BOOSTER IOT ASSET OVERVIEW

14 Mar 2024

https://www.sadeinnovations.com/iot

SADEinnovations

COMPANY SNAPSHOT

- Established Sep 2017
- Owned by personnel
- Offices in Salo & Turku, Finland, ex-Nokia mostly
- Revenue 3.5M€ (2023), constant growth

32 experienced and widely skilled engineers

- Concepting and management
- Full stack software
- Electronics
- Mechanics
- Industrial design
- Testing

Over 120 successful customer projects with 70 customers in 6 years

Responsible
Flexible
Efficient
Always up-to-date

PARTNERS

aws PARTNER Select Tier Services

CREO CENTER

Solution partner, mechanics and ID

gavon

Solution partner, UI design

SENSOAN Sensor Architectures and Networks

Solution partner, IoT & sensors

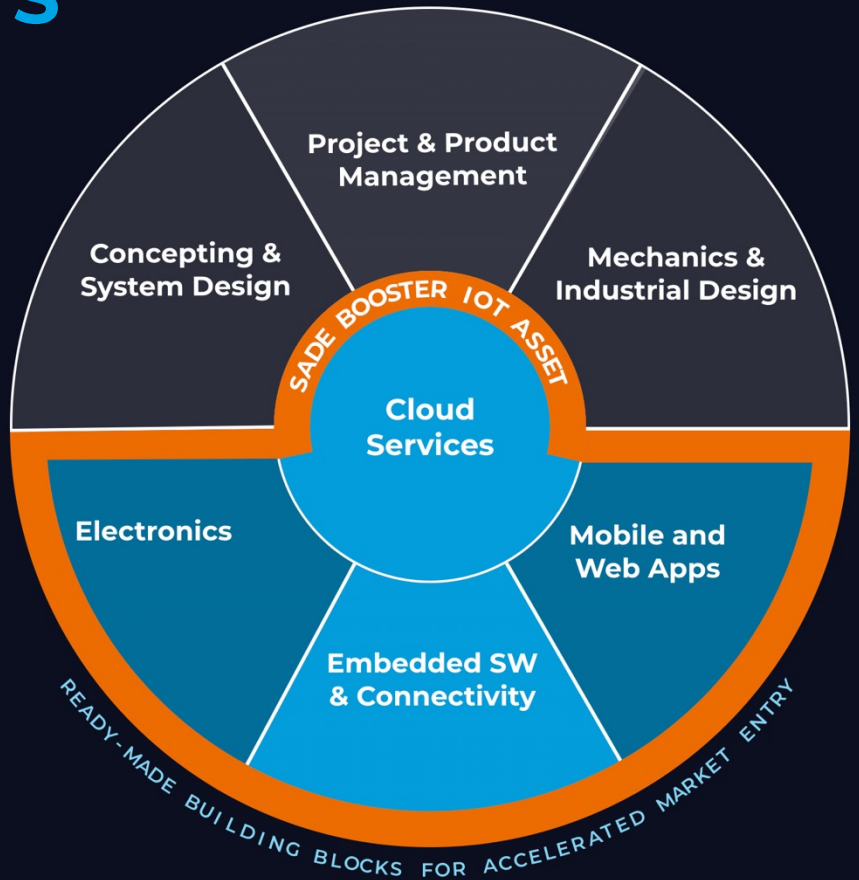
SADE innovations

SADE Innovations is your full-service cloud and IoT partner.

We will make your technological change and renewal happen.

HOW →

OUR COMPETENCIES
AND ASSETS



REFERENCES


OUMAN


evondos.


VAISALA


Helvar


vaadin}>


VARJO


enersense


L7DRIVE


awake.ai


SOLAR
FINLAND

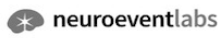

CeLLife


HEINA


SENSOAN

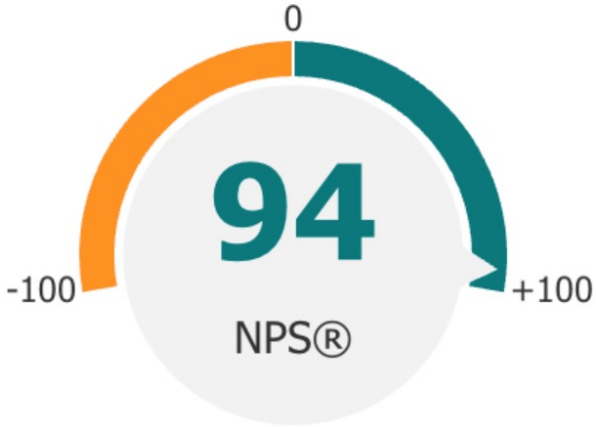

Farpointe Data
Readers • Credentials


TELESTE


neuroeventlabs

NET PROMOTOR SCORE (NPS)

“What do you think has been the best thing in SADE Innovations' work & way of working?”



