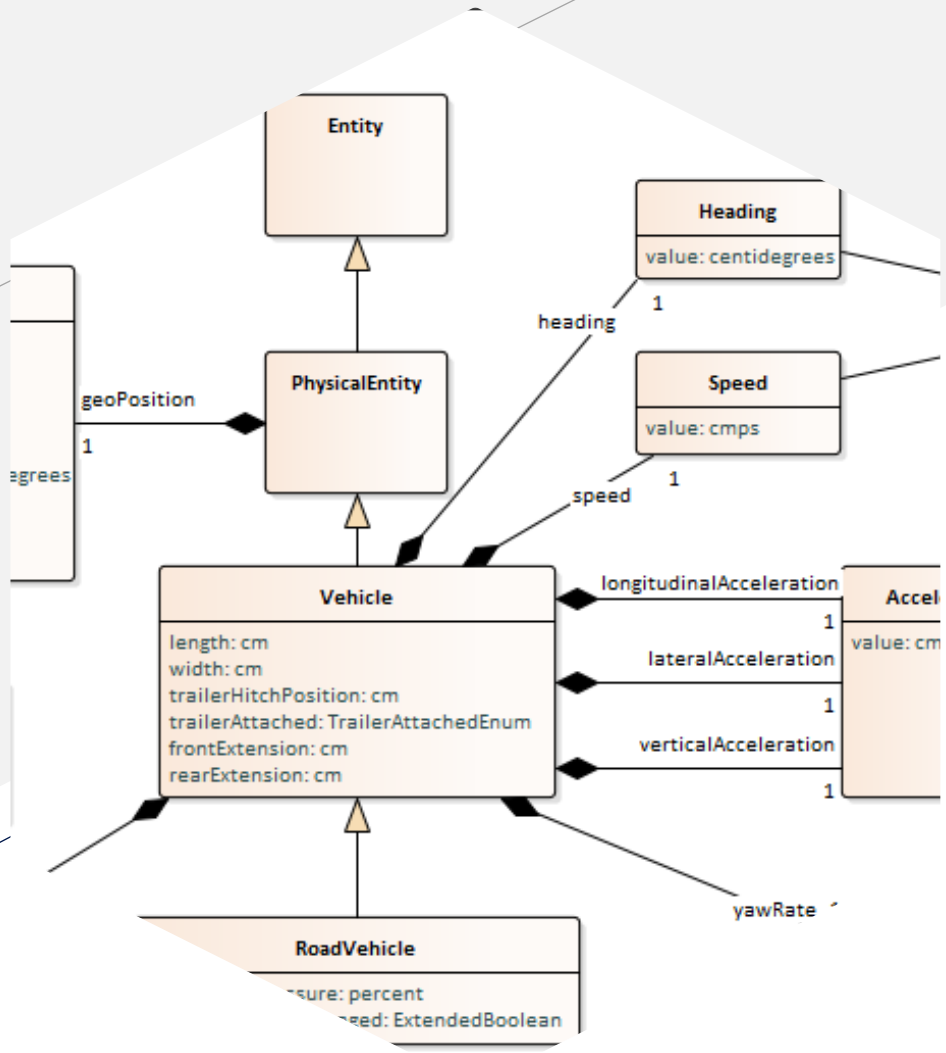


SDO Coordination

Ken Vaughn

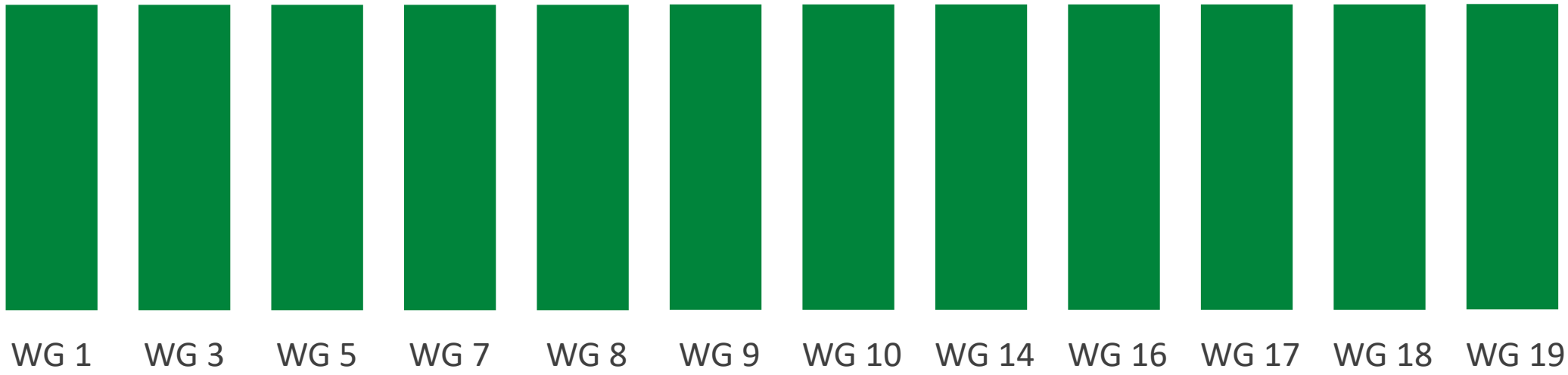
ISO/TC 204/WG 1 Convenor

14 Oct 2019

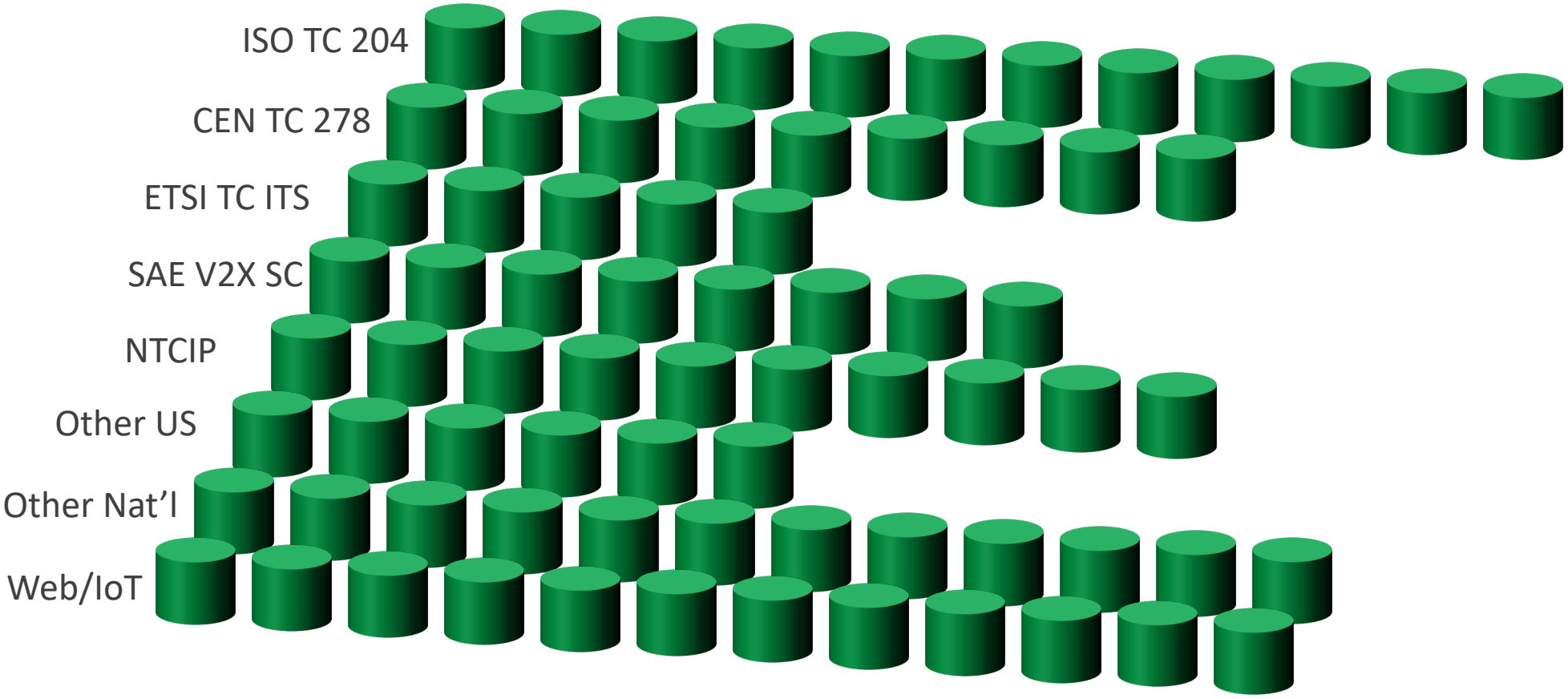
Data Principles

1. Data is an asset
2. Data should be shareable
3. Data should be accessible
4. Data definitions must be consistent
5. Data definitions must be precise
6. Data must be properly secured
7. Data design should leverage existing investments

