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Singapore Healthcare's Journey towards Interoperability, Sharing and Reuse

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National Healthcare Group · Alexandra Hospital · Tan Tock Seng HOSPITAL · THE EYE INSTITUTE · NATIONAL SKIN CENTRE · National Healthcare Group POLYCLINICS · SingHealth · National Neuroscience Institute · Singapore National Eye Centre · National Dental Centre · National Heart Centre · KK Women's and Children's Hospital · Singapore General Hospital · Changi General Hospital · Polyclinics SingHealth · National Cancer Centre Singapore · National University Hospital · INSTITUTE of MENTAL HEALTH WOODBRIDGE HOSPITAL · THE CANCER INSTITUTE · THE HEART INSTITUTE

Outline

➤ **Introduction**

➤ MOHH Plan & Key Initiatives

➤ Architecture Initiatives Highlight

  ➤ Service Catalogue

  ➤ Interoperability & Integration Architecture (IIA)

  ➤ National Health Service Bus Reference Architecture

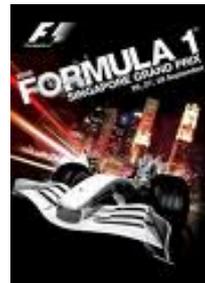 ➤ Enterprise Architecture Repository

➤ Conclusion

1819

1965

704 km²

5.08 million population

#1 Healthcare System in Asia,
#6 in the World
World Health Organisation, World Health Report

Diversified Providers for Full Spectrum of Healthcare Ecosystem

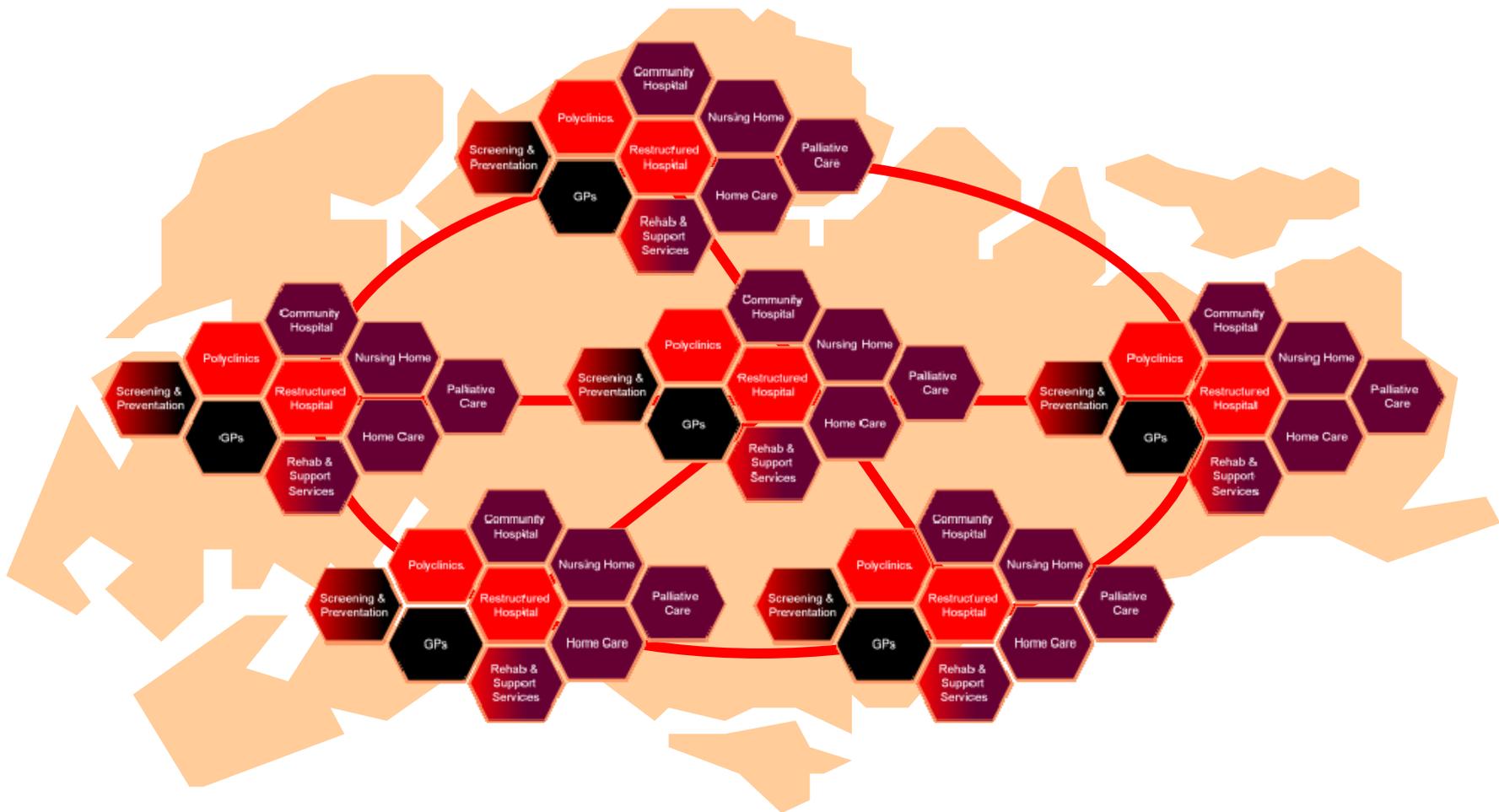**Primary Care**

Acute & Intermediate Care

Long-Term Care
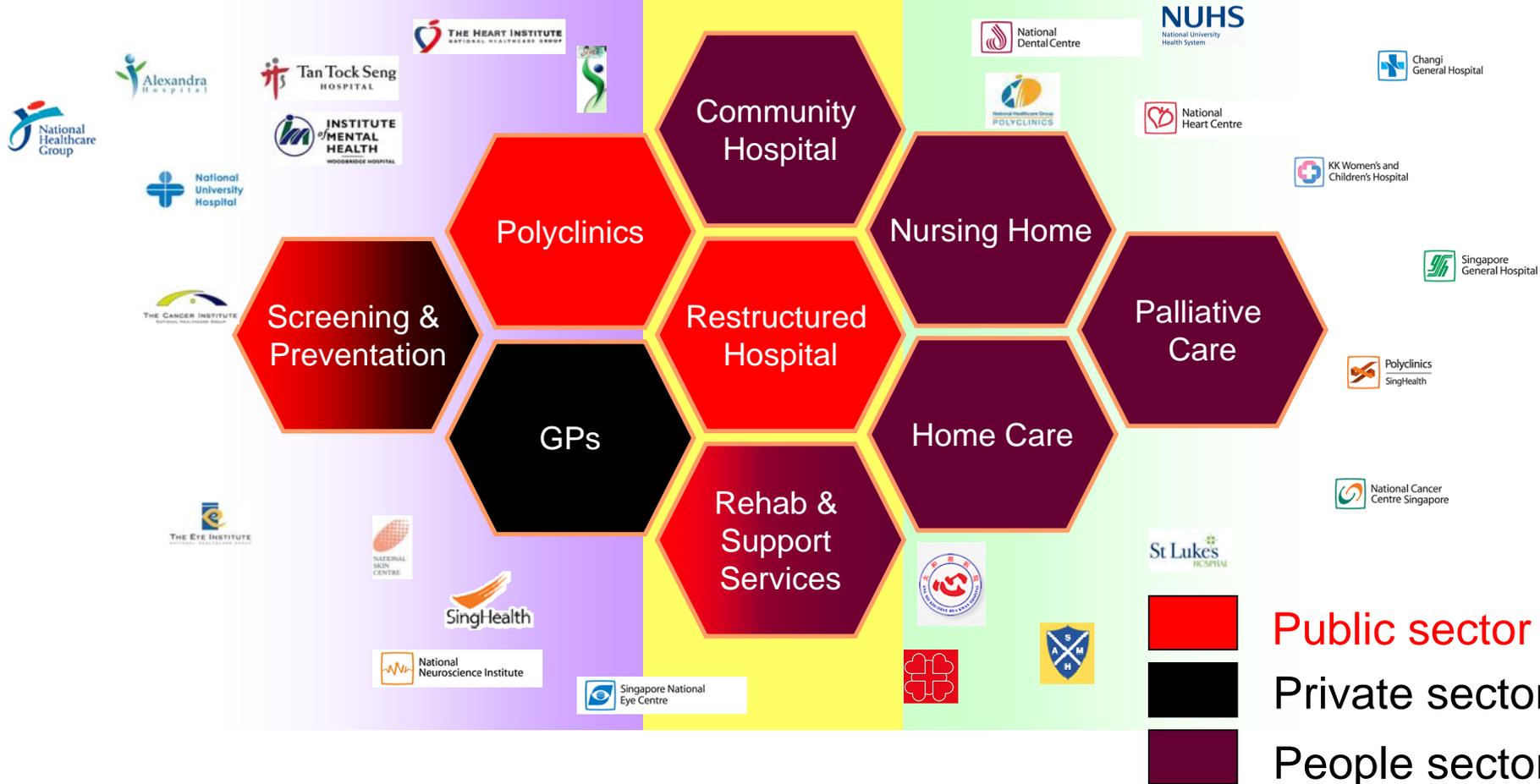
- Polyclinics
- Screening & Preventation
- GPs
- Community Hospital
- Restructured Hospital
- Rehab & Support Services
- Nursing Home
- Home Care
- Palliative Care

Legend:
- Public sector (red)
- Private sector (black)
- People sector (maroon)

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Electronic Medical Record (EMR)

Specific to an facility (institution, private office); the equivalent of its paper predecessor and includes everything that is recorded by that organization about a given patient. It has "depth" but lacks "breadth".

