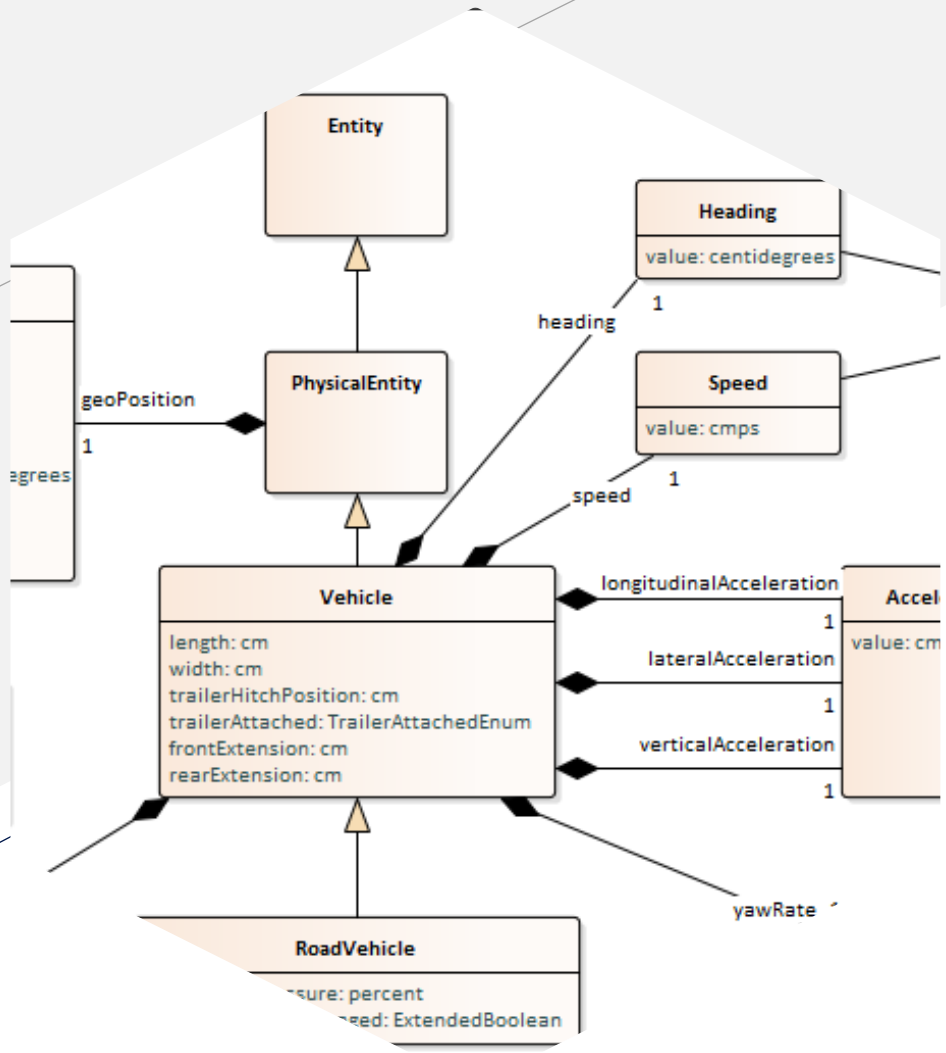


Information View

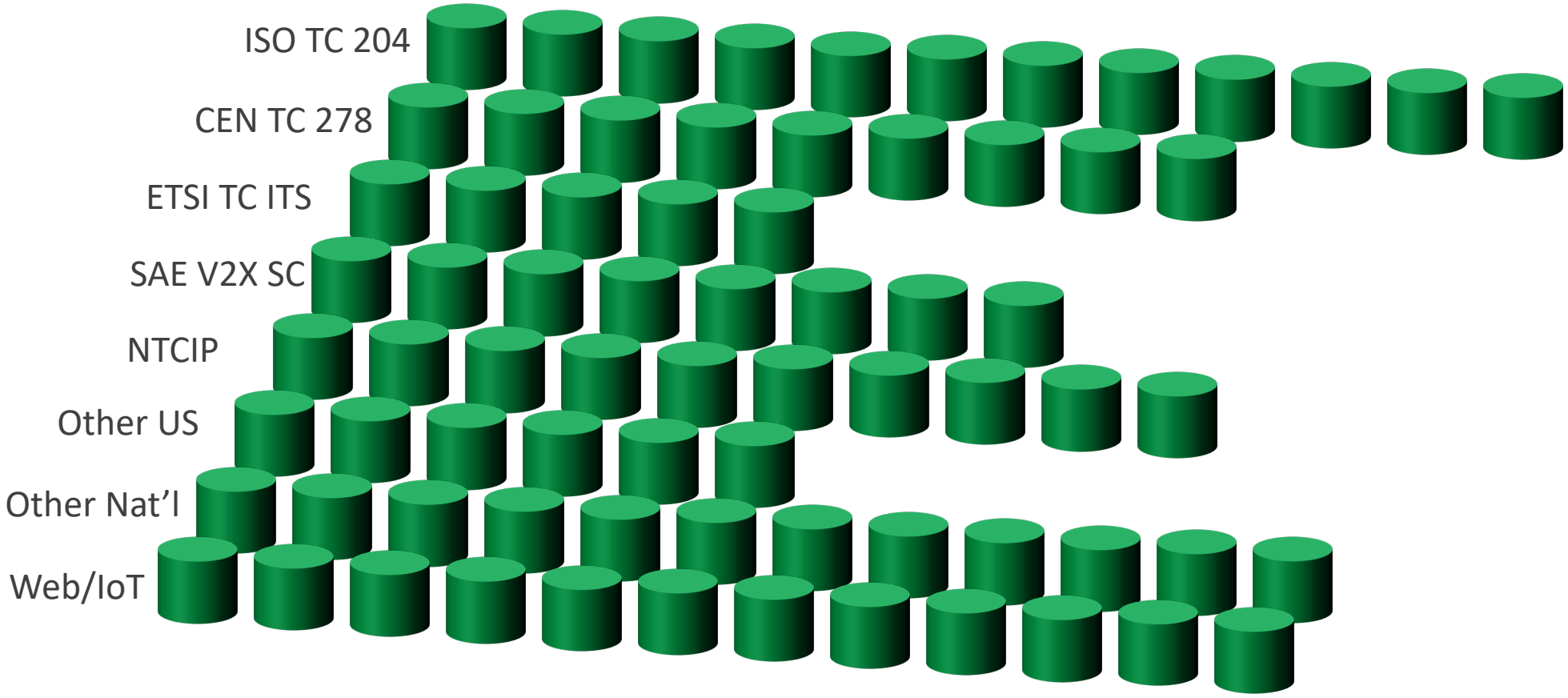
Ken Vaughn

ISO/TC 204/WG 1 Convenor

Presented to W3C Automotive

23 March 2020

A tendency for silos



Generally, physical data models

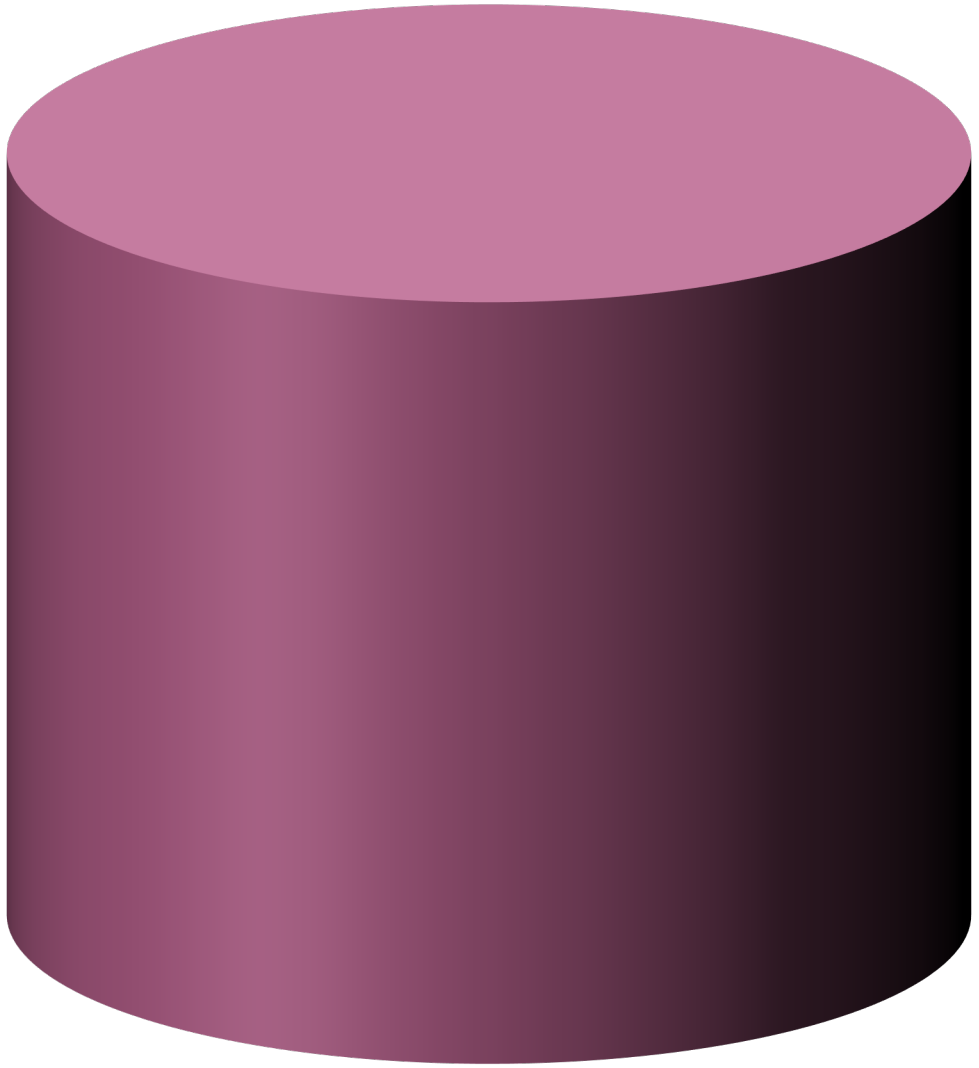
ITS is part of larger ecosystem

List is not intended to be all-inclusive or to identify a precise structure

- IoT
  - Smart Cities
    - Transport
      - **ITS**
      - Air travel
      - Maritime
      - Space travel
    - Power Grid
    - City services
    - Emergency services
  - Industrial Internet of Things (IIoT)
    - Energy
    - Manufacturing
  - Consumer IoT
    - Wearables
    - Home Automation

What is needed

IoT Logical
Data Model



A long-term, theoretical goal

How do we get there?

One piece at a time

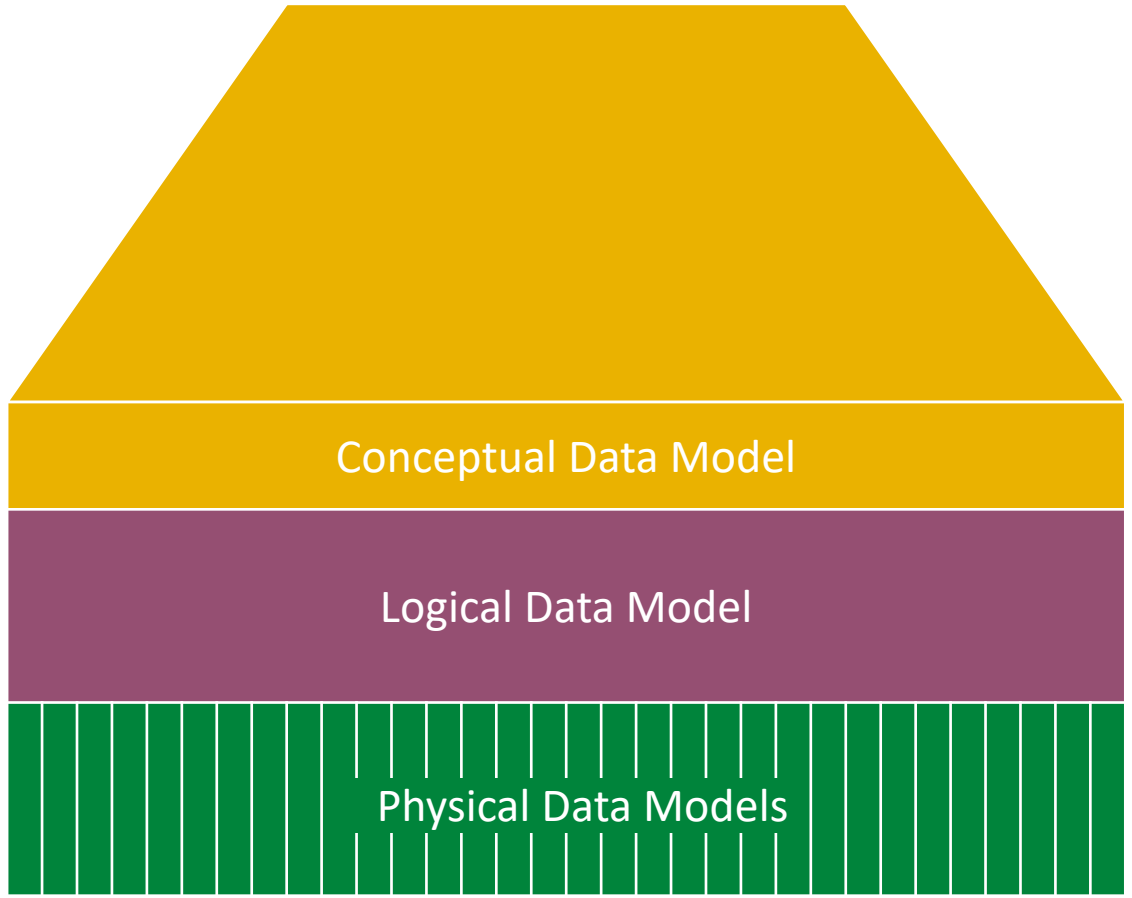
Three major components

- Framework: How do various models and views fit together
- Conventions: What modelling rules are used
- Governance: How do we reach consensus across such a diverse group

Framework

ITS Data Model Framework

Long-term integration requires top-down



Formal vocabulary

Platform-generic data model

Interface standard data model

Business pressures dictate bottom-up

Physical Data Model Goal

- Define data aspects of an interoperable interface
  - Usually for a specific purpose
- Defines
  - Data element semantics
  - Data element syntax
  - Data structure semantics
  - Data structure syntax, including representational form

Data Dictionaries

- Define semantics
  - Meaning of data
  - Some with explicit relationships among data
- Define syntax
  - Format of each piece of data
- Represent one segment of industry

Logical Data Model Goal

- Define the Rosetta Stone for translating among different formats
- Need to identify
  - Data
  - Relationships
  - Reference measurement units
- Does not require representational form