A tendency for silos



Silos across SDOs as well



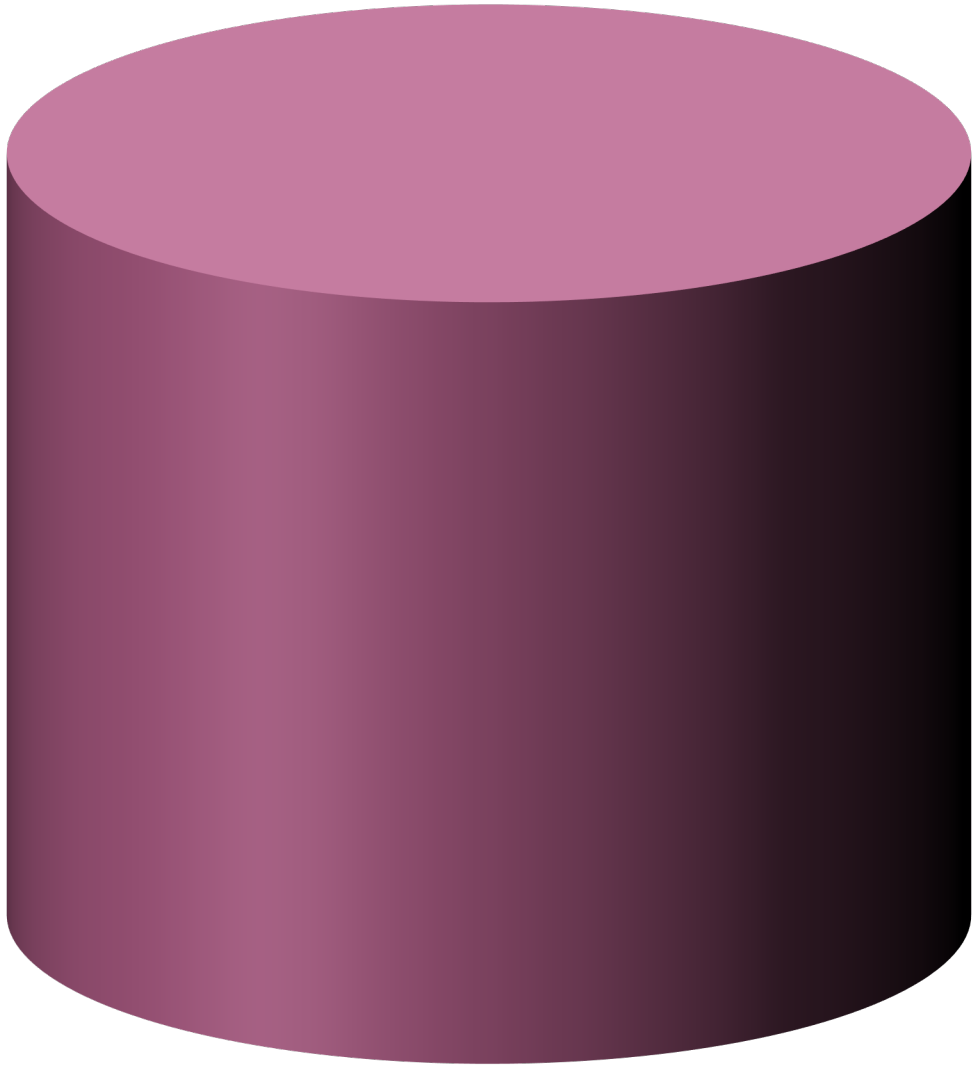
Generally, physical data models

Not limited to ITS

- 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

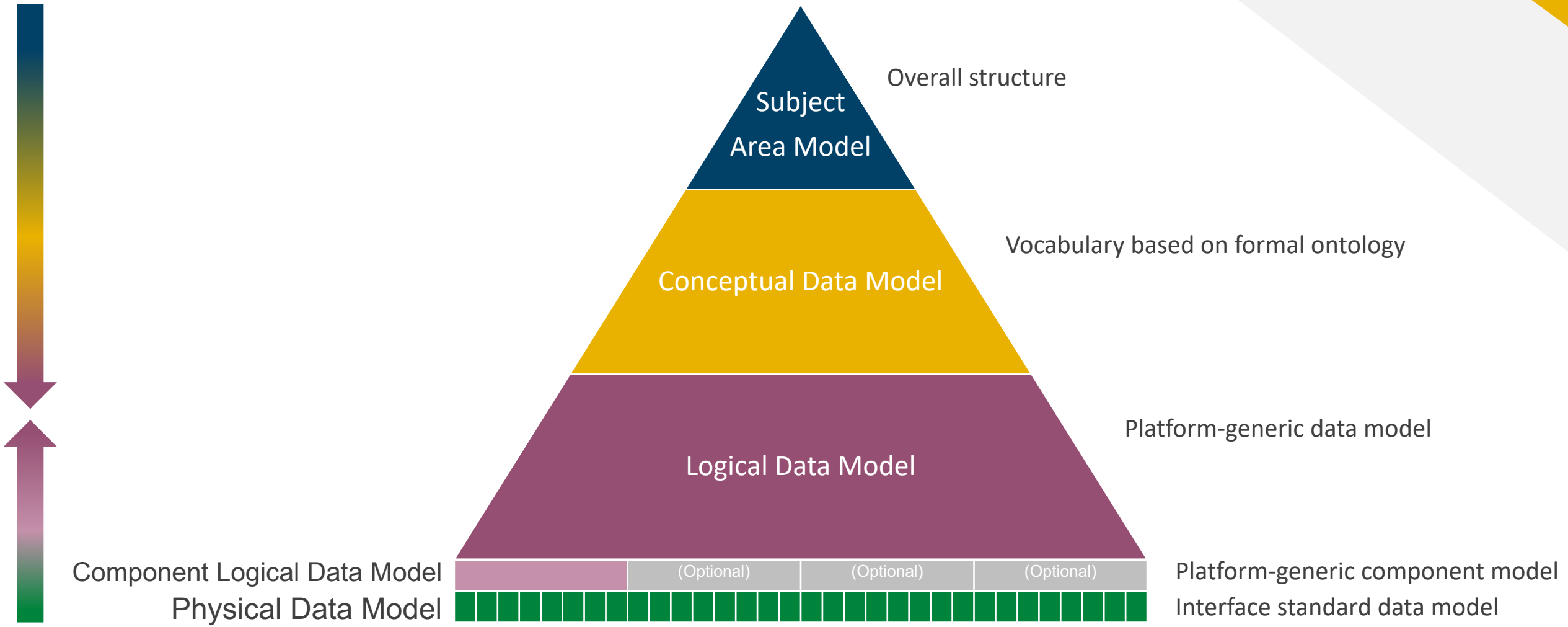
Three major components

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

Framework

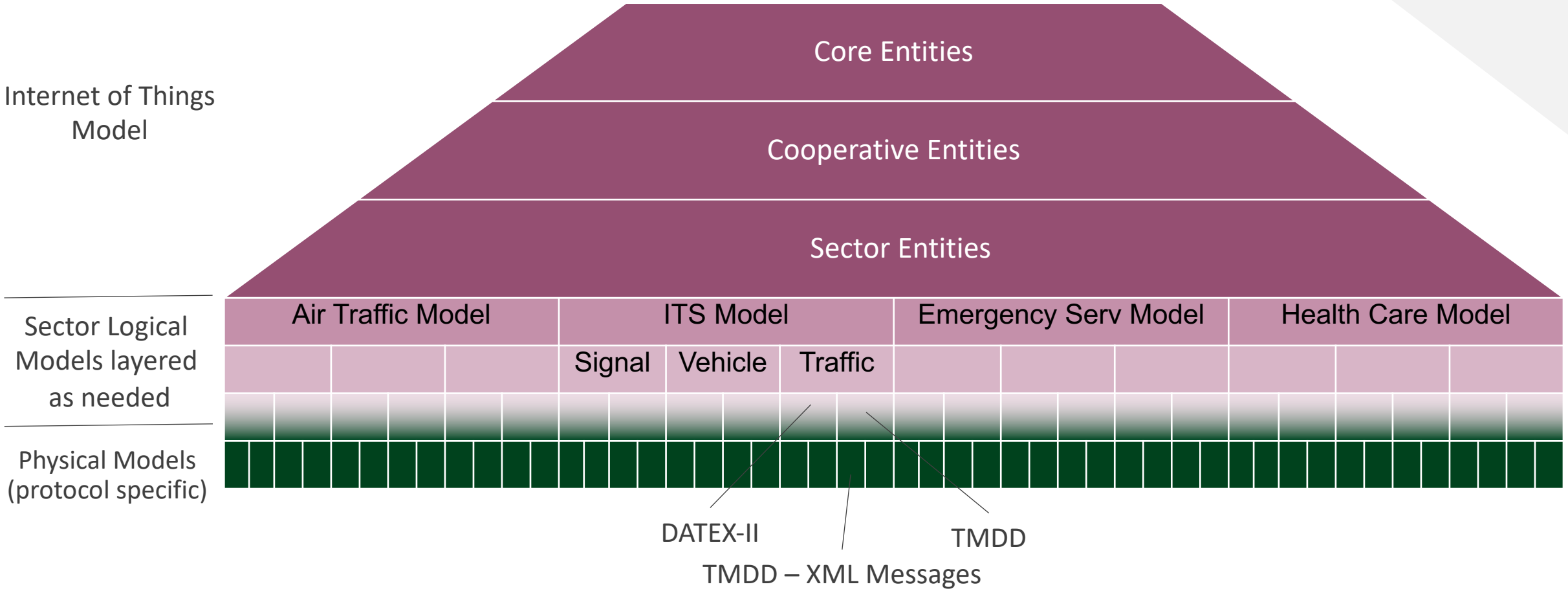
ITS Data Model Structure

Long-term integration requires top-down



Business pressures dictate bottom-up

Transportation is one small piece of a bigger puzzle



Divisions of each silo

Core Components

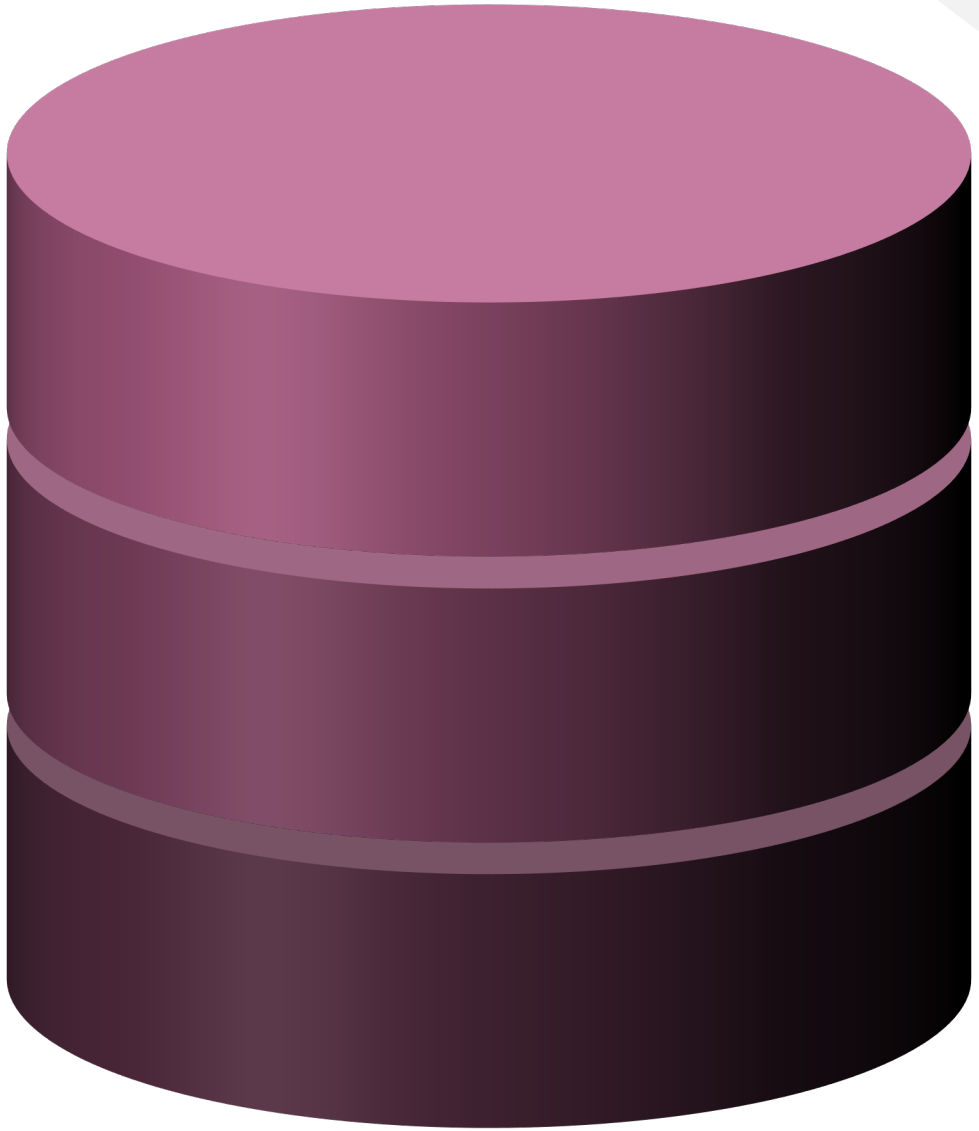
Most generalized entities and data types

