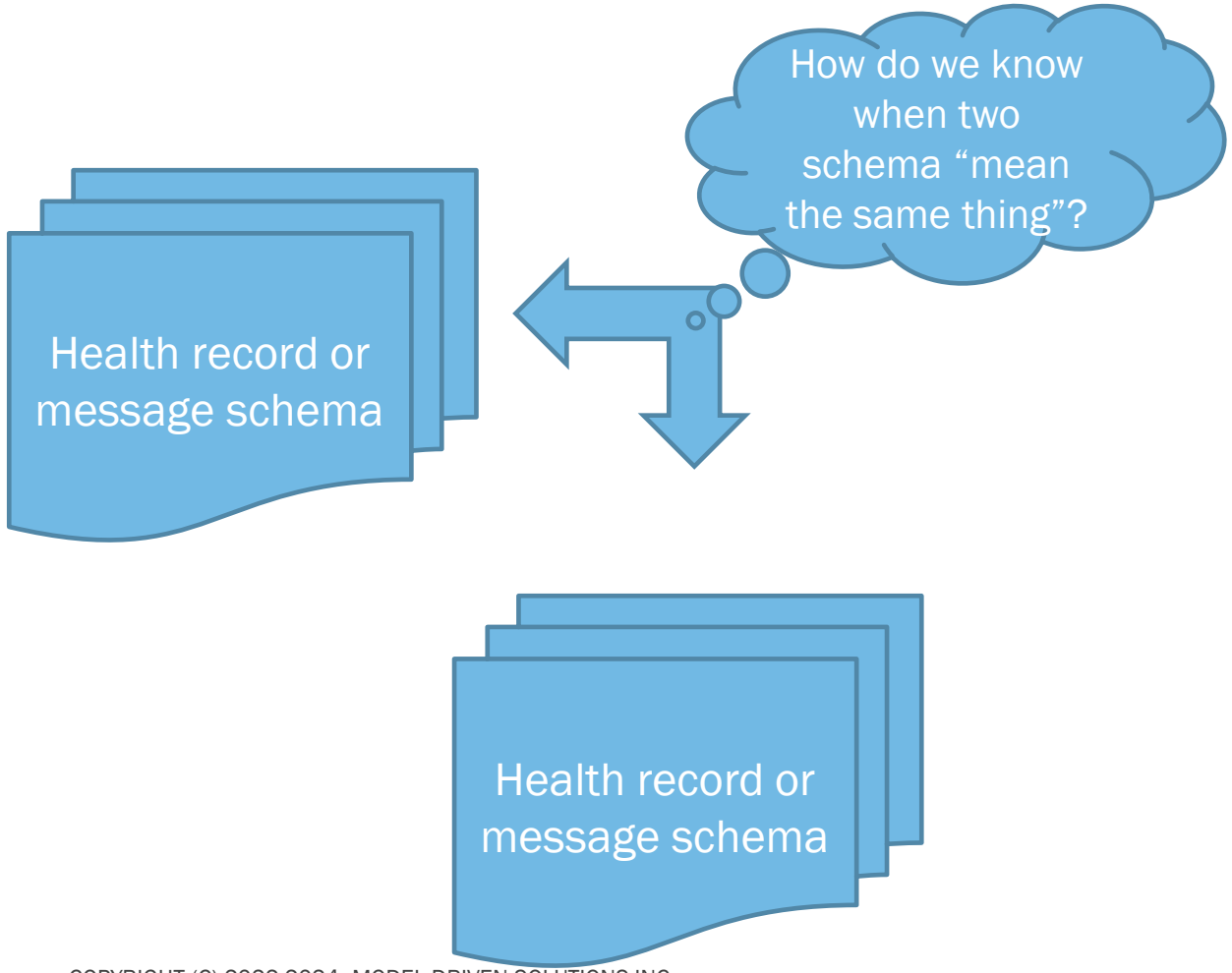
CLINICAL CONCEPTS FOR HEALTHCARE INFORMATION SHARING

THE ONTIC & EPISTEMIC MODEL

CHALLENGE ONE – INFORMATION IS MESSY. PEOPLE COMPLICATED



- Clinical information sharing is currently defined by modeling the data as needed for a particular application or situation
- While vast effort has been expended to "connect the dots" with "pre-coordinated codes" and data mappings, the complexity of the domain shows the inherent weakness in focusing on data for a particular purpose rather than the domain – people, their conditions and healthcare.
- But, people, their conditions and healthcare are very complicated, making solutions hard to understand or to scale.