“Concentrating on the essential and not selling nonessentials.”

“Dependability, flexibility and transparency.“

“Technical depth and agility as company.”

“Innovation with latest AWS offerings.”

“Open communication and seamless co-operation.”

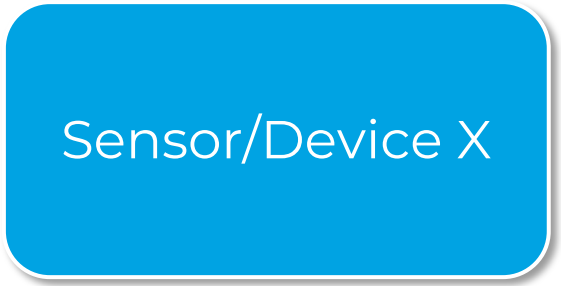
“Booster service was well customizable for us.”

“The work was done well and in schedule. Communication was easy and there was no need to watch over to make sure that everything is done & done correctly.”

“Best thing - SADE's ability to interpret and understand our needs, and then express them efficiently in a cloud environment. We also appreciate the camaraderie developed across the teams.”

COMMON CUSTOMER PROBLEM

DEVICE WITH CLOUD CONNECTIVITY NEEDS



Device/set of sensors without cloud connectivity, located anywhere in the planet

- No information about device status (location, battery level, etc.)
- Not possible to communicate with device using secure connection
- Not possible to control device remotely
- Not possible to update device functionality over-the-air (OTA)

SOLUTION – SADE BOOSTER IOT ASSET

Provides **building blocks for any connected device** concept
Focus immediately on value creation instead of wasting time & money on basics
Fast RnD phase enabling first release of the IoT solution in a matter of months
Tested and tried out, several customers using the same basis
Scalable, world class cloud solution. **Cost level scales** with your business

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USE CASE AREAS FOR IOT SOLUTIONS

FUNCTIONALITY SUPPORTED BY BOOSTER

REMOTE STATUS MONITORING

EVENTS/ALARMS & ACTIONS/NOTIFICATIONS

REMOTE DEVICE CONTROL & CONFIGURATION

CLOUD BASED AUTOMATIC CONTROL AND OPTIMIZATION

AUTOMATIC FAILURE DETECTION

DASHBOARDS, BUSINESS INTELLIGENCE AND DATA ANALYTICS

DEVICE AND USER MANAGEMENT

HIERARCHICAL CUSTOMER ORGANIZATIONS + USER ROLES

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USE CASE EXAMPLES - SADE PROJECTS