Electronic Health Record (EHR)

Specific to an individual; captures a key subset of health information from multiple point of service systems. It is available electronically to authorized healthcare 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.
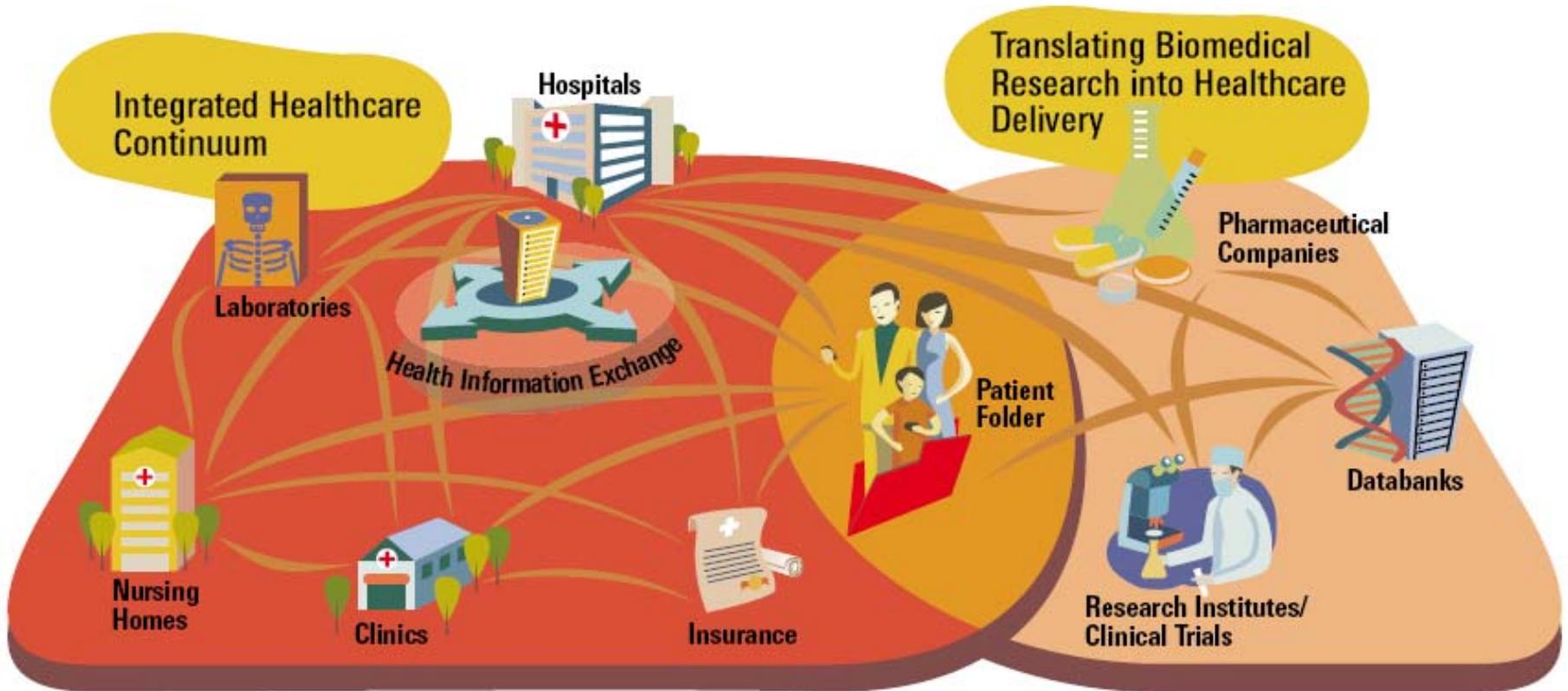
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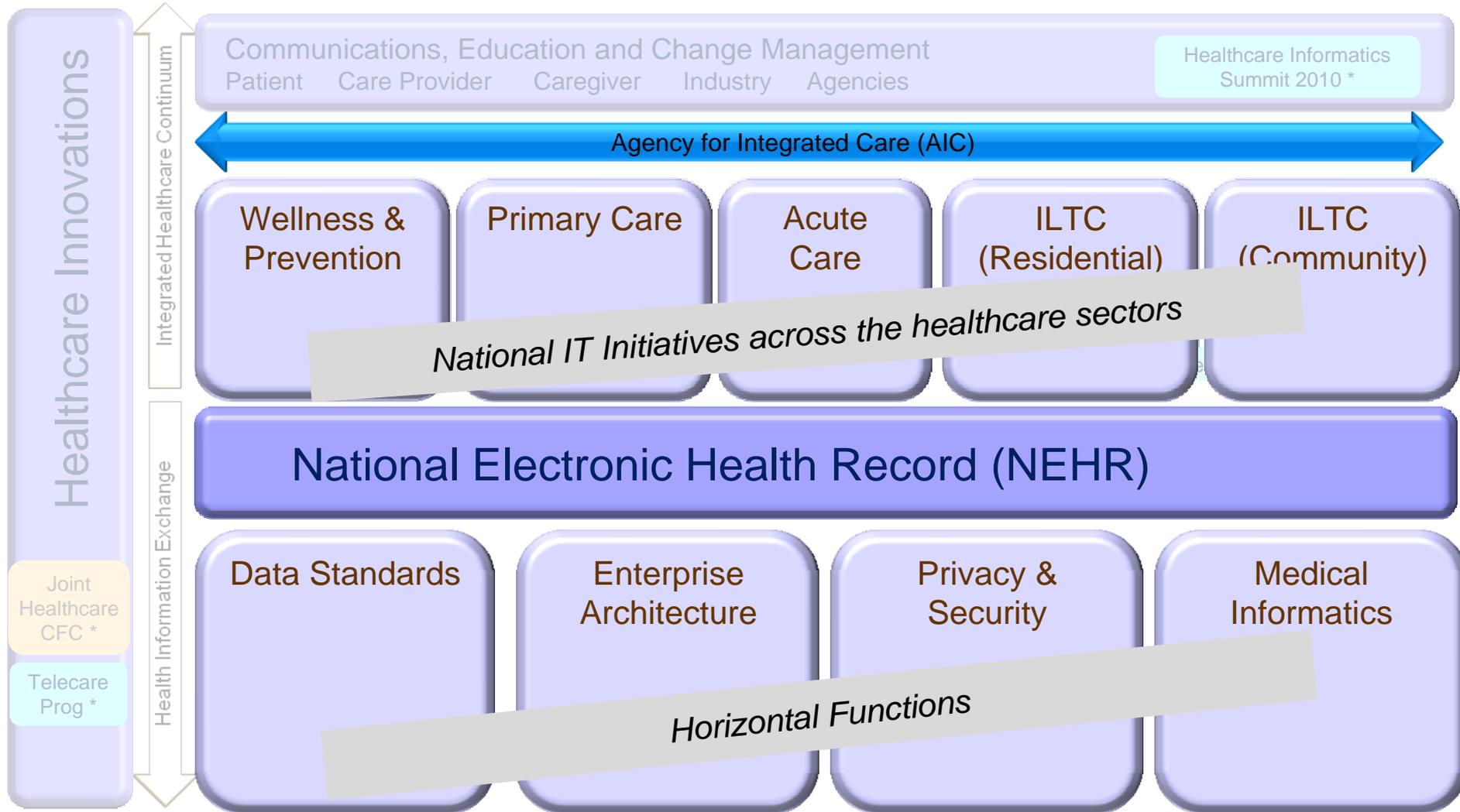
  ➢ Enterprise Architecture Repository

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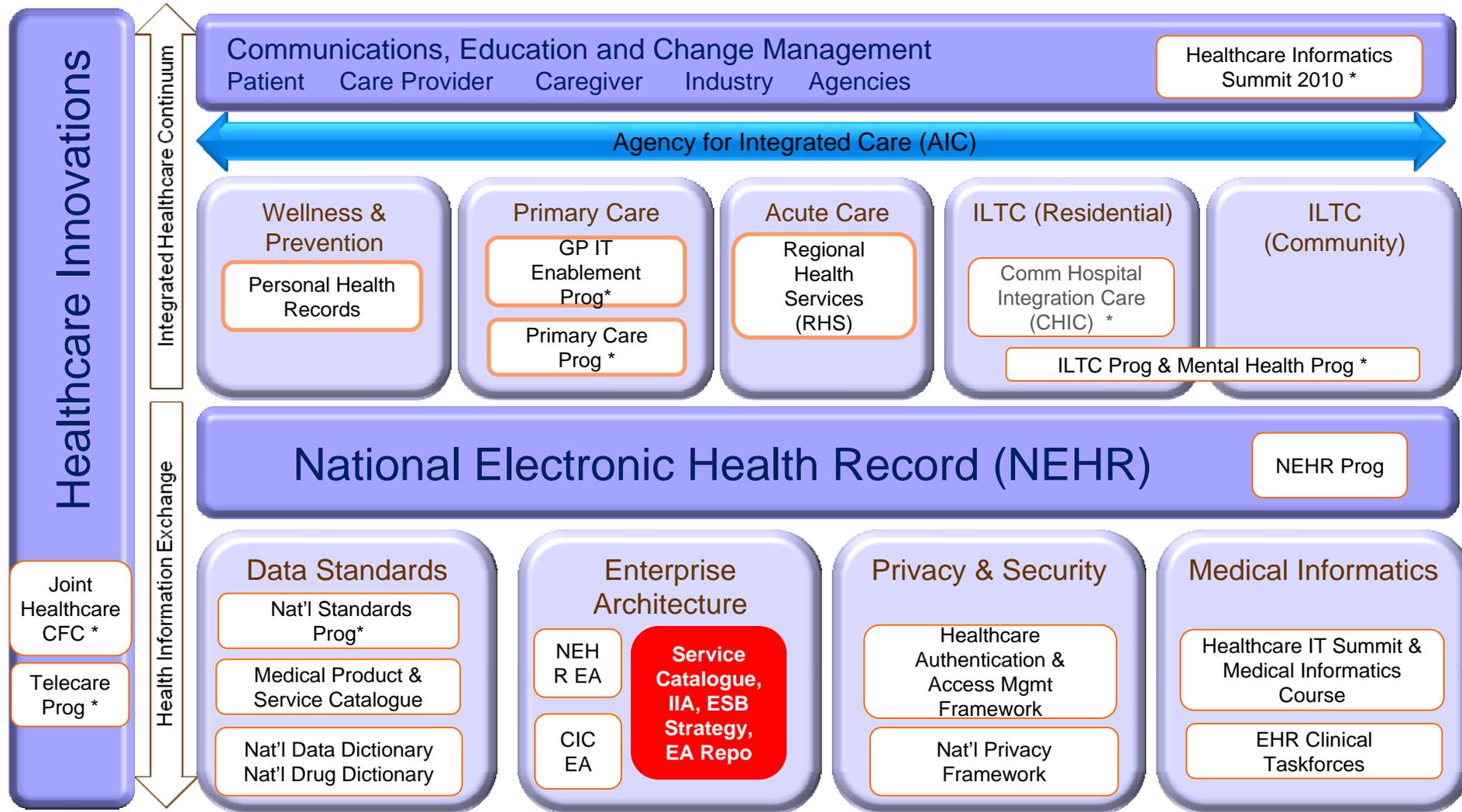## Singapore iN2015 Goal for Healthcare and Biomedical Sciences

