Enabling Digital Government: Interoperability and Data Exchange Between Registries

The benefits of a connected landscape

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Forward

During my tenure as the President of Shared Services Canada I was responsible for providing information technology services to all federal government departments and agencies. The theory was that technology platforms, data, and services were ubiquitous. The reality was in fact the opposite. The job was larger and more complex than it should have been. Much of the landscape was still basically a series of unique systems and their related data sets, that were bespoke implementations within each department. The same basic services, data and functionality would be configured and delivered in a plethora of different forms. There was simply not enough sharing of data across services. In fact, interoperability and data sharing was an afterthought, and where it did exist, it was cumbersome, often unreliable, and extremely difficult to maintain.

It was not for a lack of effort. At the Federal level we had “tell us once” and “user centric” approaches and policies. From a fiscal perspective there was a push to consolidate and simplify services in order to reduce costs. Government as a Platform, or GaaP, was being discussed, as well as the need to modernize approaches to procurement. It all sounded positive and it was widely supported in principle. In spite of the support and recognition that these approaches would reduce cycle times, improve data quality, and reduce costs, the truth was that meaningful progress was sparse. The excuses put forward were often the same: the legislative frameworks created barriers, privacy concerns, unclear ownership and accountability, timing, and budget. However most frustrating was an inherent bias and belief that their data and related functionality was unique and did not need to be interoperable. In short, there was agreement in theory, but practice was still tied to the old ways of doing things.

These observations were not limited to the federal government. They can be found at other levels of government and across our provincial service organizations like Service Ontario, Service Alberta, Service New Brunswick and Service Nova Scotia, where interoperability and data exchange remain limited across the foundational registers and the baseline data.

The default approach was, and continues to be, the duplication of data and the building of similar functionality. This “bespoke” approach creates un-necessary complexity and results in huge amounts of data duplication. It also meant that simple things ended up being incredibly complex. We need to step away from these ways of working. We need to challenge the belief that our requirements are unique and that our data cannot or should not be shared. We need to ensure we have foundations that support interoperability as a core requirement. And we need direct procurement and development efforts to align with these principles.

We need to insist that the technologies we deploy have the built-in capabilities to facilitate data exchange across systems and with other registers. We need to insist policy makers adopt, enforce and fund only projects and procurements that align with the “once only principle”. Without these foundational elements we will continue to have projects and system transformation costs ballooning. We need less complexity, not more, to reduce costs and risks.

If we continue down the current path, one of duplication and unnecessary complexity, we waste precious time and resources doing the basics. Simple tasks like updating base data become tidal waves of complexity crashing through the various unique systems and registers that duplicate the data. Functionality changes ripple through a myriad of systems leading to further changes, unforeseen outcomes and testing that often fails to fully assess the impact of all the changes. This in turns reduces our time and budget to improve, and to expand services and their respective outcomes. The result is less innovation and systems that struggle to accommodate new demands and the increased expectations of users and clients.

In Canada, the lack of even the most rudimentary interoperability means we spend too much time and resources addressing basic issues. It also means we are not innovating at the pace required to compete on a global stage. International data demonstrates the impact of our failure to address this issue. Canada has been dropping year over year, consistently slipping in global competitiveness and innovation rankings. OECD data indicates Canada is consistently at the bottom of the international rankings and the year over year trend is negative. To prevent further erosion Canada needs to keep pace with other jurisdictions that are mandating and legislating processes and technology that align with interoperability frameworks, such as those in the European Union.

To truly tap into the potential of the technology we need to break from the practices of the past, those ways of working and approaches that kept us from sharing systems and functionality. We need interoperability frameworks to ensure we share what should be shared and keep simple what should be simple. This will involve forward thinking and making interoperability a required foundational part of our design thinking and procurement processes. And the good news is that the technology that promised this in the past has evolved, and in fact now makes these tasks so much easier. Frameworks and policies need to be adopted, but it is equally important that we begin to take action now to build the foundations of interoperability.

This paper, **Enabling Digital Government: Interoperability and Data Exchange Across Registries**, educates us on the foundational constructs of our public registers and outlines a clear and achievable path to begin to address this important challenge. Our registries hold valuable data that are developed under legislative frameworks and are duplicative across information silos. Interoperability, that concept that is required is achievable. Policy makers need to demand interoperability up front and include it in legislation, policy frameworks and procurement approaches. Practitioners need to stop believing every piece of data and functionality needs to be replicated and embrace interoperability as a core tenant of modern design thinking. The path is in front of us. It is time to get going. Starting with the transformation of our base registers will ensure we have a robust framework to build upon.

Paul Glover
President Shared Services Canada (2019-2022)

Introduction

Governments all over are increasingly working on digitalizing their administrations. This is an ongoing and continuous process driven by constantly evolving technologies and policy goals. For any digitalization initiative, interoperability is crucial towards enabling the provision of digital services. It allows data to be shared across repositories and registries, between governmental organizations and across jurisdictional boundaries, and enhances the flow of information. This level of connectivity improves the effectiveness of governance, elevates client services and allows government to operate in a more cost-effective manner.[i]

Interoperability is a multifaceted and complex issue, requiring support from policy makers, regulatory bodies and adoption from governmental and private sector actors to become truly successful. In the early 2000s, the Organization for Economic Co-operation and Development (OECD) already noted numerous issues and barriers being faced by governments developing interoperability solutions. This included problems integrating legacy systems, a lack of shared standards and infrastructure, and slow adoption of technological improvements. These have been longstanding issues that are often still present in many jurisdictions around the globe.[ii]

In the past 2 years of the global pandemic the need for better digital services, interoperability across government systems and data sharing has never been more apparent. Today public officials are increasingly making investments toward removing barriers across siloed data repositories and procuring new and adaptable technological solutions that can help to drive interoperability and whole of government digitalization.[iii]

Data is a strategic asset and is the “currency” of digital government, and in most jurisdictions the current legislation, governance and standards do not allow for consistent and effective sharing and reuse of data, thus allowing for interoperability. Governments retain significant amounts of data and much of the information held in these public repositories and registers is duplicative and not coded or standardized in a way to be leveraged or shared across systems and administrative boundaries.

