Reimagining public safety operations

A next-generation approach for incident management

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Cities today are aspiring to become cognitive to enhance livability, creating memories and experiences that centralise the human experience. A key pillar of a cognitive city is the safety of its citizens, supported by the capability of its public safety agencies (PSA). Today PSAs still rely on traditional operational approaches to respond to an incident and are marked by limited data sharing, interoperability, and functionality.

Therefore, PSAs are seeing a need to adopt next-generation technology-driven operations that enable them to address complex incidents and thus meet the growing expectations of their citizens.

This paper outlines how the PSAs are currently leading the operations, some of the current challenges faced by them and the key accelerators that will further propel them toward next-generation operations.

In the evolving landscape of public safety operations, the transformative force multiplier of technology is undeniable. Integrated Operation Centers (IOC) herald this evolution, facilitating unparalleled cooperation among agencies through seamless data sharing and unified situational perspectives.

The paradigm shifts toward ensuring functionality by harnessing advanced technology such as intelligence monitoring, immersive technologies and IOCs, coupled with cognitive insights correlation.

This paper delves into how cutting-edge technology is being applied to redefine the future of public safety operations, promising a secure tomorrow for all.
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In an era marked by rapid technological advancement and a shifting global landscape, the nature of public safety operations around the world is undergoing significant transformation. The traditional paradigms, built on foundational principles and practices that served communities for decades, are now being revisited, refined, and reinvented in response to the unique public safety challenges of the 21st century. This paper delves into the evolution of public safety agency operations, coupled with the technological innovations of the 21st century that are reshaping the future of public safety.

Historically, public safety agency operations have been grounded in a reactive model, responding to incidents and emergencies as they arise. But the multifaceted challenges of today, from cyber threats to urbanisation pressures, demand more proactive, integrated, and agile operational strategies. The complexities associated with these challenges not only test the capabilities of our traditional systems but also compel us to innovate and adapt in unprecedented ways.

"Public safety agencies can maximise the benefits of emerging technologies by establishing a cognitive operating model"
Across the globe, traditional public safety agencies have largely developed incident response models that follow a similar theme. The following map visually represents this global trend, with focused references from the USA, UK, Finland, and Australia.

**United States of America**

The Police Executive Research Forum has developed a Critical Response Toolkit for First-Line Supervisors (FLS). This includes what to do before a critical incident such as investing in first-line supervisors by preparing and training them well before they encounter a critical incidents.

The next stage in the toolkit involves managing a critical incident and this includes several strategies for effectively managing a critical incident including The Police Executive Research Forum (PERF) Critical Decision-Making Model. The final stage is post-critical incident and this involves assessing how the response went and is essential for improving both individual and agency performance.

In 2017, the Las Vegas, Nevada, Metropolitan Police Department (LVMPD) adopted a series of interventions to reduce gang and gun violence across Las Vegas. LVMPD developed the Place Network Investigations (PNI) strategy which follows the SARA model (scanning, analysis, response, and assessment).

**United Kingdom**

The United Kingdom has pioneered a world-leading national approach to resilience and emergency response. Central to this is the Integrated Emergency Management (IEM), a concept aimed at ALL responder organisations across the UK. This comprehensive approach encompasses six interconnected activities: Anticipate - focus on horizon scanning for potential hazards; Assess - analyse emergencies to understand their likely occurrence and impact; Prevent - reduce the likelihood or impacts of a crisis; Prepare - develop and validate emergency plans; Respond - address the immediate effects of an emergency; and Recover - rebuild and restore post-emergency.

The Joint Emergency Services Interoperability Programme (JESIP) is integral to this collaborative approach, which ensures effective collaborative working across these agencies.

**Finland**

In Finland, comprehensive security is the cooperation model of Finnish preparedness, where vital societal functions are handled together by authorities, businesses, NGOs and citizens.

This model promotes inter-agency collaboration, encompassing fire and rescue departments, medical services, police, volunteer organizations, and the public. Central to this approach is the integration of prevention, preparedness, and communication strategies. The model's objective is not only to respond efficiently to emergencies but also to reduce incident risks through shared information and coordinated efforts, ensuring a unified approach to both everyday incidents and major disasters.

**Australia**

In response to terrorist threats, Victoria Police in Australia have developed several current and future initiatives including SHIELD that aims to Prevent, Disrupt, Protect and Respond to terror incidents. SHIELD focuses on increasing resilience in the Victorian community by building a strong security culture.

