

Intelligent Road Intersections: A Case for Digital Twins

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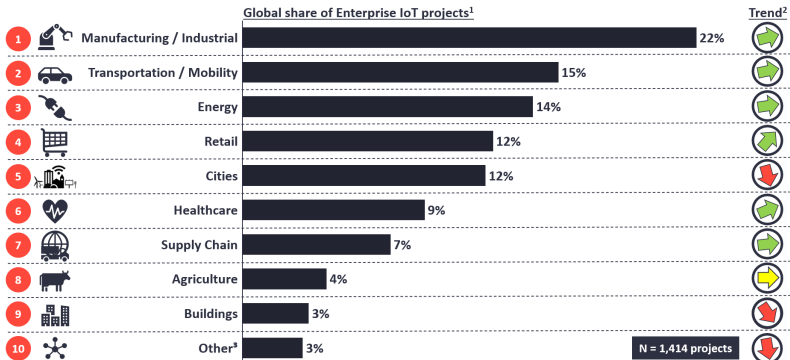
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Top 10 IoT Application areas 2020

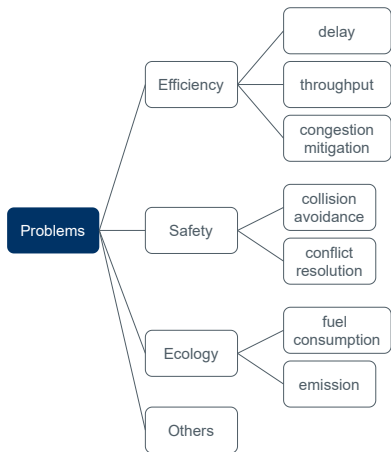


Note: 1. Based on 1,414 publicly known IoT projects (not including consumer IoT projects eg smart home, wearables, etc.) 2. Trend based on relative comparison with % of projects in the 2018 IoT Analytics IoT project list e.g., a downward arrow means the relative share of all projects has declined, not the overall number of projects. 3. Other includes IoT projects from Enterprise & Finance sectors. Source: IoT Analytics Research - July 2020

The top 10 Smart City use cases

Use Case	Share	Category
1  Connected Public Transport	74%	Mobility & Transportation
2  Traffic Monitoring and Management	72%	Mobility & Transportation
3  Water level / Flood Monitoring	72%	Environment
4  Video Surveillance & Analytics	72%	Public Safety
5  Connected Streetlights	68%	Energy & Utilities
6  Weather Monitoring	68%	Environment
7  Air Quality / Pollution Monitoring	68%	Environment
8  Smart Metering - Water	66%	Energy & Utilities
9  Fire / Smoke Detection	66%	Buildings & Infrastructure
10  Water Quality Monitoring	64%	Environment
... 21 more use cases		

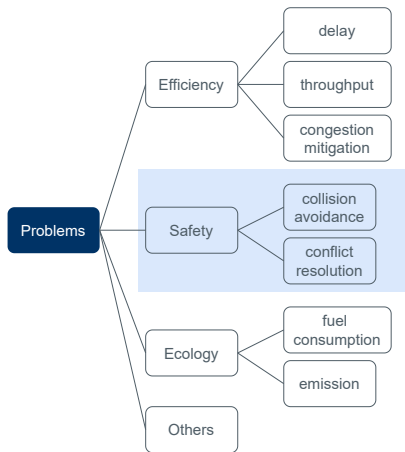
Share = Percentage of cities that have fully or partially deployed the use case as part of their Smart City initiative; n= 50 cities across the globe
Source: IoT Analytics Research – August 2020 (For more information, refer to: Smart City Use Cases & Technology Adoption Report 2020)



