HL7 FHIR & openEHR

Interoperability & Intraoperability

Edited/polished version of the slides

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Interoperability vs Intraoperability

- A model is agreed to that allows all systems to exchange what needs to be exchanged, **without requiring any design changes to the way their systems works** ☺
- Whatever is done can be done on the periphery. And **what can be done is therefore constrained** to the **lowest common denominator** of the way that the systems function – all **systems are constrained to the dumbest system** ☹
  (But it is a fast start for many simple use-cases ☺)
- **Smarter systems need to come up with their own (only partly standardized) "extensions"** to the basic model so they can do smarter things. Many well known deficiencies of this (semantic scalability, fragmentation etc.) ☹
- Examples: **Messaging**, **HL7 FHIR** etc.

Based on a post by Grahame Grieve (member of FHIR-core team) on February 28, 2012: http://www.healthintersections.com.au/?p=820

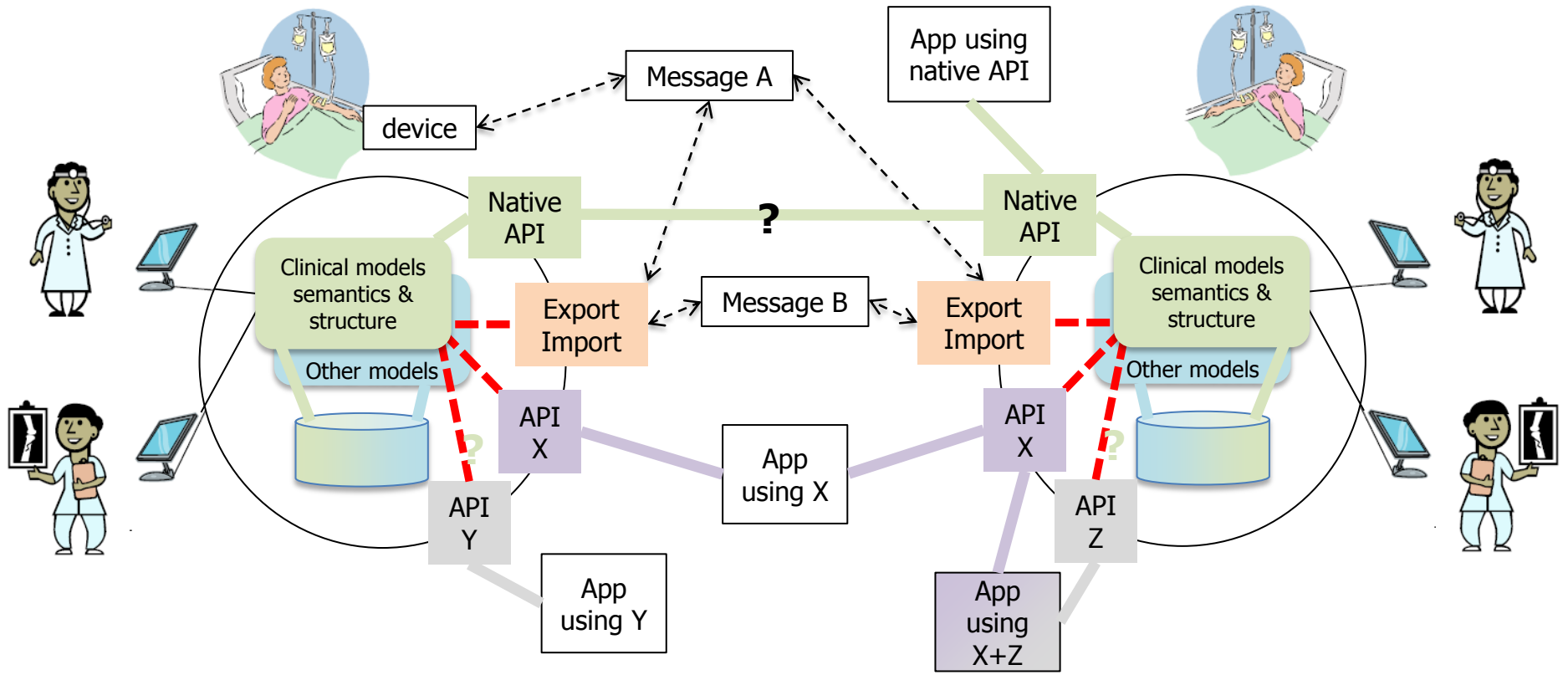
Interoperability vs Intraoperability

- **Rework the core structures** of the systems **to function in an agreed way**. Because all the systems work the same way, then **exchange between the systems is easy and straight forward.** ☺ (And internal model maintenance/update workload can be shared globally/nationally ☺.)
- Intraoperability has fewer deficiencies, but they are much bigger: it's much **harder to get agreement**… ☹