Another example of traditional public safety operations in Australia is ACT Policing which is the community policing arm of the Australian Federal Police (AFP). ACT policing comprises of two teams, ‘Planning’, and ‘Emergency Management’. Each team works towards increasing the preparedness and response capabilities of ACT Policing for Major Events, Guest of Government visits and major incidents. Major incidents include, but are not limited to terrorism, natural disasters, health pandemics, recovery operations and crowded places.
In the realm of public safety, there’s a longstanding Resilience Cycle, which provides the phases for emergency management that has been the backbone of public safety agencies worldwide. This traditional model is built on a systematic progression: starting with Anticipate & Assess to gauge potential threats, their probability and impact followed by steps to Prevent any adverse incidents. The Prepare phase ensures readiness, while the Response phase starts when an incident occurs, deploying immediate actions. Finally, the Recovery phase involves the restoration of essential services and communities following an incident. Together, these stages offer a comprehensive approach to assessing risk, managing and mitigating incidents.

This phase is dedicated to forecasting potential risks and challenges by analysing data, trends, and intelligence inputs. The goal is to understand possible future risks and their implications. This foresight is crucial in guiding subsequent phases and allocating resources effectively.

Focuses on proactive measures to deter or reduce the likelihood of threats materialising. This includes public awareness campaigns, security enhancements, and early interventions. Ensuring safety and mitigating risks are paramount in this phase.

Agencies establish plans, protocols, and strategies to handle anticipated threats. Resources are mobilised, personnel are trained, and backup plans are developed to ensure the best possible response in case of an incident. Collaborative exercises and drills are often conducted to test and improve readiness.

Represents the immediate actions taken to mitigate the adverse impacts of an emergency, safeguarding lives and infrastructure. This phase is characterised by rapid decision-making, effective resource allocation, and inter-agency collaboration, ensuring that the affected community receives timely assistance and a foundation for subsequent recovery.

Initiated post-incident, the 'Recovery' phase focuses on both immediate and long-term operations. Immediately, it aims to restore essential services and ensure public safety, providing a foundation for normalcy. Long-term efforts are geared towards restoring business-as-usual operations, rehabilitating affected areas or communities, and supporting victims. The 'Build Back Better' ethos is adopted to ensure the community is more resilient than before. Furthermore, comprehensive evaluations are conducted to draw lessons for future enhancements and improvement.
Challenges with existing public safety operations

As the public safety landscapes evolve, existing operational frameworks are facing unprecedented challenges across strategy, operations and technology. Many agencies grapple with outdated legacy systems, disparate public safety platforms, and inconsistent operating procedures. Additionally, in recent times challenges such as staffing constraints, governance discrepancies, and cybersecurity vulnerabilities have emerged. The table below delves into these key challenges, offering insights into their implications for public safety agency operations.

### Key Challenges

#### Strategy
- Lack of specialized technical and operational resources - Given the evolving threats, there is an urgent need to design, recruit, train and empower a committed, agile workforce for 21st-century public safety. Capabilities of existing workforce need to be assessed to make it ‘fit for purpose’.
- Limited innovation culture - Public safety agencies generally rely on COTS solutions or third party partners for system customization. This hinders the adoption of emerging technologies.
- Dispatcher skill-gap - Call-takers can sometimes lack the tools and training to send the right response during high pressure incidents which is an inefficient use of public safety resources.
- Outdated risk assessments - With increasing hazards such as floods, wildfires and criminal activity, agencies that do not periodically review and update their risk registers struggle to ensure safe & resilient communities.
- Non alignment of strategy and budgeting - Public safety agencies need to continuously revisit their strategic objectives for providing services to the society while addressing technology enabled challenges. Agile strategic approach aligned with a clear vision and mission should be key to important decisions.

#### Operations
- Minimal interagency collaboration during incident response - Major incidents always require a multi-agency response and there are challenges in ensuring seamless collaboration and communication across public safety agencies and jurisdictions due to different incident management tools and misaligned ConOps.
- Slow adoption of regulatory implications - Legislative changes affect public safety operations and agencies do not have an agile operating model to adapt to the regulatory changes (for example: changes in facial recognition rules must be incorporated in the algorithms).
- Ineffective communication - Traditional mission-critical systems lack QoS and extended coverage for remote, rural areas, satellite integration, deep indoor coverage, and national/international roaming.
- Rigid Operating model - Public safety agencies require lateral thinking and agile models. A key goal should be future-proofing public safety agencies with innovative operating models that appropriately prioritise demand and resources, boosting efficiency at the same time.

