Service & Digital Target Enterprise Architecture

Digital Government

Tags: Enterprise Architecture, BIATSP, Digital Strategy, Government as a Service, TOGAF, Reference Architecture, CDXP, Microservices Architecture, OneGC, Tell us once, Interoperability, DOSP

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Version History

	Date	History
0.01	September 3rd	Early Concept Release
0.02	September 23rd	Presented to GC Enterprise Architecture Community of Practise
0.03	September 30th	Reviewed with industry research partner
0.04	October 1st	Reviewed with GC SMEs and Stakeholders
0.05	October 22nd	Incorporated feedback from GC SMEs
0.06	October 29th	Released for Chief Architect Feedback
0.07	November 27th	Updates based on wider peer review, cleanup of structure and addition of Internal Feedback.

Message from the Chief Technical Officer of the Government of Canada

(to come)

Purpose of this paper

This white paper will examine adoption of modern technologies, addressing technical debt, enabling interoperability, supporting cohesiveness in services for citizens, and driving coherence as a reference architecture used by public servants within the Government of Canada (GC).

Its primary objective is to assist federal institutions by providing recommendations on how systems should be implemented to provide Canadian citizens with a more cohesive and sustainable “Digital Landscape” when interacting with the GC.

The “Digital Landscape” is defined as the total of all systems and technologies required to provide a unified, yet simplified and secured user experience to consumers of services be they

individuals or businesses, Canadians or foreigners, other systems or devices internal or external to an organization. All organizations across the GC have some form of digital landscape at various states of modernness, and the further behind this landscape lags behind modern technology the more difficult and costly it becomes to keep active.

The secondary objective is to increase the cohesiveness of enterprise architecture within the GC. The effectiveness of Enterprise Architecture has been criticised in Government, Financial and Insurance Institutions for years in its inability to affect change, and in general it's requirement and integration into Project Management as a gating model and burdensome documentation. In the GC it has been wildly different in implementation across each Department with varying levels of authority, staffing, support, ideology and value to Citizens.

This examination will be done across the lenses of business, information, application, technology, security, and privacy. The intended audience is broad, ranging from Deputy Heads and/or Chief Information Officers wishing to understand the complexities related to delivering new technology; to managers and service designers, implementers and operational teams.

Unless otherwise specified, any examples do not represent any existing plans of the Government of Canada and should be considered theoretical only.

The GC's mission-critical IT infrastructure is aging and at risk of breaking down. Technical debt has been accumulated that must be addressed. As stated in the Shared Services Canada Resource Alignment Review, cloud computing presents a significant opportunity to address these challenges and achieve cost savings. A key driver for cloud adoption is the need to move from managing aging assets to focusing on using commercially available services that will be the foundation for the GC to deliver business value.

Outside of this paper's scope

This paper is not meant to provide a comprehensive overview of digital services or the GC's strategic direction regarding those services.

Other documents, such as:

- The Government of Canada Strategic Plan for Information Management and Information Technology 2017 to 2021
- The Government of Canada Strategic Plan for Information Management and Information Technology 2018 to 2022
- Directive on Automated Decision-Making
- The Government of Canada Open Source Guidance
- The Government of Canada Cloud Adoption Strategy
- The Government of Canada's Federal Sustainable Development Strategy

Are available and provide information strategic direction.

Executive Summary

The GC has an opportunity to leverage industry best practices to provide a more cohesive experience to Citizens, make back-end systems more coherent, future proof across departments, and address technical debt in a sustainable environmentally friendly way.

Technical Debt, being the implied cost of additional work caused by choosing a limited solution in the now instead of a better approach that would take longer. It is inherent in all Technological solutions, and accrued over time as better and more innovation occurs. Without addressing it, it results in exponentially increased costs to ensure the system remains functional and meets the needs of Canadians.

Digitally, the GC must operate as one to provide benefits to all Canadians.

By taking advantage of established models for interoperability and cloud hosting, as well as taking a systematic approach to the GC Target-State across the Architecture domains of Business, Information, Application, Technical, Security and Privacy, the GC can begin to rapidly replace legacy systems.

These architectural domains inform the way integration is handled, the selection solution and any other decisions and dimensions required for consideration. Be it the functional completeness of a solution, reduction of number of solutions, ensuring a common look or feel or otherwise.

The adoption of this will drive more responsive services as well as position the GC to better mitigate risks and reduce overall concerns related to maintenance. The long term benefits of this transformation will provide better return on IT investments and further build the rationale on GC IT spending.

Business Outcomes

The reference architecture provided will use this target state to evaluate GC investments presented to the Government of Canada (GC) Enterprise Architecture Review Board (EARB), as an extension to the GC Enterprise Architecture Standards.

It will support further alignment with the commitment to the D9 Charter such as the criteria on User needs, Open standards, Open source, Open government (transparency), Connectivity, and Assisted digital to support all its citizens to access digital services.

The expected results of the implementation of the Service & Digital Target Enterprise Reference Architecture are as follows:

Improved User Experience

An improved user experience that focuses on efficiency, quality and reliability of services for Canadian Citizens and GC Employees.

By providing a common language to identify solutions that meet the needs of an organization, and supporting those solutions in the open we can increase collaboration within the Crown Institutions in Canada and with our international partners and allies.

Through the creation of Enterprise Systems of Record, we can ensure that user experience remains cohesive, and that citizens and staff aren't required to redo the same request for a separate service aka : "Tell Us Once".

Improved Cost Effectiveness of Service Delivery

This will provide improved cost effectiveness of service delivery providing better usage of taxpayer dollars, allowing further rationalization of increased IT spending and the return on IT investments.

To support this the GC Enterprise will focus on improving the overall availability and discoverability of reusable technology within government and society. This adoption of Open Source will decrease duplication of functionality and data across systems, while increasing the use of Enterprise Systems and Interoperability between them.

With all Departments capable of improving and innovating on these Open Enterprise Solutions the cost effectiveness and value delivered by the Solution raise exponentially in comparison to one off projects that will generally require workarounds for years until the next project to replace the solution.

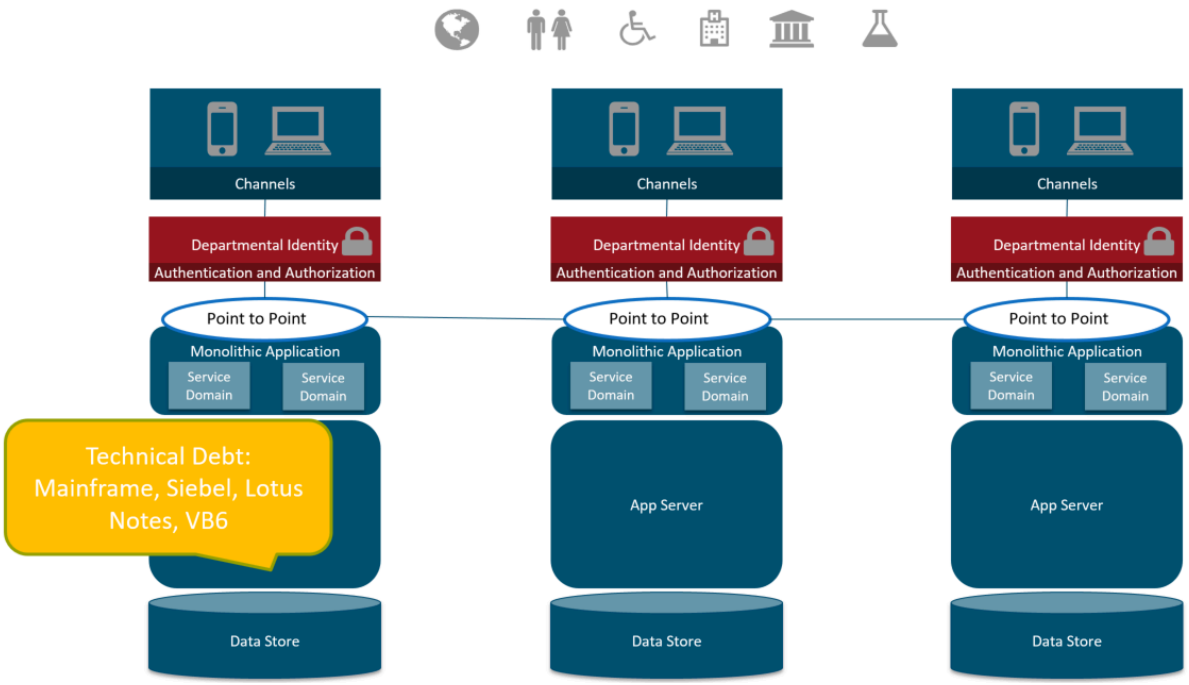
Improved Morale and Engagement of IT Professionals

More engaged IT professionals with improved morale will serve as a motivating factor to improve Employee retention in the GC.

