Project Team

- Fraser Moffatt
  DEFENCE SCIENTIST, CSS, DRDC
- Brendan Dodd
  SUPERINTENDENT - OPERATIONAL SUPPORT, WINDSOR POLICE SERVICE
- Kathy Wunder
  DIRECTOR, VANCOUVER POLICE DEPARTMENT
- Eldon Amoroso
  PRINCIPAL, BIRCH FOREST PROJECTS INC.
- Alison Brooks
  RESEARCH DIRECTOR, SMART CITIES & PUBLIC SAFETY, IDC
- Brian Howden
  DIRECTOR, INDUSTRY INSIGHTS, IDC CANADA
- Julie Tiley
  CONSULTING VP, IDC CANADA
Objectives

1. To better understand the strengths, weaknesses and capabilities of existing off-the-shelf advanced analytics and data visualization software that caters to law enforcement.

2. To showcase case studies of global real-time operating centers and/or real-time crime centers and Canadian police agencies that are using or planning to implement real-time analytics solutions for their investigative and operations teams; to understand how these tools affect decision-making in real-time, complex environments.

3. To conduct preliminary investigations into some larger policy and regulatory issues involved in the mass amalgamation of data sets as well as the sharing of analytic solutions, and the concerns, barriers, or impact of sharing this with other public safety organizations.
Research Approach: Vendor Assessment
(Aligns with IDC’s Vendor Assessment Methodology)

1. Market scan identified over 30 big data, advanced analytics and visualization tools suppliers.

2. Vendors with presence in North America and whose solution has been successfully deployed in by law enforcement were invited to participate.

3. 18 vendors (list in Appendix A) were sent a detailed vendor assessment survey (Appendix B) to fill out and return based on the project objectives, IDC’s taxonomy big data functionality (Appendix B) and list of visualization features (Appendix C).

4. 11 vendors completed the assessment (Appendix A).

5. Vendor interviews were completed by IDC to clarify responses where necessary.

6. Vendors were scored based on a modified version of IDC’s vendor assessment methodology which positions each vendor relative to their current strengths and future strategy (see Appendix D for a detailed description of the assessment factors and weights).
Vendor Assessment Weighting Overview

The vendor assessment addressed six distinct areas: company background; product offering; visualization; service capabilities; customer base, and; market strategy.

The project team tested several weightings scenarios concluding that the following weightings were the most balanced, and what law enforcement organizations would similarly prioritize:

While the team's weighting choices determined this result set, different weightings scenarios resulted in very similar, but slightly different results.
Vendor Assessment Summary

Leaders

- IBM and SAS scored highest overall due to their deep analytics and visualization capabilities, as well as their broad public safety customer base.

- IBM and SAS scored virtually identically, although their visualization and product offering strengths vary between categories.
Vendor Assessment Summary

Major Players

- Unisys, ESRI, Hitachi and Hexagon are considered major players given their deep analytics and visualization capabilities, as well as their broad public safety customer base.

- Unisys, despite being considered generally a systems integrator has considerable IP in the public safety space.

- ESRI is best of breed geospatial but has very deep analytical underpinnings to its solutions.

- Hitachi’s analytics strengths stem from the acquisition of Pentaho.

- Hexagon’s strengths are derived from its acquisition of Intergraph, as well as its strong public safety intellectual property.
Motorola, NICE, IBI and Rapid Deploy all have very deep understanding of the public safety space, and have proficient analytics and visualization solutions that are specific to public safety. They do not necessarily offer a full complement of advanced analytics offerings as many of these fall outside of what is needed in public safety.

The Motorola and NICE offerings are particularly strong in the law enforcement context.

The vast majority of Motorola’s business is derived from its public safety clientele.

Rapid Deploy’s offerings leverage the Microsoft analytics and visualization offerings in a mobile cloud-delivered CAD and RMS capacity.
Vendor Assessment Summary

Participants

- The project team asked Versaterm to participate, understanding that the comparative was slightly mis-matched, but the team wanted to get an understanding of the analytics and visualization capabilities that police forces would have already contained in their existing RMS systems.