FOLLOW IN-DOOR AIR QUALITY

ALARM WHEN PERSON FALLS DOWN ON FLOOR + SEND SMS

DISABLE / ENABLE ELECTRIC BICYCLE REMOTELY

VIEW POWER CONSUMPTION STATISTICS OF 5G SMART CITY POLES

UTILIZE POWER FROM BATTERY TO BALANCE POWER GRID

DETECT BATTERY CELL FAILURES

CONTROL YOUR SAUNA USING MOBILE APP

ANALYZE COVID-19 FROM EXHALED BREATH SAMPLE

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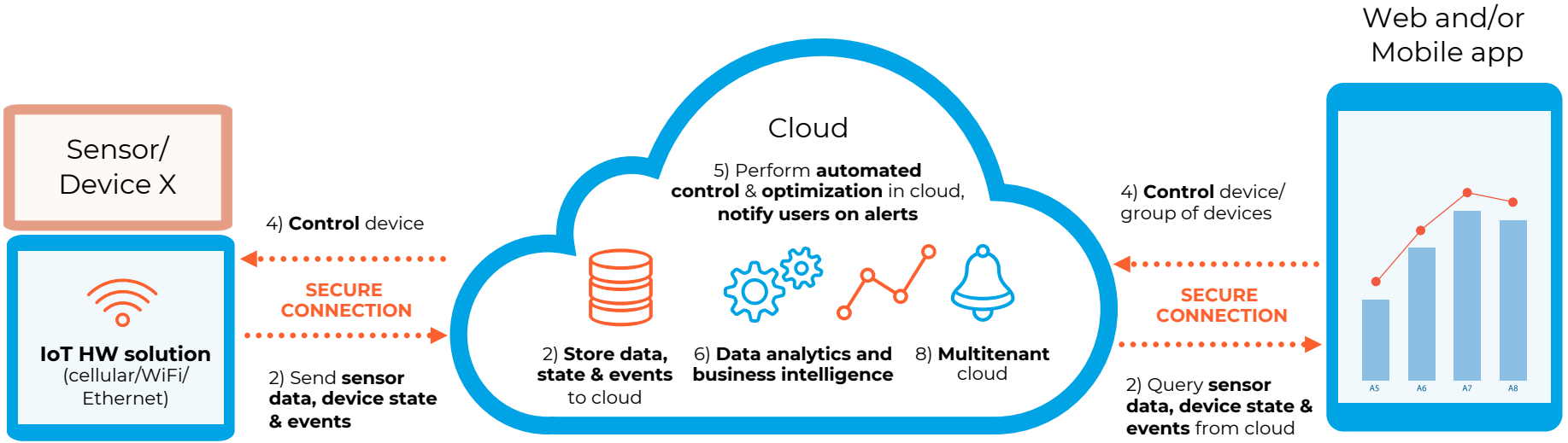
SADE BOOSTER
IN NUMBERS

>25 000 ACTIVE DEVICES	**21** COMPANIES WITH BOOSTER LICENSE	**>18 000** HOURS OF RND INVESTMENT
4 CONTINENTS WITH BOOSTER DEVICES	**3** BOOSTER RELEASES DURING THREE YEARS	**800 000€** EUROS OF RND INVESTMENT

BOOSTER OVERVIEW

MAIN BUILDING BLOCKS



1) General purpose **IoT hardware** with **several connectivity options**, **part of/connected to** the device

9) **Secure, scalable, available, updatable, manufacturable, robust & cost efficient** HW & SW & Cloud architecture

3) **Visualize data** + **control device**

7) **Manage devices, users and organizations**

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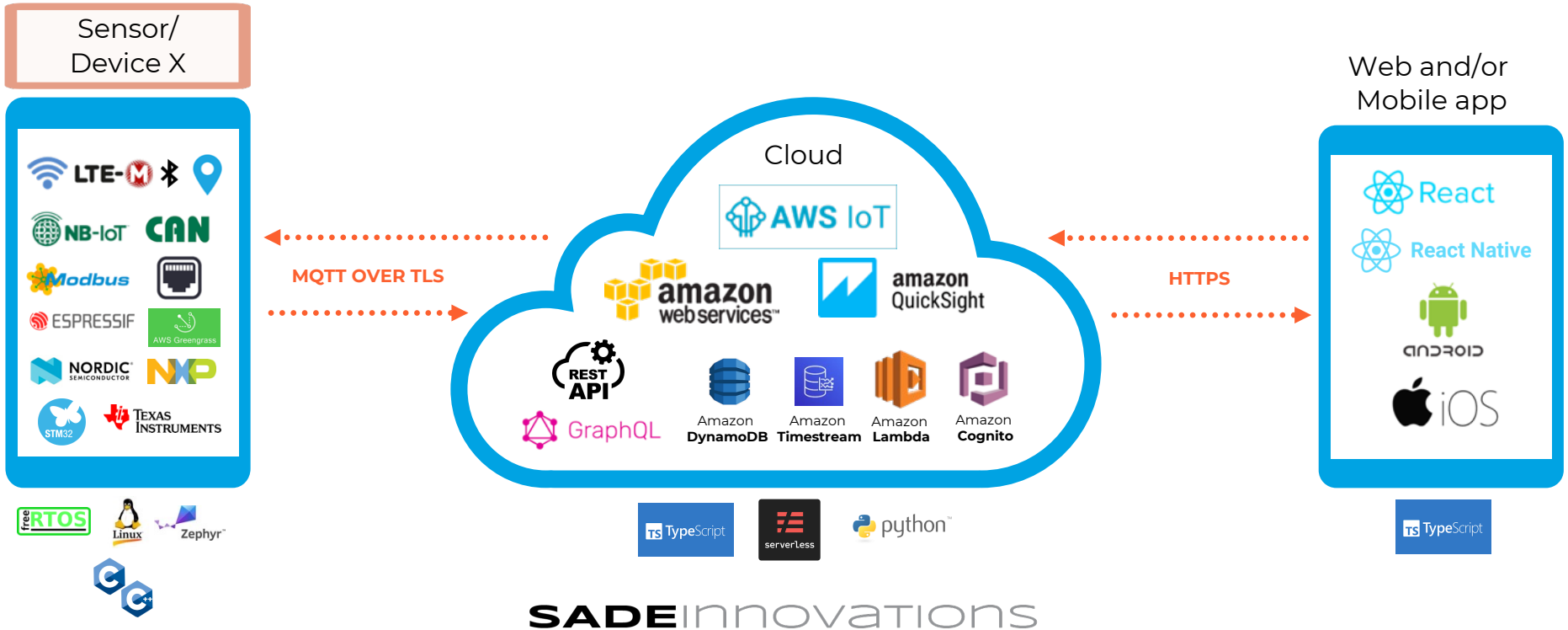
BOOSTER OVERVIEW