THE “REAL WORLD” AND RECORDS OF IT GET CONFLATED

Health Record
Vital sign Observation
Patient: John Snow
Time: 10:30am 3/21/2010
Taken By: Sue Miller
Topic: Body Temperature
Value: 101.5
Unit: DF
…

Related but not the same thing

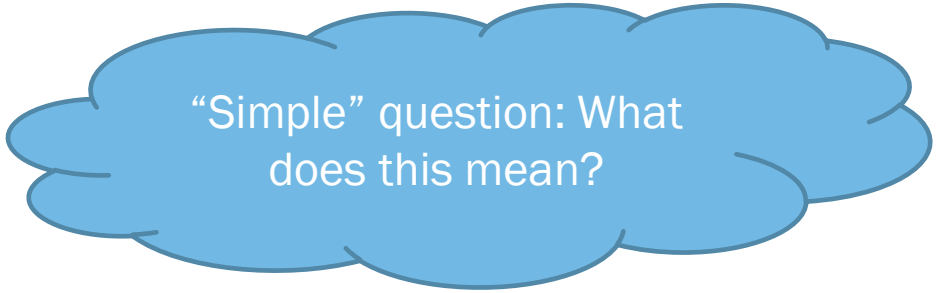
At 10:30AM 3/21/2021 John’s body temperature was 101.5 degrees Fahrenheit

But you can’t understand the data without the real-world concept and you can’t communicate the concept without data

AND IT GETS WORSE

- People and healthcare situations are extremely dynamic, change and time is critical – many data schema and ontologies do not handle time well
- Evidence is indirect, often assumed based on complex measurements
- Critical decisions have to be made on incomplete and sometimes contradictory information
- Context is critical

MDMI DEPENDS ON CONSISTENT AND UNIQUE MEANING



MDMI Business Element

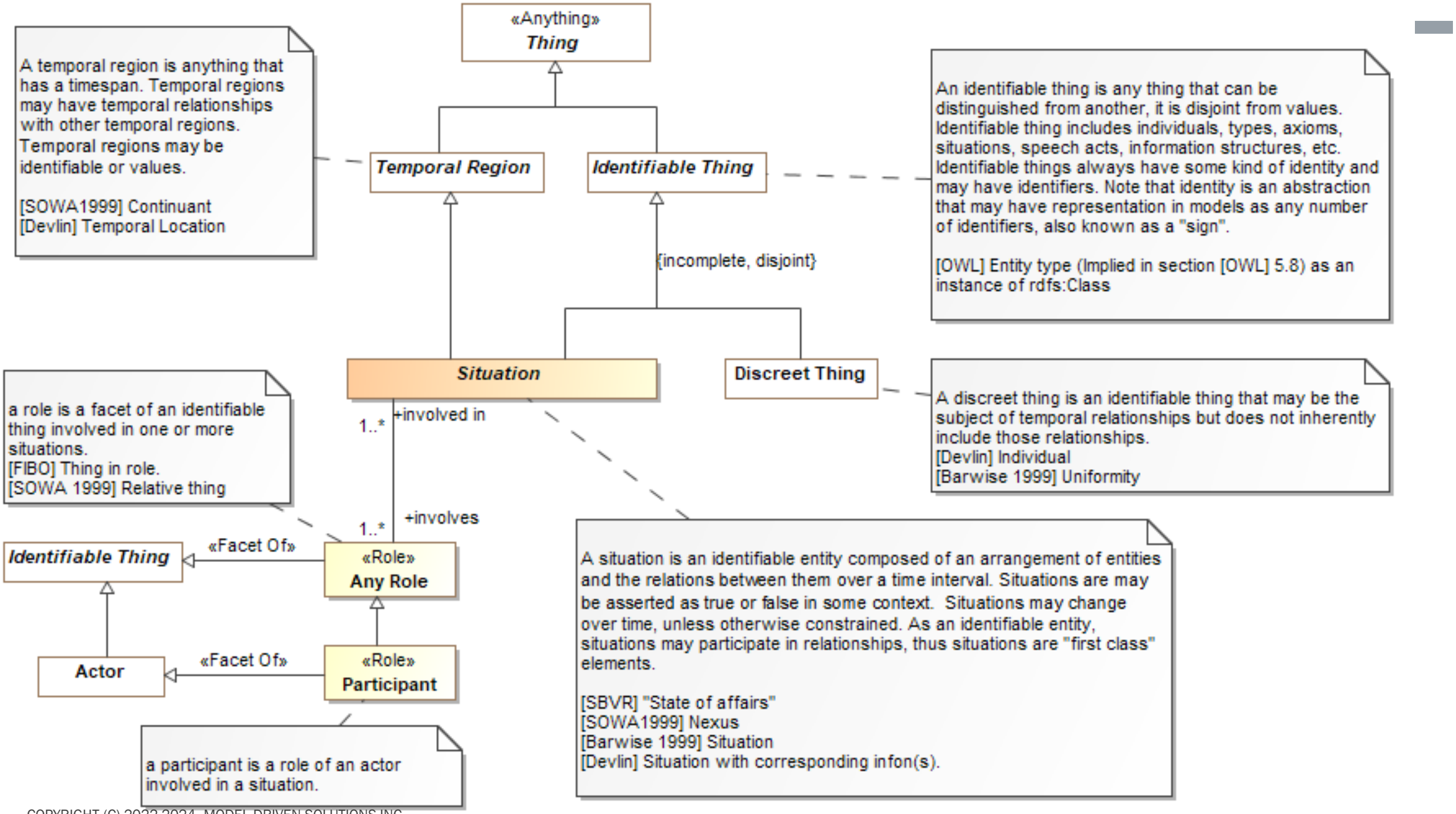
```
<componentOf>
    <encompassingEncounter>
        <id extension="11946852" root="2.16.840.1.113883.19"/>
        <effectiveTime value="20160825"/>
        <encounterParticipant typeCode="ATND">
            <assignedEntity>
                <id extension="1518349638" root="2.16.840.1.113883.4.6"/>
                <code code="207Q00000X" codeSystem="2.16.840.1.113883.6.101"
```

