Developing the NYPD's Information Technology

"The democratization of data has become the central theme of the NYPD's technology planning and future: the concept of placing information, real-time analysis, and intelligence directly in the hands of officers, whether they are at a desk or in the field, to promote safety, efficiency, and effectiveness."

The major technology initiatives of the previous NYPD administration were focused on organizing and consolidating data for law enforcement use. Yet, until recently, only a handful of specialized commands had access to the Department's many sources of data. Commissioner William Bratton made it a priority for the Information Technology Bureau to open these data sources to the entire Department. The democratization of data has become the central theme of the NYPD's technology planning and future: the concept of placing information, real-time analysis, and intelligence directly in the hands of officers, whether they are at a desk or in the field, to promote safety, efficiency, and effectiveness.

In the 21st century, all NYPD officers should have direct, self-service access to data from all sources appropriate to the performance of their duties, with the exception of certain highly sensitive or legally constrained sources. Self-service, rather than service through an intermediary, provides a level of access and immediacy that will greatly enhance the speed and quality of investigations as well as the response to incidents.

REFORMS UNDER COMMISSIONER KELLY

Prior to 2002, the Department's information technology capabilities were managed by police officers as opposed to IT professionals. When Commissioner Raymond Kelly was appointed by Mayor Bloomberg in 2002, the new commissioner abolished the title chief of Information Technology and appointed the Office of Information Technology's (OIT) first deputy commissioner, James Onalfo. Unlike the police chiefs who had run OIT before him, Deputy Commissioner Onalfo had a background in commercial information technology.

The Bloomberg Administration and Commissioner Kelly ensured that OIT had the resources to develop new and revolutionary systems, and the Department made enormous strides on the information technology front. OIT became increasingly civilianized, developed a preliminary disaster recovery system, established digital arrest processing (commonly known as OMNIFORM), provided email for all executives and upgraded its network.

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OIT also developed an analytic and investigative support suite unlike anything the Department had ever seen. On top of the newly developed digital arrest processing system, OIT built the Crime Data Warehouse (CDW), COGNOS, the Real Time Crime Center (RTCC), the Enterprise Case Management System (ECMS) for managing investigative cases and a license plate reader database. These systems brought the Department's crime analytics into the 21st Century and provided vastly improved technology in support of NYPD's overall mission.

ACHIEVING DATA DEMOCRATIZATION

To make data democratization a reality, the Department must make significant investments in infrastructure, applications, security, platform consolidation and network. The Office of Information Technology has been reconstituted as the Information Technology Bureau. The bureau has

estimated a cost of $350 million to complete the modernization of the IT landscape at the NYPD necessary to meet the Department's current and future operational needs. Essentially, the investment will provide the ground from which new Department applications and capabilities can grow. An additional $83 million will be needed over the next five years to support information exchange with other city, state, and federal law enforcement agencies and with public safety and criminal justice entities.

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Neither the complexity nor the necessity of this undertaking should be underestimated. Technology has changed dramatically in the decade or more since much of the Department's existing information technology systems were built. The Department's information technology infrastructure, platforms, and applications are currently a mix of aging systems, supported by end-of-life hardware, built on decades-old infrastructure, and run on unsupported platforms. The solution cannot be limited to improving certain applications or swaping out pieces of hardware. The solution must be wholesale replacement of the Department's information technology systems. And that is what Commissioner Bratton has set out to do.

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UPGRADING THE NYPD'S NETWORK: FINEST 2.0

The series of wholesale replacements will begin at the most fundamental level, the network across which all NYPD data traverses. The Department's main network, called the FINEST network, was designed in 2002 to support only basic data applications. Over the past 12 years, the Department has been adding to the FINEST network in a piecemeal way, resulting in a network capability that has been insufficient in four key areas:

1. The capability to reliably transmit high-bandwidth data;
2. The capability to support best security practices;
3. The capability to support a reliable failover system;
4. And cost effectiveness.

Historically, the NYPD has been largely reliant on leases with telecommunications providers resulting in both high costs and generally insufficient network capability. Consequently, the NYPD has decided to build a new network, called FINEST 2.0, with proprietary fiber.

