Ontological Representation of CVNs for Anomaly Detection Purposes

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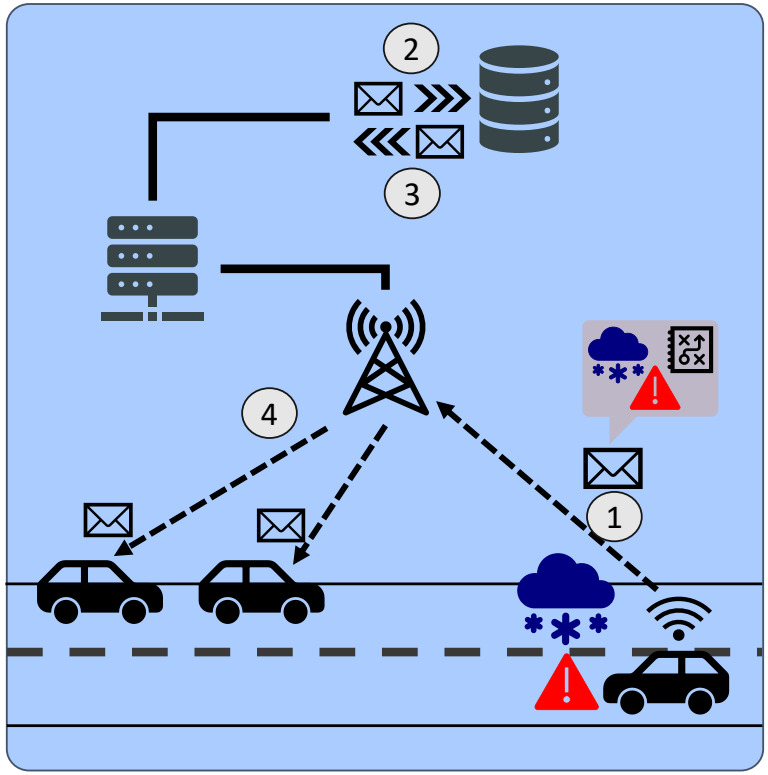
September 26, 2019

Problem Statement

Continental's E-Horizon

- New communication channel between vehicles and the rest of the world



Hence new attack vectors

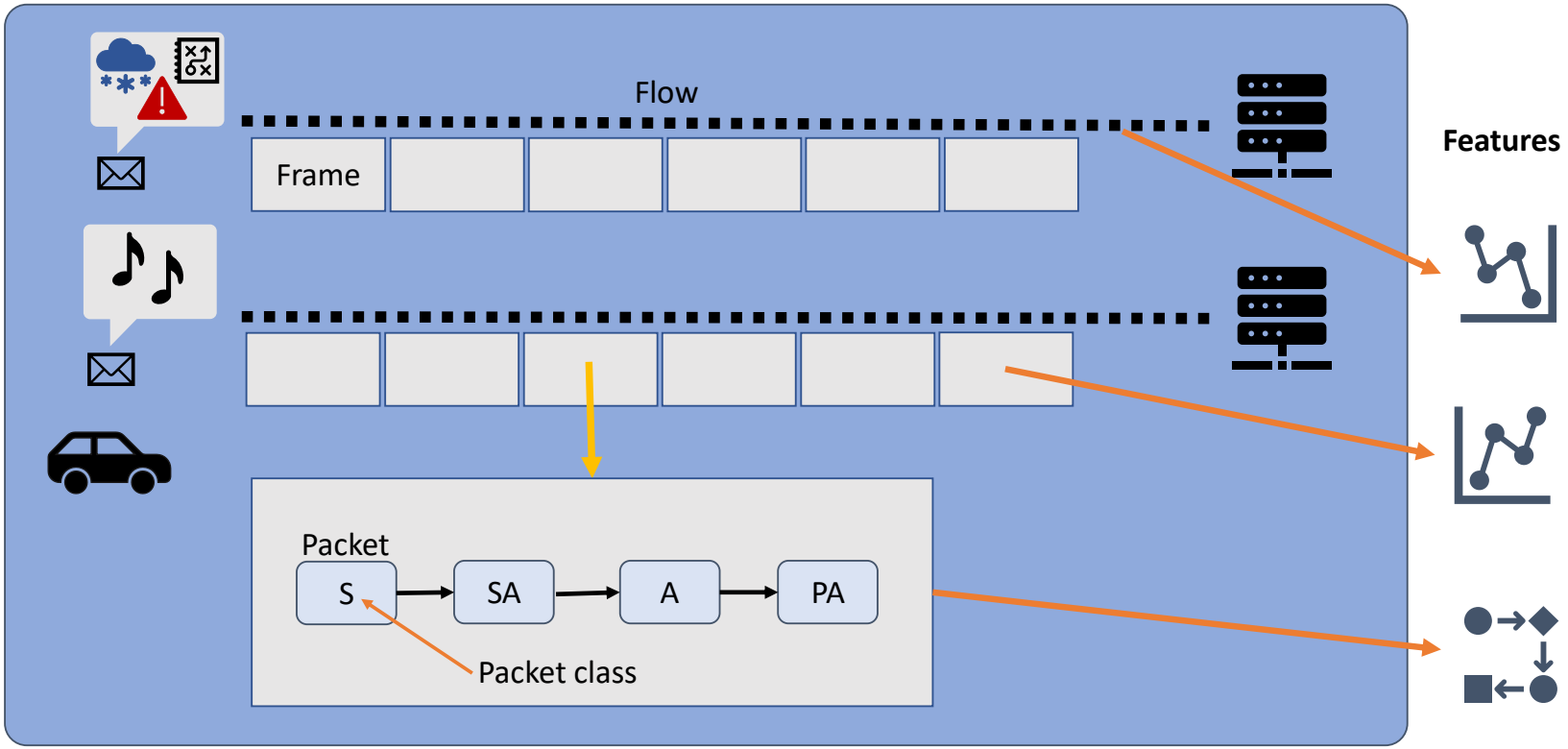
- Jeep Cherokee, 2015, (Charlie Miller and Chris Valasek)
- Nissan Leaf, 2016, (Troy Hunt)
- Volkswagen/Audi, 2018, (Daan Keuper and Thijs Alkemade)

