



# Formal Cybersecurity Techniques for Cyber Physical Systems

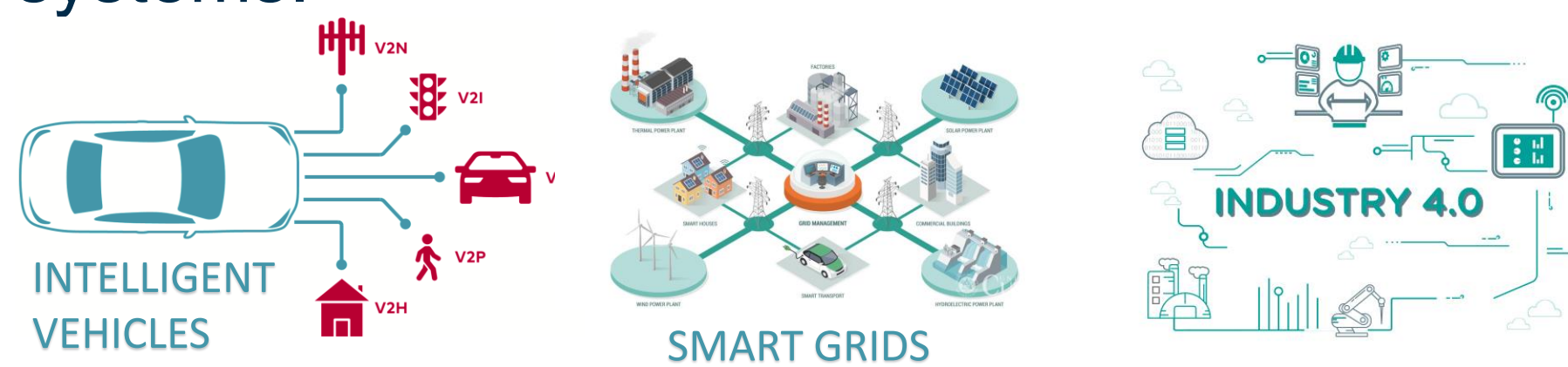
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## 1. Introduction

Cyber physical systems are becoming more and more **complex**. This complexity impacts on both **safety** and **security requirements**. Since possible errors can cause great damage, it is important to find solutions that automate the process of configuration and verification of these systems.