- Enables integration of data from different standards

Smart City Proposal

Based on input from ISO/IEC JTC1 WG 11

Core Components

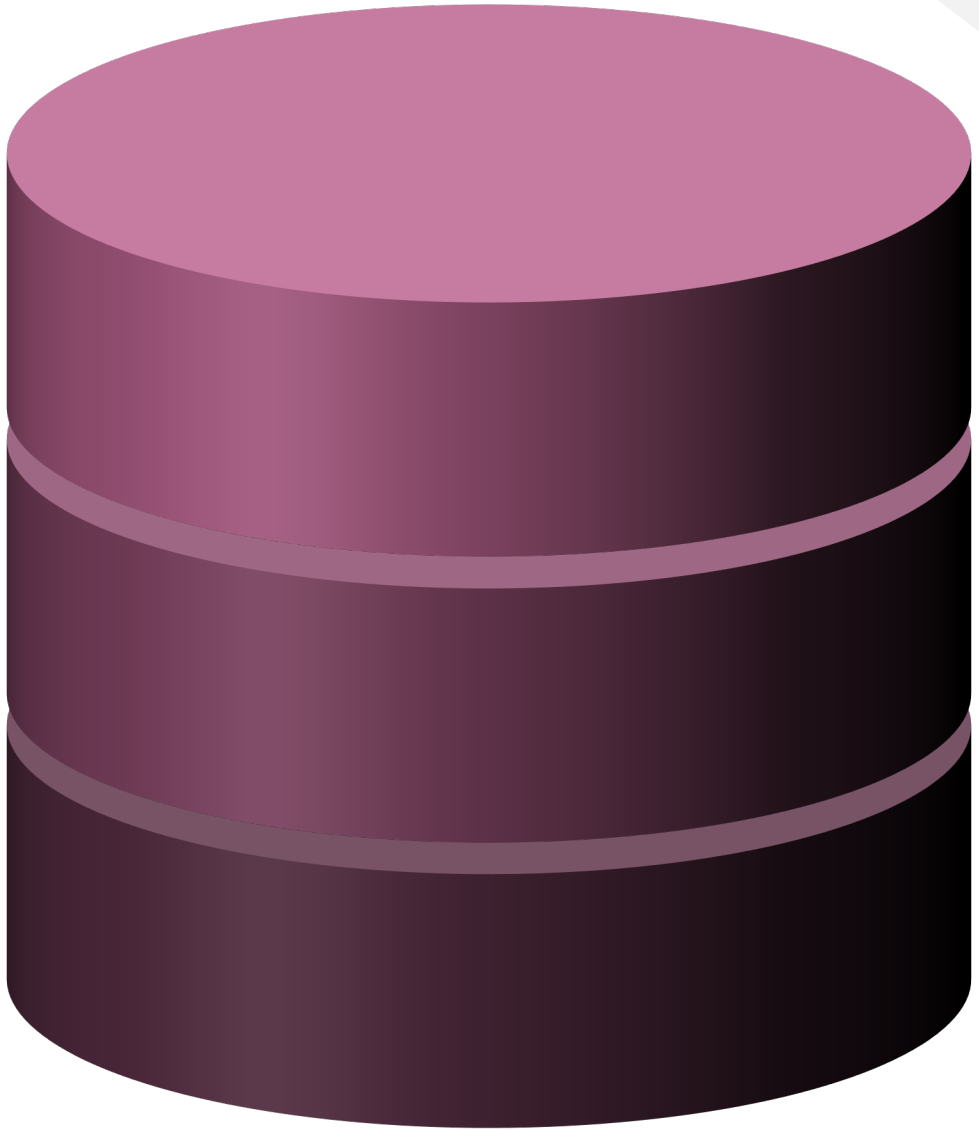
Most generalized entities and data types

