Virtual Care
Interoperability Enablement Project

pan-Canadian Projectathon
March 21 – 23, 2022

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Context

To support Health Canada's digital health strategy to ensure "*Health system data flow seamlessly across the care continuum — whether care is delivered in-person or virtually"* and "*opening up data access and sharing – with patient access to data as top priority,"* Canada Health Infoway (Infoway) has been working with multiple jurisdictions to develop a pan-Canadian specification for Patient Summaries (PS-CA), built on the International Patient Summary (IPS) standard. In advancing the PS-CA specification, Infoway organized and delivered a Projectathon event to bring together vendors and jurisdictional project teams to test a common, national specification for the patient summary. This work directly relates to the delivery of 3 goals outlined in Infoway's proposed work plan for current and future years:

1. Availability of health data in a common, standardized format.
2. Secure exchange of data in healthcare settings.
3. Access for Canadians to their personal health data in a digital format.

By executing these foundational programs and current work plan, the initiative improves the ability for health systems to access and share data according to pan-Canadian standards.

The first Canadian Projectathon was held in March 2022 and was organized and sponsored by Infoway, with support from IHE Catalyst, a world leader organization in the space. This no-fee event was designed to be the first in a line of events that will introduce increasingly more complex scenarios to the market; and work with vendors and stakeholders to identify, test, and solve typical data exchange and workflow challenges that hinder the current integration efforts.

Objectives

The goal of the pan-Canadian Projectathon was to identify potential issues in the pan-Canadian Patient Summary (PS-CA) and pan-Canadian FHIR Exchange (CA:FeX) specifications. The Projectathon offered Canadian implementers exposure to a flavor of international testing for interoperability, one that helps strengthen implementation guidelines and standards in the health sector.

Infoway views Projectathons as a preliminary stage before any conformity assessment, quality label or certification process.

Key objectives of the Projectathon were to:

- Test the readiness and completeness of the PS-CA specification.
- Evaluate participating vendor systems' ability to compose a well-formed, complete Patient Summary (PS-CA) as defined in the published specification package.
- Provide a jump start and value add to the provinces and territories implementing the PS-CA and the CA:FeX specifications.
- Communicate with Projectathon participants and observers regarding the development of the PS-CA and the CA:FeX specifications.

- Receive feedback on improving the specifications; and identify potential issues in the specification, test tools, and the test plans.
- Provide vendors the opportunity to test their product development in support of patient summaries.
- Use the opportunity to socialize a Gazelle-based testing platform that ties a specification to the environment in which it is expected to operate.
- Promote the use of integration profiles as established patterns in solving typical integration problems.
- Introduce international testing tools to the Canadian market to raise vendors' awareness and experience with them and to better align Canada with international trends.

Approach

The pan-Canadian Projectathon included three distinct phases (Figure 1):

1. Registration: Participating vendors registered their organizations, systems, and identified the profiles their systems can support.

2. Pre-Projectathon Testing: Participating vendors performed pre-event testing to check that their systems could interoperate with the platform simulators.

3. Projectathon Execution: Vendors participated in the event where testing was done against other live systems, simulating actual implementation environments.

Figure 1. Summary of phases of the pan-Canadian Projectathon

The Projectathon event was held over three days, each with a specific focus, as shown in the table below:

	Date	Objective
Day 1	March 21, 2022	No-Peer Testing
Day 2	March 22, 2022	Peer-to-Peer Testing
Day 3	March 23, 2022	Demonstrations and Business Focus

The first two days of the Projectathon were focused on No-Peer and Peer-to-Peer testing, exploring the interoperability aspects of the specification, where tests offered coverage for six profiles represented in the PS-CA Companion Guide to Reference Architecture. Two categories of integration profiles were proposed for testing (Refer to Appendix B for details):

1. Core integration profiles: MHD, CA:FeX

2. Supporting integration profiles: IUA, ATNA, CT, PIXm/PDQm

Day 3 wrapped up the Peer-to-Peer testing and included a symposia format, where participants and observers were invited to attend facilitated round-table conversations focusing on technical aspects as well as clinical and business needs, lessons learned in implementing the PS-CA specifications, and exploring potential next steps for the evolution of the specification.

It is to be noted that primary care EMR vendors could not participate in the Projectathon event because of the very short lead up time to the event (six weeks).[1]

In preparation for the Projectathon the following activities were completed:

- Developed a Patient Summary FHIR document viewer.
- Developed simulators that implement the MHD and CA:FeX specifications.
- Provided OpenAPI web-based client-side simulators to communicate with the MHD and CA:FeX APIs.
- Developed clinical scenarios including scenario test data.
- Developed a synthetic data generator that produces PS-CA documents in JSON and XML format.
- Offered PS-CA sample documents for MHD and CA:FeX transactions.
- Created test scenarios in the Gazelle platform (Actor/Transactions).
- Offered technical support to the vendors.

Projectathon participants completed the following activities:

- Registered for the event.
- Attended training webinars.
- Reviewed training materials.
- Completed pre-Projectathon and connectivity testing.
- Integrated with the Gazelle platform.
- Executed No-Peer and Peer-to-Peer test scenarios for specific transactions.
- Implemented APIs.
- Prototyped FHIR transactions.
- Prototyped the PS-CA FHIR document.
- Prototyped the submission and retrieval of a FHIR document.

Five vendor systems, including Allscripts, Cerner, Epic, JuniperCDS, and Smile CDR registered for the event. Over the first two days of the event, a total of 35 vendor representatives participated in the testing.

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[1] *Post-Projectathon vendor feedback revealed that specifications should be available and stable for at least six months prior to a Projectathon, as it takes months to prepare and participate effectively.*

Day 3 of the event saw extended participation and collaboration from the following stakeholders (Figure 2). A complete list of participants can be found in Appendix C.

- 19 vendor participants from Allscripts, Cerner, Epic, JuniperCDS, Smile CDR and Orion.
- 18 jurisdictional participants from British Columbia, Alberta, Saskatchewan, Ontario, and Newfoundland.
- 1 representative from Ontario MD.
- 3 representatives from pan-Canadian Health Care Organizations (e.g., CIHI).
- 3 representatives from IHE Canada, IHE Europe and IHE International.

