ATLAS RESFIT

Reputation-based Security Framework for Internet of Things

In a hyper-connected digital world, weak security mechanisms can be linked to a broad range of consequences, such as private data disclosure, financial frauds, industrial espionage or sabotage. In this context, trust plays an important role in the way IoT devices communicate and interact. Trust management is based on two vital tasks: designing the trust model and evaluating device reputation. A reputation-based system can provide the means to detect malicious or malfunctioning devices.

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The ATLAS RESFIT Security Framework provides the tools needed to securely administer an IoT system and offers a reputation-based S^2aaS (Sensing-as-a-Service) platform. Implementing the ***gateway-centric*** paradigm, ATLAS RESFIT has a modular architecture, with ***lightweight*** and ***independent*** software components, running at each layer of an IoT system:

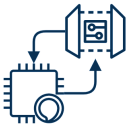
- ATLAS Client - lightweight agent that monitors, in ***real-time***, several parameters of the IoT device and ***securely*** sends this data to the gateway. It exposes an API that proprietary applications can use to ***interconnect*** with the ATLAS Client.
- ATLAS Gateway - software module that aggregates ***telemetry*** data received from connected clients, manages the application layer ***firewall*** rules, computes clients' ***reputation*** scores and ***securely synchronizes*** data with the cloud component.
- ATLAS Cloud - web-based SaaS portal providing ***administrative*** and ***real-time visualization*** tools for managing the IoT system.
- ATLAS Android - smartphone application to authorize commands received by the IoT client device (ATLAS Client)

Main features of ATLAS RESFIT

Reputation-based nodes classification (Sensing-as-a-service)