Cooperative Components

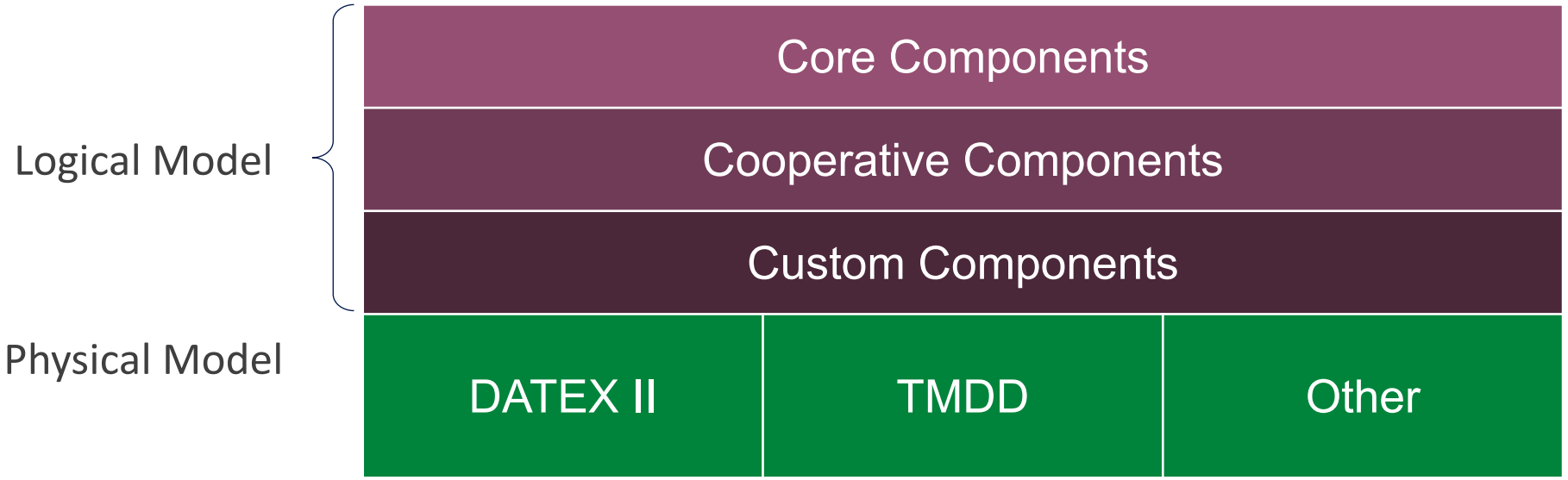
Data produced by multiple peer models

Custom Components

Data only produced within this model space



Traffic Management Domain



Example Data for message signs

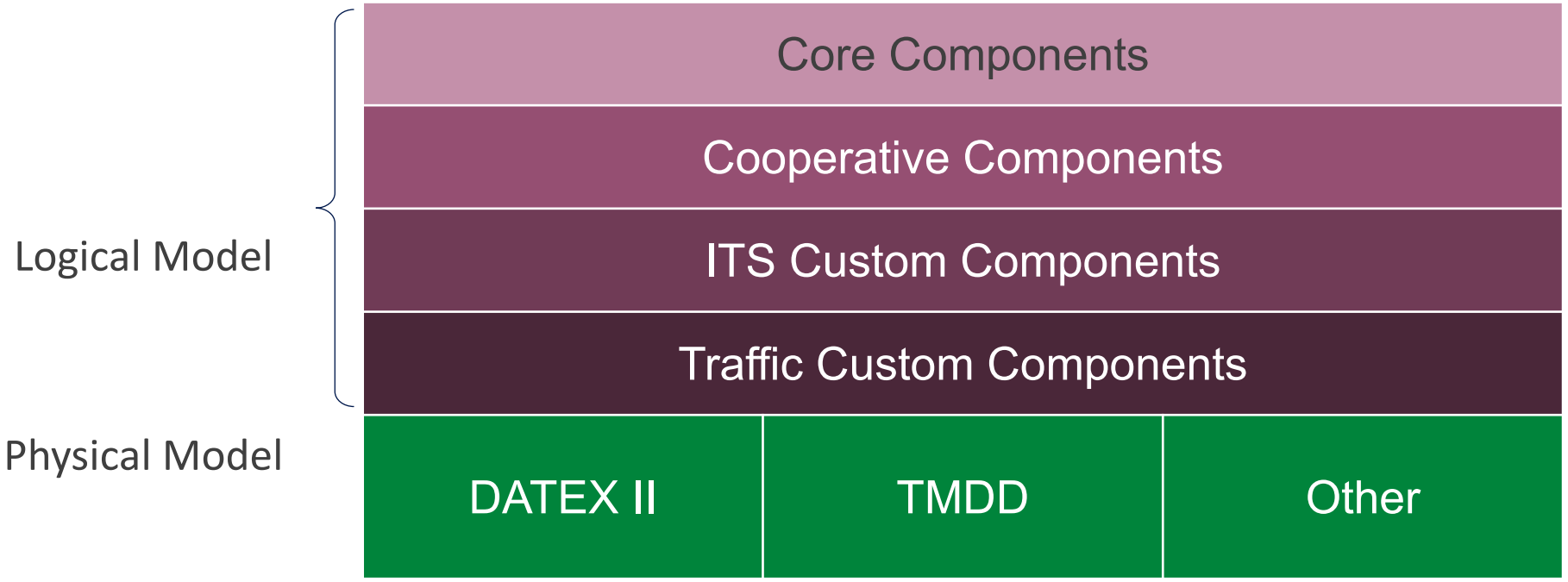
Physical Entity, Location, Time measure

Ambient air temperature

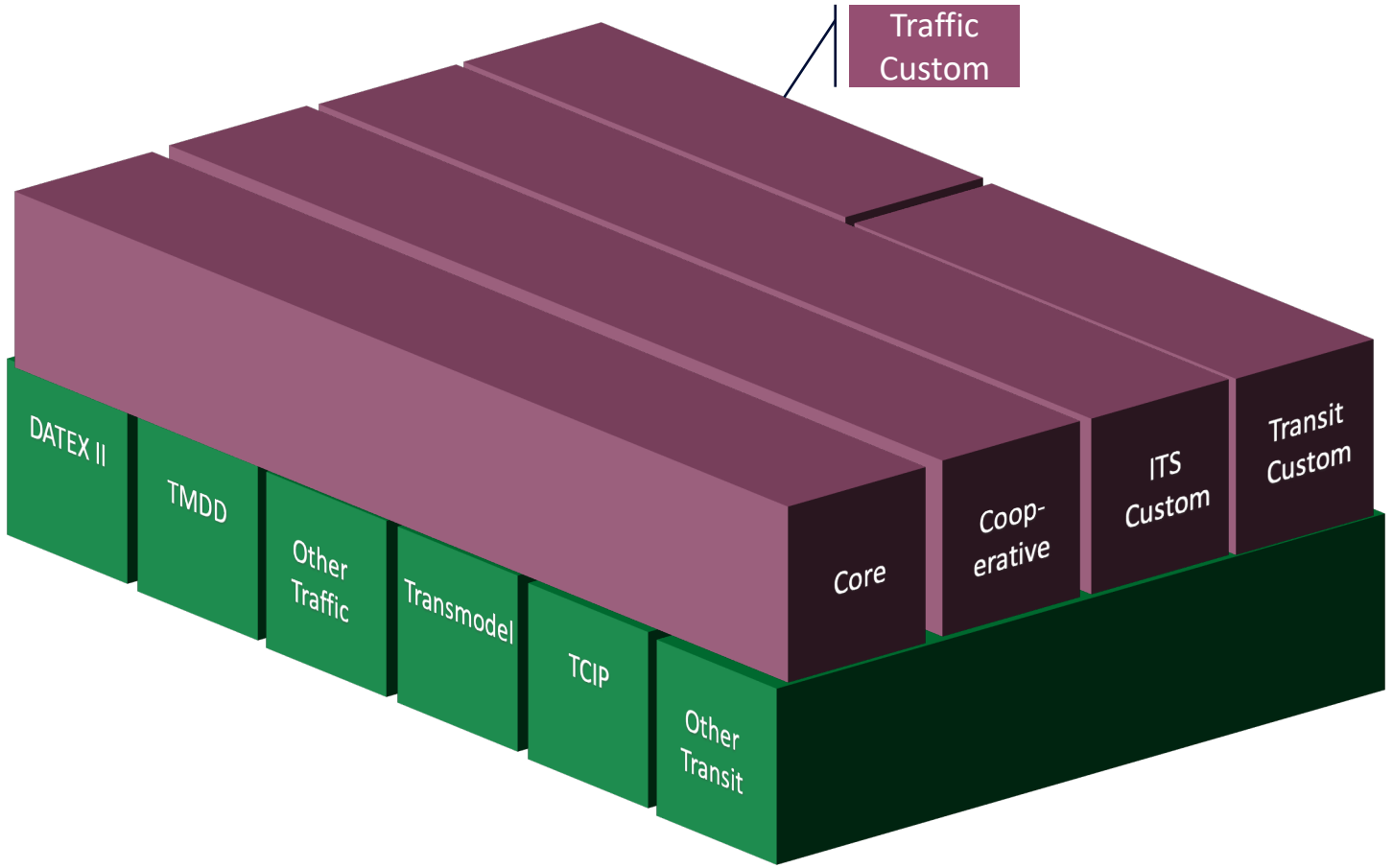
Message, pixel status, etc.

