# TERMS OF REFERENCE, DEFINITIONS, and PARTIAL FRAMING for HIEA Technical Forum, Aug 17-18

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**Domain model**: An explicit description of a domain in terms of concepts, properties and attributes, and constraints, defining a common vocabulary. Domain model characteristics: Closed (but extensible), useful for defining objects, properties, and relationships, often (not exclusively) expressed in UML. Sometimes called “conceptual” or “domain analysis” model.

In discussing any specific domain model, it is important to understand its **purpose**, **scope** and **modeling perspective**.

* **Purpose** can be defined in terms of a certain set of use cases, such as medication management, and the intended users (e.g., PCP, hospitalist, payer, or patient).
* **Scope** defines the breadth of the model; e.g., whether to include or exclude over-the-counter medications
* **Perspective** deals with how the same thing can be seen from different points of view; for example, hospital operations can be modeled from the perspectives of resource management, patient treatment, safety and quality, finance, etc.

*Example: Pressure Ulcer Prevention Domain Analysis Model (http://wiki.hl7.org/images/b/be/PressureUlcerPreventionDomainAnalysisModel\_May2011.pdf)*

**Information model**: A representation of what data is associated with a domain and how that data is structured. Similar to a domain model, but with a focus on representing the information associated with the domain, rather than the domain objects themselves. Information models commonly are developed at the logical level, that is, they are specific about what data is captured, but do not specify database structures. Should include metadata (information about the information collected). Information model characteristics: Closed, includes metadata, useful for constructing artifacts using Model-Driven Architecture.

*Example: FHIM, FHIR*

**Ontology:** A formal naming and definition of the types, properties, and interrelationships of the concepts that really or fundamentally exist for a particular domain. An ontology can be developed for specific domain model or it can also be used across multiple domain models. Ontology characteristics: Open, useful for automated reasoning, often (but not exclusively) expressed in OWL.

*Example: SNOMED-CT*

**Taxonomy:** A taxonomy is similar to an ontology, but taxonomy is usually only a hierarchy of concepts, while an ontology supports complex relationships between concepts.

*Example: CMS Healthcare Provider Taxonomy Code Set (https://www.cms.gov/medicare/provider-enrollment-and-certification/medicareprovidersupenroll/taxonomy.html)*

**Data Element:** A unit of data for which the definition, identification, representation, and permissible values are specified. May not, in itself, provide complete context. May also be posed as a question-answer pair.

*Example: US National Library of Medicine Data Element Catalog (https://www.nlm.nih.gov/healthit/dec/)*

**Exchange package:** A set of information that is transferred between systems. The logical contents of exchange packages will be defined in terms of individual or groups of data elements. The logical content is independent of the wire format (syntax), but often the definition of an exchange package includes a specific syntax (how the information is serialized for transport).

*Example: HL7 V2.5 ADT message, Continuity of Care Document*

**Transformation (often just called mapping)** is the process of mapping between data fields and the translation of terminology needed when the source information model, the local contents of the exchange package, or the target information models are not identical.

## Questions and Answers (Open for Discussion)

**What is required for data exchange between systems?**

To transfer data between systems, and to use the data that is transferred, the exchange partners need to decide on:

1. The logical contents of the exchange package(s)
2. The wire format of exchange packages (how the logical contents are rendered for exchange) – e.g. FHIR JSON or FHIR XML
3. Mechanism by which exchange packages are requested, sent, and secured (API, transport, encryption, etc.)
4. Any business rules associated with sending and receiving exchange packages

Exchange partners then must provide data transformation between the local information model and the information required by the exchange package.

**Are common models required for data exchange?**

No. Defining exchange packages requires definition of data elements to be exchanged, and must be enough in-band or out-of-band context to use that information, but that does not require a model. HL7 V2 messages communicate very effectively without requiring an explicit healthcare model.

**Then why have common models?**

A common domain model (also called a reference model, federated model) is useful for aligning different domain models, helping people understand exactly how things relate to in other domain models. A common information model, aka the common logical model (CLM), shows how different information models relate to each other. A common ontological model has similar value in relating concepts built can also be used by applications required to support reasoning across multiple domain models.

**In what ways can a common logical model (CLM) be “common”?**

In three ways. The CLM can be adopted for ***data at rest***, adopted for ***data in motion***, or both.

**Does adopting a CLM make data exchange easier?**

If the CLM is used to align ***data at rest***, then data exchange can be greatly simplified. If the CLM is only used to define a ***common exchange standard***, but data at rest (local data store) is not aligned, it doesn’t necessarily help. The difficulty of exchanging information (and being able to use the information that is exchanged) is primarily controlled by the semantic distance between the at-rest data representations.