Retention has been identified as an issue across the whole of GC, with IT Professionals being poached from both other Crown Institutions and Private Industry.

When empowered, IT professionals will be more willing and capable of greater flexibility in the management of Information and Communication Technologies (ICT). A cornerstone of this is the adoption of IT practices like DevSecOps and Agile Frameworks.

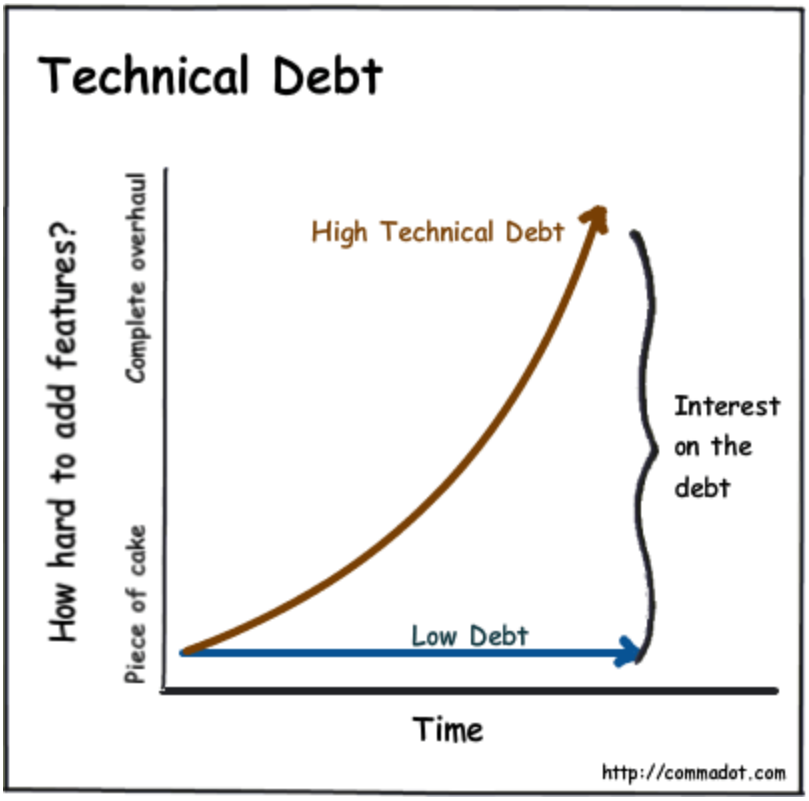
Current State



The current state of the GC is a series of macroservices, with point to point integration. These systems depending on Department can have an average age of greater than 40 years, having accrued technical debt to the level that even a replacement of the system has become too cost prohibitive and further investment compounds in cost each and every year. Platforms still requiring expertise in obsolete Programming Languages or Hardware are all too common, and the cost continues to rise on services associated with keeping the lights on for these services each and every year.

Addressing Technical Debt

Technical Debt is inherent in all solutions involving the use of technology. Accrued over time as better solutions exist, more efficient processes and methodologies are found and innovation occurs. Without addressing it results in the creation of a legacy system.



A Legacy system is defined as a system where the cost and complexity to improve the system begins to outpace the cost to simply replace the system as a whole. As all technical debt is an exponential function, it out paces any and all efforts outside applying continuous improvement.

These legacy systems hold departments back from leveraging new digital technologies and creating new experiences for citizens, stakeholders, and partners. Often slow, with little to no interoperability, these systems limit the flow of data when real-time data is required to meet the expectations of citizens and GC Employees.

Monolithic applications, architectural complexity and extensive technical debt place burdens on development teams and limit their ability to support digital business transformation. This can and does impact employee morale and is a driving factor in inability to retain IT staff in the GC.

Monolithic systems should be disassembled, and components re-developed to expose RESTful APIs. The Strangler Fig pattern can be used to minimize risk from the migration of these systems and spread the development effort over time.

For technical debt in the form of Mainframes, Customer Relationship Management Systems, and Financial Management Systems, automation technologies may help to accelerate legacy code analysis, business rule extraction and code transformation.

For other forms of technical debt, Open Source and proprietary Enterprise Complexity Analysis tools may be leveraged to deconstruct and abstract capabilities in order to redevelop exposable RESTful APIs.

Strategic disassembly of legacy systems is preferable to Lift and Shift re-hosting, as emulation increases complexity, continues to accrue technical debt, and in general is far more costly.

Addressing Interoperability

Interoperability is defined as the ability for differing systems and software to exchange information. The protocols and formats in doing so have evolved over time, but with the majority of the GC leveraging Legacy systems these innovations in ability to share have not been leveraged often.

The Westminster Model of Government has further proven to be a detriment to the uptake of collaboration via Technology. Incentives to work collaboratively, proactively share information and access to services are few and far between, and a Transformation in the way the GC maintains Software and Services is the perfect opportunity to address the growing need to collaborate and share information across the GC.

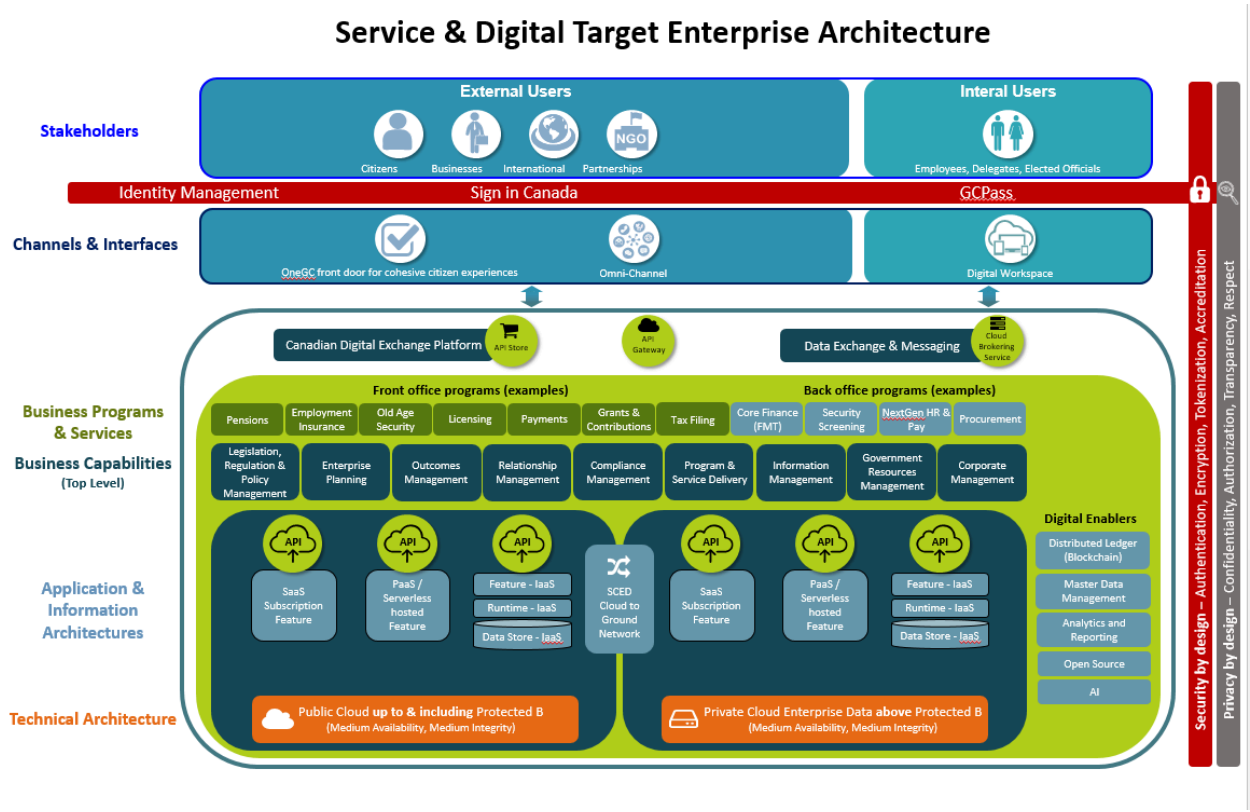
Addressing Environmental Impact

Originally undertaken in 2015, Shared Services Canada was tasked with consolidation of over 700 legacy data centers, with close to 90% of these ‘data centers’ being simple rooms in office buildings. While these consolidation efforts have done wonders for improving the environmental footprint, the GC has a long way to go in ensuring the IT practices are environmentally sustainable.