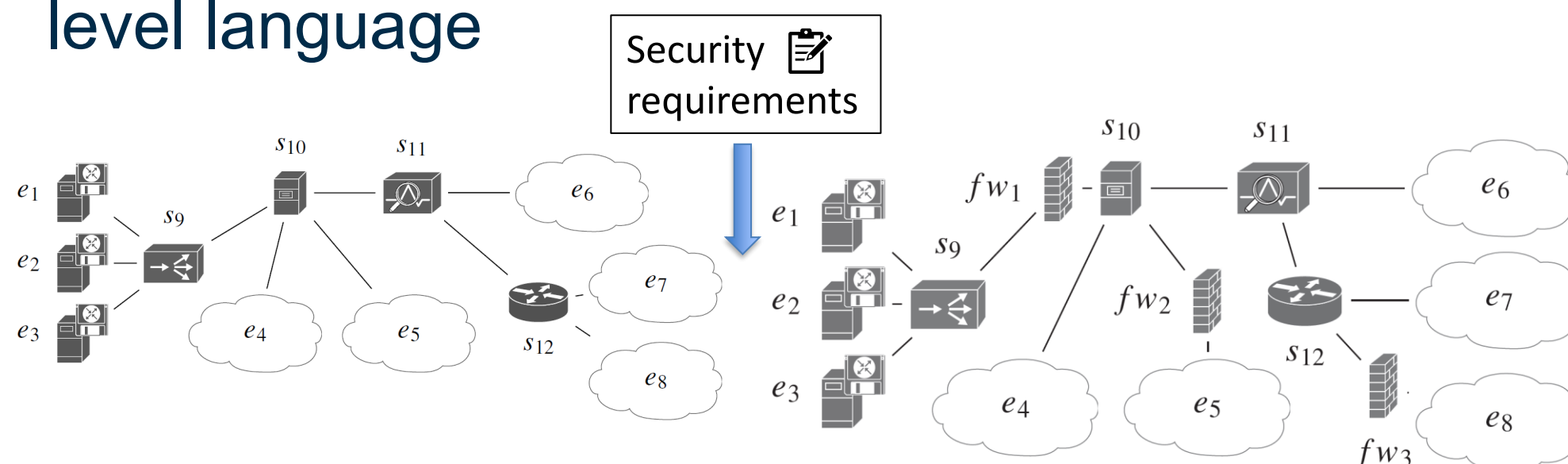
## 2. Goal / Objectives

The goal of my PhD is exploring the potential of formal methods in the process of

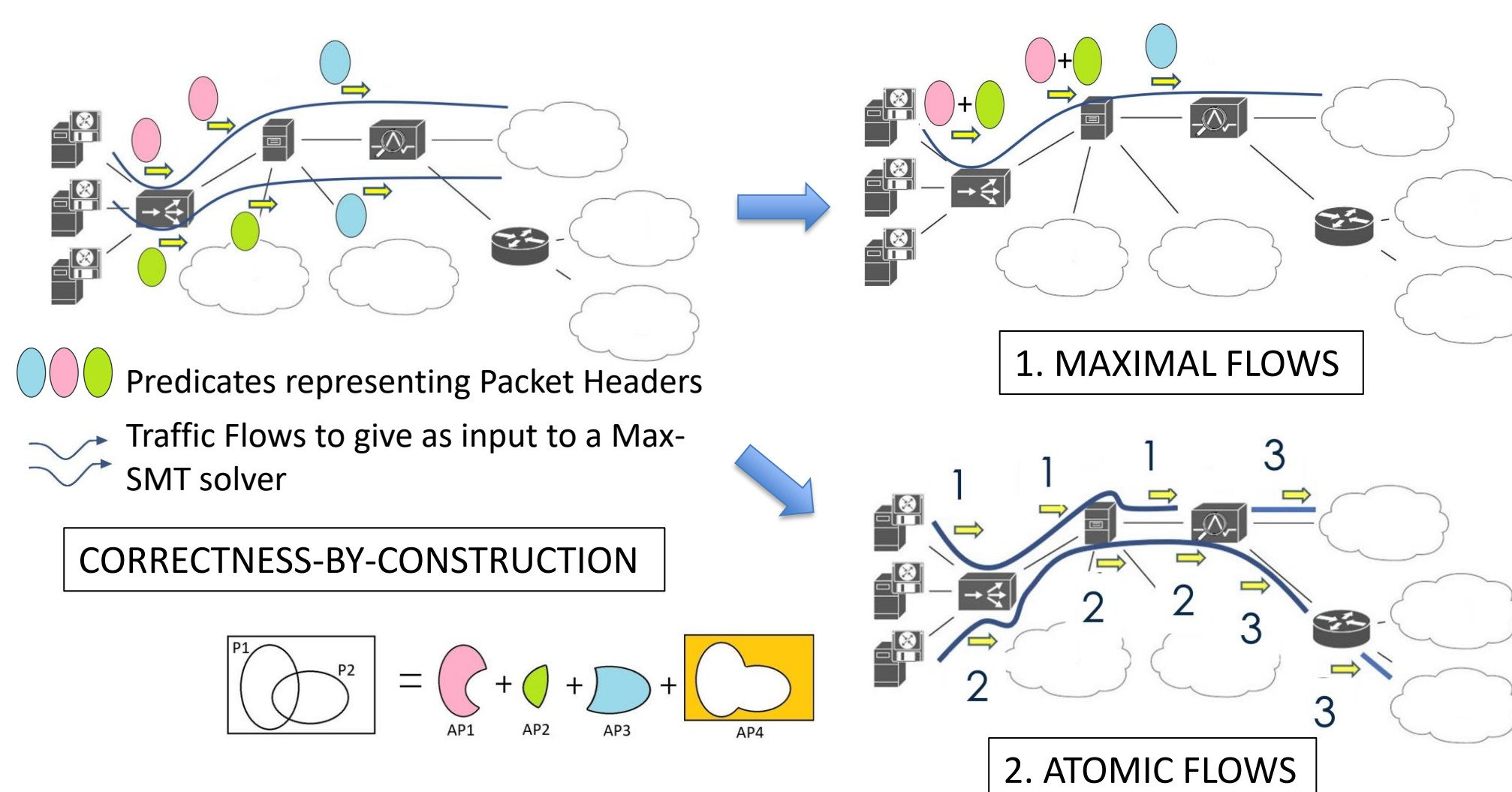
- **Automatic cybersecurity configuration** in large-scale networks
- **Automatic security verification** of state-of-the-art CPS protocols