TECHNOLOGIES, LANGUAGES & TOOLS



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IOT HW SOLUTIONS

COVERING DIFFERENT USE CASES AND PRICE POINTS

IoT EdgeNode
(optional display & camera)

IoT CoreNode
(optional display)

IoT Wireless Sensor Node

Edge solution for SADE Booster IoT asset

- Respond to local events in real-time, operate offline, auto-deploy functionality from cloud, manage Linux OS based devices and their software from cloud
- Linux OS + AWS Greengrass IoT Edge software solution, supporting any Linux based hardware
- Several different hardware solutions that SADE has been using as basis for EdgeNode, examples
  - Variscite SOM modules: NXP i.MX8 Quad ARM Cortex™-A53, 2-8GB RAM, 16-128GB eMMC, WiFi & BT
  - NVIDIA Jetson Nano: 4×ARM Cortex-A57 1.43Ghz, 4GB RAM, 16GB eMMC, Ethernet, USB

Basic building block for IoT device

- Full cloud connectivity over secure data connection (WiFi, 2G/NB-IoT/LTE-M, ethernet), both data and control. Bluetooth and BT Low Energy for wireless local connectivity & device setup.
- Two alternative IoT chipsets
  - ESP32 family: Xtensa dual core, 520kB RAM, 1-16MB flash, WiFi+BT, FreeRTOS + external cellular modem
  - nRF9160: 64 MHz Arm® Cortex®-M33 CPU, 1 MB Flash & 256 KB RAM, integrated 4G IoT cellular modem
- Supports both mobile (battery) and on-premise installations, optional display & touch, GPS, basic sensors

Ultra-low power wireless sensor solution, n years usage times with battery

- Wireless local connectivity (Classic Bluetooth, Bluetooth LE, Bluetooth LE mesh, Thread)
- nRF528xx: ARM Cortex-M4F CPU 64MHz, 32-256kB RAM, 256-1024kB internal storage
- nRF5340: ARM Cortex-M33 CPU 64MHz, 512kB RAM, 1MB flash
- Basis for low power, low cost wireless sensor, capable of supporting various sensors (I2C, UART, SPI, ADC)

BOOSTER CASE EXAMPLES

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CASE: OUMAN WIFI THERMOSTAT & RELAY

- Booster based cloud, mobile app and admin web UI for Ouman WiFi Thermostat & Smart relay concepts
  - Extends local user interface with remote status & control
- Monitor and control room temperature/heater/EV charger with crossplatform (Android & iOS) mobile app
  - Zones and thermostats + smart relays
  - Target temperature, home/away
  - Manual, week clock or electricity price based control
  - Follow temperature history, energy consumption and money saving
  - Events on abnormal behaviour (e.g. temperature limit reached)
  - Device management (add/remove/update)
- Booster based multi-tenant cloud service capable of serving globally large numbers of devices and users
- More info: https://evesta-home.com/

