Greater China eHealth Forum 2011
大中華電子健康及醫療信息化論壇

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Use of Clinically Driven Information Model in SOA

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Agenda

- Introduction – Singapore Healthcare Landscape
- Enterprise Architecture – Ensure the alignment of IT and Clinical Needs
- National Data Standards – Standardize the meaning of the data
- SOA Design – Maximize the reuse of IT assets

SINGAPORE HEALTHCARE LANDSCAPE

Singapore Vision

" What does it mean when we say our population will be older? It means there will be more demand on healthcare because older people are sick more often.

But this also means it is
a different pattern of healthcare

So we have to respond to this by putting in more resources into our hospital system, building new hospitals.

… get the whole system to be structured properly so that it will be adapted to cater o the ageing population. To structure it properly means we need step-down care."

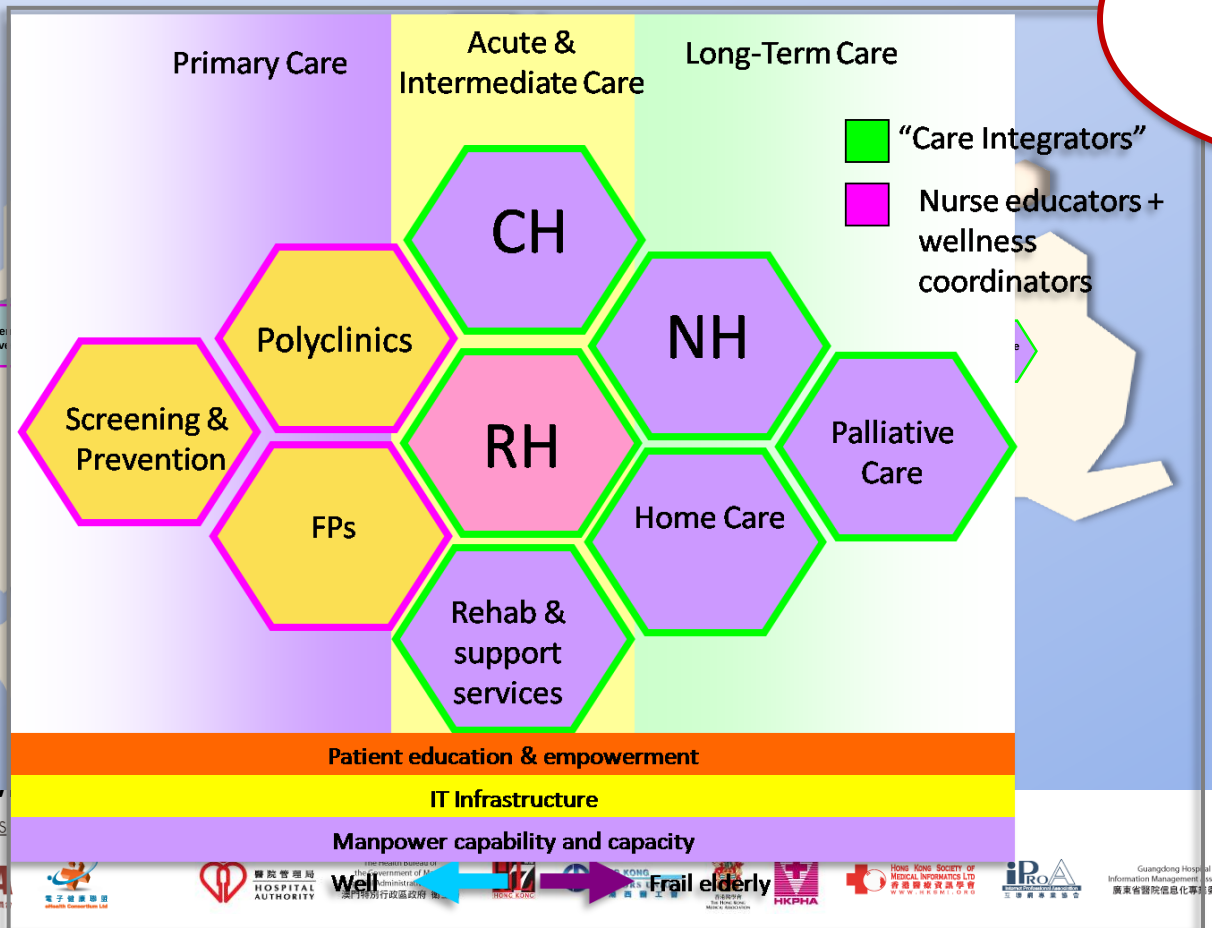
And one key thing we must do with this **step-down care is to link "up our acute hospitals […] with community hospitals**, so that you can have the best of both worlds."

Prime Minister Lee Hsien Loong
National Day Rally 2009

Organization Landscape

Strategic vision of patients moving seamlessly across the healthcare system, receiving coordinated patient-centric care at the most appropriate settings.

