Model Checking the EAP-NOOB Protocol

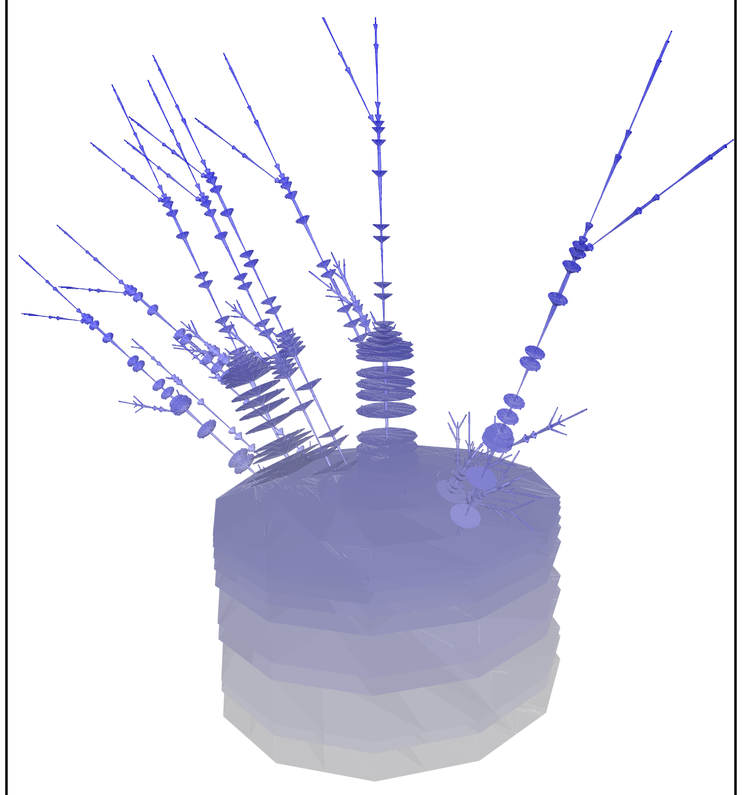
Aleksi Peltonen, Mohit Sethi, Tuomas Aura

EAP-NOOB protocol background

- New IoT appliance has **no owner or domain, no credentials** for cloud or Wi-Fi
- EAP-NOOB:
  - Connects the device to access network
  - Registers the device to AAA server/cloud
- Security from a **single user-assisted out-of-band** message between peer device and AAA server

Modelling EAP-NOOB

- Modelled with mCRL2 (micro Common Representation Language 2)
- Goals of model checking:
  - Protocol simulation and visualisation
  - Debugging the specification, liveness and safety properties
    - Reachability of good and bad states
    - **Deadlock freedom**
    - **Recovery from errors and timeouts**
    - Handling persistent vs. ephemeral data
  - **Detecting persistent denial of service**
    - Recovery after message loss and manipulation



Visualisation of states and transitions

Results and changes

In the **protocol**:

- Recovering from rejected nonces caused by attackers or unreliable channels
- Recovering from expired out-of-band messages caused by timeouts
- Handling of redundant out-of-band messages caused by delays or replays

In the **implementation**:

- Recovering from message type mismatches

In the **modelling language**:

- Detected and reported a bug in the linearisation of user-defined type aliases

Aalto University
School of Science and Technology

Contact: aleksi.peltonen@aalto.fi, mohit.sethi@aalto.fi, tuomas.aura@aalto.fi
Specification: https://tools.ietf.org/html/draft-aura-eap-noob-03
Implementation: https://github.com/tuomaura/eap-noob