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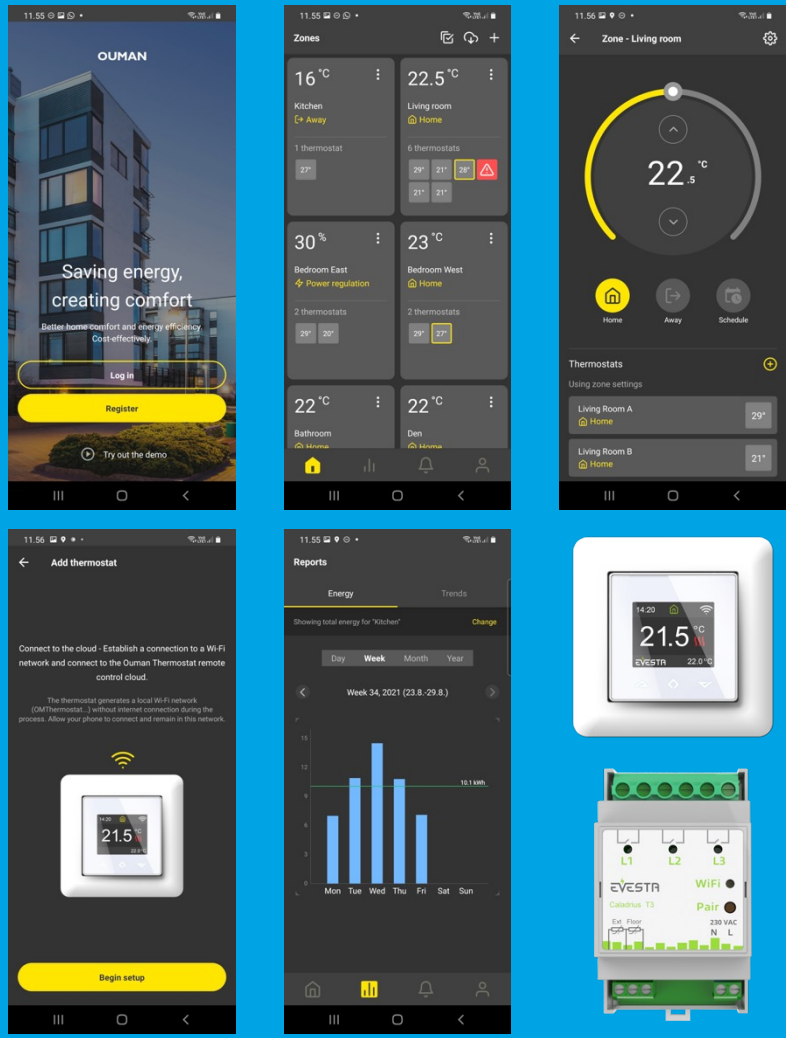

CASE: CELLIFE BATTERY ANALYZER

- Battery analyzer device + cloud solution for electrical fingerprint (EFP) measurements
  - Computing platform with touch UI based on NXP i.MX8 Plus
  - Cloud-managed software based on Linux & AWS Greengrass
  - Data collection to Booster IoT asset-based cloud, cloud-based analysis algorithm
  - Web App for test management and data visualizations
- Use cases
  - Fast and accurate quality assurance for batteries
  - Safe and efficient second-life battery cell use
  - Accurate health and performance analyses for used batteries
  - Cell lifetime and future performance estimation
  - Works for all cell and battery chemistries and types
- https://www.cellife.fi/

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CASE: LUXTURRIM 5G SMARTPOLE

- Intelligent, cloud based battery backup system for 5G smart city poles + smart pole control
- Use cases
  - Remote monitoring and control of LiFePo based innovative battery backup solution
  - Real-time control of fleet of smart batteries enabling Virtual Power Plant (VPP) usage
- Deliverables from SADE
  - Pole controller IoT connectivity module
    - CAN connection to L7Drive battery system
    - Ethernet based connection to cloud
    - Smart pole internal conditions management (temp, humidity) + light control (MQTT⇔DALI)
  - L7Drive cloud + admin web UI solution
    - Remote management and control of power backup solution
- More info: Luxturrim news, L7Drive

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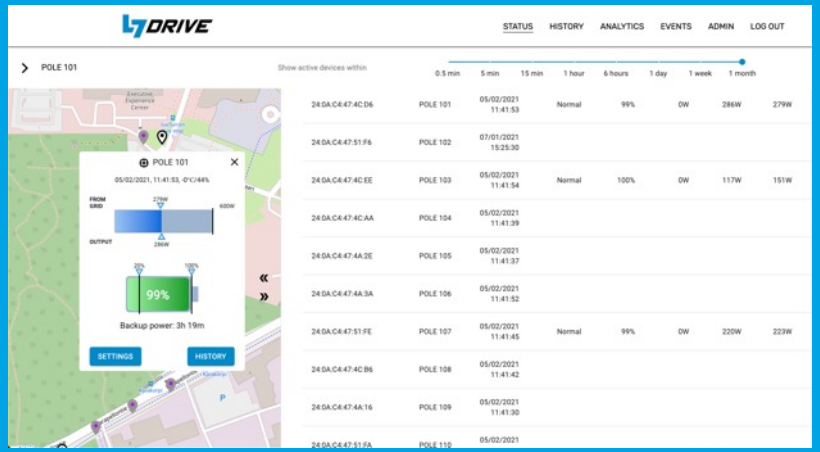