Figure 2. pan-Canadian Projectathon stakeholders

Projectathon Details

Projectathon events that are conducted around specifications that are not yet considered Trial Implementation typically focus on providing a collaborative testing environment for vendors to experiment with and provide feedback on the proposed specifications. The ultimate objective of these types of events is to evaluate the appropriateness and ease of adoption of a specification, typically achieved through the following activities:

- preparations focused on implementing the specification,
- trialing exchange patterns using the testing platform through simulation,
- learning about the logistics of live testing, providing feedback on the specification through targeted discussion sessions, and others.

The scope of the Projectathon included the PS-CA specification, use cases, FHIR content data model, supportive clinical scenarios and test data, pre-Projectathon training and connectivity support, testable profiles, a loaded suite of interoperability testing tools (collectively referred as the Gazelle platform), several supplementary tools and simulators, and facilitated symposia sessions aimed at soliciting the vendor experience implementing the specification to identify challenges and opportunities for future refinement.

Interoperability Specifications

The Interoperability specifications included the pan-Canadian Patient Summary (PS-CA) specifications and the pan-Canadian FHIR Exchange (CA:FeX) specification. The PS-CA specifications include the PS-CA FHIR Implementation Guide, PS-CA Specifications, Companion Guide to Use Case and Definitions (Figure 3), and Companion Guide to Reference Architecture. A complete list and description of the documents can be found on the Projectathon March 2022 Event Page.

Use Cases

Two use cases from the PS-CA specifications v0.2 were tested during the Projectathon (use cases and definitions can be found here):

- UC-01: A Health Care Provider in any care setting creates a Patient Summary for use at the point of care, which is made available to Patient Summary consumers.
- UC-02: A Health Care Provider in any care setting, views and uses a Patient Summary at the point of care.
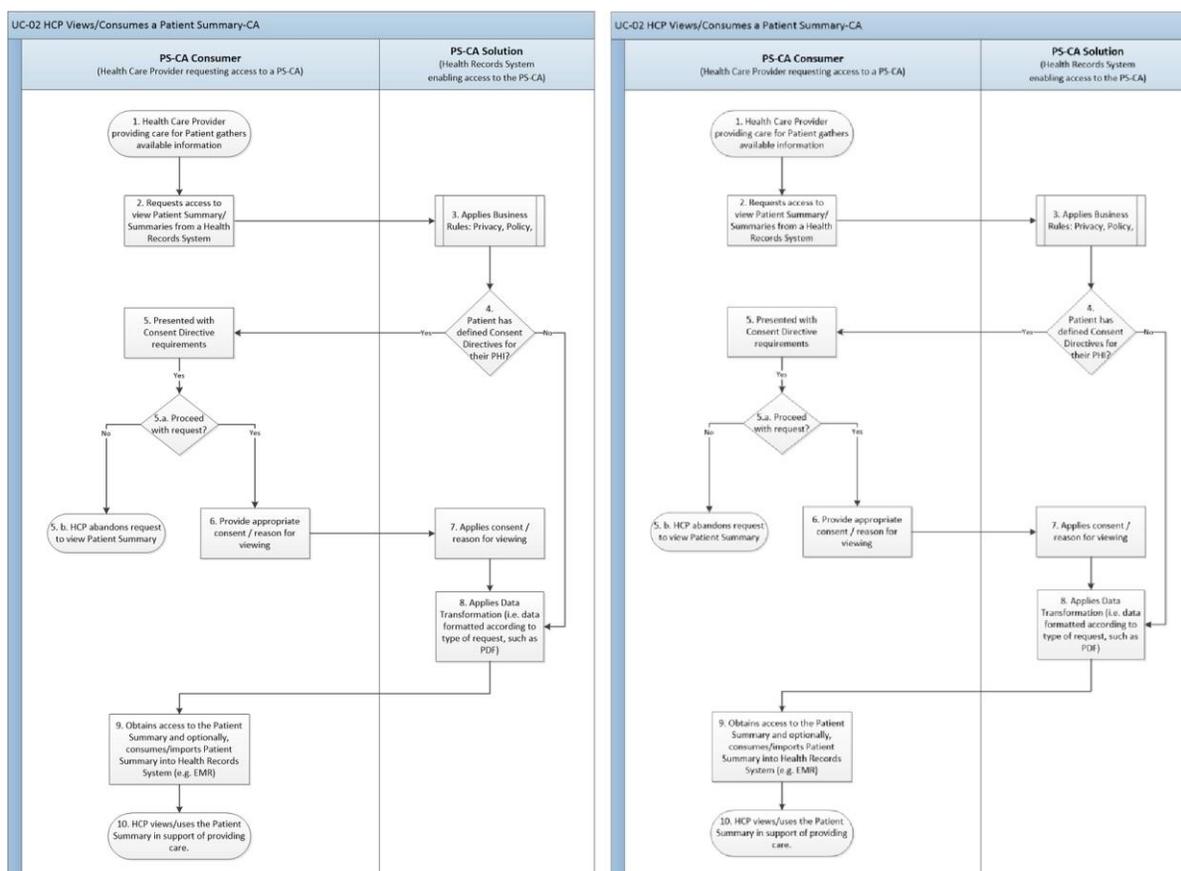

Figure 3. Use Case Flow Diagram of the PS-CA Specifications

FHIR Content Data Model

The PS-CA specifications v0.2 content data model is communicated in the form of FHIR profiles that are compiled together in the PS-CA FHIR Implementation Guide v0.2. These profiles describe the minimal expectations for expressing information in each patient summary domain (e.g., Medication Summary, Problem List, Immunization, etc.). A complete list of data that were tackled as FHIR profiles in Release 1 can be found in Figure 4. Readers are encouraged to review the full list of releases here.

IPS-UV		PS-CA		AB	BC	MB	NL	ON	SK	Release 1	Release 2+
Header	Subject	Header	Subject								+
	Author		Author								+
	Attester		Attester								+
	Custodian		Custodian								+
Required	Medication Summary	Recommended	Medication Summary								+
	Allergies and Intolerances		Allergies and Intolerances								+
	Problem List		Problem List								+
Recommended	Immunizations		Immunizations								+
	History of Procedures		History of Procedures								+
	Medical Devices		Medical Devices								
	Diagnostic Results		Diagnostic Results								
Optional	Vital Signs	Optional	Vital Signs								+
	Past history of Illness		Past History of Illness								+
	Social History		Social History								+
	Advance Directives		Advance Directives								
	Pregnancy		Pregnancy								
	Functional Status		Functional Status								
	Plan of Care		Plan of Care								
		EXT	Extension(s)								
			Family History								

Figure 4. PS-CA FHIR Content Data Model and Domains of Interest by Canadian Jurisdictions

Clinical Scenarios and Test Data

Early Projectathon events aimed at testing interoperability can leverage existing use cases and data model of a specification but tend to be more oriented towards testing technical transactions rather than clinical testing/conformance validation.