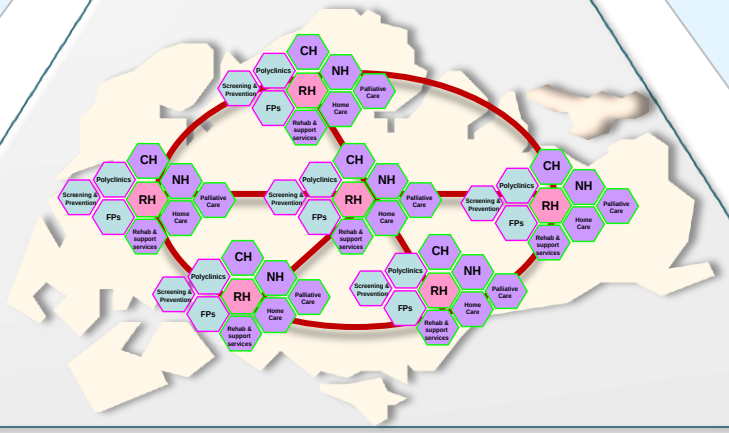
Enabled by the National Electronic Health Record (EHR)



Singapore Healthcare Setting

- A pyramid model,
- Anchored by Regional Hospitals

- More autonomy in day-to-day operations
- own networks of general practitioners
- step-down care facility in respective zones.



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Singapore General Hospital SingHealth
National University Health System
National University Hospital
NUS
Jurong Health Alexandra Hospital
Tan Tock Seng HOSPITAL
Changi General Hospital
Khoo Teck Puat Hospital Bringing Quality Healthcare to the North

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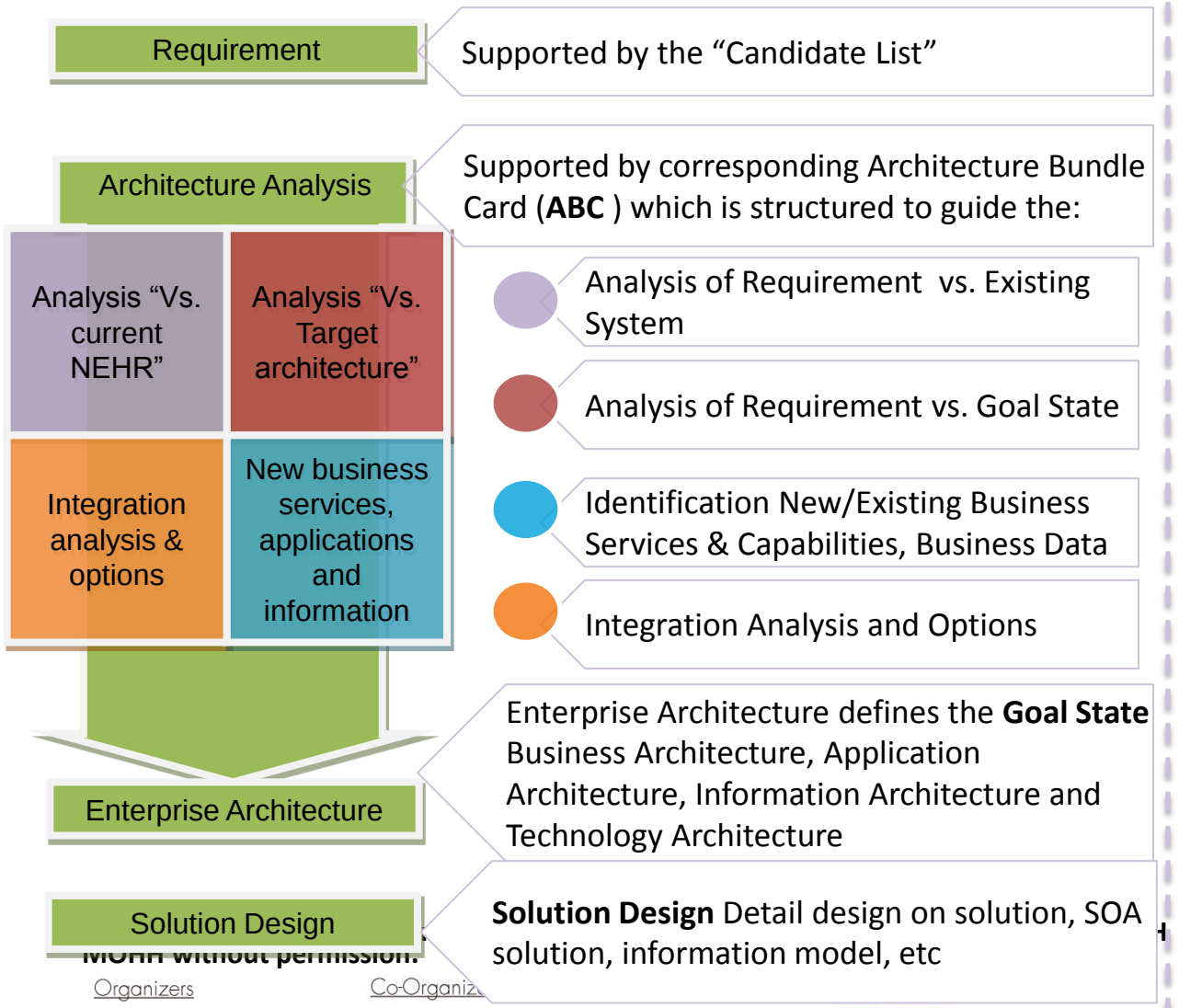
ENTERPRISE ARCHITECTURE