Cooperative Components

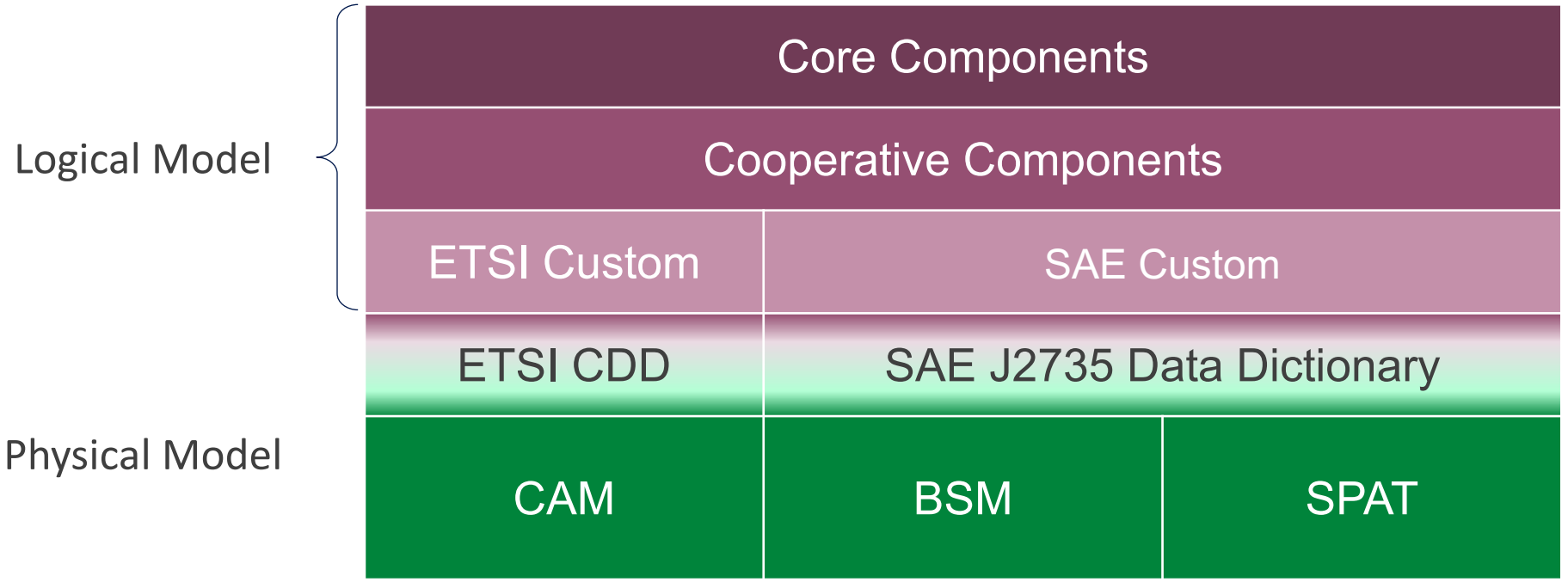
Data produced by multiple peer models

Custom Components

Data only produced within specific model

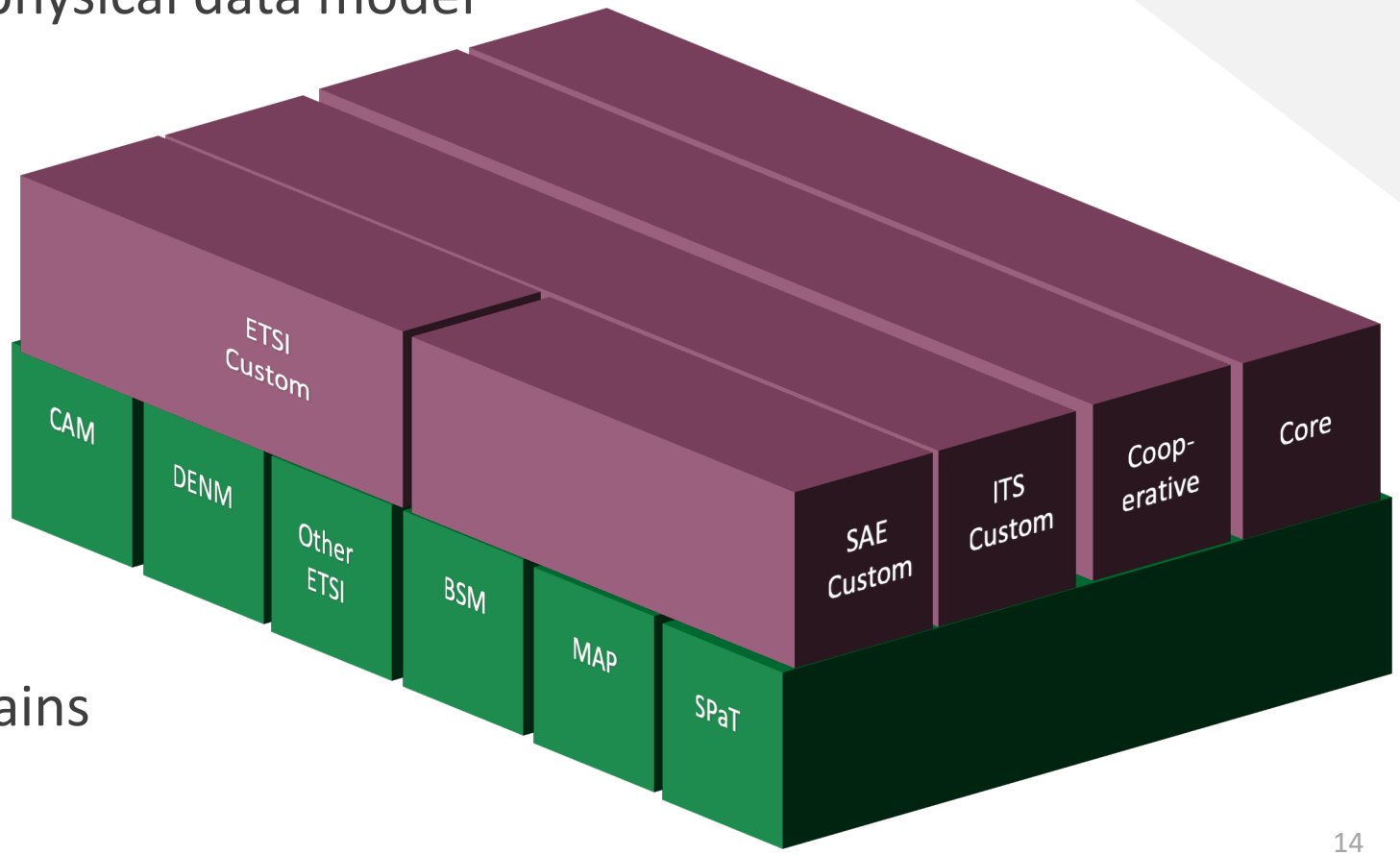


Applied to Our Example



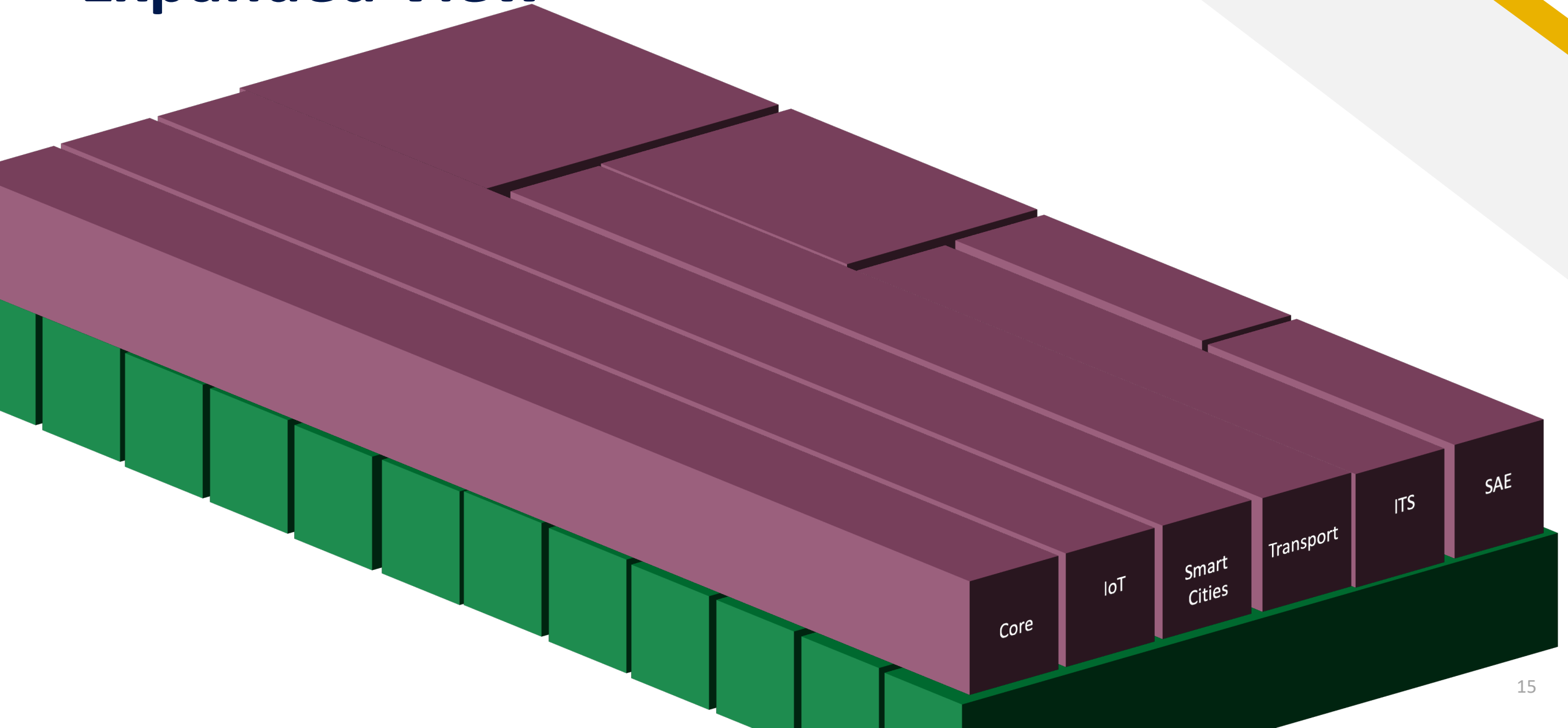
A 3-D View

- Each box represents a separate work product
- Interface specifications include a physical data model
  - Identifies all data for the interface
- Logical Data Models divided by logical topics
  - Traceability defined between physical and logical



- Location is used in many contexts and we need to share across domains

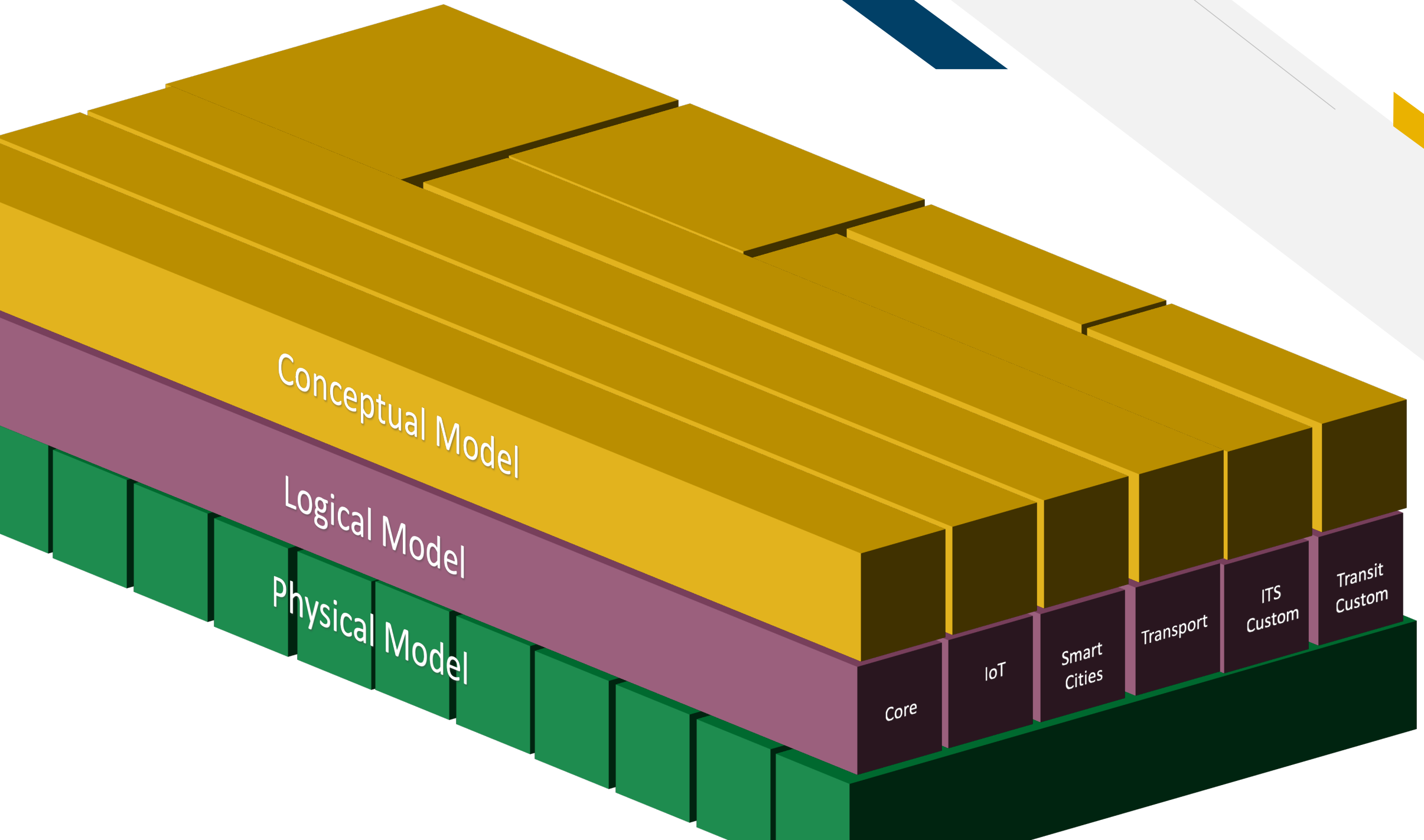
Expanded View



Conceptual Data Model Goal

- Define industry vocabulary
- Need to identify
  - Terminology
  - Relationships
- Does not require representational form or units

- Ensures consistent human understanding
- Enables machine learning


Conceptual Model
Logical Model
Physical Model
Core
IoT
Smart Cities
Transport
ITS Custom
Transit Custom