Two clinical scenarios, that aligned with the PS-CA Use Cases and FHIR Content Data Model, were developed to help anchor the test scripts in realism. These clinical scenarios were carefully drafted by practicing physicians to ensure they reflected what vendors could expect in real-world environments, particularly in the community (i.e., EMR) and hospital (i.e., HIS) settings. For more information on the clinical scenarios, please refer to this link.

The main objective of these datasets was to evaluate participating systems' ability to compose a well-formed, complete Patient Summary (as defined in the PS-CA specifications v0.2). To support this objective, vendors were provided with the Clinical Scenarios and the content data as shown in Figure 5.

Figure 5. Screenshot of Clinical Scenario 1

The first clinical scenario focused on a typical patient record and its data elements that would be expected to be found in an EMR or HIS system. While the focus was on trying to match the data elements covered by the PS-CA's FHIR Content Data Model, it was not an exhaustive data set. The main objective was to allow for a fair evaluation of a vendor system's ability to reproduce this test data in the generated summary. The approach was meant to support the following objectives:

- Test for the ability to render the data types.
- Test for the ability to support semantic constructs.
- Allow for an assessment of throughput of the vendor system (e.g., how much of the data model was reproduced in the summary).

- Allow for the comparison of two summaries based on the same data set.

The second data set was prepared to test the full coverage for the FHIR Content Data Model. This latter data set was not a realistic one, rather, it was focused on providing full coverage for all the data elements contained in the FHIR Content Data Model.

The main purpose of this second data set was to test a vendor system's ability to fully render the PS-CA data model.

Systems that claimed capabilities of creating a PS-CA document were encouraged to use the clinical scenarios to populate their systems and generate a JSON or XML document based on the data.

Testable Profiles

The PS-CA specification lists several integration profiles that offer established patterns for solving common and targeted information exchanges. These include the MHD and CA:FeX profiles, as well as a few optional IHE profiles available for solving specific challenges. Participants registered their systems for profiles they claimed support for, and they were encouraged to test for profiles listed as optional patterns (e.g., IUA, ATNA, etc.).

Given that some of the profiles are Normative or Trial Implementation profiles from IHE International, Gazelle enforces testing rules that represent dependencies when using those profiles. For example, testing for MHD automatically selects the need to support ATNA and CT integration profiles.

Given the similarities between MHD and CA:FeX, the test scripts for the Projectathon testing of CA:FeX also bundled ATNA, CT and IUA as a testing package.

Profiles were preloaded as test cases into the Gazelle testing platform.

Testing Tools

Gazelle offers participants test cases where they can independently verify their solutions' ability to implement a profile. This is done using a combination of the testing platform features and simulators, as represented in Figure 6. These are test cases that can be executed in isolation, typically pre-Projectathon, and are typically referred to as "No-Peer" testing.

During the event, No-Peer testing is replaced by collaborative testing with other industry participants, introducing the term, "Peer-to-Peer" testing.

Figure 7 displays an image of the Gazelle Test Instances Overview page.

To support various testing roles (e.g., Data Source, Data Consumer, Data Recipient and Data Responder), in addition to existing tooling in Gazelle, Infoway also prepared several renders and simulators that implemented the core MHD and CA:FeX specifications, including:

- An OpenAPI browser built to simulate core MHD and the new CA:FeX profiles (Figure 8).
- A PS-CA FHIR Renderer used to render and perform light validation of structure for a PS-CA FHIR bundle uploaded as a JSON structured data document by vendors (Figure 9).
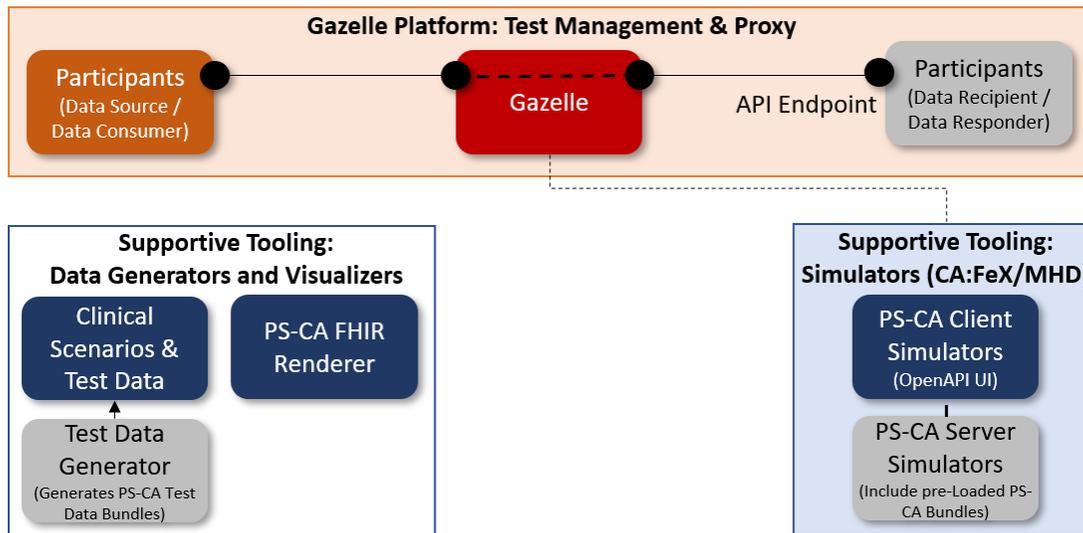

Figure 6. Tools Supporting Projectathon Testing

Figure 7. Gazelle Test Instances Overview Page

Figure 8. OpenAPI User Interface

Figure 9. PS-CA FHIR Renderer

For more information on these tools, please view this link.