A major obstacle to interoperability arises from legacy systems. Historically, applications and information systems in public administrations were developed in a data siloed, bottom-up fashion, focused on trying to solve domain-specific and local problems. This resulted in fragmented Information Management/Information Technology (IM/IT) which are difficult to interoperate. Due to the size of public administration and the fragmentation of IM/IT solutions, the plethora of legacy systems creates an additional interoperability barrier in the technical layer.[iv]

Interoperability, even that focused directly on base registries, covers a wide area and it is not realistic to expect that a single methodology or set of specific steps can be used to solve registry interoperability problems in general. There are however common elements, services and features across registries that will provide mechanisms to improve on and enable both technical and process interoperability to support intelligent data exchange and vastly improve on digital government directives and initiatives.

Without the presence of interoperability and the ability to efficiently exchange data, it is not possible to have a well-functioning digital government.[v] Interoperability is essential for a connected government. At its simplest construct, technical interoperability describes the ability of two systems, and for the purposes of this paper we are focused on statutory registries, to exchange data with one another, understand this data, and use it effectively. Interoperability is also defined across a number of other critical layers such as the organizational, legal, and political components. By focussing on technical interoperability, at the base register level, we can lay a strong foundation to support sustainable digital government initiatives.

This paper will provide a baseline understanding of the evolution, structures and operational modes surrounding public data repositories and registers. It will describe their intended applications and use, the desired outcomes and benefits, and how enabling them under an interoperability reference framework will directly influence the success of digital government. We will provide insights from within the European Commission that have successfully evolved the pan-European interoperability platform, and as well as a view of the progress underway within the Canadian Federal government towards the conceptual design of a digital exchange platform. From these reference examples and our combined experiences and research we will highlight some of the design and operational considerations towards the implementation of government interoperability frameworks. In conclusion, the authors will outline some of the foundational building blocks and component level considerations needed towards achieving successful technical interoperability and data exchange across government registries.

Statutory Registers Defined

All registers, irrespective of the legislative base from which they came into existence, share a common set of functions, that are agnostic indeed to the purpose of the register. These could be described in simple terms: to file, to store, and to publish the entries on the register. In computer terms this would translate to the operations of create, read, update, and delete (CRUD) that are the four basic operations of persistent storage. However, the complexity of a statutory register does go beyond the simple maintenance of such operations.

Statutory registers are the constructs that store the data of government. They are singularly the most important element or construct in the provision of Digital Public Services. Good practice in terms of data exchange across government, inherently means interoperability between these registers or what the European Commission (EC) through the Directorate General of Informatics (DG-DIGIT) describes as base registers[vi]. Registers can vary significantly in form and type.

In terms of understanding the modes of interoperability that can and do exist between registers, it is important to define the characteristics of registers that form the end points of this exchange. These characteristics exist in some registers, but they do apply to all types of registers.

The general characteristics of a register, irrespective of the domain that it governs, are as follows[vii]:

1. **Registers are canonical and have a clear reason for their existence**

   A register is the only authoritative list of a specific type of thing. It is the source of that information, kept accurate and up to date. For example, a business register administered by a business registration authority should be the single, authoritative place to go to find data directly related to legal entities within that authority's jurisdiction. The purpose of a register should fall within the bounds of a registrar's public task, that is its core role or function.

2. **Registers represent a 'minimum viable dataset'**

   A register only holds the data it was created to record, and nothing else. It never duplicates data held in other registers. Registers should be linked to data in other registers to avoid the need for any duplication (e.g., Corporate or Companies Registers integrated to Beneficial Ownership Registers to Land Registers integrated with Ownership Transparency Registers). It is our contention that this is the primary reason for interoperability. In order that registers can exchange information they must be able to uniquely identify their own entities, and ideally update information, on their registers. The register should always use available and accepted references such as ISO standard list conventions. Registers by their very nature are long-lived because the services they expose and the other registers within their ecosystem, depend on them. The register is always just the data persisted and it is the services extrapolated to present this data in an intuitive manner to the registers' stakeholders that is the differentiating factor.

3 Registers are live lists, not simply published data

Registers are living constructs that must continually represent the domain to which they were created. It is our contention that a static list is not a register. Making changes to a register shouldn't take long and should only be the elapsed times for the custodian to validate a new entry and guard the register against fraud and error. A modern register will employ all the automation techniques available to remove any manual intervention in terms of maintaining the register relevant. Registers should have a standard interface for reading and querying their contents, which follows the Application programming interface (API) principle.[viii]

There should be a clear process for challenging data held in a register with high standards for transparency, adjudications, and the processing of other issues discovered by users with register data. A register API should be highly available. Public register data should be cacheable by intermediaries and web clients to enable the incorporation of the register directly in live services, as well as being easily downloaded in bulk for offline applications, and updated using a streaming API.

4 Registers use standard names consistently with other registers

Wherever possible a register reuses standard names for fields to enable discovery. The data held in a register may evolve over time: new fields may be added to new entries in a register so long as they have a sensible default value for entries, and existing field names are not used for a new, different purpose. Again, this is consistent with the canonical principle.

5 Registers are able to prove integrity of record

Each individual entry in a register is immutable, addressable using a 'fingerprint' which may be used by a user as a digital proof of record – Source of Truth. A record in a register is a series of entries sharing the same identifier. The latest entry being the current value for a record. Older entries for a record must remain addressable, but their contents may be removed if instructed by legislation. The record of changes made to a register should be transparent and independently verifiable.

6 Registers are clearly categorized as open, shared or private

The privacy of a register should be clear, and either open, shared or private: open registers are public. The data may be accessed, copied, and derived freely, by anyone, either as single register entries or as a complete register, with clear licensing terms designed for reuse, and shared registers allow access to a single register entry. Private registers contain sensitive information which cannot be accessed directly by services. Public registers should not reference private registers.

7 Registers contain raw not derived data

Data held in a register should be factual raw data, not informational content, or counts, statistics, and other forms of derived data.