National Coordinator of Health IT

Healthcare Innovations

Integrated Healthcare Continuum

Health Information Exchange

Communications, Education and Change Management
Patient   Care Provider   Caregiver   Industry   Agencies

Healthcare Informatics
Summit 2010 *

Agency for Integrated Care (AIC)

| Wellness & Prevention | Primary Care | Acute Care | ILTC (Residential) | ILTC (Community) |

National IT Initiatives across the healthcare sectors

National Electronic Health Record (NEHR)

| Data Standards | Enterprise Architecture | Privacy & Security | Medical Informatics |

Horizontal Functions

Joint Healthcare CFC *

Telecare Prog *

Our plan

Healthcare Innovations

Integrated Healthcare Continuum

Communications, Education and Change Management
Patient   Care Provider   Caregiver   Industry   Agencies

Healthcare Informatics Summit 2010 *

← Agency for Integrated Care (AIC) →

Wellness & Prevention	Primary Care	Acute Care	ILTC (Residential)	ILTC (Community)
Personal Health Records	GP IT Enablement Prog*	Regional Health Services (RHS)	Comm Hospital Integration Care (CHIC) *	
	Primary Care Prog *			

ILTC Prog & Mental Health Prog *

Health Information Exchange

National Electronic Health Record (NEHR)

NEHR Prog

Joint Healthcare CFC *

Telecare Prog *

Data Standards	Enterprise Architecture		Privacy & Security	Medical Informatics
Nat'l Standards Prog*	NEHR EA	**Service Catalogue, IIA, ESB Strategy, EA Repo**	Healthcare Authentication & Access Mgmt Framework	Healthcare IT Summit & Medical Informatics Course
Medical Product & Service Catalogue				
Nat'l Data Dictionary Nat'l Drug Dictionary	CIC EA		Nat'l Privacy Framework	EHR Clinical Taskforces

General evolution pattern of Architecture Initiatives

MOHH Architecture Initiatives

Set the initial key architecture **requirements**

NEHR Phase 1

Apply, validate, fine-tune and extend the architecture
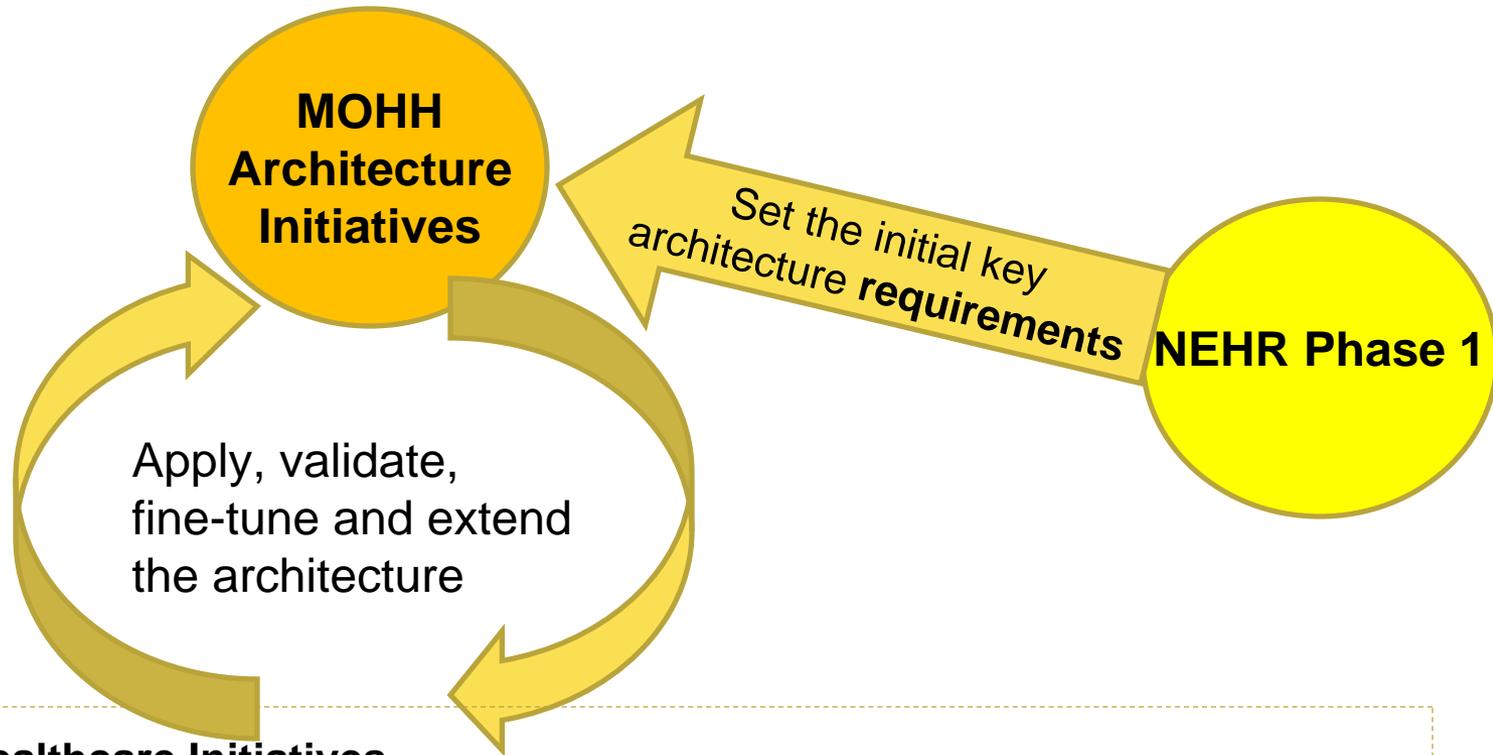
Other National Healthcare Initiatives
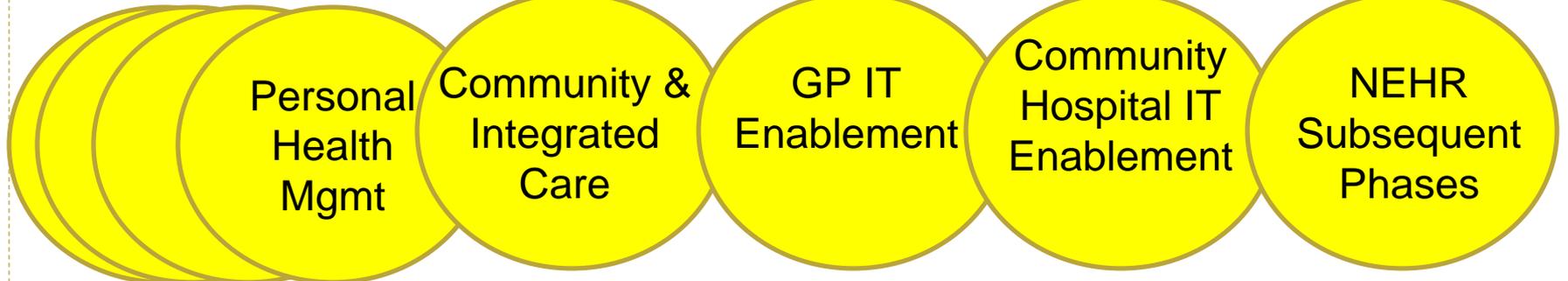
Personal Health Mgmt

Community & Integrated Care

GP IT Enablement

Community Hospital IT Enablement

NEHR Subsequent Phases

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Two Key Dimensions

	Interop & Sharing	Re-use
Answers on 5W & 1H *Who, What, Where, When, Why, How*		
Planning & Enabling Tools		

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Two Key Dimensions

Interop & Sharing   **Re-use**

Answers on 5W & 1H

Who, What, Where, When, Why, How

Planning & Enabling Tools

| Interop & Sharing	Re-use
Interoperability Architecture	Service Catalogue
National Health Service Bus Reference Architecture	
Enterprise Architecture Repository	

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Service Catalogue

- Background:
  - Early 2010, two-month effort
  - Leverage on previous architecture work

- Objectives:
  - Provide a baseline of NEHR services
  - Take a step towards SOA-based NEHR architecture

- Deliverables:
  - Approach for identifying services
  - Template for documenting identified services
  - A initial set of services required by the NEHR