To streamline communications during the Projectathon, the following tools were leveraged:

- Zoom for establishing a command center during the Projectathon and offer live support throughout the testing days.
- Rocket.Chat instant messaging platform integrated with the Gazelle testing platform that allowed vendors to interact with each other, Projectathon Monitors, and Test Managers.
- Moodle for hosting pre-Projectathon training and webinar recordings.

Supporting Tools for Pan-Canadian Projectathon

Systems and Exchange Interfaces

During Day 1 and Day 2, profiles that were subject to testing based on vendor registration included CA:FeX, MHD, XDS, IUA, ATNA, CT, and PIX. Participating vendors worked with partners to execute the test steps for the selected profiles. For the scenarios where a vendor could not find a partner or wanted to do multiple tests, Infoway provided simulators for CA:FeX and MHD. Table 1 represents the vendor pairing for Peer-to-Peer profile testing.

Vendor	Allscripts	CERNER	JuniperCDS	Smile CDR	EPIC	Infoway*
Allscripts		IUA		CA:FeX		
CERNER	IUA CA:FeX		IUA CA:FeX	CA:FeX	XDS	CA:FeX MHD
JuniperCDS		CA:FeX MHD		CA:FeX		CA:FeX MHD
Smile CDR	IUA	IUA	IUA			
EPIC		XDS				
Infoway*		CA:FeX MHD	CA:FeX MHD			

*For more information about the Infoway Simulators, refer to the **Testing Tools** section.*

Table 1. Peer-to-Peer Test Pairing

During testing, participating vendors exchanged Patient Summaries using one (or both) of the recommended data exchange patterns outlined in the PS-CA specifications (Table 2):

- Option 1: Document Repository using MHD.
- Option 2: FHIR HIE using CA:FeX.

Based on the chosen option, participating vendors selected a PS-CA actor to test their ability to play the roles of the required supporting profile. To successfully exchange a Patient Summary (PS-CA), participating vendors had to meet the requirements of the actor roles and associated transactions as outlined in the PS-CA specifications (Table 3).

PS-CA Actor	Required Supporting Profiles (Actors)	Optional Supporting Profiles (Actors)
Option 1: Document Repository using MHD		
PS-CA Producer	MHD Document Source	IUA, SVCM PDQm (Consumer)
Document Repository	MHD Document Recipient	
Central Infrastructure		PMIR (Patient Identity Registry)
PS-CA Consumer	MHD Document Consumer	IUA, SVCM PDQm (Consumer)
Option 2: FHIR HIE using CA:FeX		
PS-CA Producer	CA:FeX (Data Source)	IUA, SVCM PDQm (Consumer)
Document Repository	CA:FeX (Data Recipient, Data Responder)	
Central Infrastructure		PMIR (Patient Identity Registry)
PS-CA Consumer	CA:FeX (Data Consumer)	IUA, SVCM PDQm (Consumer)

Table 2. Summary of PS-CA Actors and Required or Optional Profiles

Transactions by Option
Option 1 Transactions (**Document Repository using MHD**)
Save PS-CA to Document Repository • Provide Document Bundle [ITI-65]
Retrieve PS-CA from Document Repository • Find Document Lists [ITI-66] • Find Document References [ITI-67] • Retrieve Document [ITI-68]
Option 2 Transactions (FHIR HIE using CA:FeX)
Save PS-CA to Document Repository • Submit Data [CA:FeX-1]
Retrieve PS-CA from Document Repository • Search Data [CA:FeX-2A] • Retrieve Data [CA:FeX-3A]

Table 3. Summary of Required Transactions by Options for Recommended Exchange Patterns

Tests Performed and Notable Highlights

Tests Performed

In total, 67 tests were executed during the Projectathon by five participating vendor systems, of which 31 were verified by Projectathon monitors (Table 4 and Table 5). Table 4 depicts the test instance workflow in Gazelle with different statuses such as Running, Paused, Verified, and others (Refer to Appendix D for definitions of test instance statuses).

Test Types	# of test instances	To be verified	Partially verified	Verified	Aborted	Paused	Running	Failed
No-Peer Tests	26	0	1	14	3	0	8	0
Peer-To-Peer Tests	41	0	2	17	19	0	2	1
Total	67	0	3	31	22	0	10	1

Table 4. Summary of Tests Performed During the Projectathon

Table 5 breaks down the verified results into integration profiles (the table shows the transaction and actors for each profile as per the PS-CA specification). For CA:FeX and MHD core integration profiles, there were two vendors who were able to successfully create a PS-CA document payload. The test instances for the optional profiles (such as XDS.b, ATNA, CT, and PIXV3) were also tested and verified by a few vendors (however, some vendors had no objective to test the optional profiles).

Integration Profiles		Peer Type	Verified	Partially Verified
CA:FeX	Submit Data [CA:FeX-1] (Data Source -> Data Recipient)	Peer-to-Peer	3	-
	Search Data [CA:FeX-2A] (Data Consumer -> Data Responder)	Peer-to-Peer	2	-
	Retrieve Data [CA:FeX-3A] (Data Consumer -> Data Responder)	Peer-to-Peer	4	-
MHD Profile	Provide Document Bundle [ITI-65] (Document Source -> Document Recipient)	Peer-to-Peer	2	-
	Find Document List [ITI-66] (Document Consumer -> Document Responder)	Peer-to-Peer	2	-
	Find Document References [ITI-67] (Document Consumer -> Document Responder)	Peer-to-Peer	1	1
	Retrieve Document [ITI-68] (Document Consumer -> Document Responder)	Peer-to-Peer	2	-
	Other Tests	No-Peer	4	-
XDS.b		No-Peer	4	-
		Peer-to-Peer	-	1
ATNA		No-Peer	5	1
CT		No-Peer	1	-

Integration Profiles	Peer Type	Verified	Partially Verified
PIXV3	No-Peer	1	-

Table 5. Tests Verified by Specification Category during the Projectathon

Assembling and Retrieving the PS-CA Documents

During the Projectathon, vendors were encouraged to produce their own patient summary documents. However, content creation was limited, and this aspect of the specifications was not able to be tested end-to-end in part due to lack of primary care EMR participation in the event. There were two vendors who could successfully create a PS-CA Patient Summary document (Allscripts and JuniperCDS).

Allscripts was the first vendor to generate a PS-CA document populated using data samples from the clinical scenarios presented in the introduction. JuniperCDS generated a Patient Summary document using data collected from the Smile CDR repository through a SMART on FHIR integration. Cerner tested core and optional integration profiles and Epic demonstrated the client-side transactions of an XDS pipeline.