#### Technology
- Disparate & siloed systems - The lack of standardization and interoperability between public safety agency systems can obstruct seamless information flow, create data redundancies, and complicate inter-agency collaboration. Such fragmentation often slows decision-making processes and hampers the effectiveness of coordinated incident response.
- Increased digital security threats - With an increased reliance on digital tools, public safety operations are increasingly vulnerable to cyber threats, metaverse hacks, and data breaches. Thus there is a need for an integrated physical and cyber security platform.
- Vendor locked solutions - The proprietary, black-box approach from vendors is no longer acceptable in today's world. In fact, it has been shown that open source solutions can actually be more secure, although supply chains must be vetted carefully by PSAs. Systems needs to be secure by design and open to scrutiny based on global standards supported by a competitive, multi-vendor ecosystem.

### Key global incidents impacting public safety operations

**Hawaii Wildfires - 2023**

In August 2023 wildfires devastated Maui killing over 90 people becoming the deadliest in modern U.S. history. The early warning sirens had failed to sound which impacted residents being able to evacuate before the wildfire swept through the island.

**Suffolk Flooding - 2013**

Areas in Suffolk had suffered devastating effects from the most serious tidal surge in over 60 years. The 2013 event highlighted the blurred lines between response and recovery and a need to adapt the initial recovery effort to reflect that.

**Manchester Arena Bombing - 2017**

A suicide bomber detonated an improvised device outside the Manchester Arena. Lessons learnt on the response indicated that fire crews took more than two hours to attend the scene due to poor communication and lack of a Common Operating Picture.

**Hurricane Maria - 2017**

Hurricane Maria, a Category 5 storm, struck Puerto Rico in September 2017, causing the death of approximately 2,975 people. The hurricane inflicted an estimated $90 billion in damages, making it the third costliest tropical cyclone in U.S. history. The emergency response agencies faced significant criticism due to delays in aid distribution, logistical challenges, and inadequate pre-storm preparations.
The changing landscape of public safety operations

Public safety operations have traditionally involved linear processes and systematic protocols. In the past, we've followed a step-by-step approach, where the phases of 'response' and 'recovery' took place one after the other. However, modern technology can enable these phases to operate concurrently, allowing a quicker, more effective initial recovery phase and changing how we manage crises. With the help of advanced analytics, real-time data, and modern communication tools, agencies can act more flexibly, swiftly and accurately. As we embrace tools like Artificial Intelligence, Augmented Reality, and Fusion Technology, this enables the integration with a diverse set of data sources allowing for real-time correlation to enable faster analysis of risk data. Public safety agencies will not only react to incidents but will also adapt and improve continuously, leading to faster and more effective public safety measures.

The illustration below captures the essence of a next-generation public safety operational fabric model as it weaves through the public safety landscape of a city. It offers a visual journey of how intelligence, communication infrastructure, training, and other key layers seamlessly interlink the police, medical, and fire and rescue responder agencies. These interdependencies underscore the paramount importance of interoperability, ensuring that, regardless of the challenge, the city's safety mechanisms act in unison, enhancing efficiency and effectiveness in safeguarding its residents.
The changing landscape of public safety operations

Our proposed operational fabric comprises of several crucial components to redefine public safety operations. At its core, accurate intelligence guides decision-making. This is complemented by consistent data standards and protocols, ensuring unified and clear information flow. The common operating picture provides a real-time visual representation, enhancing situational awareness. Bolstering this is a robust communication infrastructure for seamless inter-agency interactions. All these elements are strengthened through continuous capacity building and training, ensuring personnel are always equipped with the latest skills and knowledge.

And anchoring this entire fabric, ensuring its coherence and functionality, are the foundational Concept of Operations (ConOps) and Standard Operating Procedures (SOPs).

