Operations Center portal My Activities portlet.
 - f. Correlate events that are received within a specified time and location. For example, trigger a notification whenever two events happen within 5 miles of one another and under 2 hours between them.
 - g. Check the resources and capabilities database, link the event to the appropriate resource, and display the information in the user interface.
 - h. There are also many alternative flows that are enabled by IBM Intelligent Operations Center that allow data in various forms to be brought in over the service bus, which is interrogated by the event engine and stored or surfaced to the user interface. The rich diversity of alternatives available make the IBM Intelligent Operations Center an ideal integration platform for older and current applications, bringing together metrics, data, and alerts or events from various sources into one intuitive interface.

Resources: Resources in IBM Intelligent Operations Center are specialized assets with location and capabilities information, such as hospitals or a warehouse.

Solution architecture

Figure 7 provides an overview of the IBM Intelligent Operations Center architecture.

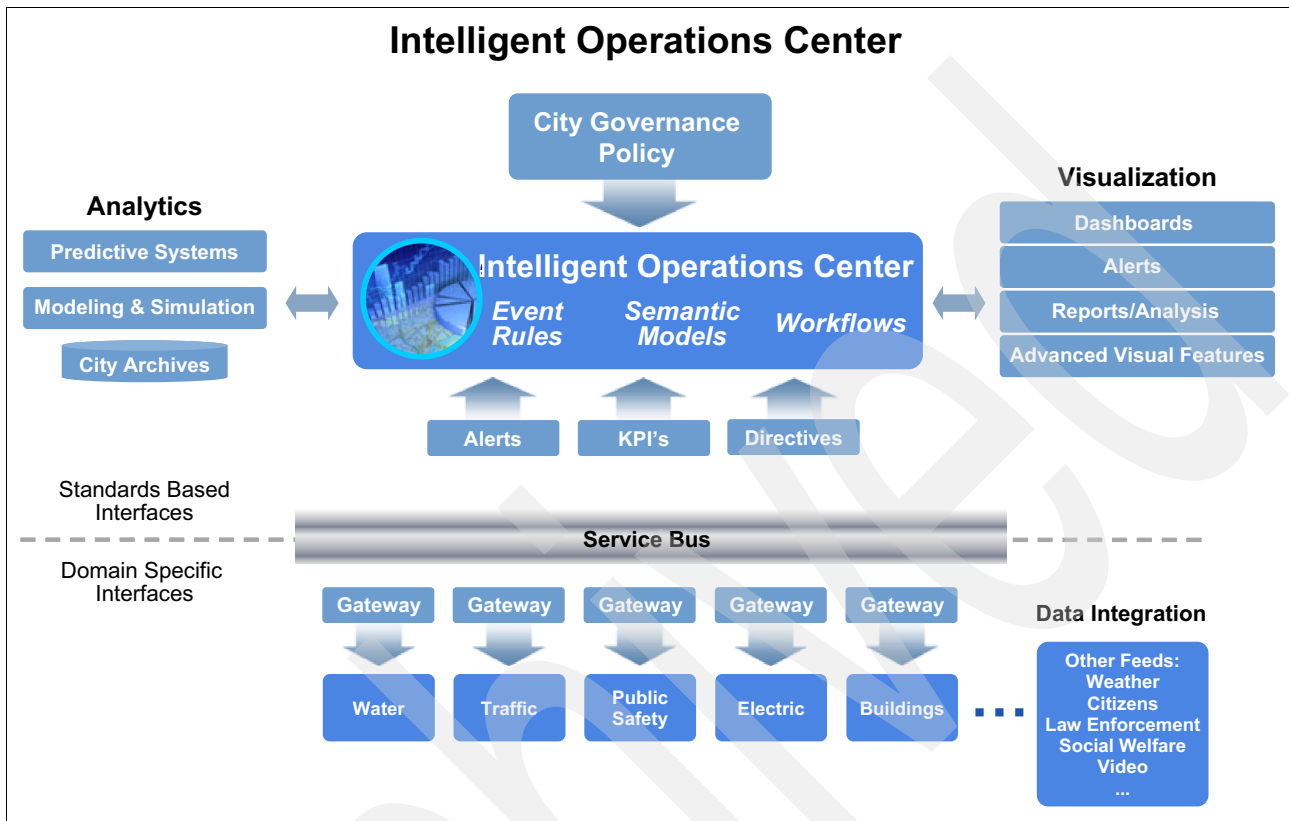


Figure 7 IBM Intelligent Operations Center architecture

Data from various configurable sources is received through various means (directly through XML standards-based exchange formats, or through adapters) into an enterprise service bus and world class message queuing system. This system can forward events, alerts, notifications, and KPI metrics, and initiate directives.

The IBM Intelligent Operations Center architecture has the following components:

- ▶ The *service bus* handles internal and external messages. It provides a loosely coupled interface for exchanging data and operations in a service-oriented architecture (SOA).
- ▶ The *event manager* handles anything that comes into the system, and interacts with the service bus to ensure that incoming data is treated appropriately. The event manager interrogates all incoming data and performs correlations, storage, and other activities as prescribed by the user. This flexible system can be used to apply business rules and logic to all incoming data, allowing fluid control and immediate response to critical information.
- ▶ The *KPI manager* watches all incoming data that is routed to it to continually update the KPI dashboard in accordance with user preferences. KPIs are typically viewed on the executive dashboard and provide a quick and thorough top-level status of all key processes. KPIs are tunable and can reflect the status of aggregated data, roll-up data, current versus historic performance, expenditures versus revenue, and so on. Drill down from the executive dashboard is also possible to ascertain the specific cause of a KPI changing status or color.

- ▶ The *workflows* engine helps automate and track SOPs to kickstart response to incidents automatically in accordance with a specified policy. They also afford consistency and auditability of responses, and help coordinate responses among many stakeholders.