At different stages of the Projectathon, vendors demonstrated intensive use of the OpenAPI Client simulators, CA:FeX and MHD backend simulators, PS-CA Renderer and the PS-CA data samples (JSON/XML). This supports the evidence that interoperability accelerators, simulators and tooling is a very helpful addition to assisting vendors in these events.

There were a few challenges/limitations that were encountered by the participants while creating PS-CA document payloads: limited time for preparation and connectivity, issues in pre-Projectathon tests and system configurations, and questions related to the profiles.

Details regarding these issues are discussed in the later sections of this report.

Notable Highlights

Overall, the Projectathon is considered a successful event, delivering on many of its stated objectives.

The event received praises from the vendor community, participants, and observers for being able to demonstrate benefits, value, and future opportunities to key players in the Canadian digital health ecosystem. The following list presents a few of the notable highlights:

- A first in pan-Canadian interoperability, using international tools to test the new Patient Summary interoperability specifications (PS-CA and CA:FeX).
- Jumpstarted adoption of the PS-CA specification by promoting generation of PS-CA FHIR-based documents.

- Exposed participating vendors to and confirmed the validity of the recommended exchange patterns.
- Created the conditions for an engaged industry participation with 35 vendor representatives participating in the testing event across Day 1 and Day 2.
- Created a focused technical and clinical conversation on Day 3 with over 44 stakeholders.
- High energy event where participating vendors performed 67 tests in total (i.e., No-Peer and Peer-to-Peer), which is considered exceptional in the IHE community for a first Projectathon.
- Participating vendors quickly oriented themselves with the Projectathon tool (e.g., Gazelle) and the Projectathon communication tools (e.g., Rocket.Chat), which helped streamline the event logistics.
- The IHE Catalyst and Infoway teams provided effective troubleshooting support, where they quickly resolved issues related to onboarding, configuration, and testing.
- Strong industry engagement and collaboration was observed, where feedback and lessons learned were collected from business, clinical, technical, and jurisdictional perspectives (to improve the Patient Summary Interoperability Specifications and overall testing process).

Feedback

The following section outlines feedback received from participants across multiple themes (Figure 10).

FHIR Operations & Features	Privacy	Security	Data Governance & Custodianship	Projectathon & Release Management

Figure 10: Key Themes Across Participant Feedback

FHIR Operations and Features

- **CA:FeX FHIR Transactions:** Given that the CA:FeX profile is a new specification for exchanging documents using FHIR, additional training or webinars would have helped vendors in their testing during the Projectathon.
- **CA:FeX Search:** Some vendors expressed difficulty with configuring their systems to support nested searches against content within the Bundle resource in time for the Projectathon.
- **Provenance:** The support of Provenance and unique identification of documents and resources were identified as items to be added to the PS-CA specification backlog for consideration in the roadmap.
- **FHIR-based integrations:** In the current state, FHIR-based integrations are still primitive, one-off, and point-to-point. Appropriate change management, communication

of the value and advantages of FHIR-based integrations (e.g., re-usability), along with supporting structures (e.g., regulatory requirements, ROIs) may need to be developed for the digital health ecosystem.

Privacy

- **Access Management:** SMART on FHIR enables granular access management for clients and applications, where this capability can be very useful for clinical and administrative workflows. There is a need to explore how access management and consent can be standardized at the pan-Canadian level.
- **Trust:** Regardless of how data is recorded on the Patient Summary, there is a need to trust the system to ensure appropriate capabilities and policies exist to capture relevant access events.
- **Access Tokens:** The current exchange patterns expressed by the recommended integration profiles, specifically CA:FeX, do not properly address the use of access tokens. This is an area that requires updates.

Security

- **Patient Identification:** There is a need for further exploration of data modeling and other mechanisms (e.g., FHIR $match) to tackle challenges in patient identification for the PS-CA specifications.
- **Authorization:** There is a need to ensure IUA stays up to date with advancements in technology and to communicate this consideration to IHE International.

Data Governance and Custodianship

- **Curation of Patient Summaries**: Jurisdictions are considering how enablers (e.g., templates, creation/management workflows) can facilitate the curation of Patient Summaries for different specialist groups and how to keep the information relevant.
- **Workflows and Data for Clinicians**: Vendors would like to understand how to keep the data in Patient Summaries relevant, organized and updated for clinicians to facilitate transitions of care.
- **Terminology:** Some vendors tend to be more open in their approach to supporting multiple terminologies to accept as much data as possible, with the effort for mapping across different code systems being an important consideration. Others rely on buy-in from their current/potential clients to adopt new terminology.
  - Vendors noted that the Allergy terminology is a particular challenge in Canada and that there is a need to work with intermediaries to load more localized and regional terminology.
- **Data Duplication:** Data duplication is a fundamentally challenging problem in the industry. Governance is key to solving this problem, with important interoperability behaviors that need to be agreed on and adopted to become a good "HIE citizen." Implementation guides and profiles enforce these requirements by modeling how to assert provenance and manage unique business identifiers.

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- **FHIR Infrastructures in Lower-and-Middle-Income Countries:** During the Day 3 round table discussions, it was learned that for countries that are building health data exchange infrastructures for the first time, there is a keen interest in exploring RESTful APIs and FHIR as key building blocks of the infrastructure. Although this may vary by country, there is a great deal of interest in Canada's efforts in FHIR.

Projectathon and Release Management

- **Vendor Release Cycle Timelines:** Vendors indicated they need a longer lead time for terminology service changes, terminology mapping changes, major structural changes, and new data elements. They noted that it is easier for vendors to adopt changes in specifications when the specifications are consistent with international standards.
- **Testing Process:** Vendors indicated longer event time, early testing opportunities, live technical support, and enhanced documentation as points for consideration for future improvements to the overall testing process. These have been described in detail in the Lessons Learned and Future Improvement sections of this report.

Lessons Learned

The following themes were identified for improvement in future testing events, including:

Projectathon Time and Preparation:

- Most of the participating vendors expressed that more time would have been beneficial for them to get configured and connected, test the integration profiles (e.g., No-Peer and Peer-to-Peer), respond to feedback on the test instances, and work through minor issues through the testing process and platform (i.e., Gazelle). For instance, No-Peer testing took longer than expected, two days of Peer-to-Peer testing was too short to complete all the scenarios with multiple vendors. For this reason, vendors suggested extending the Projectathon event to one week and asked for early testing opportunities to be offered prior to the Projectathon to account for their learning curve.