APPROACH TO SOLUTION

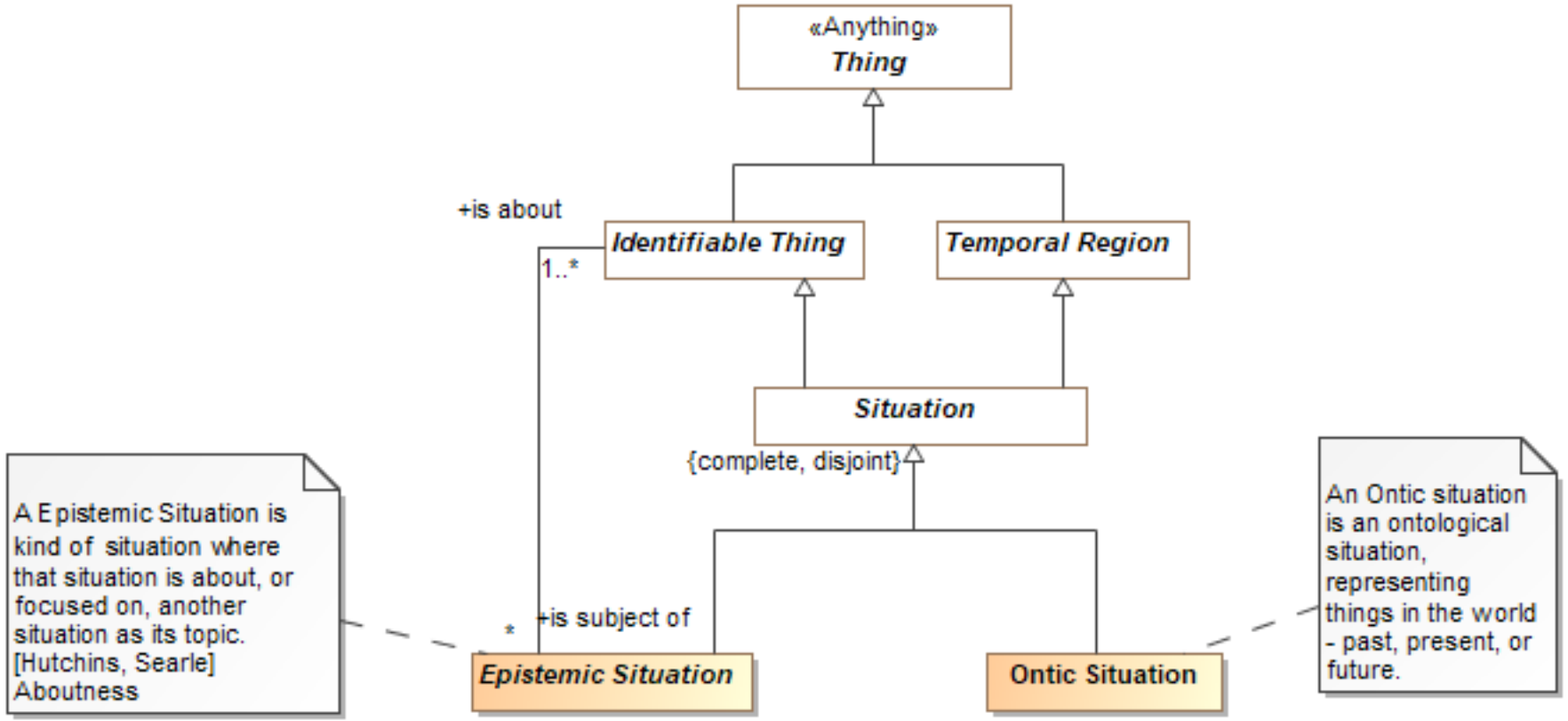
- Create a model encompassing both **Ontic** (about the “real world”) and **Epistemic** (About what we know, share and record)
  - Connect the record to what it is about
- Represent both based on **Situations** – conceptual groupings of related things and values over a time period
  - Situations can be as **granular** as John’s temperature or as large as the Corona-19 Virus
  - Situation semantics has a long history, pioneered by Jon Barwise and John Perry in the early 1980s
  - Provide the basis for **context**
- **Roles** things play V.s the things playing the roles
  - Understanding how the same thing may have different characteristics and relationships in different roles
- **Leverage** detailed concepts in other vocabularies, code lists, and models
  - Provide a unifying framework without trying to model all of biology and healthcare
- Provide a **general framework** which is then specialized to **clinical healthcare**