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Organisation

- 5 Domains: EHR, National Health Identification Service, Identify & Access Mgmt, Terminology, Integration
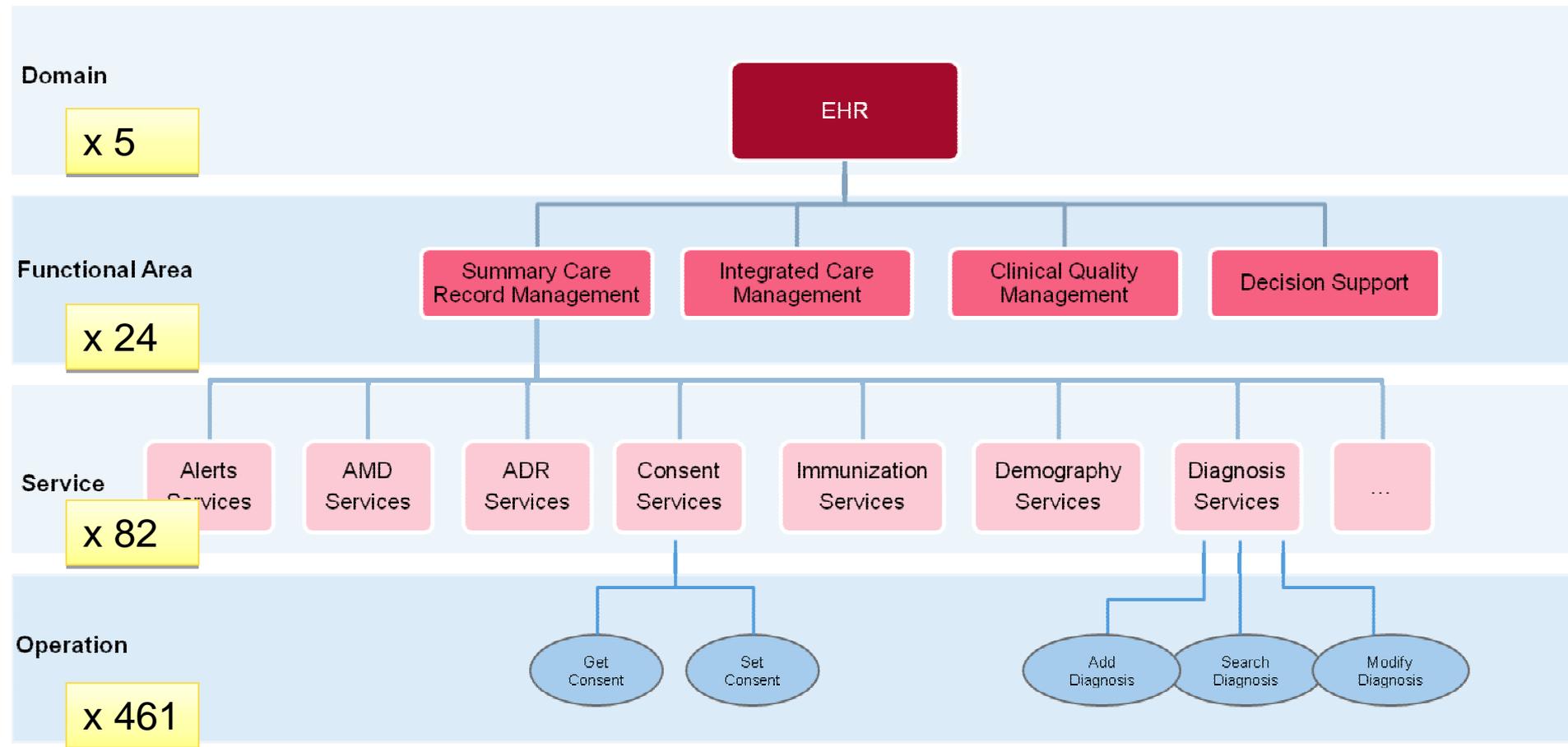
A Peek into the Service Catalogue
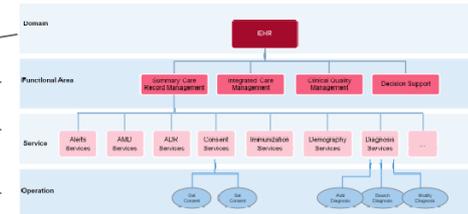
Domain	Functional Area	Service Name	Service Name Description	Service Operation	Service Operation Description	Service Input	Service Output
EHR	1. Summary Care Record	Patient	Manages the services to register patients.	AddPatient	Registers a new patient with the EHR based on inputs from the source systems	Patient Particulars; e.g. Last Name, First Name, etc	Success or failure indicator
EHR	1. Summary Care Record			DeletePatient	De Registers the patient from the EHR based on the source systems	PID	Success or failure indicator

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Service Catalogue Construction Approach

- Develop first-cut based on available information before vendor selection
- To be revised after finalisation of use cases and detailed requirements
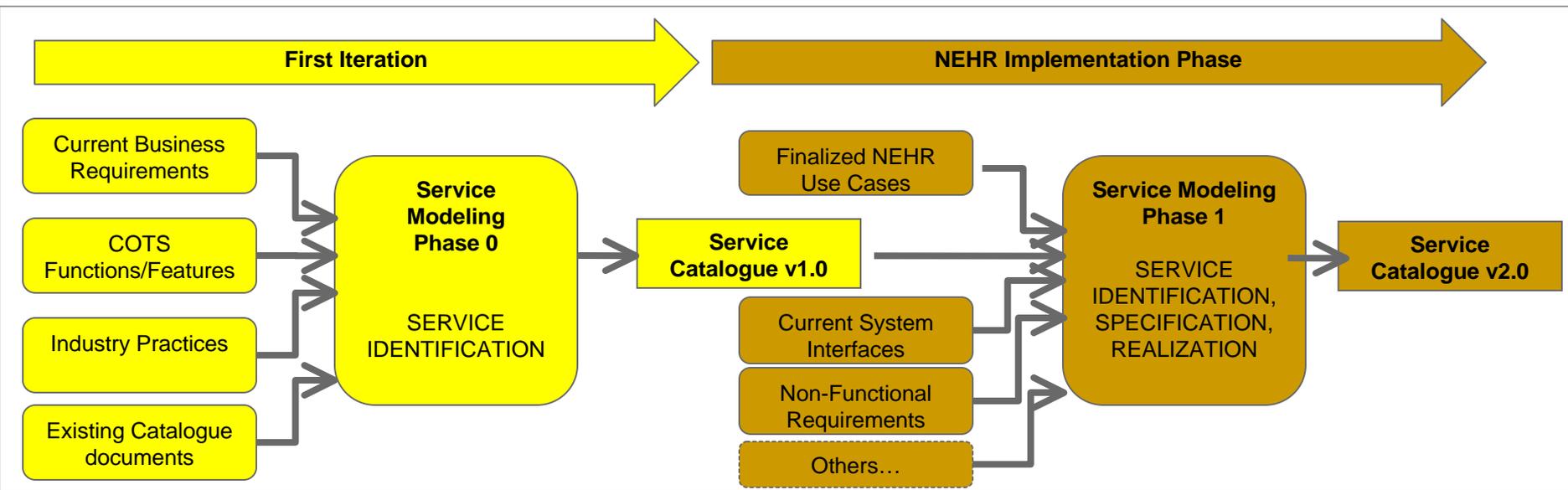
Service Catalogue – Next Step

- Review and update the catalogue after detailed design (completed) of NEHR phase 1, for example
  - *Subsume some operations into one another (e.g. add, update, delete)*
  - *Further split some operations*
  - *Inter-operations dependency to align with general business rule/architecture decision (e.g. patient registration shall exist done before medication orders)*

- Reuse the NEHR services for new applications

- Stronger tie-up with Interoperability and Integration Architecture

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Interoperability and Integration Architecture (IIA) – Standards/Guidelines/Pattern

Interoperability Specifications

Administration

Integration Services

Security

Infrastructure
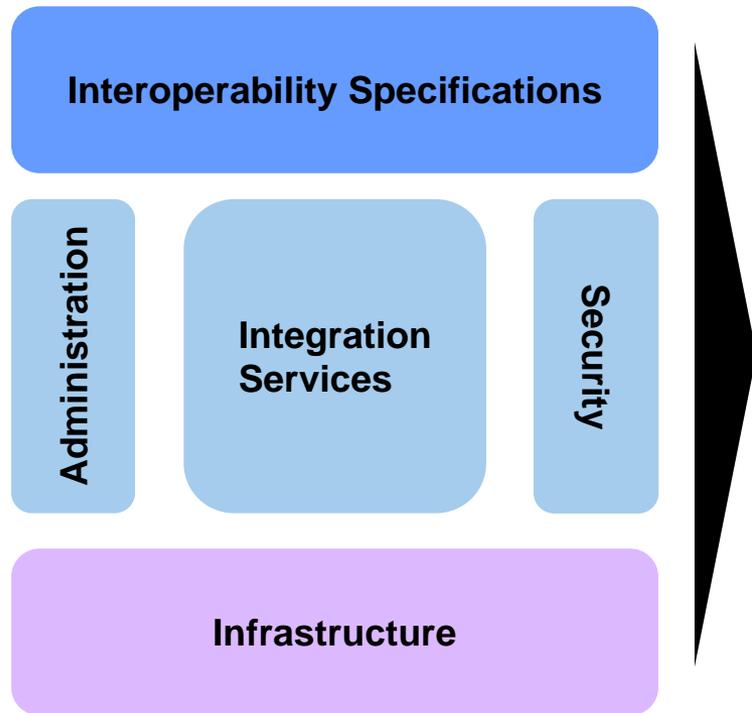
Key Questions Answered:

- **Interoperability Specifications**
  - How can EHR information be understood in a consistent manner?

- **Integration Services**
  - What capabilities does the EHR need to provide to support interoperability and integration?

- **Security**

- **Administration**
  - How does interoperability impact administration and operations of EHR and EMR systems?