Cloud offerings provide a medium for the Government to run software in a more environmentally friendly way, especially if incentivization around green initiatives for private industry remain. While the GC is capable of running “private” cloud offerings it has been proven time and time again that the private industry is more capable of keeping up with hardware refresh speed, maximizing utilization so that compute power isn’t wasted, and developing out eco friendly data centers in a fashion that the GC is incapable of doing simply due to the logistics and budgets involved.

Furthermore the GC can improve its commitment to Greener Government by ensuring that the procurement of Cloud services takes into context the environmental performance, especially in comparison to GC end state data centres and in Technology and Application Architecture designs below.

Service & Digital Target Enterprise Architecture



Introduction

The expectations of Canadian citizens and businesses are ever changing. The normalization and proliferation of consumer web and mobile technology high quality user experiences has led to the expectation that technology should be intuitive, cohesive, responsive, and available. The supporting technologies to enable these expectations such as Software as a Service (SaaS) solutions, mobile channels, and the Internet of Things (IoT) require a new level of connectivity that cannot be achieved with our current integration strategies.

The Service & Digital Target Enterprise Architecture provides the fundamental architectural capabilities that enable applications to support multiple experiences and respond rapidly to digital business demands. This approach will provide the architecture for individual applications as well as a strategy for modernizing the application portfolio. It is an evolutionary approach that enables departments to iteratively modernize their applications in direct response to business priorities.

The future state of the GC Enterprise Architecture will achieve this new level of connectivity by more widely leveraging Application Programming Interfaces (APIs). APIs can be defined as an interface or communication protocol between a client and a server intended to simplify the building of client-side software. It has been described as a “contract” between the client and the server, such that if the client makes a request in a specific format, it will always receive a response in a specific format or initiate a defined action. APIs have evolved from being a developer-specific technology to a service for the public as a whole. APIs can now be used as not just a supporting mechanism for other systems to support services to citizens, but as a service for citizens themselves.

The use of API-led connectivity provides the fundamentals required to support collaboration, integration and is the core to the development of Micro and Mini services. Without the adoption of which the creation of new systems will become more costly, prohibitive and unsupported as time goes on.

A Structured Approach

Enterprise Architecture (EA) is a conceptual blueprint that defines the structure and operation of an organization considering and aligning business, information/data, application, technology, security, and privacy domains to support strategic outcomes.

The use of an industry standard framework called TOGAF (The Open Group Architecture Framework) is useful for providing a structured approach to these standards, and it has been adapted using the same building blocks, the B-I-A-T-S+P (Business - Information - Application - Technology - Security + Privacy). The "P" (Privacy) was added as an important dimension of Security important for the Canadian public.

Business Architecture

Business Architecture is the discipline that focuses on the business process in its entirety including authorities, accountabilities, legislation, policies, directives and mandates surrounding an outcome or result. It ensures that systems are designed to be measurable and accountable, and delivered by multidisciplinary teams.

It is focused on the people, process and tools, and as such it is the discipline that defines business capabilities and ensures that the design is focused on outcomes for users.

It is best defined as blueprint of the enterprise built using architectural discipline that provides a common understanding of the organization and is used to align strategic objectives and tactical demands.

Information Architecture

Information Architecture is the discipline that focuses on the data and information gathered by a process and its solution(s).

It establishes a structure for data collection, management, storage, and sharing (with a focus on open sharing as per the Directive on Open Government).

Application Architecture

Application Architecture is the discipline that focuses on the interaction of applications with each other and with users. It focuses less on internal mechanics and specific programming and more on overall design on how data is consumed and created by the system. It views the interactions between applications, databases and middleware to ensure scalability, reliability, availability and manageability.

It emphasises the use of open standards and solutions, develops in design methodologies that ensure reuse is maximized, and developers in modular ways to focus on enabling interoperability.

Technology Architecture

Technology Architecture is the discipline that defines standards for using Cloud hosting (and related models such as Software as a Service), and designing for performance, availability, and scalability.

It emphasis the use of resiliency reinforcement such as Chaos Engineering (the practice of killing services at random to ensure redundancy and fallbacks work correctly), that services are monitored and can recover from disaster.

Security Architecture

Security architecture is the art and science of designing and supervising the construction of information systems, which are: secure from harm; resilient to attack; reliable and predictable in operation; available to users; and protect the confidentiality, integrity, and availability of users' data. *(adapted from ref: SABSA)*

Modern security architecture practices support achieving business outcomes, driven by business needs for security, and strive to balance ease of use and controls, while applying security in a more consistent manner.

Undertaking a proper security architecture process helps ensure that security is built in to service and system design from the outset, across all architectural layers (business, information,

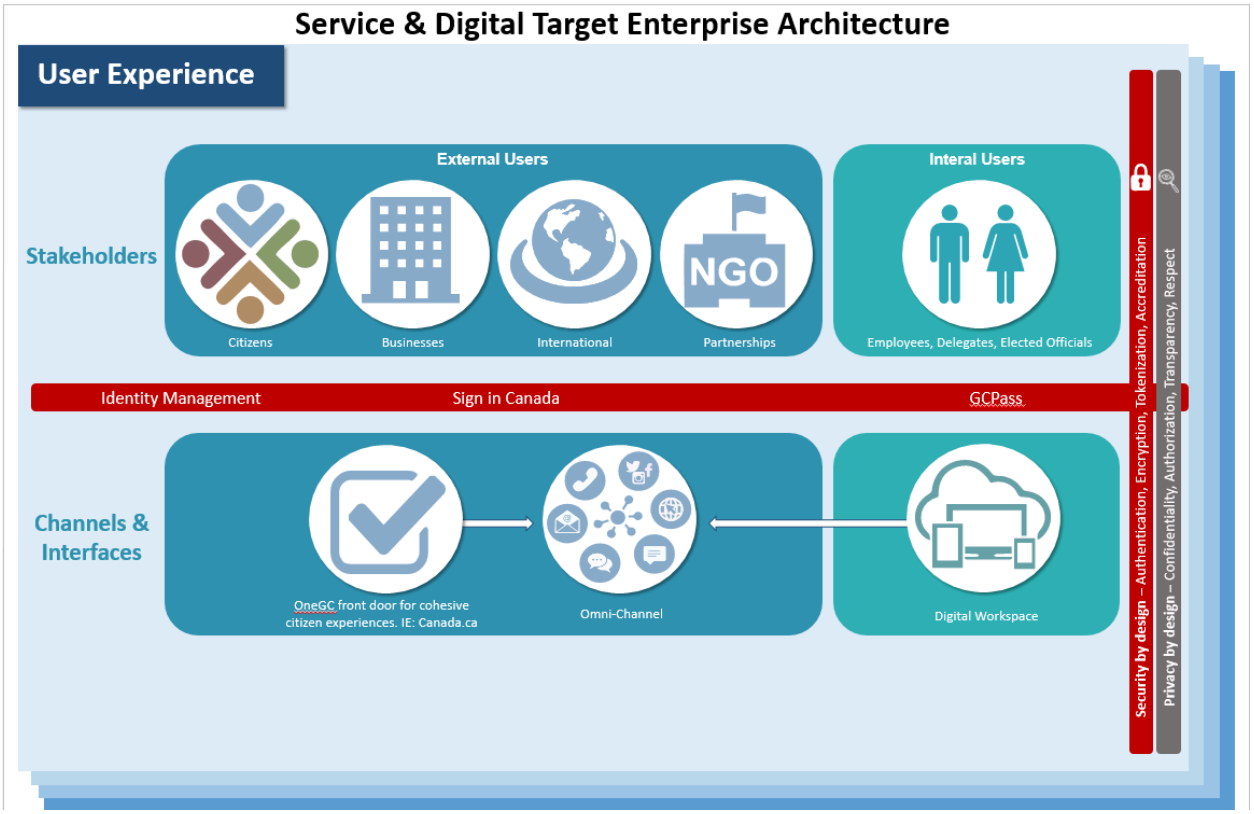
application, and technology), including continuous renewal, considerate of a constantly changing threat environment.

Privacy Architecture

Privacy Architecture emphasizes the need to perform a privacy impact assessment (PIA) when personal information is involved, and ensures a balance between user and business needs with proportionate security measures.

The Service & Digital Target Enterprise Architecture depicts the long term (2025) high level target state for each of these layers to provide direction for GC Architects and to assist in the assessments of GC initiatives presented at the GC EARB.

User Experience and Systems of Engagement



For the 21st century, the focus of any kind of service delivery is on the experience of the users. Government service is no exception to such user-centered expectations in the experience economy. This can be seen through Canada's commitment to the D9 Charter, with it's first guiding principle being user experience and the first GC Digital Standard, **Design with Users.**

The definition of this standard: “Research with users to understand their needs and the problems we want to solve. Conduct ongoing testing with users to guide design and development.” is to support deep understanding and empathy for users.