Collection, aggregation and consumption of client"s telemetry data

Packet filtering at application layer



Lightweight communication protocol between clients and gateways

API for integrating proprietary applications with ATLAS IoT

Integrated administration enabled through a cloud-layer web portal

Visualize real-time status updates in the cloud-layer web portal

Smartphone application for authorizing commands received by IoT devices

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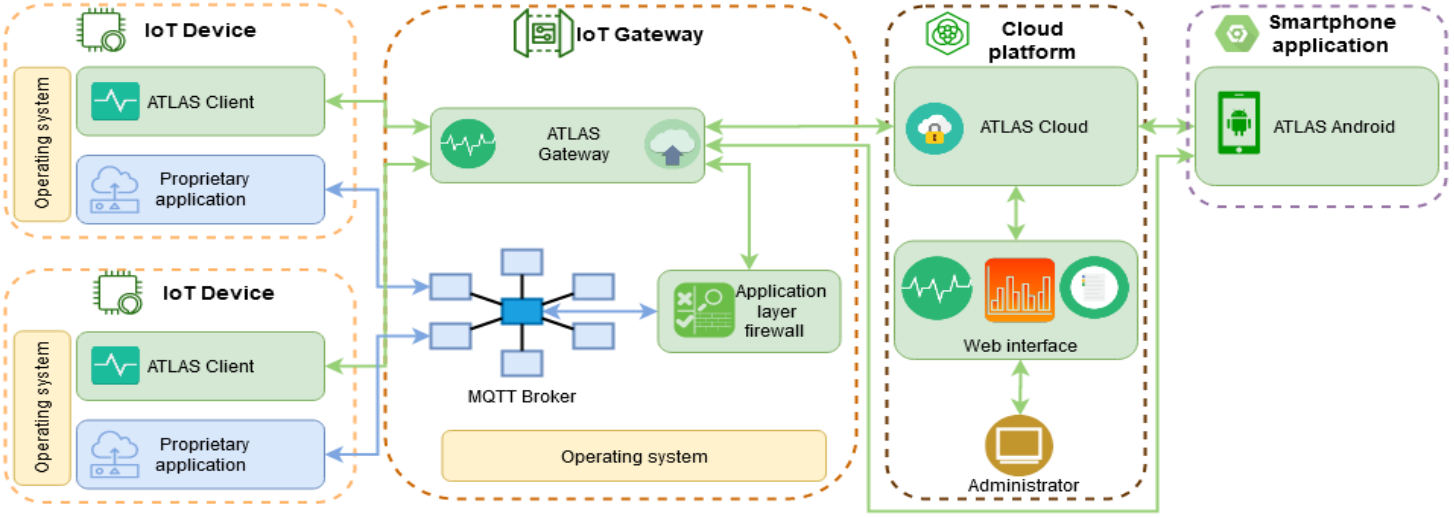
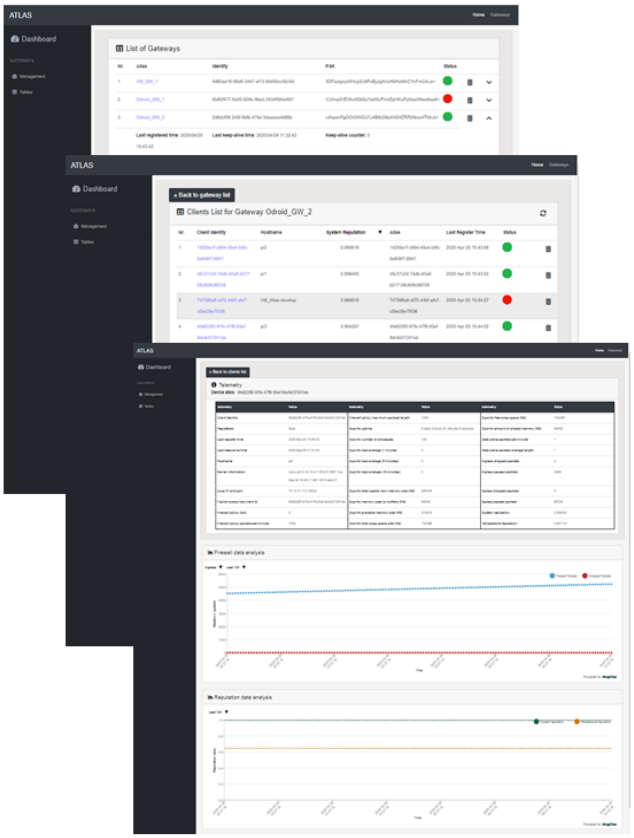


How it works

After being installed on each device, ATLAS Client will start collecting a set of system parameters (telemetry data) and will establish a secure communication channel with the gateway (that runs the ATLAS Gateway component). Traffic filtering rules can be defined at the ATLAS Gateway component by integrating proprietary applications that collect sensor data with ATLAS Client, using the provided API. Telemetry data is being processed by the ATLAS Gateway to obtain values for several metrics that are used in the ***system reputation*** score computation algorithm, whilst the application firewall rules are being installed in the MQTT broker (it will provide statistics that are also being used to compute the system reputation score). Depending on the feedback given by proprietary applications for data received from neighbouring IoT devices, ATLAS Gateway will compute a second reputation score, for ***sensor reputation*** (data plane). Based on these two reputation scores, IoT nodes can consume data from trustworthy devices with the highest reputation, while an administrator can detect malicious or malfunctioning devices. The status of IoT devices connected to each gateway is being updated in real-time and sent to ATLAS Cloud, where data is integrated and displayed in a web-based portal. An administrator will now have a better overview of the underlying IoT system. ATLAS Android enables the control of commands received by the IoT devices (ATLAS Client) that are connected to a specific ATLAS Gateway element (***ATLAS RESFIT implements a claim mechanism for creating links between gateways and admins***).



Software available for download at https://github.com/atlas-iot/resfit

About ATLAS

The ATLAS project ("Hub inovativ pentru tehnologii avansate de securitate cibernetică") plans on improving research and collaboration performances in the cyber-security domain, by addressing themes of high interest: security of applications, operating systems, IoT and cloud.
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