- **Infrastructure**
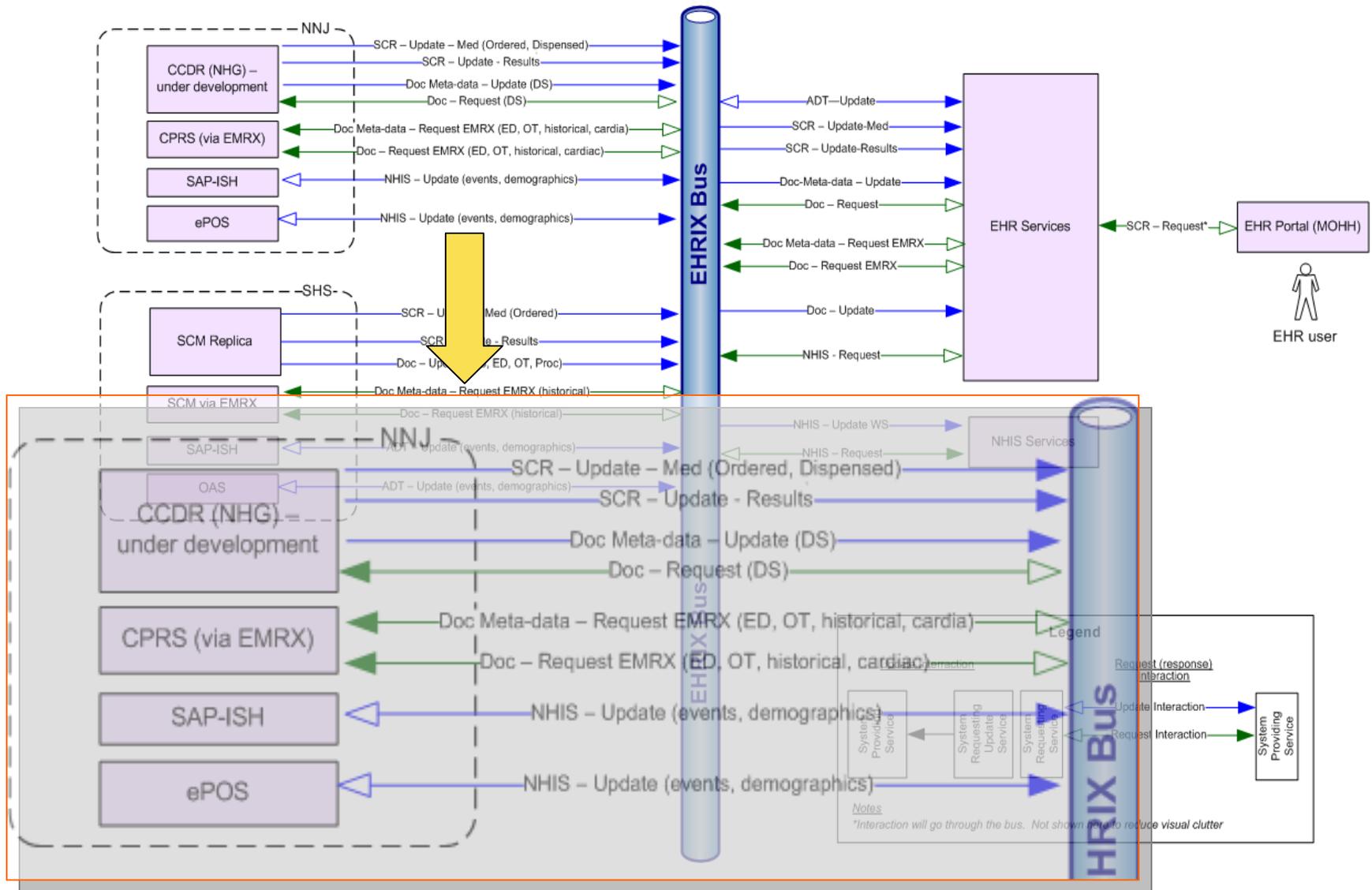
Linkage to Standards
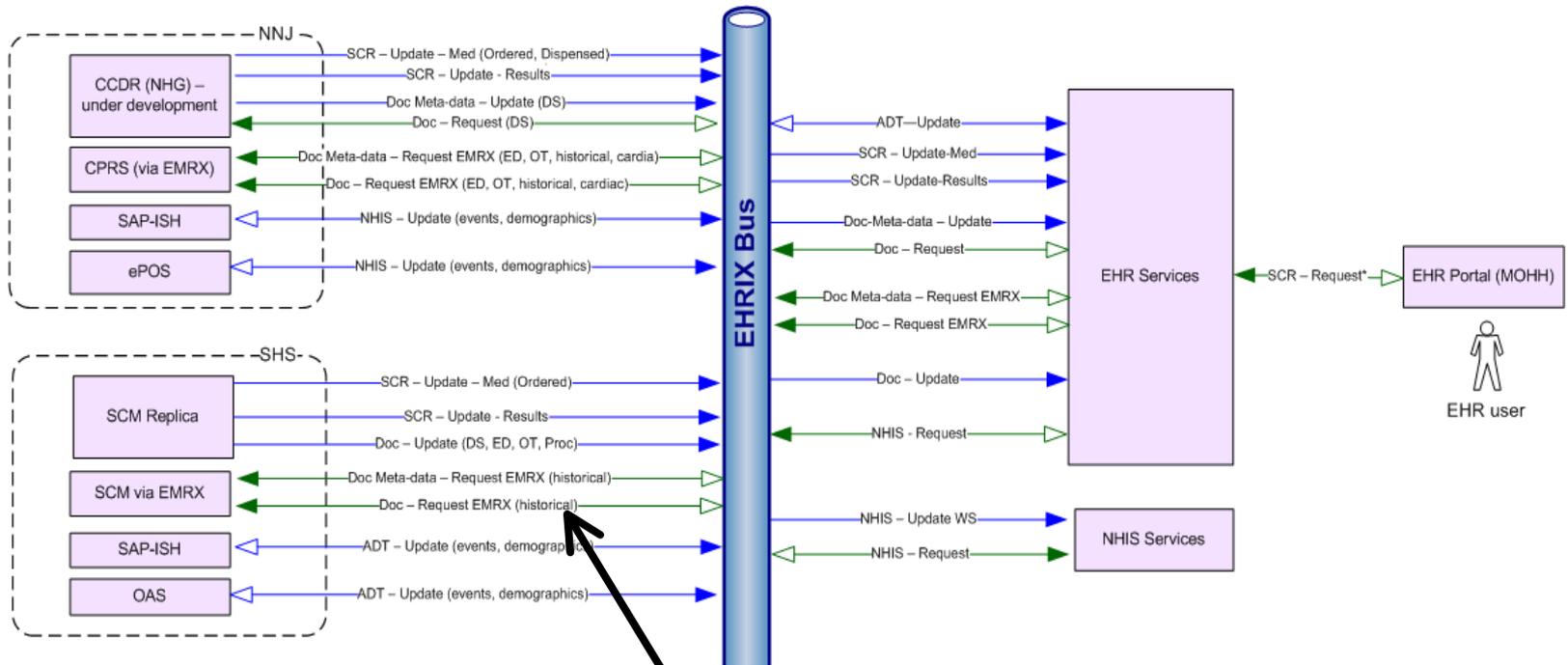
S/N	Name	Purpose	Integration Standards	Semantic Standards
5	Doc – Request EMRX	Request source system for a specific document. Leverages on EMRX's GetDoc functionality.	Web Service	EMRX XML

Linkage to Service Catalogue
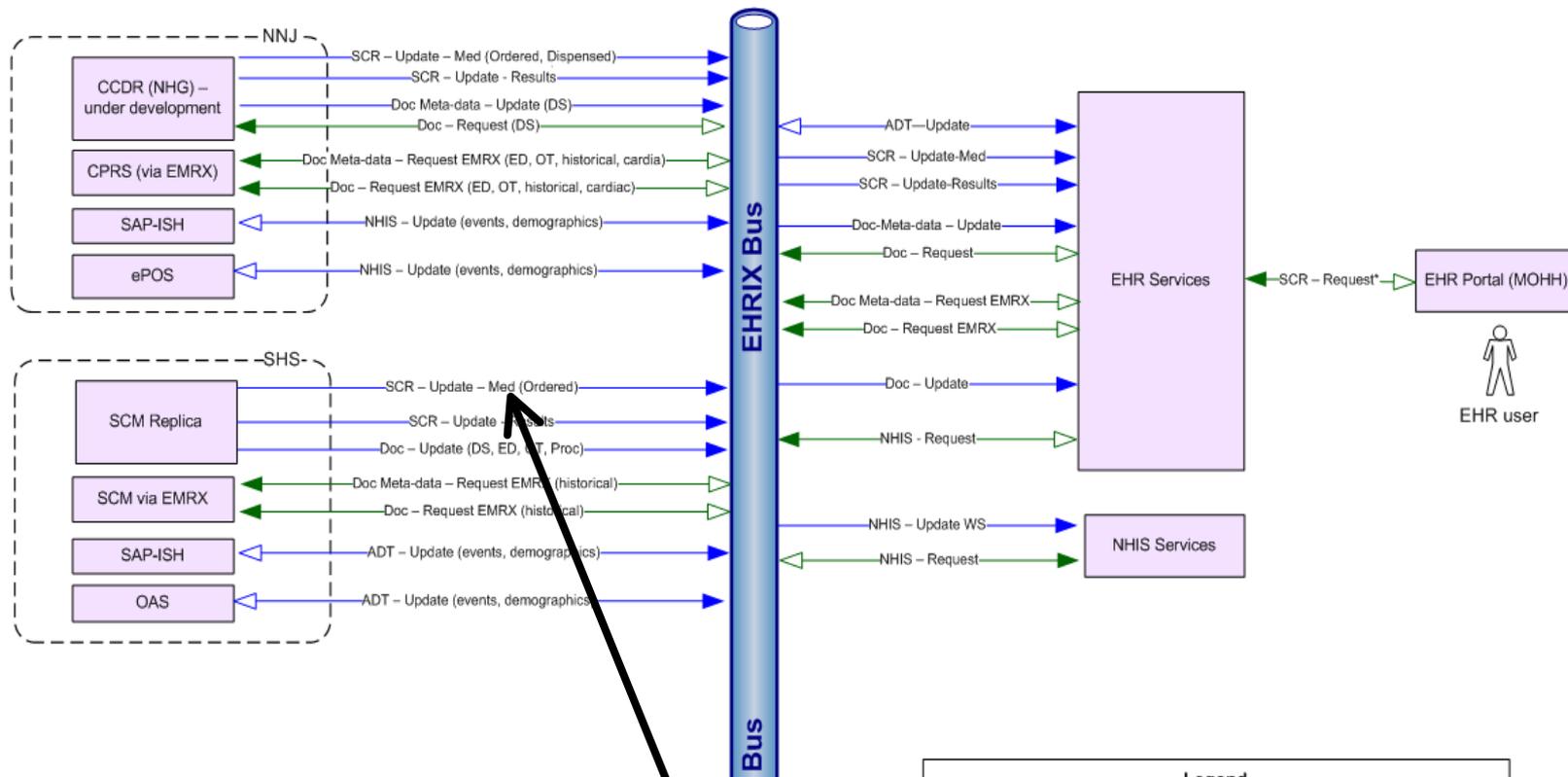
Domain	Functional Area	Service Name	Service Operation	Service Operation Description
EHR	1. Summary Care Record	Medication	UpdatePatientMedication	Update medication(s) on the patient medication list.