- ▶ IBM Intelligent Operations Center is a configurable role-based interface that authenticated users can use to see the huge array of information available to them in whatever manner they find the most useful and actionable. Maps, lists, reports, and other views are user-configurable so that the users see exactly what they want to see and what they are allowed to see. Integration of outside sources of data is possible, such as video and social media.
- ▶ The *semantic model* provides an unparalleled ability to model objects in an enterprise or city and the relationships between them. This representation and the flexible ability to traverse the relationships between equipment, processes, and materials makes possible the complex analysis of the impact of device status changes on processes and things like cash flow and revenue. Semantic models can create a holistic model of multiple systems of hardware and their interrelationships and their impact and effect on business processes and non-device issues.

IBM Intelligent Operations Center takes full advantage of this capability to provide a simplified view of a complex world and analytical capabilities, which leads to unique insight. Advanced analytics can analyze the data, identifying optimizations and predictions that can help guide decisions and develop policies.

Other systems can be integrated with the solution. There are several common integration points where customizations can be done, which provide consistency. IBM Business Partners and independent software vendors (ISVs) can use these integration points and the included infrastructure services to build a powerful and broad solution that is tailored to the client's specific needs.

Usage scenarios

IBM Intelligent Operations Center-based solutions span a broad range of industries and organizations. Several use cases apply to water management, public safety, transportation, social programs, entertainment venues, buildings, energy, and more.

This section includes only a few scenarios of usage that are based on solutions that are developed with IBM Intelligent Operations Center.

Advanced emergency response system

In this scenario, IBM Intelligent Operations Center is used to build a city's advanced emergency response system. The city's operations center integrates information and processes from across many different city agencies into a single operations center that provides a holistic view of how the city is functioning on a 24 x 7 basis.

Business needs

Improve city safety and responsiveness to various types of incidents, such as flash floods and landslides.

Solution

An automated alert system notifies city officials and emergency personnel when changes occur in the flood and landslide forecast for the city that is based on predefined thresholds. In contrast to previous systems, where notifications are manually relayed, the new alert system should drastically reduce the reaction times to emergency situations by using instantaneous mobile communications, including automated email notifications and instant messaging, to reach emergency personnel and citizens.