Methodology and Process to Develop NEHR Architecture

Integration Challenges in Singapore

- Different cluster uses different systems
- Mostly in HL7v2.3.1 existing with localized Z segments
- Inconsistent data structure/format (e.g event Id)
- Incomplete information (e.g some of the information is filtered/not sent to NEHR)
- Lack of end-to-end code set management process

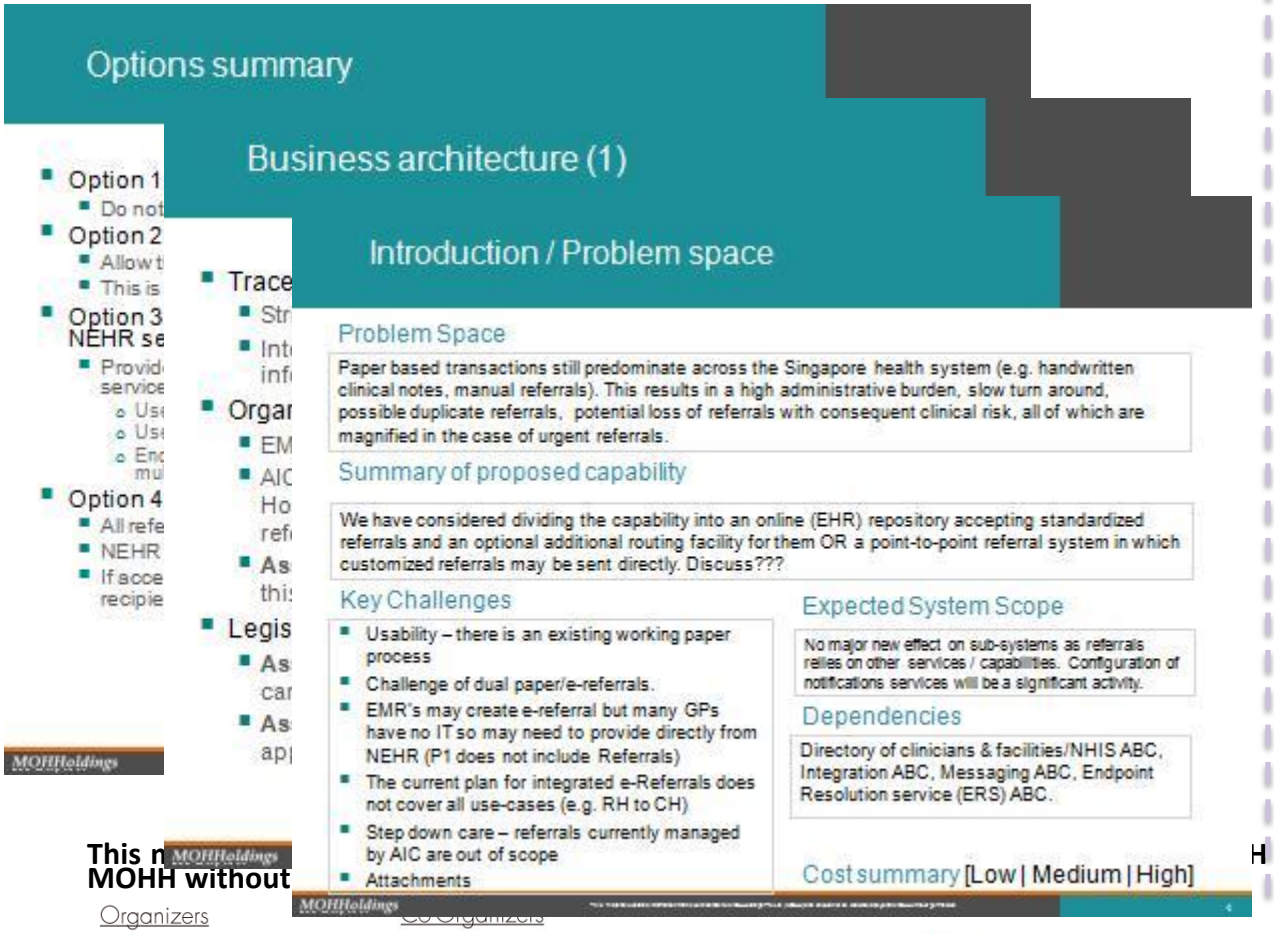
EA Approach



- Elaborated candidate list from MOHH
  - **Capability centric EA**
- Each requirement will be elaborated via an industry standard **"ABC" process**
- Utilizing a **meta-model** to encourage a disciplined approach ands to ensure a clear communication and traceability for each architecture segment.
  - Aligned with Alfabet meta-model
  - Extended meta-model to cover additional (important) items

Architecture Bundle Cards (ABC)

Supported by corresponding Architecture Bundle Card (ABC).