Interoperability Specifications

Administration

Integration Services

Security

Infrastructure
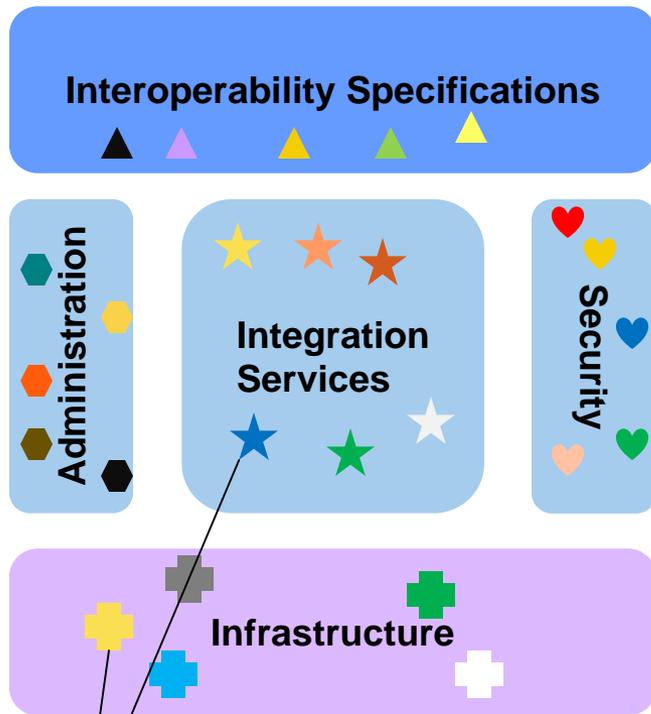
Standards/best practices/existing implementation (e.g. services catalogue, NEHR ESB) for each areas
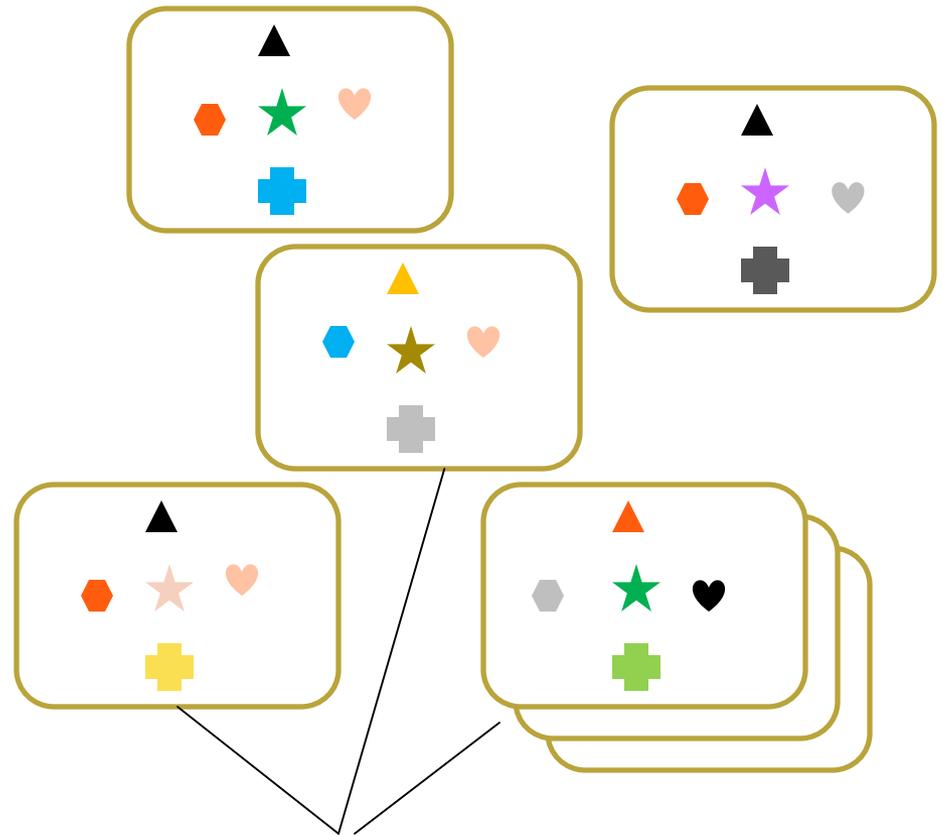
List of profiles to cater to common implementation need for specific domain areas (SSO, lab results update, event summary retrieval, record reconcilation etc)

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➢ **Background**

  ➢ Most systems integrations (EMR, LIS, RIS … etc) in large healthcare settings are using traditional MLLP via integration engine

    ➢ *minimal Enterprise Service Bus (ESB) investments to-date.*

  ➢ However, ESB is being considered in a number of upcoming large scale healthcare IT initiatives (NEHR, NHIS, CLEO, Hospital Cluster wide Initiatives)

  Opportunity for early alignment !!!

National Health Service Bus Reference Architecture

➢ **Process**

    ➢ One month exercise

    ➢ Over 10 internal/external stakeholders engaged for interviews, major stakeholders participated in working group

➢ **Deliverables and Outcome**

    ➢ A Reference Architecture for ESB landscape

    ➢ Key directions identified for moving towards the reference architecture
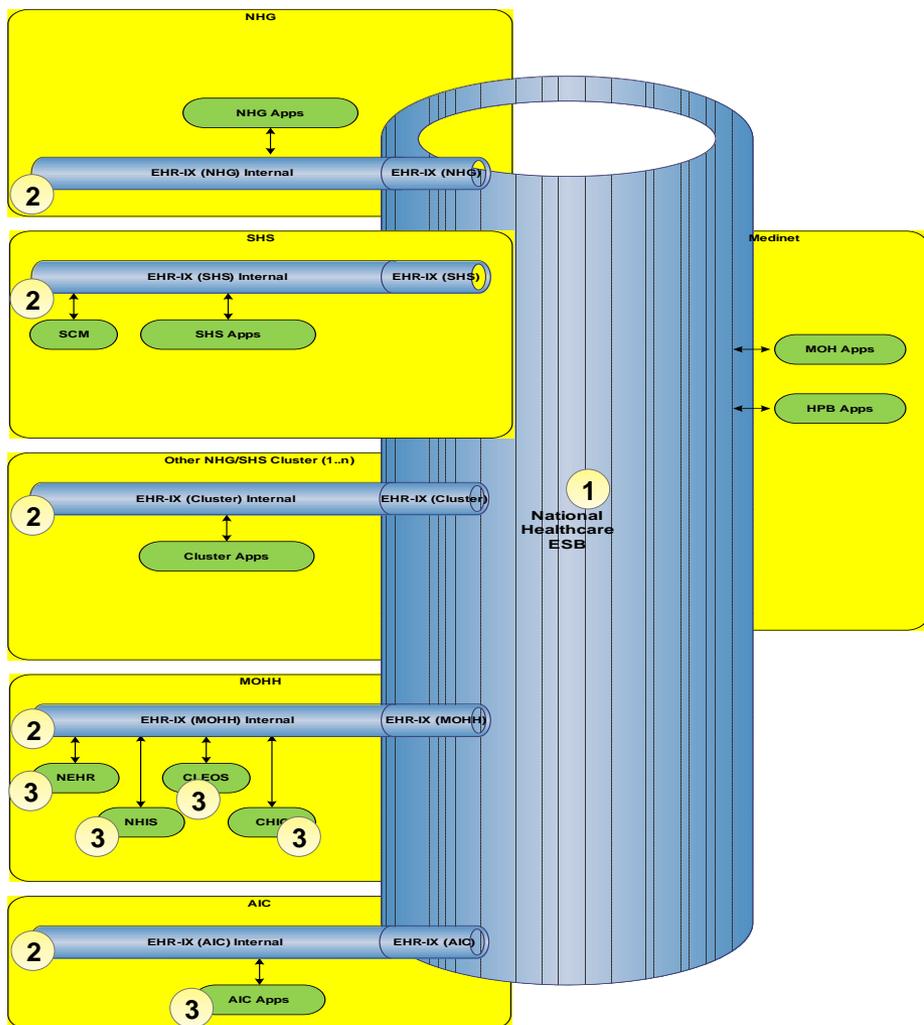
Characteristics

1. Federated Model. No one single ESB for everybody. Multiple ESB instances in the whole landscape
2. Each hospital cluster will have own physical instance of ESB, with dedicated ESB partition for external integration.
3. Planned initiatives that required ESB capability (e.g. National EHR)

Key Considerations:-

Org/structures, governance, operation performance, effort/cost

Isolated Infrastructure

Shared Infrastructure

ESB
NHG

ESB
NEHR & NHIS

ESB
CLEOS

ESB
AIC

ESB
CHIC

ESB
SHS

ESB
NHG

Hospital cluster(s)