The emergency management solution that is based on IBM Intelligent Operations Center:

- ▶ Integrates information from across agencies and systems
- ▶ Provides a dashboard to manage and visualize workflows
- ▶ Facilitates cross agency decision making and collaboration
- ▶ Optimizes intra-agency resource and task scheduling
- ▶ Flags event conflicts automatically between city agencies
- ▶ Efficiently controls and uses cross agency resources, thus reducing the time to resolution of emergency and crisis situations

Benefits

The emergency response system that is based on IBM Intelligent Operations Center:

- ▶ Helps save lives by enabling city officials to react and respond to disasters faster and more efficiently
- ▶ Maximizes efficiency and improves service levels that are provided to citizens

Wastewater management

With the IBM Intelligent Operations Center acting as the central point of command, the solution collects, analyzes, and monitors live data from sensors and level indicators in the sewer system. This setup helps control wet weather flow through the remote use of wireless sensors, smart valves and ballasts, or inflatable bands.

Business needs

A city's department of water works utility maintains a complex system of water mains, water meters, filtration plants, well fields, and water storage facilities. The system uses a combined sewer overflow model in which one large pipe carries all wastewater, storm water, sanitary sewage, and other pollutants, to the water treatment plants. In a heavy rainstorm, the city's aging infrastructure might not handle the large volumes of rainwater and wastewater. The resulting overflow of raw sewage never reaches the treatment plants and, instead, is released directly into the river, which poses significant health and property risks.

City officials are looking for a way to solve this problem and further extend and use the water system's existing data and sensor technology. They are looking for a more sophisticated and intelligent alternative to digging up the city's streets and rebuilding virtually the entire water works infrastructure.

Solution

The solution that is based on IBM Intelligent Operations Center collects information from sensors that are placed in the sewer system. These sensors proactively monitor the water flow and alert the city water authority when water is rising to dangerous levels or a blockage occurs. This sensor data can then be used to create a dashboard with geospatial mapping that shows precise "hotspots" where the risk of sewage overflow is greatest.

Key features and capabilities of the solution include:

- ▶ Overlay mapping of key data values for an at-a-glance status
- ▶ Collection system for wastewater levels and pumping station operation
- ▶ Collection of trending and historical data from water and wastewater operations for planning
- ▶ Basement backup heat map
- ▶ Calculation of combined sewer overflow volumes from supervisory control and data acquisition (SCADA) collection system wastewater levels
- ▶ System level and GIS view of cross-silo SCADA components

The solution relies on data that is collected by sensors and integration of software that is provided by IBM Business Partners. This integration is possible because of IBM Intelligent Operations Center architecture and defined common integration points.

Benefits

The city can use this solution to make proactive decisions, and initiate and monitor predefined action plans to alleviate or manage a flood threat. City operators can take proactive measures, such as deploying a crew to repair a sewer line, call in fire, police, or rescue personnel, or send an urgent alert to citizens to prevent public health disasters before they occur.

The solution helps the city to attain real business results:

- ▶ The solution cuts down on wet weather overflows and dry weather overflows.
- ▶ The city gains millions gallons of capacity in its water system.
- ▶ The city avoids millions of dollars in infrastructure investments plus more in potential government fines.

In addition to collecting and aggregating data to deliver a unified view of the combined sewer overflow infrastructure, the solution employs sophisticated analytics and monitoring capabilities that help the city predict where sewage overflow is likely to occur.

Entertainment venue operations center

This example focuses on an entertainment venue that must manage a continuing series of events. The venue could represent a sports complex or stadium, cruise ship, theater, or a concert hall, and the events can range from a regular schedule of games, shows, concerts, or a combination of these events.

Business needs

A major goal of entertainment venues is to improve the overall customer experience, such as getting to the stadium, ease of parking, waiting in lines, and the quality of the entertainment itself. Improving the entry and exit flow from the event is an important part of customer satisfaction.

