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Singapore Healthcare's Journey towards Interoperability, Sharing and Reuse

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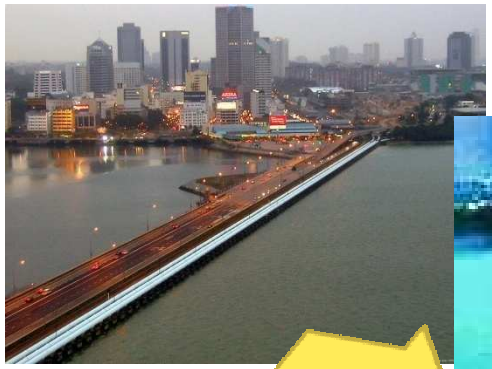
**Also staff of Infocomm Development Authority of Singapore*

National Healthcare Group
Alexandra Hospital
Tan Tock Seng Hospital
The Eye Institute
National Skin Centre
National Healthcare Group Polyclinics
National University Hospital
Institute of Mental Health
The Cancer Institute
The Heart Institute
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

The Crooked Bridge

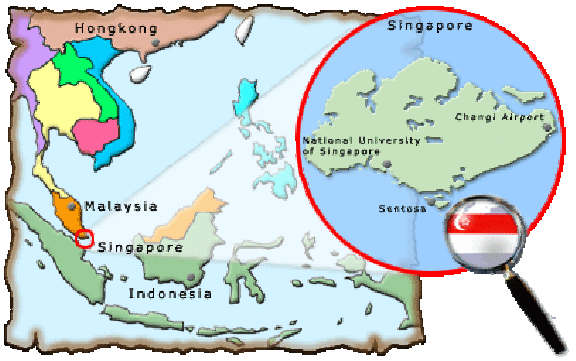


Outline

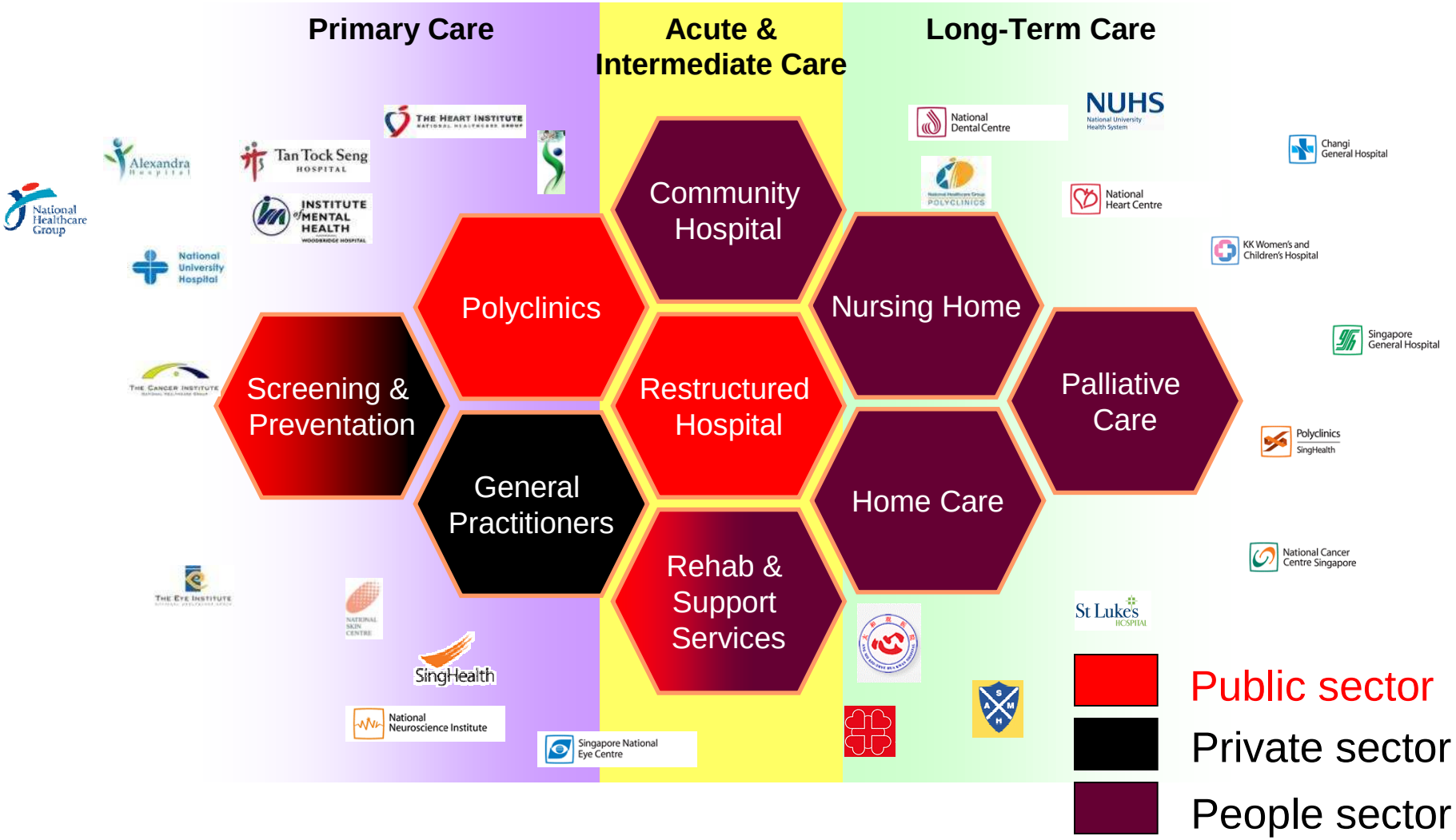
- Introduction
- MOHH Plan & Key Initiatives
- Architecture Initiatives Highlight
  - Service Catalogue
  - Interoperability & Integration Architecture
  - National Health Service Bus Reference Architecture
  - Enterprise Architecture Repository
- Conclusion

Singapore: Small Country but Big City

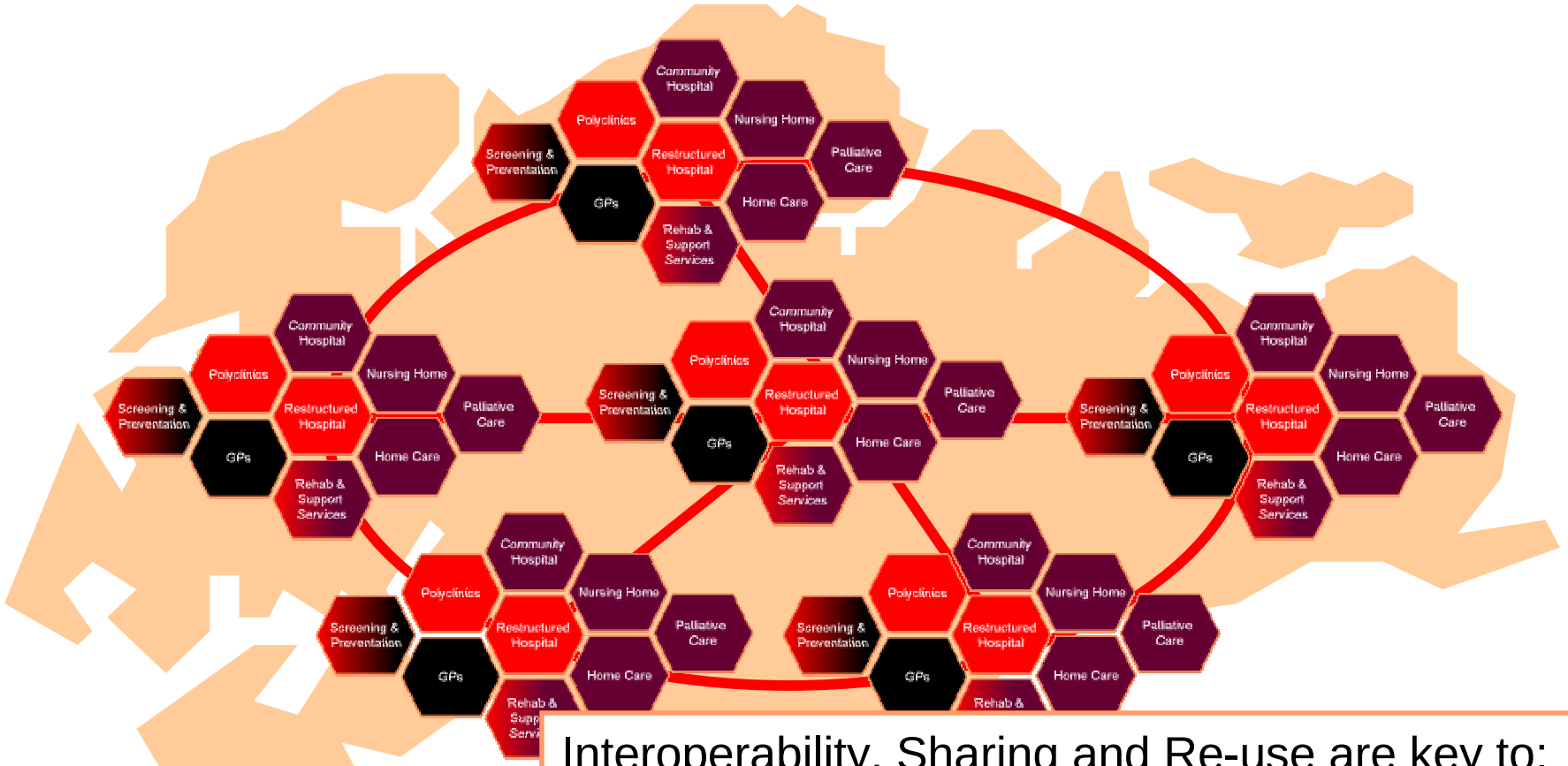
- 4.99 million people on 710.3 sq km (7,025/km^2)
  - 125% of Los Angeles' population in half its area
- Ethnically diverse:
  - Chinese: 75 per cent
  - Malays: 14 per cent
  - Indians: 9 per cent
- 35,000+ healthcare workers
- 11,580 hospital beds
- 429,744 hospital admissions (2007)
- Public sector out-patient visits (2007)
  - Specialist Outpatient Clinics 3,687,910
  - A&E 752,122
  - Polyclinics 3,797,953



Fragmented IT Landscape



“One Singaporean, One Health Record”



Interoperability, Sharing and Re-use are key to:
1.Achieve this vision
2.Maximise Return on Investment

Electronic Records - EMR vs. EHR

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”.