MOHH driven initiatives

ESB
NEHR, NHIS CLEOS, CHIC AIC

ESB
SHS
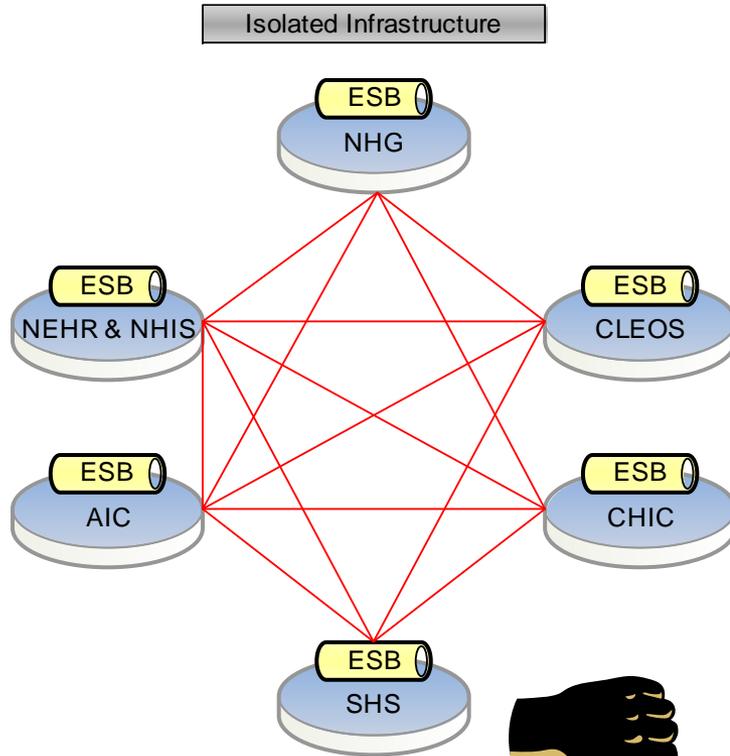
Isolated

1. Investment in more sets of ESB platforms and implementation.
2. Investment in more physical network connections and data centre operations.
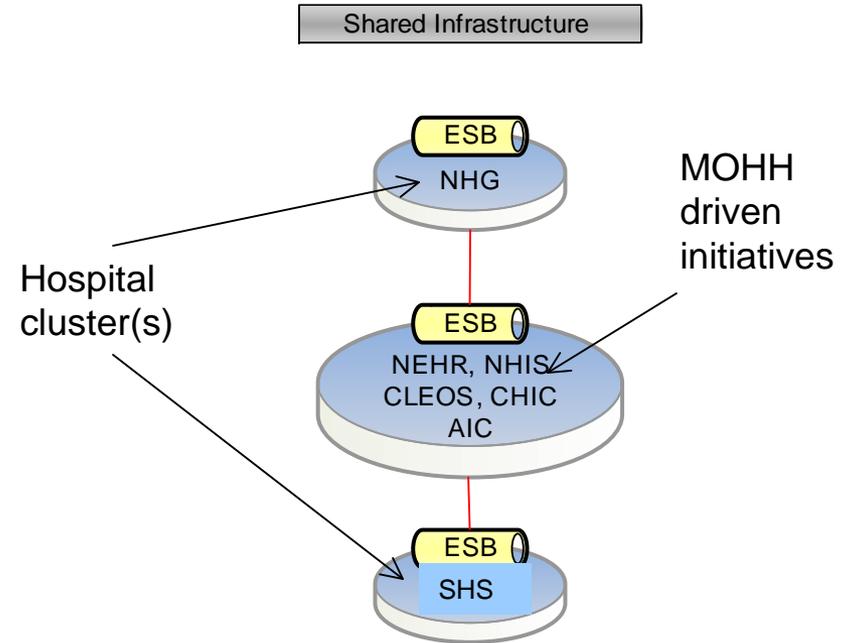
Shared

1. Investment in less sets of ESB platforms and implementation.
2. Investment in less physical network connections and data centre operations.
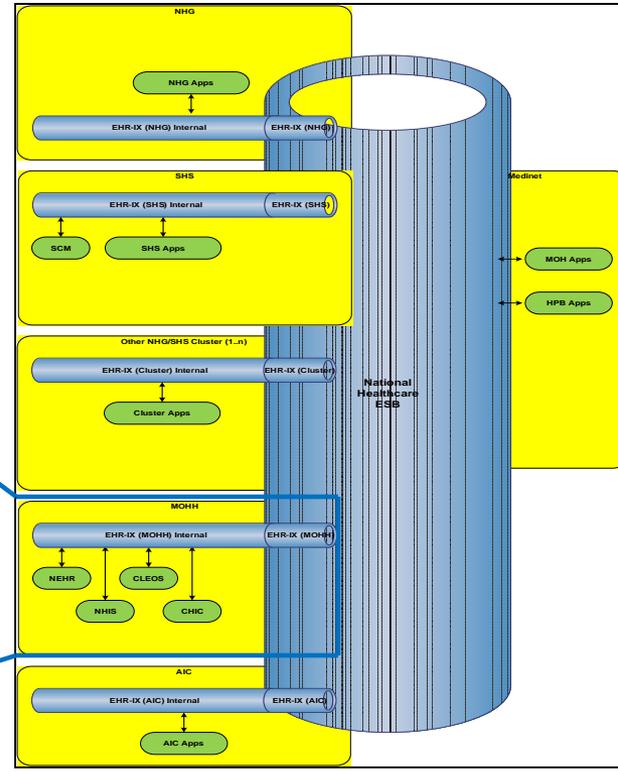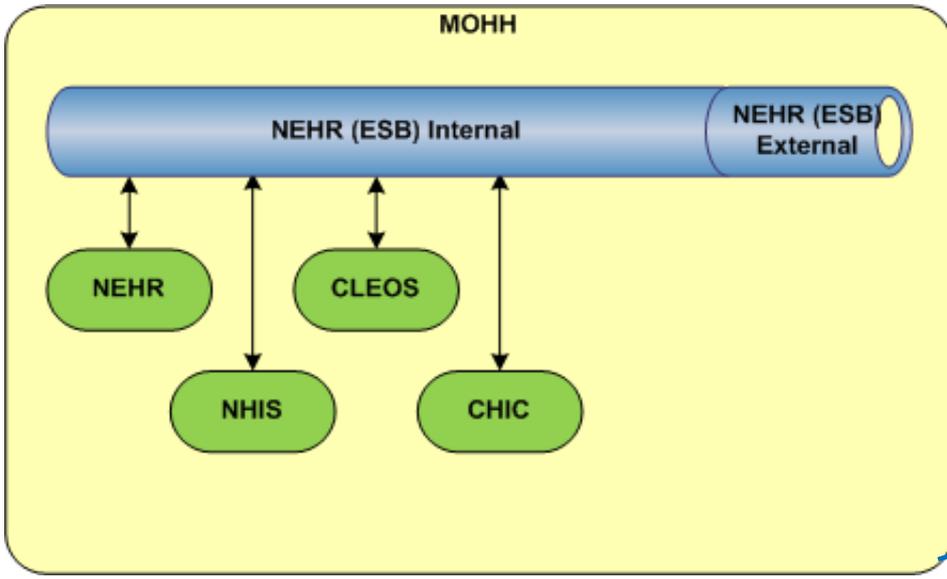
Considerations: Scale and project timeline dependency

Key Direction #3 – Leverage on same products/technologies for other ESBs
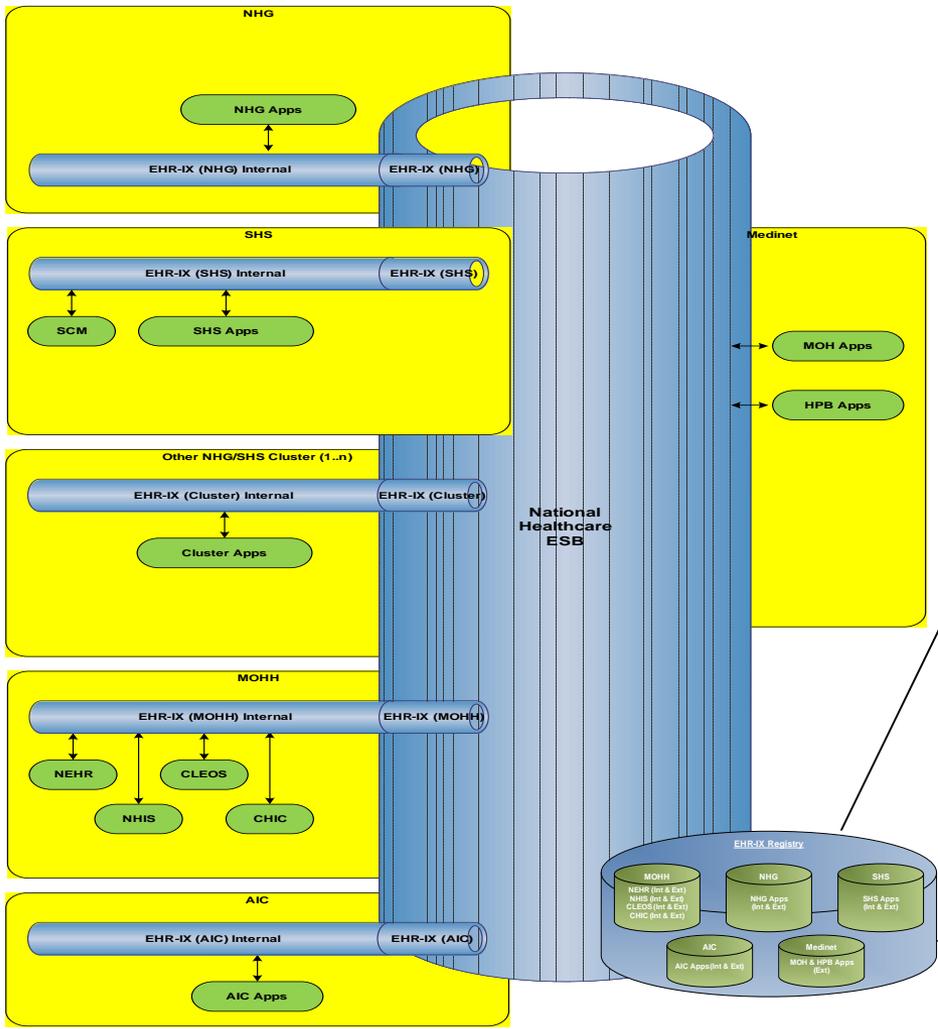
Service Registry
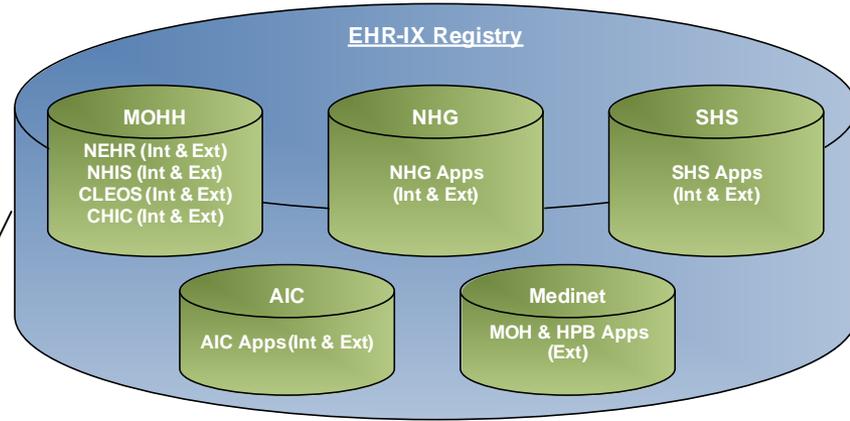
Considerations
- Ease of Integration, establishing of logical SOA registry for all cross-org services to facilitate reuse

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Enterprise Architecture (EA) Repository

Background

- Our IT initiatives involve a lot of integration -> need intensive planning

- For planning purpose, we gather & generates vast amount of architecture artefacts in <u>different</u> formats, stored in <u>different</u> locations and captured from <u>different</u> perspective.