Advantages

- **Enhanced situational awareness**: Public safety agencies benefit from a unified perspective of ongoing incidents, ensuring effective decision making and streamlining multi-agency response operations.
- **Unified communications**: With shared protocols and dedicated communication platforms amongst public safety agencies information exchange becomes efficient and instantaneous.
- **Harmonised operations**: The implementation of holistic CONOPs across public safety agencies eliminates overlaps, and ensures coordinated response efforts and efficient incident management.
- **Joint intelligence exchange**: Fostering a shared intelligence ecosystem that empowers public safety agencies to seamlessly share and benefit from correlated insights for enhanced and proactive decision making.
- **Continuous improvements**: The built-in feedback and review mechanisms ensure that public safety agencies have the capability to constantly refine, evolve and learn refine based on real-world incident scenarios.
In a world of evolving threats and challenges, public safety agencies must constantly innovate to stay ahead. A new public safety operational model comprising of "Predict, Pre-empt, Prescribe" considers a progressive approach to public safety that leverages advanced analytics, proactive strategies, and sustained prevention measures. This model represents a paradigm shift from traditional reactive methods to a holistic, proactive model. By accurately forecasting threats, intervening before they escalate, and implementing robust preventative protection measures, agencies can navigate the complexities of the modern landscape with enhanced agility and efficiency. This model doesn't just seek to address challenges; it aims to redefine the environment in which they arise, ushering in a new era of public safety. The illustration below provides an overview on each phase of the next generation public safety operational model:

**01 Predict**

A proactive pillar in next generation public safety operations, placing emphasis on intervening before threats or incidents fully materialise. By leveraging real-time data analytics, advanced urban surveillance, and cognitive insights, this phase enables agencies to strategically deploy resources, initiate early technology interventions, and enact measures that deter or diminish the impact of potential threats. In essence, "Pre-empt" is about strategic foresight and timely action, ensuring a step ahead in safeguarding communities.

**02 Pre-empt**

Through the application of advanced technologies like AI and machine learning, PSA's will have the capability to process vast amounts of data to identify patterns and trends. This technological prowess, combined with real-time data analytics, allows for the accurate forecasting and correlation of potential security & safety risks. By utilising predictive modelling, agencies can anticipate areas of concern ensuring they're always one step ahead of emerging threats or hazards.

**03 Prescribe**

For this phase, public safety agencies leverage insights from predictive analytics and pre-emptive measures to outline specific, actionable strategies. This phase focuses on ensuring that the most effective interventions and resources are deployed, optimising outcomes and enhancing the overall efficiency of public safety operations. This phase also embraces continuous learning which is subsequently embedded into the "predict" and "preempt" phase. This ensures an adaptive, responsive, and ever-evolving approach to public safety.
The changing landscape of public safety operations

Several weeks before a high-profile government conference there have been several suspicious security incidents throughout the city. Using the new public safety model of **Predict, Preempt and Prescribe**, we illustrate how public safety agencies can automatically detect unrelated security incidents, predict threats via pattern analysis and suggest proactive protection measures instantaneous via technology enabled force multipliers.

**Predict**

On further pattern analysis it was ascertained that a drone was also detected flying near a hotel where a senior government official and undertaking reconnaissance of planned vehicle routes from the hotel to the conference venue.

Facial recognition technology detected a known criminal within the group of people loitering near the hotel.

**Preempt**

Based on the insights generated, proactive measures can be taken to mitigate against potential threats during the government conference:

01 - Concept of Operations (CONOPs)  
Exaggeration of threat profile from business as usual to heightened threat mode. Increase in the number of vehicles screened at land border entries.

02 - Strategic Resourcing  
During the government conference Fire Brigade and Ambulance services are strategically deployed near the hotspots to minimise response times. Traffic police are also deployed at key road intersections to ensure smooth traffic flow.

**Prescribe**

03 - Enhanced Situational Awareness  
Deployment of a variety of counter-drone measures such as ground based jammers, to intercept rouge drones and mobile command centres to provide on-site coordination and inter-agency collaboration leading up to the government conference.

04 - Training Simulations  
Utilise XR/VR to provide immersive training environments, simulating real-world scenarios for public safety personnel.

05 - Real Time Communication  
Unified communication platform to foster seamless collaboration amongst public safety agencies (Police, Fire, Ambulance, etc)

Adoption of actionable strategies for efficient incident response  
01 - KPIs - Measuring the effectiveness and efficiency of prevention measures against agreed KPIs  
02 - Inter-agency communication  
High quality video and audio connectivity with the ability to transmit large amounts of data for seamless collaboration and coordinated action between agencies  
03 - Decision Support Systems  
Provides real-time recommendations based on situation data, assisting public safety officers in making informed decisions  
04 - Public feedback mechanisms  
Community engagement platforms used to provide feedback from the public that can inform and refine incident response strategies
The changing landscape of public safety operations

Based on the example scenario, specific futuristic technologies seamlessly align with the "Predict, Pre-empt, and Prescribe" model. These tools facilitate pinpoint threat anticipation, timely preemptive actions, and strategic prescriptions for optimal outcomes. The adoption of these technologies showcases the transformative potential for modern public safety operations.