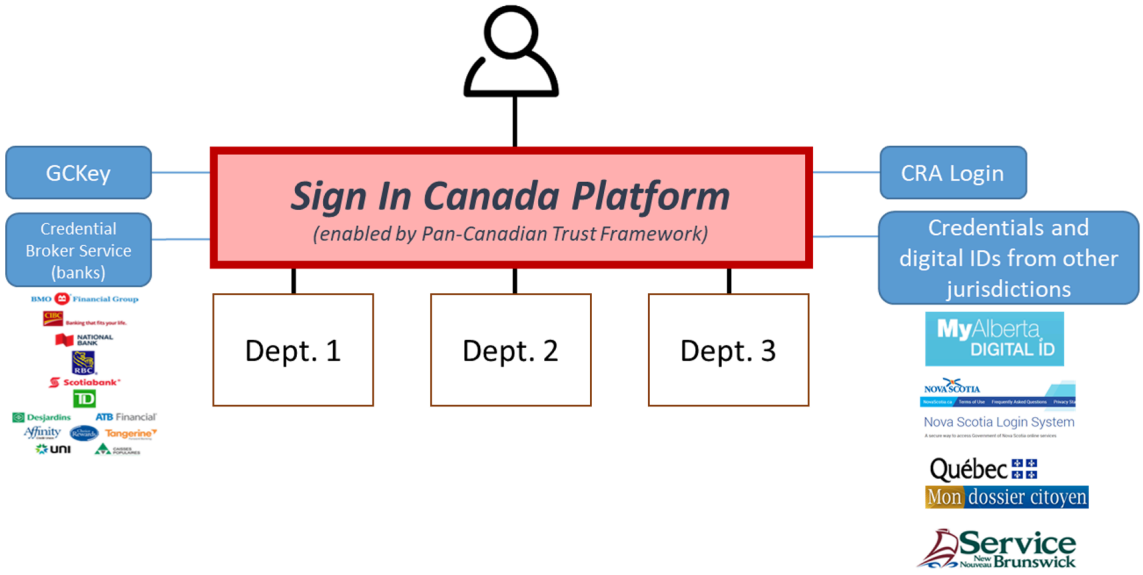
This view ensures government services are delivered in a cohesive, respectful, inclusive, and value-added manner throughout all service delivery channels. Internally within the government, the same principles and practices are also encouraged when design services for employees.

Beyond providing government services around citizens’ life events and activities, other consideration examples include accessibility, unique requirements for indigenous people, Gender Based Analysis Plus (GBA+) and official languages.

The first step of GC digital service delivery is acquiring access to services. The first contact users have with the governments digitally is either through browsing, or anonymous based request, or user account creation and the required user identity authentication and validation. Without secured access, it is impossible to deliver digital services.

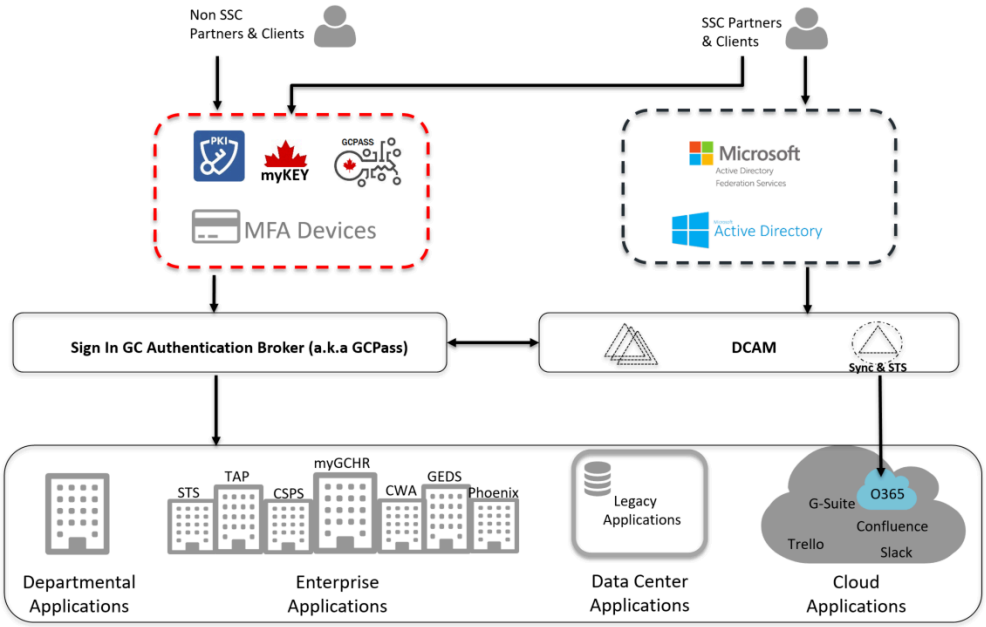
In order to streamline government service delivery, GC proposes a Pan-Canadian Trust Framework to manage the identities of users for services of all levels of government.

Sign in Canada Target Architecture



Sign-in Canada is the proposal of the coming mechanism for the new governmental digital engagement with citizens. Users would only need to tell all governments one time who they are; there is no need to sign up multiple times to access different government services.

GC Internal Authentication Target Architecture

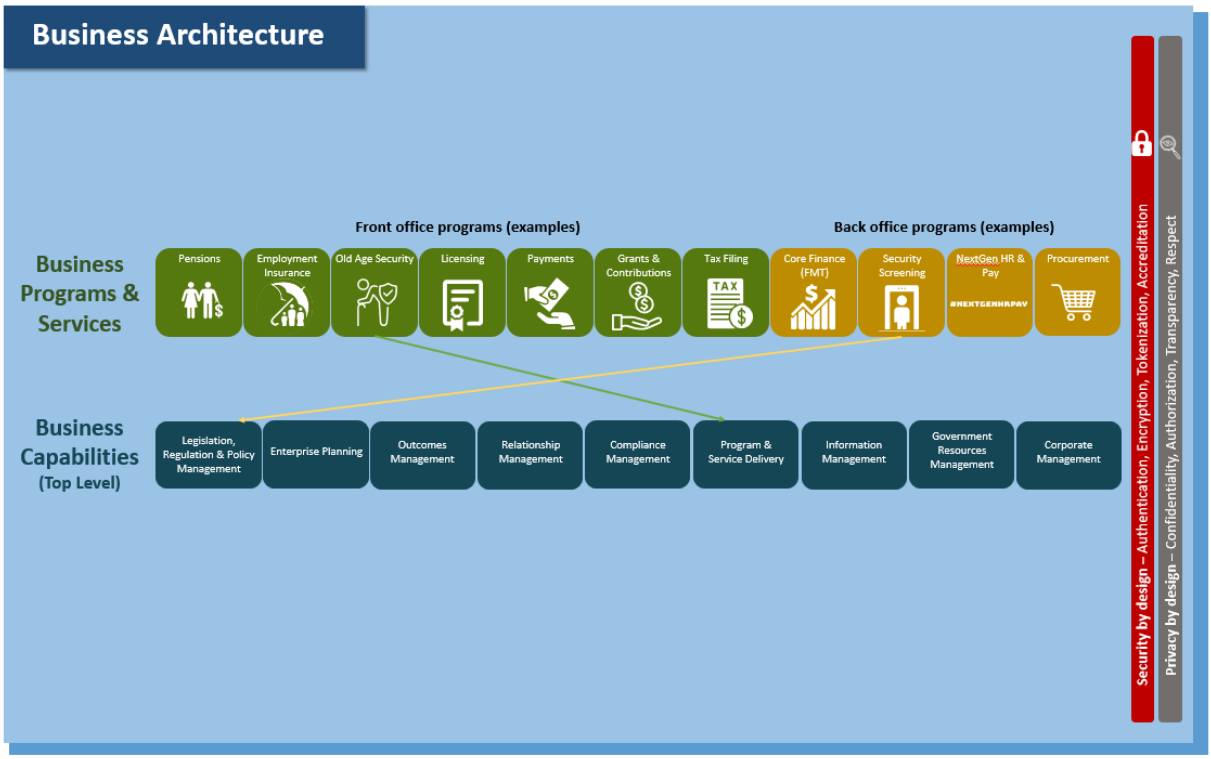


Internally within the government, the coming **GCPass** will streamline secure and appropriate access to GC systems for the public servants. GC values positive employee experience as the foundation step for improving government services.

In an effort to minimize disruption in projects on the release of these services, the Government of Canada API Standards note that the use of Authorization methods like OpenConnect or OAuth 2.0 be used. As previously mentioned, the Strangler Fig pattern can be used to rebuild Authentication services to support the necessary changes and move from legacy authentication schemes.