- The Information Technology Bureau is in the process of building this new network by running hundreds of miles of fiber-optic lines, ultimately connecting every NYPD facility in the city. This will increase bandwidth to the precincts by a factor of 100 times. In addition, diverse routing paths will ensure reliability through redundancy.
- By replacing the leased lines with proprietary fiber, the Department will benefit from lower lifetime costs as well as the capability to support high-bandwidth applications, including video, video teleconferencing and voice-over-IP, among other beneficial capabilities. The cost for the Finest 2.0 network to connect all NYPD facilities has been estimated at $53 million.
- The NYPD will not stop there. Plans are in place to expand the fiber network to connect non-NYPD sites that have camera feeds or other data sources that the Department wishes to access in real-time. For example, the New York City Housing Authority (NYCHA) has spent millions of dollars installing cameras at its facilities, but the NYPD does not have access to these feeds because its current network does not connect to NYCHA. The NYPD cannot view these cameras in real-time or use them efficiently during investigations. The estimated five-year total to build a new network that connects not only all NYPD facilities but also NYCHA developments and other city agencies is $104 million. The NYPD intends to expand on the fiber network in a cost-efficient manner by leveraging existing city resources, such as the private fiber cables owned by other agencies.

UPGRADING THE DEPARTMENT'S DATACENTERS

In addition to the network itself, the NYPD datacenter is the other key piece of information technology infrastructure that currently constrains the goal of democratizing data across the Department. The Department's progress in building out a number of information technology capabilities has been stalled because of the lack of appropriate datacenter space.

Datacenters house computing equipment, servers, storage and network gear to enable data processing and storage. In general, datacenters must have physical space for equipment, highly redundant electrical power, and adequate cooling. The primary NYPD datacenter is severely constrained in physical space, power and cooling capacity. These datacenter constraints, as well as the fact that many of the NYPD's critical systems were developed on antiquated platforms for which maintenance is costly and operationally complex, have stymied the NYPD's ability to build computing and storage capabilities to support the Department's operational, investigative and analytic needs.

- The challenges of the current NYPD's datacenter can be overcome by moving to a hybrid datacenter solution that leverages on-premises, off-premises, and cloud models.
    - o The primary NYPD datacenter sits on a floor in One Police Plaza, a building designed and constructed in the 1960s. It is moving to a new space, away from the headquarters building, specifically designed as a datacenter. The new facility offers more rack space, as well as adequate cooling and power. ITB is in the process of outfitting the new center with new equipment.
    - o In the short-term, the NYPD will use some of the datacenter space at its current location as a backup datacenter. Ultimately, the NYPD's backup datacenter also will move to a new, modern datacenter, when the facility, chosen to house the back-up datacenter becomes available.

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    - o The two redundant datacenters will be complemented with cloud capabilities that provide low cost, high reliability, ample security, and enormous flexibility. The estimated five-year costs are $64 million for the primary datacenter and $19 million for the backup center.
- The NYPD will also seek to remove antiquated computing platforms and bring the workload to a standardized NYPD platform using virtual machines that will consolidate systems, cut costs and reduce operational complexity. These improvements will cost an estimated $16 million over the next five years.

BUILDING THE NYPD'S FIRST COMPREHENSIVE DATA FUSION SYSTEM

From 2002 to 2005, the NYPD worked with IBM to aggregate existing databases in the Crime Data Warehouse (CDW), providing consolidated access to certain data sources that originated in different operational applications. The Crime Data Warehouse includes police databases that track arrests, complaints and criminal summonses, among other things.

The amount of information available through the Crime Data Warehouse is astonishingly large and incomparable to other law enforcement and public safety agencies. Yet, the consolidation remains incomplete. Numerous data sources remain separated from the Crime Data Warehouse in individual applications. Moreover, the Crime Data Warehouse does not accommodate real-time access to data and provides only minimal data normalization.

In the performance of their duties, members of the service often have to draw from a number of different data sources in seven key areas:

1. NYPD internal databases (e.g., arrests, complaints, etc.);

2. Internal Computer Aided Dispatch (CAD) data;

3. Sensor data, both internal and external (e.g., CCTV, license plate readers, radiation sensors, and chemical sensors);

4. External city data (e.g., locations of public schools)

5. State databases (e.g., state warrants and Department of Motor Vehicles), regional databases and federal databases (e.g., Terrorist Watch List and fusion center data)

6. External information aggregators;

7. Social media

The Information Technology Bureau is working to develop a system to contextualize these seven data sources with respect to each other and to enable automated correlations among the sources. Contextualization will enhance an officer's understanding of an event or an entity by drawing on all relevant information at the Department's disposal and establishing a fuller picture. When the Data Fusion Project is complete, officers will be able to view data from one data source in the context of data from the other data sources.