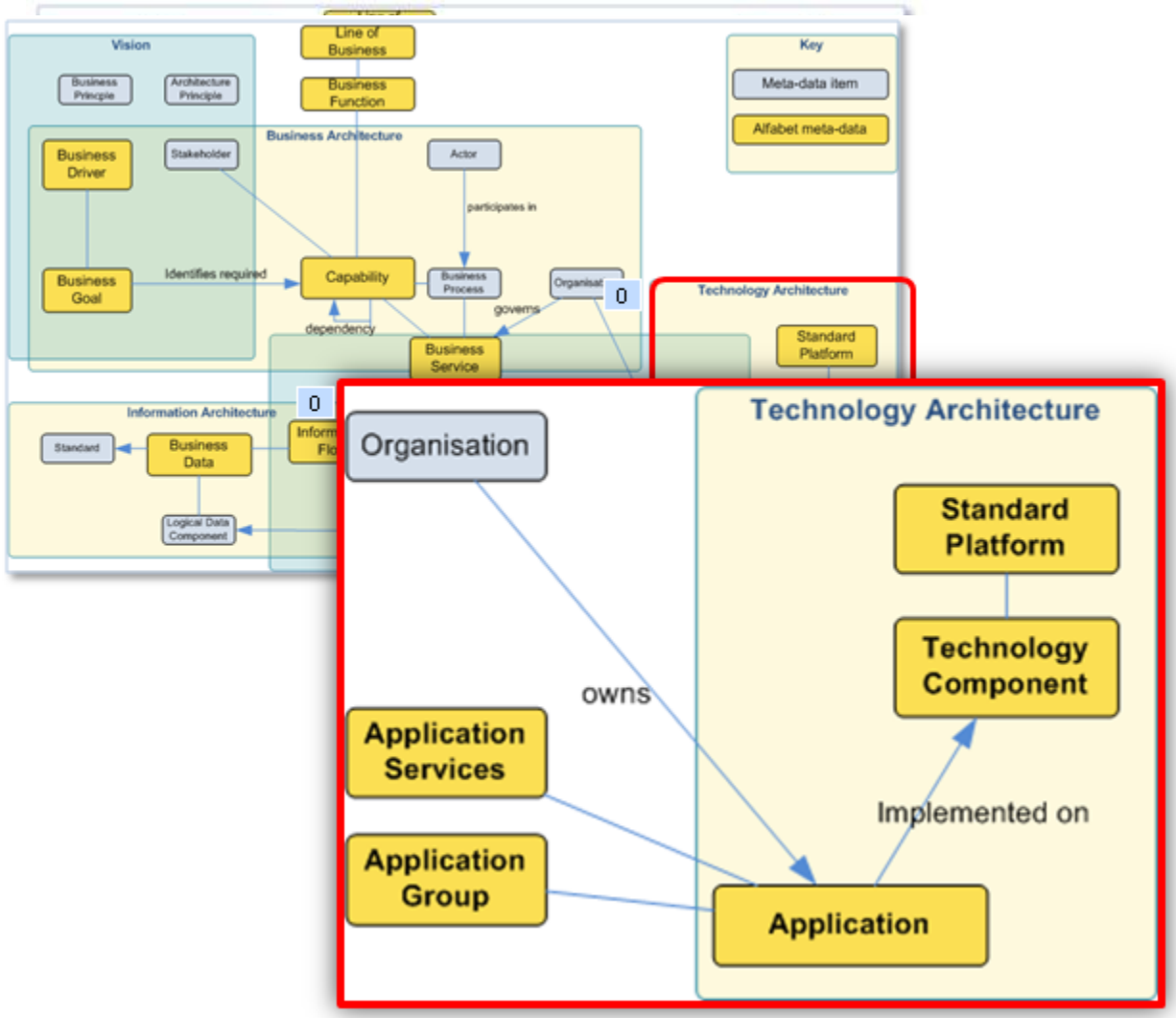


This n MOHH without

Each ABC include the following:

- A **Introduction/ problem space** page
- A **"Current state" summary** of both NEHR and wider landscape.
- A **Business architecture** section : e.g: Business driver, Organization scope & Challenges, legislative and Legal challenges.
- An **Information Architecture** section : e.g.: existing/New Business Data, Information Exchange Matrix, Data provenance/audit/data quality.
- An **Application Architecture** section : e.g.: Context diagram, Security consideration, performance & scalability, SOA/integration.
- A **Technology Architecture** section: e.g.: Technology Strategy, Platform/technology constraints, operation management consideration.
- And an **Options Analysis & Recommendations** section

EA Meta Model



Example:

- Singapore's
  - **Rising Healthcare Costs** *are a* **Business Driver**
- which is tackled by the improved
  - **Sharing of clinical information** *whose* **Goal**
- is supported by the example of improved sharing in the
  - **Imaging - Capability**
- This capability contains the
  - **resolveRecordLocation** - **Application service**
- Found in the
  - **NHIS - Application**
- That can be implemented on
  - **Linux - Technology Component**

NATIONAL DATA STANDARDS

Vocabulary for the meaning of the information

National Data Standards

Establishing a suite of Standards that are:

to ensure clinical data included in the EHR can be:

- ✓ Shared and exchanged safely and reliably
- ✓ Relied on for the monitoring and care of patients
- ✓ Used meaningfully for secondary purposes including the production of clinical knowledge

Global Standards Engagements

- HL7 (Health Level Seven)
- IHTSDO (International Health Terminology Standards Development Organization)
- ISO TC215 on Health Informatics

Standards also provide a platform for long term semantic interoperability and research informatics

