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IoT Device Identific***A***tion and Reco***G***nition (***IoTAG***)

Lukas Hinterberger **(OTH Regensburg, lukas.hinterberger@st.oth-regensburg.de)**
Bernhard Weber (OTH Regensburg, bernhard1.weber@st.oth-regensburg.de)
Sebastian Fischer (Fraunhofer AISEC, sebastian.fischer@aisec.fraunhofer.de)
Katrin Neubauer (OTH Regensburg, katrin1.neubauer@oth-regensburg.de)
Prof. Dr. Rudolf Hackenberg (OTH Regensburg, rudolf.hackenberg@oth-regensburg.de)

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Presenter

- Name: Lukas Hinterberger
- Date of birth: July 27, 1995
- Education:
  - 2006 – 2014: Werner von Siemens Gymnasium Regensburg (Abitur)
  - 2014 – 2018: OTH Regensburg (B.Sc. Technical Computer Science)
  - 2018 – 2020: OTH Regensburg (M.Sc. Applied Research)

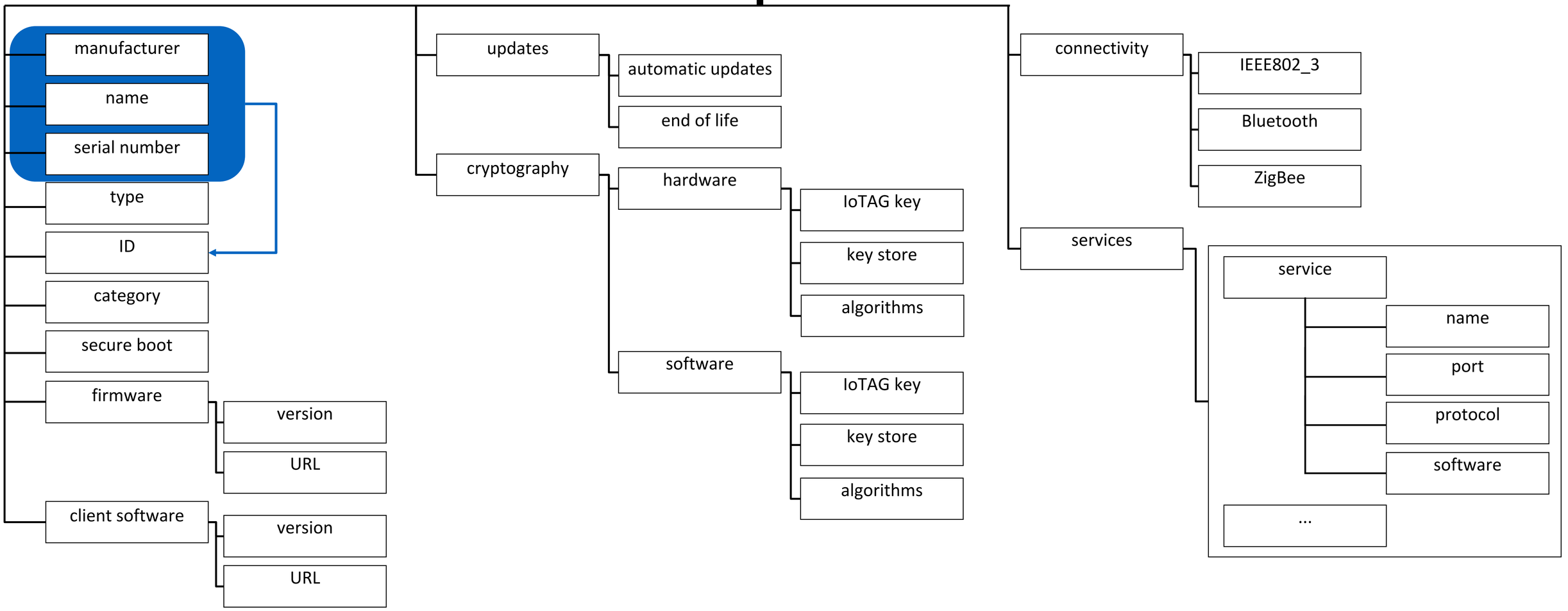
What is IoTAG

- Open Standard for **IoT** Device Identific**A**tion and Reco**G**nition
- Provision of security relevant information by IoT devices themselves
- Predefined communication channels
- Data protection against manipulation
- Easy implementation through the use of existing standards

Why IoTAG?