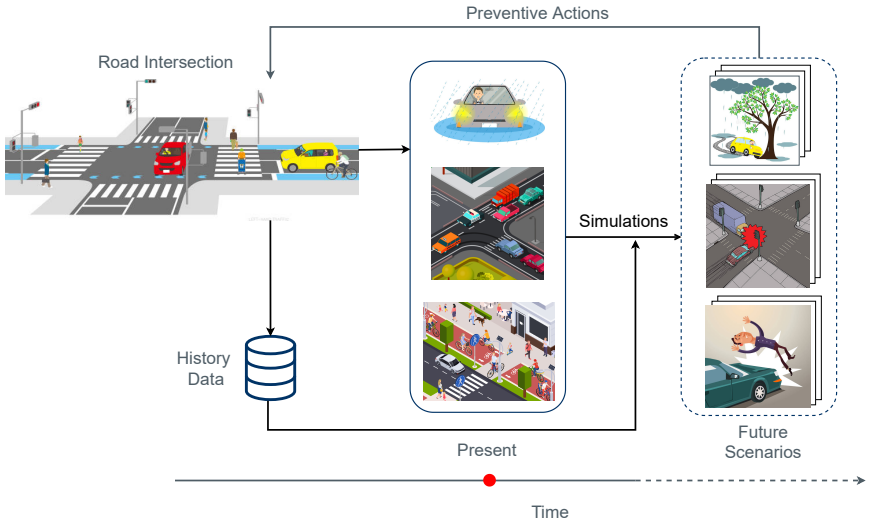
Complex systems

It is **not easy to analyze all specific states and scenarios** during the system's design, operation, and management stages.

Road Intersections Safety

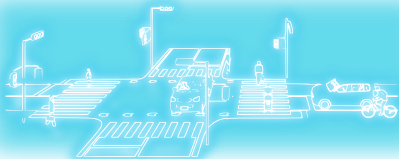


How to interact with the road intersection to apply proactive actions that help in the safety of the intersection and the agents of this system?





*"A digital twin is a **virtual representation of real-world entities and processes**, synchronized at a specified frequency and fidelity."*

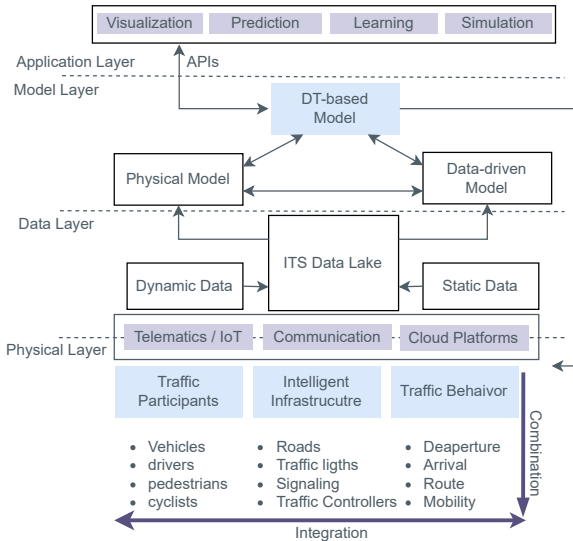


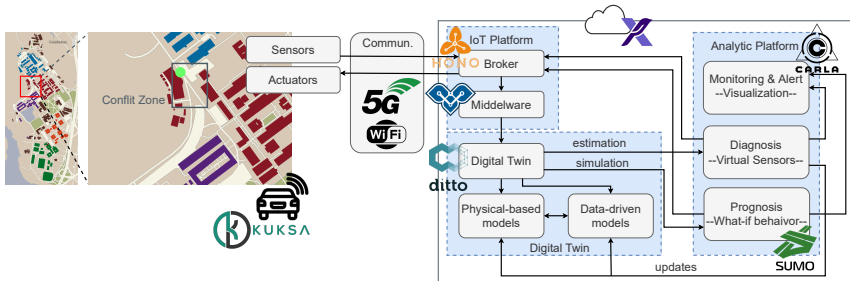
virtual representation
computational models