- The Information Technology Bureau will make data collected by the Department immediately available for use. Officers should have the most complete, up-to-date information to inform real-time response to events or incidents.

- The NYPD will seek to integrate more data from CCTVs, sensors, other city agencies (e.g., Administration for Children's Services, Department of Health and Mental Hygiene, and Department of Education), and social media. Integrating new data will promote preventative policing and enhance collaboration.

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The five-year cost to develop the appropriate data architecture to begin to accommodate these data fusion needs is estimated at $10 million.

EXPANDING THE DOMAIN AWARENESS SYSTEM (DAS) AND LMSI

Beginning in 2009, the NYPD, in partnership with Microsoft, built a powerful counterterrorism and policing tool called the Domain Awareness System (DAS). The DAS is a central platform used to aggregate data from internal and external closed-circuit television cameras (CCTV), license plate readers (LPRs), and environmental sensors, as well as 911 calls and other NYPD databases. The DAS uses an interactive dashboard interface to display real-time alerts whenever a 911 call is received or a sensor is triggered. The DAS also includes mapping features that make it possible to survey and track targets. The DAS was originally built to support the Lower Manhattan Security Initiative (LMSI) – a public-private partnership – but has since expanded to cover the entire city, giving NYPD personnel direct access to thousands of cameras owned and operated by private organizations. Until the development of the mobility platform and the mobile DAS system described below, the full capabilities of DAS have only been available to the Counterterrorism Bureau and a few other specially trained officers on desktop computers. As the NYPD upgrades its network, access to all DAS capabilities and resources will be expanded to all NYPD's commands.

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In 2012, the NYPD entered into a revenue sharing agreement with Microsoft under which the city will receive 30 percent of gross revenues from Microsoft's sales of DAS, as well as any updates or capabilities developed for other DAS customers. The city made major contributions to the

design of DAS, and the money received for this intellectual property through sales of DAS can be used to support new and innovative counterterrorism programs. The creation and utilization of the DAS system and its leveraging of LMSI's data will serve as a model for systems the NYPD develops in the future.

THE NYPD MOBILITY PLATFORM AND THE MOBILE VERSION OF DAS

Because much of police work occurs in the field, making data accessible to the field can significantly improve the Department's effectiveness. For this reason, mobile data platforms will be perhaps the single largest driver of information technology growth in the Department over the next several years. With funding provided by Mayor Bill de Blasio and New York County District Attorney Cyrus R. Vance, Jr., the NYPD will undertake a $140 million mobility initiative to transform the way police officers perform their duties . The mobility initiative will place a tablet in every police car and provide a smartphone to every uniformed member of the service. In the next few years, these devices will give every police officer access to many of the technological capabilities of the Department from the field. The mobility initiative will enhance patrol efficiencies, increase officer safety, allow for direct communications, and strengthen the Department's already robust counterterrorism efforts. It will also increase information sharing between the NYPD, prosecutors, and other law enforcement agencies.

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- Any coherent strategy for building a mobility capability on this scale must holistically account for networking, operating system, devices, application configuration, and security.
- Funds will be allocated for data plans, infrastructure to support the delivery of the applications to 41,000 endpoints, security to manage the devices and protect the network, development of network capacity, resiliency, and redundancy and ongoing technical support.
- In the coming years, the NYPD anticipates incorporating features such as fingerprint scanning, which will allow for in-field identifications and warrant checks.

The NYPD has developed a mobile version of the Domain Awareness System (DAS) that the Department pioneered in the past five years to detect and prevent terrorist acts. Like the DAS itself, the Mobility Platform – including the hardware that supports it and the applications that run on it – was built separate and apart from the rest of the NYPD's dated, increasingly unreliable technology systems. With the purchase of the new tablets and phones, the NYPD can extend to all its officers the world-class counterterror and crime-fighting technologies that the mobile DAS and the Mobility Platform can provide.

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The Mobility Platform will deliver the following in-field capabilities, which will have an immediate impact on officer efficiency, safety and effectiveness:

- Patrol Efficiencies – Patrol officers will have universal search capabilities, including access to the majority of NYPD databases and will be able to run record checks in field without calling dispatch. The tablets and phones will also receive immediate notifications of 911 calls, often prior to radio dispatch, enabling swifter response to breaking crime and requests for service. Within the next year, officers also will have capability to enter reports in the field and to make certain fingerprint identifications without returning to the precinct.

