

Purchase SAF-001

Technical Requirements: Development and analysis of a MIOTY Network Management System (NMS)

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1 General

This document is executed in both Latvian and English. Since the terminology of the subject is not well developed in Latvian, in the event of any conflict or inconsistency between the two language versions, the English language version shall prevail and govern the interpretation.

This document invites qualified service providers to design and implement a production-ready MIOTY Network Management System (NMS), which is hereafter considered to be fully compliant with following specifications:

- 1) ETSI TS 103 357-2 V2.1.1 standard.
- 2) mioty® Base station Service Center Interface – a description issued by Technical Committee of the MIOTY alliance.

The solution must support MIOTY device classes Z, A, B, and C, provide multi-tenant capabilities, and be implemented primarily in Golang. The system is expected to integrate cleanly into Kubernetes-based environments and support robust operations, monitoring, and lifecycle management.

2 Use cases the solution should support

2.1 Context

Aranet Cloud has the “tenancy” concept built around a workspace. Each client can create one or more workspaces. Each workspace has a license associated with: Pro, Basic, Management & Trial (Pro or Basic). License gives the client time-limited full or limited access to process, manage and store their network of sensors and base stations inside their workspace.

Base station can only be attached to a single workspace at a time. Initially, all base stations are registered under an “inventory” workspace.

The expectations of this project are to extend Aronet Cloud capabilities to be able to support MIOTY compatible devices as well. These devices should be able to be registered, managed and their data collected in Aronet Cloud.

An additional outcome of this project should include the capabilities for SAF Tehnika’s manufactured MIOTY devices to be automatically registered (in a workspace) & remotely managed - both things should be possible to be done by a client via Aronet Cloud (and not require involvement of technical support).

2.2 Functional Use Cases

2.2.1 UC1: Create a new workspace (tenant)

Description: A new (or existing) client logs into Aranet Cloud and clicks the "New Workspace" button. In a manner of seconds, the client receives a successful response and gets redirected to the new workspace page.

Actors: client

Trigger: client has decided to create a new workspace in Aranet Cloud under his account

Pre-conditions: client has an account in Aranet Cloud and is logged in

Post-conditions:

- 1) system has created a new workspace under client's account
- 2) system has created a new "MIOTY network" and linked it to the workspace
- 3) system has generated a tenant root certificate for the network/workspace
- 4) client gets redirected to the new workspace

Organization benefits:

- 1) workspace creation is an automated, self-service process
- 2) clients(tenant) MIOTY network is automatically created for the client's workspace

2.2.2 UC2: Register a SAF Tehnika's MIOTY base station to a workspace

Description: Client logs into Aranet Cloud, selects an existing workspace and goes to the base station tab. Then clicks the "Register a SAF Tehnika Base Station" button – which prompts a window for PIN code to be entered. Then the client opens base station GUI and clicks "Connect to Cloud" button, which generates a PIN code. Then the client enters this PIN code into Aranet Cloud prompt window. In a manner of seconds, client receives a successful response, and a new base station card shows up in status "registration in progress". After 1 - 2 minutes, the base station status changes to "registered".

Actors: client

Trigger: client has decided to register it's SAF Tehnika's MIOTY base station to an existing workspace

Pre-conditions:

- 1) client has an account in Aranet Cloud and is logged in
- 2) client has an existing workspace
- 3) client has a SAF Tehnika's manufactured MIOTY base station & is connected to

internet

4) (optional) client has already registered at least one MIOTY sensor to its workspace

Post-conditions:

- 1) system has generated a certificate for this base station (under tenant root certificate)
- 2) system has linked the device to the relevant MIOTY network
- 3) system has notified base station to use the new certificate to communicate with Aranet Service Center
- 4) system has notified base station to use a new authentication key (workspace specific) to communicate with Aranet Cloud
- 5) base station has established a connection with Aranet Service Center
- 6) client has a registered base station in its workspace
- 7) sensors start sending data & can be viewed in client's workspace (if any sensors were already registered – see pre-condition #4)

Organization benefits:

- 1) SAF Tehnika's MIOTY devices can be registered in an self-service & automated manner
- 2) clients(tenant) MIOTY network configuration is done automatically