WHAT ARE SITUATIONS?

Situation	Not a situation
A cup falling off of a table	A cup
The Novel Corona Pandemic	Covid-19
The lifetime of George Washington	George Washington
The height of a person (or any other physical characteristic) at a particular time.	6 feet
The change of a person's temperature over a timeframe (or any other change)	2 Degrees per hour
Sue's obligation for a person to pay for a medical service	The general concept of a medical service
John's healthcare appointment at 2PM	John

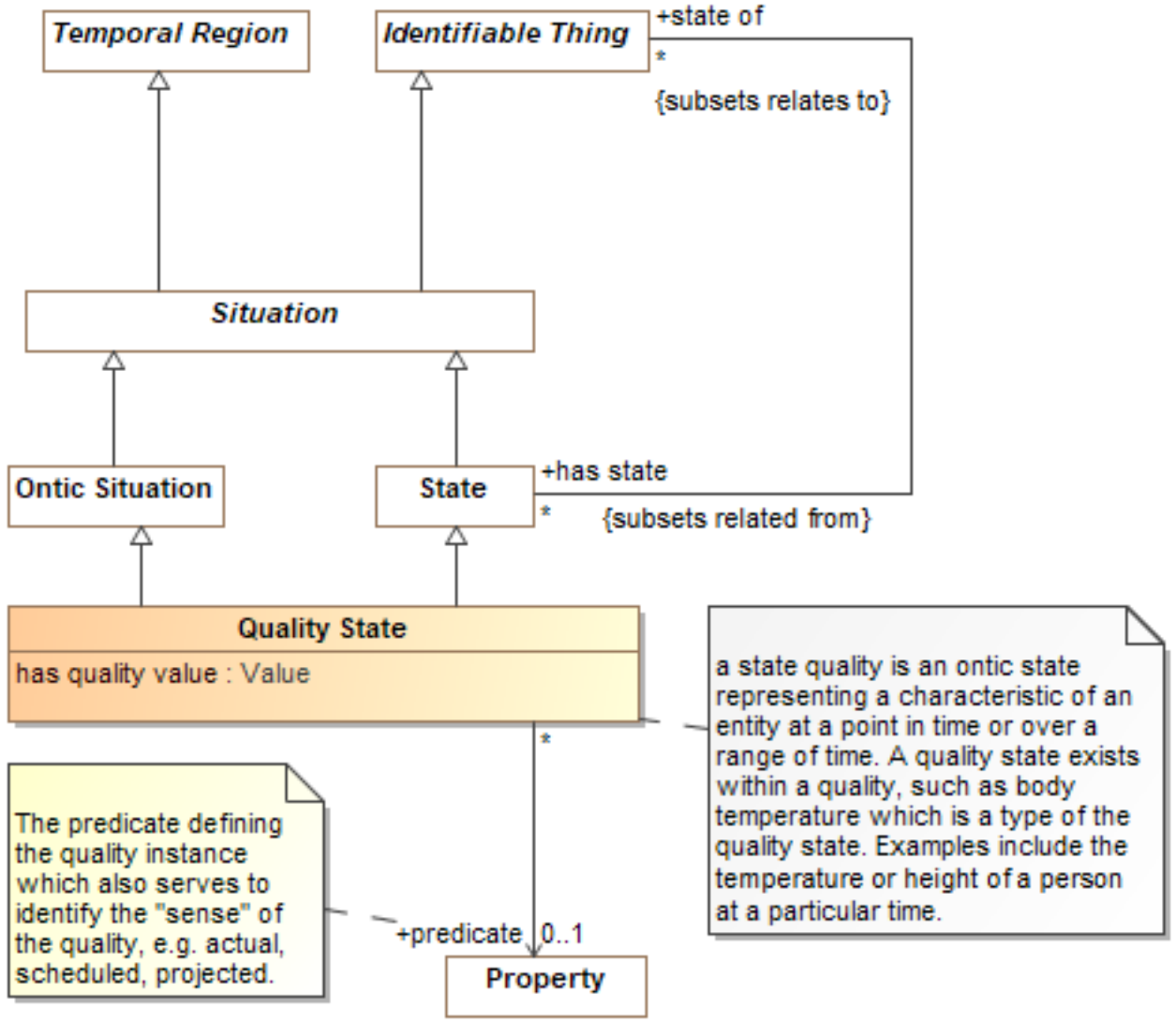


THE “ONTIC” / “EPISTEMIC PARTITION

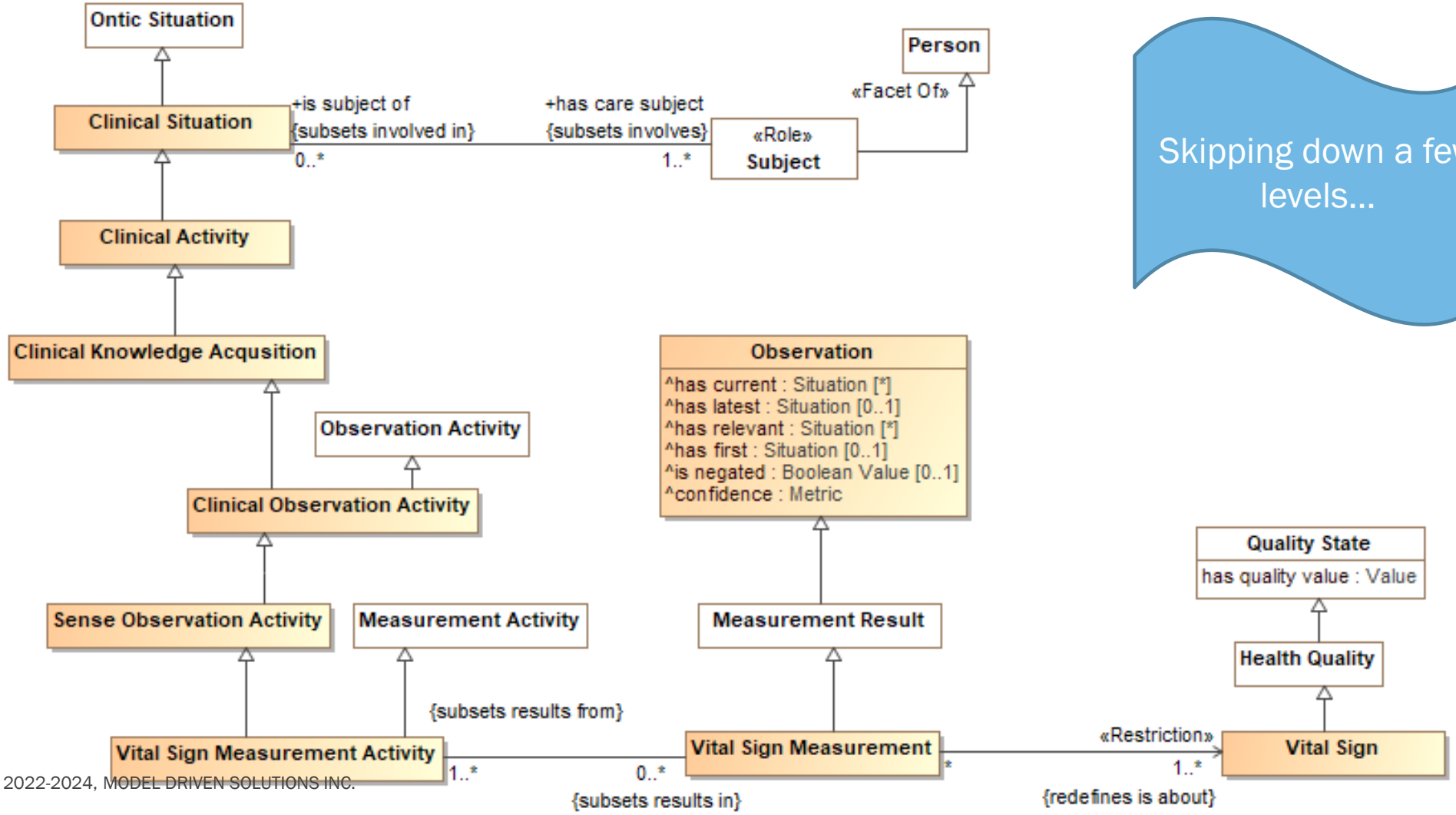


QUALITIES

- The most “atomic” situation is a “quality” of something over a timeframe
- Think of qualities as temporal attributes, like body temperature, that changes over time for a particular individual