CASE: DSA BREATHPASS

- Development of electronics, software and cloud solution for Deep Sensing Algorithms (DSA) BreathPass solution
- VOC gas measurement based breath test to analyze person from COVID-19 point of view
- Deliverables from SADE
  - Electronics design + firmware for DSA BreathPass device for breath measurement sample collection
  - Crossplatform DSA BreathPass application for controlling sample taking (Android & iOS)
  - DSA Cloud with DSA COVID-19 algorithm to store measurement samples & perform analysis for breath measurements
  - DSA Web UI for device, user and customer organization management and reporting
- More info: DSA web pages

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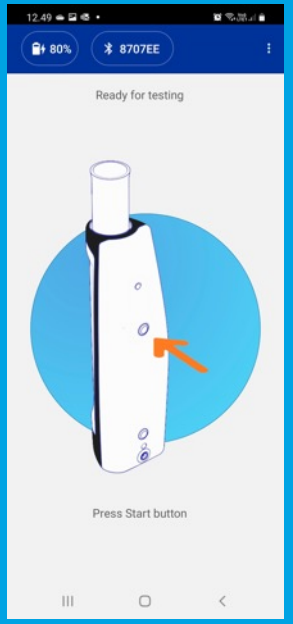

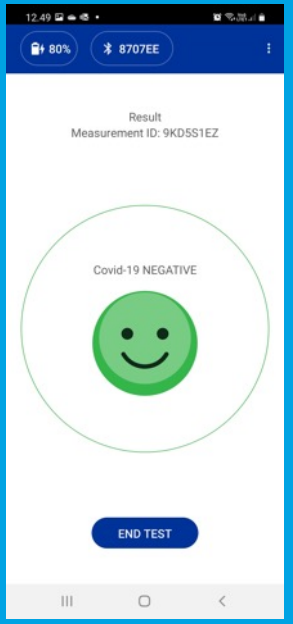

CASE: L7DRIVE CAN GATEWAY

- Solution composed of three parts
  - CAN Gateway device (based on Booster CoreNode)
  - Cloud service to store and query CAN data
  - Web UI to visualize CAN data and manage devices
- Enables connecting any CAN interface enabled device or vehicle with a cloud backend
  - Cellular, WiFi and BT
  - GPS/Glonass/Galileo
  - Various I/O solutions
    - 2 x CAN2.0, I2C, GPIO, Relay control, PWM
- Designed for vehicle & outdoor usage
  - IP67 casing, supports challenging environmental conditions
  - 5-48V, max 65V
  - Integrated & external antennas
- For more info, see here

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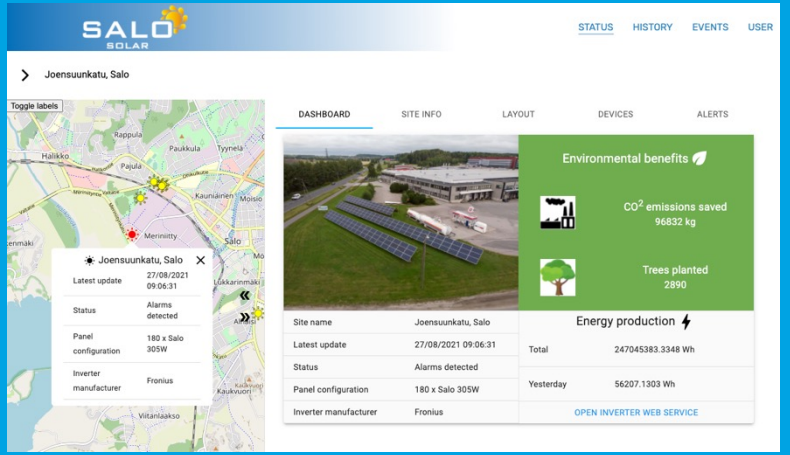
CASE: SALO SOLAR SENSOR + CLOUD