- For some public safety agencies, Versaterm’s visualization capabilities will be sufficient.
Key Findings: Data Amalgamation & Sharing
Data quality management (DQM) requires a combination of guidelines, processes, and technologies to preserve the accuracy, completeness, timeliness, and consistency of enterprise information.

To address these needs many of the vendors we assessed offer a comprehensive environment for effectively monitoring, managing, and controlling information assets enterprise-wide.

- IBI leverages the iWay Omni-Gen Data Management Platform. It includes the Omni-Gen Data Quality Edition which has features designed to optimize the integrity of enterprise information, regardless of its source, location, or format.

- Hexagon has a Business Intelligence practice that helps customers with data governance to ensure quality of data in their source systems. It also provide consulting and implementation services to help customers identify incomplete or incorrect data in the data source and to correct or alert and log data irregularities. Additionally, HSI leverages Microsoft’s SQL Server Integration Services and Data Quality Services for data cleansing.

- IBM’s i2 Enterprise Insight Analysis solution cleanses data through correlation and indexing, whenever data is loaded into its internal analytical store. The index is organized around entities, links, and properties to make the data ‘analysis ready.’ Recognizing that it is not always possible or desirable to ingest data, i2 Enterprise Insight Analysis can also access data from external sources and adapts to the data quality provided.
Establish data sharing agreements with authoritative data sources. Typically, these are the respective local governments. If the agency is part of a regional or provincial force, ensure a coordinated and collaborative data sharing infrastructure is in place to provide a seamless street centerline and address dataset. The Esri platform offers the ability effective manage these data management requirements from a small individual agency/detachment, through the largest city, and up to the national level. Please note that Esri technology is used by approximately 90% of the local governments in Canada, thereby allowing for easier data sharing.

Ensure all levels of the organization know the importance of quality data. Senior management needs to understand the impact in order to justify the expenditures, while officers and dispatchers need to understand the negative downstream impact of poor location data entry (typographical errors, use of punctuation and abbreviations, etc.) during the call process.

Despite the above efforts, the data will likely still require cleansing. Once the data is extracted from the external systems (ex. CAD & RMS), automation of the data cleansing process frees up an analyst’s time for the actual analysis. This is typically done prior to bringing it in to geocode within Esri. Steps include:

- Parse the addresses.
- Normalize street prefixes
- Normalize street suffixes
- Select addresses with matching street number, street prefix, street suffix, city, province, postal code.
- Compare Street name and correct where necessary
SAS – Data Cleansing Best Practices

SAS delivers a complete data quality methodology to our customers through a dedicated data management team, providing consultative guidance and/or post-sales project implementation that spans people, process and technology. Some examples of these best practices and techniques are found in these 3 online documents:


EXCERPT:
▪ Simplify access to traditional and emerging data.
▪ Strengthen the data scientist’s arsenal with advanced analytic techniques.
▪ Scrub data to build quality into existing processes.
▪ Shape data using flexible manipulation techniques.
▪ Share metadata across data management and analytics domains.


EXCERPT:
▪ When you’re ready to put your data management strategy into action, get started by following the SAS Data Management methodology. This step-by-step process guides you in performing data management tasks and incorporating data quality throughout the entire process. The methodology guides you through building a foundation that can help optimize revenue, control costs and mitigate risks. The methodology includes three stages:
  • PLAN. Where you discover data and define processes and rules for managing it.
  • ACT. Where you design and execute those defined processes.
  • MONITOR. Where you evaluate the data and control it as it flows into and through your organization.


EXCERPT:
▪ Elevate the visibility and importance of data quality.
▪ Formalize decision making through a data governance program.
▪ Document the data quality issues, business rules, standards and policies for data correction.
▪ Clarify accountability for data quality. Applaud your successes.
IBM – Data Cleansing Best Practices

IBM offered a number of best practices and recommendations for improving data quality based on the specific environment and requirements of the client. The IBM InfoSphere QualityStage product provides a methodology and development environment for cleansing and improving data quality for any domain. Data is high quality when it is up-to-date, complete, accurate, and easy to use. Depending on your organizational goals, high quality data can mean any of the following items:

- Customer records do not include duplicate records for the same person
- Inventory records do not include duplicates for the same materials
- The agency is confident that Paul Allen and Allen Paul are records for two different customers, not the result of a data entry mistake
- Employees can find the data they need when they need it, and are not creating their own individual version of a database.
- Organization complies with NIEM standards for data exchange.