  (Both technical and clinical agreements are needed to get maximum benefit of this approach ☹)
- Examples: **CIMI, openEHR**, some usages of **ISO13606** etc…

Typically, at this point, the system designers (often vendors) get the blame. But – it's not as simple as that – vendors do whatever sells, which is whatever the purchaser wants to buy…

Based on a post by Grahame Grieve (member of FHIR-core team) on February 28, 2012: **http://www.healthintersections.com.au/?p=820**
A more descriptive name for this kind of open intraoperability approach might be something like "**shared internal core structures**"
Note that the view of intraoperability described above is concerning vendor neutral models, there is another different (risky, lock-in-prone) definition of intraoperability focused around dominating market actors described at http://www.ecis.eu/intraoperability/)

Exploring details of the interoperability-intraoperability continuum



Usually not available to independent developers (trade secret)
Exceptions: open Source EHRs (VistA etc) or
openEHR based EHRs (both closed- and open source)

Native API connection (complete and semantically lossless)

Mapping (risk of semantic loss – see next slide)

Vendor controlled but "openly" published API connection

Vendor neutral API connection (HL7 FHIR etc.)

<-------> Standardized message exchange (HL7 v2, CDA etc.)

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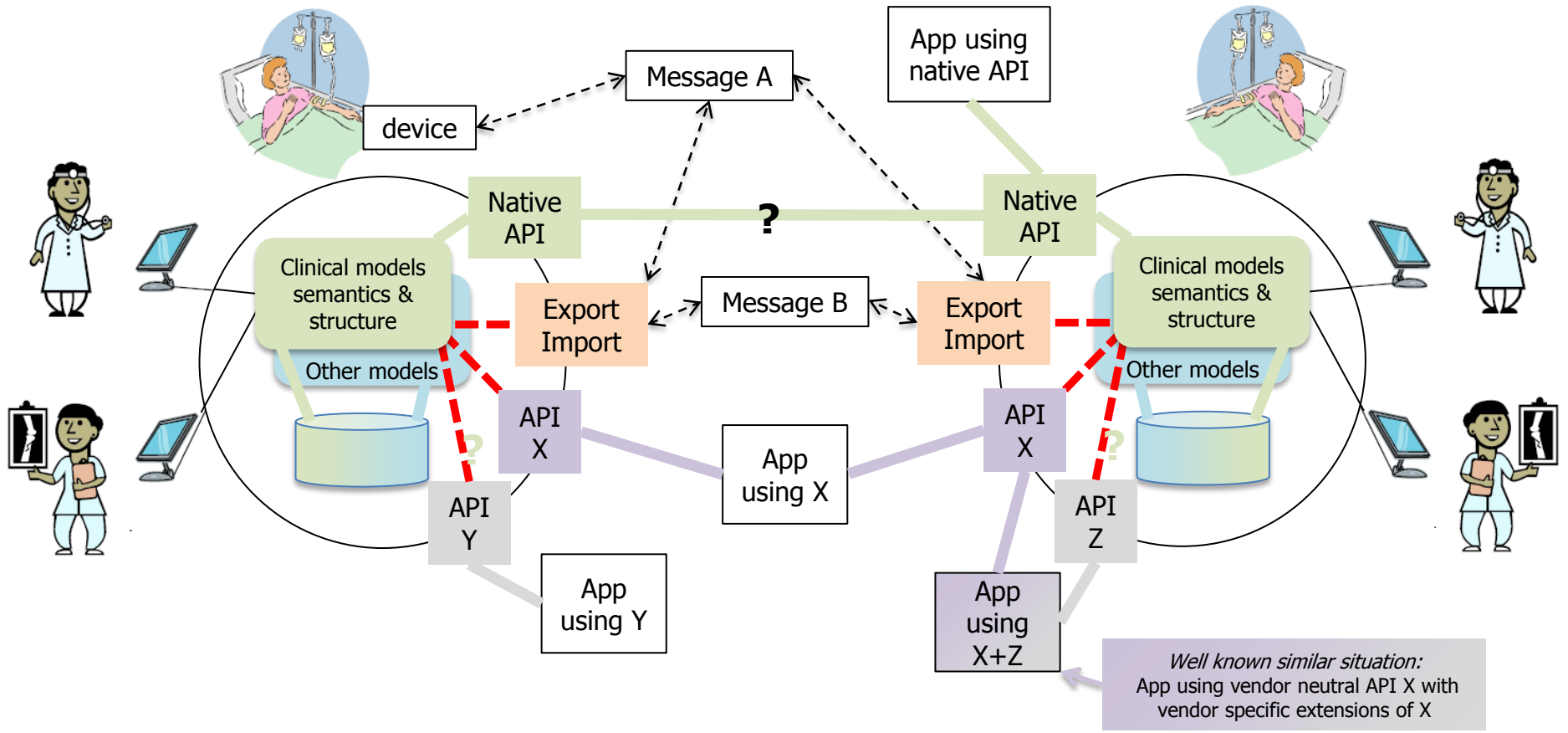