All data from physical models are traced to logical model

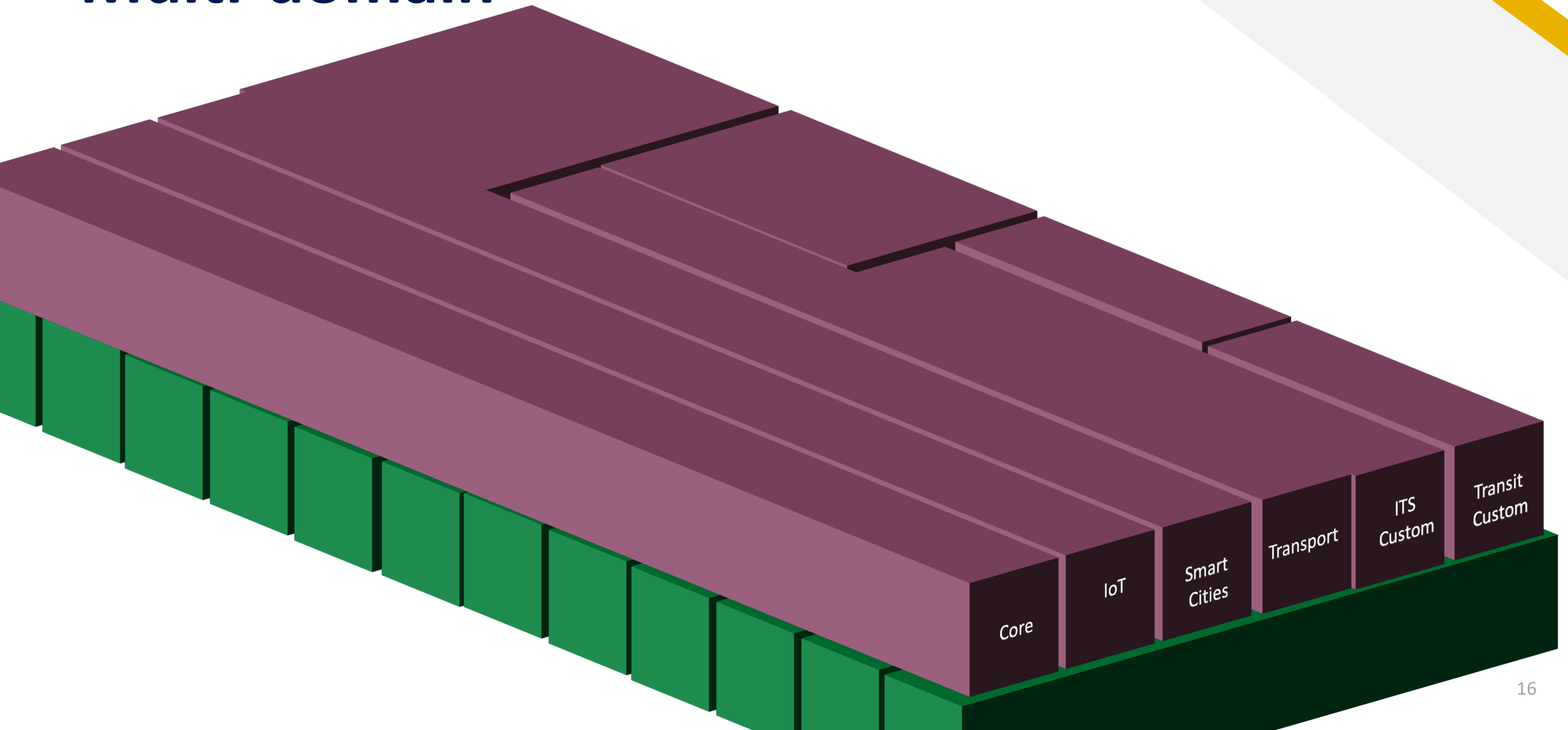
Traffic Management Domain



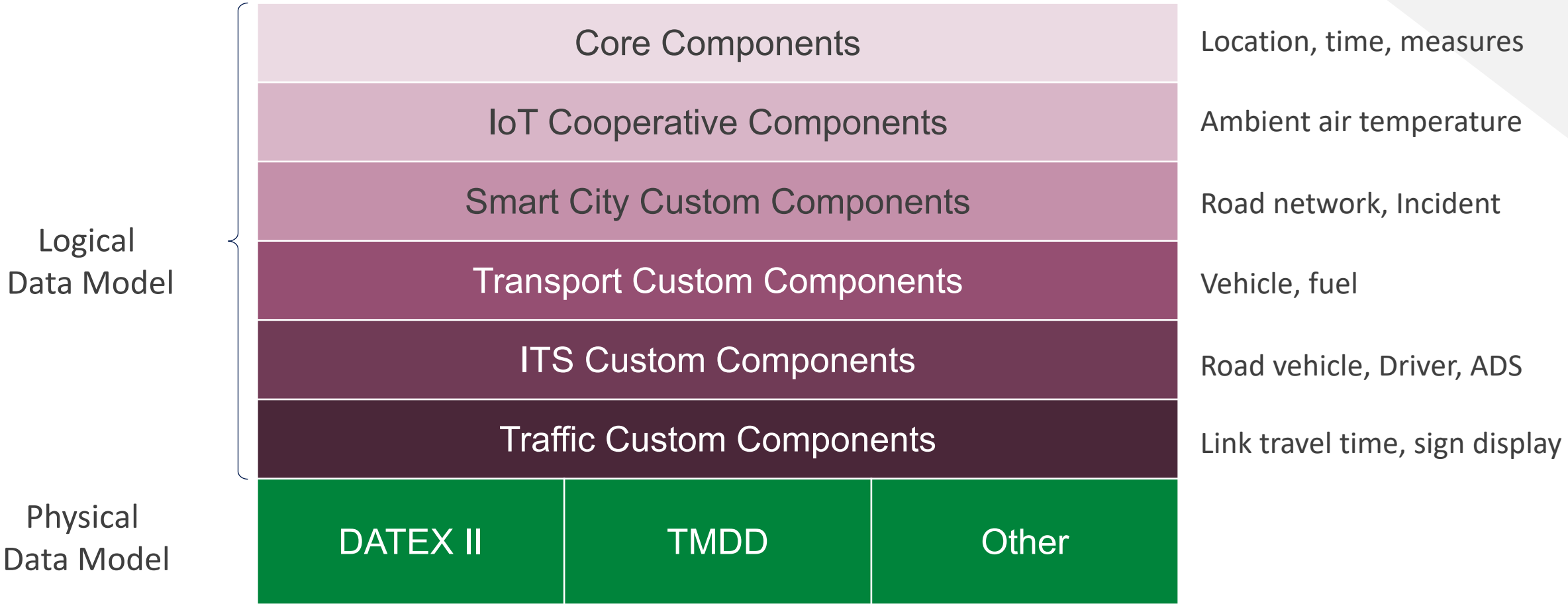
Traffic and Transit domains

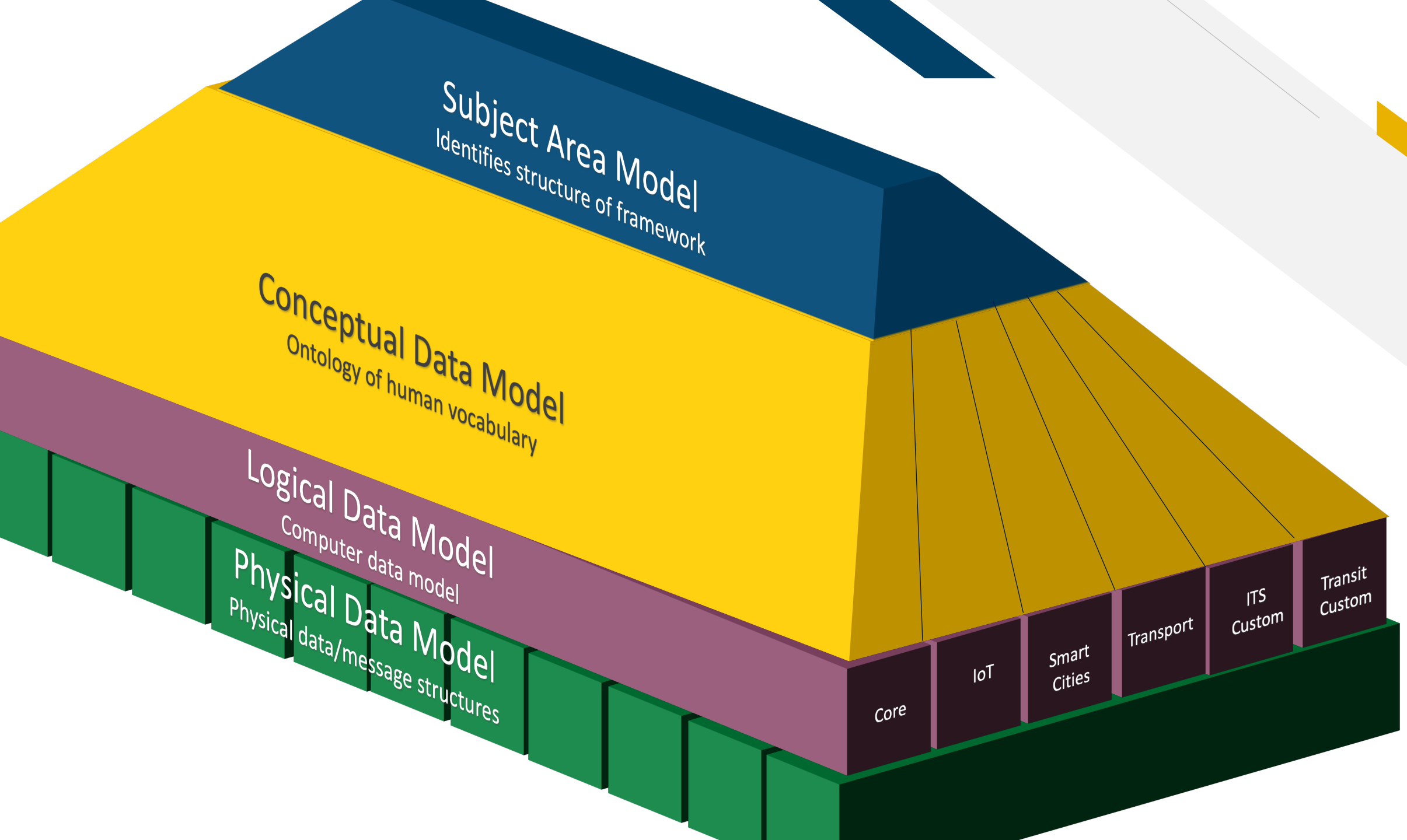


Multi-domain



IoT Logical Model