Target Business Architecture

Service & Digital Target Enterprise Architecture



The business architecture layer of the target state architecture includes two components: **Front office** programs that deliver departmentally-mandated services to Canadians and businesses and **Back office** programs that support the GC Enterprise. These use a common language across the GC known as the **Business Capabilities**. These capabilities provide the framework for a common language to facilitate discussion of where collaboration can occur.

The business architecture is a structure that encapsulates the following principles:

Fulfill the Government of Canada stakeholder's needs

- Clearly identify internal and external stakeholders and their needs for each service including user centric design
- Include policy requirements applying to specific stakeholder groups, such as accessibility, Gender Based Analysis Plus (GBA+), and official languages in the architecture design and implementation.
- Model end-to-end service delivery to provide quality, maximize effectiveness and optimize efficiencies across all channels.

Architect to be Outcome Driven and Strategically Aligned to the Department and to the Government of Canada

- Identify which departmental/GC outcomes and strategies will be addressed with the business service solution
- Establish metrics for identified business outcomes throughout the lifecycle of an investment
- Translate business outcomes and strategy into business capability implication in the GC Business Capability Model to establish a common vocabulary between business, development, and operation

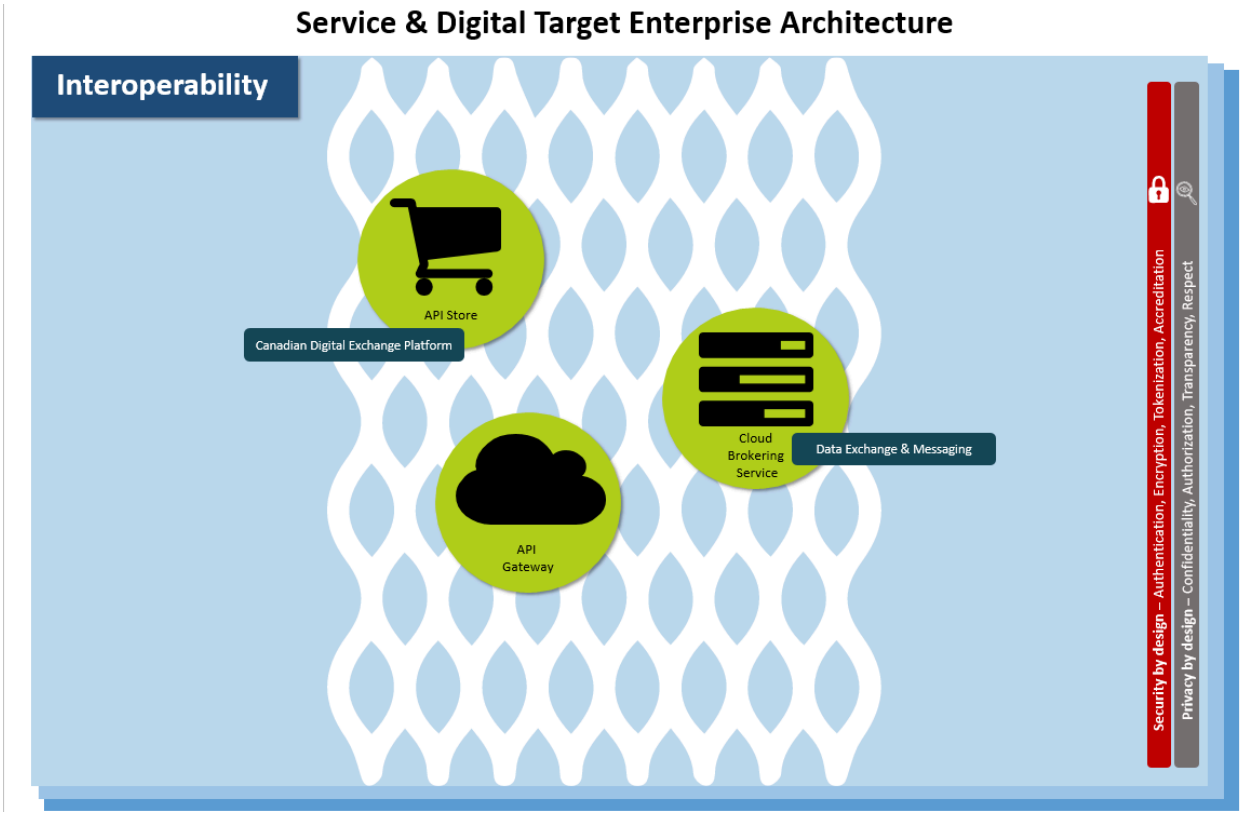
Promote Horizontal Enablement of the Enterprise

- Identify opportunities to horizontally enabled services and provide cohesive experience to stakeholders
- Reuse common business capabilities and processes from across government and private sector
- Publish the implementations of business capabilities and related processes (eg: Source Code & Documentation) in the open for others to develop cohesive services

Next Steps

Concrete steps to achieve common citizen and employee experiences will involve more work and details than just the high level service inventories and business capability model. For example, we can construct the user journey, value chain, processes, use case model, user stories; we can produce heat maps, identify the inter-dependencies among various activities in the service consumption, user interaction segments. Business Architecture analysis can provide guidance and requirements to the other architectures.

Target Interoperability Architecture



In order for government to engage with citizens and employees effectively, the GC must be able to extract data from the existing large amount of legacy and siloed systems. APIs are an effective mechanism to expose data from systems and provide access to that information to various services to be consumed by end users and IT specialists.

In the past, point-to-point integrations created an unmanageable number of connections and introduced bottlenecks. Hundreds of systems are tightly coupled together, making it difficult to address technical debt or modernize existing systems. This resulted in reduced flexibility and responsiveness to change.

As an improvement to point-to-point integration, the Services Oriented Architecture approach began to be embraced a decade ago by the GC by some departments. As a further evolution, API-led connectivity offers a lighter-weight and more flexible approach to interoperability. Modern APIs are by default versioned, allowing the ability for systems to introduce improvements without impacting other systems currently relying on the specific implementation of those APIs.

This leverages a distinct ‘connectivity building block’ that encapsulates three distinct components:

- Interface: Presentation of data in a governed and secured form via an API
- Orchestration: Application of logic to that data, such as transformation and enrichment
- Connectivity: Interoperability between components

This interoperability approach includes three layers:

- System Layer: This layer abstracts complexity such as connectivity, insulate from version changes, provides SaaS connectivity, Restful API connectivity, and legacy connectors. This abstraction layer will be leveraged heavily to address technical debt as the GC transitions from monolithic architectures towards miniservices and microservices by connecting to legacy systems and exposing data as APIs, without requiring changes to the legacy systems.
- Process Layer: This layer supports the GC Back office and the Departmental Front Office. Specific functions and logic are exposed to support business capabilities. This layer also includes orchestration functionality to support composite services comprised of multiple microservices via APIs.
- Experience Layer: This layer reconfigures processes as required to support channels such as mobile, web, voice activated assistants, IoT, in-person kiosks, or call centres.

To achieve large-scale interoperability across government, APIs must be programmatically consumable by other agencies and by the private sector. The GC must develop experience in the delivery of APIs to a wide variety of consumers as part of the migration towards an API-led integration Architecture.

Since building APIs does not guarantee that they will be used to deliver citizen value, GC APIs must be made available in a consistent and predictable way, making them easily accessible to developers and other consumers. Working in the open can increase the probability that any specific GC API provides value. Open Source code can be leveraged, and feedback from the Public and GC as a whole can be leveraged to ensure value is met.