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If truly* open: intRAoperability – of the "good" open kind
*) truly = openly maintained, not controlled by specific vendor

Native API connection (complete and semantically lossless)

Mapping (risk of semantic loss – see following slide)

Vendor controlled but "openly" published API connection

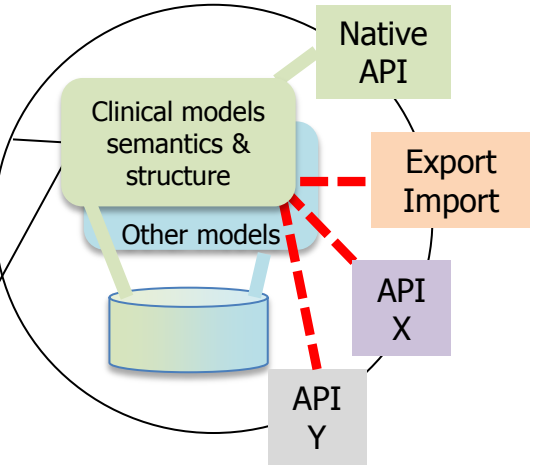
Vendor neutral API connection (HL7 FHIR etc.)

Standardized message exchange (HL7 v2, CDA etc.)

intRAoperability – of the risky lock-in-prone kind
Often focused around dominating market actors as described at http://www.ecis.eu/intraoperability/

intERoperability

Let's zoom in…



?

Mappings

The red lines represent manually maintained mappings between internal EHR model and standardized API- or message-models.

Important but too often overlooked questions:
Are all use-case relevant mappings algorithmically solvable (safely) or not?
Creation+maintainance costs?

Source of table to the right:
Erik Sundvall's PhD Thesis
"Scalability and Semantic Sustainability in Electronic Health Record Systems"
http://urn.kb.se/resolve?urn=urn:nbn:se:liu:diva-87702
Full text available online.