## 3. Automatic security configuration

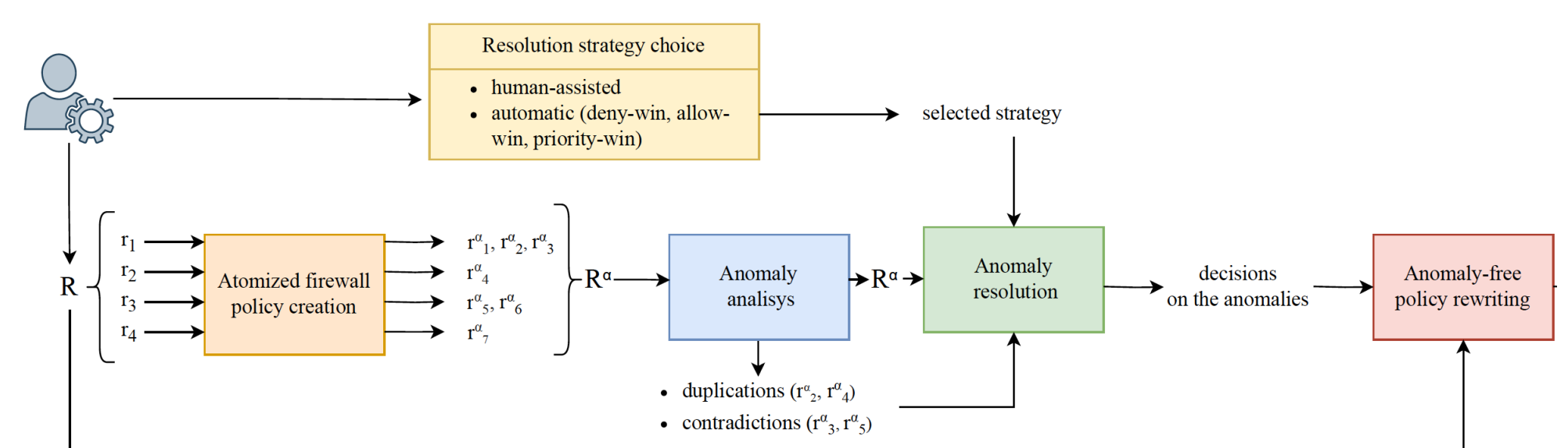
Automatically configure the **security** functions to protect a network, given **requirements** expressed by a network administrator in a high-level language



We proposed two models to represent the traffic that can flows in the network [1]