- Additionally, shortage of time is the predominant reason that primary care EMR vendors were unable to participate in the Projectathon event. Some vendors requested that specifications are available and stable for at least six months prior to the Projectathon as they need to be able to configure a testing environment to support the use cases, data model, and transaction expectations.

Transaction Partners:

- During the Projectathon there were some test instances where a participant did not have a test partner. Few vendors have broad enough capabilities to test all desired profiles in Peer-to-Peer tests, so test coverage is typically achieved by engaging more vendors – each with their own set of capabilities.

- Infrastructural vendors that could act as authorization servers or patient identity sources did not participate in this Projectathon, making it impossible to test true Peer-to-Peer scenarios for IUA and PIX/PDQ.

- Since the scope of the Projectathon was relatively small it was challenging to register vendor interest in testing these profiles before the full list of participants was known. Simulators can be leveraged in these cases but need to be further developed to ensure coverage of all supportive profiles.

Technical Tooling and Infrastructure

Several issues were identified around technical tooling and infrastructure:

- Some test instances required additional tooling (e.g., External Validation Service Client, NIST XDS Toolkit, etc.) that was not immediately apparent in the Gazelle interface and instructions. This created confusion around the pre-requisites and dependencies for those tests and identified the need to reduce the complexity of specific test scenarios and better integrate the content data model (i.e., FHIR Profile) validation into the set of Gazelle test cases.

- The pre-Projectathon connectivity testing included scripts that were developed for Unix-based platforms and were not working on Windows. Vendors with systems running on Windows had to come up with alternate ways to test their connectivity to Gazelle and test partners.

- One of the values that the Gazelle platform provides is the ability to act as a monitoring proxy between two testing systems. There was some fragility identified around the proxy infrastructure when systems needed to be set-up for integration with Gazelle. These manifested as inflexibilities in configuration such as usage of static IP addresses, different ports for each transaction for the same API and DNS issues. When system endpoints were updated, Gazelle required restarts, changing of ports and re-configurations.

- There were also some issues regarding TLS certificates as the Gazelle tool issued their own certificates, requiring vendors to re-configure their systems and replace their original certificates issued by trusted certificate authorities with the one generated by Gazelle.

- Simulators that support pre-Projectathon and Projectathon testing were limited to the MHD and CA:FeX core integration profiles provided by Infoway. The implementation of the APIs within the simulators was minimalistic, particularly the MHD profile simulator. These limitations had an impact on the scope and versatility of the test scenarios that could be performed, particularly given the lack of transaction partner coverage, where the usage of the simulators was the only feasible option.

Integration Profiles:

There were a few challenges around test instances for the integration profiles such as IUA, ATNA, etc. Some tests were complicated, some vendors requiring additional guidance, also mandatory grouping of profiles made testing fairly complex:

- **Grouping of Profiles:** In the Projectathon, the grouping of profiles (e.g., MHD, IUA, and ATNA) was not explicitly stated or enforced. However, when Projectathon participants ran their reports, the testing status unexpectedly reflected this dependency.

- **Profiles Literacy:** There were some profiles where vendors were not well-informed and could not demonstrate the level of understanding that was needed to perform the testing. For example, some participants were not aware/versed in existing IHE Infrastructure profiles (e.g., ATNA, CT, IUA) or were unfamiliar with how to interpret the relationships between IHE profiles. IHE Infrastructure is not as common in Canada as it is internationally, and there may be a learning curve to overcome with specifications training and events.

- **Limitations of IHE Profiles:** There were instances where participants could show they were addressing interoperability concepts (e.g., authentication/authorization) but could only do so through mechanisms that have not been fully addressed by IHE profiles (e.g., SMART on FHIR launches instead of IUA). Since the adoption of IHE profiles is still evolving in Canada, it is important to recognize that there are vendors who have invested in methods that may not necessarily conform with what IHE depicts as the industry standard, however, are still addressing important interoperability concepts.

In addition to the issues above, there were further challenges/suggestions identified for the following individual profiles:

- MHD Profile: There was confusion in the MHD search pattern and concerns around the use of the List FHIR resource which has a relatively low level of maturity.
- CA:FeX Profile: There were challenges in getting search capabilities built for the CA:FeX-2A Search Data transaction before the Projectathon for one vendor, another vendor expressed similar difficulties through the public review process. Further engagement and industry feedback is needed on this transaction to evaluate its feasibility against other search mechanisms.
- IUA Profile: There is a need to ensure the IUA profile stays up to date with advancements in use of OAuth in health standards (e.g., SMART on FHIR) and additional guidelines for consent and authorization.

Live Technical Support:

A few vendors experienced challenges receiving real-time technical support pre-Projectathon. This was in at least part due to time zone differences of the participating vendor resources and the Projectathon support team.

Future Roadmap Items for Discussion:

During Day 3 facilitated roundtable discussions, vendors emphasized their interest in discussing future roadmap items for the PS-CA specifications, which unfortunately was not set as a prior agenda item.

Future Improvements

The following section identifies future improvements that are focused around addressing the main issues experienced by the Projectathon participants.

Projectathon Time and Preparation:

As this was the first pan-Canadian Projectathon, a lot was learned along the way.

Infoway will adapt its training and testing strategy to ensure that sufficient support is provided for vendors to be ready for testing. For example, process improvements to ensure that vendor connectivity is in place prior to the event (some connectivity can be tested without the involvement of the vendor). Additional improvements include spreading out the testing activities (e.g., No-Peer tests) to the week before the Projectathon and leveraging the pre-Projectathon webinars to set up the testing successfully.

Regarding primary care EMR vendors' participation, Infoway will be considering a longer timeframe (and notice) for the future Projectathon events that needs to be provided to the vendors to prepare and participate effectively.

Transaction Partners:

Having a diverse ecosystem of testing partners increases the value vendors get from interoperability events by expanding the span of the test cases they can perform end-to-end and by increasing opportunities for collaboration with others in the Canadian market. We believe providing time to prepare is a primary driver behind the difficulty engaging certain types of transaction partners, however we also recognize that some types of systems may have different motivators and requirements to participate in early testing events that will have to be addressed in planning.