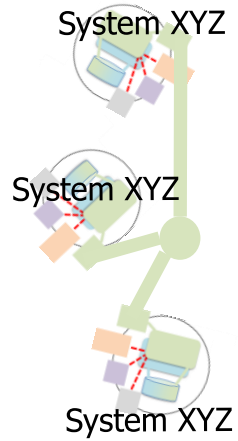
Type 1. Same kind of information, but captured in different ways; *Resolvable by computer systems* For many non-changing such patterns and data structures it is possible to implement automated export and import mechanisms. Example: Body weight	
A: Weight at birth: 3300g	B: Weight: 3.3 kg
Type 2. Same kind of information, but captured in different ways; *Resolvable by medically competent human but not by computer systems* Example: Medical history in two different systems	
A: • Chief Complaint • History of the present illness • Past medical history • Family diseases • Social history • Substance use (tobacco, alcohol, drugs) • Diet • Exercise	B: • Chief Complaint • Medical History • Social History
Type 3. Same kind of information, but captured in different ways *Not resolvable even by medically competent human (but often useful for a human anyway)* Example: Aggregations using different intervals (cigarettes/week)	
A: 0, 1-5, 5-10, 11-15, 16-30, 31-50, 51-100, 101+	B: 0, 1-3, 4-7, 8-14, 15-28, 29-56, 57+
Type 4. Different kinds of information or missing information *Not resolvable even by medically competent human (not reusable for certain purposes)* Example: Substance use	
A: • Alcohol yes/no • Tobacco yes/no	B: • Cigarettes yes/no • Snuff (snus) yes/no

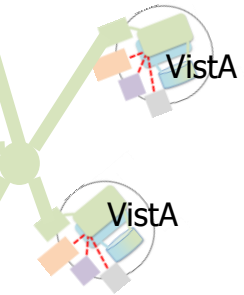
Interoperability vs Intraoperability

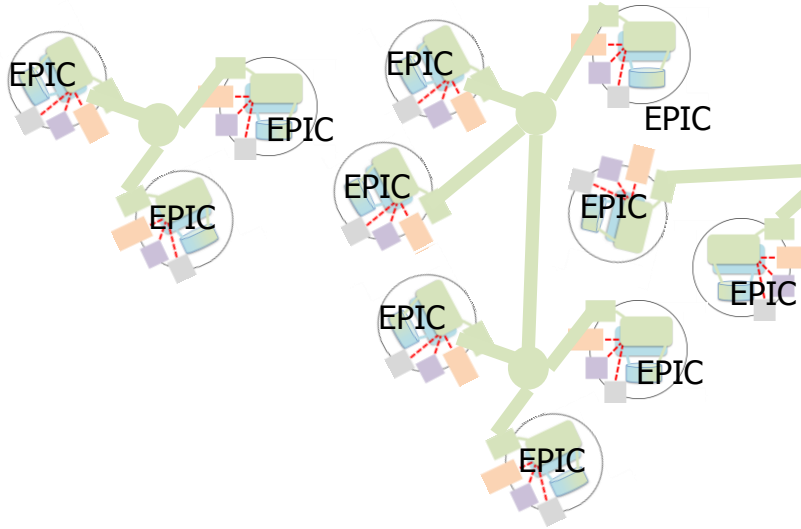
Can you **get inside** the ”the walls of semantic difference”
or just peek in and interact through vendor-selected API-holes and GUI?
Can you do a lossless move of entire healtth records between systems?