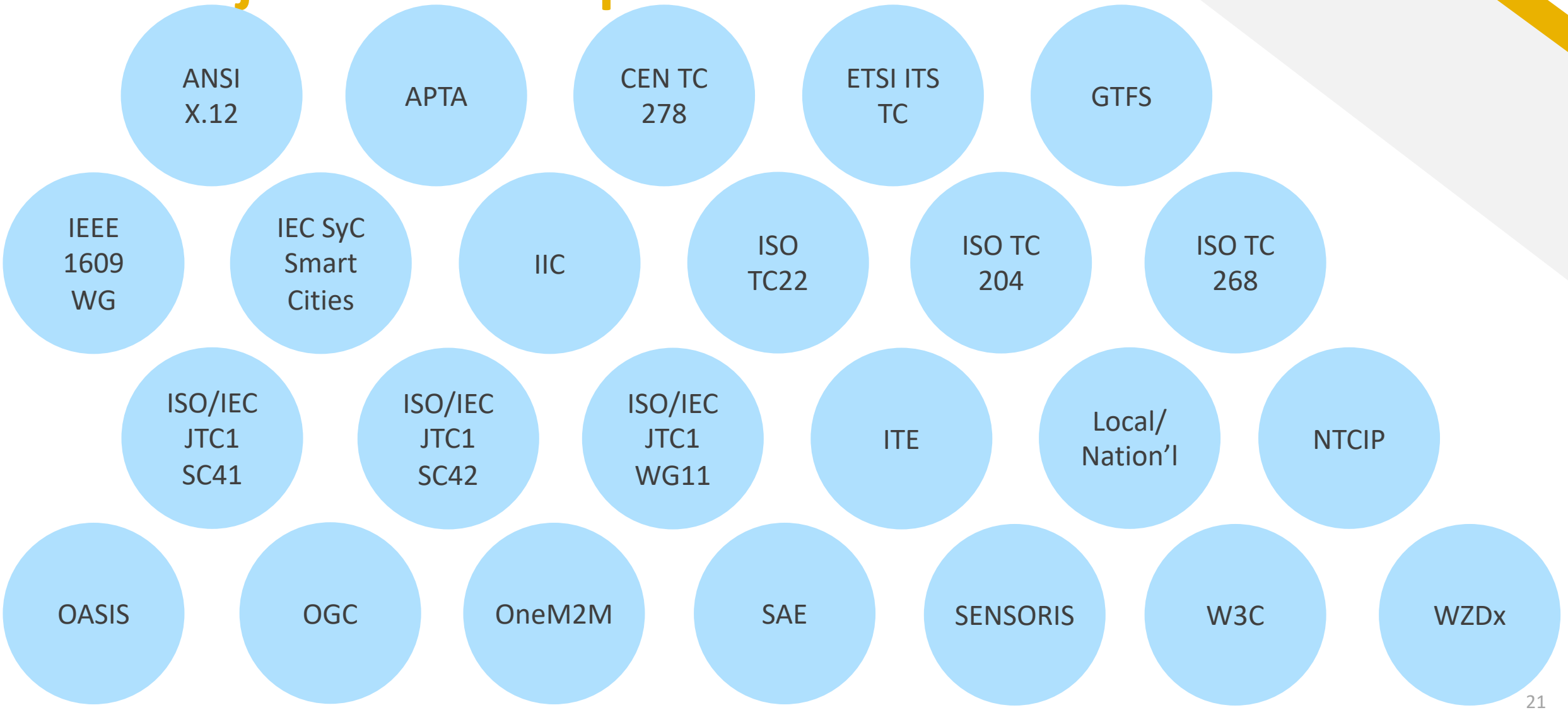

Subject Area Model
Identifies structure of framework
Conceptual Data Model
Ontology of human vocabulary
Logical Data Model
Computer data model
Physical Data Model
Physical data/message structures
Core
IoT
Smart Cities
Transport
ITS Custom
Transit Custom