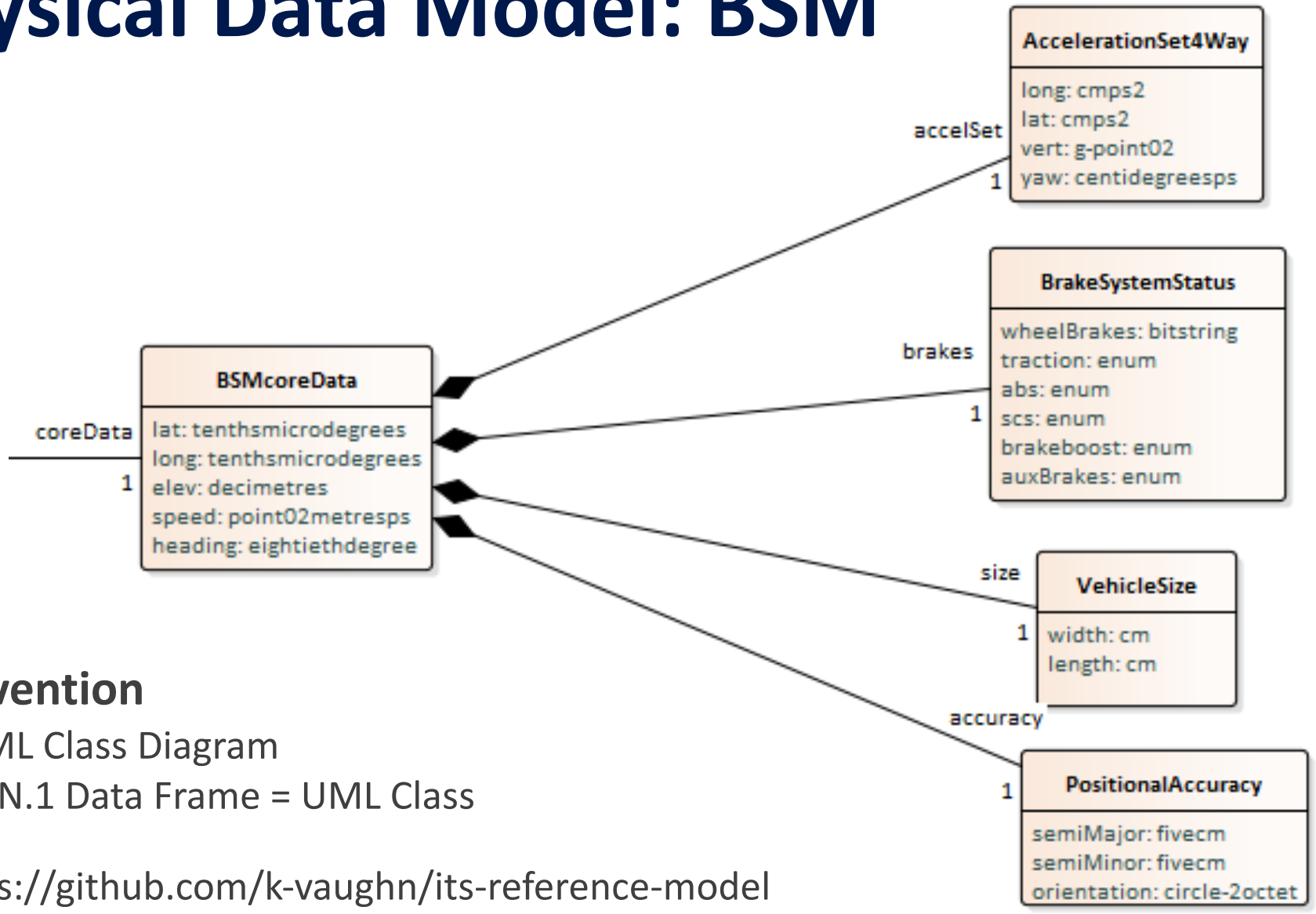
Conventions

Physical Data Model

Physical Data Model defines

- Semantics
  - Meaning of data
- Syntax
  - Format of each piece of data
  - Allowed structures of data (data frames and messages)