The Problems To Solve

Vocabulary
- Knowledge of words

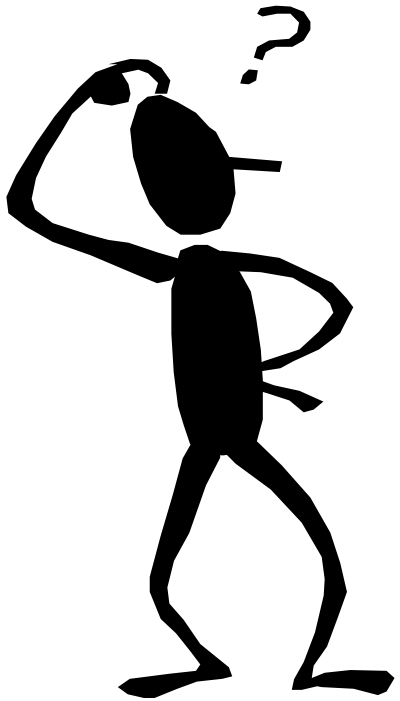
Grammar
- Understanding of the structural rules that govern the composition of sentences, phrases, and words in any given natural language
- Semantics

Syntax
- Understanding of principles and rules of the language
- Sentence construction, etc

Transmission Errors
- e.g. typos, missing words, letters, etc
- Miscommunication

Translation
- Able to understand different language, grammar and Vocabulary

Knowledge
- Understand and analyse words from different languages



How are the problems solved

Vocabulary
- Knowledge of words

Grammar
- Understanding of the structural rules that govern the composition of sentences, phrases, and words in any given natural language
- Semantics

Syntax
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Transmission Errors
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SNOMED CT, LOINC, SDD (Singapore Drug Dictionary)
- Use of International Standards
- Terminology Code sets

MOHH Data Dictionary
- Vocabulary Code Sets
- Includes SGDRM

MCS (Mapping Code Sets)
- Mapping Code Sets
- Migration Path

NDDS (National Data Definition Specifications)
- Structured data
- Syntax, Grammar and Vocabulary

NXDS (Standard Exchange Formats)
- HL7 (Health Level Seven), XML,
- Syntax and transmission error

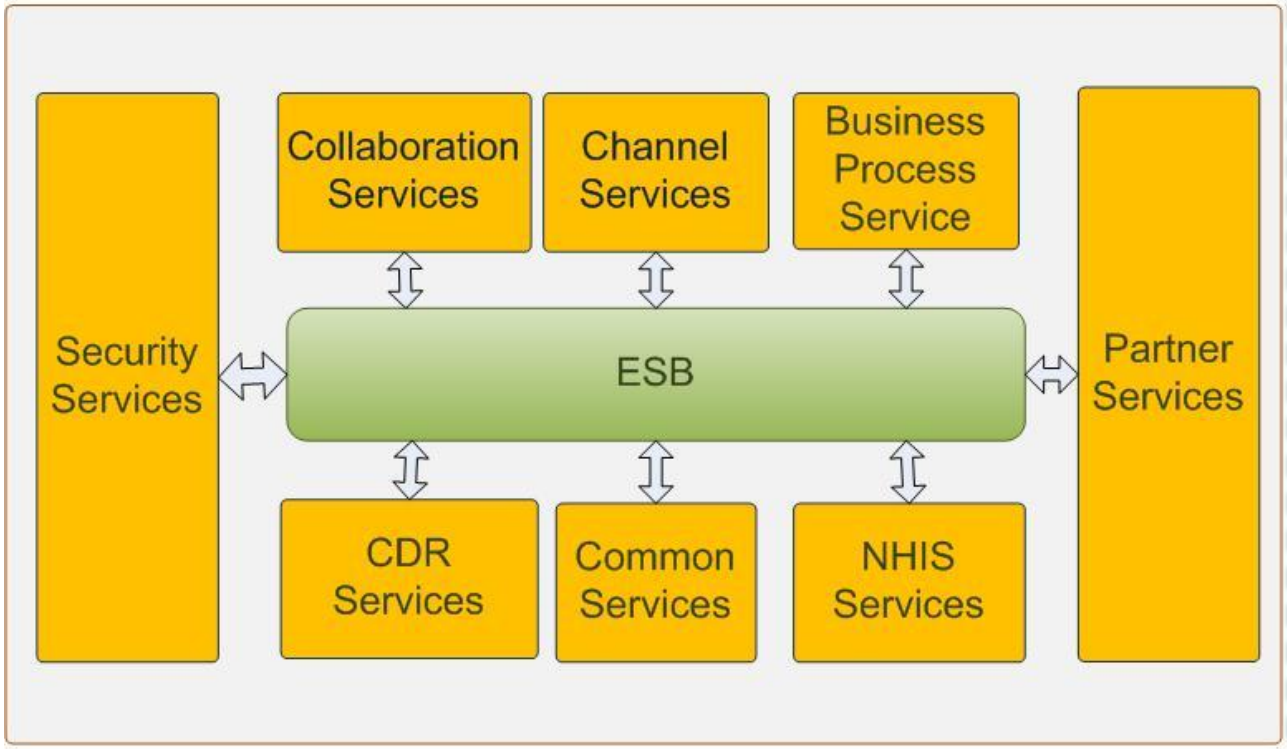
LIM (Logical Information Model)
- Vocabulary
- Grammar
- Syntax,
- Transmission
- Translation
- Knowledge