- IoT devices ARE insecure (most of them) -> see botnets
- Increasing complexity of IoT networks
- Security indicator for devices is necessary
  - Information about devices needed
  - Existing device scanning methods (e.g. Nmap) are too inaccurate
  - ➢ Devices have to provide information themselves

IoTAG Dataset



IoTAG Serialization

- JSON (UTF-8)
  - Expandable
  - Human readable
  - Standardized
  - Broadly supported

```
{
  "Manufacturer": "Beispiel GmbH",
   "Name": "PoC-Device",
   "SerialNumber": "D1.0",
   "Type": "weather station",
   "ID": "67c8acf906269aecd5e3fa85f5be1042b6712adfc529e727534332edb8cef66e",
   "Category": "infrastructure",
   "SecureBoot": false,
   "Firmware": {
      "Version": "1.0",
      "URL": "https://192.168.102.94:10000/FirmwareInfo"
   },
   "Updates": {
      "AutomaticUpdates": false,
      "EndOfLife": "2021-01-01T00:00:00"
   },
   "Connectivity": {
      "IEEE802_3": [“WPA2”, "b", "g", "n", "ac"],
   }, …
}
```

IoTAG Data Integrity

- Without integrity check:
  - Every device can send false data
  - An attacker could use IoTAG to masquerade himself as a harmless IoT device
  - ➢ **It's necessary to sign this information to ensure their authenticity and correctness**

IoTAG Signature

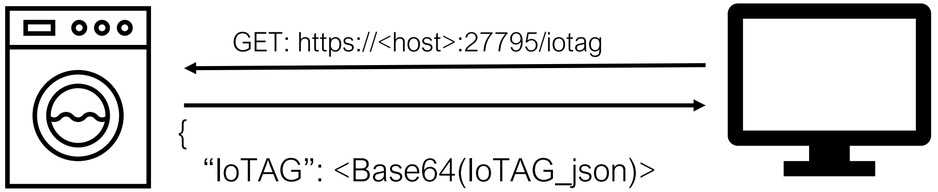
- RSASSA-PSS
  - Asymmetrical
- Certificates for key exchange
  - According to ITU-T X.509 and RFC 2459
- Key size: at least 2048 bits (as recommended by NIST)
- Application to SHA256 hash of the serialized record

IoTAG Communication

- General
  - HTTPS (HTTP/2 + TLS)
  - GET-Request
  - JSON formatted data

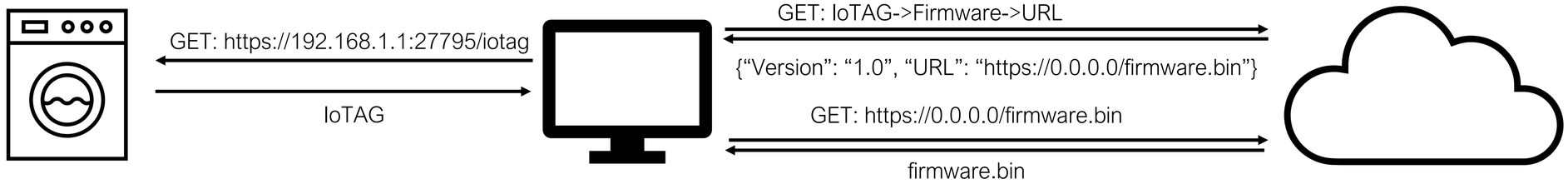
IoTAG Communication

- Retrieving IoTAG
  - JSON object containing “IoTAG”, “Signature” and “Certificates”
  - Base64 encoded data to prevent errors due to different formatting
  - URL: https://<host>:27795/iotag



IoTAG Communication

- Retrieving Software Resources
  - URL contained in IoTAG inside “firmware” or “client software”
  - Software not downloaded directly
  - JSON object containing “URL” and “Version”



IoTAG Conclusion

- Detailed information about devices available
- A central gateway (e.g., the router) can periodically check all devices
- New services for automated scanning for new vulnerabilities (CVE) are possible
- In case of an outdated service or missing software updates:
  - Display security warning
  - Temporarily disable the communication with the insecure device

Pending Issues And Further Work

- How to prevent an attacker who has access to the network to use the provided information from IoTAG to scan for insecure or unpatched devices?
- Add support for multiple signature procedures (e.g. elliptic curve cryptography)
- Add new entries to the dataset (e.g. required cloud resources)
- Development of a security rating system based on the IoTAG dataset

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