BEST PRACTICES:

- Understand organizational goals and how they determine requirements;
- Understand and analyze the nature and content of the source data;
- Design and develop the jobs that cleanse the data;
- Evaluate the results
Research Approach: Case Studies

Case Studies were based on in-depth executive interviews (See Appendix C for Guide) with:

- York
- Detroit
- NYC
- NSW RFS
- Seattle
- Calgary

Additional discussions with Edmonton and the RCMP
There are four prominent types of intelligence centers in operation in North America, with slight variations in the scope of jurisdictions included and how embedded the center is across the entire police force:

**Real-time crime centers**

RTCCs are singularly focused on the prevention of, and response to, crime. While they leverage advanced analytics to prevent, predict, and respond to crime, they tend less to use said software to optimize workforce deployments or internal operations.

**Real-time operations centers**

RTOCs are focused on intelligence gathering at the operational level, as well as leveraging analytics and visualization to respond to criminal events and conduct investigations. Data interoperability tends to be limited to a couple of agencies, unlike fusion centers, which share information across dozens of organizations and/or jurisdictions.

**Fusion centers**

Fusion centers operate as focal points for the receipt, analysis, gathering, and sharing of threat-related information between federal; state, local, tribal, and territorial (SLTT); and private sector partners, whereas RTCCs and RTOCs are focused on local jurisdictions only (county or city) (definition modified from https://www.dhs.gov/state-and-major-urban-area-fusion-centers).

**Virtualized intelligence centers**

Virtualized intelligence centers are cloud-based centers (crime, operations, or fusion) that amalgamate, analyze, and share data and insights virtually. LexisNexis’ Accurint virtual crime center is an example of this type of offering that links available data sources in context. LexisNexis has a virtualized offering for data collection, ingestion, discovery and cleansing, integration, analysis, delivery, and sharing.
Typically, the central driver to RTIC implementation is a recognition by senior leadership that there is a gap in situational awareness or an unacceptable lag in information coming back to the right people. Preparations for large-scale events (Olympics, G8/G20, papal visit, etc.) can also drive RTIC adoption as seen in Rio de Janeiro, Brazil, prior to the Olympics and World Cup. Data warehousing initiatives also lead organizations to take the next step, implementing an intelligence center to maximize the value of the data consolidation back out to the investigative officer or patrol.

Another key adoption driver is when police departments relocate head quarters. Taking advantage of net new space and operational imperatives contributes to the business case.
Key Findings: Implementation Time & Costs

<table>
<thead>
<tr>
<th>RTIC Type</th>
<th>Example City</th>
<th>Cost Ranges</th>
<th>Time to Implement</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTCC</td>
<td>NYC</td>
<td>$25,000,000</td>
<td>1.5 – 3 Years</td>
</tr>
<tr>
<td>RTOC</td>
<td>Calgary, York</td>
<td>$5,000,000 - $8,000,000</td>
<td>2 – 4 Years</td>
</tr>
<tr>
<td>Fusion Center</td>
<td>Chicago</td>
<td>$3,000,000 - $10,000,000</td>
<td>2 – 4 Years</td>
</tr>
<tr>
<td>Virtualized Center</td>
<td>Unspecified, 70 US deployments</td>
<td>Unspecified</td>
<td>3 – 6 Months</td>
</tr>
</tbody>
</table>

- Implementation and operational costs vary widely according to the breadth of the implementation, size of the force, and solution scope. Calgary's RTOC costs C$5.5 million annually to operate, spanning 2,200 sworn officers and a population of 1.2 million. New York City's RTCC reportedly cost US$25,000,000 to implement. On a smaller scale, cost breakdowns for the real-time crime center in Albuquerque, New Mexico, are shown on the next slide.
Albuquerque, New Mexico, Real-Time Crime Center Cost Allocations