- Officer Safety Features ¬– Real-time 911 data, including call-taker notes, the past history of police actions at dispatched locations, and a list of all 911 calls to any location will be available to every officer responding to any call. Officers will have the clearest possible picture of what they are walking into. Within

six months, GPS applications will provide officers with mapped locations of other police cars in the vicinity so they can gauge the availability of back-up cars and otherwise coordinate with other patrols. GPS will also enable better patrol oversight by supervisors and more vigorous and efficient management of patrol resources than is currently possible through radio dispatch.

- Detective Support – Detectives working breaking cases in the field will have access to the full range of investigative databases, making every detective a walking Real Time Crime Center. The detectives will be tied into the Department's Enterprise Case Management System, allowing them to update case folders from the field.

- Direct and Decentralized Communications – Wanted posters and missing persons photos can be sent to every police officer immediately, rather than awaiting distribution at the precincts and perhaps losing an opportunity to make an arrest or a rescue. Over the next year, the NYPD will build out the capability for domestic violence victim documentation, crime scene photos, and other photos and videos collected in the field to be readily communicated and ingested through the Mobile Platform. E-mail addresses for every officer will improve Department communications across the board.

- Counterterrorism Force Multiplier – The ability to alert every officer will have particular benefits for counterterrorism. Alerts in a breaking terrorist situation, which go now to centralized locations, will move directly to each officer's device. A license plate reader on a bridge, for instance, could "ping" a notification of a plate identified as having a connection to terrorists to the entire department, multiplying, in effect, the NYPD's 1,000 counterterror cops to 35,000.

SHOTSPOTTER GUNSHOT DETECTION SENSORS

The NYPD is currently enhancing of the sensor capabilities of its Domain Awareness System (DAS) by adding audio sensors to the DAS network of cameras, license plate readers, and environmental sensors. The Department has a pilot program under way in select precincts in the Bronx and Brooklyn using ShotSpotter technology to identify and locate gunfire with audio sensors. The precincts in question have been identified as having a high level of reported shootings and shots fired. Because it is tied to the DAS, the ShotSpotter technology can be synchronized with CCTV cameras in vicinity of the shots. The system provides an alert, pulls up the relevant CCTV, identifies the likely address of the shots, preserves an audio record of the shots, determines the number of rounds fired and some times even the type of weapon used. If there are multiple shots, and the shooter is moving, it can often determine the direction of travel.

The ShotSpotter technology has proven accurate, and early experience with the system seems to demonstrate that only about 20 percent of shots fired results in 911 calls. By identifying the locations of the other 80 percent, the technology is providing a fare clearer picture of what is happening on the street with respect to shootings and shots fired and of how to deploy police resources to counter gun violence. Occasionally, responding units arrive quickly enough to arrest the shooter. In many more cases, shell casings are located that assist the Detective Bureau in the investigation of shooting incidents and murders. The cost of ShotSpotter is estimated to be about $2.5 million per years

DATA ANALYTICS/PREDICTIVE POLICING

The rapid growth in Department data has increased the opportunities to apply immensely powerful analytical tools to NYPD operations and processes. In the area of data analytics, the NYPD must develop analytic engines that derive actionable intelligence and decision support from its raw data. Current analytic capabilities, for the most part narrowly focused on statistics, are insufficient to support the NYPD's full vision of preventive policing. The NYPD is seeking to develop

capabilities, including predictive policing, pattern analysis, and correlation engines.

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- Department documents that publish statistical information will be modernized and digitized, providing a direct link between statistical output and the underlying data. The weekly CompStat book, a paper document that collects current crime data on a weekly, 28-day period and year-to-date basis, has been transformed into a real time function that provides the most up-to-date mapping, data analytics, and reporting tools. The new electronic CompStat book also allows the use of more advanced metrics in the CompStat process as part of the performance assessment of field commanders, precincts and units.

- Predictive policing will allow the NYPD to make better data-driven decisions about deployments. The Department has been experimenting with custom-built algorithms that have been shown to be better predictors of crime incidents than traditional hotspot analysis. Drawing on historical data about past crime, including time, date, seasonal patterns, location, and crime type, the algorithms provide precinct and other commanders with an informed guide to emerging crime patterns and the deployment of resources within their respective areas of command. The use of algorithms saves time for human crime analysts who can focus more intently on other types of crime analysis.