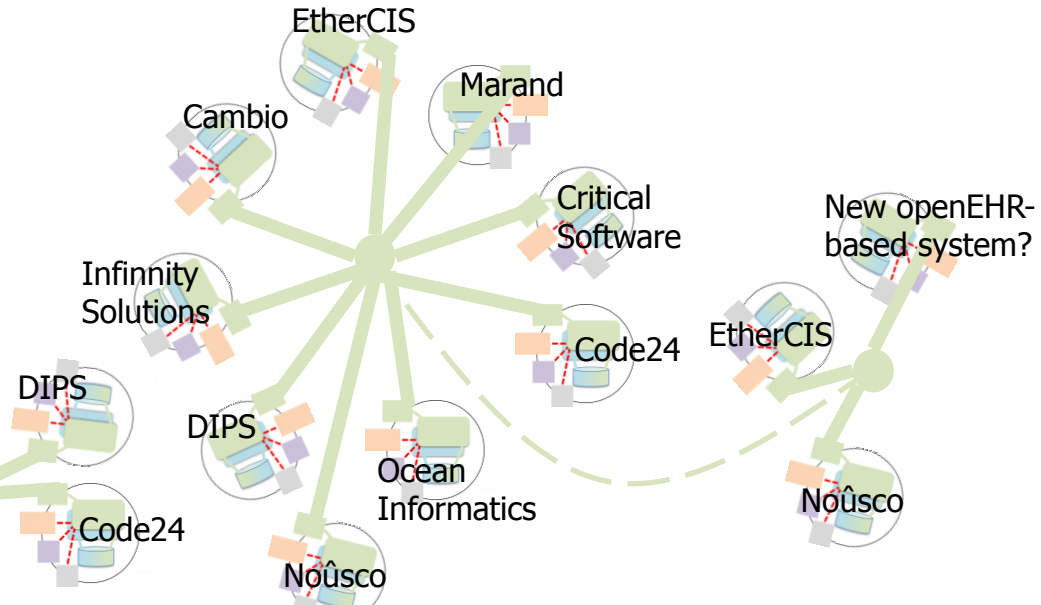
Where are you?
Where do you want to be?
What you want to do?

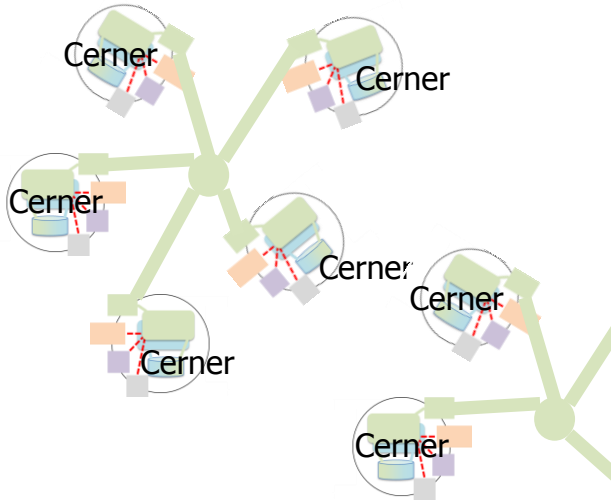
- App delveloper?
- Healthcare provider?
- EHR system provider/vendor?
- External infromation provider? (e.g. lab or pathology service)











When to use what? Inter- vs Intra-operability?

- **A continuum, not black/white. Some degree of both is often needed.**
  What is your main pain?
  - **Too much variation in input** → focus on **intra…**
  - **Too much variation in output** → focus on **inter…**

- **Interoperability focused approaches e.g. HL7 FHIR, HL7 V2 messaging etc**
  - Focus: exchange/messaging . ”Usual” way - mappings. Familiar to system providers etc.
- **Intraoperability focused approaches e.g. openEHR, HL7 CIMI (long term goal)**
  Focus: sharing clinical documentation + sharing modeling workload
  - Easy to move entire health records (to other organizations or competing systems)

- Approaches somwhere **inbetween or all over** the continuum: **HL7 CIMI, ISO 13606 etc.**

When to use what? Inter- vs Intra-operability?

- **How competent are you compared to your systems provider(s)**?
  - **We know more (and stay updated)**, and can specify it well → **intra…**
    But **you'll need to get involved** in international (and national) collaboration.
  - **Equal** or varies a lot → **???** (very context dependent)
  - **They know more** → **inter…** Let them do internal modeling and tell you how to use it.

- **How much can you influence decisions** (implementation/configuration) inside EHR systems?
  - Not much →
    interoperability! Intraoperability if of interest to system provider(s).
  - A lot →
    Might get intraoperability if you know what you are asking for, and why.