- Solution composed of following parts
  - Wireless solar panel sensor
  - Gateway device connecting solar panels sensors to cloud over cellular connection
  - AWS/Booster based cloud service
  - Admin web UI with various visualization options
- Enables remote monitoring of solar panel sites
  - Panel level sensor data
  - Site level status & alarms
    - Ability to detect issues related to electrical behaviour, temperature and vibrations
  - Possible to optimize solar panel energy creation, spot issues in the panels related to both electrical and mechanical issues
  - Visualize data also from the inverter manufacture cloud



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CASE: VAISALA AIR QUALITY DISPLAY

- Cloud connected Air Quality Display
  - Finnish Meterogical Institute (FMI) based data for air quality
- LED matrix display + breathing LED strip showing the air quality info
- Proof of Concept project in Helsinki center (Lasipalatsi & Hakaniemi)
  - Installed into JCDecaux bus stops
  - Based on SADE Hyper HW connected to AWS based cloud
  - Web UI to monitor and manage display devices
- SADE responsible for all parts of the developed solution (mechanics, electronics, software, cloud)
- More info: Vaisala LinkedIn post

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BOOSTER 1.1

Released P10/2021

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BOOSTER 1.1
NEW BUILDING BLOCKS

- Mobile app
  - React Native based app - Android and iPhone
  - Shares app engine/model with web app
  - Login, on-boarding, status, map and settings views
  - Ease of use: device selection using 2D barcode
  - Connect to device – cloud or locally using Bluetooth
- Production testing & provisioning solution
  - Basic production test asset (device + PC side) for ESP32 based product
  - Production test PC solution based on Exsensio Product Test Platform
  - Automated device testing, support for operator assisted testing and device provisioning (serial number, certificates, etc.)

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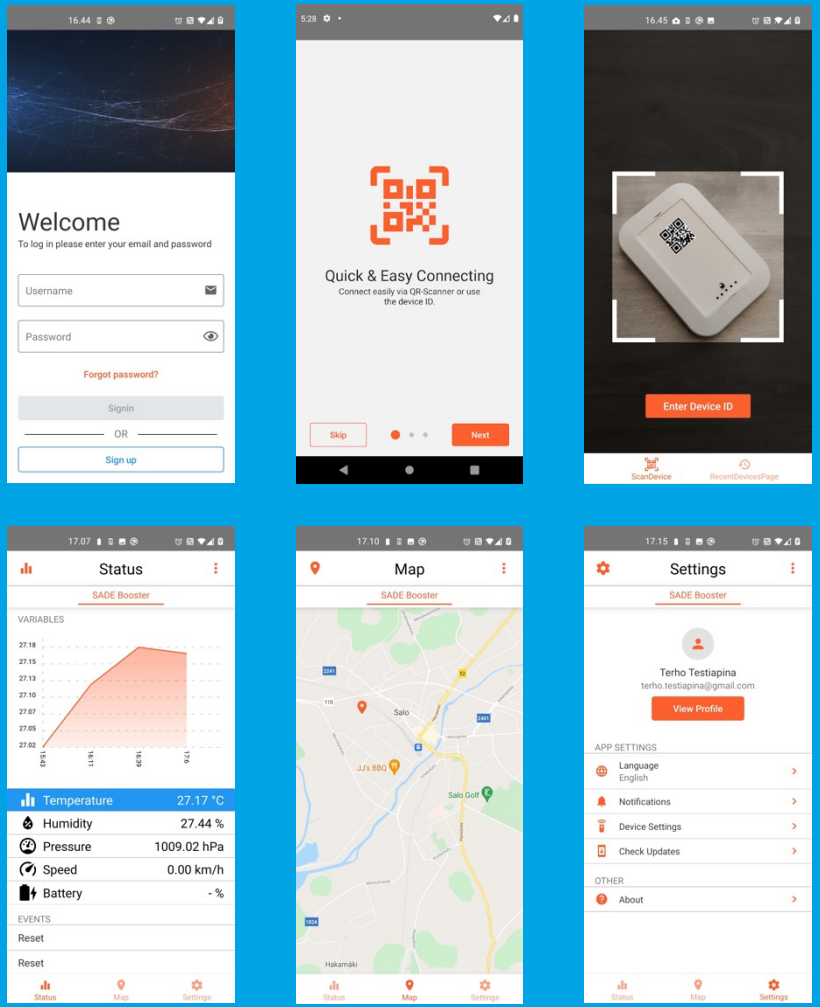