Importance of traceability

- Framework supports any physical data model design
  - Full backwards interoperability
  - Development of new standards are not delayed
  - Each physical data model can be implemented in an interoperable fashion by multiple enterprises
- Physical model components trace to logical model components
  - Trace identifies any necessary transformations
    - Change feet to meters
    - Changing the reference point of a vehicle
  - Physical and Logical models evolve independently
    - Traces should be updated to avoid ambiguities
    - Efforts should be made to define entities at the most appropriate layers
    - Data elements (attributes of entities) migrate to higher layers (e.g., from ITS to Transport) as cross-domain consensus emerges
- Graceful evolution into the ultimate IoT model

Governance

An Expansive Coordination Effort just for Transport



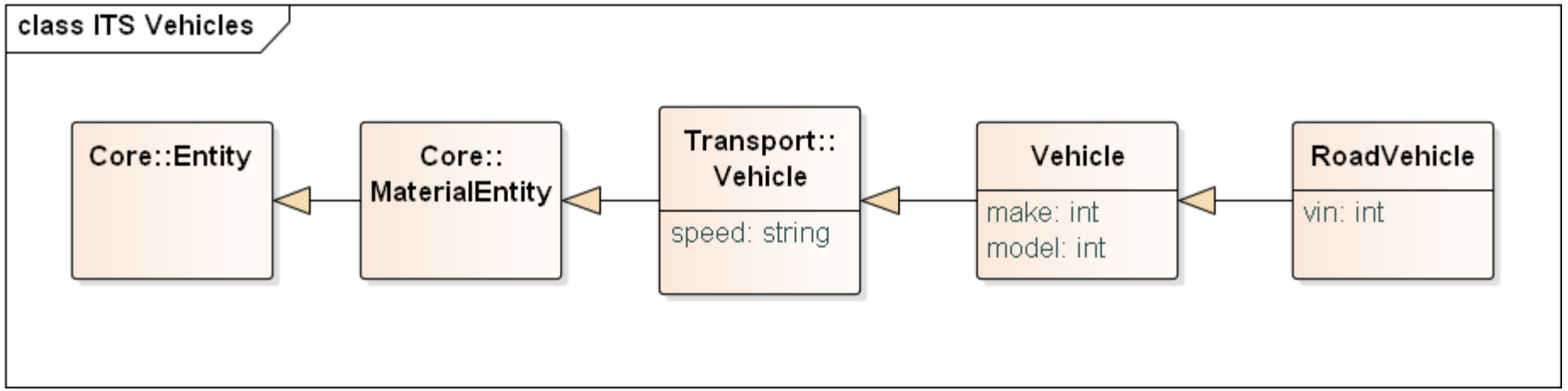
Not a typical ISO or joint standard

- 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

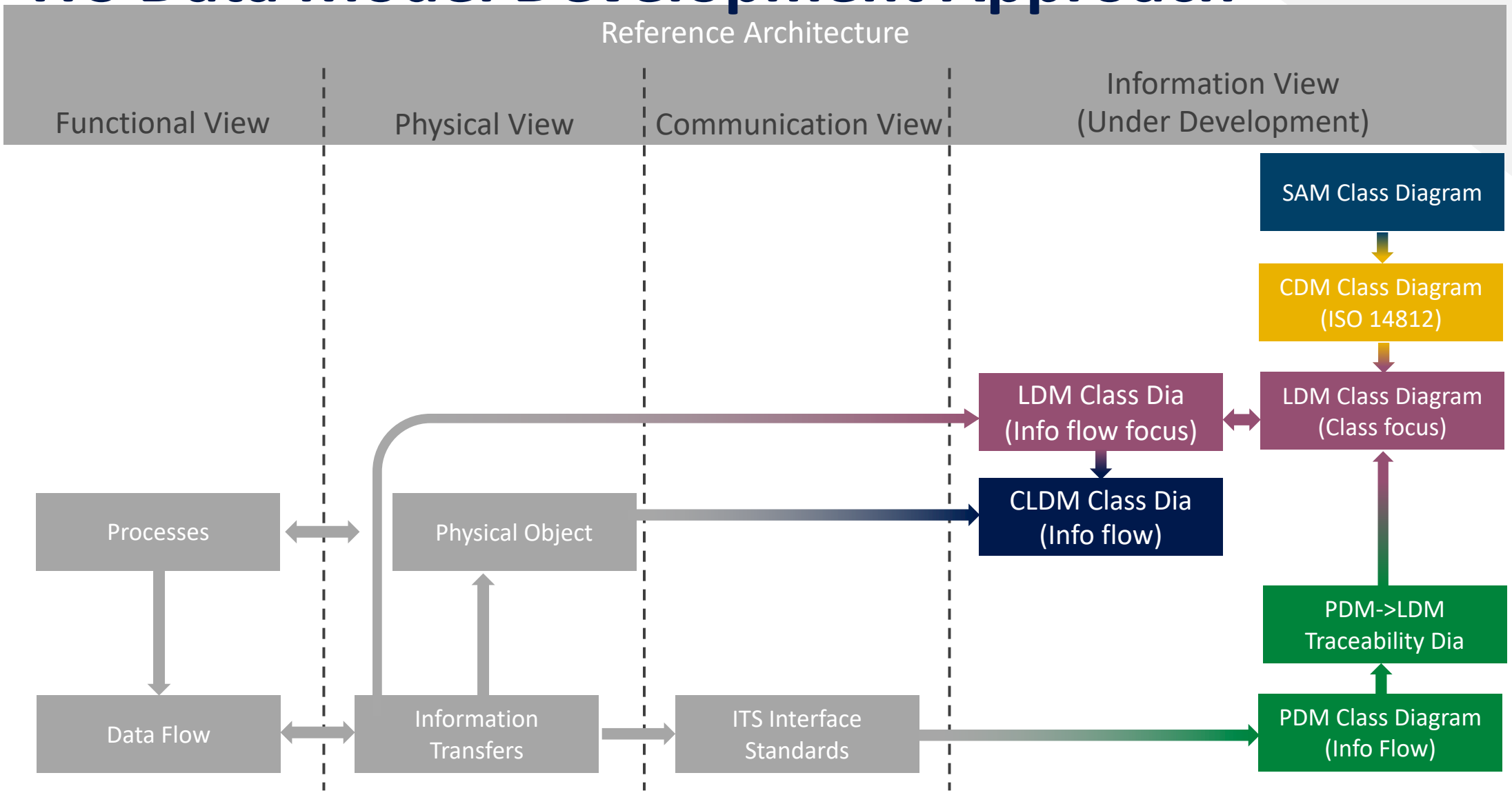
Proposed approach

- ISO Innovation Project for:
  - GitHub based solution
    - Free access
    - Version controlled
    - Designed with development and approved branches
  - Likely 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
    - Integrated with GitHub
  - Link logical model diagrams to use cases
    - Model links to/from companion models (e.g., ITS reference architecture)

