THE BRIDGING RESEARCH & INTEROPERABILITY COLLABORATION

Public-safety in the 21 Century

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Expression of Interest Document (EOI)

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The Bridging Research & Interoperability Collaboration

TOWARDS THE 21ST CENTURY PUBLIC-SAFETY

PREFACE

Following discussions with the emergency services community, government organizations, researchers and associations, coordinated by the Collaborative Centre for Justice and Safety (CCJS) at the University of Regina, a decision was made to undertake an initiative broadly focused on emergency services interoperability. In this Expression-of-Interest document we cover The Bridging Research & Interoperability Centre (BRIC) initiative in terms of motivation, focus, vision, and activities, as well as defining interest groups, stakeholders, benefits and return-on-investment for the different interest groups. BRIC is designed to be part of the CCJS and to serve as an academic research and educational centre focused on a critical mass of leading-edge research and technology, as well as specialized education and training opportunities, to address the needs and challenges facing the police and public safety sector in Canada. The BRIC initiative is focused on uniting efforts of governance, policies, and digital technologies in order to effectively lead and proactively shape the 21st century public-safety endeavor.

The current approach to public-safety adapts technologies as they become available rather than influencing and leading the technologies to serve its immanent needs, alternatively, BRIC aims at changing this approach. One of the major downfalls could be seen as compatibility and integration. For instance, legacy and current radio technologies cannot interoperate without lengthy efforts towards one-to-one compatibility. Alternatively, fourth generation wireless broadband can be leveraged to create advanced mobile networks to serve current and future public-safety applications and to provide common interoperability. While interoperability is a clear and immediate issue, we present the broader view on how big-data can be consolidated, visualized and analyzed to serve public safety needs by embedding the governance and policy models. We are motivated by our deep understanding of the proliferation of issues that could develop by the lack of action. We understand the absolute need for collective collaboration between relevant stakeholders and have designed the BRIC initiative to ease the involvement of stakeholders and to bridge the gaps between seasoned professionals, academia, security professionals, policy makers, and researchers for the benefit of evolving effective public safety computing platforms.
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INTRODUCTION

The Bridging Research & Interoperability Centre (BRIC) initiative envisions a fully open, standards-based model; operated and maintained to balance local functionalities, regional coordination and national resource sharing. Such an approach would allow the use of current public-safety real-estate assets when deploying the new LTE system, thereby drastically reducing the capital required for deploying nationwide systems. The BRIC approach reduces long-term operating costs by avoiding the leasing costs prevalent in the commercial models, and by allowing future systems to adopt a blended model. The cost reduction results from the systematic focus on requirements, evaluation and implementation that is absent in the current system. The exponential benefits of achieving this balance cannot be predicted, just as the explosion of capabilities that commercial wireless technologies have enabled could not have been predicted several years ago. However, it must be a prime responsibility for BRIC to begin the true cooperative and collaborative efforts to lead the modern wireless evolution within the public-safety domain.

SCOPE

This Expression-of-Interest (EOI) document is focused on defining the major objective and the main highlights of the proposed BRIC initiative including equipment, tools, research personnel, vision, objectives, and approach. As such, this document is intended to be shared among the founding stakeholders listed in Appendix-A, in addition to the necessary sharing of information with granting agencies.

THE BRIC INITIATIVE

In order to understand the vision of the BRIC initiative, we first present the current state of public-safety computing. Following, we discuss the motivation and the vision of the BRIC initiative.

Current State of Public-Safety Computing

During the last two decades, the continuous and fast developments in digital communications and high technologies have led public safety agents to utilize streams of devices that seem consistent with each agent’s rules of governance, but prove incompatible when looking at the connectivity between public safety agencies. Typically, public safety agencies follow different rules in selecting the supporting technology rules to fit their individual needs, budgets, and the rules defining their governance and policies.

This practice has led to the spread of silos of systems, tools, and devices across the public-safety scene creating the complex problem of interoperability and inefficient sharing of information. Public safety agencies possess and operate wide ranges of systems, tools, and devices that are typically disconnected and
incompatible. As technologies get smarter and more sophisticated, a new course of development is possible, and with it, great benefits to public safety efforts.

Complicating the matter further, Canadian public-safety agencies do not have a dedicated nationwide backbone network to serve their needs at critical times. While the current providers' networks could serve some of the public-safety needs, nationwide attack scenarios reveal multiple vulnerabilities to this option. Therefore, public-safety computing requires a complete rethinking from the ground up to influence and guide the next generation growth in terms of interoperability, relevance, integrality, and effectiveness.