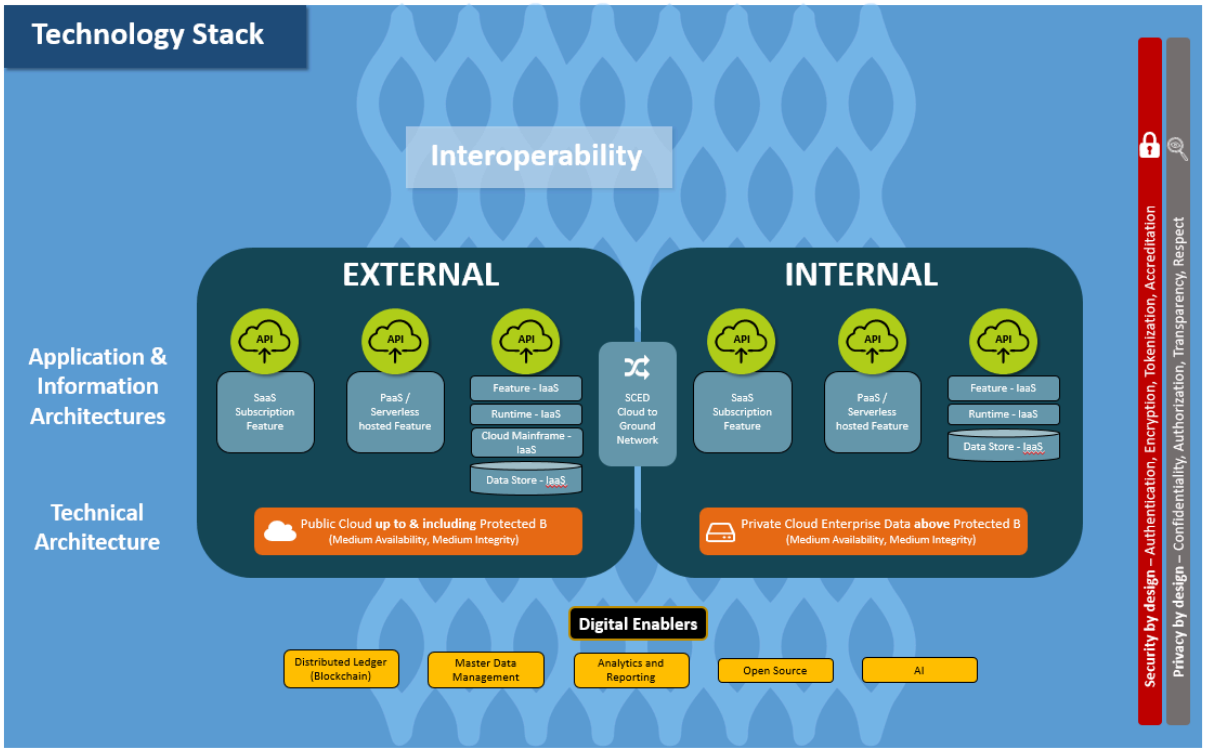
In designing for security by default, APIs must be compliant with industry standards for security [1] to ensure data privacy and to ensure business confidence in this service delivery channel. APIs intended for access to public data must be protected from inappropriate use or abuse such as denial of service.

[1] industry standards for security such as ISO 27001, PCI DSS, SOC 2, and GDPR

Also included in the interoperability layer of the Service and Digital Target Enterprise Architecture, the GC Cloud Brokering Service is a portal that simplifies the procurement and fulfillment of cloud services. As the future state leverages the public cloud to support data classified as Protected B, Medium Integrity, Medium Availability and below via an easy, standardized access to cloud services for GC departments is key. Combined with the GC API store for discoverability, this will help ensure reuse of components and increase the return on GC IT investments.

Target Application, Information, and Technical Architecture

Service & Digital Target Enterprise Architecture



Target Application Architecture

As the GC addresses technical debt it will evolve from Monolithic systems towards Miniservices, Microservices, and API-led connectivity. These building blocks will be structured across distinct systems, process and experience layers, to achieve both greater organizational agility and greater control.

Microservices are defined as a discrete software service, independent of the core of an application and capable of being leveraged and run without any other services. When updated or redesigned the entirety of the application can remain the same and a single microservice failure may not necessarily leave the entire application vulnerable. For very large and complex applications the adoption of Microservices may make the entire system more manageable, but will generally lead to increased complexity in smaller applications. These services are prime targets for Government publishing as Open Source to allow reuse across the GC and industry.

Miniservices are defined as non-discrete software services that rely on the core of an application. They in general can be refactored via versioning with minimal to no disruption of

other services. For small applications they can vastly reduce the cost, complexity and time required to build in comparison to the technology stack required to support Microservices. These services are prime targets for Government utilizing Open Source Software directly and contributing back any necessary modifications such as Official Languages support.

These Microservices and Miniservices produce more energy efficient solutions that when designed to be platform agnostic can be executed in the lowest cost operating environments allowing maximization of utilization rates of the underlying equipment and thus reduction in the total impact on the environment.

To address the issue that a problem scope is easier to move around than it is to solve it, abstraction of application architecture layers that focus on maximization of value of a layer over maximizing the number of abstractions.

The following standards were developed to support this modernization of the application architectural layer.

Use Open Standards/Solutions by Default, Enable Interoperability and Maximize Reuse

- If an Open Source option is not possible, favour platform-agnostic commercial off the shelf software (COTS) over proprietary COTS, avoiding technology dependency, allowing for substitutability and interoperability. For custom-built application, by default any source code written by the government must be released in an open format.
- Expose all functionality as services and make all services available through a well-defined interface, such as a HTTPS-based application programming interface (API). All APIs with potential for cross-departmental, inter-jurisdictional, or public consumption must be published to the GC API Store
- Reduce integration Complexity - design systems to be highly modular and loosely coupled to be able to reuse components. Use micro services scoped to a single purpose and made available for cross-business use. Select enterprise and cluster solutions over department-specific solutions

Target Information Architecture

The GC must modernize the collection, management, and sharing of data in order to meet the expectations of Canadians.

The following standards govern the treatment of GC data:

- Ensure data is collected responsibly in a format following an enterprise or international standard
- Ensure data is managed responsibly and in a manner that maximize use, reuse and availability

- Data should be shared openly by default as per the Directive on Open Government via the GC Open Portal, taking into consideration existing laws and regulations to safeguarding of data

GC Data Community of Practice is an active group functioning under the GC EARB governance umbrella. Its many subgroups and large amount of participants have been working on the above challenges. They shared information and lessons learned in GCconnex. For the very first time, there is a forum to facilitate discussions on GC wide data standards and data sharing.

GC requested all departments to complete their change management focused, strategic Departmental Data Strategy to TBS CIOB, Privy Council and Statistics Canada September 2019. More information is available in GCconnex.

Target Technical Architecture

As the GC progresses toward the target state, the technical architecture will become more distributed, optimized, and loosely coupled. This will enable increased agility, performance, availability, and support enhanced measurement.

The following standards have been established to support the Target State Technical Architecture:

Use Cloud first

- Adopt the Use of the GC Accelerators to ensure proper Security and Access Controls; design for cloud mobility and develop an exit strategy to avoid vendor lock-in
    - More Information on the GC Accelerators can be found here.
    - If functionality is missing from the GC Accelerators, share your improvements or additions back with the GC at large.
- Enforce this order of preference: Software as a Service (SaaS) first, then Platform as a Service (PaaS), and lastly Infrastructure as a Service (IaaS)
- Enforce this order of preference: Public cloud first, then Hybrid cloud, then Private cloud, and lastly non-cloud (on-premises) solutions

Design for Performance, Availability, and Scalability

- Ensure response times meet user needs, and critical services are highly available
- Run applications in containers or leverage PaaS and CI/CD to enable rapid deployment and scaling
- Establish architectures that supports new technology insertion with minimal disruption to existing programs and services

The Technical Architecture can also improve upon the Environmental Impact of a Solution by ensuring that the correct virtualization and technologies are used to support a solution based on the profile of the workload.

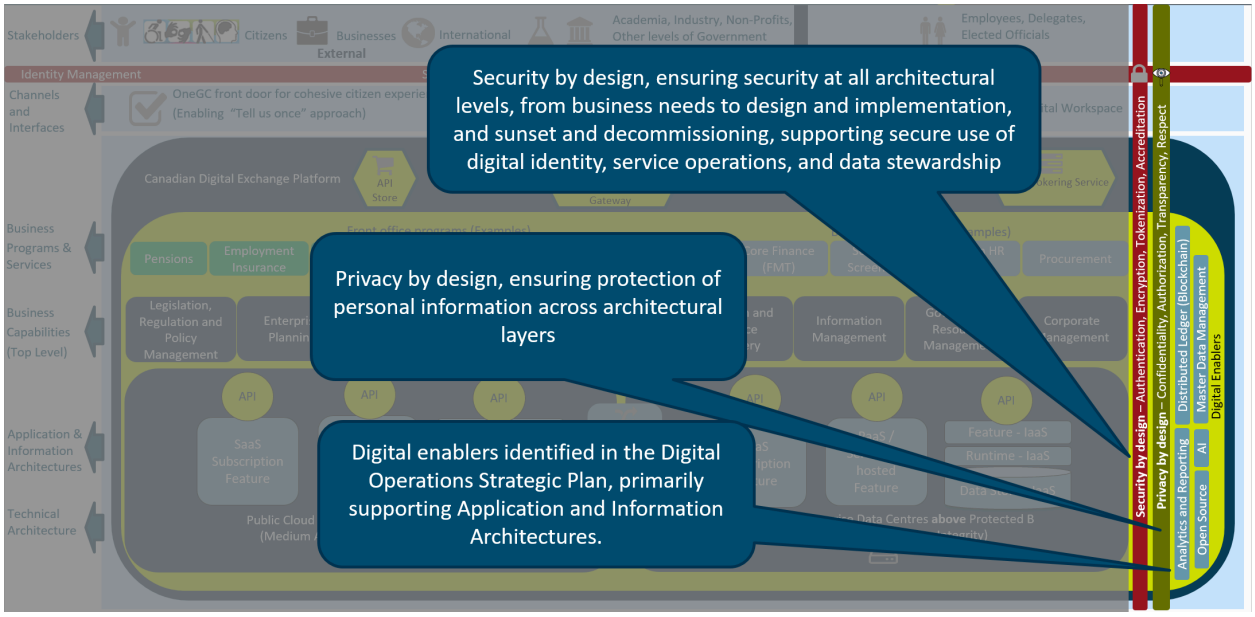
Supporting connectivity with the Public Cloud

The GC Enterprise Backbone will enable the GC to maintain visibility of the information stored, processed, and transmitted when using public cloud-based services while maintaining a consistent security posture across the GC, including public cloud environments for data classified as Protected B, Medium Integrity, Medium Availability and below.