Allows work to proceed easily



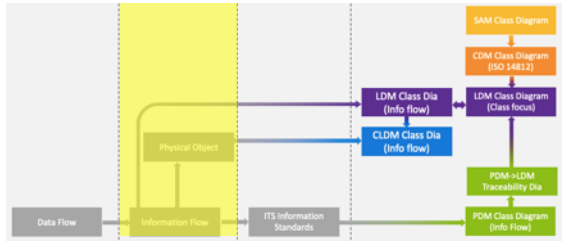
ITS Data Model Development Approach

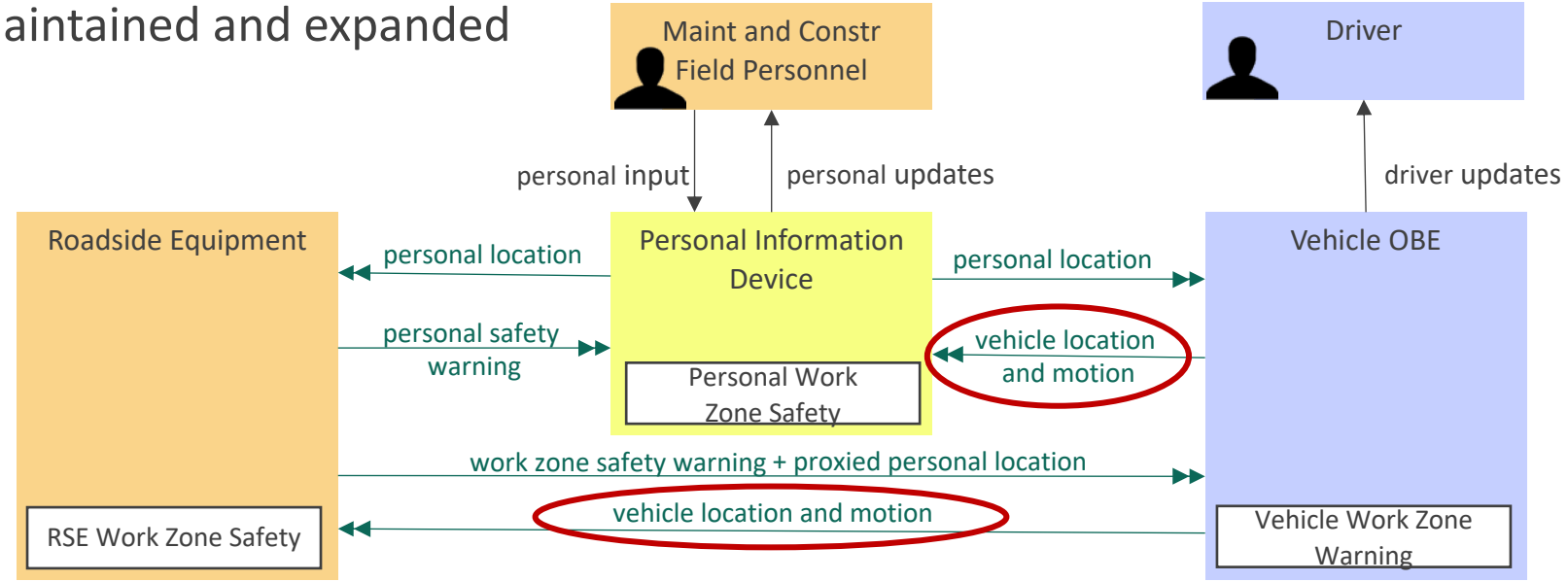


ITS Reference Architecture

- ARC-IT (http://arc-it.org)
  - Currently being updated to add international content from HARTS (http://htg7.org)
  - Over 140 service packages
  - Over 800 information flows
  - Over 1700 information transfers (a.k.a., information flow triples)
  - Most flows have different solutions in different regions of the world (~200 data standards)
  - Architecture actively maintained and expanded

Simplified service package for Worker Safety





Comm View

Vehicle Location and Motion

Triple

Vehicle OBE to Other Vehicle OBEs: vehicle location and motion

Flow Description

Data describing the vehicle's location in three dimensions, heading, speed, acceleration, braking status, and size.

Solutions

US: SAE Basic Safety Messages - WAVE WSMP
EU: CA Service - FNTP/M5
EU: CA Service - BTP/GeoNetworking/G5

Solution Description

This solution is used within the E.U., and Australia. It combines standards associated with EU: CA Service with those for V-X: BTP/GeoNetworking/G5. The EU: CA Service standards include upper-layer standards required to implement V2x safety situation awareness information flows. The V-X: BTP/GeoNetworking/G5 standards include lower-layer standards that support broadcast, near constant, low latency vehicle-to-vehicle and vehicle-to-infrastructure communications using the ETSI GeoNetworking Bundle over the 5.9GHz spectrum.

ITS Info (Gap, Gap)

ETSI 102 894-2
ETSI 102 638

Click gap icons for more info.

Mgmt (Gap)

ETSI 102 890-1
Bundle: G5 Congestion Control Management

Facility

ETSI 302 637-2

TransNet (Gap, gap)

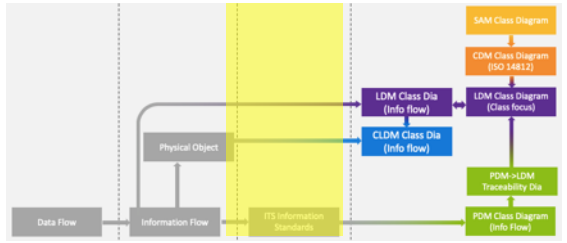
Bundle: GeoNetworking BTP

SubNet

Bundle: ETSI ITS-G5

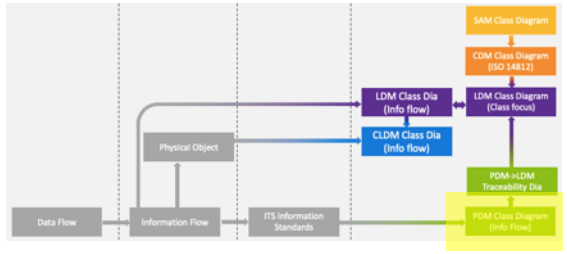
Security (Gap)

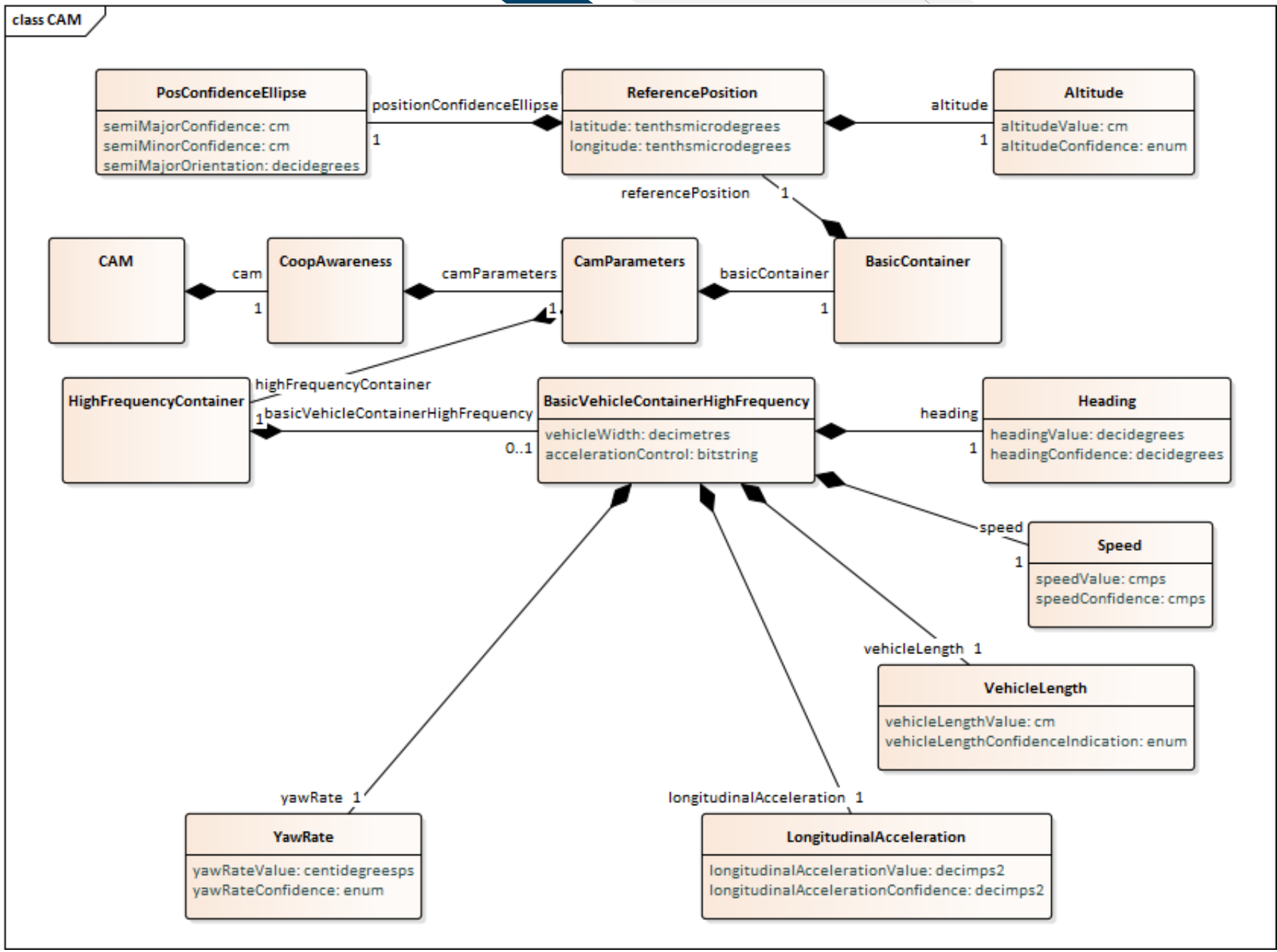
Bundle: ETSI ITS-S Security Architecture