**BRIC Motivation**

Currently, investigating next generation public safety computing is an orphan problem that is calling for attention. We are motivated by our passion to influence and shape public-safety computing for the next generation. We believe that the next generation of computing devices can provide functionalities that were never thought possible before. The continuous development in location-based-applications, smart devices, mobile computing and the wide spread of sensor-based devices and environmental sensing along with the revolutionary development on connected-car and next-generation-911, lead to the following:

1) increased responder safety and increased responder situational awareness
2) evidence-based development of new policies, procedures, and governance models
3) smarter tools to enhance public-safety
4) efficient, interconnected databases to support emergency service
5) increasing interoperability and connectivity when authorized

Unfortunately, the following issues highlight the risks associated with improvements in computing systems:

1) the rapid change in technology, governance, and the cost and time required to change legacy systems is an impediment to interoperability and community safety
2) the growth in availability and functionality of analysis tools and situational awareness applications in the hands of those who would do harm to our communities
3) isolation between researchers, industry and end users in the public safety communities.

The evolution of LTE systems and the role of 700 MHz provide a promising platform that has the potential, if guided by proper research, to transform modern public safety capabilities. The evolving location-based-applications, smart-devices, mobile computing, and the wide spread of sensor-based devices and environmental sensing, along with the revolutionary development on connected-car and next-generation-911, lead to the issue of how Canadian public safety can handle the management and availability of big-data. As soon as the connectivity barrier is crossed, handling big-data is the next challenge.

Finding the proper answers for public safety challenges is pivotal to the development of modern public safety information management. A continuation of the current approaches would lead to isolated silos of public safety agencies. There is strong support for a collaborative focus on interoperability and support has been expressed in the large number of stakeholders joining the BRIC initiative. We believe the use of a joint taskforce to combine efforts from the public-safety agencies, municipal, provincial, and federal governments, national and international academics is needed to empower BRIC with the strongest possible collaboration efforts.
Public-Safety Information Management Challenges

Current and historic developments on public safety information management have been dominated by individualistic efforts to fill-in gaps in the system as seen by concerned officers. Limited collaborative efforts through the Canadian Association of Chiefs of Police and the Canadian Interoperability Technology Interest Group (CITIG) have demonstrated the success of multi-stakeholder initiatives. The following diagram shows the anticipated developmental bubbles that are currently taking shape or expected to grow as hardware and software grow faster and smarter.

![Anticipated Technology Developments to Public-Safety Computing](image)

**Figure 1: Anticipated Technology Developments to Public-Safety Computing**

The overall picture shows genuine singular attempts to improve public safety computing and those efforts are expected to provide limited improvements at best. The overall vision of public safety computing requires focused efforts to combine silos of narrow interests into a grand view that helps the decision maker as well as the responders on the ground. This kind of grand view can never be achieved if the hardware remains without interoperability. Once the hardware interoperability issues are resolved, the software interoperability issues become apparent. Following resolution of the software interoperability, a much needed way of making sense of the volume of data and data exchange becomes a necessary step. Further, a well-designed approach is required to link public safety information management to events on the web, following development on social network or sensed issues relevant to cyber safety. The processing of sensing feeds, environmental alerts, connected-car events, and surveillance systems, increase the complexity of the system and require fairly dense analysis and processing to reasonably view and present the entire system at a controlled level.

All anticipated technical advances cannot be realized in the absence of good governance and policies. We envision a strong model for electronic-governance and automatic-policy to generate the right platform based on situational analysis. The proposed eGovernance would be engaged automatically in situations
requiring complex analysis to provide decision makers with the required intelligence while preserving the privacy and anonymous rights of the public.

Figure 2: The Canadian Communications Interoperability Continuum

Following the Canadian Communications Interoperability Continuum as in figure 2, the development of modern technologies in terms of hardware, software and sensors require a parallel development and research on how we guide and influence the future public safety computing. In order to smooth the transition, collaborative work on interoperability of hardware and modern models for governance are required in the near future. Following, a sophisticated work on software interoperability and management of big-data would be required. Further work on situational analysis and management of complex scenarios would be supported by the collective consensus on eGovernance and will be reflected in modern tools that provide decision makers with insight on public safety situations including cyber safety and environmental developments.

BRIC ONTOLOGIES

To mobilize public-safety interoperability and information management from the current state to the desired state, parallel developments on multiple fronts need to advance with some level of synchronization. In the following section we identify BRIC vision for the future of public-safety interoperability and information management. Following we define the main development ontologies and how we can focus and synchronize independent developments.
BRIC Vision

In order to simplify the guided evolution on public safety interoperability and information management, it is important to have deep understanding of the current systems, operational limitations and the continuous development in the technical arena. To demonstrate this understanding, we use the color coded chart displayed in Figure 3.

