EHR

Adaptovaná, volně dostupná, prezentace Canada Health Infoway
EHRS BLUEPRINT
an interoperable EHR framework

Infoway Architecture Update

March 2006
Solution Architecture Group
Outline

- Introducing Infoway
- EHRS Blueprint Scope
- Business Context
- Clinical/Work Process Architecture
- System Architecture
- Information Architecture
- Integration & Deployment Options
- Potential Applications
- Summary & Conclusion
What Does Infoway Do?

End User Adoption & Setting the Future Direction

The Electronic Health Record

Domain Repositories & Healthcare Applications

Cross Program Foundation Components

Architecture & Standards

Innovation & Adoption $60M

Interoperable EHR $175M

Drug Information Systems $185M

Laboratory Information Systems $150M

Diagnostic Imaging Systems $220M

Public Health Systems $100M

TeleHealth $150M

Client, Provider & Location Registries $110M

Infostructure $125M

Innovation & Adoption $60M

Interoperable EHR $175M

Drug Information Systems $185M

Laboratory Information Systems $150M

Diagnostic Imaging Systems $220M

Public Health Systems $100M

TeleHealth $150M

Client, Provider & Location Registries $110M

Infostructure $125M
EHRS Blueprint Scope

**EHRS Blueprint V1.0 Addressed Business Context**
(Mission, objectives, stakeholders, benefits)

- **Work Process**
  - Conceptual: Blueprint V1, Blueprint V2
  - Logical: Blueprint V2
  - Physical: Blueprint V2

- **Information**
  - Blueprint V2

- **System**
  - Blueprint V1, Blueprint V2
  - Blueprint V2

- **Technology**
  - Blueprint V2

**EHR Implementations across Canada**
Architecture Perspectives

CONTEXT

- Business Architecture
- Clinical Work Process Architecture
- System Architecture
- Information Architecture
- Integration & Deployment Models
- Potential Applications
Architecture Perspectives

CONTEXT

Business Architecture

Potential Applications

Clinical Work Process Architecture

Integration & Deployment Models

System Architecture

Information Architecture
Business Context
Healthcare Industry

Providers

Health Authority

Planning & Resources

Clients/Patients

Ministry of Health

Provides $

Health Authority

Elected Government

Tax $$$

Health Authority

Homecare

Emergency Services

Community Care Center

Hospital Emergency

Pharmacy

Laboratory

Diagnostic

Specialist Clinic

Tax Payer
International Industry: IT Spending Comparisons

IT spending as a % of total expenditures

- Financial Services: 12.1%
- Government: 5.7%
- Telcos: 5.5%
- Worldwide Health Providers: 4.2%
- Transportation: 3.3%
- Utilities: 2.7%
- Textiles: 2.2%
- Manufacturing: 1.9%
- Petroleum: 1.7%
- Pulp & Paper: 1.6%
- Canadian Healthcare: 1.4%
- Food & Bev: 1.2%

Mean Hospital: IT spending in Canada <2%

Canadian IT budgets as a % of total hospital budget

- Less than 1%: 25
- 1-1.4%: 27
- 1.5-1.9%: 27
- 2-2.4%: 12
- 2.5% or more: 10

Why an EHR? The World of Healthcare is Changing…

The Old World
Provider-focused
Illness
Site-of-care
Episode Management
Supply Management
Solitary decision making
Efficiency
De-centralized, generalized care

The New World
Patient & family-focused
Wellness
Continuum of care
Disease Management
Demand Management
Collaborative, evidence-based decisions
Effectiveness
Centralized, specialized care
Why an EHR?
The World of Healthcare is Changing…

The changes in healthcare require significant capability from the health infostructure, capability which does not fully exist today
The Timing Has Never Been Better!

**WILL**
- Public wants more accessibility
- Health Authorities recognize benefits
- Increased financial pressures
- Healthcare professionals embracing technology
- Willingness to collaborate

**CAPACITY**
- Better infrastructure
- More mature application technologies

**CAPABILITY**
- Political will
- Funding is now available
- Infoway mandated to pursue investments
EHRS Blueprint: Key Definitions
An Electronic Health Record (EHR) provides each individual in Canada with a secure and private lifetime record of their key health history and care within the health system. The record is available electronically to authorized health providers and the individual anywhere, anytime in support of high quality care.

This record is designed to facilitate the sharing of data – across the continuum of care, across healthcare delivery organizations and across geographies.
The **EHR Solution** is a combination of people, organizational entities, business processes, systems, technology and standards that interact and exchange clinical data to provide high quality and effective healthcare.
The EHR Infostructure is a collection of common and reusable components in the support of a diverse set of health information management applications. It consists of software solutions for the EHR, data definitions for the EHR and messaging standards for the EHR.
EHRS Outcomes

Providers
- Relevant data, granular
- Real time
- Rapid access from multiple locations, anywhere, anytime
- Decision support
  - Clinical reference data
  - Guidelines & protocols
  - Common terms & codes
- Case management & workflow
- Safety
- Improved quality of care
- Regulation & accountability

Patient/Public/Clients
- Convenient, relevant access to accredited health information
- Access to relevant personal health information
- Safety
- Improved quality of care

Public Sector Health Managers
- Registry solutions & initiatives
- Objective analysis of results & benefits
- Management reports
- Funding & resource allocation
- Policy

Researchers & Health Surveillance Professionals
- Appropriately summarized data
- Anonymized
- Designed for analysis:
  - Statistical sampling
  - Trends
  - Outbreak detection
  - Outcome analysis
- Regional
- Pan-Canadian

Payer/Payee
- Relevant data to adjudicate claim
- Workflow management
Key EHRS Architecture Concepts

EHR SOLUTION (EHRS)

EHR INFOSTRUCTURE (EHRI)

- Ancillary Data & Services
- Health Information Data Warehouse
- EHR Data & Services
- Registries Data & Services

Longitudinal Record Services

Health Information Access Layer

- Point of Service Application
- Point of Service Application
- EHR Viewer

EHRS Locator
EHRS Blueprint Recommended Approach: A Pan-Canadian EHR Service
Guiding Principles for EHRS

- Patient-centric
- Mass customized views of all clinical data
- Value add for the provider
- Timely, accurate information
- Enable sharing at local, regional, cross-jurisdictional
- Interoperable, integrated
- Standards based
- Replicable solution – patterns, components