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<thead>
<tr>
<th>Technology</th>
<th>Public Safety Operations</th>
<th>Remarks</th>
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<tr>
<td>4K Multi sensor camera with embedded analytics</td>
<td>Predict</td>
<td>Pre-empt</td>
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<tr>
<td>Facial recognition (FR)</td>
<td>Predict</td>
<td>Pre-empt</td>
</tr>
<tr>
<td>Social media monitoring</td>
<td>Predict</td>
<td></td>
</tr>
<tr>
<td>Counter-drone measures i.e Jammers, and spoofer</td>
<td>Predict</td>
<td>Pre-empt</td>
</tr>
<tr>
<td>Unified communication platforms</td>
<td>Predict</td>
<td>Pre-empt</td>
</tr>
<tr>
<td>Mobile command control center</td>
<td>Predict</td>
<td>Pre-empt</td>
</tr>
<tr>
<td>XR/VR</td>
<td></td>
<td>Pre-empt</td>
</tr>
<tr>
<td>Holographic display</td>
<td>Predict</td>
<td>Pre-empt</td>
</tr>
<tr>
<td>Community engagement portal</td>
<td></td>
<td></td>
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<tr>
<td>Cognitive public safety platform</td>
<td>Predict</td>
<td>Pre-empt</td>
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Accelerators for adoption of next-gen public safety operations

In order to accelerate the transition from traditional public safety operations to NextGen operations, key accelerators need to be adopted. These accelerators can be adopted as per the current state assessment of the Public Safety Agency (PSA) ranging from stakeholder involvement, ecosystem readiness, regulatory mandate, technology partners and other relevant parameters. To expedite the conceptualisation, design, implementation and adoption of the NextGen Operational Model, it is crucial to leverage key accelerators as shown below.

### Accelerators

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
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<tbody>
<tr>
<td><strong>User-centric approach</strong></td>
<td>Placing users at the center of the design process to ensure that their needs are taken into account, and the following are the key accelerators under this category:</td>
</tr>
<tr>
<td>Motivated leadership</td>
<td>Align user experience with requirements</td>
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<tr>
<td>Immersive training and capacity building programs for users</td>
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<td><strong>Innovation in the DNA</strong></td>
<td>Infusing innovation and creativity into the development and deployment to achieve optimality through leveraging emerging technologies, and the following are the key accelerators under this category:</td>
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<tr>
<td>Setting up of Innovation lab</td>
<td>Setup sandbox environment</td>
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<td>Proof of concepts and minimum viable product</td>
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<td><strong>Cognitive operating model</strong></td>
<td>Leveraging emerging technology including AI to transform the service and capabilities of the public safety agencies enabling improved response, decision making and efficiency. The following are the key accelerators under this category:</td>
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<tr>
<td>Delivery of futuristic services and capabilities</td>
<td>Agile organisational structure</td>
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<td>Integrated CONOPs</td>
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<tr>
<td><strong>Governance</strong></td>
<td>Establishing a robust and comprehensive governance structure to oversee and manage the implementation, and the following are the key accelerators under this category:</td>
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<tr>
<td>Establishment of dedicated entity / Special Purpose Vehicle (SPV)</td>
<td>MOUs with different participating agencies</td>
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<td>Robust PMO setup</td>
<td>Framework for KPI and SLA monitoring</td>
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<td><strong>Repurpose over recreate</strong></td>
<td>Reducing costs by renewing existing systems rather than building new ones, and the following are the key accelerators under this category:</td>
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<td>Leverage lessons learnt from others (leading practices)</td>
<td>Repurpose existing use cases over create</td>
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<tr>
<td>Adoption of open international standards</td>
<td>Leveraging proven design/simulation tools</td>
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<td><strong>Conducive environment</strong></td>
<td>Ensuring the availability of a favourable environment for all the needs of the implementation, and the following are the key accelerators under this category:</td>
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<tr>
<td>Enable wider tender participation</td>
<td>Ensure market scan / Expression of Interest (EOI) prior to procurement initiation</td>
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<tr>
<td>Adoption of open international standards</td>
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<tr>
<td><strong>Collaboration</strong></td>
<td>Fostering the participative efforts of all involved stakeholders from all relevant sectors, and the following are the key accelerators under this category:</td>
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<tr>
<td>Deployment of a PPP model</td>
<td>Co-creation with industry players</td>
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<tr>
<td>Leverage global expertise</td>
<td>Alignment with regulators</td>
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