Infoway will make best efforts to identify methods to attract more Point of Care systems (e.g., primary care EMRs) as well as infrastructural systems to future events to ensure that there is sufficient Peer-to-Peer testing coverage going forward. Infoway will also explore the expansion of simulators to increase flexibility in testing profiles independent of partners (e.g., No-Peer testing, offline/ad-hoc testing of profiles).

Technical Tooling and Infrastructure

Creating a reliable and easy-to-navigate experience with Projectathon tools will be a key goal for future interoperability events. This includes working with Gazelle platform vendor to address

challenges with the flexibility of the tool, as well as identifying and prioritizing ways to augment the platform's current capabilities with integrations and external tools.

The following items have been identified for improvements related to the Gazelle platform:

- Stabilization of the proxy infrastructure in Gazelle to reduce disruptions in Projectathon testing and better instructions inside the tool regarding configuration to decrease the corrections that are required during connectivity testing.

- Provide connectivity testing tools for both Unix and Windows-based environments.

- Work with the Gazelle team to use TLS certificates from trusted certificate authorities.

- Request the ability to decouple interdependent profiles to support initial testing and/or develop test cases that can be used for testing IHE profiles in isolation.

- Integrate validation against FHIR profiles into the test suite to allow participants an easy way to reliably test against the content data model and demonstrate test results with minimal disruptions to participant workflow within the tool.

- Better leverage existing tools that integrate with the Gazelle platform. This involves further education on what is available and how to incorporate the integrations in a way that does not result in more test interdependencies. Further collaboration with IHE partners and assessment of similar Projectathon events in other countries (i.e., May 2022 Latin America Projectathon, September 2022 Swiss Projectathon) will be critical for building further capacity in the IHE tooling space.

- Improving the existing simulators for MHD and CA:FeX profiles and providing reference implementations that fully support the specifications and a comprehensive set of test scenarios. Ensuring simulators make more robust use of the FHIR infrastructure, for example using real FHIR resource servers on the backend to support sending, finding, and retrieving a Patient Summary. This infrastructure could be reusable across future interoperability initiatives (outside the PS-CA specification) and could be scaled to support basic testing and secured testing using an authorization server. Expanding the use of FHIR Infrastructure also creates the opportunity to incorporate emerging FHIR operations that are discussed as part of the CA:FeX specification that typically requires further feedback and feasibility testing before implementers are willing to incorporate the operations into their own test environments.

- Developing simulators for supporting IHE profiles such as IUA, ATNA, and CT and where possible, leveraging existing services that were already built and available in Infoway's sandbox environment (Cognito, Identity UI, etc.).

- Making the supportive tools accessible beyond the Projectathon will also allow vendors to implement and test against the specification between events. Tools such as the PS-CA Test Data Generator and PS-CA Renderer are valuable assets that could be leveraged by participants to support internal testing year-round.

Integration Profiles:

- **Grouping of Profiles:** Going forward, Infoway will ensure that if there are any dependencies for a particular profile, it is explicitly stated along with the appropriate tests so that vendors are aware of the grouping of profiles that would need to be met before they can complete tests during the Projectathon.

- **IHE Profiles Literacy:** This education needs to be tackled more broadly at a program and affiliate level to provide Canadian stakeholders with the base understanding of the integration profiles (e.g., how IHE-style documentation and events work, benefits of the IHE approach, etc.). Having this foundational literacy will help ensure that participants are well versed and prepared in use of the profiles as well as how to demonstrate them prior to participating in future events. This may require further improvements to tooling documentation and overall Projectathon support materials to provide a clearer on-ramp for participants unfamiliar with IHE tools to onboard to the testing suite.

- **Limitations of IHE Profiles:** Infoway recognizes that these types of early interactions with the Canadian vendor community help assess the feasibility of existing standards and identify potential areas where IHE profiles can be further refined/expanded to meet the emerging needs of the industry. Clear channels for providing these types of insights to IHE Canada and IHE International will help further refine the specifications and ensure vendors feel their emerging needs are being heard and addressed.

Live Technical Support:

For this first Projectathon, Infoway leveraged the external assistance of the IHE Catalyst and Kereval teams to complete the configuration of Gazelle and provide live technical support for participants. Developing IO team capacity and expertise in IHE tooling and processes will be important to effectively providing support to participants in future interoperability events. Technical and monitoring team members that are well versed in Gazelle (and its configuration) will ensure prompt support for vendors before and during the Projectathon in the vendors' local time zones.

Future Roadmap Items for Discussions:

While Projectathon testing encouraged interaction and feedback on the existing aspects of the PS-CA specification, participants also showed an appetite for discussing (and potentially shaping) how the specification would evolve in later releases. A handful of future facing items and insights have been added to the backlog for consideration in the roadmap, but going forward, future testing events will dedicate session time to discuss future roadmap items with participants.

Post-Projectathon Survey

A post-Projectathon survey was conducted at the end of the Projectathon through Survey Monkey (Figure 11). The following is a summary of the survey's results:

Stakeholder / Demographic Group: All the respondents of the survey were vendor representatives.

Overall Experience: Most of the respondents ranked their overall experience of the Projectathon as "Good" or "Very Good", with positive comments on the Projectathon process, technical support, and use of communication tools. For example, one of the comments was, "*This was my first Projectathon and it was very enjoyable to be a part of. It was organized extremely well, and the support offered on Rocketchat was incredible*".

Value Gained from Participation: Most of the respondents ranked the value gained from their participation in the Projectathon as "High value gained" or "Very high value gained".

Days / Sessions Attended of the Projectathon: Based on the survey responses, it can be observed that participants attended nearly all the days and sessions of the Projectathon, with *Day 3, Session 2: Supporting Profiles for the PS-CA Exchange (e.g., IUA)* being the most valuable to participants.

Future Projectathons: All the respondents indicated they would be interested in participating in future Projectathons hosted by Infoway.

Future Improvements: Some vendors indicated early testing opportunities as areas of improvement for the Projectathon.

Figure 11: Screenshot of Survey Monkey

Conclusion

This Projectathon was the first pan-Canadian interoperability event using international tooling and it was quite successful. Even though the event was missing a major component (i.e., primary care EMR vendors), it was still able to successfully demonstrate its benefits and value to the key players in the Canadian digital health ecosystem. This was a critical first step towards exposing the Canadian market to new ways of testing and refining emergent interoperability specifications.