- Leverage legacy systems & solutions
- Design for phased rollout with near term results
- Scalable
- Extensible to support future growth
- Cost-effective
- Secure & private
- Allow for innovation & competition
- Comprehensive
Generations of EHR Capabilities

- **Gen 1**: The Collector (1993)
- **Gen 2**: The Documentor (1998)
- **Gen 3**: The Helper (2005)
- **Gen 4**: The Colleague (2010)
- **Gen 5**: The Mentor (2015+)

Availability of Products:
- End of 2009

Source: Gartner (December 2005)
A Few Misconceptions About EHR Solutions

Misconception

• A person’s health data is in only one physical EHR
• All data for a person must be in the EHR to have value and generate adoption
• A jurisdiction is a province/territory
• The EHR is a data warehouse to support research and surveillance

Reality

• EHR: an integrated service covering all available EHR Solutions; a client’s record is seen as coming from a single integrated EHR
• Quality, safety & effectiveness enhanced with only subsets of clinically relevant data available for sharing
• Any geo-political entity mandated to govern the operation of an EHR Solution
• The EHR: an information support service available to caregivers in the daily context of care provision work activities
Business/Clinical Scope
EHRS Serving Healthcare Service Delivery

EHR SOLUTION (EHRS)

EHR INFOSTRUCTURE (EHRi)

Ancillary Data & Services

Health Information Data Warehouse

EHR Data & Services

Registers Data & Services

Longitudinal Record Services

Health Information Access Layer

Point of Service Application

Point of Service Application

EHR Viewer

Clients/Patients

Community Care Center

Specialist Clinic

Hospital Emergency

Emergency Services

Laboratory

Pharmacy

Diagnostic

Diagnosis

Health Information Access Layer

Longitudinal Record Services

EHR Viewer

Point of Service Application

Point of Service Application

EHR SOLUTION (EHRS)

EHR INFOSTRUCTURE (EHRi)
Public Health Business Requirements

- Focuses on managing health status of populations
- Managed and executed through complex network of public/private organizations acting at different levels of the health system (Federal, Provincial/Territorial, Regional, Local, Individual)
- Involves:
  - Research & analysis to identify/define population health programs
  - Surveillance activities to detect and pro-actively react to potential population health problems
  - Application of health programs to prevent the appearance and/or dissemination of preventable diseases
  - Active management of communicable disease outbreaks
  - Active management of the delivery of health services to individuals in the context public health related programs
- Current focus limited to:
  - Surveillance and detection (focused on human health-related diseases)
  - Outbreak Management
  - Public Health Alert Management
  - Disease Information Dissemination
  - Immunization Management
  - Communicable Disease Case Management
Integrating Public Health in the Architecture

New services required to support:

- **Surveillance & Detection:** introduces a formal business need for the Health information data warehouse introduced in V2

- **Outbreak Management:** requires the addition of a new category of service called Ancillary Services where a specific service is introduced to address outbreak management

- **Disease Information Dissemination:** introduces the need for a formal terminology registry system that would maintain information about diseases and other key terminologies required for many services of the EHRi
  - Terminology registry would go beyond simply maintaining to allow for maintenance, dissemination of education, etc. associated with diseases

- **Public Health Alert Management**
  - Public health disease alert reporting requires use of specific applications also positioned as ancillary services
  - Public health alerts dissemination relies on terminology registry and HIAL Alerts and Notification services

- **Immunization Management**
  - Immunization programs and their management requires a specific application that would live under the ancillary services category
  - Delivery of immunisation would be tracked by the drug information domain as part of the EHR

- **Communicable Disease Case Management**
  - Delivery of health services in relation with the treatment of a CD case would be tracked by the shared health record and other domains as part of the EHR
  - Management of a CD case from the perspective of the public health specialists involved in detection and tracking would require a specific application that would live under the ancillary services category
Integrating Public Health in the Architecture

Some Public Health business requirements can be sustained by the existing services of the EHR Infostructure

• **Public Health Alert Management:** HIAL and LRS to provide for mechanism to help with detection & reporting on communicable diseases

• **Immunization Management:** Drug Information Domain is the home of immunisation information as part of the core clinical data in client’s health records. HIAL and LRS to provide mechanisms to communicate the data and coordinate its location and access within the EHRi

• **Communicable Disease Case Management:** CD Cases, from the perspective of the EHR are treated like any other health delivery encounter
Telehealth Business Requirements

- **Telehealth**: the use of information & communication technologies to deliver health services in contexts where the providers and clients are in separate locations
- **Telecommunication infrastructure** is a pre-requisite
- **Telehealth solutions** enable health service delivery channels:
  - Tele-consultations
  - Videoconferencing stations, communication enabled medical devices
  - Tele-education
  - Videoconferencing stations used for training/education
  - Tele-homecare
  - Active or passive monitoring of remote patients for pre-/post-op procedures, chronic diseases management, etc
  - Tele-triage
  - Centralized call centers to offer first line delivery of service to clients as part of primary care and emergency response

- **Scheduling solutions** – a key enabler required for the effective use of telehealth service delivery
- **EHR Infostructures** support telehealth applications as per any other Point-of-Service Application
EHRS Serving Telehealth Scheduling

JURISDICTIONAL INFOSTRUCTURE

Registries Data & Services
- Client Registry
- Provider Registry
- Location Registry
- Terminology Registry

Ancillary Data & Services
- Outbreak Management
- PHS Reporting

EHR Data & Services
- Shared Health Record
- Drug Information
- Diagnostic Imaging

Data Warehouse
- Health Information

Longitudinal Record Services
- Business Rules
- EHR Index
- Message Structures
- Normalization Rules

Common Services
- Security Mgmt Data
- Privacy Data
- Configuration

HIA

Communication Bus

TSA Database

POINT OF SERVICE

TSA APPLICATION

Patient Info
- Event History

End-user Info
- Clinical Profile

Scheduling
- Video Session

Referring Physician Site
- Physician/Provider

Attending Physician Site
- Physician/Provider
EHRS Blueprint: Tele-Homecare

Montreal, QC

Dieppe, NB
EHRS Blueprint: Tele-Triage

**EHR INFOSTRUCTURE (EHRI)**

- Ancillary Data & Services
- Health Information Data Warehouse
- EHR Data & Services
- Registries Data & Services
- Longitudinal Record Services
- Health Information Access Layer

**Tele-Triage Application**

- Patient Info
- End-user Info
- Event History
- Clinical Profile
- Scheduling
- Video Session

**Personal Health Record Application**

- Kingston, ON
- London, ON
- Sault Ste-Marie, ON
- Oshawa, ON
Clinical, Business & Socio-economic Drivers for EHR Solutions
Why is Value Created by an EHR Solution?