2.2.3 UC3: Register a 3'rd party MIOTY base station to a workspace

Description: Client logs into Aranet Cloud and selects an existing workspace and goes to the base station tab. Then clicks the "Register a 3'rd Party Base Station" button – which prompts a window for EUI code to be entered. Then client enters the 3'rd party base station EUI code and after successful submit – a new base station card shows up in status "registration in progress". Then client clicks on generate a new network certificate and stores it on the local machine. Then the client opens the base station GUI and enters the Aranet Service Center URI and uploads the network certificate. In a manner of 1-2 minutes, client base station status changes to "registered"

Actors: client

Trigger: client has decided to register its 3'rd party MIOTY base station to an existing workspace

Pre-conditions:

- 1) client has an account in Aranet Cloud and is logged in
- 2) client has an existing workspace
- 3) client has a 3'rd party MIOTY base station & is connected to internet
- 4) (optional) client has already registered at least one MIOTY sensor to its workspace

Post-conditions:

- 1) system has generated a certificate for this base station (under tenant root certificate)
- 2) system has linked the device to the relevant MIOTY network
- 3) base station has established a connection with Aranet Service Center
- 4) client has a registered base station in its workspace
- 5) sensors start sending data & can be viewed in client's workspace (if any sensors were already registered – see pre-condition #4)

Organization benefits:

- 1) 3rd party MIOTY devices can be registered in Aranet Cloud in a self-service manner
- 2) clients(tenant) MIOTY network configuration is done automatically

2.2.4 UC4: Register a SAF Tehnika's MIOTY sensor to a workspace

Description: Client logs into Aranet Cloud and selects an existing workspace. Then clicks the “Register a SAF Tehnika's Sensor” button – which prompts a window for sensor credentials to be entered. Then the client scans the sensor passport QR or enters the sensor's serial number and the initial symbols of the network key. In a manner of seconds, client receives a successful response, and the sensor has been successfully paired and shows it's in pending status. After 1 - 2 minutes, sensor status changed to connected.

Actors: client

Trigger: client has decided to pair it's SAF Tehnika's MIOTY sensor to its workspace

Pre-conditions:

- 1) client has an account in Aranet Cloud and is logged in
- 2) client has an existing workspace
- 3) (optional) client has registered at least one MIOTY base station in its workspace

Post-conditions:

- 1) system has linked the sensor to the relevant MIOTY network
- 2) system has notified all base stations in the workspace to start processing the sensor
- 3) system has identified the sensor blueprint & will use it to automatically parse the measurements & provide remote configuration options
- 4) client has a registered sensor in its workspace with information about its supported measurable metrics & configuration options (if applicable)
- 5) sensor starts sending data & it can be viewed in client's workspace (if base station was already registered – see pre-condition #3)

Organization benefits:

- 1) SAF Tehnika's MIOTY devices can be registered in an automated, self-service manner
- 2) clients(tenant) MIOTY network configuration is done automatically

2.2.5 UC5: Register a 3'rd party MIOTY sensor to a workspace

Description: Client logs into Aranet Cloud and selects an existing workspace. Then clicks the "Register a 3'rd Party Sensor" button – which prompts a window for the sensor passport information to be entered (at least EUI & network key). Then the client enters the sensor's passport. In a manner of seconds, client receives a successful response, and the sensor has been successfully registered and is in status "registration in progress". After 1 - 2 minutes, sensor status changes to "registered".

(additional notes: client should provide more information inside the "sensor passport" like sensor class & blueprint file ... for the system to provide more capabilities for the sensor)

Actors: client

Trigger: client has decided to pair it's 3'rd party MIOTY sensor to its workspace

Pre-conditions:

- 1) client has an account in Aranet Cloud and is logged in
- 2) client has an existing workspace
- 3) (optional) client has registered at least one MIOTY base station in its workspace

Post-conditions:

- 1) system has linked the sensor to the relevant MIOTY network
- 2) system has notified all base stations in the workspace to start processing the sensor
- 3) system has identified the sensor blueprint & will use it to automatically parse the measurements & provide remote configuration options
- 4) client has a registered sensor in its workspace with information about its supported measurable metrics & configuration options (if applicable)
- 5) sensor starts sending data & it can be viewed in client's workspace (if base station was already registered – see pre-condition #3)

Organization benefits:

- 1) 3'rd party MIOTY devices can be registered in a self-service manner
- 2) clients(tenant) MIOTY network configuration is done automatically

2.2.6 UC6: Unregister a SAF Tehnika's MIOTY base station from a workspace

Description: Client logs into Aranet Cloud and selects an existing SAF Tehnika's MIOTY base station. Then clicks the "Unregister" button – which prompts a confirmation window. Then the client confirms the action. In a manner of seconds, the client receives a successful response, and the base station becomes in a removed state.