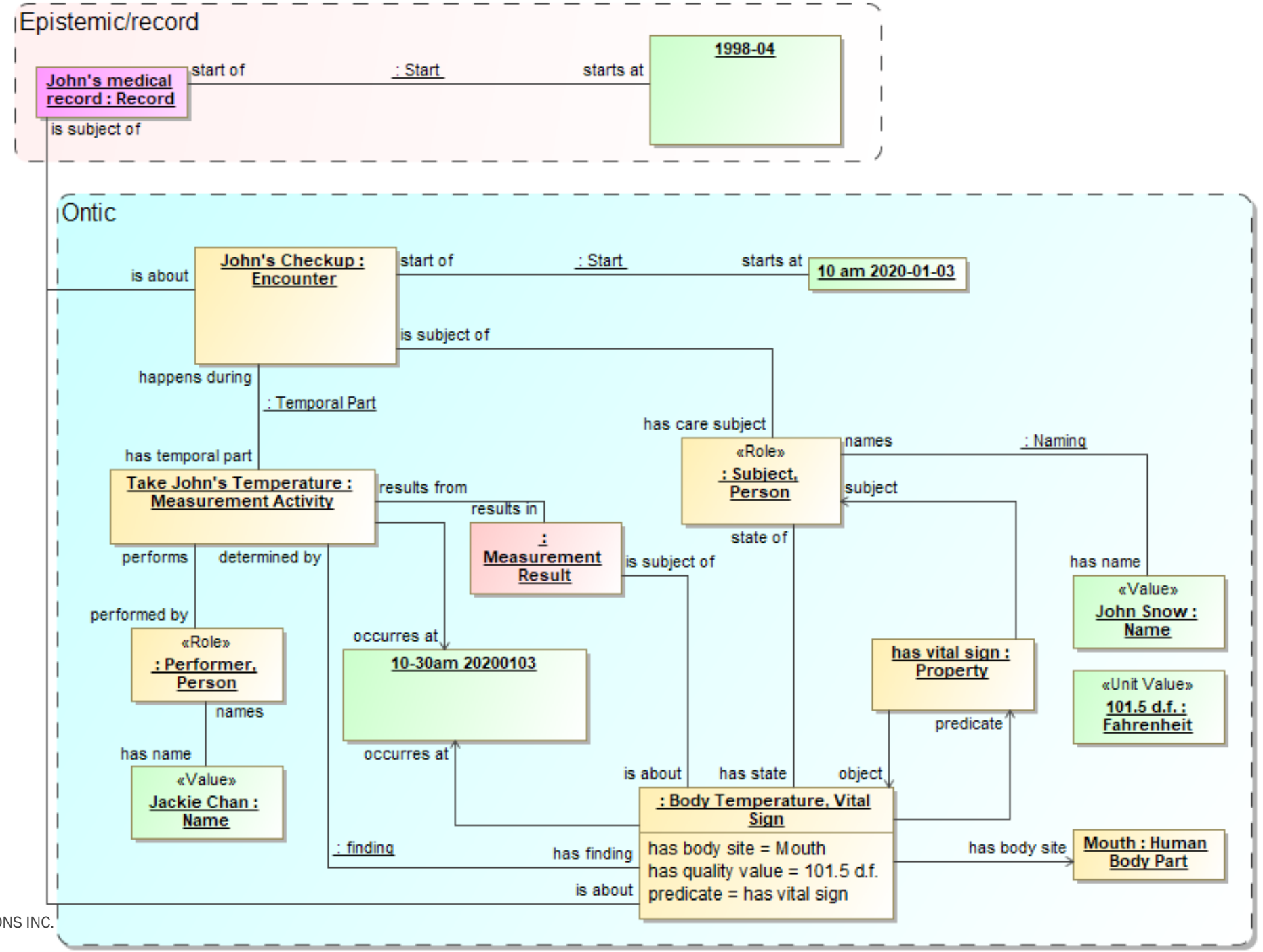


LINKING TO DOMAIN CONCEPTS



Skipping down a few levels…

AN INSTANCE EXAMPLE

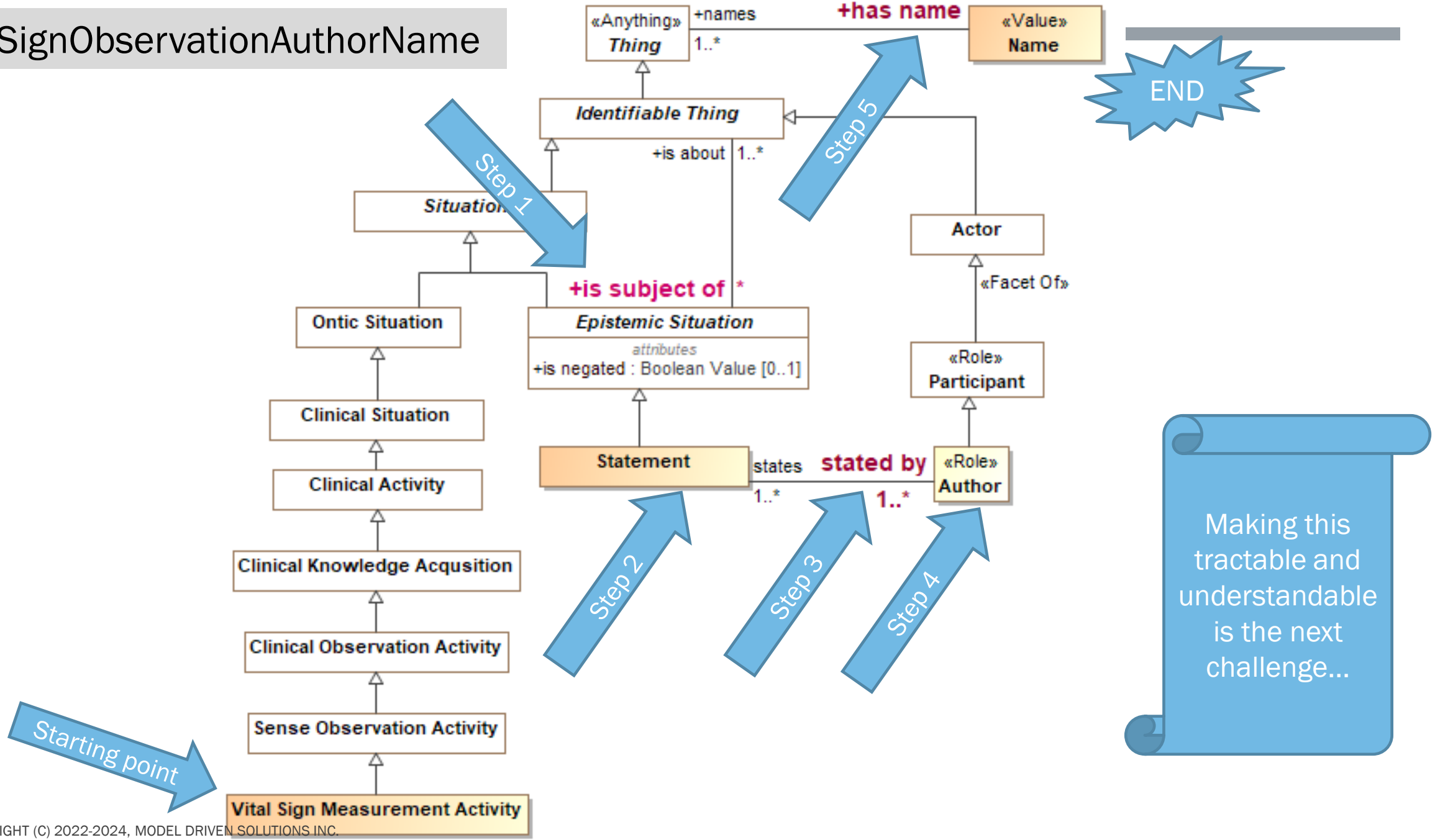


MDMI* BUSINESS ELEMENTS ARE DEFINED BY A “PATH” THROUGH THE MODEL

- MDMI uses the model as a reference for meaning, not to enable inference of actual data.
- Given a starting point, a class in the model, a “path” through that model, including relationships and constraints, ends in a particular value
- That path fully and uniquely defines a business elements meaning
- A path is like an OWL property chain, but the “chain” may be constrained at each “hop” constrained based on types and restrictions
- Lets look at: VitalSignObservationAuthorName

* MDMI: Model Driven Message Interchange, an OMG standard.

VitalSignObservationAuthorName



EXPERIMENTAL TOOLING

"Flattens" the model to enable following and restricting paths

Starting point

Step 1

Definition

Vital Sign Measurement Activity

Structured English Definition

Vital Sign Measurement Activity is a Entity specializing Sense Observation Activity
- defined in Clinical Situation