- Healthcare professionals make clinical decisions based on knowledge
- Better knowledge translates to better care
- Knowledge starts with accurate, relevant clinical information
- The EHR creates the capability to share relevant clinical information
- The 5 Rs of the EHR:
  - The right information
  - About the right client
  - Available to the right person
  - In the right place
  - At the right time
The value of the EHR for clients, families and their providers increases with the completeness of the information contained as well as the level of standardization of the data.
Why Pursue The EHR: Circle of Care
Why Pursue The EHR: Benefits

QUALITY

SAFETY

ACCESSIBILITY

Clinic

Homecare

Emergency Services

Community Care Center

Pharmacy

Specialist Clinic

Hospital Emergency

Laboratory

Diagnostic
The EHR is a Key to a Renewed Health System!

EHR solutions provide an opportunity to

- Improve the quality, safety, accessibility and timeliness of care for Canadians
- Support more informed healthcare decision making, research and management
- Improve the efficiency of the healthcare system and reduce costly duplication
- Maximize return on IT investments
- Achieve standards based solution allowing interoperability
EHR Key Clinical & Business Requirements

- Life-long longitudinal record of clinical data
- Allowing private and secured access to data made available in EHR
- Focused on clinically relevant data shared beyond organizational boundaries
- Support for accurate, complete, timely delivery of information
- Shared across multiple organizations, jurisdictions
- Adaptive to the future of healthcare delivery in the 21st Century
- Requiring ongoing governance and operations management with 24/7 high availability service
- Affordable in relation to complexity and size of integration challenges (connecting large numbers health points of service)
- Scalable to allow continuous, extensive growth of clinical and $ ROI
  - More POS applications sourcing data to EHR
  - More users accessing and using data from EHR
  - Allowing natural growth of capabilities towards Generation 3 and beyond
Different Approaches To Achieving EHR
EHR: How Do We Do This?
Sharing Information From Multiple Systems

INTEGRATED VIEW

Clinic
Homecare
Emergency Services
Community Care Center
Pharmacy
Specialist Clinic
Hospital Emergency
Laboratory
Diagnosis
<table>
<thead>
<tr>
<th>The “Big Database in the Sky”</th>
<th>Broadcast to all or a logical subset of systems</th>
<th>The “Big Index in the Sky”</th>
<th>Use of a shared reference information source</th>
</tr>
</thead>
<tbody>
<tr>
<td>• All Point-of-Service (POS) systems share same data store</td>
<td>• Replication of data from one system to all other relevant/participating POS systems • Every POS system holds same information</td>
<td>• EHR Index or locator service that holds links to all POS systems where information resides • Each POS system interfaces to other systems</td>
<td>• POS systems populate it • POS systems or viewers reference it • External to the “operational” store</td>
</tr>
</tbody>
</table>
Key Factors Affecting How to Share

• Sharing creates some very profound issues & requirements
  • Unique identification of clients, providers, service delivery locations, etc.
  • Protecting privacy and confidentiality of patients and providers while simultaneously not limiting the ability to deliver appropriate services
  • Ensuring information is stored, shared securely
  • Ensuring compatibility of how data is interpreted/understood

• Issues the same no matter which model is chosen to share patient identified information

• Canadian governance model for healthcare means these issues are F/P/T jurisdictional responsibilities – requirements vary

• People increasingly mobile, especially when considering long periods of time

• Provider’s confidence in the mechanisms to enable sharing is crucial
The Integration Challenge of EHR Solutions
Integrating Heterogeneous Systems

- Clinic
- Emergency Services
- Pharmacy
- Laboratory
- Specialist Clinic
- Hospital Emergency
- Diagnostic
- Community Care Center
- Homecare
- Clients/Patients

Canada Infoway Health Infoway du Canada
Integrating Heterogeneous Systems: Hospital

Hospital Emergency

- Finance, inventory, payroll
- ADT
- Order/Results
- Electronic Patient Record
- Specialized Care
- Pharmacy
- Human Resources
- Scheduling
- Laboratory
- Clinical Data Repository
- Radiology PACS
- Emergency
- Hospital Emergency
- Clinic
- Community Care Center
- Specialist Clinic
- Emergency Services
- Pharmacy
- Laboratory
- Diagnostic
Integrating Heterogeneous Systems: Hospital

- Clinic
- Community Care Center
- Specialist Clinic
- Hospital Emergency
- Laboratory
- Diagnostic
- Emergency Services
- Pharmacy
- Scheduling
- Accounting/Billing
- Electronic Medical Record

Clients/Patients

Hospital

Pharmacy

Laboratory

Diagnostic

Homecare
Canada has approximately 40,000 systems
Integrating Health Information Systems: Key Challenges

- Protecting Privacy
  - Governance, accountability & data custodianship
  - Controlling access
  - Managing & applying consent directives
  - Controlling feeds and queries to the data
  - Trust relationships & contracts

- Existence & availability of data
  - Discovery capability
  - Availability in electronic format
  - Timeliness

- Harmonization
  - Data structures (format)
  - Vocabularies (encoding, normalization)
  - Semantics

- Heterogeneous technology environments
- Number of organizations, connection points & systems
- Costs inherent to integration
EHRS Blueprint
Recommended Approach: The Cost of Integration As A Key Driver
Integrating Health Information Systems: Point-to-Point Connectivity

**Costs basis**
- Cost of one integration
  - Simple = $32K; Medium = $95K; Complex = $190K

**Futile approach**
- 38,783 systems in Canada
  - Simple = 4,527; Medium = 20,081; Complex = 14,175
  - 1.5 B integration points
  - 183.928 B CDN

**We need a different approach**
Integrating Health Information Systems: Hospital Networks Approach

**Costs basis**
- Cost of one integration
  - Simple = $32K; Medium = $95K; Complex = $190K

**Hypothesis**
- 1,126 Hospital networks, each includes 71 systems to integrate and group (EAI) in 44 points of integration
- 1,892 (44 x 43) integrations per network totalling 2.1 M (1,126 x 1,892) integrations in Canada
- Assuming existence of standardized protocol for interfaces
  - 68.172 M $CDN (if Simple – 32K)
  - 202.316 M $CDN (if Medium – 95K)

We need a different approach
Integrating Health Information Systems: EHRS Blueprint Approach