Note: Data is from IACP 2013 LEIM Presentation, Setting up the Albuquerque Police Department's Real Time Crime Center (RTCC), Clint Hubbard, APD Technical Service Unit, Technology Manager. Source: LEIM Conference Workshop by Albuquerque New Mexico Police Department, 2013
New York City (NYC) started down the path of creating an enterprise data warehouse in 2004–2005; prior to that, all of its data sources were in disparate systems, which was creating vast inefficiencies and adding considerable time to the process of collecting basic data related to an incident—need to log into and search through 32 different databases to collect every potential information source.

Of the 32 systems, the New York City Police Department (NYPD) began integrating a batch of eight key systems and went through a process where it would internally verify and vet the data using sample data sets, leveraging data dictionaries to facilitate integration.

For each of those original eight systems, the NYPD needed to understand the vendor’s data structure and certain idiosyncrasies related to that data set. Then, they needed to match and test the data elements to ensure accuracy across systems. NYPD used a simple issue tracking program to solve discrepancies, but there was considerable back and forth given the sheer volume of systems (eight) being integrated simultaneously.

This approach was leveraged for each of the remaining 24 systems being brought in to the crime data warehouse, but to optimize this process, the NYPD devised a system whereby it integrated 2 systems per 90-release cycle (45 days of development, 45 days of testing), which, while time consuming, was far more manageable and ensured better results at the end of a three-year integration period.

BEST PRACTICE: As Data Sources Proliferate, Take a Measured Approach to Data Integration
When dealing with large numbers of data sources, take an iterative approach — work with a small batch to develop a repeatable process for integrating and continue at a pace that is manageable for your organization.

Be aware of small but critical differences in data elements, such as the location example mentioned previously.

Work with each of your providers to obtain a list of data elements/data structures and examine them for discrepancies across sources.
Calgary Police Department (PD) was set up in 2014. It uses a number of key operational and investigative solutions including Palantir and IBM to integrate disparate databases into one common platform, to provide one single version of the truth to responding officers as well as its crime analysts. The center's information coordinator collects and filters pertinent information and, in real time, pushes out needed information during incident response and for ongoing investigations.

Working in real time has generated some profound resourcing implications for Calgary PD. First, working in real time means that the traditional hierarchical structure of the policing organization needs to morph into more of a "liquid network." Historically, specialized forces (e.g., homicide, gangs, drugs), covert operations, and police districts operated in isolation. Working in real time forces these separate units to work more collaboratively, as well as changing the roles, responsibilities, and workflow for both commanding officers and responding officers.

Second, as police forces move toward real-time situational awareness, the gap between the incident response and investigation phases narrows, affecting the roles and responsibilities of responding personnel.

**BEST PRACTICE:** Working in Real Time Means Restructuring to Operate More Like a Liquid Network
Calgary PD – RTOC Guidance

- Invest in change management. Police forces are used to working in parallel tracks and are likely to resist changes toward a more collaborative organizational culture.

- Obtain buy-in from key leadership. Re-envision decision-making and command structures to better approximate a living organism or a liquid network.

- Retrain resources to reflect the blurring of response and investigative roles. As organizations shift toward real-time data sharing, the differences between response and investigation blur.
The New South Wales Regional Fire Service (NSWRFS) is a best practice in facilities design and video wall design/structure to best depict and portray critical information. It is situated in the atrium of the building, which makes it a focal point for the entire organization. All involved lead and supporting agencies and stakeholders are present in the operations center, and their positioning was carefully thought out. The center of the room is configured for the regional fire service; the next circle out are local police, fire, paramedic, and St. John's; then meteorology; and finally critical infrastructure (water, power, gas, and communications providers) and other agencies that might have an interest in being involved like agriculture or social services.

Functionally, each agency's workstation performs exactly as it would back at the office, so if an incident escalates, it is able to draw on real-time expertise from those involved. An example of this occurred three years ago when the NSWRFS was fighting a large bush fire, and the water representative intervened to let the fire service know that in just under an hour it would run out of water from the source it was drawing from, and it was able to draw water elsewhere.