Physical Data Model: BSM



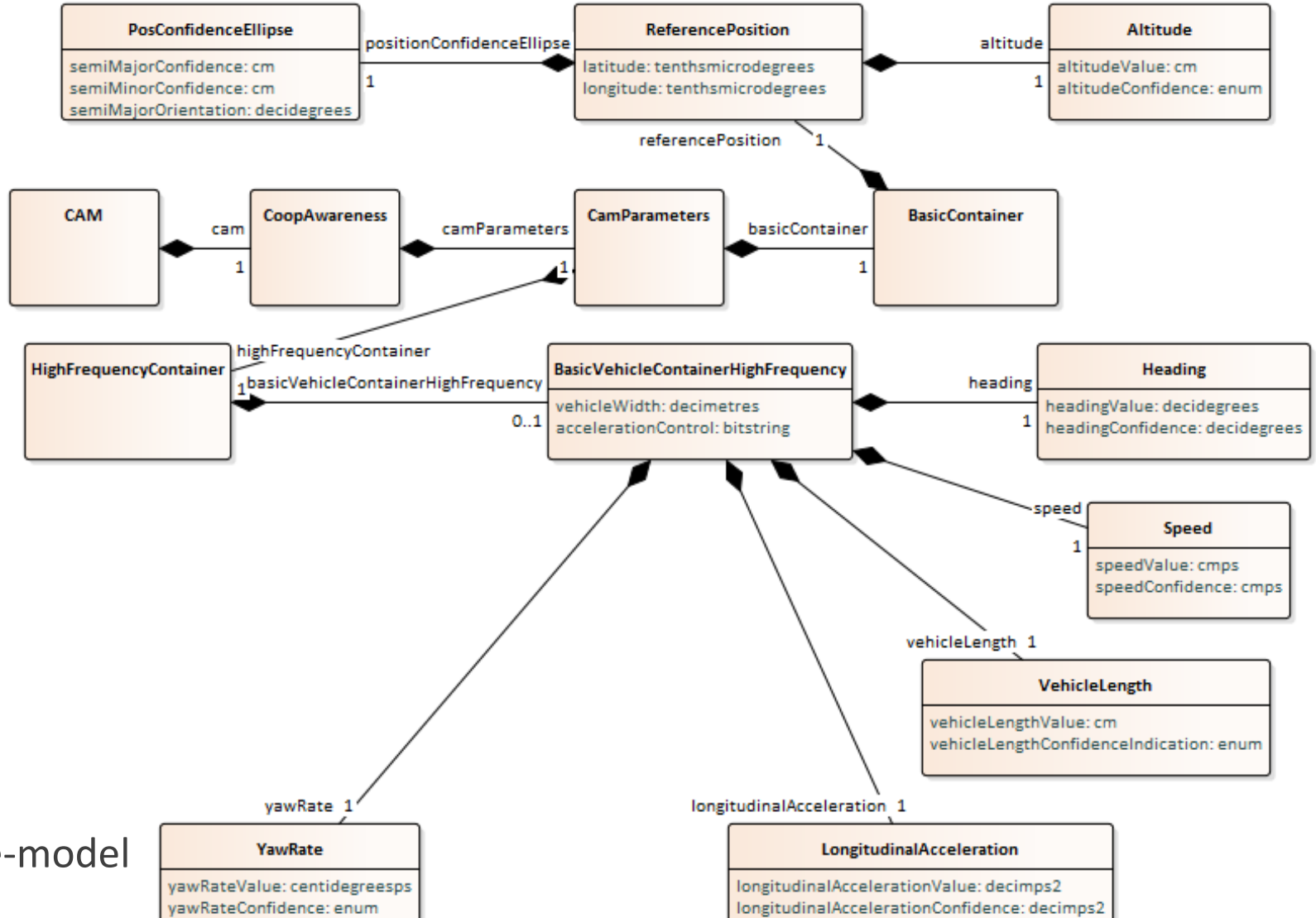
Convention

- UML Class Diagram
- ASN.1 Data Frame = UML Class

https://github.com/k-vaughn/its-reference-model

Physical Data Model : CAM

Different standards have different models



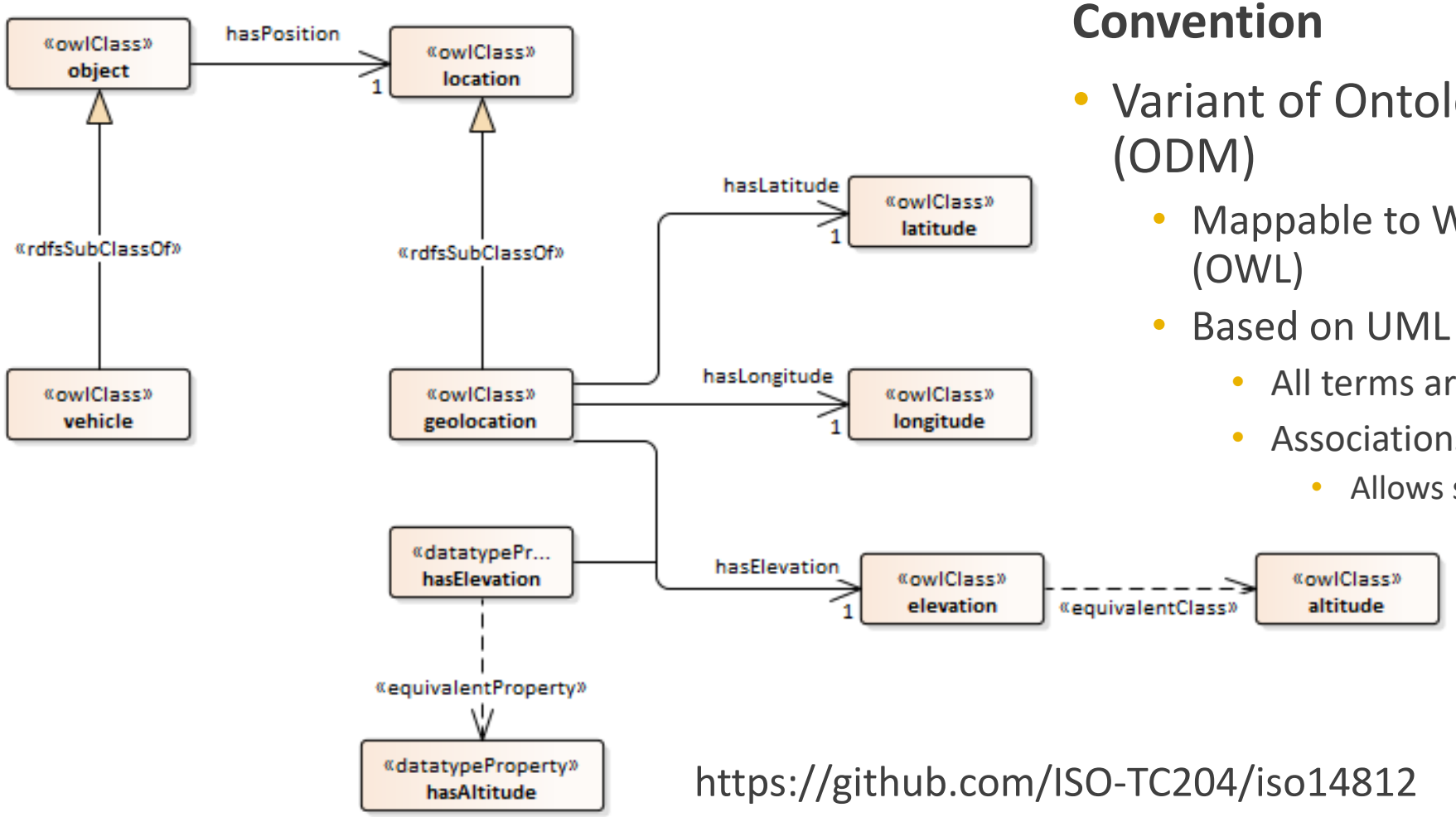
https://github.com/k-vaughn/its-reference-model

Conceptual Model

Conceptual Data Model defines

- Semantics
  - Meaning of data
  - Relationships among data (open)
    - Positive assertions
    - Negative assertions
    - Cardinality rules
  - Context of data
- No syntactical information
  - No units
  - No structures
    - Identifies data that could logically exist

Conceptual Model



Convention

- Variant of Ontology Definition Model (ODM)
  - Mappable to Web Ontology Language (OWL)
  - Based on UML Class Diagrams
    - All terms are classes
    - Associations also map to classes
      - Allows subtyping among associations

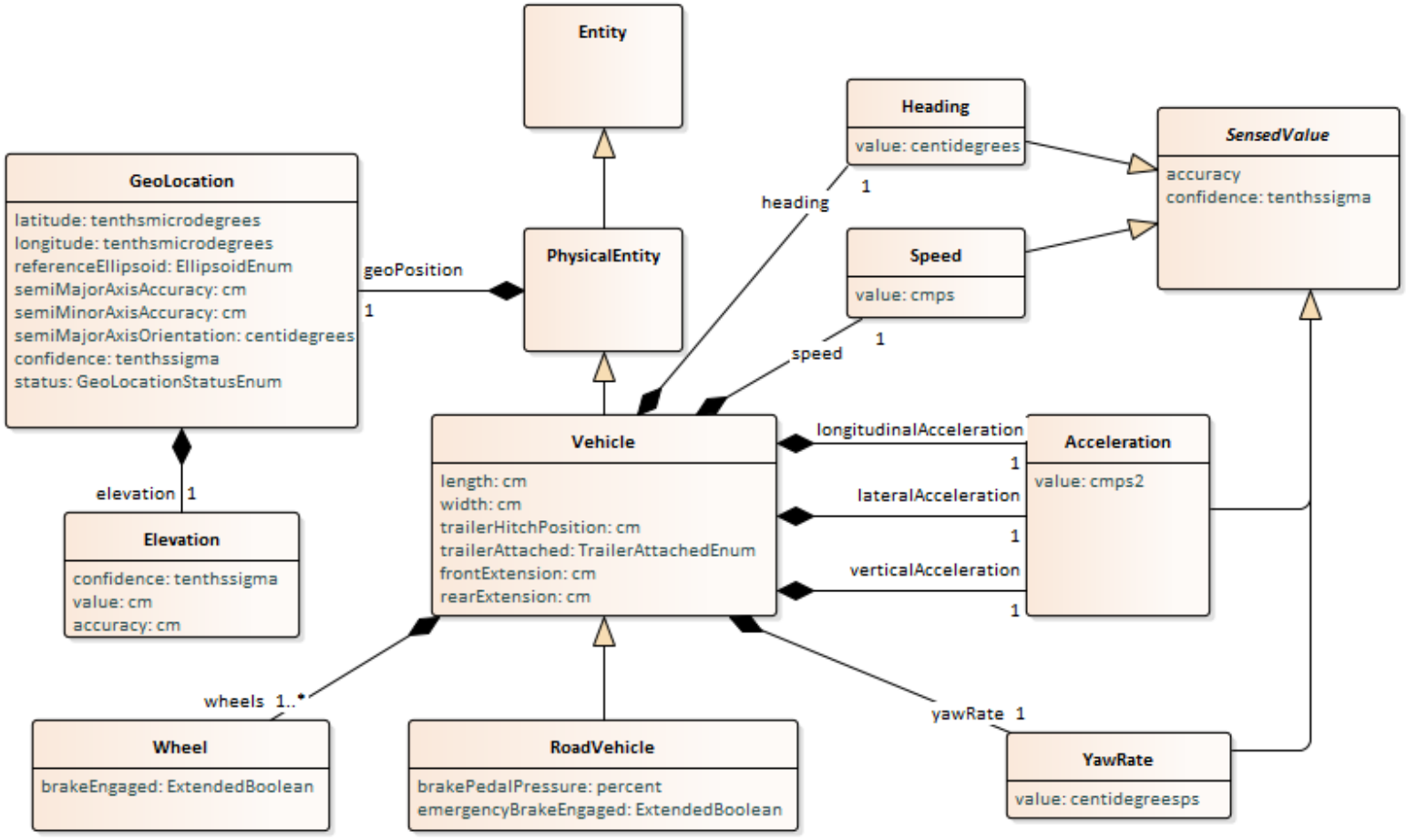
https://github.com/ISO-TC204/iso14812

Logical Data Model

Logical Data Model defines

- Semantics
  - Meaning of data
  - Relationships among data (closed)
    - Positive assertions
    - Cardinality rules
  - Context of data
- Default syntactical information
  - Default units of measure
  - No structures
  - No representational form