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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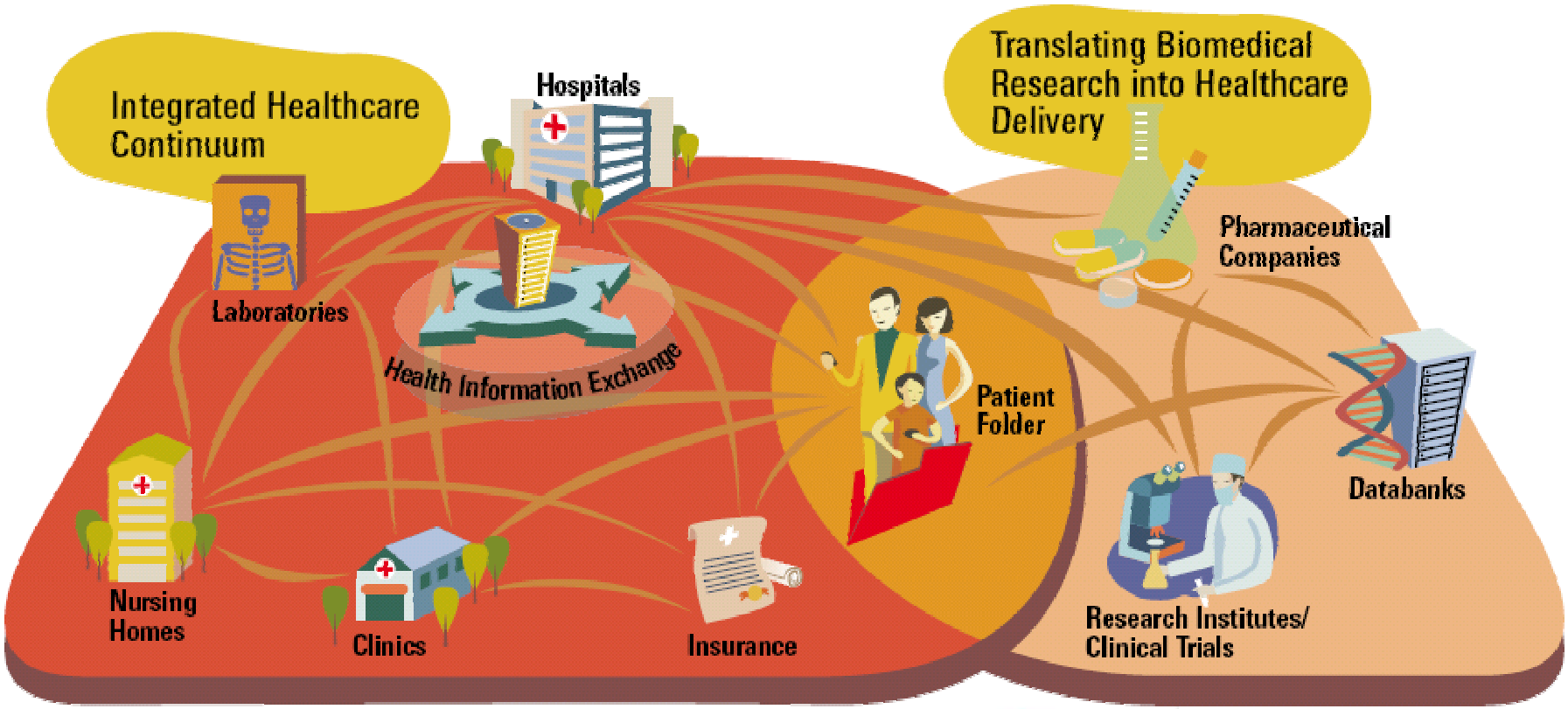
About MOHH

Singapore iN2015 Goal for Healthcare and Biomedical Sciences



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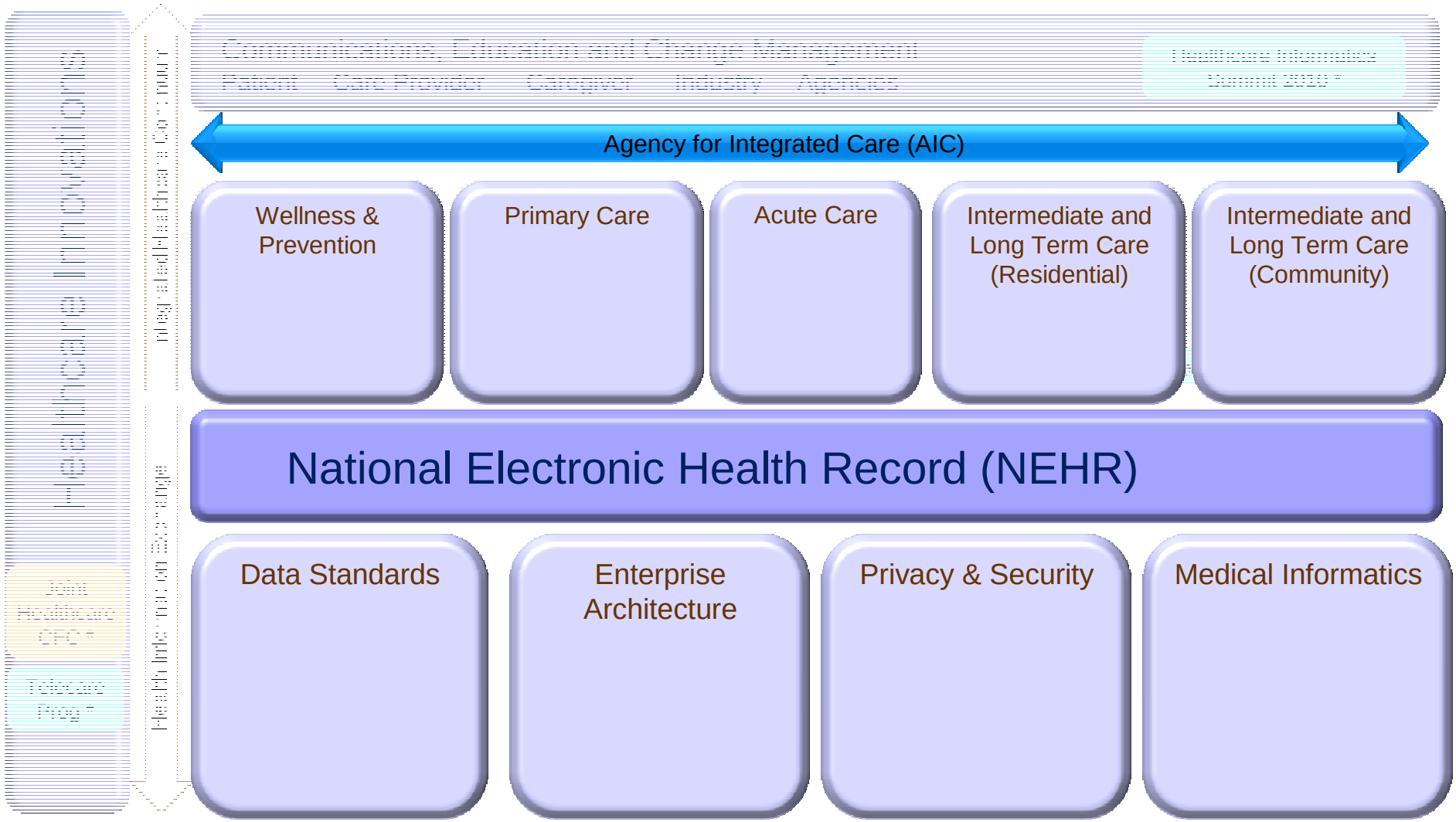
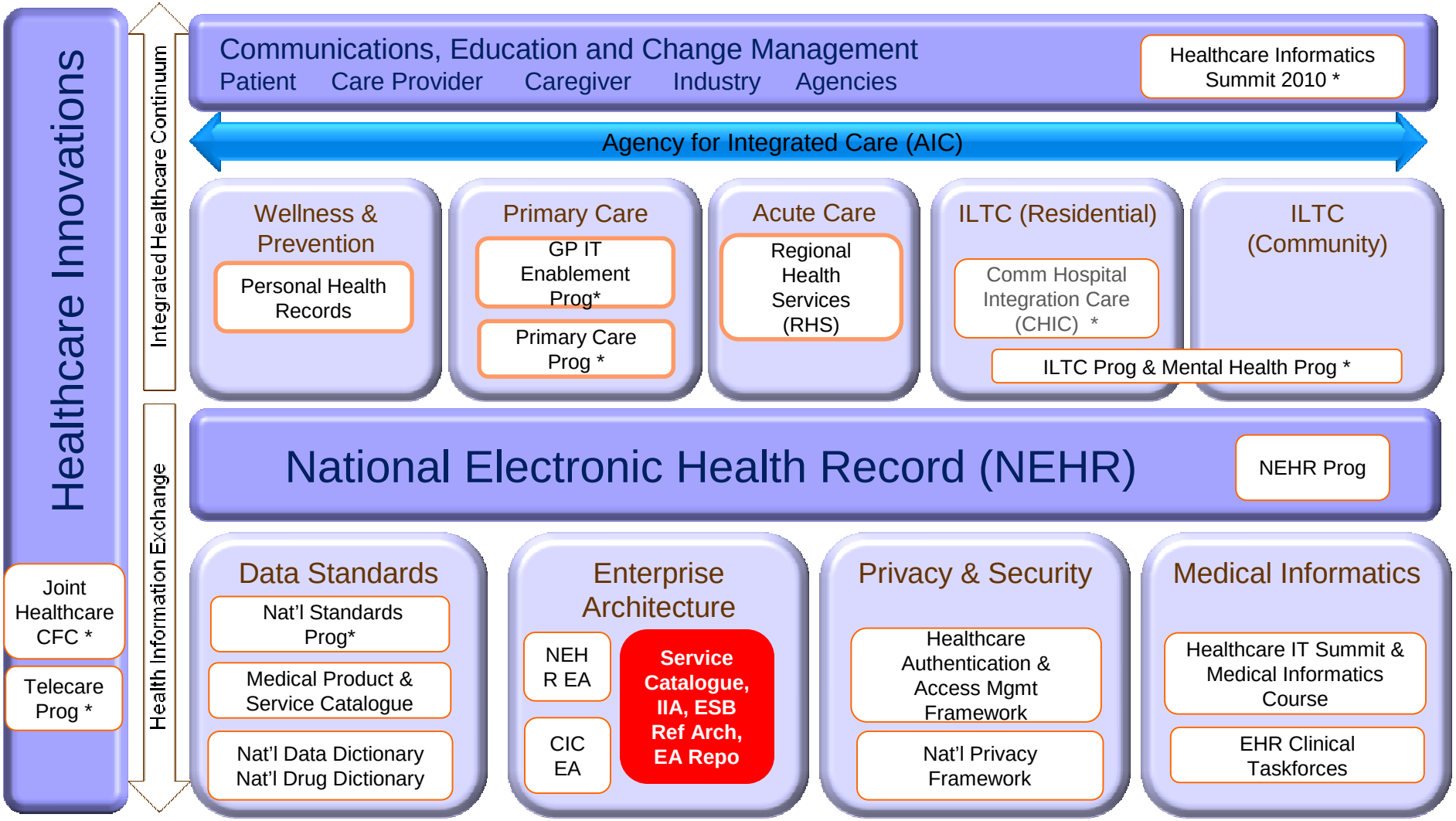
Our Plan