8 **Registers must have a custodian**

A register should directly meet a user-need or legal obligation. A custodian is appointed that confers trust and is responsible for the register.

In describing the characteristics of the constructs that form the end points between which the interoperability exists, it is also equally important to determine what makes a register more complex than other forms of registers. The authors seek to determine whether a more complex register infers more complexity at the interoperability layer.

Complexities of a Register

The authors have described what should be common to all registers in terms of general characteristics, but it is important to determine what creates complexity within a register. That is, what types of registers are more complex and what makes them more complex and what impact that has on interoperability.

A register has the following common attributes[ix]:

Purpose –
registration of entities

Services –
collection and providing register data to users, exchanging data with other registers and information systems

Legal –
registers are established and function following the legal acts

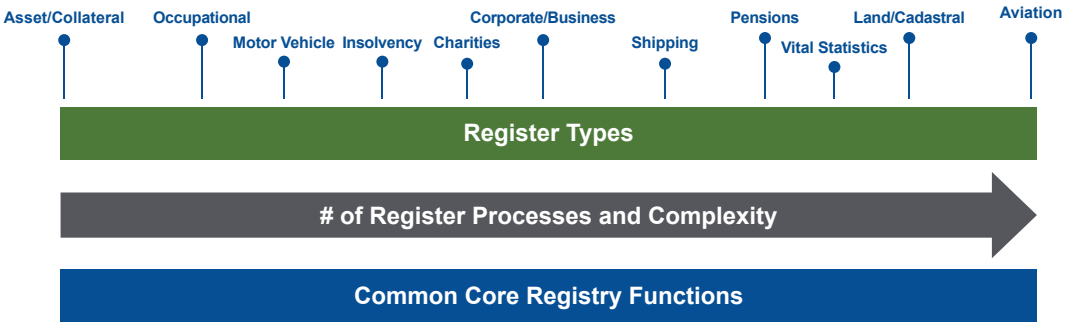
Systems –
registers are managed with information technology

Custodian –
registers require a custodian and can include an organization with a structure

The custodian of a register that is typically in the form of a registration or regulatory authority, can be viewed like all other organizations in terms of the PPT Framework of People, Process and Technology[x]. However, within the registry domains, there is an additional dimension of the legislation or regulation that created or instantiated the register. To review the complexity of a register, it must be reviewed within the context of the legislation that created it.

This legislation is what explicitly governs and bounds the functions of the register. It is uniquely important in terms of assessing the function and characteristics of the register. It is even more important when any changes are taking place in the register. That is in terms of any digital transformation efforts that a register may embark upon. The legislation governs all aspects and functions of the register, but it also governs the interoperability between the register and other systems or organizations . In terms of the PPT, the legislation dictates the natural order of sequence to which the PPT can be reengineered. The legislation defines the extent to which the processes can be refined and automated; and in turn the processes define what the technology needs to support, and finally the technology defines the organizational structure required to support the technology.

It is clear that registers differ fundamentally in terms of their complexity, though they have a common core set of functionalities. It is the interaction between the legislation and the PPT components that the complexity is derived. The complexity of a register is largely determined by the number of processes that are required to support the register's functions. A common misunderstanding outside of the registry domain, is that the size of the register, in terms of number of a registered entities or the number of transactions, dictates its complexity. The complexity of a register is never increased by the number of transactions it provides. The authors set out the following spectrum of various registers (note: health excluded) and their complexity.



The authors contend that irrespective of the complexity of the register that form the endpoints of the interoperability layer, it does not nor should it confer complexity on the interoperability layer that is implemented and we would go as far as suggesting that the interoperability layer should resist any attempt to institute domain/register specific complexity during the design and transformation phase.

Why do registers exchange information?

We have established what a register is characterized by, and what determines its complexity, but now the authors seek to describe why registers exchange information between other registers and other government bodies. It is important to understand the reasons why registers exchange information, and then to assess how they historically have done so, that is before we posit any recommendations that will afford the best method of implementing interoperability between registers.

- **External register entity dependencies** – dependencies to other registration authorities or peer organizations that are referenced at the registered entity level. Parent and child relationships can exist between registered entities that are within a jurisdiction or even across borders. This demands that there is a formalized exchange between the parent and child registers e.g., 11th Company Law Directive on Branches in the EU[xi].

- **Trade Agreements/Cooperation** – jurisdictions cooperating under a trade or other agreement, promote such agreements by streamlining the processes for transactions between the parties to the agreements. This requires information exchange between the respective peers of both parties.

- **Principle of canonical registers** – registers should only store the data they are required to under their respective legislative frameworks. If the data exists elsewhere, it is incumbent on the register to interrogate that data source. E.g., a Business Register should validate a tax number of a legal entity with its respective tax authority.

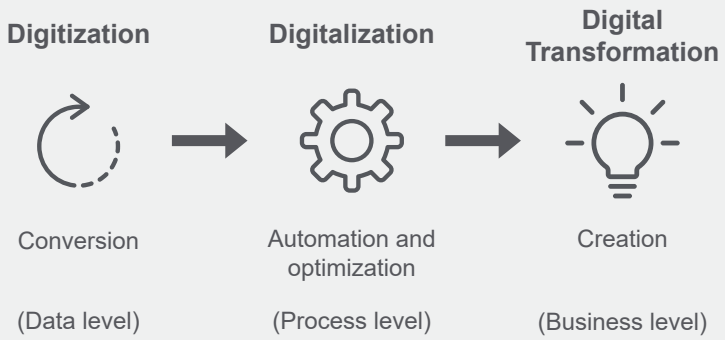
- **Demand for customer centric services** – Registers in recent times and particularly post COVID have seen the demand for the services exposed to their customer to be designed to be customer centric. This means streamlining processes and fulfilling a transaction completely without referring a customer to other agencies – e.g. One Stop Shop (OSS).