The backbone includes a combination of cloud based sensors and host based sensors to provide capabilities such as the following:

- Trusted connectivity between the GC and Public Cloud Exchange Providers,
- Visibility,
- Data security,
- Threat protection,
- Compliance,
- Enterprise integration,
- Data loss prevention,
- Malware detection and prevention,
- Single sign-on, authorization, tokenization, and encryption

Target Security Architecture and Digital Enablers



Security Architecture

Building on the identity management layer, and supporting security by design across all architectural layers, the Security architecture includes considerations such as authentication, encryption of data in motion and at rest, tokenization, and accreditation.

Privacy

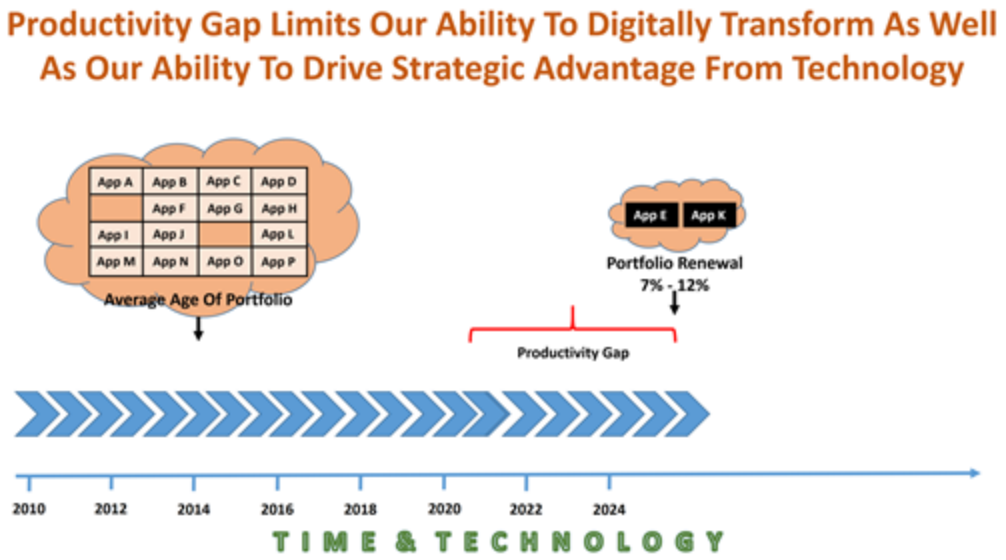
Privacy is included in the design considerations of all GC investments, guided by principles of confidentiality, authorization, transparency, and respect for data.

Digital Enablers

Innovation in IT is rapid, and the Service & Digital Target Enterprise Architecture is supported by emerging technologies with disruptive potential. In order to govern this disruption, GC EA has established guardrails to encourage innovation while mitigating risk. Some of the disruptive technologies that may be included in the target state have been included in the Digital Operations Strategic Plan such as Distributed Ledger Technology (DLT / Blockchain) and Artificial Intelligence.

The GC will also benefit from other digital enablers such as Master Data Management for finance and citizen data, open source, and advanced business intelligence, analytics, and reporting. GC Data Community of Practice created a sub-group for MDM. More information is available in GCconnex.

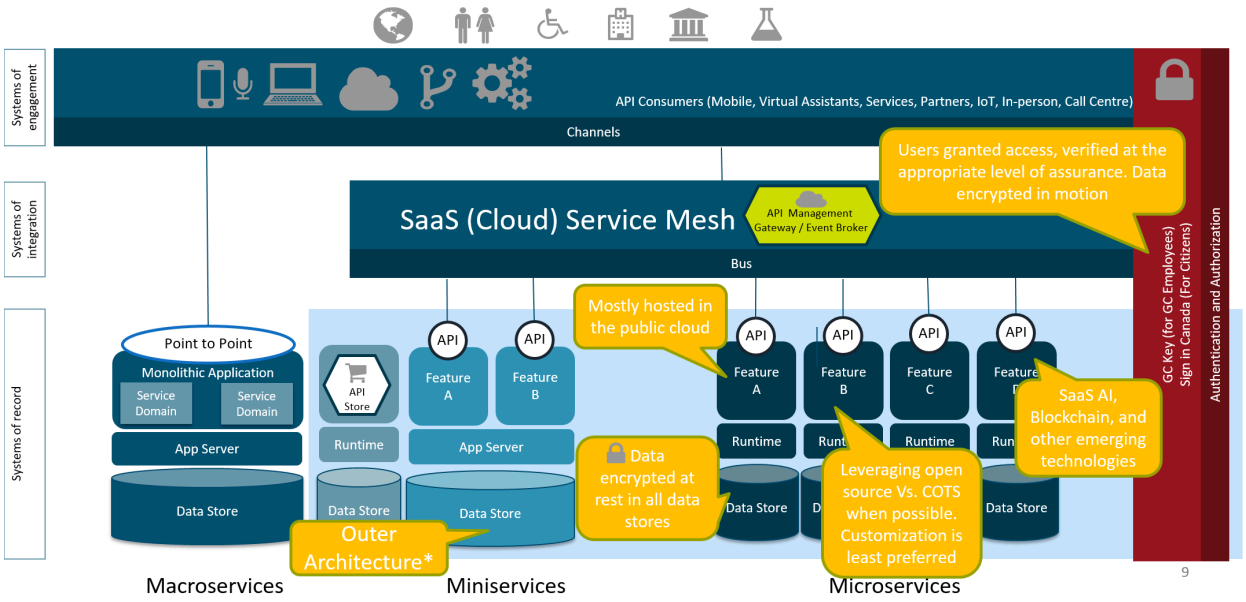
Risks and Challenges



Without actual transformation occurring, the GC is at risk of facing the inability to close the gap on the average application portfolio age. Attempting to leverage general application portfolio renewal process will not allow the level of modernization required to keep up with an ever increasing rate of improvement of technology.

Departments that fail to make the cultural changes required are unlikely to succeed, and a variety of behavioural changes are required to facilitate this change - no single improvement will be enough to support the level of transformation required.