Our Plan


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
Personal Health Records
Primary Care
GP IT Enablement Prog*
Primary Care Prog *
Acute Care
Regional Health Services (RHS)
ILTC (Residential)
Comm Hospital Integration Care (CHIC) *
ILTC (Community)
ILTC Prog & Mental Health Prog *
National Electronic Health Record (NEHR)
NEHR Prog
Data Standards
Nat'l Standards Prog*
Medical Product & Service Catalogue
Nat'l Data Dictionary
Nat'l Drug Dictionary
Enterprise Architecture
NEH R EA
CIC EA
Service Catalogue, IIA, ESB Ref Arch, EA Repo
Privacy & Security
Healthcare Authentication & Access Mgmt Framework
Nat'l Privacy Framework
Medical Informatics
Healthcare IT Summit & Medical Informatics Course
EHR Clinical Taskforces
Joint Healthcare CFC *
Telecare Prog *

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Two Key Dimensions

	Interop & Sharing	Re-use
Answers *Who, What, Where, When, Why, How* 		
Enabling Tools 		

Two Key Dimensions

Interop & Sharing | **Re-use**

Answers

Who, What, Where, When, Why, How

Enabling Tools

Interoperability Architecture

Service Catalogue

National Health Service Bus Reference Architecture

Enterprise Architecture Repository

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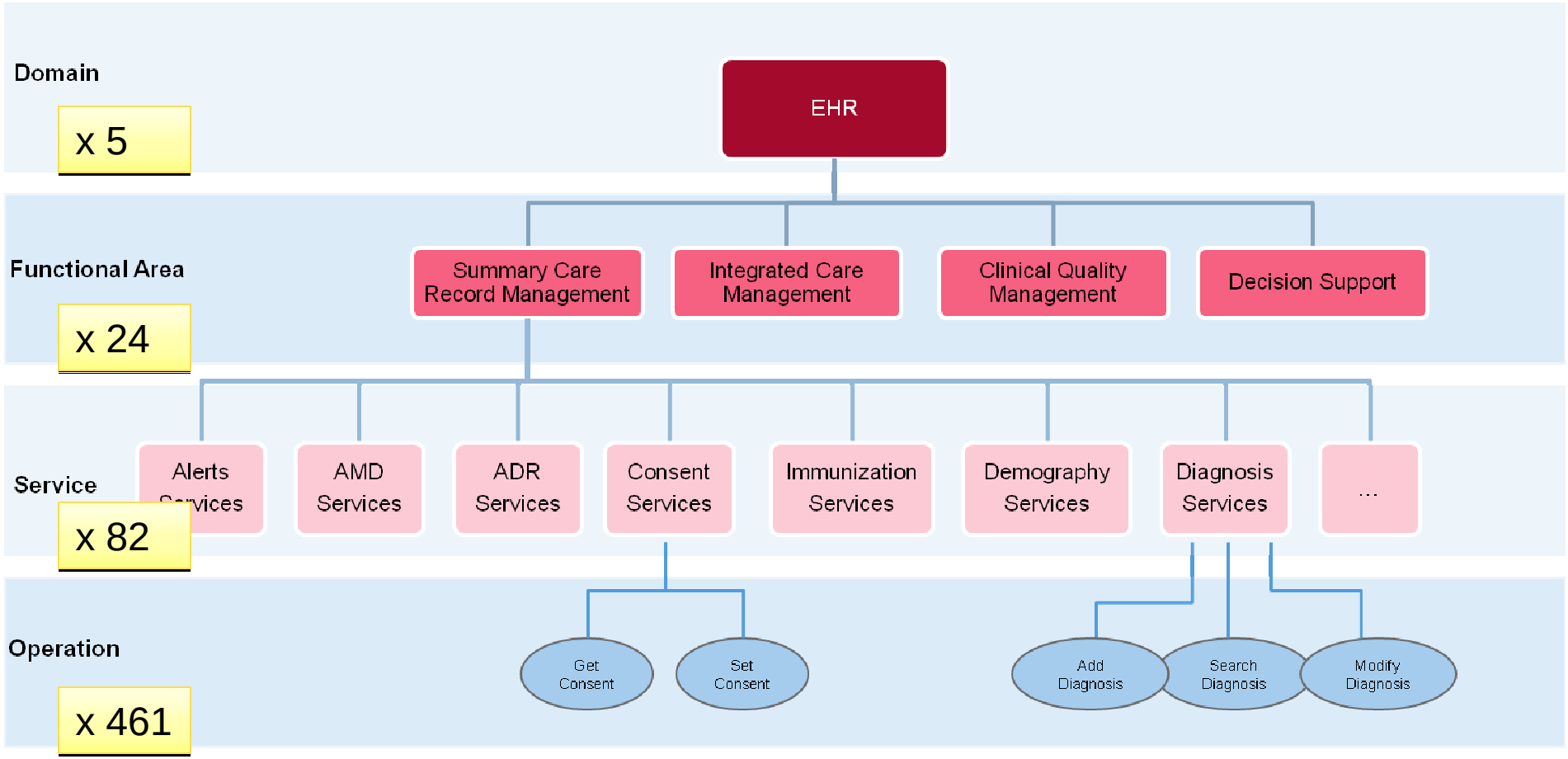
Service Catalogue

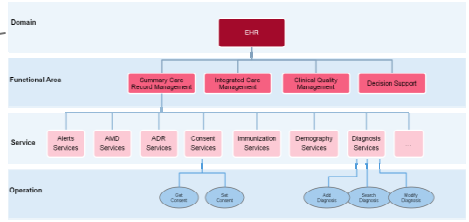
- Background:
  - Early 2010, two-month effort
- Objectives:
  - Provide a baseline of NEHR services
  - Take a step towards SOA-based NEHR architecture
- Deliverables:
  - Approach for identifying services
  - Template for documenting identified services
  - Roadmap for realising services during NEHR implementation

Organisation

- 5 Domains: EHR, Identify and Access Mgmt, Terminology, National Health Identification Service, Integration



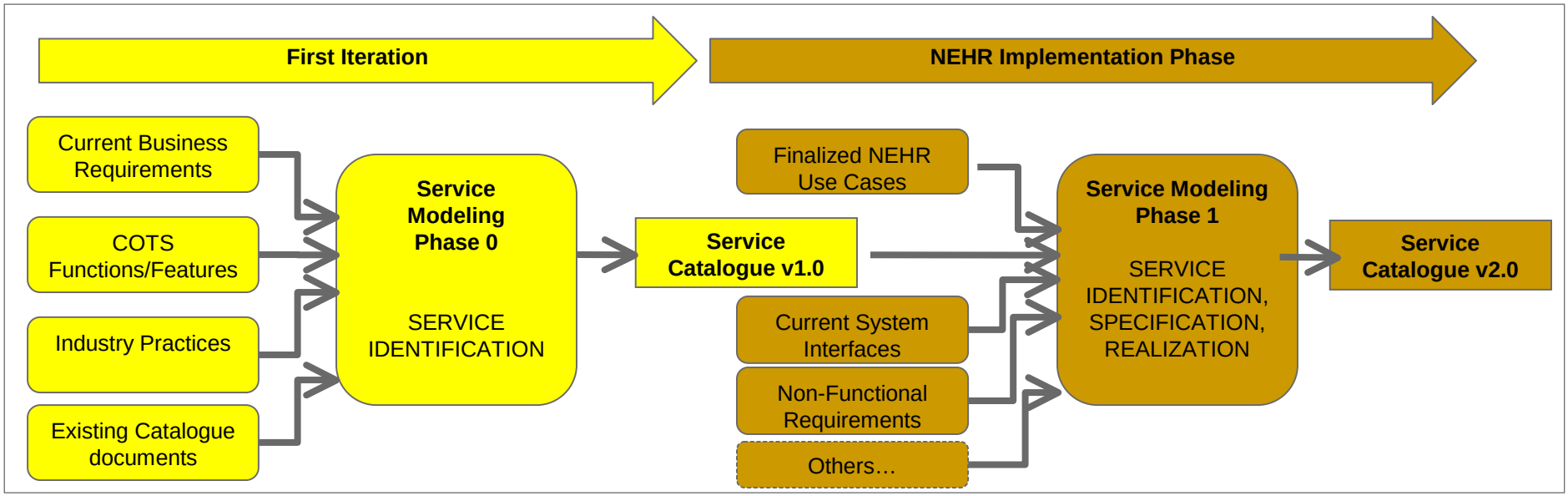
A Peek into the Service Catalogue



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

Service Catalogue Construction Approach

- Develop first-cut based on available information
- Plan to revise after NEHR vendor selection and finalisation of use cases and requirements



Next Steps

- Review and update catalogue (leveraging on EA Repository)
- Get other applications to re-use NEHR services
- Stronger tie-up with Interoperability Architecture