- **Joined Up Government** – the slogan from the 1980s from the UK that was the banner call for Governments worldwide is epitomized by the quote by Peters (1998) – "The challenge of improving coordination horizontally within government is an eternal one". In the domain of registers that are traditionally the silos of government data, the promotion of such initiatives demands information exchange between registers. In the European Union, 'The Once Only Principle' (TOOP) project seeks to use a federated architecture on a cross-border collaborative pan-European scale to identify drivers and barriers, in order to provide a basis for future implementations and wider use.

- **Identity Validation/ Identity Federation** – modern registers will rely more and more on identity validation services for natural persons that are entered on their registers. Indeed, the authors would contend that identity services will become as important as the registry services that they support. Identity validation means that registers will have to interrogate and rely on external validation services from their peers and other organizations to cover as wide an arena as possible of identities. Accepting the identities validated by or accredited by peer organizations and other federated organizations will mean implementing a means of information exchange between these organizations .

Evolution of Data Exchange between Registers

Registers have historically always communicated with other registers, other data sources and other regulatory organizations , to efficiently and effectively perform the functions of the register. The reasons they did so was to triangulate the data being filed on their register. Registers over the last three decades have moved through three distinct paradigms: **Digitization; Digitalization; and lately Transformation.**



Digitization occurred when registers, largely for business continuity reasons, digitized the paper that was filed. This meant that registers globally were the early adopters of Image Management Systems (IMS) and Document Management Systems (DMS).

Digitalization was the next paradigm that encompasses the efforts of the registers to automate and stream-line processes by implementing electronic filing and search services to their registers. Various techniques and technologies were employed by registers. But the fundamental and widespread mistake that was made is the register's simply replicated the filing of paper in an electronic medium. This was largely due to the fact that it is inherently more difficult and takes more time to modernize legislation for a digital economy. The past decades have been about the catch up of legislation to provide for a new operating model for registers.

This leads us to the next and current paradigm of **Transformation**. The registers are changing fundamentally the way they operate and in their provision of more customer-centric public services. In their efforts to transform, registers have sought, and indeed been forced to seek interoperability with other registers and data sources, to fully automate their processes, leverage common information stored in base registers, to improve decision making through data analytics and to create innovative new business services for their stakeholders.

The Evolution and Modes of Interoperability Across Registers

In the course of our research, the authors note the following modes of interoperability that have been deployed by registers globally:

1. **Informal** – communication between known contacts by fax, e-mail, and phone; Jersey Financial Services Company (JFSC) indeed proposed a 'Company Passport' for the continuance of legal entities across borders to ease the administrative burdens at the European Commerce Registers Forum in 1996. Informal communication between registers could never meet the needs of registers that were digitized particularly when the number of register records requiring validation moved beyond what was possible manually.

2. **Extracts** – various technologies and formats employed to share information with peer organizations at a national level and to third party intermediaries. Entire extracts of registers that were digitized were provided to other bodies and agencies, particularly at a national level, where the interfaces to such were not available and where existing portals and web sites would not meet requirements. The latency of the validity of these data sets continued to cause issues and the effort required to expose such was always troublesome.

3. **Peer-to-peer** – the exchanges of information between registers began when registers deployed their own 'search' web sites. The first formalized exchange of information between registers begun around the same time with the European Business Register (EBR) which started in 1992. EBR remained a peer-to-peer network until 2007. The first registers to deploy a search site dynamically interrogating a register was in Ontario, Canada through Teranet's Teraview® system that automated search access to land registry data in 1995, then followed by the New Zealand government in 1997 with the ability to not only search but also create and maintain corporate entities on the register within the Companies Office.

   There were several bilateral trade arrangements that also led to peer-to-peer data exchanges. These emerged between Australia and New Zealand, and then Norway, and Sweden in the 2000s. In Canada around 2014, the New West Partnership (i.e. XP registration) created a simplified interoperability data exchange for the registration of extra-Provincial legal corporate entities, between the provinces of British Columbia, Alberta, and Saskatchewan. Most recently, also in the Canada, the Multi-Jurisdictional Registry Access Service (MRAS), focused on reducing red tape and internal trade barriers for companies by connecting business registries across the country.

   With other examples of peer-to-peer being between European Land Registration Authorities (ELRA, formerly EULIS) and Camden Assets Recovery Information Network (CARIN). Peer-to-peer though it achieved a layer of interoperability between the registers, it made the governance of those participating members difficult, and more so in the settlement of any fees attached to services provided to another participant.

4. **Hub and spoke** – The primary breakthrough in terms of interoperability between registers emerged from the European Commission funded BRITE (Business Register Interoperability Throughout Europe) that started in 2005 and ended in 2007. This project created three primary constructs that became the central pillars of the European Company Law Directive on the Interconnection of Business Register[xii]. The constructs created a central point where the minimum set of data would be persisted to allow a more meaningful exchange of information. These were the Central Names Index, the Directory of Registers, and a Registered Entity Identifier. These three constructs were included in the deployed pan-European platform of the European Business Register in 2007.

5. **Web Services** – As registers rearchitected their system to provide more online services, the advent of web services was used to expose interfaces to various stakeholders to 'self-service'. Web services recognized the importance of creating specific channels and interfaces for the large filers of information to registers, to directly integrate their systems to the systems of the registers. Thus, dawned the era of G2B for registers. These registered consumers used exposed sets of web services for internal consumption and drastically reduced the error count of information filed, as forms could be prepopulated by consumers directly from the register, without having to use the register's portals.

6. **Open Data** – Registration authorities provide a subset of web services data to open data forums. Open data afforded registers an opportunity to provide their data to other platforms, with the explicit proviso of this creating greater transparency to the register data. The set of data usually provided was a set of data less than what was provided through their own web services channels.