The knowledge wall is a two-story video wall, broken into various screens with a social media sniffer and a series of news channels down at the bottom, including weather info, live scans from surveillance helicopters' line scanners, and other valuable situational awareness. The information on the center's video wall is prioritized with the statewide common operating picture presented at the center and less pivotal but still valuable information depicted on the edges.
NSWRFS Guidance

- Leverage workflow, architect, and human-centered design specialists to thoughtfully plan for usability. In conversations with these specialists, address what, how, and how much information the human brain can absorb, as well as psychologically understanding what can be taken in.

- Understand that your technology needs will evolve over time, and this will require a rethinking of workflow processes, presumably to optimize operations.

- Recognize that setting up a leading-edge operations center is exciting, but it does not come easily; moreover, it is not all about the technology. It requires constant open dialogue with multiple stakeholder sets, where you're sharing information, data, and so forth with people who historically have not been comfortable doing so. Progress requires relationship building.

- Work with facilities to fortify infrastructure. Video walls can be very heavy (some up to 1.8 tonnes). Having to retroactively strengthen the floor to install a wall is far less efficient than if facilities were to be involved early on.
Key Findings: Data Amalgamation & Sharing Analytic Solutions

**SEATTLE:** Seattle has a very specific political culture that is particularly negatively predisposed to surveillance and data collection. As a result, each time they procure a solution the PD has to assess the solution for why the PD needs it, what it’s being used for, what data it is collecting, etc. The department tries to focus the discussion squarely on the technology, rather than the data.

**NSWRFS:** Had only very minor issues related to concerns from other agencies regarding the use of their data. NSWRFS implemented a series of MOUs and SLAs with these organizations to remedy.

**CALGARY:** In Calgary there was concern about the mass amalgamation of data, but not necessarily resistance. Calgary tries to involve its privacy commissioner in advance.

**NYC:** New York City PD stated that they encounter this frequently and almost with every new technological advance. NYC PD has a legal bureau to address these issues. The latest hotbed issue for NYC is facial recognition, but previously it has been in-car cameras, license plate readers, and body worn video cameras. Any type of new technology that is storing information about innocent people is challenged, so they have a legal department to address this proactively. NYC’s stop and frisk procedure was challenged, and while they can still stop somebody for reasonable suspicion of a crime, they can no longer keep a database of those encounters. “I'd like to say that we're a pretty smart department and we wouldn't do those type of things that would hinge on somebody's civil liberties. But, it doesn't stop people from asking questions about it.”

**DETROIT:** Detroit was very conscious about how Greenlight was going to be implemented, as well as being very deliberate in the language with its partners so that if it was challenged in court it would stand-up.
Key Success Factors
Successful centers identify the following major efforts as being critical to success.

**Proactively get political support.**
Getting political engagement is a key success factor for strategic and financial support. NYC’s crime center, for example, was originally housed within the police commissioner’s office. This gave the center an inordinate amount of clout.

**Educate the community.**
Successful intelligence centers educate the public as to what the center is for, how the center is being used, where privacy is being protected, and so forth. This entails having clear policies in place for both the use of the technology and for the retention of the data being collected.

**Consider civilian crime analyst and support staff.**
Understand where civilian crime analysts and/or support staff can factor into the resources deployed in the intelligence center. With costs escalating across law enforcement organizations, this could contribute positively to the economic feasibility of running a center.

**Hire analysts whose skills align to your agency’s organizational structure.**
This will vary by city and center. NYC’s RTCC has five units, each having a slightly different skill set or background experience: investigative support (in-depth understanding of warrants), youth (previous background and talent in the complexities of processing youth), facial recognition (combination of investigative and graphic arts or graphic manipulation), social media (gang and troubleshooting experience), and general support (go-to people for random issues related to infrastructure, unforeseen issues, or technology and coding skills).
Process

- **Pay attention to change management.**

  Real-time intelligence centers shift police organizational culture from top-down/hierarchical control to more of a distributed leadership model, and yet there is rarely a deliberate, strategic change management organization managing this transition, fleshing out how the new model works and how it changes roles in the organization. Previously, the organization structure had a central point of information collection and dissemination, but the speed and variety of information sources entering the organization have rendered this top-down model unsuitable and ineffective. The roles and responsibilities in the center allow for greater individual latitude in decision making — hence the ability to operate "real time" — but this requires an extra level of trust and understanding of the interrelationships and interdependencies.