communication channel
synchronization & interaction



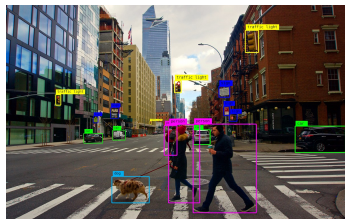
physical world
assets & processes



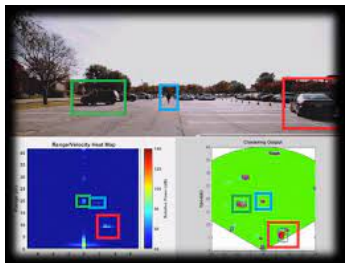


Testbed - Sensors

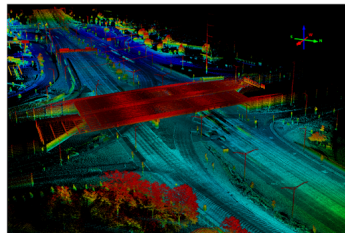
Computer Vision



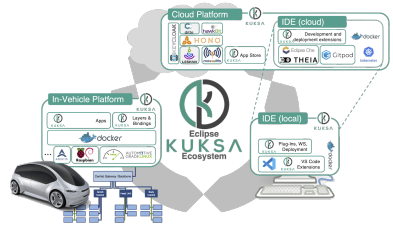
mmWave RADAR

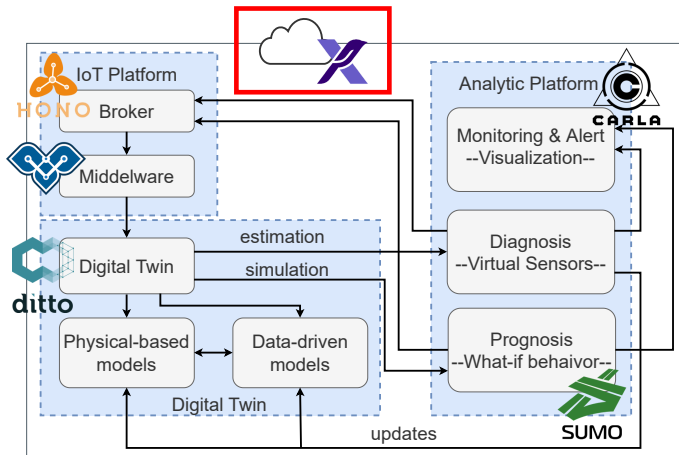


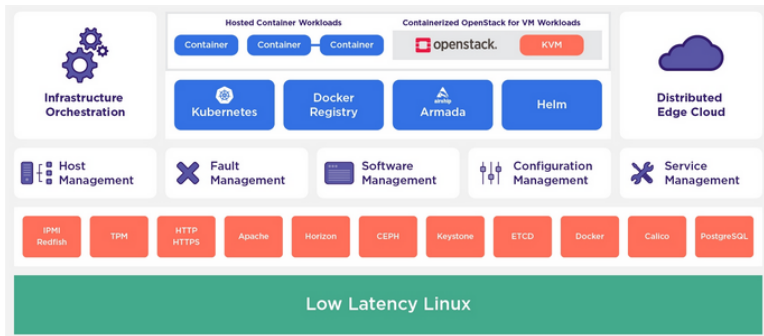
LIDAR



Eclipse Kuksa

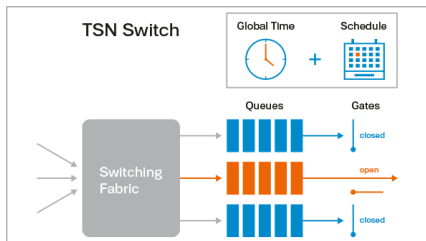






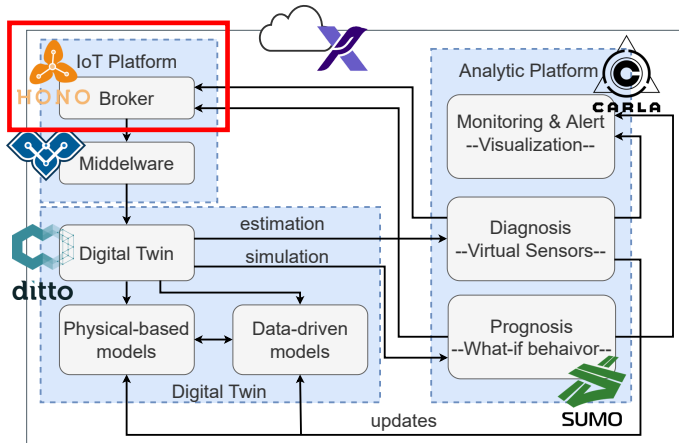