**Costs basis**
- Cost of one integration
  - Simple = $32K; Medium = $95K; Complex = $190K

**Hypothesis**
- All hospitals/long term care organizations use an integration engine and count as 1 integration point
  - Simple = 4,575; Medium = 8,134; Complex = 6,597
- 19,306 integration points
- Assuming existence of standardized interface and protocols
  - 2.170 M $CDN
Rational for Recommended Approach

- Only cost effective scenario to handle degree of application integration required
- Maximized ability to deliver proper response time and consistent access to data across thousands of source systems
- Maximized ability to apply privacy and security policies in a harmonized and consistent fashion
- Enables evolutionary path to semantic harmonization of health information across service delivery points
- Enables high degree of scalability from local health services integration, to regional, provincial or territorial and cross-jurisdictional
- Enables high degree of flexibility in reconfiguration of health services delivery networks
Architecture Perspectives

CONTEXT

Business Architecture

Clinical Work Process Architecture

Integration & Deployment Models

System Architecture

Information Architecture

Potential Applications
EHRS Work Process Architecture

- The EHR Clinical Reference Framework: Life of the Lamberts
- Depiction of the use of an EHR Solution in different contexts of health service delivery
  - 14 different storyboards created
  - Extensible by adding new use cases
  - System or security administration use cases not represented

- Life of the Lamberts
  - Patient centric framework
  - Focused on different members of a family and their health status evolution
  - Focused on health related events

- Represented with UML use case notation
  - Developed under Magic Draw case tool

- Published as artefacts under the Artefact Repository
  - Available in HTML and PDF format
  - Available in Magic Draw format and XMI for upload to other case tools
Documenting EHRi Services Requirements

JURISDICTIONAL INFOSTRUCTURE

Registries Data & Services
- Client Registry
- Provider Registry
- Location Registry
- Terminology Registry

Ancillary Data & Services
- Outbreak Management
- PHS Reporting

EHR Data & Services
- Shared Health Record
- Drug Information
- Diagnostic Imaging
- Laboratory

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REGISTRIES DATA & SERVICES

- Client Registry
- Provider Registry
- Location Registry
- Terminology Registry

ANCILLARY DATA & SERVICES

- Outbreak Management
- PHS Reporting

EHR DATA & SERVICES

- Shared Health Record
- Drug Information
- Diagnostic Imaging
- Laboratory

POINT OF SERVICE

- Physician
- Physician/Provider
- Laboratory
- Radiologist
- Lab Clinician
- Physician/Provider

Common Services

- Business Rules
- EHR Index
- Message Structures
- Normalization Rules

Longitudinal Record Services

- Security Mgmt
- Privacy Data
- Configuration

Data Warehouse

- Health Information

EHRS Reference Architecture
First class of deliverables are contextual & informational
They describe the end-user functional requirements and assumptions for use of an EHR Solution
Establish when POS applications expected to interact with an EHR in the context of daily work activities for caregivers
Infoway not attempting to document all forms of potential uses of an EHR
Scope is broad enough to cover large spectrum of healthcare and public health service delivery to achieve representative set
EHR Interoperability Profile (EHR IP)

- Second class of deliverables normative; specify the interfaces between POS applications and EHR
- Establishes a language to describe types of service requests made to an EHR
- Positions which data to be exchanged by referring to data views of the data model
- Assumes SOAP-based web services calls where XML encoded HL7 V3 message requests and responses are carried between POS applications and the EHR
INFOSTRUCTURE INTEROPERABILITY PROFILE

- Third class of deliverables normative; specify inner workings within EHR Infostructure to orchestrate and process transactions
- Express sequencing of activities to process transactions
- Express expected capabilities of services within an EHRi to process transactions
Architecture Perspectives

CONTEXT

- Business Architecture
- Clinical Work Process Architecture
- System Architecture
- Information Architecture
- Integration & Deployment Models
- Potential Applications
EHR Infostructure: Communication Bus

COMMUNICATION BUS

MESSAGING
- Transformation Services
- Routing Services
- Encrypt/Decrypt Services
- En/Decoding Services
- Parser Services
- Serialization Services

PROTOCOL
- App Protocol Services
- Network Protocol Services

HIAL

Communication bus
EHR Infrastructure: Common Services

**COMMON SERVICES**

**INTEROP**
- Interoperability Services
- Search/Resolution Services

**PRIVACY & SECURITY**
- Anonymization Services
- Identity Protection Services
- User Authentication Services
- Identity Mgmt Services
- Encryption Services
- Access Control Services
- Secure Auditing Services
- Digital Signature Services
- General Security Services

**INTEGRATION**
- Service Catalogue Services
- Broker Services
- Mapping Services

**SUBSCRIPTION**
- Alert/Notification Services
- Pub/Sub Services

**MANAGEMENT**
- Management Services
- Configuration Services
- Policy Mgmt Services

**GENERAL**
- Auditing Services
- Log Mgmt Services
- Exception/Error Handling Services

**CONTEXT**
- Caching Services
- Session Mgmt Services

**POINT OF SERVICE**

- Data Warehouse
EHR Infostructure: Longitudinal Record Services
**EHR Infostructure: Longitudinal Record Services**

**JURISDICTIONAL INFOSTRUCTURE**

*The EHR Index* maintains a sequential list of all events that affect the clinical picture of a client. It also provides the location where the data relevant to each event is kept in the EHRi. It can be used to retrieve the history of events for a client or to trace the information about a specific event.

**EHR INDEX**

- Event ID (Instance ID of an event)
- Parent Folder ID
- Focal Class Type
- Focal Act Subject (Client ECID)
- Focal Act Author (Provider)
- Focal Act Service Delivery Location
- Focal Act Timestamp
- Focal Act Status
- Focal Act Language
- Focal Act Type:
  - Act Mood (e.g. Order Request)
  - Act Class Code (type of class, e.g. Lab order)
  - Act Code (Class value, e.g. CBC)
- Focal Act Source ID (ID provided by POS)
- Focal Act Template ID
- Focal Act Data Location ID (URI)

**POINT OF SERVICE**
EHR Infostructure: EHRS Locator Data

**EHR SOLUTION (EHRS)**

**EHR INFOSTRUCTURE (EHRI)**

- Ancillary Data & Services
- Health Information Data Warehouse
- EHR Data & Services
- Registries Data & Services
- Longitudinal Record Services
- Health Information Access Layer