- **Define and evangelize the center's vision.**

  Successful centers have a crystal clear vision of the center's role in the force and community. Calgary's vision, for example, which is explicitly stated in all of its communications regarding the RTOC, is centered on trust, transparency, situational awareness, and effective information sharing. Specifically, Calgary's vision is: "To enhance public trust in police by becoming world leaders in real-time operational and investigative support. Through people-centered leadership, we maximize public safety by providing real-time information sharing, effective Incident Command, and support to investigations for our members and partners."

- **Visit other centers to glean best practices.**

  Successful centers typically visit six to eight centers to understand better the range of implementation options available and to understand how they addressed certain challenges. NYC, for example, struggled with the amount of work and complexity involved in consolidating 35 separate databases and making sure that data quality was not an issue. What it devised was a best practice to integrate two systems at a time, with a 45-day development and 45-day test environment to manage the changes.

- **Track ROI.**

  This will be critical to the overall success of your center, as well as other police forces looking to stand up a center; hard data on the value of intelligence centers to the community is marketable and portable. Illustrate the various hard and soft benefits the system delivers in the reduction of crime.

- **Proactively work with legal and privacy officers.**

  Agencies need to work with legal and privacy on an ongoing basis to ensure that new developments in technology adoption are managed in the best interests of everyone concerned. This allows organizations to handle the legal and privacy issues associated with emerging technologies like facial recognition, stop and frisk databases, and body-worn video.
Technology and Infrastructure

Establish a technology fund for constant evergreening.
The ability to track and respond in "real time" doesn't exist unless you have technology; invest in technology wisely, as a leading adopter. Plan to iterate and mature both your technology and the strategic direction of the center. Recognize the system's limitations and correct those deficiencies.

Don't underestimate the role that facilities play.
Setting up the right kinesthetically functional space will be critical. Some centers' floor plans are premised on the idea of a marketplace, where individuals can come together when needed for one on ones or together as a unit. This allows agencies to make better quality decisions, but it also ultimately delivers better public value and helps with forces seeking to become more transparent as the work is done the right way the first time.

Work to have your information processes automated to as real time as possible.
Agencies like NYC struggled with the lack of automated workflow from the street with data entry only occurring once every 24 hours. Today in NYC data entry occurs from the mobile device and is refreshed hourly.

Do not comingle facial recognition with other biometrics.
DNA, fingerprinting, and retinal scans are all scientifically verifiable pieces of evidence that can lead directly to a conviction. Facial recognition software is a lead-generation tool and needs to be treated differently in terms of workflow and resources; a civilian analyst, for example, would be able to manage the DNA process, whereas investigative officers must be involved to follow-up facial recognition leads.

Capitalize on existing infrastructure and opportunities.
Leverage your city's existing infrastructure (fiber, wireless network, etc.). If your organization is moving to a new building, take advantage of new infrastructure and space requirements.

Choose your analytics solutions wisely.
Work with vendors whose solutions conduct the searches for you, and find the patterns and linkages without analysts and officers hunting around for the right questions. Try to leverage advanced analytics like cognitive solutions where data overload is a problem for human resources; use human resources when tasks are relatively unique and manageable.
# Appendix A: Vendors Asked to Participate