- Reliability
- Environments with severe resource constraints
- Deterministic

Testbed - Edge Communication

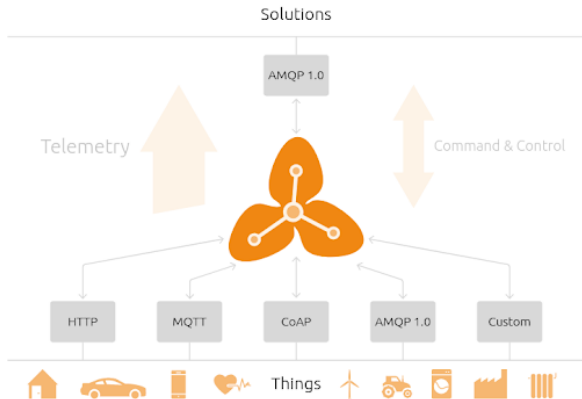


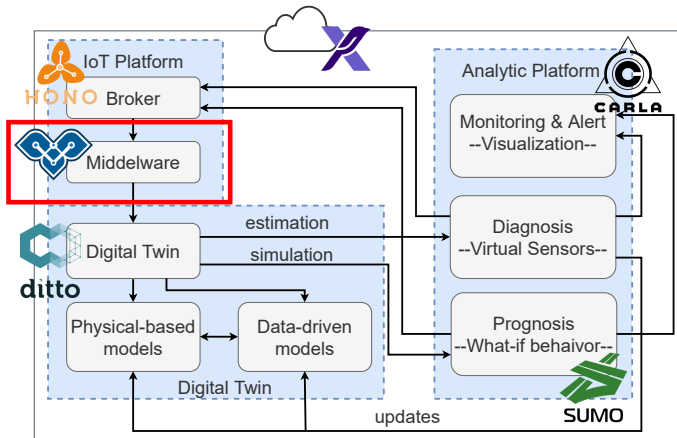
Time Sensitive Networks

- o IEEE 1588/802.1AS precision time synchronization
- o IEEE 802.1Qav traffic shaper: Modelagem de tráfego usando classes de prioridade.



Eclipse Hono provides remote service interfaces to connect a large number of IoT devices to a backend and interact with them.