7. **Interoperability Reference Architecture** – The European Commission (EC) through the Directorate General of Informatics (DG-DIGIT) has been at the forefront globally of facilitating an ambitious level of interoperability between all Member States of the European Union. The sheer volume of published policies and tools available to Member States to create interoperability layers that facilitate cross border data exchange and services is impressive. DG-DIGIT propose the use of Digital Services Infrastructure (DSI) and specific pre-built components to implement interoperability. Examples of such are Business Register Interoperability System (BRIS)[xiii], Beneficial Ownership Register Interconnection (BORIS)[xiv]. The fundamental of the EC push in terms of interoperability is included in the European Interoperability Reference Architecture v5.0 (EIRA)[xv]

Interoperability in Support of Digital Government – Developments across the European Union (EU) and Canada

There are some key developments underway in the EU and Canada as it relates to digital government and architecting frameworks to support data interoperability. The EU has made significant advances and investments into the design and implementation of their interoperability framework for all Member States. There are some fundamental building blocks and lessons learned that can be applied to the Canadian landscape as it relates to future collaboration between federal, provincial, and territorial jurisdictions overseeing public data repositories and registries.

Like the EU countries, Canadian registries covering land, businesses or corporations, secure transactions, beneficial ownership regimes are legislatively mandated and operated independently at the provincial and federal levels. However, unlike the level of interoperability maturity across registers in the EU, Canada has very limited provincial-federal cooperation across the registry domains, and in most cases, there is no data interoperability or platform architecture vision across provincial boundaries beyond simple peer-to-peer exchanges, as we have noted above.

While the Canadian federal government has constructed a clear vision of a digital exchange architectural framework, the lack of coordination and collaboration across administrative boundaries has impeded valuable progress. This continues to represent a significant cost burden with limited digital services that remain extremely time-consuming for businesses and citizens. Much can be gained from the foundational work around interoperability and data exchange across registers under the European Union's digital government initiatives.

The Canada-EU relationship is based on shared values, a similar federated structure, a long history of close cooperation, and strong people-to-people ties. Canada's relationship with the EU is the oldest formal relationship the EU has with any industrialized country, dating back to 1959.

Most recently, the European Commission has entered negotiations with the Canadian government for Canada to join Horizon Europe. Horizon Europe is the world's largest research and innovation funding program (2021 to 2027), with a budget of €95.5 billion. One of the key innovation actions and expected outcomes of the Horizon Europe programme is to contribute towards improving the digital technologies, base registries, and the interoperable frameworks for data markets and the digital economy. The focus is to ensure data and metadata interoperability, including the application of appropriate standards, reference architectures, common ontologies/vocabularies/data models allowing for smooth and efficient data sharing. As it relates to Canada's efforts to maintain their global competitiveness and the ongoing investments in the future of digital government, this will be a valuable area of ongoing cooperation.

1 European Commission – The New Interoperability Framework for EU Public Services

In recent decades, European public administrations have invested in ICT to modernize their internal operations, reduce costs, and improve the services they offer to citizens and businesses. Despite the significant progress made and benefits obtained already, administrations still face considerable barriers to exchanging information and collaborating electronically.

The EU Commission's department for informatics (DG DIGIT) is responsible for digital infrastructure and services in the Commission. DG-DIGIT proposes interoperability through its European Interoperability Framework that proposes four layers to assess the dimensions of interoperability: legal, organizational, semantic, and technical. They have been defined as such:

Legal interoperability:
is about ensuring that organizations operating under different legal frameworks, policies and strategies can work together.

Organizational interoperability:
concerned with modelling business processes, aligning information architectures with organizational goals, and helping business processes to cooperate.

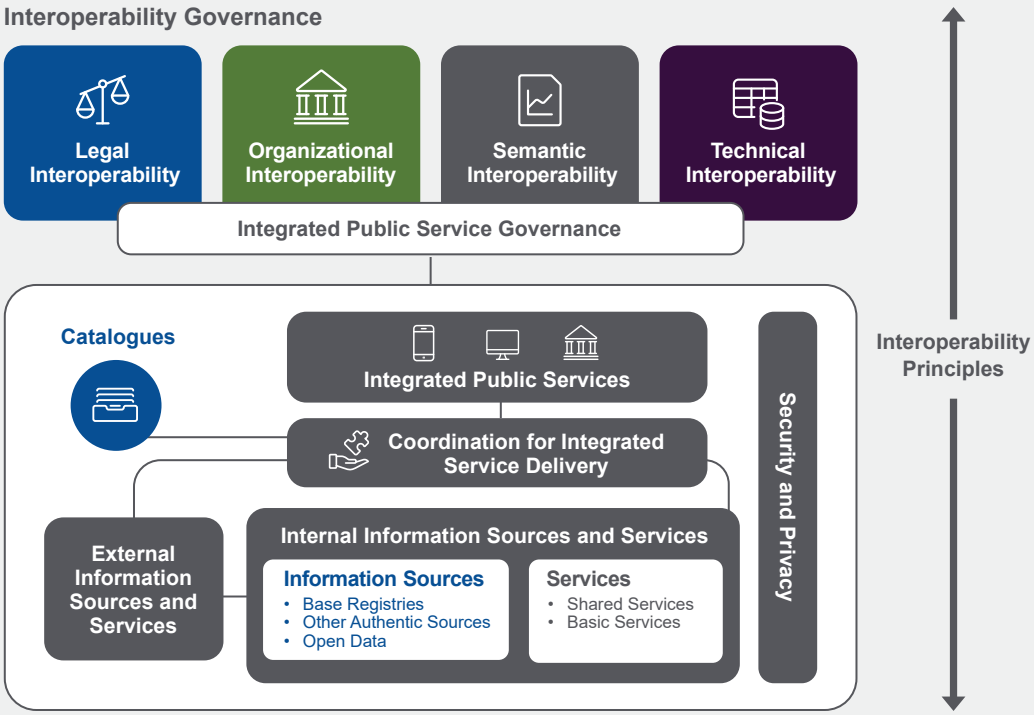
Semantic interoperability:
related to ensuring that the precise meaning of exchanged information is understandable by any other application not initially developed for this purpose.

Technical interoperability:
concerned with technical issues regarding computer systems, definition of interfaces, data formats and protocols.

A cross-cutting component of these four layers, is **'integrated public service governance'**. Interoperability governance refers to the oversight and compliance on decisions across interoperability frameworks, institutional arrangements, organizational structures, roles and responsibilities, policies, agreements, and other aspects of ensuring and monitoring interoperability at provincial/state, and national/federal levels.[xvi]

This interoperability framework first was published in 2010 and has more recently undergone a second revision. The new European Interoperability Framework (EIF2) conceptual model for public services covers the design, planning, development, operation, and maintenance of integrated public services at all governmental levels from local to EU level. The general principles set out here guide decision-making on establishing interoperable European public services.