SOA DESIGN

Maximize the reuse of IT assets

A SOA model to sustain and pave the way for Singapore NEHR going forward

SOA Reference Architecture



Channel Services: Presentation Services

Collaboration Services: User to User collaboration such as subscription & notification

Business Process Services: Composite services to support business process services such as eReferal

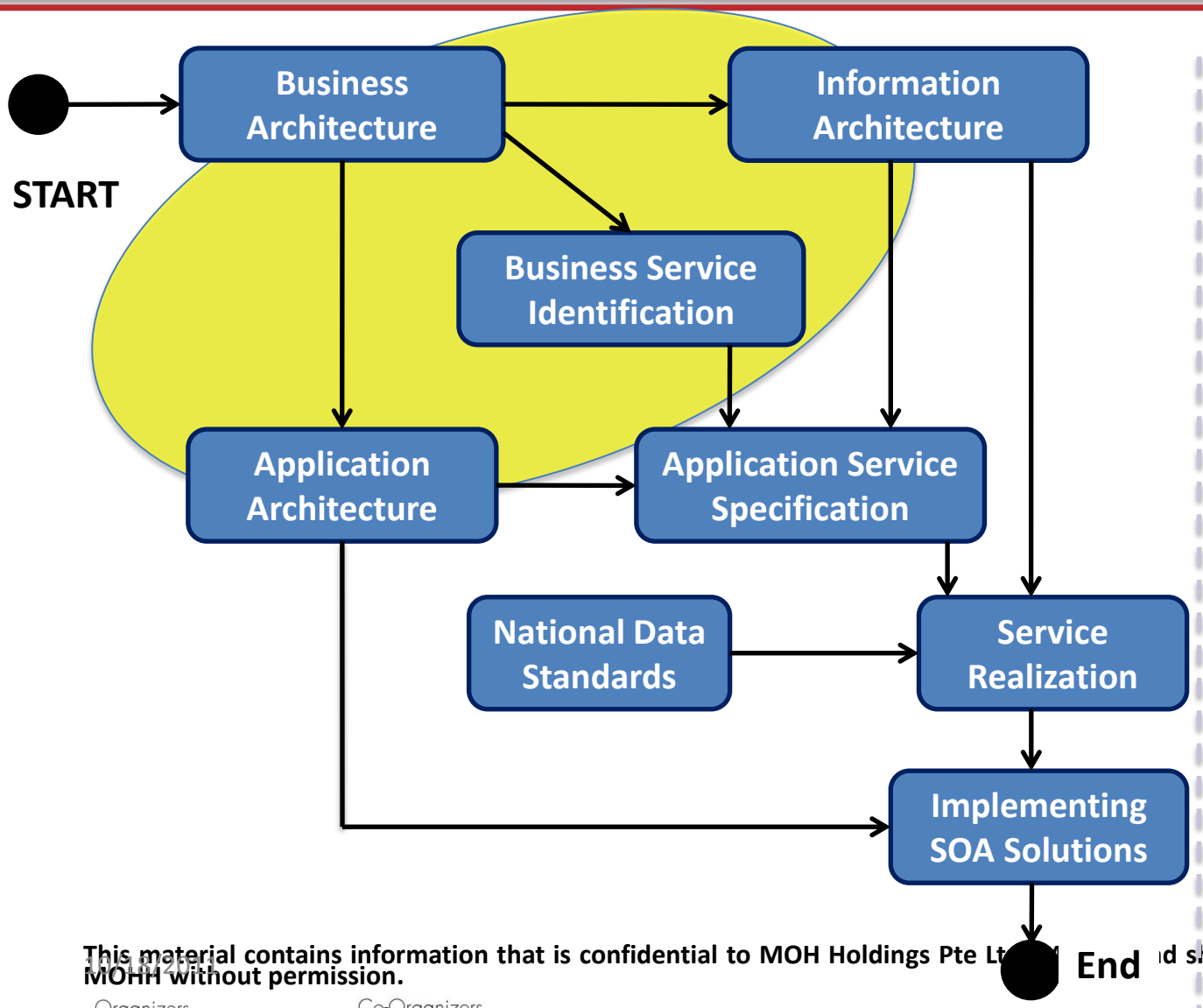
CDR Services: Services to manage data into/out of Clinical Data Repository which is based on Oracle HTB

NHIS: Services to manage identity for patient, care provide, facility and relationships