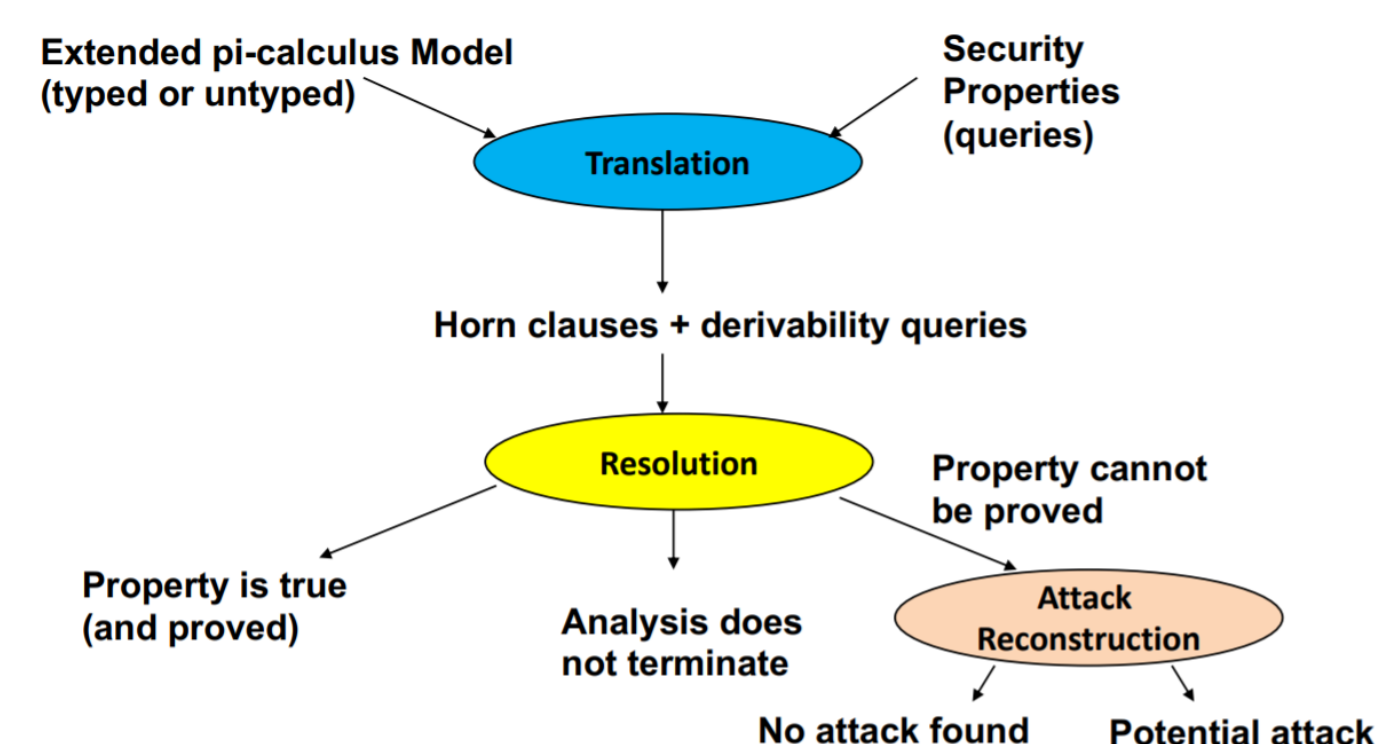
Related work: Firewall policies anomaly analysis and resolution, applying the concept of atomic predicates