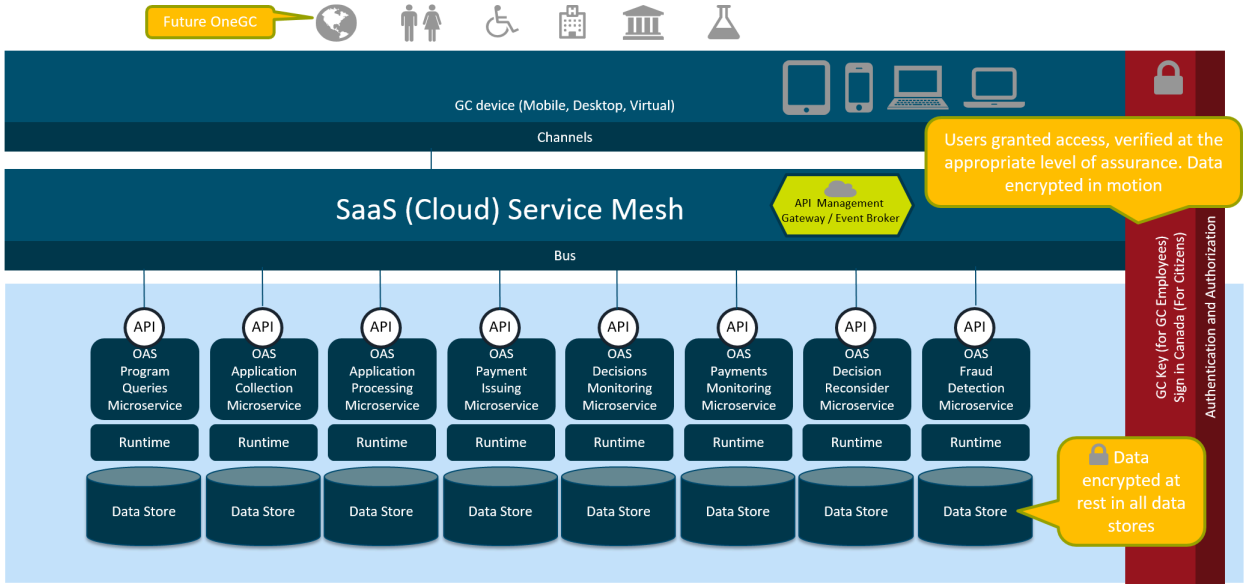
Interim State



The Journey Towards Alignment with GC Enterprise Architectural Standards

Microservices are not a panacea, and technical debt can not always be addressed holistically. Therefore, an interim state between the current state and the future state architecture of 2025 may include a mix of macroservices, miniservices, and microservices. It may also include a mix of cloud and on-premise hosting arrangements. There is much work to be done to migrate to Cloud for Protected B, Medium Integrity, Medium Availability and below, and to Enterprise Data Centres EDCs for systems categorized above Protected B, Medium Integrity, Medium Availability.

Example: OAS Microservices



Microservices can improve development agility with deployment flexibility and feature-level scalability. Implementing this type of architecture should begin with the identification of measurable business goals tied to agility, release cadence and scalability. The principles should be applied incrementally and pragmatically to improve application delivery by implementing smaller, more loosely coupled services where distinct system capabilities, to respond to the need to develop and evolve rapidly and independently.

In this example, a hypothetical set of microservices to support the Old Age Security service to citizens has been considered.

Conclusion

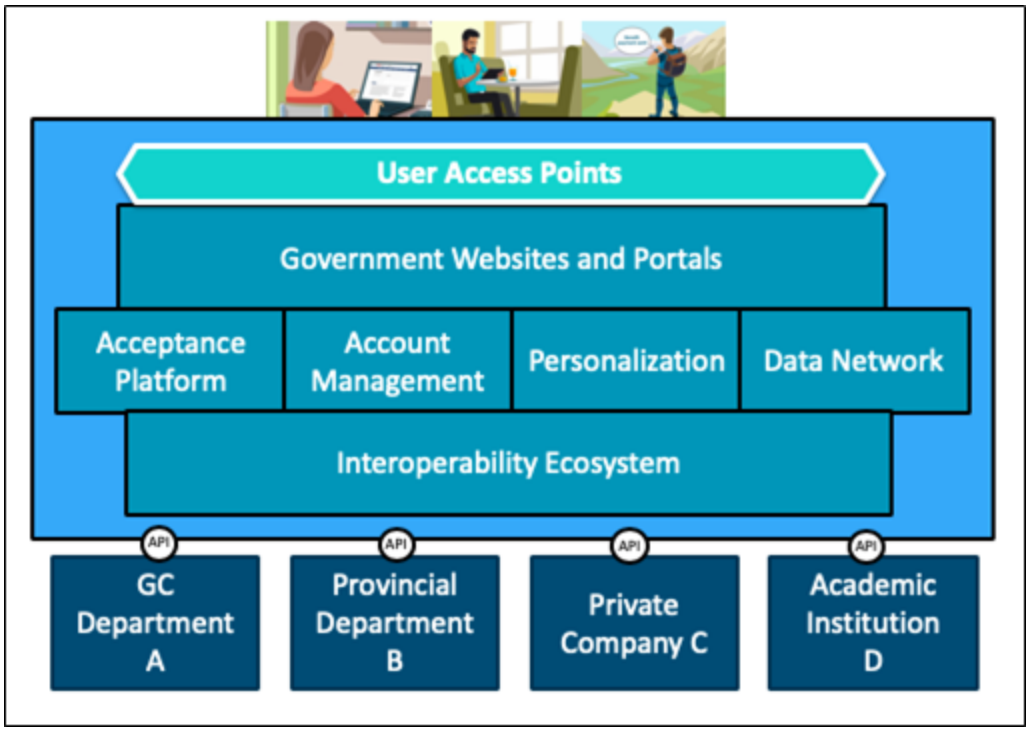
Canadians expect cohesive interactions with the GC anywhere, any time, on any device. This Service & Digital Target Enterprise Architecture will enable this outcome by providing a structured approach and strategy to guide GC investments to optimize the business, information, application, technical, security, and privacy architectural layers. By moving toward API-led connectivity supported by Public Cloud services, the GC will ensure services meet the expectations of Canadians and provide a solid return on GC IT investments.

Appendix

List of Abbreviations and Acronyms

API: Application Programming Interface
GC: Government of Canada
EARB: Enterprise Architecture Review Board
TOGAF: The Open Group Architecture Framework. A framework for enterprise architecture that provides an approach for designing, planning, implementing, and governing an enterprise information technology architecture. TOGAF is a high level approach to design. It is typically modeled at four levels: Business, Application, Data, and Technology. It relies heavily on modularization, standardization, and already existing, proven technologies and products.
ICT: Information and Communication Technologies.
Outer Architecture: Load balancing, data persistence, and other scaling architecture to support the development, deployment, and execution of microservices and API-led integration.
SaaS: Software as a Service
PaaS: Platform as a Service
IaaS: Infrastructure as a Service
IoT: Internet of Things
COTS: Commercial off The Shelf Software

Logical GC Target State Concept Diagram



Policy on Service and Digital

The Policy on Service and Digital and supporting instruments serve as an integrated set of rules that articulate how Government of Canada organizations manage service delivery, information and data, information technology, and cyber security in the digital era. Other requirements, including but not limited to, requirements for privacy, official languages and accessibility, also apply to the management of service delivery, information and data, information management and cyber security. Those policies, set out in Section 8, must be applied in conjunction with the Policy on Service and Digital. The Policy on Service and Digital focuses on the client, ensuring proactive consideration at the design stage of key requirements of these functions in the development of operations and services. It establishes an enterprise-wide, integrated approach to governance, planning and management. Overall, the Policy on Service and Digital advances the delivery of services and the effectiveness of government operations through the strategic management of government information and data and leveraging of information technology. The management of these functions is guided by a commitment to the guiding principles and best practices of the Government of Canada Digital Standards: design with users; iterate and improve frequently; work in the open by default; use open standards and solutions; address security and privacy risks; build in accessible from the start; empower staff to deliver better services; be good data stewards; design ethical services; collaborate widely.

Business Architecture Current State

- Some of the existing official information for understanding parts of the As-Is GC Business Architecture:
    - External facing business programs and services
        - Departmental External Service Inventory
        - Departmental Mission Critical Service and Application List
        - Departmental Report on Plans and Priorities
    - Back office programs and services
        - Departmental IT Services Catalogue, Inventory
        - Departmental Application Portfolio
        - SSC and PSPC IT Services Catalogue, Inventory
        - SSC and PSPC Application Portfolio
    - Service reviews
        - MAF Performance Measurement and Evaluation led by TBS
    - GC Business Capability Model
        - Other than services inventories, business capability model also helps to paint a picture of what does the government do. The Business Capability Model for the Government of Canada (GC BCM) is a collaborative effort between several departments to provide a view of the GC enterprise. The model cuts across departmental silos to describe what we do to achieve our business outcomes. GC BCM can help to build the simplified, streamlined common citizen experience by leveraging a common language, common look & feel. More information is available in GCConnex (GC BCM group).
    - GC Common Grants and Contributions Reference Architecture
        - TBS Comptroller General organization is responsible for the GC Common Gs&Cs Reference Architecture. More information is available in GCConnex.

References and Credits

- Gartner 13 August 2018 | Published: 13 March 2017 ID: G00317192 Add Full Life Cycle API Management to Your Digital Government Platform
- Mulesoft API-led Connectivity The Next Step in the Evolution of SOA https://www.mulesoft.com/fr/lp/whitepaper/api/api-led-connectivity
- Braunstein, Mark L. (26 July 2018). Health Informatics on FHIR: How HL7's New API is Transforming Healthcare. Springer. p. 9. ISBN 978-3-319-93414-3. Non-technical readers may not understand what an API is. In non-technical terms, it can be understood as a 'contract' that says to software developers that if you send a request from a 'client'

computer (e.g., a phone, tablet, notebook or desktop) to a 'server' (the computer where the information is stored) in the specified format you will always get a response in a specified format or initiate a defined action.

- ESDC Strategy Team “Case for Continuous Improvement” 2019-10-15