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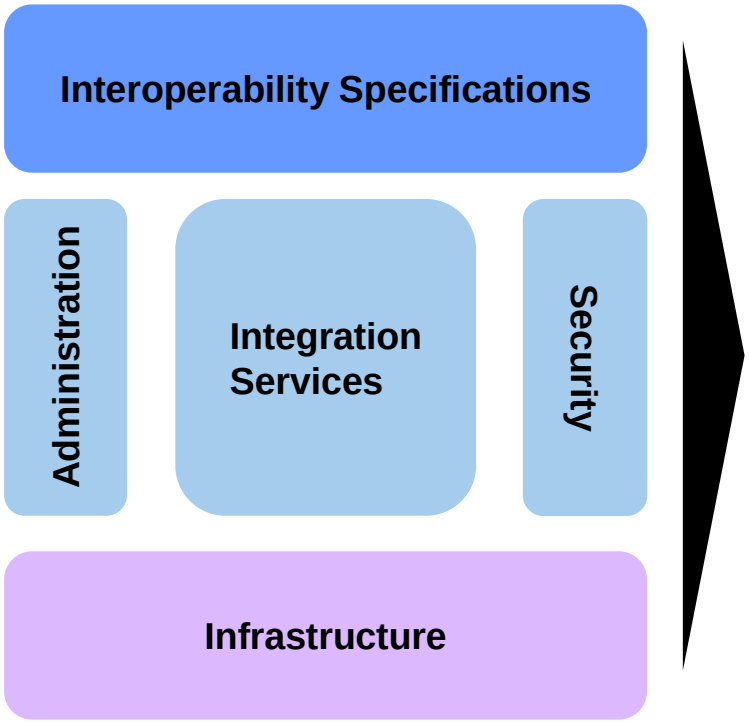
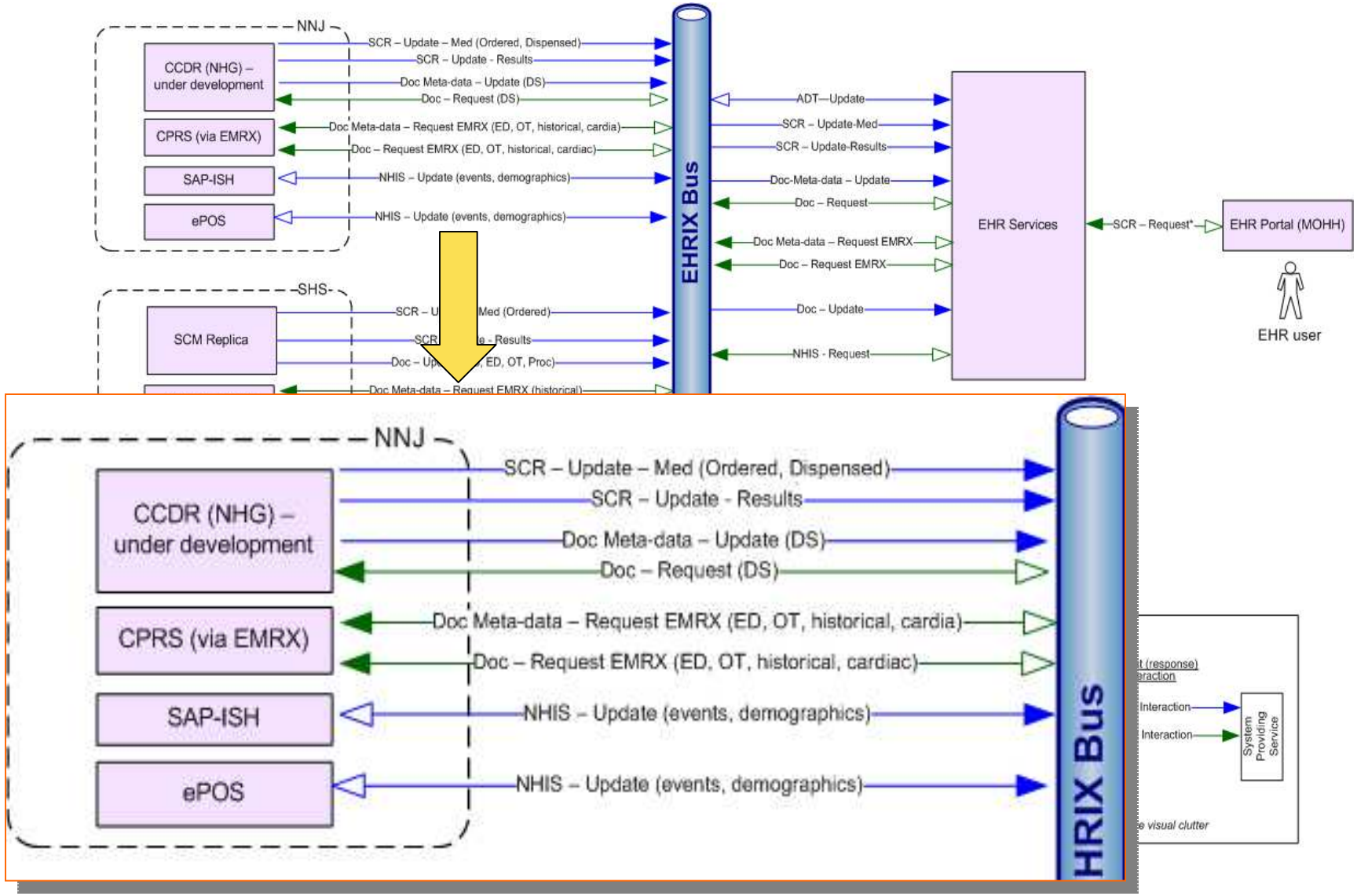
Interoperability and Integration Architecture



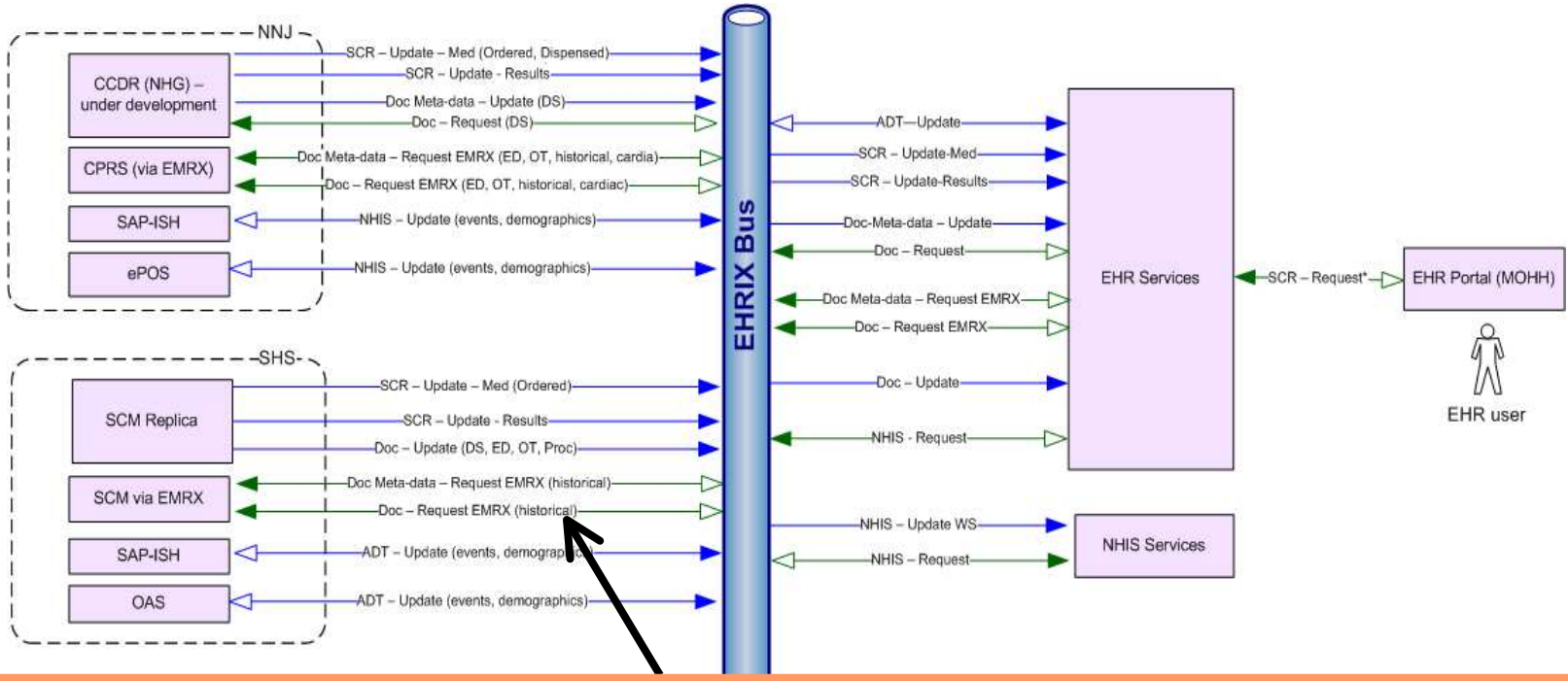
Key Questions Answered:

- **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**

Information Exchange Requirements

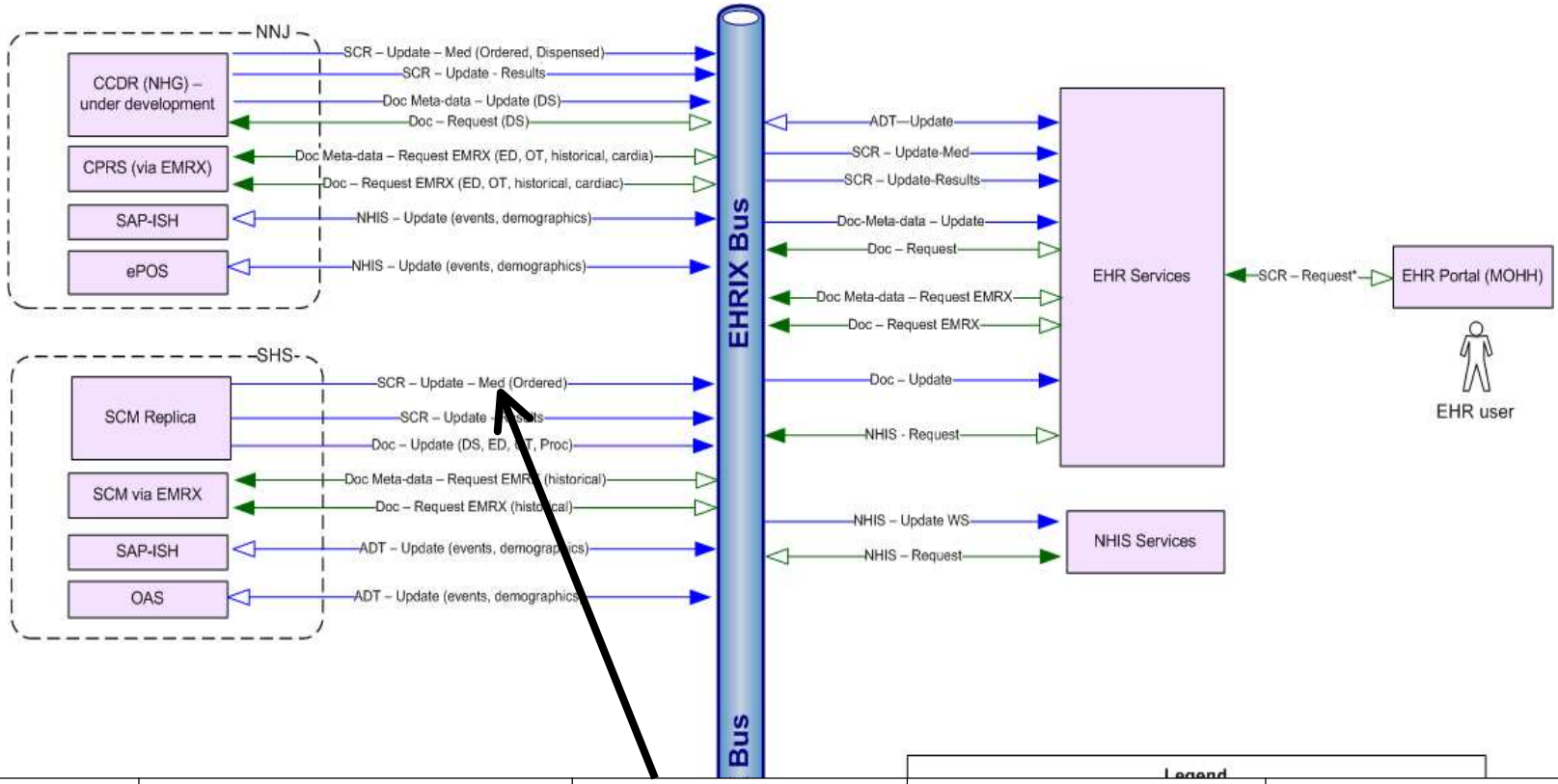


Linkage to Standards



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.

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National Health Service Bus Reference Architecture

- **Background**
  - Most systems integrations (EMR, Labs, Rad … 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. For example, National Electronic Health Records (NEHR), National Health Identify Services (NHIS), Clinical and EMR Operation System (CLEO) and other hospital cluster wide projects.

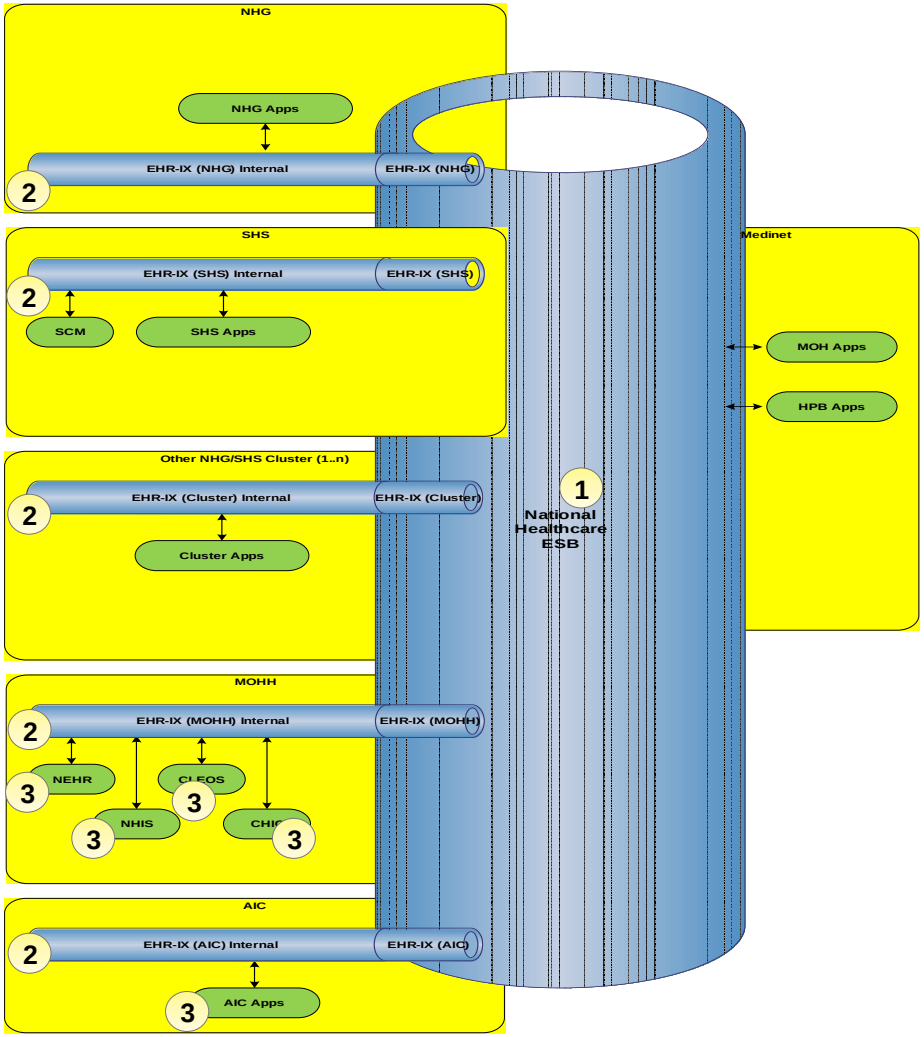
Opportunity for early alignment !!!

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

Reference Architecture



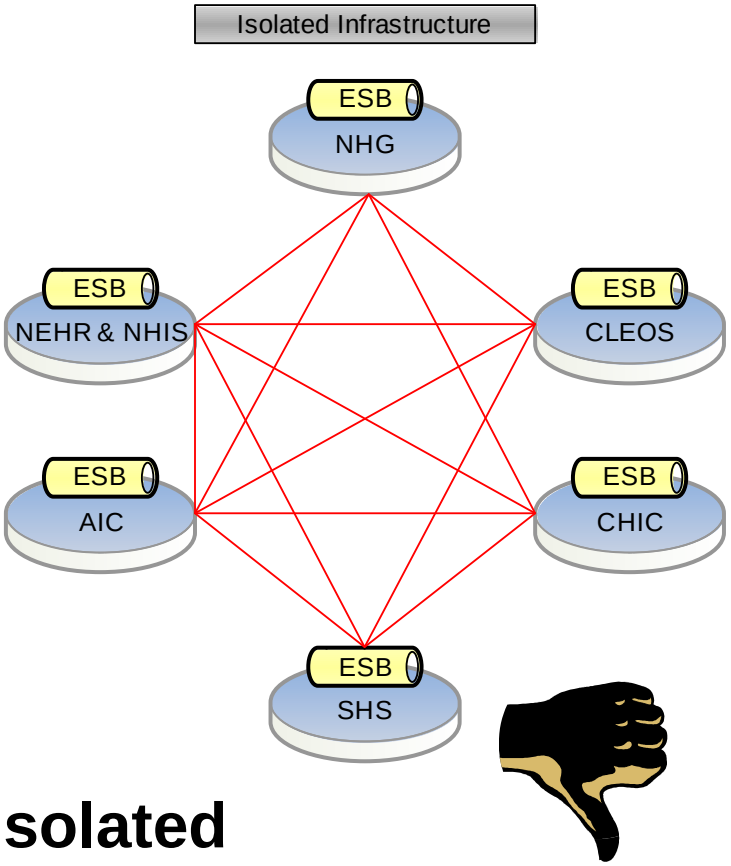
Characteristics

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:-

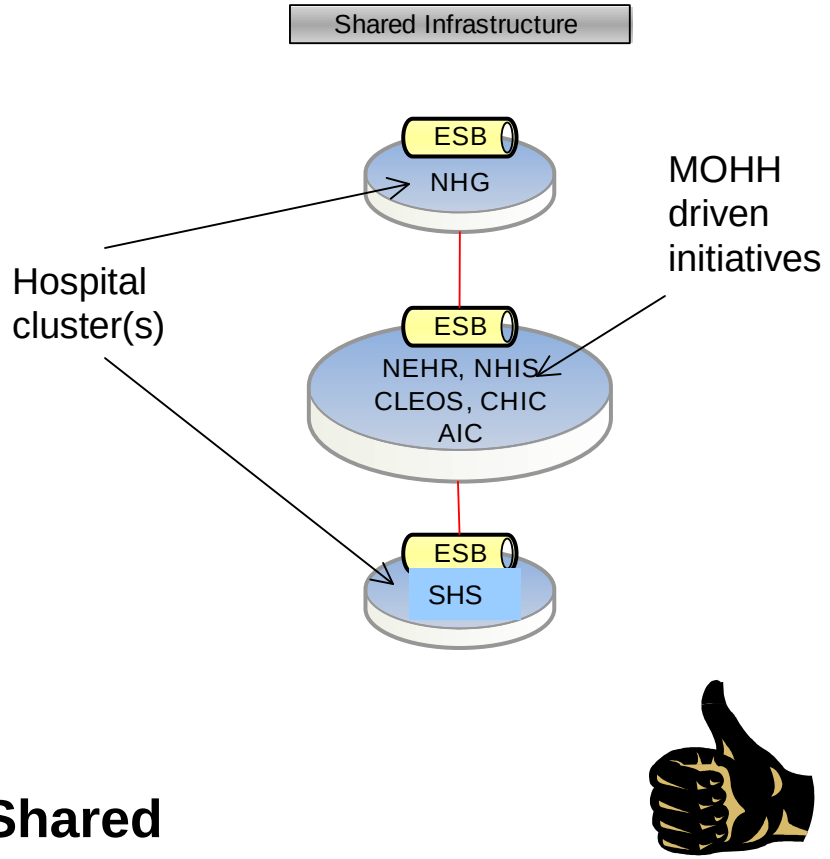
Org/structures, governance, operation performance, effort/cost