## 4. Automatic security verification

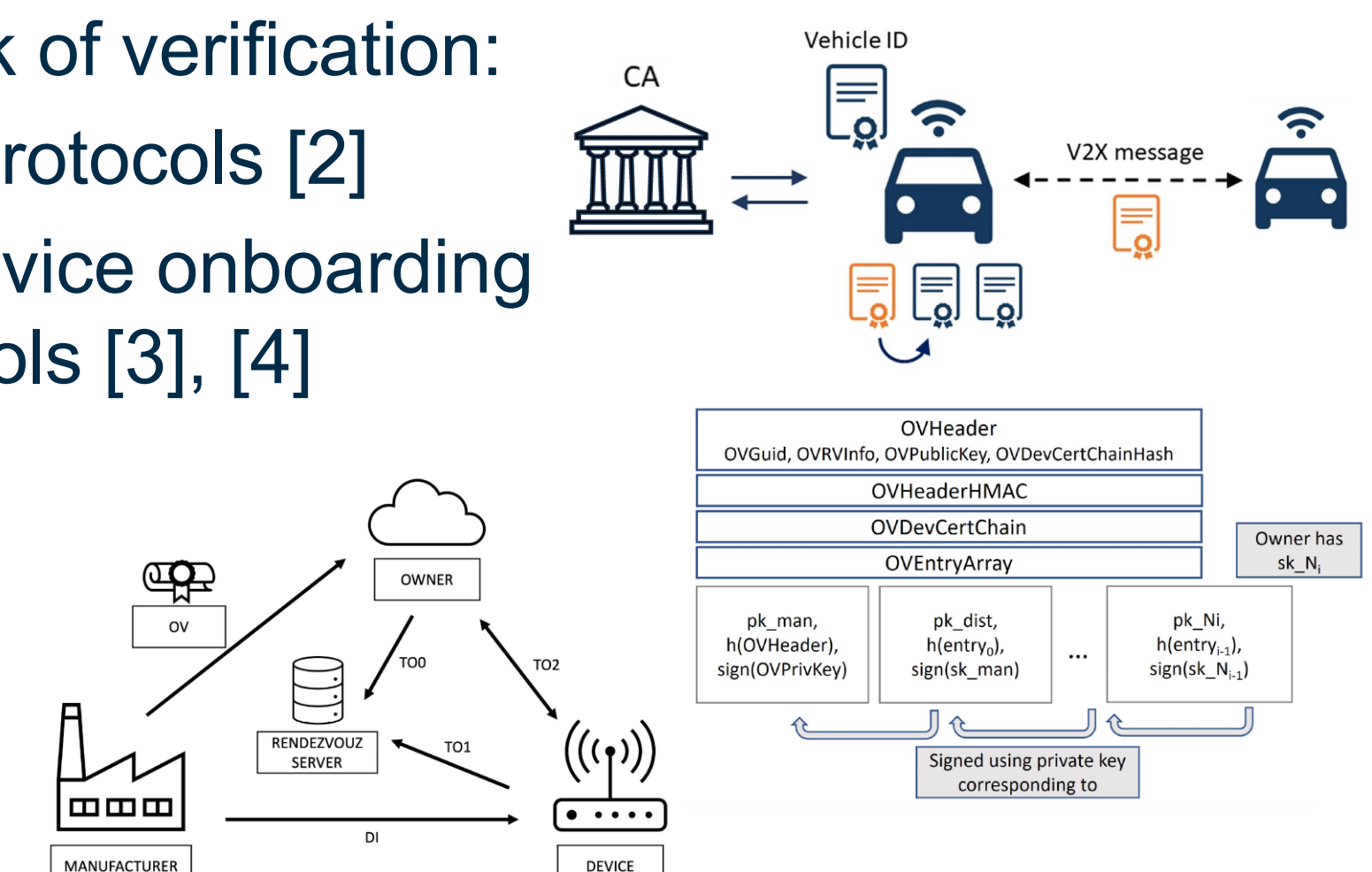
Take existing protocols and **formally** verify if they satisfy the expected security properties.

Modelling approach: Symbolic, Automatic tools: Proverif and Tamarin



My work of verification:

- V2X Protocols [2]
- IoT Device onboarding protocols [3], [4]



## 5. References

1. D.Bringhenti, S.Bussa, R.Sisto, F.Valenza, "A Two-Fold Traffic Flow Model for Network Security Management". IEEE Transactions on Network and Service Management
2. S.Bussa, R.Sisto, F.Valenza, "Formal verification of a v2x privacy preserving scheme using Proverif ". IEEE International Conference on Cyber Security and Resilience (CSR 2023), Venice, Italy, July 32 – August 02, 2023
3. R.Schermann, S.Bussa, R.Urian, C.Steger, "Zero touch privacy preserving provisioning in an Edge-, Fog, and Cloud environment ", IEEE International Conference on Fog and Mobile Edge Computing (FMEC 2023), Tartu, Estonia, September. 18-20, 2023
4. S.Bussa, R.Sisto, F.Valenza, "Formal verification of the FDO protocol", IEEE International Conference on Standards for Communications and Networking (CSCN 2023). Munich, Germany. November 6-8, 2023