<table>
<thead>
<tr>
<th>Invited</th>
<th>Completed Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Capita</td>
<td>1. ESRI</td>
</tr>
<tr>
<td>2. ESRI</td>
<td>2. Hexagon</td>
</tr>
<tr>
<td>3. Hexagon</td>
<td>3. Hitachi</td>
</tr>
<tr>
<td>4. Hitachi</td>
<td>4. IBM</td>
</tr>
<tr>
<td>5. IBM</td>
<td>5. Information Builders</td>
</tr>
<tr>
<td>6. Information Builders</td>
<td>6. Motorola</td>
</tr>
<tr>
<td>7. LexisNexis</td>
<td>7. NICE</td>
</tr>
<tr>
<td>8. Microsoft</td>
<td>8. Rapid Deploy</td>
</tr>
<tr>
<td>10. Motorola</td>
<td>10. Unisys</td>
</tr>
<tr>
<td>11. NICE</td>
<td>11. Versaterm</td>
</tr>
<tr>
<td>12. Niche</td>
<td></td>
</tr>
<tr>
<td>13. Palantir</td>
<td></td>
</tr>
<tr>
<td>14. Panorama Necto</td>
<td></td>
</tr>
<tr>
<td>15. Rapid Deploy</td>
<td></td>
</tr>
<tr>
<td>16. SAS BI</td>
<td></td>
</tr>
<tr>
<td>17. Unisys</td>
<td></td>
</tr>
<tr>
<td>18. Versaterm</td>
<td></td>
</tr>
</tbody>
</table>

Regretfully, SAP, Microsoft, Palantir were not able to dedicate the time required to complete the assessment even though all vendors were given more than 3 months to respond. Some other vendors elected not to participate after reviewing the assessment criteria.
Case Studies: Essential Guidance

- Intelligence centers typically mature operations through phases; understanding where your organization is in terms of overall stages of maturity will help drive what you should implement in a given time frame. IDC’s Smart Cities Maturity Model places organizations into five stages: ad hoc, opportunistic, repeatable, managed, and optimized. Note that each stage builds on the capabilities of the one before it.
- Using IDC’s maturity framework, we see intelligence centers with the following characteristics maturing operations through the following phases:

<table>
<thead>
<tr>
<th>Stage</th>
<th>Description</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ad Hoc</td>
<td>Relatively devoid of interoperable digital processes, police chiefs and personnel begin to formally recognize the need for enhanced situational awareness as they are unable to answer questions about an event, or there is too much of a lag time in terms of information coming back to involved personnel. At this stage, organizations begin to prove the value of the intelligence center concept and develop the business case via demonstrated success from pilot projects and other preliminary investigations.</td>
<td>Example: Edmonton</td>
</tr>
<tr>
<td>Opportunistic</td>
<td>Agencies in the opportunistic stage ramp up their intelligence center efforts as executive sponsors and key stakeholders buy into the concept and start to provide leadership and some strategic direction. Success from initial pilots, with fewer staff, temporary facilities, and basic technology provide lessons learned and may result in some proactive collaboration between units within the force and across municipal executive leadership. Data is still largely fragmented, but there is greater understanding about the governance, process, culture, and data changes needed to reach the long-term strategic vision. High-priority areas — sensors, video, or other “things” — begin to get investment at this stage.</td>
<td>Example: Washington, D.C.</td>
</tr>
<tr>
<td>Repeatable</td>
<td>The goal of the repeatable stage of maturity is improved outcomes and service delivery as a result of repeatable, standard processes within the intelligence center, with far better use of information, and the coordination of initiatives between units and out to involved jurisdictions or partners (i.e., FBI, RCMP, and DOJ). Typically, in this phase, agencies recognize that they need to polish and refine how information is coming in, being used, and shared, but there is a recognition that organizational performance remains suboptimal.</td>
<td>Examples: Detroit, York, and Toronto</td>
</tr>
<tr>
<td>Managed</td>
<td>At the managed stage, the intelligence center's vision and implementation plan are accepted and formalized with documentation, KPIs, and timelines for achieving specific goals. Strategy is implemented by a formal advisory team with funding and budgetary support. Technology plans are longer term and include innovation accelerators such as IoT, robotics, drones, and cognitive analytics. The aim at this stage is to have the center's strategy and digital transformation goals in place, resulting in better response times, better predictability, and the achievement of social and financial goals and desired outcomes.</td>
<td>Examples: Calgary, Chicago, and Seattle</td>
</tr>
<tr>
<td>Optimized</td>
<td>Agencies in this phase have an agile center strategy and consolidated IT and data sources. A process focused on continuous improvement delivers superior outcomes and differentiation from the way crime has been traditionally managed. A culture of innovation and engagement coupled with technology investments in cloud-based open platforms, broadband connectivity, and edge data collection devices support key outcomes. Data is a shared, quality asset supported by information sharing policies and real-time visualization in the manner most suited to the needs of personnel. In this phase, there is considerable quality control of information and data sources and automated partnerships between previously siloed parts of the police organization. This can take a fair bit of time as the existing policing hierarchy struggles against changing the way it works.</td>
<td>Examples: NYC, Memphis, Boston, and Houston</td>
</tr>
</tbody>
</table>
Appendix B: Vendor Assessment & Big Data Taxonomy