	HL7 FHIR	openEHR
Main focus	• Int**er**operability (find & use similarity?) • Exchange and access "**FHIR is not written for clinicians, it's written for software developers**" [2a] (and other implementation experts)	• Int**ra**operability [1] (reduce differences inside?) • Clinical documentation "**openEHR … working at the clinical semantics level with implementation as a downstream activity**" [2b]
Clinical content selection	• Common patterns implemented in existing systems. (Plus some other new needs that can be agreed widely upon.) • "The 80/20-principle". [3]	• Reqirements expressed by clinicians and implementing organisations via an international (sometimes national) online consensus process, open to all.
Technical focus	• Easy/fast to understand and implement	• Easy to maintain & extend EHR systems (new RESTful I/F make it easier to implement)
Local and speciality-specific adjustments	Extensions & Profiling Only non-extended FHIR resources guarantee easy international interoperability/similarity. (Extensions can be retrieved and analyzed. Data entered using previously unseen extensions follow the FHIR model and can thus be transferred and read by any system.)	Templates & Archetypes Only templates and archetype specializations based on international archetypes guarantee easy interoperability/similarity. (Local archetypes etc. can be retrieved and analyzed. Data entered using previously unseen archetypes follow the openEHR model and can thus be transferred and read by any system.)
Final decisions	HL7 member balloting	**Clinical:** mainly consensus in online review rounds – mostly clinicians **Technical:** Specifications Editorial Committee (SEC) – mostly EHR system implementers

[1] Open internal clinical models as in Grahame Grieve's: **Interoperability vs Intraoperability** http://www.healthintersections.com.au/?p=820
(We do **not** mean intraoperability around a dominaitng vendor as in the definition at http://www.ecis.eu/intraoperability/)
[2a] Lloyd McKenzie 2016 March 28 and [2b] Thomas Beale at March 29, both in https://chat.fhir.org/#narrow/stream/openehr
[3] Grahame Grieve, **FHIR and confusion about the 80/20 rule,** http://www.healthintersections.com.au/?p=1924

Options when using FHIR and openEHR

- **No alignment (just mapping)**
  - To FHIR, openEHR can be seen just as any other EHR-system
    (and mappings can be done for some things)
  - To openEHR FHIR can be seen just as any other exchange format
    (and mappings can be done for some things)

- **Partial alignment (giving better mapping possiblilities)**
  - Align the clinical content of some important resources and archetypes. Then keep each other updated regarding new versions. (Already done e.g. for Adverse Reaction)
  - Create shared and (inter)nationally maintained FHIR extensions/profiles to carry the extra datapoints from openEHR systems.
- **Encapsulate one in the other [Ian!]**
  - Discussions between FHIR and openEHR developers (and inside HL7) regarding finding ways to carry openEHR-modelled data using new kinds of FHIR formalisms (enabling more automated transformations rather than manual mapping)
  - Facade FHIR-repositories (and legacy systems) as openEHR data-sources and use in openEHR query/retrieval/display (related to DIPS's experiments, Norway)
  - HAPI (open Source FHIR wrapper)?
  - SMART on FHIR on openEHR (shown e.g. by FreshEHR, UK – using mappings etc.)