**EHR SOLUTION (EHRS)**

**EHR INFOSTRUCTURE (EHRI)**

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**POINT OF SERVICE**

**CROSS-JURISDICTIONAL INFOSTRUCTURE**

- EHRI Client ID (resolved ECID)
- CR instance ID (OID root)
- EHRI instance ID (which instance of an EHRI)
- EHRI URI (the URI to access the HIAL)
- Optimized for performance
  - Information type (drug, lab, DI) (derived from HL7 act classes)
  - First created date
  - Last updated date
Centralized Service Approach

CROSS-JURISDICTIONAL INFOSTRUCTURE

JURISDICTIONAL INFOSTRUCTURE

EHR SOLUTION (EHRS)

EHR INFOSTRUCTURE (EHRI)

Ancillary Data & Services

Health Information Data Warehouse

EHR Data & Services

Registers Data & Services

Longitudinal Record Services

Health Information Access Layer

Point of Service Application

EHR Viewer

EHR SOLUTION (EHRS)

EHR INFOSTRUCTURE (EHRI)

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EHR SOLUTION (EHRS)

EHR INFOSTRUCTURE (EHRI)

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Point of Service Application

EHR Viewer

POINT OF SERVICE

Jurisdiction

A

B

C
EHR Infostructure: EHR Data Domain Services

Jurisdictional Infostructure
- Registries Data & Services
- Ancillary Data & Services
- EHR Data & Services
  - Shared Health Record
  - Drug Information
  - Diagnostic Imaging
  - Laboratory
- Data Warehouse

Shared Health Record
- DATA
  - Key Mgmt Services
  - Data Services
- BUSINESS
  - Domain Business Components (Registries, EHR, Domains, User, Context)
  - Normalization Services
  - Business Rules Services
  - EHRi Interoperability Services
  - Assembly Services

Point of Service
EHR Infostructure: EHR Viewer
EHR Infostructure: Client Registry
Has Mr. Lambert had any ER visits since I’ve last seen him one year ago?
EHRi Client Registry: The Challenge

1: A 123 Robert Lambert 1 Main St
1: B 456 Bob Lambert 1 Main St
1: C 789 Robert Lambert 1 Main St
1: C 987 Robert Lambert 1 Main St

2: B 444 Robert Lambert 2 Elm St

Pharmacy
A

Lab
B

???
C

123 Robert Lambert 1 Main St
456 Bob Lambert 1 Main St
444 Robert Lambert 2 Elm St
789 Robert Lambert 1 Main St
987 Robert Lambert 1 Main St
The generation (or sourcing) of the **EHRI Client Identifier (ECID)** is a service offered by the Client Registry.

The ECID is the foundation for interoperability both locally and across EHR Infostructures.
EHRi Client Registry: Interoperability Pattern

ECID: J1 Root ID. Client ID

Client Registry J1

Client Registry J1.1

Client Registry J1/2

ECID: J2 Root ID. Client ID

Client Registry J2

Active synchronization of travelling clients only

Applications

Applications
EHR Infostructure: Provider Registry
EHR Infostructure: Why A Provider Registry?

Have any new test results been published for me?
Provider Registry: Data Sources

JURISDICTIONAL

Doctors

Dentists

Unlicensed Providers

EHR SCP Standards
Provider Registry

Provider Registry

EHR SCP Standards
Provider Registry

Applications

Applications

Applications
Standards-based Solutions: What Does It Mean?
Interoperable EHR Solutions: Key Architectural Requirements

Standards-based Solutions

- Standardized Architecture
- Standardized Interfaces
- Standardized Data Structures
- Standardized Data Vocabularies (encoding rules)
- Standardized Functional Behaviour
Standards-based Solutions

Why Standards?
- They facilitate information exchange; are a critical foundation for EHR
- They create opportunity for future cost reduction as vendors and systems converge on pan-Canadian and international standards
- They ease effort required for replication

Mandatory Investment Eligibility Requirements
- Compliance to standards (infrastructure, architecture)
- Initiatives must comply with existing guidelines or standards adopted by Infoway
- Where standards or guidelines do not exist, projects must support longer-term interoperability and congruence of solutions

Infoway’s role is to set standards and requirements for robust, interoperable products and outcomes
Principles for Establishing Pan-Canadian EHRS Standards

- Infoway has created Principles for Establishing pan-Canadian EHRS
- Standards to provide guidance in the adoption of standards-based solutions
- 11 Principles – accessible via Infoway Knowledge Way
- Business-driven
- Adoption of existing standards where ever possible
- [http://knowledge.infoway-inforoute.ca](http://knowledge.infoway-inforoute.ca)
Principles for Establishing Pan-Canadian EHR Standards

- Standards initiatives to be driven by the business of healthcare with a clearly defined business need
- Existing standards work must be leveraged wherever possible and practical with an approach that includes adoption, or adaptation of existing standards, before development
- Health Level 7 V3 messaging standard required for all new message development related to EHR
- Infoway investments predicated on a commitment to implement pan-Canadian EHR standards
- Standards to be established, tested, refined and evaluated within the context of early adopter implementations
- Infoway will support early adopter investment projects that have the establishment of pan-Canadian standards as their goal
Principles for Establishing Pan-Canadian EHR Standards

• Establishing standards is an evolutionary process and will not be perfect the first time; implementation of standards that are not fully balloted may be needed

• Infoway is committed to supporting Canada’s leadership role in influencing EHR international standards

• Infoway will work with other countries undertaking similar EHR initiatives to leverage their work and bring synergies to the projects as they move toward internationally balloted standards

• Infoway will partner with CIHI, HL7 Canada, IHE Canada and other standards organizations in the establishment of pan-Canadian EHR standards

• Establishment of pan-Canadian EHR standards is coordinated via an open, transparent and inclusive Stakeholder Collaboration Process as defined by our stakeholders
Standards Collaboration Process (SCP)

- An integral element of and key requirement for the establishment of a pan-Canadian interoperable Electronic Health Record (EHR)

- The EHR Standards Collaboration Process includes those jurisdictions, standards-related organizations, healthcare professionals and vendors that will build, operate and use an interoperable EHR

- The EHR Standards Collaboration Process will establish pan-Canadian standards for Infoway investments through collaboration and consensus
Pan-Canadian EHR Standards: Status

Pan-Canadian Standards Groups
- Drugs
- Client Registry
- Provider Registry
- DI/Tele-radiology
- Laboratory
- Clinical Terminology
- iEHR Technical Standards (coming soon)
- iEHR Clinical Standards (coming soon)
- Public Health (coming soon)