as topic Vital Sign Measurement Activity

- has finding any number of [Health Quality, Goal, Course Of Action, or Clinical Situation]
- has finding (Measurement Activity) any number of [Health Quality]
- has finding (Vital Sign Measurement Activity) any number of Vital Sign
- results in any number of [Vital Sign Measurement, Inferred Value, Diagnosis, Risk Assessement, Clinical Exclusion, Clinical Opinion, or Recomendation]
- results in (Measurement Activity) any number of [Vital Sign Measurement]
- results in (Vital Sign Measurement Activity) any number of Vital Sign Measurement

as topic Clinical Situation

- as basis for any number of [Vital Sign Measurement, Inferred Value, Diagnosis, Risk Assessement, Clinical Exclusion, Clinical Opinion, or Recomendation]
- determined by any number of [Vital Sign Measurement Activity, Clinical Observation Activity, Value Inference, or Clinical Knowledge Acqusition]
- exhibits facet any number of [Category Type, Phase Type, or Situation Use]
- finish of any number of Temporal Region
- finishes at at most one Temporal Region
- happens during any number of Temporal Region
- has care subject any number of Subject
- has current any number of Situation
- has duration one Duration
- has first at most one Situation
- has latest at most one Situation
- has name any number of [Person Name, or Term]
- has part any number of Identifiable Thing
- has preferred at most one Identifier
- has relevant any number of Situation
- has state any number of State
- has temporal part any number of Temporal Region
- has type any number of Type
- has type (Process) any number of [Composite Process, When, or Inference Rule]
- has type reference any number of External Type Reference
- identified by any number of Identifier
- involves any number of [Performer, Author, Listener, Subject, Specimen, or Adverse Situation]
- is after any number of Temporal Region
- is before any number of Temporal Region
- is part of any number of Identifiable Thing
- is subject of any number of Epistemic Situation
- is subject of (Activity) any number of Approval
- is subject of (Situation) any number of [Vital Sign Measurement, Inferred Value, Diagnosis, Risk Assessement, Clinical Exclusion, Clinical Opinion, or Recomendation]