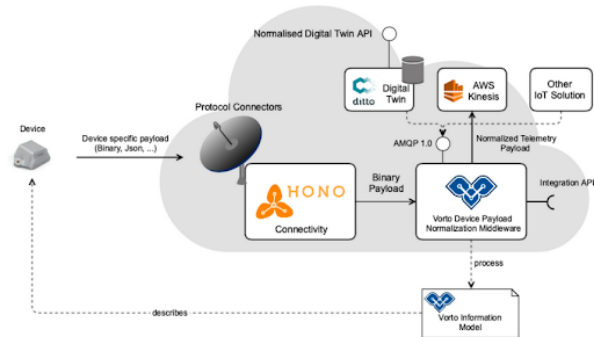


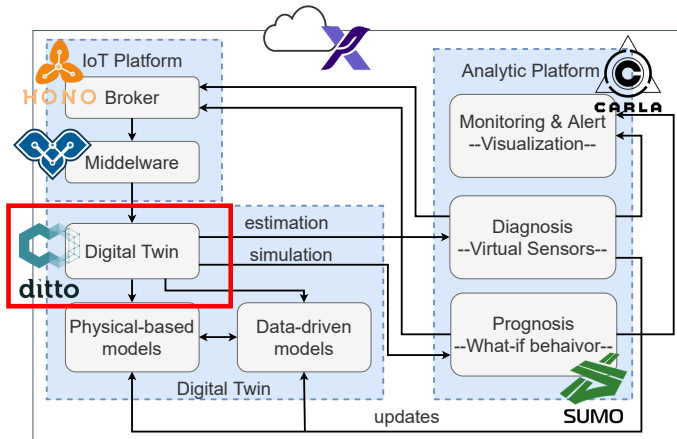


Testbed - Middleware

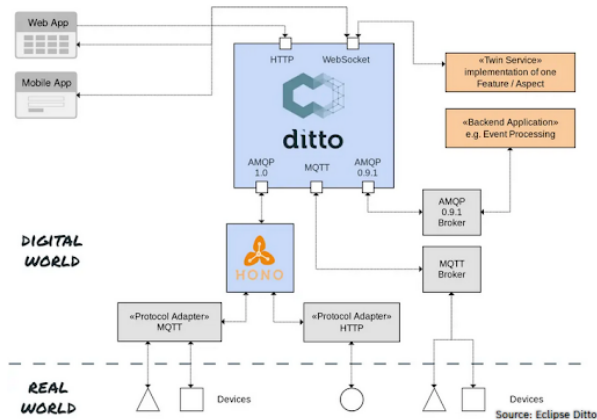
Eclipse Vorto normalizes device telemetry messages to a semantic model.

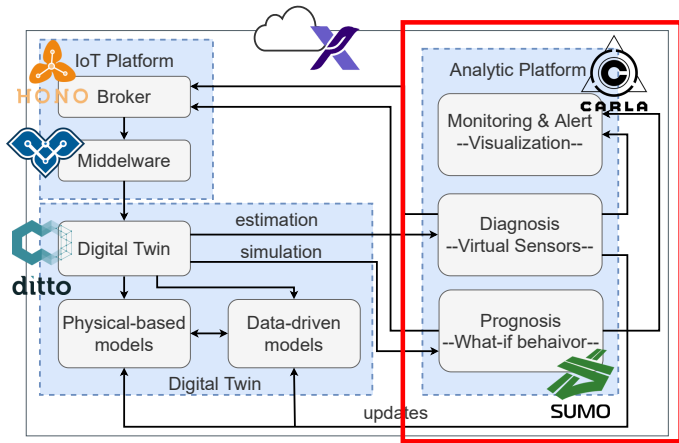
Digital Twin Vorto Language, domain-specific language (DSL) with a very simple grammar for describing digital twin models.



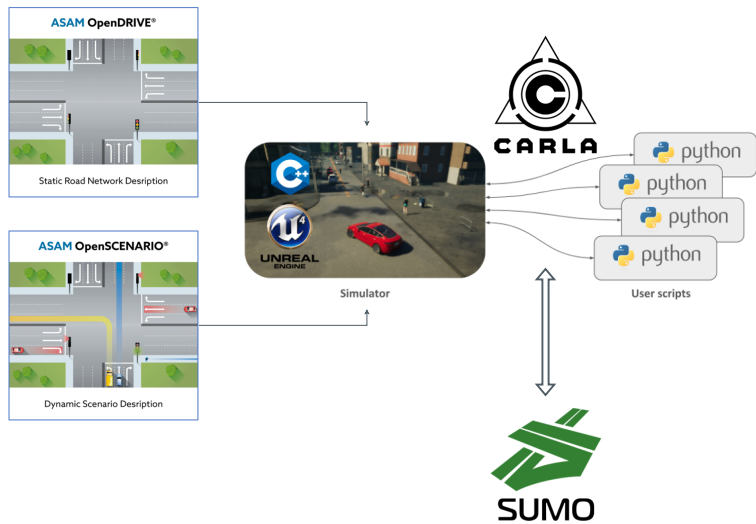


Eclipse Ditto is an IoT technology that implements a software standard for digital twins.





Testbed - Analytic



Thank you!

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