Partner Services: External source data integration

Common Services: Logging, Auditing etc

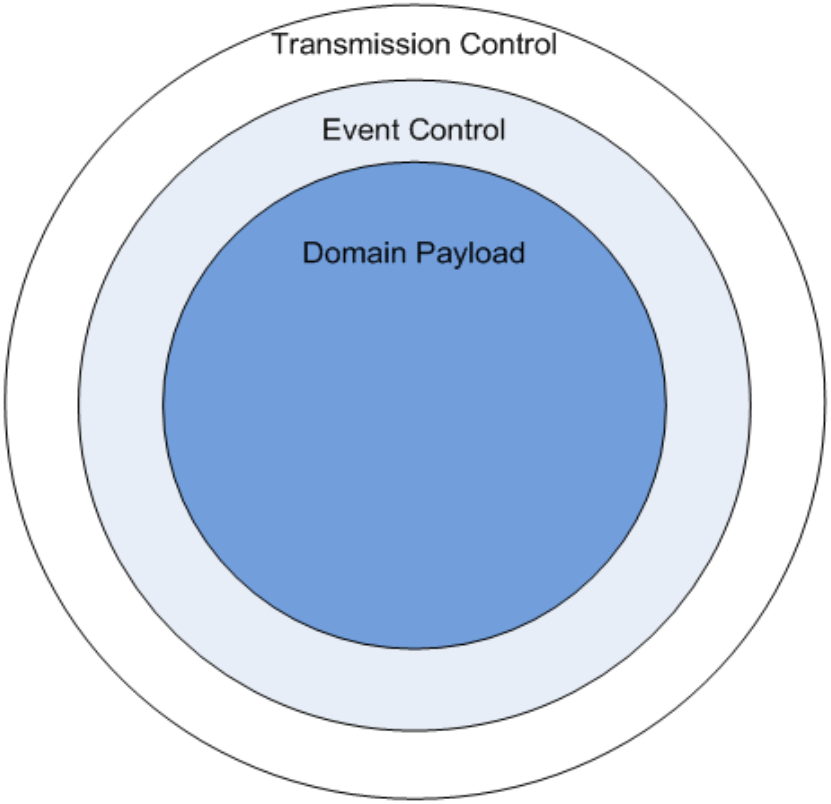
SOA Implementation Methodology



SOA Implementation Methodology - Use the artifacts from EA development to ensure the business alignment and traceability, and then develop next level detail design of application & information architecture.

Information Architecture - At EA level, only ***Business Data, Conceptual Information Model***, care setting type level information exchange are specified. The next level of ***Design Information Model*** and ***Data Architecture*** are subsequently defined and developed to provide underlying service definition and contract for service realization.

Standardized Payload



Transmission Control Layer

It contains information about the sender system/organisation and receiving system/organisation, and respective date/time such as sending date/time. This layer shall be the same across different domains of information exchange.

Event Control Layer

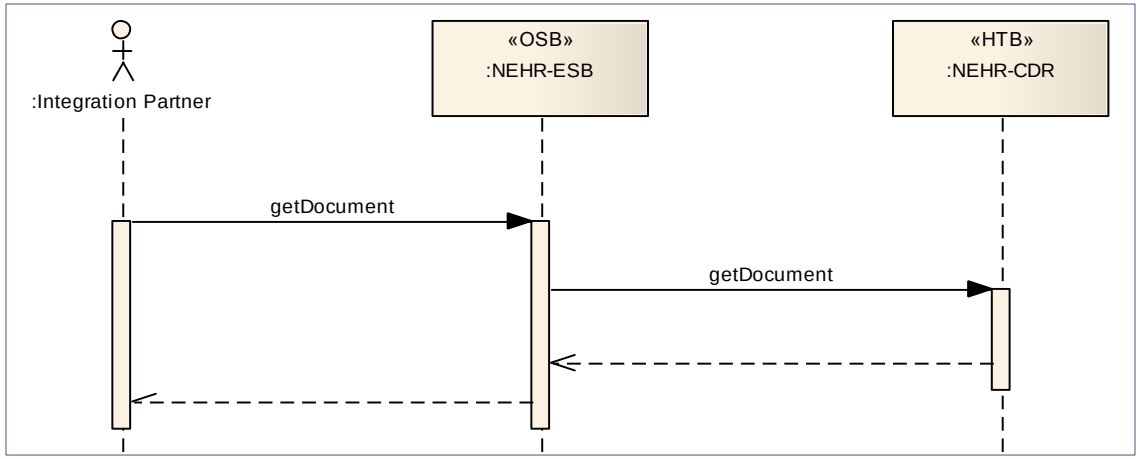
It contains information about contextual information for the payload such as the reason for triggering the exchange of the information and date/time when the event has occurred, which patient this message is for, etc. This layer shall be the same across the different domains of information exchange.

Domain Payload

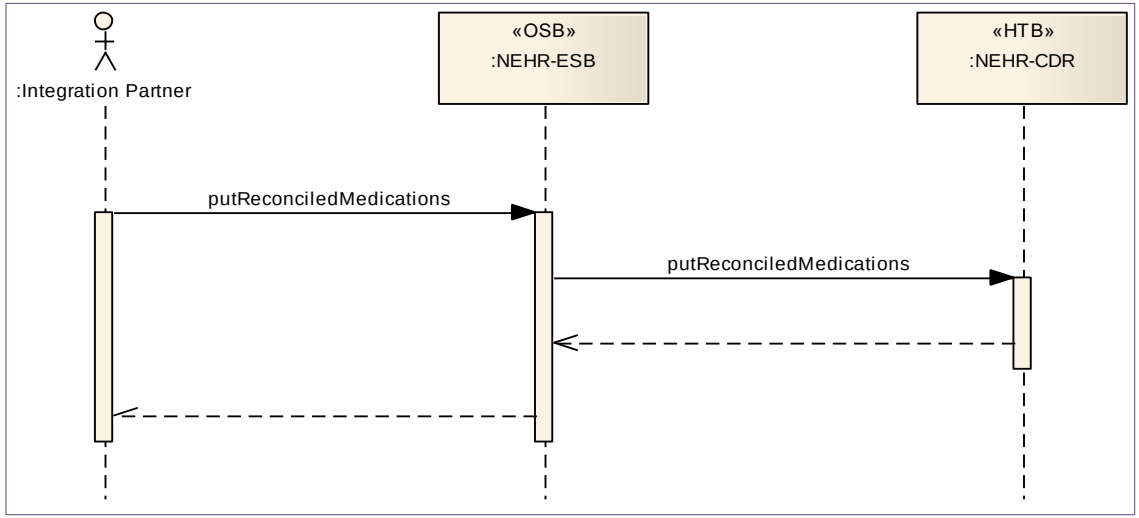
It contains the actual domain specific data elements to be exchanged