Program Projects
- EHRS Blueprint V1
- EHR Data Definition & Standards
- Standards Collaboration Process
- Standards Tactical Plan
- Artefacts Repository
- Telehealth ISO Interoperability
- Telehealth CCHSA Accreditation
- CeRx (formerly Rx5) HL7 V3 Messaging
- Client Registry
- Provider Registry
- IRIS (Infoway Reference Implementation Suite)
- Laboratory Nomenclature & Messaging
- NeCST: electronic claims messaging
- EHR Clinical Terminology Integration
- EHR Profiles for Interoperability between DI, Registries & Consumers
- EHR Blueprint Evolution Project
- Privacy & Security Architecture Project
EHR Infostructure: Standards-based Connectivity

JURISDICTIONAL INFOSTRUCTURE

Registries Data & Services
Ancillary Data & Services
EHR Data & Services
Data Warehouse

**Architecture Standards**
- EHRS Blueprint
- EHR Use Cases
- EHR Data Model
- EHR Services Model
- EHR Interoperability Profiles
- Terminology Standards
- CTI project (underway)
- Terminology implemented in data messaging standards

**Data Messaging Standards**
- Client Registry (in ballot)
- Provider Registry (in ballot)
- Pharmacy CeRx (in ballot)
- Laboratory (in Planning)
- Diagnostic Imaging/Teleradiology (in planning)
- iEHR Clinical Messaging (in planning)
- iEHR Technical Standards (in planning)
- Public Health Services Standards
- Public Health Surveillance Standards

POINT OF SERVICE
- Public Health Provider
- Pharmacist
- Radiologist
- Lab Clinician
- Physician/Provider
- Physician/Provider
- Physician/Provider
Service-oriented Architecture (SOA): What Does It Mean?
Level of Encapsulation Can Vary: Five Normal Forms of Encapsulated Software

1. External access
   - Other data
   - Own data
   - Encapsulated software
   - Programmatic interface
     - Overloaded, incomplete; any data

2. External access
   - Other data
   - Own data
   - Encapsulated software
   - Programmatic interface
     - One complete function; any data

3. External access
   - Other data
   - Own data only
   - Encapsulated software
   - Programmatic interface

4. External access
   - Other data
   - Exclusive data
   - Encapsulated software
   - Programmatic interface

5. External access
   - Other data
   - Opaque data
   - Encapsulated software
   - Programmatic interface

Source: Gartner
SOA as an Enabler

Applications of SOA in EHRi Solutions

• Repurposed legacy applications to offer services as part of SOA-based EHR Infostructure

• New breed of services to enable coordinated transactions in an EHR Infostructure (e.g. Longitudinal Record Services)

• Use of commercially available solutions to enable components of EHR Infostructure

Two Degrees of Separation

• Services exposed outside of an EHRi in the form of supported EHR Interoperability Profiles for an entire Infostructure perceived as a single system with transactional services

• Services within an EHR Infostructure to optimize scalability, maintainability and functional flexibility
Functioning Principles
Functioning Principles/Rules

- Home/no-home EHR
- EHRI Identifier Management
- EHR Index
- EHRS Locator
- POS to EHRI interface
- Level of transparency of EHR to POS applications
- Transaction scope
- Trust Models valid for an EHRI
- Normalization
- Auditing, logging, use of logs
- HL7 V3 (Messaging and templates)

- Level of parameterization
- Primary Purpose for EHRI repositories
- Other uses of the HIAL (POS to POS)
- Multilingual capabilities
- Runtime environment
- Performance principles – targets
- POS Integration environment
- Error Handling
- Consent
- Authentication & Authorization
- OIDS as a principle
- Prospective Events
Architecture Perspectives

CONTEXT

Business Architecture

Potential Applications

Clinical Work Process Architecture

Integration & Deployment Models

System Architecture

Information Architecture
EHRi Conceptual Data Model

- **High-level model** representing generalized concepts
- **Event driven model** to represent instances of clinical service impacting a patient record
- **Broad range of event typing** – governance, people playing roles, delivery, environment, resource
- **Derived from the Canadian conceptual health data model (CCHDM)**
- **Aligned and mapped to HL7 V3 RIM**
- **Mapped against several local and international EHR data models** – Quebec, Alberta, Ontario, Australia, etc.
- **More detailed views available** – transactional views, domain views
CONTEXT

- Potential Applications
- Business Architecture
- Clinical Work Process Architecture
- System Architecture
- Integration & Deployment Models
- Information Architecture
HIAL Integration Layer: Evolutionary Path
Interim State: No EHR Services (Undesirable)

JURISDICTIONAL INFOSTRUCTURE

Each Jurisdiction Infostructure level system uses patient and other required strong identifiers (e.g. provider, encounter) based on point-of-service generated IDs (e.g. MRNs). The CR-EMPI source systems make the CR-EMPI aware of client identifiers. The Point-of-Service applications and Infostructure systems query the CR EMPI for these identifiers in order to access data within any Infostructure System. The level of queries and maintenance of MRNs in the EMPI is not scalable to hundreds or thousands of Point-of-Service systems. There are performance issues accessing CR/EMPI for every Drug system interaction.

PATIENT ENCOUNTER

Client Registration
1) Search client
2) Create new client
3) Update existing client

Pharmacy Profile
4) Request drug profile
5) Request DUR
6) Enter new prescription

POINT OF SERVICE

Physician

Pharmacist
The Client Registry system "determines" a global unique ID (EHR ID) for patients. The Drug Information System (DIS) will use the EHR patient ID to store prescribing and dispensing data. Point-of-Service applications query the Client Registry and obtain the EHR patient ID and will use this ID as a token throughout the entire business transaction. This model eliminates the need for communication between the DIS and CR and reduces the transactions to the CR to one per business transaction.
The Client Registry determines a global unique ID (EHR ID) for patients. The DIS will use the EHR patient ID to store prescribing and dispensing data. EHR services will use the CR to map any local MRN found within transactions to the corresponding EHR client ID. The POS applications do not necessarily have to be aware of the EHR client ID or they can continue to provide this ID themselves after querying the CR (compatible with prior model).
The client, provider, location registries and EHR Services determine global unique IDs for patient, providers, encounters and other required strong identifiers. All Infostructure systems use these unique IDs to store clinical data about a person. The EHR Services will map any local ID to the corresponding EHR ID. The Domain services (DIS, DI, Lab) systems rely on the EHR Services to ensure that the necessary EHR IDs are provided with every transaction.
EHRS Infostructure:
Deployment Models
Large & Medium Deployment Models