Solution

The IBM Intelligent Operations Center solution provides an interconnected view of stadium activity, from weather alerts, to real-time security, to traffic flow into the stadium to create a seamless flow of visitors that attend a game, to insights into whether visitors prefer a full dining experience or buy food at concession stands before a big game.

Advanced crowd control management with geospatial intelligence and audiovisual notifications supports security personnel, who can immediately shift the flow of fans to minimize crowding.

Benefits

Stadium staff can now offer a unique fan experience by enabling event specialists to more effectively manage visitor traffic, monitor inclement weather, and analyze visitor spending habits on concessions, merchandise, and dining services to better target the fans with premium products and services.

Real-time analysis also enables staff to predict consumer preferences and plan concession and merchandise needs for current or future events. For example, as concession and dining service sales contribute a significant amount of revenue for a stadium, anticipating a fan's preference for a full dining experience or purchasing food at a concession stand during an event is key to increasing business profitability.

New features of IBM Intelligent Operations Center V1.5

IBM Intelligent Operations Center V1.5 introduces useful new features:

► Report enhancements

Users can use a configurable reporting capability to set up reports to gain insight into decision grade information that is captured by IBM Intelligent Operations Center. Twenty-four sample reports are now included.

In the new Reports portlet, users can:

- View up to six reports of events as graphs.
- Create custom reports that are based on selected criteria and data, including reports for events by date or date range.
- Copy a report URL and have the report display in a frame to the right of the portlet.

► Workflow enhancements

Users can select the most appropriate response to an event captured by IBM Intelligent Operations Center. Users can track the status of activities that are associated with events. In the new My Activities portlet, users can:

- View a group's open tasks that are associated with a procedure and an event.
- View the status of tasks that are assigned to them.
- Change the status of tasks that are assigned to them.

► Simplified configuration and customization

Handling of KPIs, SOPs, rules, and workflows for specific environments is aimed at business analysts, which helps reduce the need for dedicated IT staff to assist with these activities.

► Resource management and location map enhancements

In the new Location Map and enhanced Map portlets, users can:

- Assess the resources available to them in the vicinity of an event that is based on a geographical map.
- Work with a new type of map, a location map, with interactive areas defined. For example, a location map can be based on plan of routes for a transport system.
- View more than one event that is clustered at the same location on a map.

- ▶ Installation enhancements

The IBM Intelligent Operations Center environment is deployed on four virtual machines (VMs) (down from seven VMs in Version 1.0).

- ▶ Portlet customization enhancements

With the new portlet configuration options, administrators can set the following properties for each portlet:

- Properties that are specific to individual portlets. For example, set the center point and zoom level for a map.
- Properties that are generic across portlets. For example, set the portlet height.

- ▶ New administration tools

- System Verification Check Tool: Administrators can use the System Verification Check Tool to check the operational status of IBM Intelligent Operations Center.
- Event Scripting portlet: Administrators can use the new Event Scripting portlet to create a sequential list of events to be published at predefined time intervals.

- ▶ New supported protocols

IBM Intelligent Operations Center now supports events with protocols other than the Common Alerting Protocol. Event messages can now be in custom (non-CAP) formats. Administrators can:

- Extend enumerated types for Common Alerting Protocol and non-Common Alerting Protocol events.
- Customize the pop-up menus in the Details portlet.
- Accept events from multiple domains for display in portlets.

- ▶ New connection points to integrate more applications

IBM Intelligent Operations Center includes additional connection points to new applications found in the Smarter Cities application store. These applications can act as additional data sources. Applications currently available within the application store that can be connected to the Intelligent Operations Center include:

- City Pulse: Allows the general public to report issues through mobile services requests.
- Mayor's Dashboard: Provides an easy-to-read dashboard for executives to view issues in their city.
- Sentiment Analysis: Learns what citizens are saying through social media forms about city services and policies.
- SOP for Emergency Management: Allows trained personnel to react to emergency situations using defined SOPs.
- Weather for Operations: Delivers accurate weather forecasts and the ability to predict adverse weather conditions.
- Resource Management for Emergencies: Collects information about the condition of assets that are used during emergency situations.
- Smarter Stadiums: Provides situational awareness and actions to maximize stadium operations and stadium revenue sources.