Join the discussion at https://chat.fhir.org/#narrow/stream/openehr/

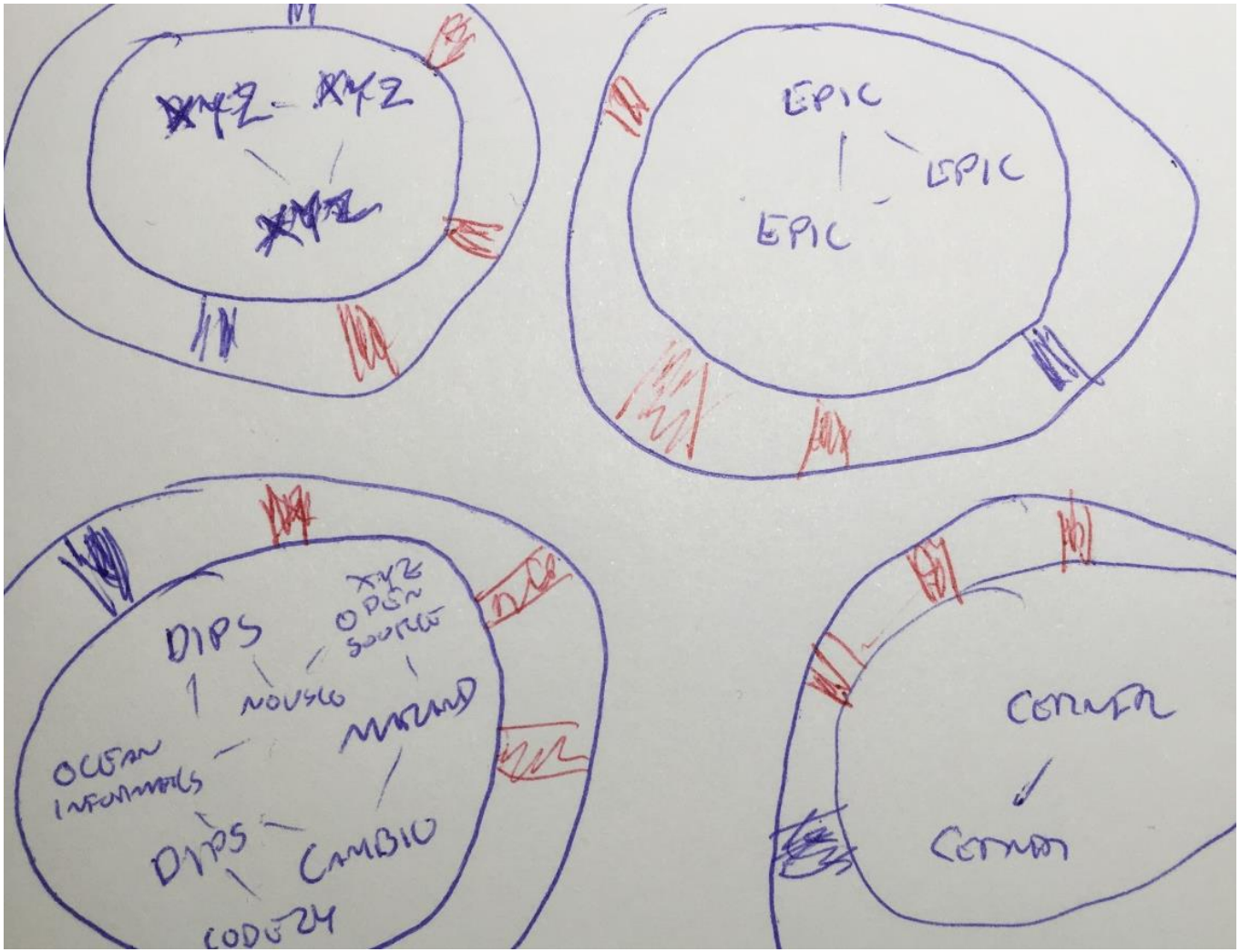
The End

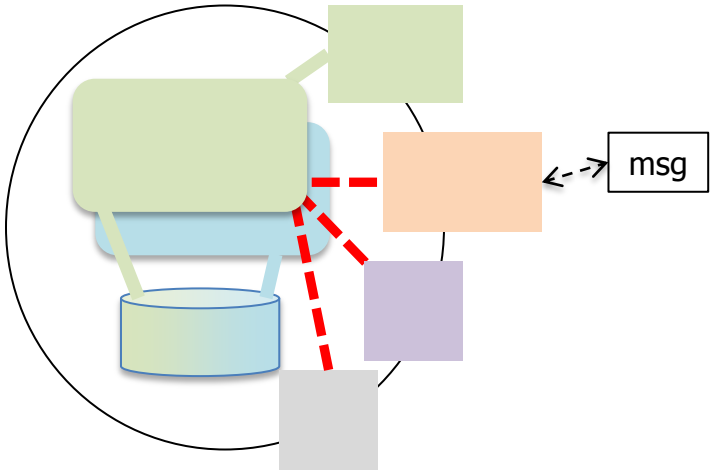
Questions?
Discussion!

Extra slides if needed

Interoperability vs Intraoperability

Can you get inside the wall or just peek in and interact through API-holes and GUI? Where are you? Where do you want to be?
(Depends on who you are and what you want to do)

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