Actors: client

Trigger: client has decided to unregister a SAF Tehnika's MIOTY base station from its workspace

Pre-conditions:

- 1) client has an account in Aranet Cloud and is logged in
- 2) client has an existing workspace
- 3) client has registered a SAF Tehnika's MIOTY base station to its workspace

Post-conditions:

- 1) system has removed base station from the workspace
- 2) system has removed base station from the client's MIOTY network
- 3) system has informed base station to drop connection to Aranet Service Center
- 4) system has informed base station to use "inventory" authentication key

Organization benefits:

- 1) SAF Tehnika's MIOTY base stations can be unregistered in an automated, self-service manner
- 2) SAF Tehnika's MIOTY base stations return to "inventory" and can be reused in another workspace
- 3) clients(tenant) MIOTY network re-configuration is done automatically

2.2.7 UC7: Unregister a 3'rd party MIOTY base station from a workspace

Description: Client logs into Aranet Cloud and selects an existing SAF Tehnika's MIOTY base station. Then clicks the "Unregister" button – which prompts a confirmation window. Then the client confirms the action. In a manner of seconds, the client receives a successful response, and the base station becomes in a removed state.

Actors: client

Trigger: client has decided to unregister a 3'rd party MIOTY base station from its workspace

Pre-conditions:

- 1) client has an account in Aranet Cloud and is logged in
- 2) client has an existing workspace
- 3) client has registered a 3rd party MIOTY base station to its workspace

Post-conditions:

- 1) system has removed base station from the workspace
- 2) system has removed base station from the client's MIOTY network

Organization benefits:

- 1) 3rd party MIOTY base stations can be unregistered in a self-service manner
- 3) clients(tenant) MIOTY network re-configuration is done automatically

2.2.8 UC8: Unregister a MIOTY sensor from a workspace

Description: Client logs into Aranet Cloud and selects an existing MIOTY sensor. Then clicks the “Unregister” button – which prompts a confirmation window. Then the client confirms the action. In a manner of seconds, the client receives a successful response, and the sensor becomes in a removed state.

Actors: client

Trigger: client has decided to unregister a MIOTY sensor from its workspace

Pre-conditions:

- 1) client has an account in Aranet Cloud and is logged in
- 2) client has an existing workspace
- 3) client has registered a SAF Tehnika's MIOTY sensor to its workspace

Post-conditions:

- 1) system has removed sensor from the workspace
- 2) system has removed sensor from the clients(tenant) MIOTY network

Organization benefits:

- 1) any MIOTY sensor can be unregistered in an automated, self-service manner
- 2) client(tenant) MIOTY network re-configuration is done automatically

2.2.9 UC9: Configure a class A, B, C MIOTY sensor from a workspace

Description: Client logs into Aranet Cloud and selects an existing MIOTY sensor. Then clicks the “Configure Sensor” button – which prompts a window with options the

sensor can be configured. Then the client selects changes for the sensor and clicks "Save". In a matter of seconds, client receives a successful response, and the sensor configuration changes have been registered and is in status "re-configuration in progress". After however long the sensor downlink interval is (and successful reception acknowledgement), sensor status changes to "re-configured".

configuration options depend on the class of the sensor & its blueprint.

example: up, down TX intervals, custom configurations (defined in sensor's blueprint)

Actors: client

Trigger: client has decided to re-configure a MIOTY sensor in its workspace

Pre-conditions:

- 1) client has an account in Aranet Cloud and is logged in
- 2) client has an existing workspace
- 3) client has registered at least one MIOTY base station in its workspace
- 4) client has registered a MIOTY sensor in its workspace

Post-conditions:

- 1) client(tenant) MIOTY network sends out configuration message to the relevant sensor
- 2) system gets informed that sensor got re-configured successfully
- 3) sensor gets re-configured

Organization benefits:

- 1) MIOTY sensors can be remotely configured in a self-service manner

2.2.10 UC12: Manage MIOTY sensor blueprints

Features:

- Add a new MIOTY sensor blueprint from administration page
- Edit an existing MIOTY sensor blueprint from administration page
- Edit an existing MIOTY sensor blueprint from administration page
- blueprints should be loaded & changed dynamically at run-time - it should be possible to change their definitions & be applied instantly (or on-demand)
- parsing of sensor measurements using blueprints should be as fast as possible – think transpiling JSON to binary

Actor: tech-support

2.3 Non-Functional Use Cases

2.3.1 NFUC1: On-demand SC cluster node scaling

(WHEN) SC cluster has experienced an increased load for a sustained period, (THEN) the cluster should provision a set of nodes and re-distribute the connections accordingly. (AND WHEN) SC cluster has experienced decreased load for a sustained period, (THEN) the cluster should gracefully terminate a set of nodes and re-distribute the connections accordingly. (RESULT) Service Center cluster provides reliable communication with base stations with consistent performance utilizing minimal resources.

2.3.2 NFUC2: Graceful SC cluster node termination

(WHEN) SC cluster node has experienced an unhandled exception & freezes or otherwise is unresponsive, (THEN) the cluster should redistribute the previously connected base station connections to a healthy node & terminate the unresponsive node & scale-up a new healthy node. (RESULT) communication with the affected base stations reassume & there has been no or minimal data loss.

2.3.3 NFUC5: Metrics/logging/tracing

Expose Architecture and Infrastructure Metrics e.g.:

- System-Level metrics: CPU, Disk, Memory, Network
- TLS Connections (SCACI & BSSCI)
- Service replicas (worker)
- Stream/Queue metrics (length, lag)

Expose MIOTY Network metrics e.g.:

- Message Traffic:
 - Received messages
 - Deduplications
 - Queued Messages
- Base Station metrics:
 - Messages per BS
 - Status (e.g. duty cycle)
- Endpoint metrics:
 - Number of connected devices
 - Messages per EP
- Network metrics:

- o RSSI/SNR
- o Packet Loss
- o Messages/Bytes per second

Expose tenant specific metrics, e.g.:

- Traffic: Messages per tenant
- Number of BS
- Number of endpoints

3 Deliverables

3.1 D1 – Network Management System Concept and Requirements Document

A comprehensive concept document covering:

- Functional and non-functional requirements
- Multi-tenancy model and tenant boundary definition
- Operational requirements (Kubernetes deployment assumptions, observability, resiliency)
- Key workflows (onboarding, routing, downlink, fail-over, monitoring)

3.2 D2 – MIOTY Network Management Core (Classes Z and A only)

Implemented production-ready NMS software including source code and fulfilling following:

- Tenant isolation for configuration, devices, data, and operational control
- Should support use cases: UC1, UC2, UC3, UC4, UC5, UC6, UC7, UC8, UC9
- Should support at least 2 000 000 Z-class endpoints with transmission interval of 2 minutes.
- Deployable on a single standalone base station with following conditions:
 - o 1000 Z-class endpoints with transmission interval of 2 minutes;
 - o CPU: Cortex A53 1.8GHz 4 core;
 - o RAM: 2GB LPDDR4;
 - o OS: OpenWRT.

3.3 D3 – Compliance, Software Architecture, and MIOTY Class Z, A, B, C Functional Specification

A consolidated deliverable including:

- Regulatory/compliance considerations relevant to the deployment context (as applicable)
- Finalized software architecture and design blueprint

3.4 D4 – MIOTY Network Management Prototype (Classes Z, A, B, C)

NMS software prototype including source code and fulfilling following:

- Should support use cases: UC1, UC2, UC3, UC4, UC5, UC6, UC7, UC8, UC9, NFUC1, NFUC2
- Application Center adapter library for Aranet Cloud should support use cases: NFUC3, UC1, UC2, UC3, UC4, UC5, UC6, UC7, UC8
- MIOTY endpoint blueprint functionality according to UC12

3.5 D5 – Comprehensive Documentation and Go-Live Readiness Package

- Technical documentation (architecture, APIs, data model, operational procedures)
- Administrator/operator documentation (Kubernetes operations, scaling, backup/restore if applicable)
- Developer documentation (build, test, contribution guidelines)
- Handover package supporting successful adoption and continued operation