Key Direction #1 – Shared ESB for MOHH driven initiatives



Isolated

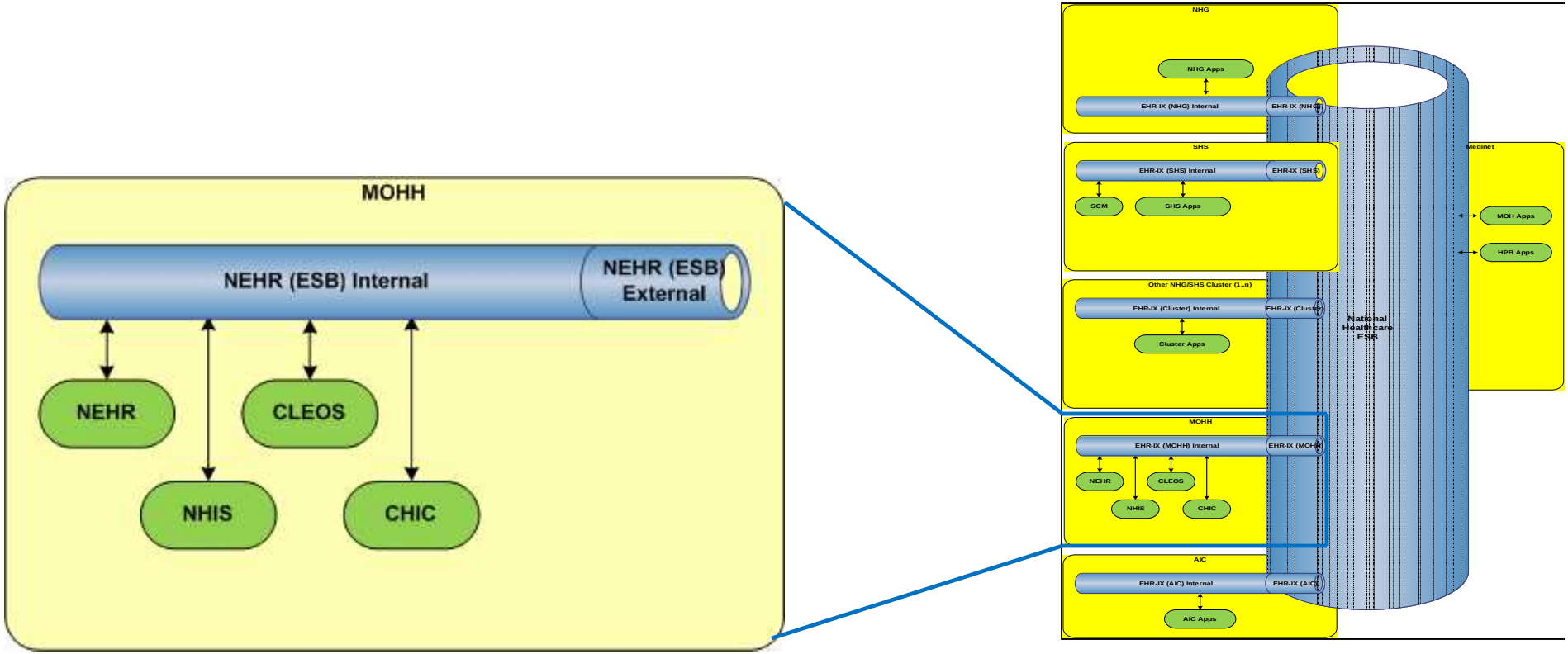
1. Investment in more sets of ESB platforms and implementation.
2. Investment in more physical network connections and data centre operations.



Shared

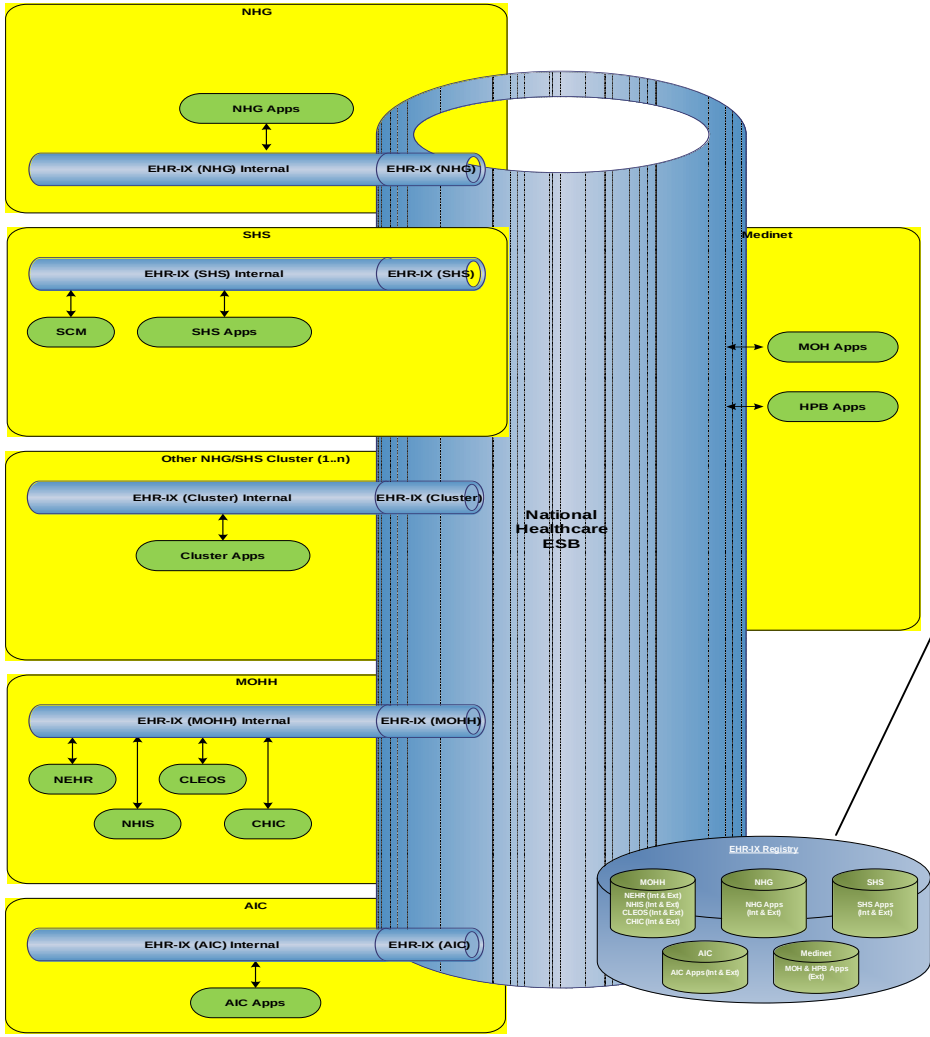
1. Investment in less sets of ESB platforms and implementation.
2. Investment in less physical network connections and data centre operations.

Key Direction #2 – National EHR to extend the Info exchange platform to support other MOHH initiatives

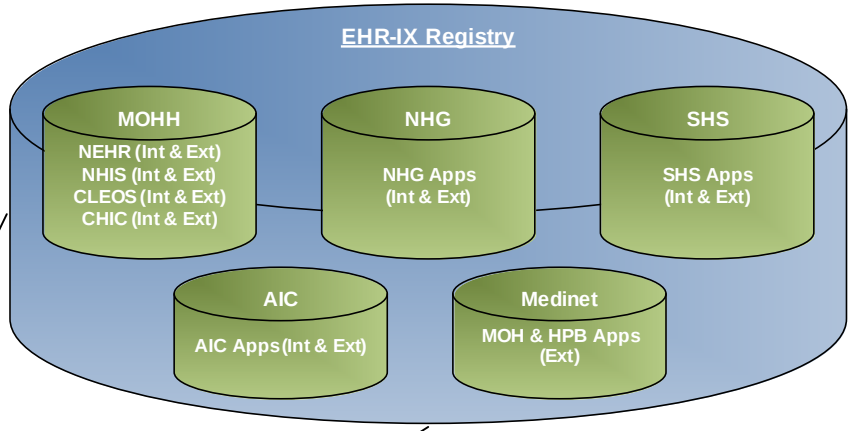


Considerations: Scale and project timeline dependency, and infrastructure requirements

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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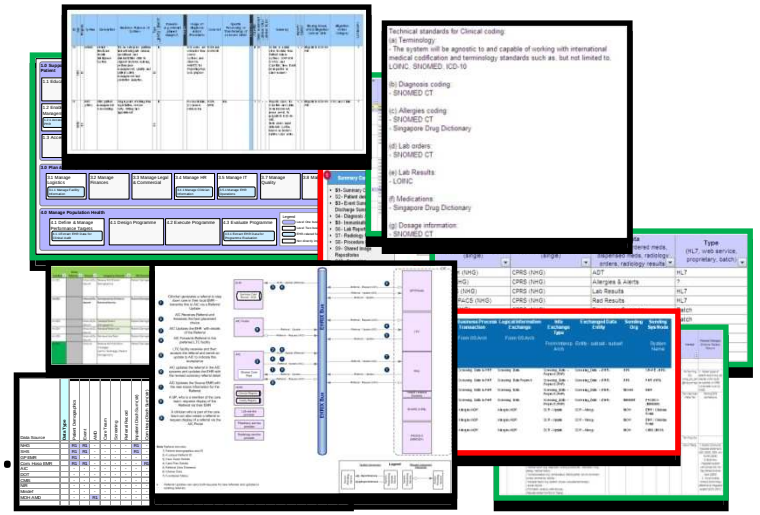
Enterprise Architecture (EA) Repository

Background

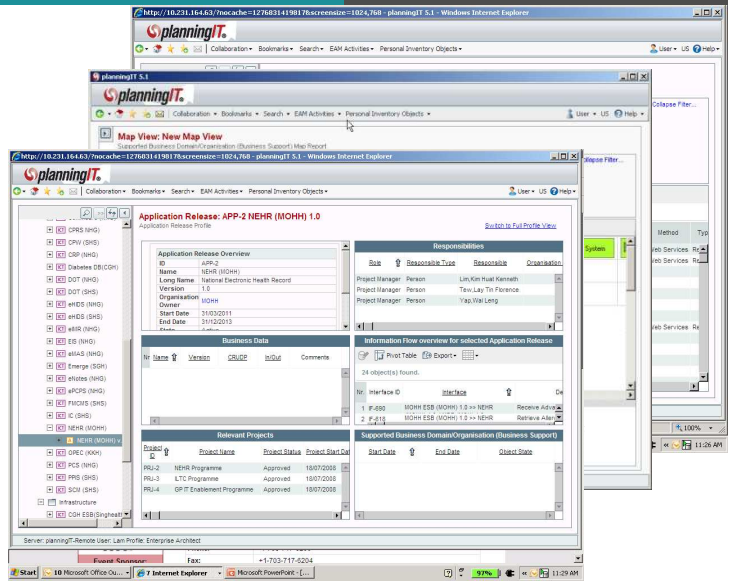
- Our IT initiatives involve a lot of integration -> need intensive planning
- For planning purpose, we gather & generates vast amount of architecture artefacts in different formats, stored in different locations and captured from different perspective.
- Lack consistent way to maintain/update. Artefacts collected become obsolete overtime
- Difficult to cross-harmonise and reuse.