The five-year cost of implementing these capabilities is estimated at $45 million.

APPLICATION DEVELOPMENT

Applications should provide users with mechanisms to record and access data and to present data in ways that support users' work processes. The Department's current suite of hundreds of applications is significantly disabled in performing these functions, largely because the NYPD has not developed or adopted a cross-application technical architecture standard. The Department's applications lack standardization in eight key areas:

1. Hardware and software frameworks;
2. Security models;
3. User interfaces;
4. Sign-on authorization models;
5. Data architectures;
6. Data classification, retention and coding standards;
7. Help documentation and training;
8. And maintenance paradigms.

Accordingly, the Information Technology Bureau will build a new, more standardized and streamlined suite of applications. This will increase efficiency and decrease expense by allowing for cost-effective management and maintenance.

- These applications will serve several main functions, such as:
  - Real-time alerts;
  - Universal data queries;
  - Electronic report generation;
  - In-field data collection;
  - Real-time asset tracking;
  - Comprehensive analytics, including crime mapping;
  - Case management;
  - And administrative assessment, including workflow and activity tracking.

- As part of the mobility initiative, the NYPD must design applications for a mobile environment. The NYPD already has a mobile version of its Domain Awareness System (DAS), which has many of the capabilities of the desktop version. The desktop version of DAS is being enhanced to include features such as:
    - o Predictive policing;
    - o Vehicle location through GPS;
    - o Business Intelligence to support more robust CompStat reporting.

The five-year total cost to decommission legacy applications and consolidate capabilities on a handful of platforms is estimated at $100 million.

BODY CAMERAS

The NYPD is conducting a body-worn camera pilot project to evaluate the different types of technology, evidence management, and data storage available, and to develop policies for the use of body-worn cameras. Body-worn camera systems have proven to be an effective tool in documenting duty-related activity. The pilot project will examine whether body-worn cameras:

1. Contribute to officer safety;
2. Provide evidence for criminal prosecutions;
3. Help to resolve citizen complaints;
4. And foster positive relations with the community.

The Police Foundation purchased 60 body-worn cameras for an NYPD pilot program, and the Department has deployed them in five precincts throughout the City and in one Housing Bureau police service area.

- The experiences of patrol officers using the cameras during the pilot program will help the NYPD determine the requisite data storage model (e.g. in the cloud vs. on premises) and the requisite evidence management model to support a larger roll-out of body-worn cameras.
- An evaluation of the respective impacts of various models on both the Department's standard operating procedures and current technology infrastructure will enable the Information Technology Bureau to determine the size, scope, and timing of a phased roll-out of body-worn cameras to a larger population of patrol officers.

The cost of the body-worn cameras is relatively small, but the cost of data storage can be extremely large. The Office of Information Technology anticipates an up-front investment of approximately $5 million for the initial purchase of devices, and an annually recurring cost in the tens of millions of dollars for storage.

EMAIL FOR ALL MEMBERS OF SERVICE

In 2014, only 22,000 members of the service, or approximately 40 percent of the Department, had access to Department-issued email accounts. Because they lack Department-issued accounts, many members of the service have been using personal accounts improperly to conduct Department business.

The NYPD is in the process of implementing a new email system that leverages the cloud to provide email addresses for all 50,000 members of service, making possible the immediate transmission of information to any number of NYPD employees and also allowing the NYPD to track and retrieve its communications as needed.

21ST CENTURY TECHNOLOGY

The Information Technology Bureau is addressing a range of problems and opportunities in the NYPD to provide the Department with the full benefits of 21st Century policing technology. From installation of a new fiber optic network connecting all Department facilities; to the build out of a new datacenter with the requisite space and the requisite cooling and power capabilities; to the development of a Mobility Platform to provide the fullest possible data access to cops in the field; to a standardized, streamlined suite

of NYPD applications; to the something as simple as email addresses for every police officer, ITB is implementing holistic solutions that will knit together a seamless technology web – fast, flexible and comprehensive. Policing has always been an information business, and the management of information has always been essential to success. Equipped as never before with information tools of the highest order, tomorrow's NYPD police officers will achieve a critical edge in the fight against crime and their daily efforts to serve the people of New York.