Info View

Physical Data Model: CAM



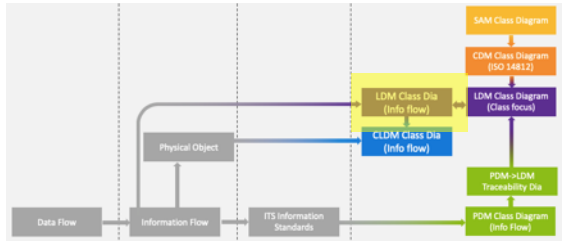


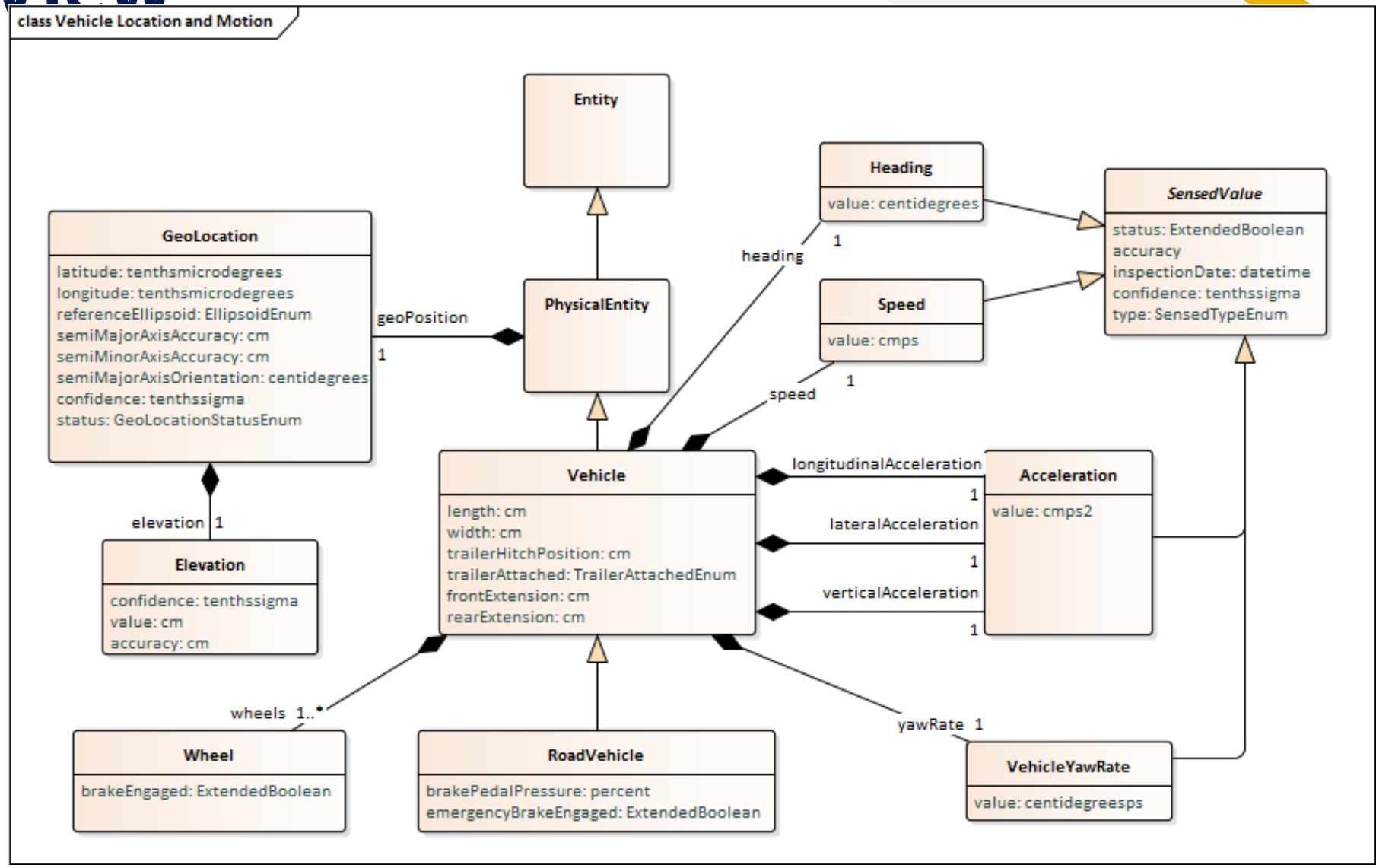
Information View

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

Logical Data Model

- Info Flow Focus for Vehicle Location and Motion

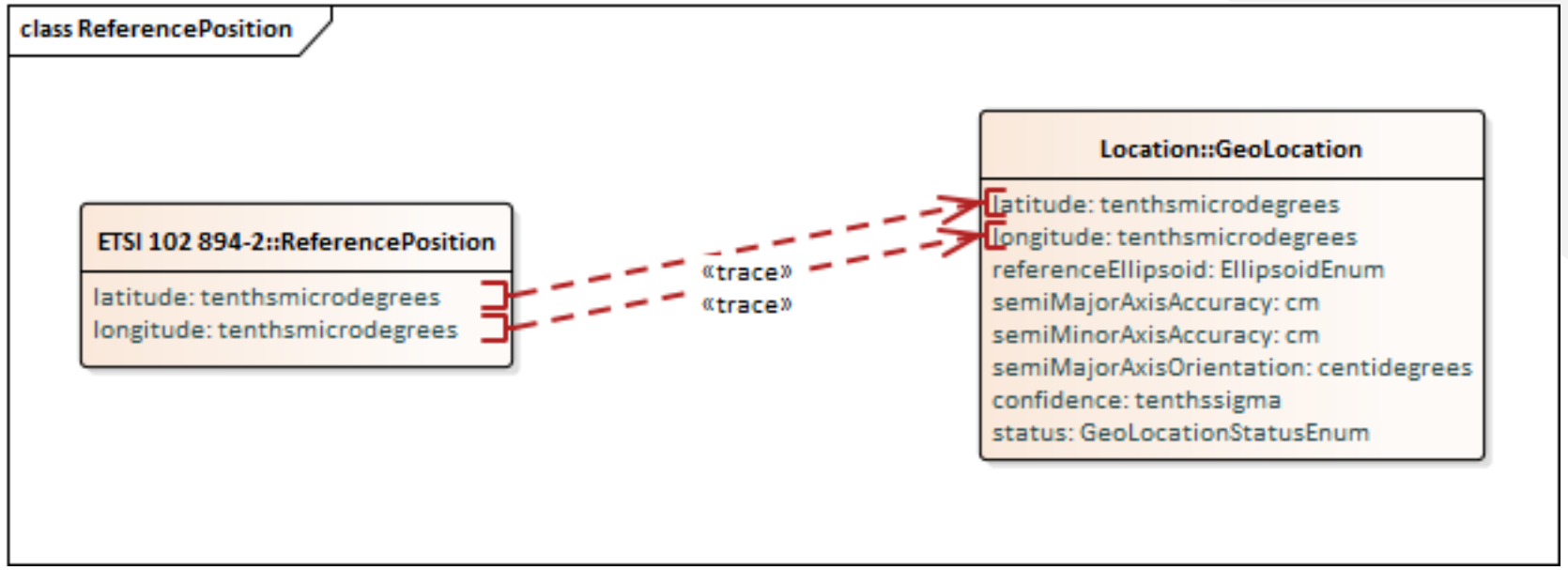


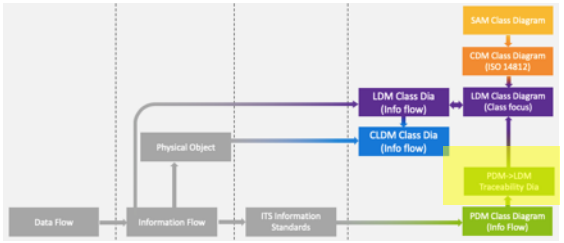


Information View

Physical Model

- Traceability Focus





Towards a Consistent Model

- Does not delay current development efforts
- Moves towards a consistent model for all stakeholders (i.e., layered approach)
- Readily accessible by all interested parties (i.e., no pay wall)
- Universal buy-in 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 define (At IoT Level?):
  - Data Modeling Framework (e.g., how do layers relate to one another)
  - Governance (e.g., who contributes, comments, approves)
  - Modeling Rules (e.g., a UML profile)
- Defining common rules will allow:
  - Easier understanding, tracing, and integration among independent efforts
  - Common toolsets
  - Work towards a common goal

Next steps

- Outreach to
  - ISO/IEC JTC1 *Smart Cities*
  - IEC SyC *Smart Cities*
  - Industrial Internet Consortium
  - World Wide Web Consortium
    - Automotive WG
    - Spatial Data on the Web IG
    - Web of Things WG
- Others to reach
  - ISO/IEC JTC1 SC41 *Internet of Things*
- Agree on general principles
  - Framework
  - Modelling conventions
  - Governance (?)
- ISO Innovation Project
  - Open GitHub development
  - Supported by an open forum
    - Requires additional research
  - Define governance
    - How content is submitted
    - How proposals are reviewed
    - How proposals are incorporated into development draft
    - How and when releases are approved
- Others of note
  - ISO TC 22, TC 211 (JTC1 Governance?)

Discussion

- Thoughts on approach discussed

Thank You.

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