EIF Conceptual Model



The revised EIF2 is a key instrument for establishing interoperable digital public services at regional, national and EU level, thereby contributing to making the digital single market a reality.

It offers public administrations 47 concrete recommendations on how to improve governance of their interoperability activities, establish cross-organizational relationships, streamline processes supporting end-to-end digital services, and ensure that both existing and new legislation do not compromise interoperability efforts.

As we look at our public registries and data exchange, some key principles have been suggested for adoption under our interoperability frameworks:

- **Legal:** Principles of data sharing across sectors and systems are formalized to bridge differences in legislation.

  Citizen, land, corporate, vehicle and other registries are generally governed by sector specific legislation, which may be a barrier to public administrations sharing electronic data across registries. Common data sharing principles, interoperability agreements on governance, accessibility and data quality will lead to improved access to data.

- **Organizational:** All base registries have data management in place.

  In the absence of interconnection, several base registries will hold the same data and create unnecessary duplication (and not one reflecting a "single source of truth"). This fragmentation generates inconsistencies, uncertainty as to which information is the most recent, and also breaches the principle of once-only registration. In addition, having duplicative entry points and authorization cycles is an administrative burden on citizens and public service entities. Robust data management processes and policies are critical for reliable sources of information.

- **Semantic:** Base registries are slowly moving towards the reuse of semantic assets.

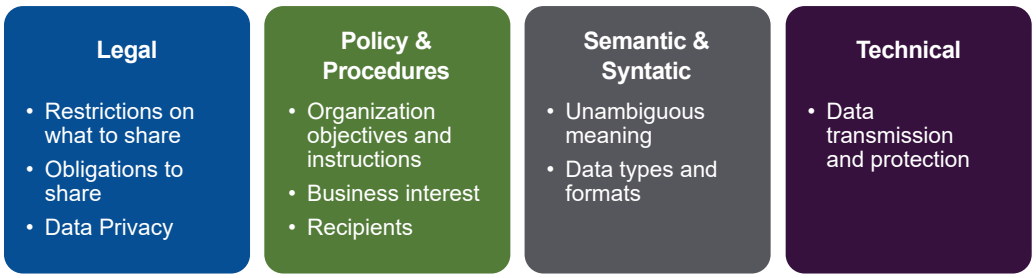
  The lack of semantic interoperability is a major obstacle to the accessibility of base registries information. Base registries often use different models for even the most basic information, such as a person's first and family name(s). Unless semantic conflicts are resolved, base registries cannot interoperate. Semantic assets, such as the Core Vocabularies being developed under the ISA2 Programme (**I**nteroperability **S**olutions for **E**uropean public **A**dministrations, businesses, and citizens) address this issue.

- **Technical:** Modular, loosely coupled service components are used for interconnecting base registries.

  The technical heterogeneity which has resulted from base registries having been developed independently of each other can be overcome by using modular, loosely coupled service components interconnected. Service oriented architecture (SOA) is emerging as the architectural style of choice for interconnecting base registries.

It is acknowledged that the information held in our registers has undoubtedly become one of the most valuable strategic assets for government and the dependence on data exchange will constantly be rising. At the same time, the frequency and ferocity of cyberattacks is also increasing, posing a great threat to the environments in which our public registers operate. It is important to refer to cyber security and protection of our data, systems and infrastructure as interoperability principles are being adopted and implemented.

The EU and many other jurisdictions, including Canada, all have initiatives underway that address Cybersecurity Threat Information and Intelligence (CTII) data exchange. When CTII is organized under our data sharing frameworks, especially data with external entities, several interoperability and security issues must be confronted, which can be categorized within the four layers of interoperability, as depicted below.[xvii]



In building our interoperability foundations by enforcing compliance and standardization around data exchange our cyber security efforts will be easier and more efficient. We will limit weak points across our systems through improved data collaboration (i.e., single source of truth, standardized APIs, more cooperation across the enterprise, limited need for multiple entry points, etc.) and significantly reduce areas of vulnerability that can be compromised, and our detection and CTII will be more effective.

2 Government of Canada Digital Exchange Platform – "The Interoperability Play"

Canada aspires to be among the best of the digital nations and to keep pace with their peers. Collaborating with international partners and participating in forums such as the Digital Nations[xviii], the International Council for Information Technology in Government Administration, the Organization for Economic Co-operation and Development (OECD) and the United Nations, allows the Government of Canada (GC) to continue to exchange ideas and solutions to challenges while moving toward the goal of fully transforming government digital services. With the future participation within Horizon Europe, Canada can look to leverage innovation and support multiple digital transformation strategies across the federal and provincial arenas.

While good progress in digital transformation has been made, Canada faces unique challenges as a geographically large and diverse country with multiple orders of government to navigate.[xix] The Chief Information Officer of Canada has established a solid foundation for its digital services strategy and recently published their Service and Digital Target Enterprise Architecture (SDTEA). The SDTEA defines a model for the digital enablement of services that address many of the critical challenges with the current GC enterprise ecosystem. It seeks to reduce the silos and improve interoperability and data exchange across the current GC ecosystem.[xx]

The ultimate vision for Canadian Digital Government is to realize a "OneGC", an ability to provide any service on any platform or device and through any trusted partner, achieved through a strategy known as 'Government as a Platform' (GaaP).[xxi]

The GaaP strategy is being realized through the Canadian Digital Exchange Platform (CDXP). The CXDP defines how services will interoperate through a standard fabric, supported by a set of common API standards specifying protocols and payloads. The CDXP is being established to help enable government departments to authenticate data with each other and the outside world in a modern, secure, and unified way to deliver secure private services in a digital age. It is be established in relation to the Estonian X-Road initiative[xxii] with a view to replicating their success, via an approach tailored to Canada's requirements.