Figure 3: BRIC View of Modern Public-Safety interoperability and information management

Figure 3 illustrates the BRIC view of modern public safety interoperability and information management. Starting from the bottom-up, we show the essential development on governance and policies (shown in tan bubbles). The BRIC initiative is expected to work on developing consensus on eGovernance and automatic policies while preserving citizen privacy, potentially by invoking anonymity rules. This development is fundamental to liberating technical efforts on many fronts leading to unprecedented levels of supervised communications between different agencies at all levels of government. The objective of eGovernance efforts is to utilize rules built to enhance the operations of each public-safety agency, but combine those rules in a way that makes first responders operate and behave like a single entity.

The second essential, parallel, development is on radio interoperability, to take advantage of the LTE and 700 MHz initiatives (shown in green bubbles). This work includes operation over carrier and utility networks and provides necessary certification, training, and consultation for small agencies. Development on interoperability will lead Canadian public safety agencies to immediate cost savings, and will guide agencies to communicate seamlessly and to stream easily in real-time with the least amount of training. Both the tan and green bubbles represent the immediate focus of the BRIC initiative.

Public Safety information management continues to expand towards the challenge of big data and location-based information. Instead of developing individual tools to serve public safety, the BRIC initiative is focused on building open platforms for those tools to develop and interoperate. This allows vendors to
focus on individual applications while guaranteeing continuous feed from other tools, databases, and sensors. The BRIC initiative focuses on building the open platforms and on developing intelligence from the major movement of information, sensing feeds, databases, etc. Maintaining this focus will allow the BRIC to answer questions such as ‘what is going on in the public scene this week?’ through the integration of systems that are already available. It senses situations relevant to the big picture and performs public safety analysis. Meanwhile, tools on cyber safety and digital forensic will continue to develop at their own pace to merge with the operational platform of public safety computing.

The BRIC initiative is planned to focus on the research and development, education and certification, advising and collaborating, and building interactive community to deal with the complex issues relevant to public safety computing.

**BRIC Developmental Focus**

BRIC brings together the relevant stakeholders and collaborators to focus on the next generation public safety computing. Our focus is realized in five major developmental routes, namely:

1) The development of eGovernance policies, rules, and procedures to be utilized by current and future tools.

2) The development of efficient hardware interoperability. This focus is best achieved by generating an abstraction layer that is developed based on prioritized use of hardware.

3) The development of a communication platform that is cross-agencies to prevent the repeat of the current practices on NG-911 and to enable wide range benefits from connected-car.

4) The development of a common application interoperability platform to facilitate smooth sharing of information and provide seamless information accessibility for M2M and M2H.

5) The development of deep analysis of available big-data in order to provide higher level intelligence on the level of the national public-safety scene.

![Figure 4: The Developmental Focus of the BRIC initiative](image)

The first two developmental routes can happen simultaneously, while the fourth developmental route must wait for the first two to take shape. Therefore, it is important to keep the first two developmental routes within the BRIC centre to guarantee closer interaction and association. The timelines in Figure 4 are meant to illustrate the relative dependency and to show the long term view of the BRIC initiative.
BRIC ACTIVITIES

The following subsections define the main activities of the BRIC and the tools used to achieve BRIC objectives. We continue to list the stakeholders, collaborators and funding agencies.

Evaluation & Exercises
In collaboration with the public safety end users, the test-bed and technical expertise can be used to:

1) develop operational requirements, use cases and test plans
2) develop and evaluate governance models
3) develop and evaluate operating practices and procedures
4) test and evaluate equipment & applications, formal and demonstrations such as a “Plug fest”
5) host exercises facilitated using the test bed
6) evaluate network security and integrity on a closed network

Research and Development
The BRIC will be involved in the complex research and development relevant to:

1) hardware interoperability, evaluation and certification of hardware, and the research on abstraction layer
2) solutions for eGovernance and automatic rules and policies
3) next-generation 911
4) application interoperability
5) developing grand view of public-safety computing
Education and Training

The BRIC will be involved in the training of Highly-Qualified-Personnel (HQP) and the training and education of public-safety officers as needed. The University of Regina will extend all cooperation possible to provide the highest quality education for the BRIC trainees at all times.

Activities and Communications Tools

In order to maintain continuous attachment and progressive collaborative environment, BRIC maintains a forum to allow all contributors to participate in identifying problems and sharing ideas. Due to the nature of the public safety issues, a periodical call for participation in a conference will be made to the BRIC members. The resulting research will be published in a limited access journal and research data will be shared among stakeholders for further investigation and as a decision support tool.