- Vendor Assessment Guide
Appendix C: RTOC/RTCC Interview Guide

- RTOC/RTCC interview guide
Appendix D: Scoring Algorithm & Weights

1. Based on current and planned product features, vendors were assigned a point for each feature. Over 65 product features were assessed.

Features were grouped into 12 categories and the points assigned were standardized to a score between 0 and 5:
1. Query, Reporting & Analysis
2. Advanced and Predictive Analytics
3. Content Analytics
4. Search
5. Spatial Information & Location Analytics
6. Cognitive and Artificial Intelligence
7. Analytic Data Integration and Integrity
8. Types of Data
9. Analytic Data Management
10. Continuous Analytics (used for real-time and near-real-time decision support and automation)
11. Deployment Models
12. Mobile Capabilities

A point was assigned for each of the 25 current and planned visualization features assessed. Visualization was treated as a separate category from other product attributes to reflect its importance.

4. The visualization score was standardized to a score between 0 and 5.

Additionally, the following current and future corporate attributes were also assessed on a 0 to 5 scale:
- Revenue growth
- % of revenue generated in North American
- R&D investment
- Integration capabilities
- Number of law enforcement customers signed in last 3 years
- Customer satisfaction
- % of Revenue generated in public safety or law enforcement
- Sales coverage model
- Licensing options

5. Corporate attributes were grouped into the following 3 categories:
- Company background (Revenue growth, % of rev. in NA, R&D investment)
- Service capabilities (integration capabilities)
- Customer base (# of law enforcement customers signed in last 3 years, customer sat.)
- Market strategy (% of rev. from law enforcement, sales coverage model, licensing options)
- Where two or more attributes were grouped, a simple average was used to create a score between 0 and 5
### Product Sub-Criteria

<table>
<thead>
<tr>
<th>Product Sub-Criteria</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Query, Reporting &amp; Analysis</td>
<td>5%</td>
</tr>
<tr>
<td>Advanced and Predictive Analytics</td>
<td>10%</td>
</tr>
<tr>
<td>Content Analytics</td>
<td>10%</td>
</tr>
<tr>
<td>Search</td>
<td>5%</td>
</tr>
<tr>
<td>Spatial Information &amp; Location Analytics</td>
<td>10%</td>
</tr>
<tr>
<td>Cognitive and Artificial Intelligence</td>
<td>10%</td>
</tr>
<tr>
<td>Analytic Data Integration and Integrity</td>
<td>10%</td>
</tr>
<tr>
<td>Types of Data</td>
<td>10%</td>
</tr>
<tr>
<td>Analytic Data Management</td>
<td>5%</td>
</tr>
<tr>
<td>Continuous Analytics</td>
<td>10%</td>
</tr>
<tr>
<td>Deployment Models</td>
<td>5%</td>
</tr>
<tr>
<td>Mobile Capabilities</td>
<td>10%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

### Assessment Criteria

<table>
<thead>
<tr>
<th>Assessment Criteria</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Company Background</td>
<td>5%</td>
</tr>
<tr>
<td><strong>Product Features</strong></td>
<td><strong>25%</strong></td>
</tr>
<tr>
<td>Visualization Features</td>
<td>25%</td>
</tr>
<tr>
<td>Service Capabilities</td>
<td>20%</td>
</tr>
<tr>
<td>Customer Base</td>
<td>15%</td>
</tr>
<tr>
<td>Market Strategy</td>
<td>10%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>