Logical Data Model



Convention

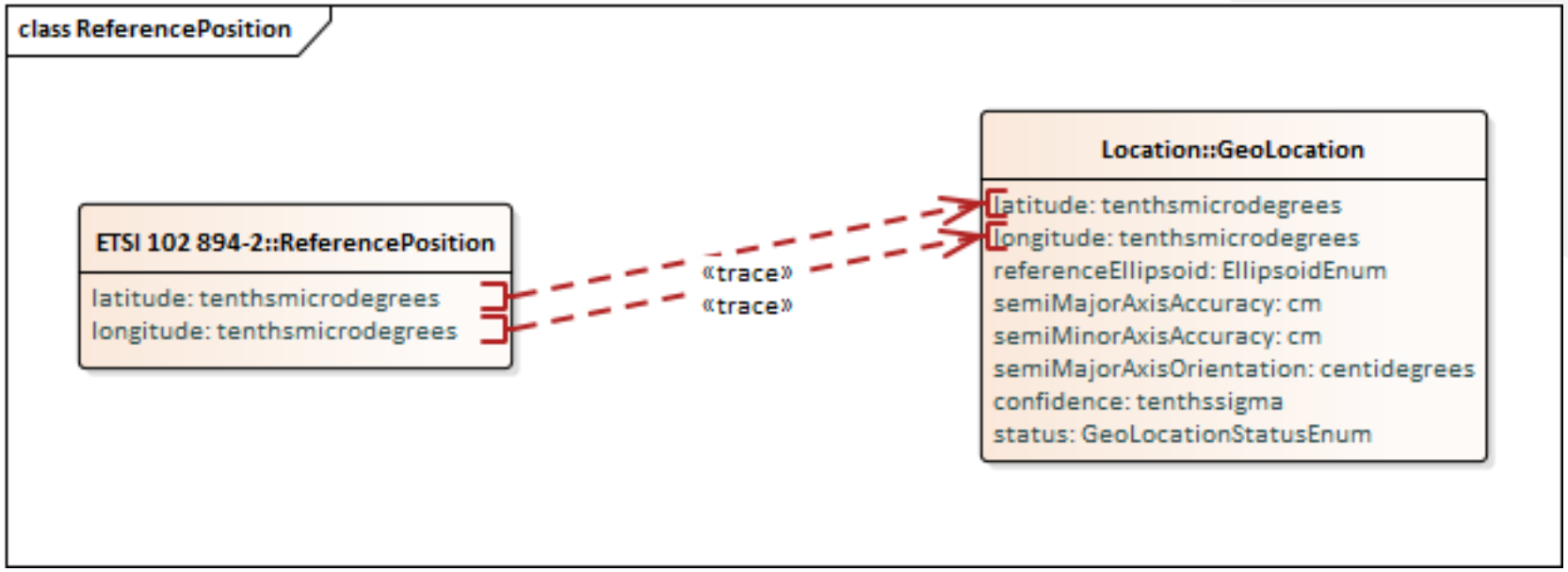
- UML Class Diagram
- Attributes shown with units
- Classes correspond with Conceptual Data Model classes