Three key foundations to the GaaP program are:[xxiii]

Digital Identity

Currently the process to access services is not intuitive, convenient, or user-friendly for Canadians, requiring separate accounts with multiple usernames and passwords. This will be addressed through 'Sign-In Canada', enabling secure access to government services using a choice of trusted digital identities.

Canadian Data Exchange Platform (CDXP)

Currently there are numerous point-to-point connections for data sharing, which are messy and unmanageable. The CDXP enables secure, private, real-time information sharing with privacy and security "baked in", allowing systems within and outside of government to connect and function in harmony to support digital service delivery to citizens and businesses.

Updated legislation and policy

Currently clients provide the same information to the government multiple times when applying for a service or benefit because some departments are unable to share this information with one another. To address this, legislation will be modernized to a system of "Tell Us Once" – Any data updates provided to one government agency will be replicated to them all.

The Government of Canada is responding to the challenge of meeting Canadian citizens' and businesses evolving expectations for cohesive digital service delivery in the face of aging IT systems and rising technical debt. GC is advocating a whole of government approach where IT is aligned to business services, and solutions are based on reusable components implementing business capabilities optimized to reduce unnecessary redundancy, it is maintaining a clear focus on improving its service delivery to Canadians while addressing the technical challenges with its legacy systems.[xxiv]

Building Blocks for Interoperability

In the context of digital government and interoperability frameworks, building blocks refer to software code, platforms, and applications that are interoperable, and provide a basic digital service at scale. They can be reused for multiple use cases and contexts:[xxv]

- Serves as a component of a larger system or stack.
- They can be used to facilitate the delivery of digital public services via functions, which may include registration and search, scheduling, ID authentication, payment, data administration, and messaging.
- Building blocks can be combined and adapted to be included as part of a stack of technologies to form a country's Digital Public Infrastructure (DPI).
- Building blocks may be open source or proprietary.

Characteristics of building blocks:

- **Autonomous** – building blocks provide a standalone, reusable service or set of services; they may be composed of many modules/microservices.
- **Generic** – building blocks are flexible across use cases and sectors.
- **Interoperable** – building blocks must be able to combine, connect, and interact with other building blocks.
- **Iterative evolvability** – building blocks can be improved even while being used as part of solutions.

The most commonly occurring building blocks within interoperability and data exchange platforms are fundamental components of any government data exchange ecosystem: identity management, trust, data management, and secure data exchange.[xxvi]

- **Identity** – these are components or services that allow for user authentication. A digital identity can apply to either a person, or an organization, and the use of a digital identity allows for authentication. It also enables systems to trace back to see who interacted with what in a system
- **Data Management** – Base registries are under the control of a public administration, government or government-appointed agency and refer to a trusted and authentic source of information. They hold information about persons, companies, vehicles, land etc, and are seen as authentic, reliable and a cornerstone for the delivery of public services. Open Data refers to information collected, produced, or paid for by the public sector which is then made available and accessible for reuse for any purpose
- **Trust** – refers to electronic services that help parties make binding decisions and this category includes the building blocks of PKI and timestamping
- **Secure Data Exchange** – which also includes API Management, refers to the ability to exchange data between different organizations in a way that maintains privacy and security, and ensures that data integrity

Interoperability is particularly important as a core capability for connected government. The capability to connect governments across boundaries to share information and integrate service delivery is considered an advanced stage in e-government maturity.[xxvii]

Towards Register Interoperability

The authors recognize that the greatest effort and indeed investment in the implementation of interoperability between registers is by the registers themselves. That is, as weighed against the effort to implement the central orchestration/interoperable layer. The technical interoperability implementation must lower the cost and effort required for registers, as the participants, to integrate their internal systems. When looking to, invest in or continue the journey towards fully enabling digital government, our recommendations are targeted across key principles at both the **Register and Interoperability Layers**.

Register Layer:

a. **Canonical** – The register retains data only for the purpose that it was instantiated. It in turn consumes data held by other registers but does not retain it. This requires the register to seek interoperability between the register and other available data sources and relevant systems.

b. **Application Programming Interface (API)** – The register platform itself is 'API-first' and can expose a set of easily consumed services to all stakeholders. The use of a COTS product in the technical implementation of the register will typically provide such capability and functionality.

c. **Extensible and Configurable** – The register platform deployed is extensible (i.e., multiple registers can be deployed using the same architectural design and service modules) and easily configurable. Economies of scale are derived by deploying multiple registers on the same integrated platform with common shared services and a set of ubiquitous user interfaces.

d. **Cascading Data** – data elements (e.g., a natural person, corporate entity, and a unique address or property identifier) are common and can be shared these across all registers. Allowing changes and updates to cascade across all registers (where permissible).

e. **Shared Common Services** – these services only need to be implemented once and then can be used across all interconnected registers (e.g., security and authentication, data validation, payment services, identity validation, etc.). Interoperability of registers benefits from defining a common registry service layer.

f. **Security Infrastructure** – modern registers are required to deploy significant security infrastructure to protect the delivery of services to stakeholders in a secure manner but also more importantly in order to protect the reputation of the custodian of the register. Compliance with cybersecurity protocols and infrastructure needs to adhered to and directly aligned. Interoperability across registers should not afford bad actors an additional route for interference and manipulation.

Interoperability Layer:

a **Domain Agnostic** – the interoperability layer should be capable of transporting any message pay load for any domain. Thus, the investment can deliver a benefit for several varied domains. The message structure implemented should be flexible to allow for such.

b **Centralized Architecture** – a central hub or point of presence is required to orchestrate the interactions between the register participants. This is essential for the settlement of payments, reflecting a real time view of data between the participants and the effective governance and compliance.

c **Provision of Technical Artefacts** – sample code, implementations to reduce the burden of integration for participants and widen the adoption of the interoperability platform.

d **Integration/ Compliance standards** – a minimum set of requirements need to be agreed upon to integrate to the technical interoperability layer. This must be published and enforced. The EU requires Member States to implement Beneficial Ownership (BO) registers, however, there are no minimum standards on how they would be created in terms of the data set and what data elements if any, are to be made public. The Canadian federal initiative for implementing a pan-Canadian beneficial ownership regime is being developed, and in order to avoid the EU pitfalls, it must ensure adoption and compliance to a common BO data standard across all provincial and territorial boundaries.

e **Governance** – the governance model employed must confer trust and reputation on all participants. The governing authority must certify participants and enforce the minimum rules of participation (SLAs - Service Level Agreements) and resolve disputes between participants. Most registers will charge for some services that are provided. The governing authority must find an equitable and easy way to settle the payments for these services between participants.

f **Semantics** – agreed semantic ontologies can take years to populate and become useful. They should never become a focus point in terms of minimization. Participants should agree on a structure, a means to populate such, and a repository to persist and share the ontology. Thus, participants can declare semantic definitions for the data set that they will share. The key is that the differences between participant registers are to be welcomed and shared, not to excluded.