Medium size Jurisdictions
- Provincial Client and Provider and Location Registries
- Provincial Lab, Drug, DI, Shared Health Record, LRS, HIAL and EHR Viewer
- EHRS Locator across Provinces
- Local EMR, CIS and other applications

Larger size Jurisdictions
- Provincial Client and Provider and Location Registries
- Provincial Lab, Drug Repositories and HIAL
- Supra-regional LRS, Shared Health Record and DI Repositories and EHR Viewer
- EHRS Locator across regions
- Local EMR, CIS and other applications
Small Jurisdictions

PROVINCIAL

- Provincial Client, Provider & Location Registry
- Integrated hospital CIS solution fulfilling the roles of the Provincial EHR Services, Laboratory and Drug services
- Provincial DI Service
- Provincial HIAL & EHR Viewer
- Local physician office systems & other CIS connect as POS Systems

LOCAL

- CIS
- EHR Viewer
- EMR

Longitudinal Record Services

Common Services

Communication Bus
Model 1: Single EHR Infostructure

PROVINCIAL

Registry & Data Services
- Client registry
- Provider Registry
- Location registry
- Terminology Registry

EHR Data & Services
- Drug Information
- Shared Health Record
- Diagnostic Imaging
- Laboratory

Business Rules
EHR Index
Message Structures
Normalization Rules

Longitudinal Record Services
Security Mgmt Data
Privacy Data
Configuration

HIAL
Common Services
Communication Bus

POINT OF SERVICE
- Public Health Services
- Pharmacy System
- Radiology Center PACS/RIS
- Lab System (LIS)
- Hospital, LTC, CCC, EPR
- Physician Office EMR
- EHR Viewer

Physician/Provider
Physician/Provider
Physician/Provider

Public Health Provider
Pharmacist
Radiologist
Lab Clinician
Physician/Provider
Physician/Provider
Model 2: Shared EHR Infostructure

PROVINCIAL

Registry & Data Services
- Client registry
- Provider Registry
- Location registry
- Terminology Registry

EHR Data & Services
- Drug Information

REGIONAL

REGION 1
- Shared Health Record
- Diagnostic Imaging
- Laboratory
- Business Rules
- EHR Index
- Message Structures
- Normalization Rules

REGION 2
- Shared Health Record
- Diagnostic Imaging
- Laboratory
- Business Rules
- EHR Index
- Message Structures
- Normalization Rules

REGION 3
- Shared Health Record

POINT OF SERVICE
- Public Health Services
- Pharmacy System
- Radiology Center PACS/RIS
- Lab System (LIS)
- Hospital, LTC, CCC, EPR
- Physician Office EMR
- EHR Viewer

HIAL
- Common Services
- Communication Bus

Longitudinal Record Services
- Security Mgmt
- Data Privacy Data
- Configuration
Model 3: Distributed EHR Infostrutures

Reuse drives down cost, accelerates timelines, reduces risk and enables interoperability.
Deployment Decisions

**PROVINCIAL**

**Registry & Data Services**
- Client registry
- Provider Registry
- Location registry
- Terminology Registry

**Longitudinal Record Services**
- Business Rules
- EHR Index
- Message Structures
- Normalization Rules

**HIAL**
- Common Services
- Communication Bus

**POINT OF SERVICE**
- Public Health Services
- Pharmacy System
- Radiology Center PACS/RIS
- Lab System (LIS)
- Hospital, LTC, CCC, EPR
- Physician Office EMR
- EHR Viewer

**Business choices?**
- Who, where, when, what
- Clinical value
- Adoption

**Solution development choices?**
- Services/functions
- Data persistence
- Communication standards
- Data standards
- Integration tooling

**Evolution plan?**
- What functionality when
- EHR Service evolution path

**Deployment configuration choices?**
- Provincial vs regional
- Single Solution/many deployments
- Multiple solutions
Architecture Perspectives

CONTEXT

Business Architecture

Clinical Work Process Architecture

System Architecture

Information Architecture

Integration & Deployment Models

Potential Applications
- Strategic planning
- Change management
- System development/integration
- EHR SCP message development

- Testing (compliance)
- System implementation
- Education & training
- Operation & maintenance
End-User Perspective: EHR Viewer

JURISDICTIONAL INFOSTRUCTURE

Registries Data & Services
- Client Registry
- Provider Registry
- Location Registry
- Terminology Registry

Ancillary Data & Services
- Outbreak Management
- PHS Reporting

EHR Data & Services
- Shared Health Record
- Drug Information
- Diagnostic Imaging
- Laboratory

Data Warehouse
- Health Information

Common Services
- Security Mgmt Data
- Privacy Data
- Configuration

Communication Bus

Longitudinal Record Services
- Business Rules
- EHR Index
- Message Structures
- Normalization Rules

HIAL

Patient Info
- Visit History
- Laboratory

End-user Info
- Drug Profile
- Diagnostic Imaging

Physician/Provider

EHR Viewer

EHR VIEWER
End-User Perspective: EMR Application

**JURISDICTIONAL INFOSTRUCTURE**

- Registries Data & Services
  - Client Registry
  - Provider Registry
  - Location Registry
  - Terminology Registry

- Ancillary Data & Services
  - Outbreak Management
  - PHS Reporting

- EHR Data & Services
  - Shared Health Record
  - Drug Information
  - Diagnostic Imaging

- Data Warehouse
  - Health Information

- Longitudinal Record Services
  - Business Rules
  - EHR Index
  - Message Structures
  - Normalization Rules

**HIAL**

- Common Services
  - Communication Bus

- EMR Database

**POINT OF SERVICE**

- Physician Office EMR

**EMR APPLICATION**

- Patient Info
  - End-user Info
    - Patient History
  - Drug Profile
  - Laboratory
  - Diagnostic Imaging
EHRS Data: Enables New Classes of Applications

EHR Infostructure (EHRI)

- Ancillary Data & Services
- Health Information Data Warehouse
- EHR Data & Services
- Registries Data & Services

- Decision support: The Helper, The Mentor
- Automated workflow: Drug interactions, Abnormal results
- New applications: Patient monitoring
- Custom projects: Data mining