https://github.com/k-vaughn/its-reference-model

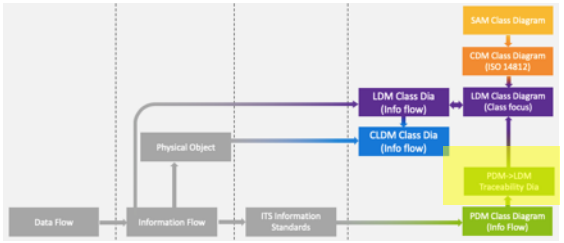
Traceability

Physical Model

- Traceability Focus

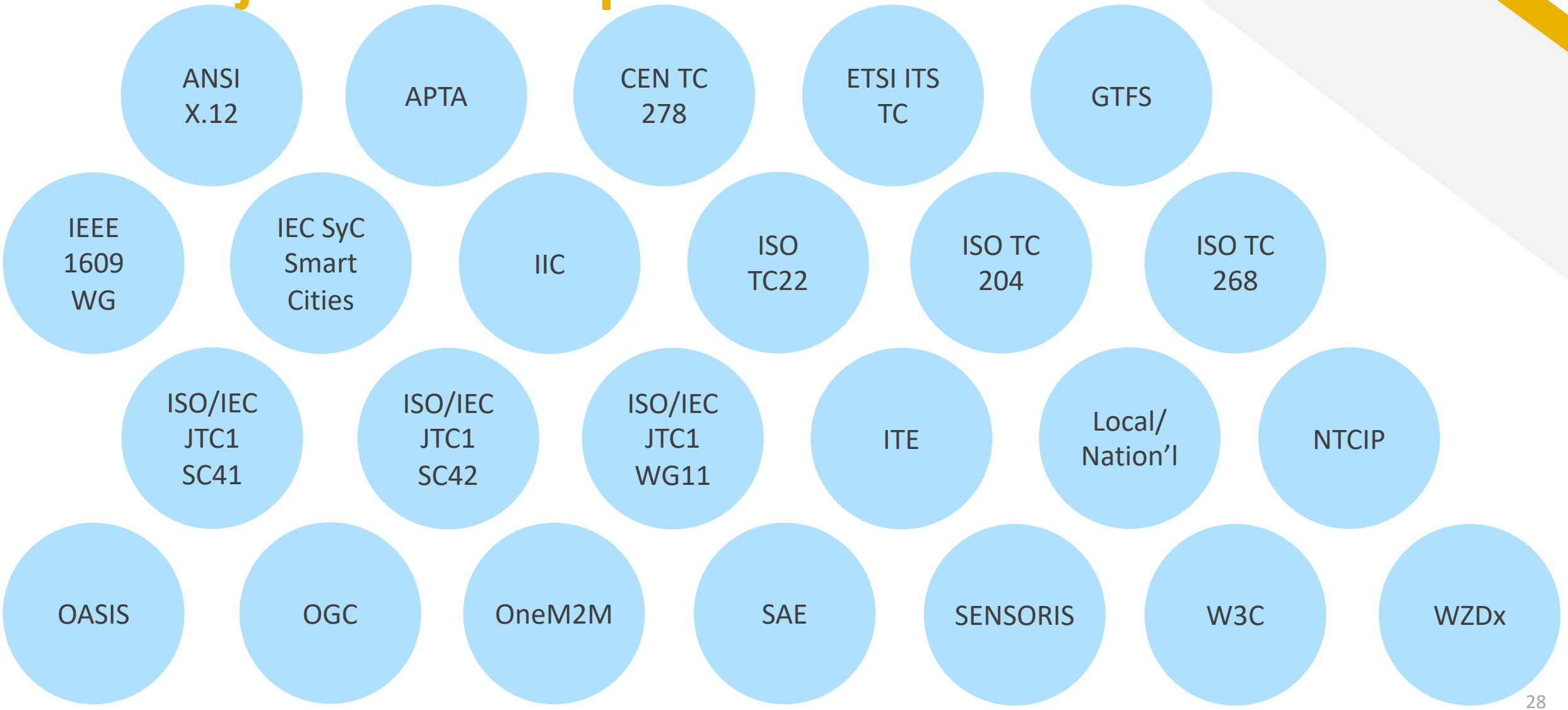


https://github.com/k-vaughn/its-reference-model



Governance

An Expansive Coordination Effort just for Transport



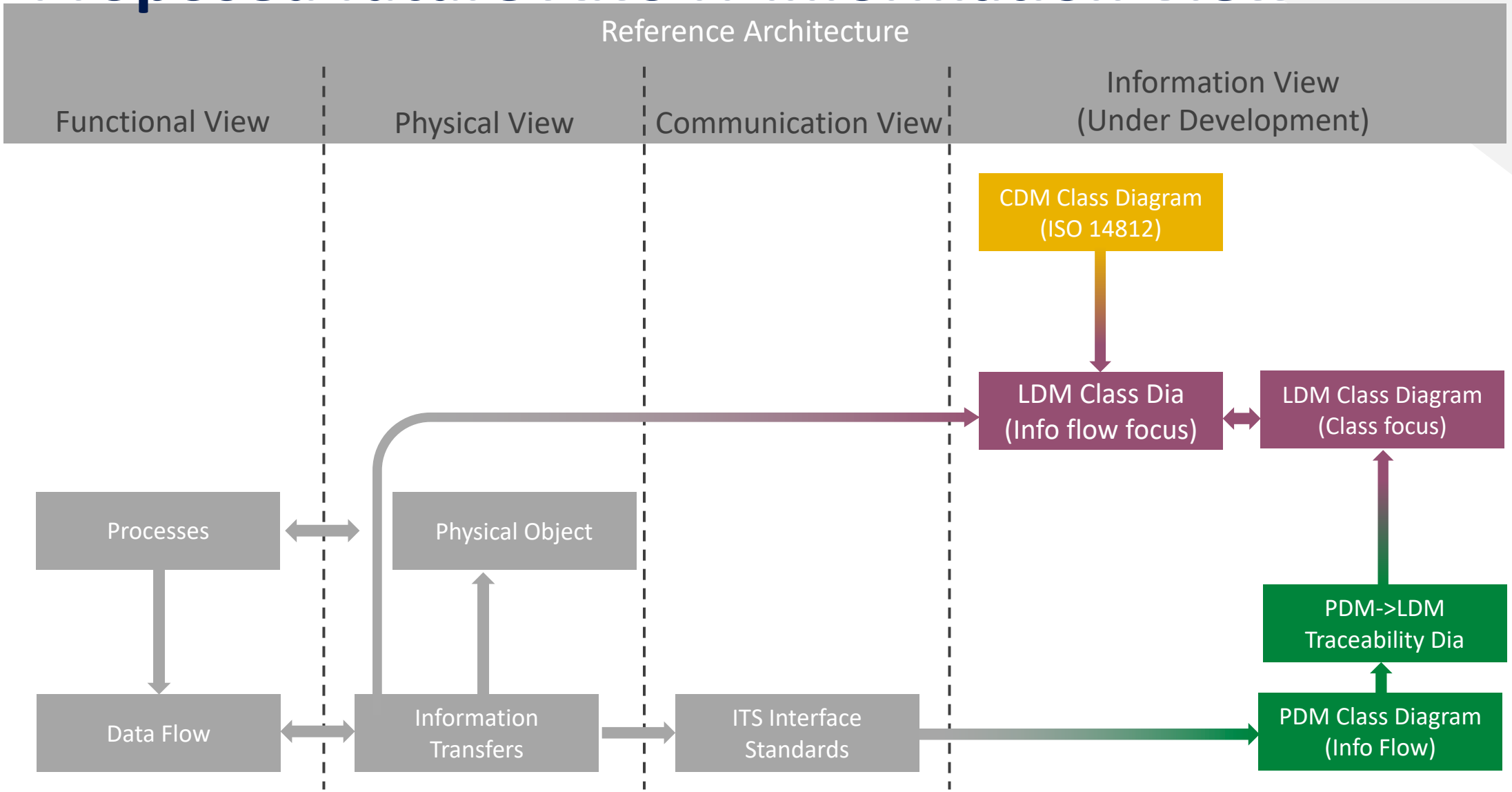
Not a typical ISO or joint standard

- Traditional liaison arrangements are not sufficient
- All stakeholders need to be able, in real-time and minimal red-tape, to
  - Identify currently approved model components
  - Identify previously approved models (e.g., to integrate with older system)
  - Identify proposals being considered
  - Be notified when changes of interest are suggested
  - Submit their own comments and proposals
  - Understand the model in relation to their service
- This will
  - Produce a sense of ownership
  - Encourage a self-sustaining community

Proposed approach

- ISO Innovation project for:
  - GitHub based solution
    - Free access
    - Version controlled
    - Development and approved branches
  - Might be integrated with a public forum service
    - GitHub's "Issue" feature does not provide hierarchical topics (Register for all comments or none)
    - Free access (to post and read)
    - Topic oriented
  - Link logical model diagrams to use cases
    - Model will link to/from companion models (e.g., ITS reference architecture)
    - Ensures an understanding of purpose of data

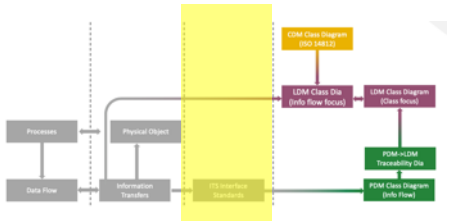
Proposed future ARC-IT Information View

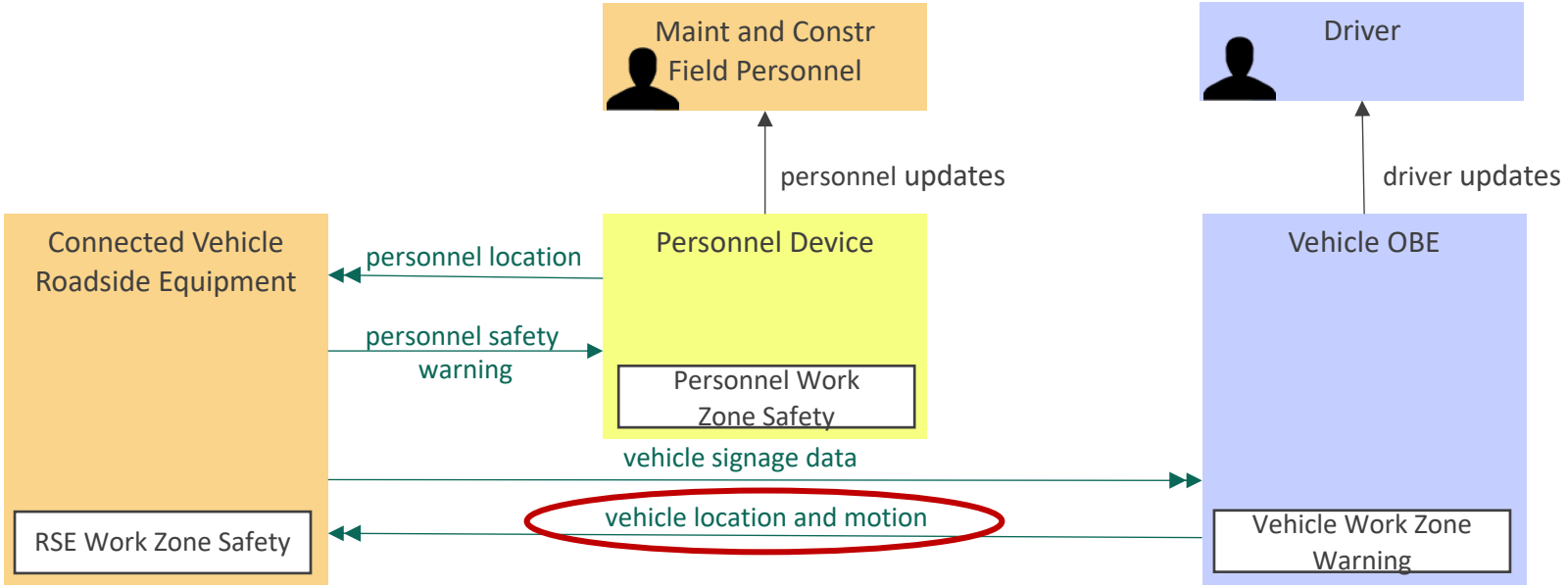


Example

- Will link information flows to information model
- Details are still being developed

Subset of service package for Work Zone Safety





Towards a Consistent Model

- Can’t delay current development efforts
- Move towards a consistent model for all stakeholders (i.e., layered approach)
- Readily accessible by all interested parties (i.e., no pay wall)
- Common sense of ownership (i.e., easy to provide input)
- Notifications when ***relevant*** changes are proposed (modularity)
- Version controlled, with ready access to older versions
- Need to finalize:
  - Framework
  - Conventions
  - Governance
- Defining common rules will allow:
  - Easier understanding, tracing, and integration among independent efforts
  - Common toolsets
  - Work towards a common goal

Next steps

- Continued outreach with
  - ISO/IEC JTC1 WG11 *Smart Cities*
  - ISO/IEC JTC1 SC41 *Internet of Things*
  - IEC SyC *Smart Cities*
  - Industrial Internet Consortium
  - World Wide Web Consortium (W3C)
  - SAE V2X Core TC
- Agree on general principles
  - Framework
  - Modelling conventions
  - Governance
- Submitted ISO Innovation Project
  - Initial focus on parking and curbside management
  - Other options exist if this is rejected
- Ideally, each group submits its data to the model

Discussion

- Thoughts on approach discussed

Thank You.

Ken Vaughn

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