Interoperability, even such that focuses on just the registry domain exposes a wide area of research and it is not realistic to expect that a single methodology or even suggest that a set of specific steps can be used to improve registry interoperability. Technical interoperability and data exchange across registries must be ensured because data used in one administration will certainly also be used by others and will have significant downstream benefits. As outlined above, there are common design and component considerations across registries that will help to improve both technical and process interoperability, support data exchange and the drive to improve digital government directives.

The authors set out in this paper to review and describe what modes of interoperability exist between registers, while clearly recognizing that registers are the core repositories of government data. We conclude that the most practical and in many regards the easiest starting point towards enabling technical interoperability and data exchange, is at the register level. By leveraging new digitally enabled technologies and registry aware platforms we will be better positioned towards achieving the outcomes and benefits of an efficient and effective digital government, these would include:[xxviii]

a. **Better Public Services** – connected government means better public services and more efficient public service as cited by the EC's TOOP project.

b. **Increased Administrative Efficiencies** – the corollary of better public services, means better administration by registration authorities, regulatory bodies, and across government as a whole.

c. **Data-driven Policy Making** – the availability of connected government data, that is enabled by interoperability between registers, makes for better decisions by government, as the true reality for citizens of a jurisdiction is more accurately portrayed.

d. **Enhance Security, Data Protection and Data Privacy** – connected government means the data within registers is triangulated, reviewed, and referenced more widely. Indeed, the principle of transparency of a register and thus the greater scrutiny of the register, increases the data integrity of the register itself. The persistence of data, particularly personal data, in a single place, rather than being replicated, increases security. The mere advent of interoperability for a register, demands that security is enhanced.

e. **Reduce Fraud, Waste and Abuse** – a connected ecosystem or landscape of government means that data from many sources is used for validating entries on a register, identifying relationships between entities on a register and between registers, reduces fraud. The current Corporate Transparency Bill routing through the UK House of Commons clearly identifies the benefits of data validation across government and internationally, to improve data integrity, reduce fraud and provide benefits to the nationally economy as a whole.

Achieving interoperability at a government wide level is difficult, but not impossible. It presents a significant challenge, demands substantial resources and can take many years. However, governments can lay the groundwork for a fundamentally more effective and efficient public sector by implementing interoperability within their statutory registers.

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Key Concepts and Definitions

Application Programming Interface (API) – a means by which two or more computer programs can communicate with each other.

Base Registry – refers to a trusted and authentic source of information under the control of a public administration or organization appointed by government. According to the European Interoperability Framework 2.0, base registries are 'reliable sources of basic information on items such as persons, companies, land, vehicles, licenses, buildings, locations and roads and are authentic and authoritative, and form, separately or in combination, the cornerstone of public services. (Source: European Interoperability Framework 2.0.)[xxix]

Building Blocks – an extension of the concept of a framework to architect an IT environment.

Core Vocabularies – are simplified, reusable, and extensible data models that capture the fundamental characteristics of an entity, such as a person or a public organization, in a context-neutral manner.

CRUD – CRUD refers to the four basic operations a software application should be able to perform – Create, Read, Update, and Delete.

Digital Government as defined by the OECD, "refers to the use of digital technologies, as an integrated part of governments' modernization strategies, to create public value. It relies on a digital government ecosystem comprised of government actors, non-governmental organizations, businesses, citizens' associations, and individuals which supports the production of and access to data, services, and content through interactions with the government".[xxx]

Digital Services Infrastructure – Infrastructure which enable networked services to be delivered electronically, typically over the internet, providing interoperable services of common interest for citizens, businesses and/or public authorities, and which are composed of core service platforms and generic services.

Digital Government Interoperability Platform seen as a building block for the digital transformation of public administrations. These interoperability platforms "allow public and private sector entities to control which external parties get access to their databases securely". A digital government interoperability platform defined in a narrow sense may include just government institutions, but the largest positive network effects are created when the platform is also open to other organizations such as the private sector and third parties.

Digital public infrastructure (DPI) refers to platforms such as identification (ID), payment and data exchange systems that help countries deliver vital services to their people.

Endpoint – physical devices that connect to and exchange information with a computer network.

Government-as-a-Platform (GaaP) – Reorganizing the work of government around a network of shared APIs and components, open-standards and canonical datasets, so that civil servants, businesses and others can deliver radically better services to the public, more safely, efficiently and accountably.[xxxi]

Digital Government Interoperability and Data Exchange Platforms (GIDEP) – are a specific form of digital infrastructure necessary for the digitalization of the public sector that consist of a government's technical infrastructure, services, and data that, through technical interoperability, enable the exchange of data, provision of services, and digital innovation.

Image Management System (IMS) and Document Management System – system for scanning, storing, archiving and the management of binary data.

Interoperability – can be defined as either the ability to share information and services, or the ability of systems or components to exchange and use information or provide and receive services from other systems.

Message Structure – a structured message or payload that contains an agreed and standardized format with coded data elements. It is often referred to as a Common Data Model (CDM) that contains Common Data Elements (CDE).

Open Data – is defined as structured data that is machine-readable, freely shared, used and built on without restrictions.

One Stop Shop – A 'one-stop-shop' is a business model by providing many services in one place, the organization can offer customers the convenience of obtaining their needs in one stop.

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