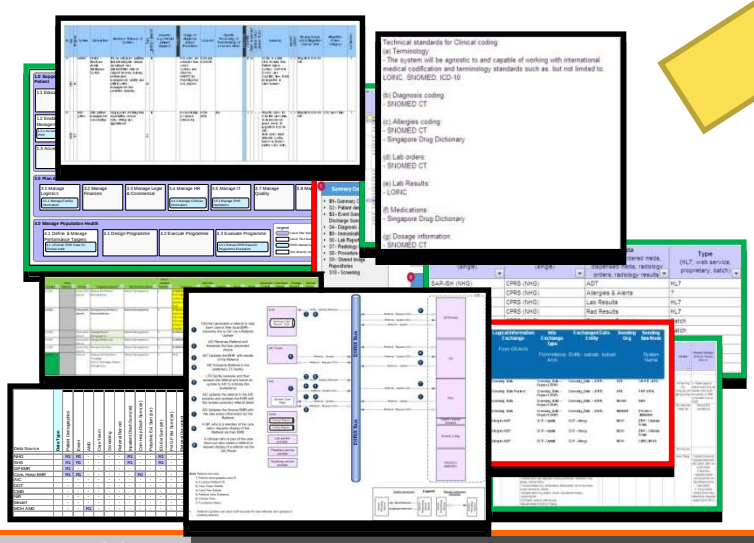
Need for EA Repository

Key Challenge:

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



Distilled Info



A repository is required to

- capture & manage the gist of the architecture information in a structured manner
- as a single source of info (though may not be the truth) to facilitate ongoing analysis and planning

Example of pain points

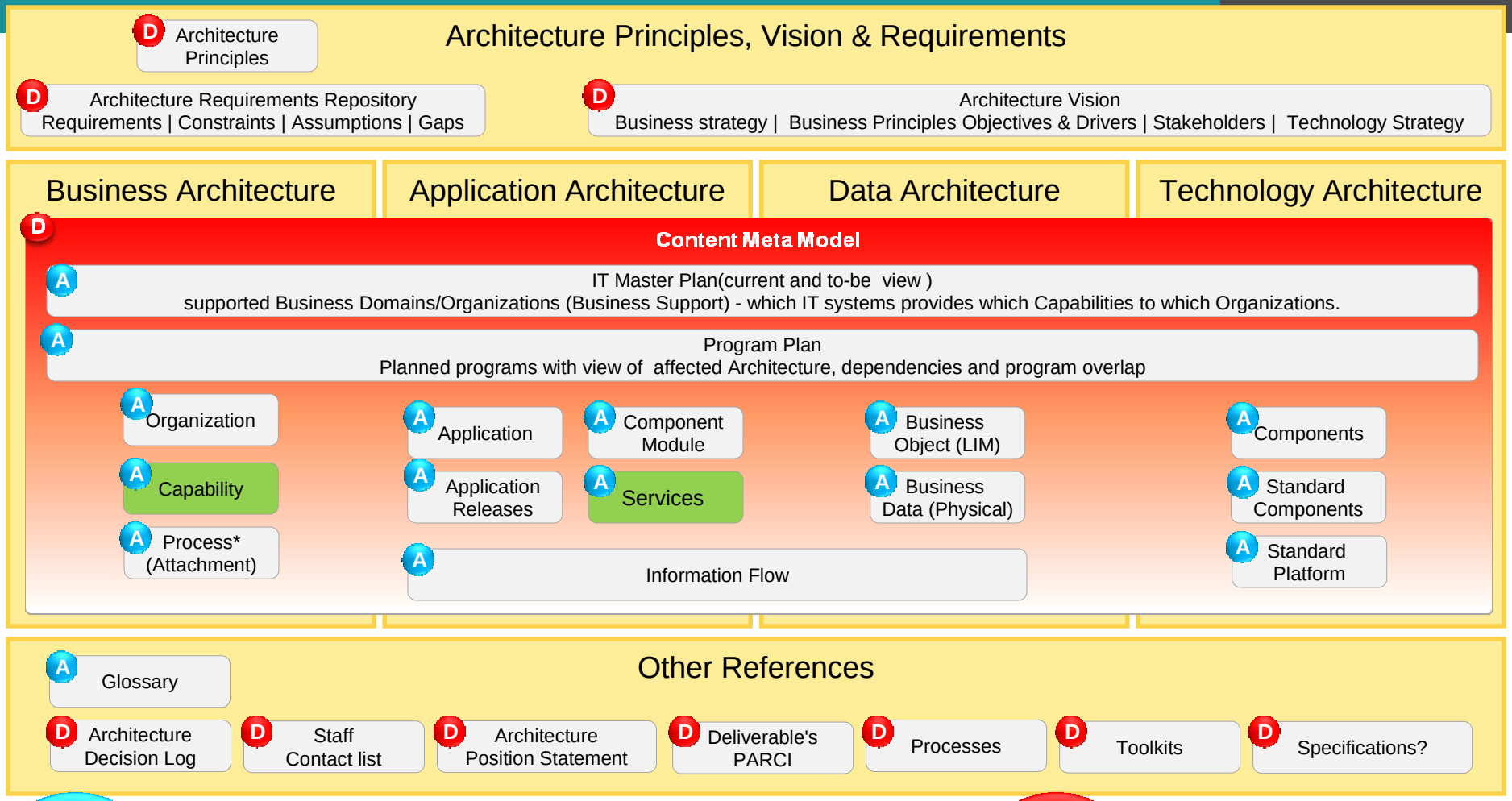
- We need clarity and visibility for the "operating" environment
  - *It is just too complex (e.g. over 150 applications, 300 known interfaces in clinical area alone for just one hospital cluster). Nobody has a full picture.*

- We want to mitigate ambiguity and standardise vocabulary
  e.g. is it "prescribed medications" or "ordered medications" ?

- 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 little bit like Knowledge Management !!!