- ▶ Connection to related IBM solutions

IBM Intelligent Operations Center base can connect to a selection of related IBM solutions:

- IBM i2@ Public Safety.
- Smarter Buildings.

- Video Correlation and Analysis Suite (VCAS).
- ▶ Support for a multilingual customer user interface for operational tools

The IBM Intelligent Operations Center is now central to its associated products, which include Intelligent Water and Intelligent Transportation. Therefore, the features and functions that are present in the IBM Intelligent Operations Center are also available in the Intelligent Water and Intelligent Transportation products.

Supported platforms

IBM Intelligent Operations Center can be deployed within a city's data center (on-premises) and through a subscription service hosted on the IBM SmartCloud™.

For city managers that prefer a subscription service model that does not require more hardware or IT management capacity, IBM Intelligent Operations Center on IBM SmartCloud is an ideal solution. This service provides rapid and secure internet access to the capabilities of the IBM Intelligent Operations Center on IBM SmartCloud so cities can rapidly adopt new capabilities while they control cost. For more information, see IBM Smarter City Solution on Cloud at:

<http://www-01.ibm.com/software/industry/smartercities-on-cloud/>

For on-premises deployments, IBM Intelligent Operations Center requires five 64-bit x86 servers. Red Hat Enterprise Linux Version 5, Update 5 or later must be installed on all servers. For information about minimum hardware requirements, see the “IBM Intelligent Operations Center hardware requirements” topic in the IBM Intelligent Operations Center Information Center at:

http://pic.dhe.ibm.com/infocenter/cities/v1r5m0/topic/com.ibm.ioc.doc/ba_plan_hardware_lite.html

Ordering information

IBM Intelligent Operations Center is only available through IBM Passport Advantage®. It is not available as a shrink-wrapped product. Following are the product specifics:

- ▶ Product Group: Smarter Physical Infrastructure
- ▶ Product identifier: 5725-D69
- ▶ Product identifier description: IBM Intelligent Operations Center
- ▶ Product Category: Smarter Cities
- ▶ Charge metric: User Value Unit (UVU)

Related information

For more information about IBM Intelligent Operations Center, see the following documents:

- ▶ IBM Intelligent Operations Center V1.5 announcement letter:
<http://www-01.ibm.com/common/ssi/cgi-bin/ssialias?infotype=AN&subtype=CA&htmlfid=897/ENUS212-250&appname=USN>
- ▶ IBM Intelligent Operations Center Product page:
<http://www-01.ibm.com/software/industry/intelligent-oper-center/>

- ▶ IBM Intelligent Operations Center Information Center:
<http://pic.dhe.ibm.com/infocenter/cities/v1r5m0/index.jsp>
- ▶ Solutions for Smarter Cities application store:
https://www-304.ibm.com/sales/gss/download/industry_solutions_catalog/CrossIndustrySolutions.do?industry=cities

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This paper was produced by a technical specialist working at the International Technical Support Organization, Raleigh Center.



Pam Nesbitt is a Senior Technical Staff Member in Industry Solutions Software, Architecture, and Technical Strategy, where she provides architecture and executive oversight to solutions that use the Smarter Cities family of products, including the Intelligent Operations Center. In her tenure at IBM, Pam has held leadership technical positions in Consulting Services, IBM Tivoli® Software Development, Corporate Technology, and Industry Solutions. Ms. Nesbitt has filed over 120 patent applications with the USPTO, is a Master Inventor, and is Intellectual Property Lead for Industry Solutions. She holds a BS degree in Neurobiology from Cornell University and an MS degree in Computer Science from Cleveland State University.

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