Common Integration Patterns

Synchronous query



Asynchronous put

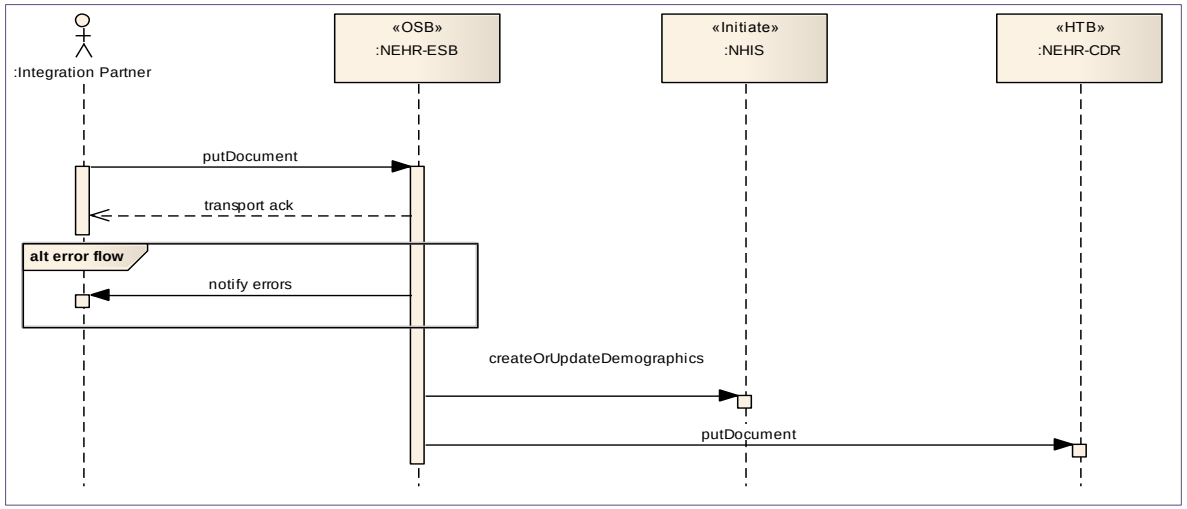


- When exposing new service interfaces on NEHR or other systems (national or otherwise) it is recommended that standard integration patterns are adopted to minimise the amount of effort it takes for integration partners to consume the new service.

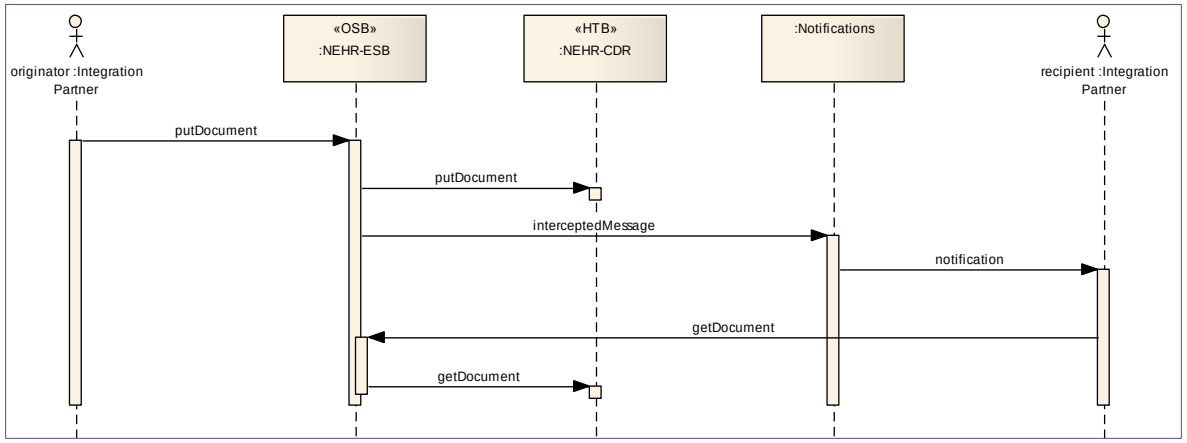
- Depending on the nature of service one of the following integration patterns should be adopted
  1. **Synchronous query**
  2. **Synchronous update**
  3. **Asynchronous put**
  4. **Store & notify**

Common Integration Patterns

Synchronous Update



Store & Notify



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Summary & Going Forward

- Successfully launched NEHR Phase 1

- Main Challenges ahead
  - NEHR as service provider
    - Reconciled problems, medications, allergies and ADRs
  - Secondary data use and decision support
    - ***Increased need for data standardization*** across the whole healthcare ecosystem

Thank you!

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