Timelines and Roadmaps

The objectives and vision of the BRIC initiative can take more than a decade to reach research saturation and can continue beyond a decade to spread the educational and knowledge benefits. The following table presents the anticipated long term timeline for the BRIC initiative.

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<tr>
<th>Stage</th>
<th>Y0</th>
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<th>Y2</th>
<th>Y3</th>
<th>Y4</th>
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<th>Y6</th>
<th>Y7</th>
<th>Y8</th>
<th>Y9</th>
<th>Outcome</th>
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<td>Focus on defining operational issues and addressing stakeholders needs</td>
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<td>Agreement on policies &amp; governance</td>
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<td>Focus on interoperability, connectivity and field testing / evaluations</td>
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<td>Agreement on tech ops layer</td>
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<td>Focus on streaming and surveillance interoperability</td>
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<td>Operational evaluations</td>
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<td>Focus on managing big-data auto-governance, situational analysis, and data-intelligence</td>
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<td>Focus on education and knowledge transfer</td>
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The previous table describes the higher-level timeline, which could be achieved by building smaller blocks towards our major vision. Smaller incremental project steps allow for sequences of realignments at each milestone to realize technology adjustments and allow involvement of stakeholders to reevaluate and realign initial objectives. Therefore, we organize the BRIC initiative into feasible milestones as described in the following table that focus on the initial 36 months.

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The displayed timelines are not designed to show all project details. For instance, periodic communications and alignment with stakeholders is a fundamental concept of the entire project. Such communications are not shown on project timelines to remove convoluted details. Similarly, we removed details relevant to hiring and procurement for hardware and software tools. Within this document we maintain focus on objectives, constraints, and vision.
BRIC OPERATIONAL ORGANIZATION

Due to the relatively large number of stakeholders and collaborators, which is demanded by the nature of the interoperability activities, a flexible organizational system is required. As part of the Collaborative Centre for Justice and Safety, BRIC links the University of Regina to governmental units, public safety agencies, industry, and international academic units through a natural collaboration model. Participants’ roles will be defined in a memorandum of agreement to be appended to this document (see appendix A: Stakeholders and Memorandums of Agreement). Non-founding partners can join the BRIC centre by signing a memorandum of agreement with the BRIC. Founding and non-founding stakeholders may be granted access to equipment, resources, and information defining the flow and integration of real-time data and information, which are based on well-defined functional and physical communication architectures.

The BRIC is an integral part of the Centre and will have an advisory board to guide its decisions. Collected data and intellectual property are governed and controlled by the rules of the CCJS and the University of Regina.

The complete control of the BRIC remains within the University of Regina represented by the principal investigator and guided by an advisory body composed of representatives of the stakeholders. The memorandum of agreement strictly governs data sharing and use, and limit data use to research purposes only by the University of Regina. The University is not at liberty to grant access to non-founding stakeholders or to other parties. Since the BRIC follows CCJS, which is constituted as a Type 1 Research Centre, internal governance of the BRIC centre is subject to well-established and well-documented academic and administrative policies.

The BRIC is expected and encouraged to expand its collaboration by communicating its mission and sharing its research outcome with newer stakeholders. As such, the BRIC is expected to display, publish, or share only non-classified information. Further, the BRIC is expected to apply for grants to cover its expected costs and to improve its research and educational abilities. Grant applications may require the sharing of fairly conclusive research outcomes without sharing any classified details. In all cases requiring comprehensive communications, the principal investigator is required to obtain the advisory board consent before sharing information.

Socialization of the BRIC Centre

- General Dynamics Canada
- Saskatchewan Power
- Saskatchewan Telecom
- SRNet
- Saskatchewan Government Relations
- Canadian Council of Emergency Management Officials
- Saskatchewan Interoperability Interest group (SIIG)
- Defence Research and Development Canada, Centre for Canadian Security Sciences (CSS)
National Science and Engineering Research Council (NSERC)

CANARIE

Western Economic Diversification Canada (WD)

Western Grid

Municipality of Cornwall

Northern/remote Community

Industry Canada: Communications Research Centre

Canadian Interoperability Technology Interest Groups

Canadian Association of Chiefs of Police (CACP)

Canadian Association of Fire Chiefs (CAFP)

Paramedic Chiefs of Canada

Suppliers of Records Management Systems

Public Safety Canada

Research Collaborators

University of Regina

University of Ottawa

Carleton University

TRTech

EDGE Innovation Network

University of Texas A&M, Austin

University of Colorado, Denver

APPENDIX A: STAKEHOLDERS, AND MEMORANDUMS OF AGREEMENT