Towards Anomaly Detection

Idea

- Apply existing algorithms to cellular vehicular networks:
  - Adapt to cellular networks behaviour;
  - Adapt to connected vehicles communications;
- Represent anomalies w.r.t the context of the communication.

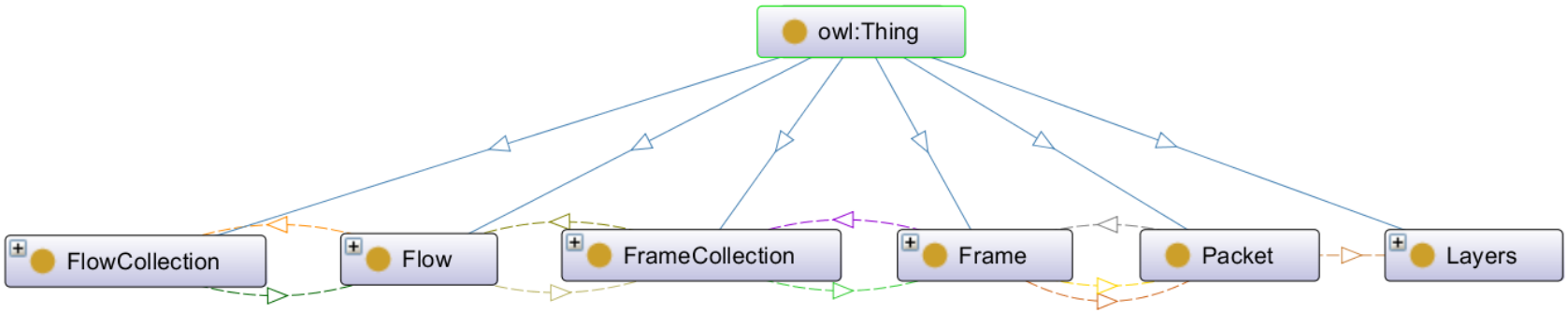
Ontological representation of the traffic



The Ontology

Traffic representation

- Multiple Scales
- Formal representation of key features :
  - Sequences of packet class
  - Sequences of Frame attributes and Flow properties ($\approx$ 70 Features)



Detection process

Multiple algorithms (Grocery List)

- Hierarchical Temporal Memory (HTM) **?**
- DBSCAN
- One-Class SVM
- Perhaps Markov models ...

Comparative Study : WE NEED YOU

- With the Ontology using other algorithms ?
- Without the Ontology using same algorithms ?
- How about feature selection, should we use the same ?

But Quentin, what are your anomalies ???

State of the Art ! (and what our intern was able to do during the summer)

- Data exfiltration via DNS-tunelling
  - That might've been a bad idea
- SCAN ALL THE THINGZ
  - Xmas for now, **todo** : moooore scanz
- Telemetry anomalies
  - i.e. We stop the flow for a while
- Malware contamination

(**todo**... *somebody stop time pls*)

Conclusion

This is going to work eventually

- Vehicular communication representation
- Feature creation on multiple scales
- Anomaly representation (more on this later)

Anomaly generation

- Still lacks realism in my opinion
- Easy enough to set up new ones though

Thanks !