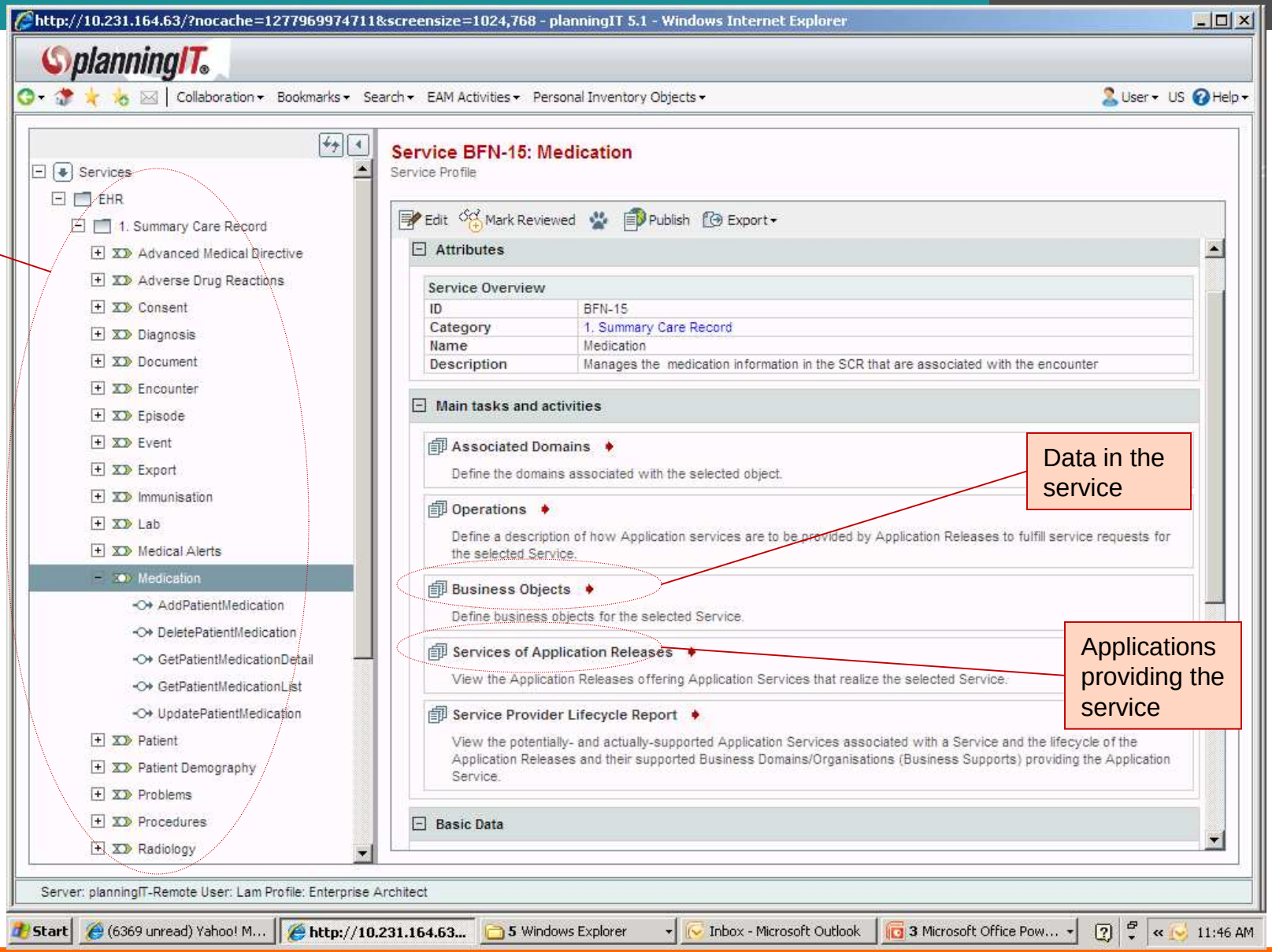
How it is used



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

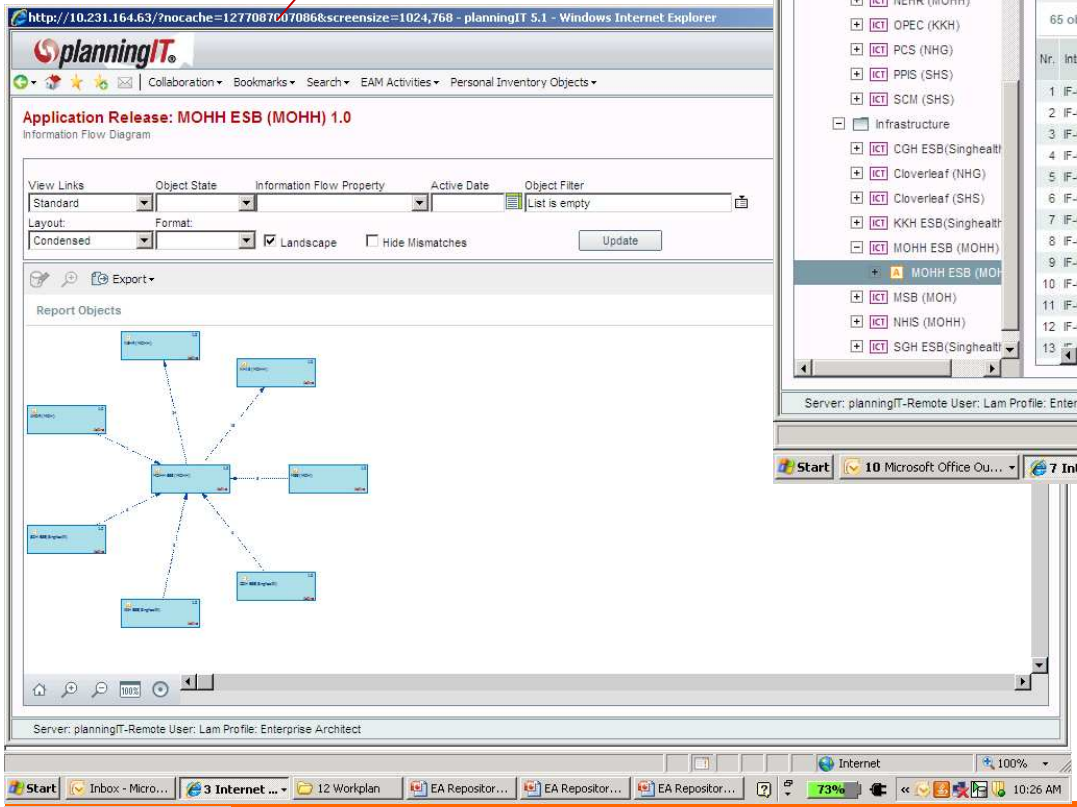
D Typically unstructured info, (e.g. docs) generated for purpose like general communications, consumption by mgmt

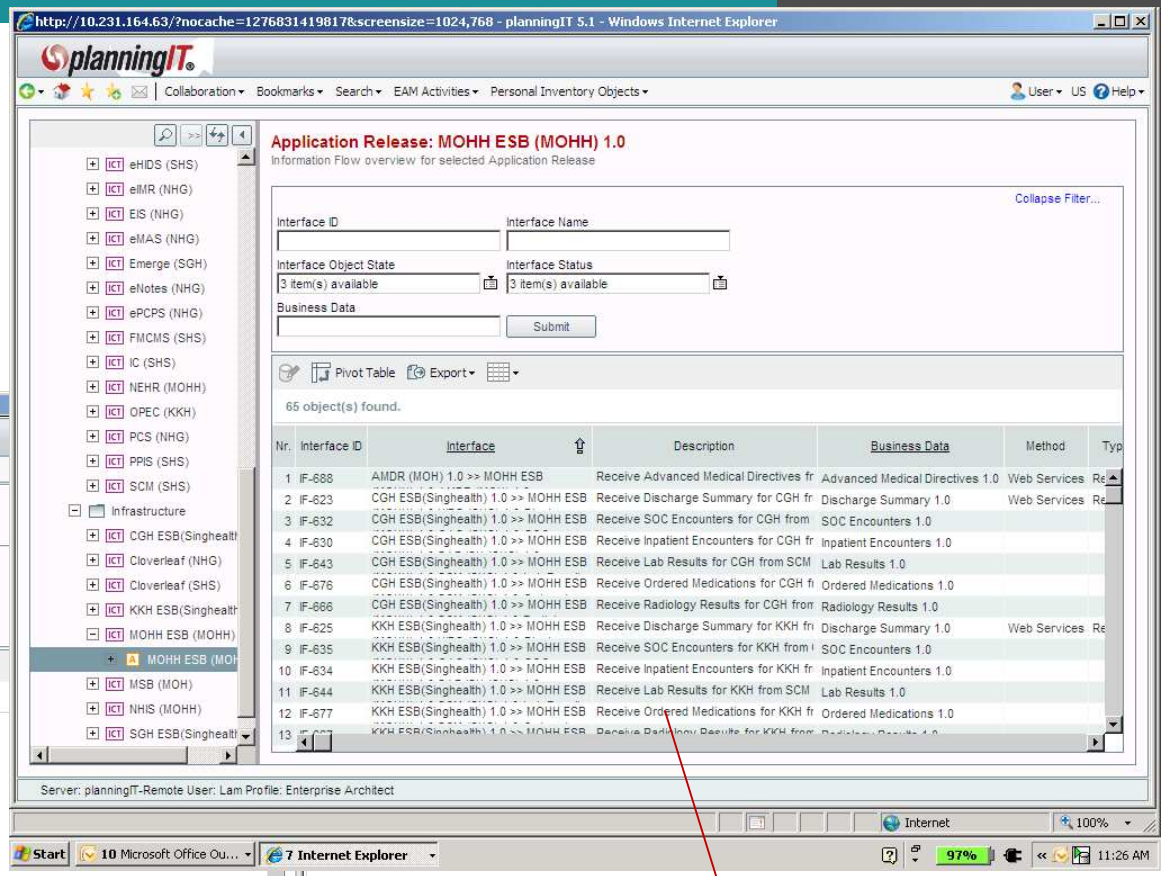
Service Catalogue in the EA Repository



Interoperability Architecture the in EA Repository

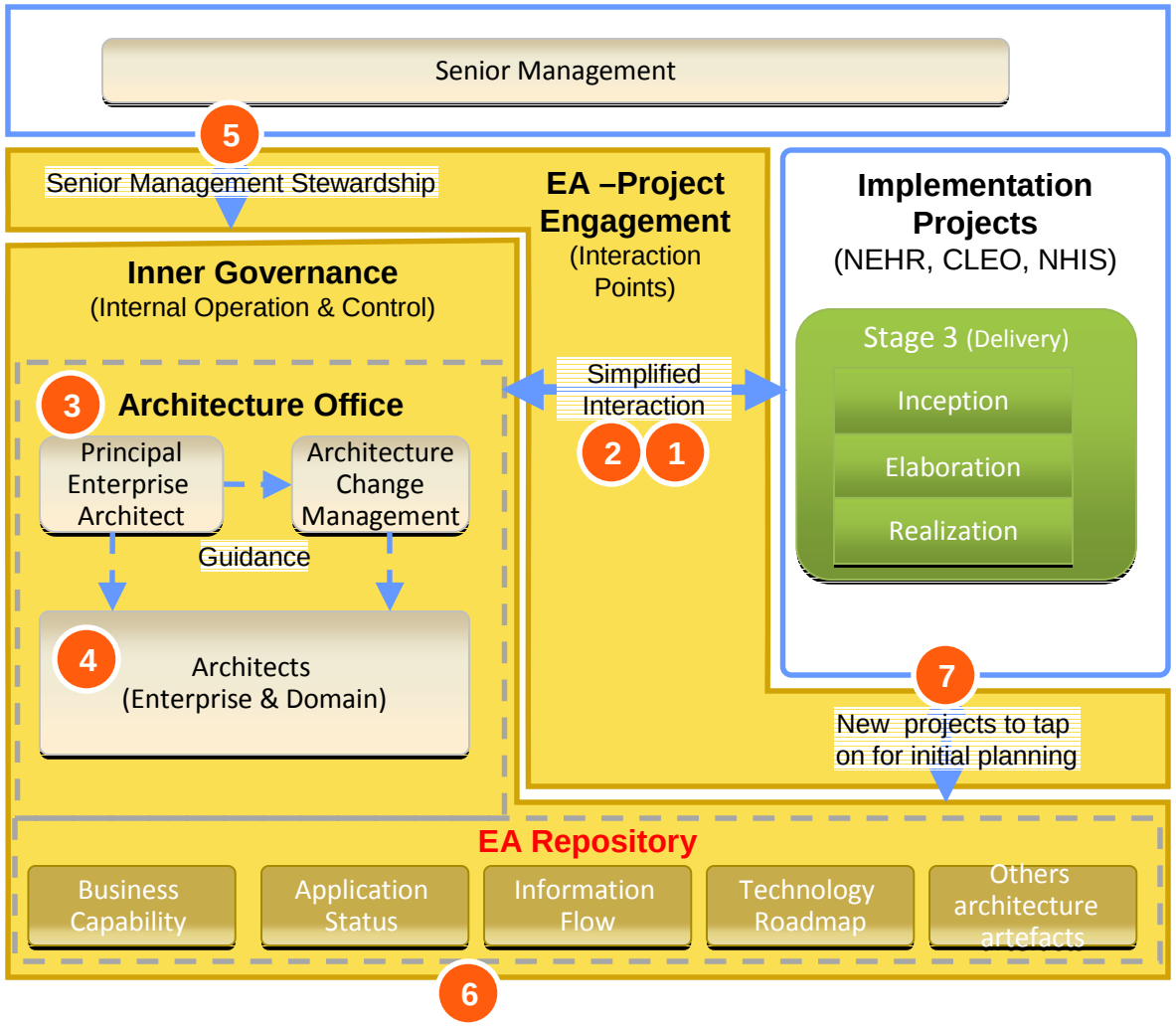
Interfaces view for a application





Interfaces view for a application

EA Repository – Supporting Architecture Assurance & Governance



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 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 to senior management for support and endorsement.
6. Project architecture info will be refreshed into the **EA repository**
7. Subsequently, new implementation 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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Answers

Who, What, Where, When, Why, How

Enabling Tools

	Interop & Sharing	Re-use
	Interoperability Architecture	Service Catalogue
	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 and re-align the architecture to ensure the relevancy*

Key Challenges are:

Diversity of current systems/solution capability, on-going parallel inter-dependent projects and forever changing landscape

Conclusion

If this whole journey is a soccer match, then we are at the end of the pre-match planning.

The real match is about to start …..

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Thank You

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