- Lack consistent way to maintain/update. Artefacts collected become obsolete overtime

- Difficult to cross-harmonise and reuse.

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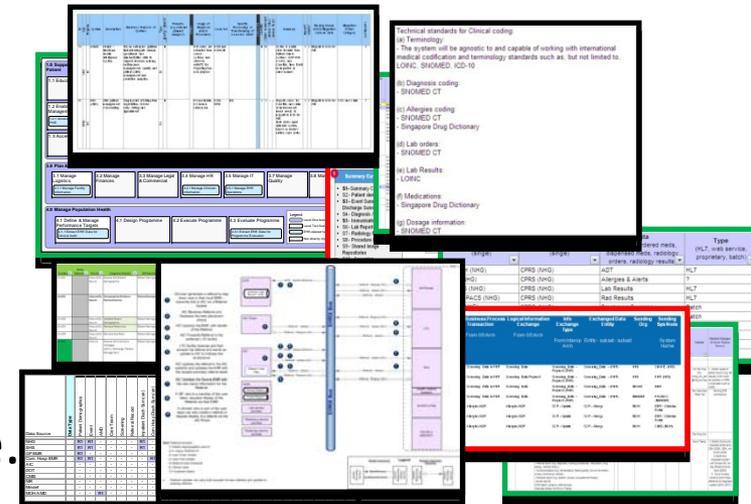
Need for EA Repository

Key Challenge:

- How to maintain, align, exploit and reuse these architecture information for ongoing planning purpose?

Distilled Info
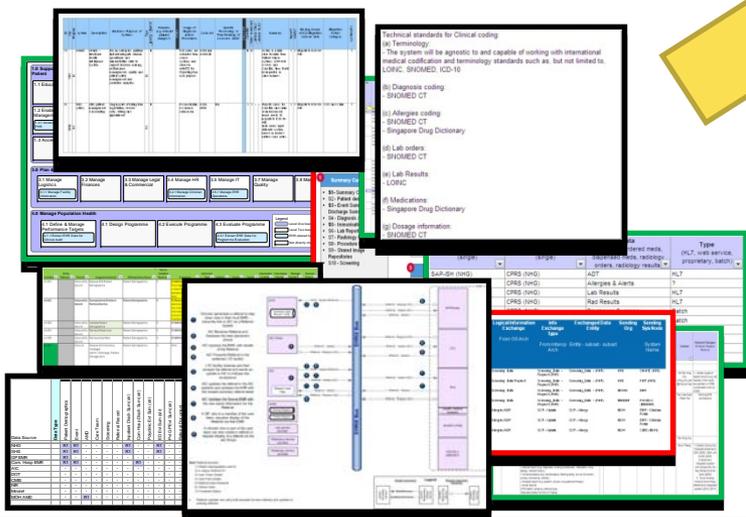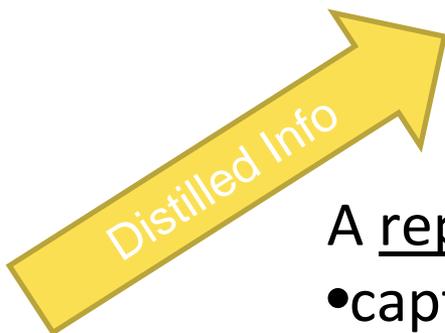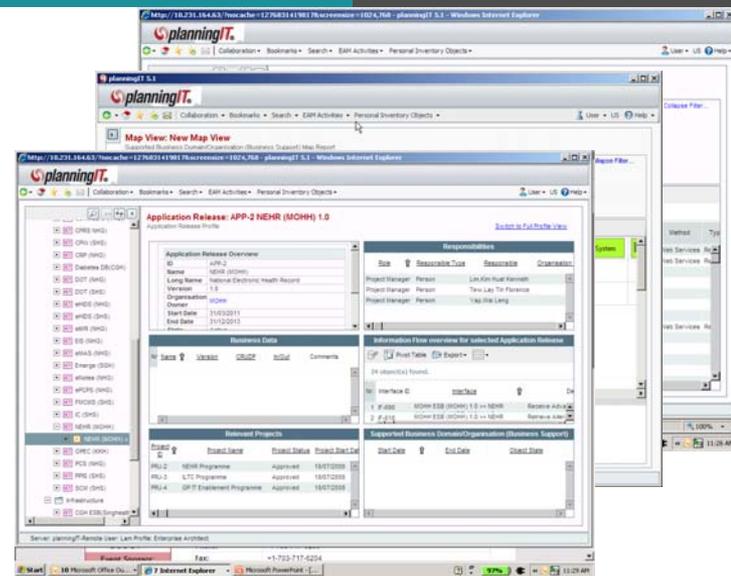
A <u>repository</u> is required to
- capture & manage the <u>gist</u> of the architecture information in a <u>structured manner</u>
- as a <u>single source</u> of info (though may not be the truth) to facilitate ongoing analysis and planning

Example of pain points

- We need clarity and visibility for the "operating" environment
  - *It is just too complex (over 150 applications, 300 known interfaces in clinical area etc). Everybody have a piece of puzzle that if we put together will likely have a clear picture.*

- We want to mitigate ambiguity and standardise vocabulary
  - *e.g. is it "episode" or "encounter" or "event" or "visit" … etc?*

- We want to facilitate Architecture Information Reuse and Sharing
  - *e.g. I would like to know roughly which systems process this type of data and who are the project managers that I should talk to for more info. I do not want to start from zero !!!*

  It is a like Knowledge Management !!!

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How it is used

Architecture Principles, Vision & Requirements

D Architecture Principles

D Architecture Requirements Repository
Requirements | Constraints | Assumptions | Gaps

D Architecture Vision
Business strategy | Business Principles Objectives & Drivers | Stakeholders | Technology Strategy

Business Architecture	Application Architecture	Data Architecture	Technology Architecture

D Content Meta Model

A IT Master Plan(current and to-be view)
supported Business Domains/Organizations (Business Support) - which IT systems provides which Capabilities to which Organizations.

A Program Plan
Planned programs with view of affected Architecture, dependencies and program overlap

A Organization

A Capability

A Process* (Attachment)

A Application

A Application Releases

A Component Module

A Services

A Information Flow

A Business Object (LIM)

A Business Data (Physical)

A Components

A Standard Components

A Standard Platform

Other References

A Glossary

D Architecture Decision Log

D Staff Contact list

D Architecture Position Statement

D Deliverable's PARCI

D Processes

D Toolkits

D Specifications?

A Typically structured Info that is crucial for architecture planning – **managed by the EA repository**

D Typically unstructured info, (e.g docs) generated for purpose like general communications, consumption by mgmt

Service Catalogue in the EA Repository

Service Catalogue

Data in the service

Applications providing the service

Interoperability Architecture the in EA Repository

Interfaces view for a application

Interfaces view for a application

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1. EA team member assigned as project architect support a particular project,
2. Identify architecture gaps & opportunities as a natural part of the project execution. E.g.:
   - Shared infra (e.g. ESB) need
   - Reuse existing services
3. Architecture office review gaps and opportunities..
4. The outcome of review will serve as input for on-going architecture development/ refresh. E.g.:
   - Change in technical standards direction
5. Architecture decision that has cross project/ program impact (e.g. NEHR to extend its ESB to cover others' need) will escalate SMM support and endorsement.
6. Project architecture info will be refreshed into the **EA repository**
7. Subsequently, other projects can make use of artifacts in the EA repository (e.g. Current state of applications, IT roadmap etc) for initial planning => avoid starting from zero.

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Two Key Dimensions

	Interop & Sharing	Re-use
Answers on 5W & 1H *Who, What, Where, When, Why, How*	Interoperability Architecture	Service Catalogue
Collaboration and Planning	National Health Service Bus Reference Architecture	
	Enterprise Architecture Repository	

Conclusion

Singapore is embarking on multiple large-scale, and multi-years initiatives across its healthcare settings, taking an SOA-based approach to facilitate interoperability, sharing and reuse.

As of now, key learning points are:

- *Pragmatic – "how does it help for investment, project planning and implementation?"*

- *"Just-enough" & "just-in-time" effort to show progress and value*

- *Continuously to re-visit, re-validate, extend and re-align the architecture to ensure the relevancy*

Key Challenges are:

- *Delivery Perspective: Diversity of current systems capability/data*

- *Architecture Perspective: Optimal detail and level of architecture. Just-enough assurance process. Ensure our architecture "reusable", "maintainable" and extensible across projects.*

Conclusion

If this whole journey is a soccer league, then we are in the midst of the opening match (NEHR Phase 1) ….

Thank You

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