- Client data
- Provider data
- Location data
- Privacy data
- Security data
- Encounter data
- Blood/allergy/immunization data
- Encounter summaries
- Clinical notes
- Observations/problems/conditions
- Orders/Results data
- Referrals data
- Lab data
- Pharmacy data
- Diagnostic Imaging data
Deployment Configurations: COTS-based Solutions
COTS: CIS with Integrated Viewer

JURISDICTIONAL INFOSTRUCTURE

Registries Data & Services
- Client Registry
- Provider Registry
- Location Registry
- Terminology Registry

Ancillary Data & Services
- Outbreak Services
- PHS Reporting Services

EHR Data & Services
- Drug Information System
- Diagnostic Imaging

CLINICAL INFORMATION SYSTEM
- Shared Health Record
- Laboratory
- Laboratory Shared Health Record
- Longitudinal Record Services
- EHR Viewer Server

EAI
- Interoperability
- General Integration
- Subscription Context
- Management

EHR IP Transactions: Get, Put, List; Pan-Canadian EHR Standards
- Public Health Services
- Pharmacy System
- Radiology Center PACS/RIS
- Lab System (LIS)
- Hospital, LTC, CCC, EPR
- Physician Office EMR
- EHR Viewer Client

POINT OF SERVICE
COTS Based: EAI Centric

JURISDICTIONAL INFOSTRUCTURE

Registries Data & Services
- Client Registry
- Provider Registry
- Location Registry
- Terminology Registry

Ancillary Data & Services
- Outbreak Services
- PHS Reporting Services

EHR Data & Services
- CIS: Shared Health Record & Laboratory
- Drug Information System
- Diagnostic Imaging

EAI
- Interoperability
- Integration
- Context
- Authentication/Acess Control
- Consent Management
- Auditing/Logging

Communication Bus

EHR IP Transactions: Get, Put, List; Pan-Canadian EHR Standards

POINT OF SERVICE

- Public Health Services
- Pharmacy System
- Radiology Center PACS/RIS
- Lab System (LIS)
- Hospital, LTC, CCC, EPR
- Physician Office EMR
- EHR Viewer Client
EHRS Blueprint As Design Pattern & Standard

Provides specifications for provider organizations & the vendor community to design and develop:

- EHR infostructure
- Interfaces to allow existing systems to interoperate using EHR infostructure
- New applications that take advantage of the EHR infostructure to provide added value to service providers, patients; to promote wellness of Canadians

Provides design pattern & set of standardized specifications that:

- Provide flexibility to meet the variety found in existing service delivery settings while providing an ability for jurisdictions to evolve their solution set, leveraging their current investments in systems
- Allowing the managed addition of contributors to and users of Electronic Health Records
Infoway’s interoperable EHR investment program provides the primary vehicle for transitioning the Blueprint from architecture to working components through:

- partnering with jurisdictions ready to build interoperability between existing systems
- jurisdictions ready to incorporate their registries and domain repositories

The second vehicle for testing and refining the Blueprint specifications is adoption by the vendor community and acquisitions of “interoperable ready” applications:

- Major vendors have incorporated the Infoway architectural approach into their product strategies
- The Blueprint can provide the framework for jurisdictions to evaluate vendor provided solutions and ensure they will work with their evolving EHR infostructures

This process will be the test-bed for the EHRS Blueprints specifications:

- Elements of the EHRS Blueprint specifications will be updated by these project teams as the concepts are tested and refined
- Implementation guidelines will be produced to assist others in implementing these capabilities

CONCEPT

IMPLEMENTATION
Maintaining the Blueprint as a Pan-Canadian Standard

• Infoway understands the importance of having a stable, managed specification for interoperability
  • Jurisdictions and provider organizations need to be confident that their commitment to implementing EHR infostructure is based on a sound specification that will be maintained and managed
  • Implementations of the infostructure will reveal where the specification needs to be adjusted to optimize performance and ensure reliability

• For this reason, the EHRS Blueprint specifications will be subject to the pan-Canadian Standards Collaboration Process established by Infoway
  • Ensuring pan-Canadian participation in requirements definition
  • Providing foreknowledge of the financial and change management requirements to all affected groups and organizations
  • Providing a scope and change-management model for the Blueprint specifications themselves
**The Architecture In Summary: EHR Repository**

**Concepts**

- Patient’s data is stored and accessed from one logical EHR
- Patient’s longitudinal clinically relevant information, authoritative & reliable
- EHR co-exists with provincial domain repositories
- EHR may be implemented at any jurisdictional level
- EHR has a common definition across Canada

**Benefits**

- Interoperability, performance, scalability
- Provider adoption, supports use cases across continuum of care, timely and accurate for provider
- Preserves investments, does not unnecessarily duplicate data
- Flexibility, configurable to local & provincial needs
- Cost effective, standards-based, Interoperability
The Architecture In Summary: HIAL

<table>
<thead>
<tr>
<th>Concepts</th>
<th>Benefits</th>
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<tbody>
<tr>
<td><strong>HIAL (Health Information Access Layer)</strong> provides common way to interoperate with EHR, registries, domain repositories</td>
<td><strong>Common and standards based is most cost effective, secure &amp; private; applications focus on clinical logic vs. integration logic</strong></td>
</tr>
<tr>
<td>Provider applications interoperate through HIAL to access EHRS</td>
<td><strong>Cost effective environment for broad set of provider applications, standards based integration</strong></td>
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<tr>
<td>Provides peer-to-peer trusted communication and value-added common services to enable interoperability across the continuum of care and across jurisdictions</td>
<td><strong>Secure &amp; private, efficient, scalable, cost effective and standard runtime environment, responsive</strong></td>
</tr>
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The Architecture In Summary: EHRi

**Concepts**
- Common standards will enable integration & interoperability
- Standard message data protocol for external communications is HL7 V3
- Registries have common definition across Canada

**Benefits**
- Reduces design, development, test & operational costs
- True interoperability, international standard will incent vendors
- Interoperability, cost, security & privacy
The Architecture In Summary: Applications

**Concepts**

- Messages initiated by point-of-care applications populate EHR with clinical data
- Provider applications read data out of the EHR via the HIAL in addition to their operational data stores
- Use cases, business rules and visualization of data is a function of the point-of-care application

**Benefits**

- Low cost and common model of integration, secure and private, scalable, extensible, preserves current investments
- Mass customized views of data tailored to provider needs, secure and private, scalable, authoritative, reliable, responsive
- Vendors compete and innovate, extensible, value added services for providers
Thank you!

**Website:** infoway-inforoute.ca

**E-mail:** rparker@infoway-inforoute.ca