Infoway is currently in the process of consulting with our partner vendors, agencies, and provincial partners to refine the future of the Interoperability program, including the evolution of the PS-CA specifications. As part of this process, feedback from the Projectathon tests and symposia sessions have been incorporated for inclusion in the roadmap for both PS-CA and CA:FeX specifications as a functional step towards Trial Implementation maturity.

Our team is actively working to incorporate lessons learned into the planning for the next Projectathon event. Further engagement of stakeholders in this planning (particularly primary care EMR vendors and standards development organizations) will be necessary to evolve the event to support a deeper range of testing and to ensure that Canadian needs are actively being met by the international standards.

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Appendix A – A Hitchhikers Guide to an Interoperability Projectathon

Please refer to this link to view detailed information regarding the full three-day programming of the pan-Canadian Projectathon. This documentation provides critical information to participating vendors on what they need to know to prepare for the Projectathon.

Appendix B – Integration Profiles (Tested during Projectathon)

Integration Profiles		Definition
Core Integration Profiles	CA:FeX	The Canadian FHIR Exchange (CA:FeX) Interoperability Specification seeks to promote FHIR RESTful exchange patterns, developed by industry leading FHIR standards that can be applied on top of an existing non-FHIR infrastructure just as easily as it can be applied on top of FHIR servers.
	MHD	The Mobile access to Health Documents (MHD) Profile defines one standardized interface to health document sharing (a.k.a. an Application Programming Interface (API)) for use by mobile devices so that deployment of mobile applications is more consistent and reusable. (Source: https://profiles.ihe.net/ITI/MHD/index.html)
Supporting Integration Profiles	XDS.b	The Cross-Enterprise Document Sharing (XDS) IHE Integration Profile facilitates the registration, distribution, and access across health enterprises of patient electronic health records. (Source: https://profiles.ihe.net/ITI/TF/Volume1/ch-10.html)
	ATNA	The Audit Trail and Node Authentication (ATNA) Profile specifies the foundational elements needed by all forms of secure systems: node authentication, user authentication, event logging (audit), and telecommunications encryption. It is also used to indicate that other internal security properties such as access control, configuration control, and privilege restrictions are provided. (Source: https://profiles.ihe.net/ITI/TF/Volume1/ch-9.html)
	CT	The Consistent Time Integration Profile (CT) provides a means to ensure that the system clocks and time stamps of the many computers in a network are well synchronized. This profile specifies synchronization with a median error less than 1 second. This is sufficient for most purposes. (Source: https://profiles.ihe.net/ITI/TF/Volume1/ch-7.html)
	PIXm	The Patient Identifier Cross-reference for Mobile (PIXm) Profile provides RESTful transactions for mobile and lightweight browser-based applications to create, update and delete patient records in a Patient Identifier Cross-reference Manager and to query the Patient

Integration Profiles		Definition
		Identifier Cross-reference Manager for a patient's cross-domain identifiers. (Source: https://profiles.ihe.net/ITI/TF/Volume1/ch-41.html)
	PDQm	The Patient Demographics Query for Mobile (PDQm) Profile defines a lightweight RESTful interface to a patient demographics supplier leveraging technologies readily available to mobile applications and lightweight browser-based applications. (Source: https://profiles.ihe.net/ITI/TF/Volume1/ch-38.html)

Appendix C – Full Participant List

The following table summarizes the full participant list of the Pan-Canadian Projectathon across Day 1, Day 2, and Day 3 in March 2022.

Vendor / Organization	Participant Name
Allscripts	Mohamad Kassem
	Cecilia Wong
	Jeffrey Danford
Cerner	Michelle Brough
	Michael Billanti
	Josh Diaz
Epic	Spencer LaGesse
	Ryan Brickner
Smile CDR	Duncan Weatherston
	Omar Hoblos
	Robyn Berridge
	Lance Adams
	Rhea Kolanko
	Abel
	Jaime Cummins
	Jennifer
	Maciej Siarkiewicz
	Stephen Ross
	Abdel Elsayed
	Florin Negoita
	Pechow Zheng
	Joe Quinn
	Daniel Bach
JuniperCDS	Alexander Goel
	Josh Liben
	Raghavan Chandrabalan
	Janani Kathirkamar
	Joseph Mitchell
IHE Canada	Derek Ritz
IHE Board	Michael Nusbaum
CIHI	Mary Byrnes
	Ann Chapman

Vendor / Organization	Participant Name
	Jacqueline Singer
	Charde Morgan
	Christine McKenzie
	Finnie Flores
Ontario	Sue Schneider
	Andrew Smith
	Cindy Jiang
	Janice Spence
	Eric Labadie
	Dwayne Pickering
	Ken Sinn
	Rita Pyle
	Diane Cowley
	Sarabjit Singh
Alberta	Michael McDermott
	Trevor Hart
	Thomas Zhou
	George Rudelich
	Sandra Lambert
Newfoundland	Sisera De Silva
	Tony Galway
	Fred Melindy
Saskatchewan	Mike Wong
	Trent Reifferscheid
British Columbia	Colin King
	Elise DeJager
OMD	Andrew King
Orion	Andrzej Wloskowicz
	Nicholas Ingratta
	Mike Craig
	Peter Seely

Appendix D – Test Instance Statuses

A test instance can have the following statuses:

- Running: When a user presses the "Start" button to begin a test instance, the initial status "Running" is applied.

- Paused: A test instance can be paused, and then restarted by the user.

- Aborted: If the test instance was started by mistake or is a duplicate of an existing test instance, the test instance can be aborted. Aborted test instances are not checked by monitors.

- To be verified: Once a test instance is complete, the user can set the status to "To be Verified." The monitors work list contains test instances with this status.

- Failed: Based on the evidence and the observation of the logs or the actual run of the test by vendors, a monitor may fail a test.

- Verified: A monitor, once convinced that the test is successful, can mark it as verified.

- Partially verified: If a monitor thinks that a test is incomplete but that there is a chance that the vendor may fix the problem during the test session, they can mark the test as partially verified.

- Critical: Toward the end of the Connectathon, the project manager activates the "Critical" status mode in Gazelle. Monitors will then verify Test instances with the status critical first.