**But isn’t a common exchange standard good thing, in and of itself?**

The theory is that having a common exchange standard reduces the overall mapping effort from O(N2) to O(N). But in practice, it is more complicated.

**How so?**

It all depends on the ***permissiveness*** of the exchange standard. A standard can be more or less flexible in terms of how it represents data. For example, it might permit multiple vocabularies (e.g., allowing diagnosis codes from SNOMED, ICD-9, or ICD-10), or it might be restrictive, and only allow one. In general, the more the flexible standard, the harder it is for the information receiver to use the information that is exchanged. A system based on C32 (an earlier version of C-CDA) may require a special adaptor for each exchange partner. Then we are back to N2, rather than N.

**Are current standards that permissive?**

The lack of consistency in healthcare data has led to exchange standards that are purposefully left extremely flexible in how they represent data. Even very recent standards like FHIR have made the decision to remain very flexible because the inconsistency of healthcare data. Achieving consistency in healthcare data is an extremely difficult problem to solve.

**How did this come about?**

Healthcare was a paper based system long after most other domains had embraced modern IT infrastructure and electronic data capture. It is only in the last 10 years that electronic specification of data has been the norm. While the adoption of this IT infrastructure is an excellent step forward, the opportunity for an evolutionary process towards data consensus was not possible. Where other industries shifted to electronic records and data gradually, healthcare very rapidly made the shift with many provider organizations and vendors developing capabilities in parallel. This rapid progress locked in many inconsistencies in data capture and representation. As a result, exchange standards are not enough to solve the interoperability problem in healthcare. We have to look at the data itself.

**Does “permissiveness” have something to do with FHIR Profiling?**

It does. FHIR is not a perfect solution for solving the exchange problem, but it provides a far more solid foundation then previous standards. FHIR out of the box, without profiles, it is very easy to use because it is very flexible. But there is a high risk of an information receiver not being able to interpret information they. If we create specific, constrained profiles, there are many more rules to comply to, but if senders and receivers are able to comply to those rules, the increased predictability it easier for the receiver to process the information exchanged.

**That sounds like a classic tradeoff**

Absolutely. A tight exchange standard makes it harder to join the exchange, but the result is a greater level of semantic interoperability. A looser, more permissive exchange standard makes it easier to join the exchange, but lowers semantic interoperability.

**Where is the optimal point on that tradeoff?**

No one really knows. But the only way to fundamentally break the tradeoff is to move towards standardizing healthcare data across providers. There will be significant resistance and building consensus will be an enormous challenge. If this were easy to solve, we wouldn’t have the massive problem we have today. However, if we can provide a target and start working towards achieving fundamental data consistency, the benefits will be significant.

**Other terms of possible interest:**

**Abstraction**: a reduction in information content for the purpose of emphasizing what’s most important and removing the details that matter less.

**Encoding**: A representation, or a change in representation, without a difference in information content. (For example, a number can be represented in base 10 or base 2, but it is still the same number).

**Vagueness**: Not clearly or explicitly stated or expressed; not clear in meaning

**Granularity**: The level of detail that can be represented in an information model; the degree to which different concepts are distinguishable. High granularity means fine details are visible; low granularity hides these details. For example, to describe a geographic area, zip+4 is more granular than a 5-digit zipcode.

**Approximation**: value or quantity that is nearly but not exactly correct. In terms of semantics, a term that is close but does not exactly capture what is meant.

## Interoperability Levels:

HIMSS, HL7, ISO and other organizations have defined different levels of interoperability. This table is an attempt to align a few of those definitions.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **HIMSS** | **HL7** | **CITL** | **ISO** | **Description** |
| 1 | Founda-tional | Technical | Machine transportable | Technical | Data sent electronically; could be fax or email |
| 2 | Structural (Syntactic) | Semantic | Machine organizable | Information is serialized for transport using a defined, structured format |
| 3 | Semantic | Information is apportioned to defined data fields, each field with defined contents and restrictions |
| 4 | Semantic | Machine interpretable | Information is communicated with unambiguous, shared meaning, using controlled vocabularies and taxonomies |
| 5 | ------ | Process | ------ | Organiza-tional | System interactions implement workflows and are coordinated under agreed business rules |
| 6 | ------- | ------- | ------- | Legal | Interactions are aligned under legal, regulatory, and incentive systems |

HIMSS, <http://www.himss.org/library/interoperability-standards/what-is-interoperability>, retrieved 6/29/2015

HL7, [Coming to Terms: Scoping Interoperability for Health Care](http://www.hln.com/assets/pdf/Coming-to-Terms-February-2007.pdf), February 2007

Center for Information Technology Leadership, "The Value of Healthcare Information Exchange and Interoperability," Wellesley, MA

ISO: http://www.iso.org/iso/home/news\_index/news\_archive/news.htm?refid=Ref1536