BOOSTER 1.1
NEW FEATURES

DEVICE

ESP32 baseline update to esp-idf v4.1

Support for SADE Hyper HW

Wireless/BT LE sensor node support

Support for device attributes

Production test & provisionin asset

USB interface towards production PC

Modbus RTU & TCP support

Ethernet support (+ PoE)

Improved power consumption

Robustness improvements

RnD events on device failures

CLOUD

Multiple device type support

Hierarchical organizations

Ability to create policy groups/roles

Policy based access management

Schemaless data and data APIs

Automated API test asset

Improved data lake (events & orgs)

Subscribe notifications API

WEB APP

Multiple device type support

OTA update UI

Improved device selector

User profile view

Updated admin UI with org support

Notifications admin view

Device search using fleet index

UI test automation set (Robot FW)

Localization support

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BOOSTER 4Q22

Released P12/2022

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BOOSTER 4Q22
NEW FEATURES

DEVICE

Support for ProtoBuf based messaging

NimBLE based BT library

WiFi provisioning using BT LE

SIM APN provisioning using BT LE

CLOUD

Mobile push notifications support

AWS Timestream DB support

Improved S3 Data lake support

Device connectivity state support

Parallel service deployments

Support for changing user email address

Improved cloud logging support

Interservice communication using SNS

Upgrade to Serverless v3

Update to Node 16

WEB & MOBILE APP

Shared data model

Mobile push notifications support

WiFi provisioning using BT LE

Ability to send app log files

Improved OTA update management UI

New device UI for admin UI

Sign-up support (mobile app)

Indicate device connection status

Update to Node 16

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BOOSTER 1Q24

Released P2/2024

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BOOSTER 1Q24
NEW FEATURES

ESP32

esp-idf v5.1 & AWS IoT Device SDK V2

Support for ESP32S3

Remote logging support

Certificate renewal support

nRF9160

nrF9160 as supported chipset

Telemetry, event and device state support

OTA Update

CLOUD

Improved Lambda performance

Parallel & faster deployment pipeline

Cost improvement: AppSync Notifications

Route53 domain support for APIs

Endpoints service

Remote logging support

AWS SDK v3

Upgrade to Serverless v3

Update to Node 20

WEB & MOBILE APP

Cellular APN provisioning using BT LE

Improved login & startup time

Forced update for old clients

Web UI look and feel renewal

Remote logging support

Material UI v5

React x.y

React Native v x.y

Update to Node 20

TECHNICAL DETAILS

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USER INTERFACE
WEB UI AND MOBILE APP

- Web UI and mobile application covering various usage scenarious
  - Based on React & React Native UI frameworks
  - Excellent starting point for great user experience
- Provides common user interface and application functionality
  - Login & signup screens
  - Device setup & selection & search
  - Status, history and event log views, including map based data visualizations
  - Settings views, support for localization
  - User and device management admin views
- Efficient user interface development
  - Web UI and mobile app sharing common application engine, React as basic technology
  - Crossplatform mobile app, single UI code base covering both Android and iPhone

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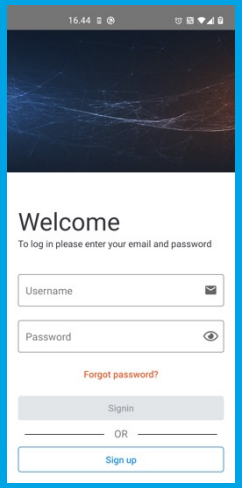
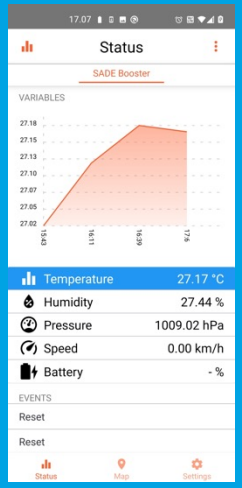
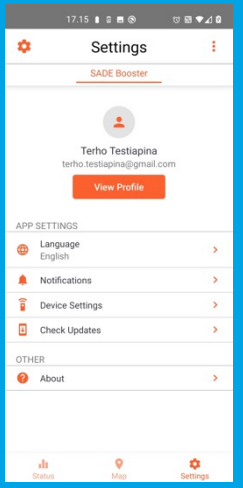
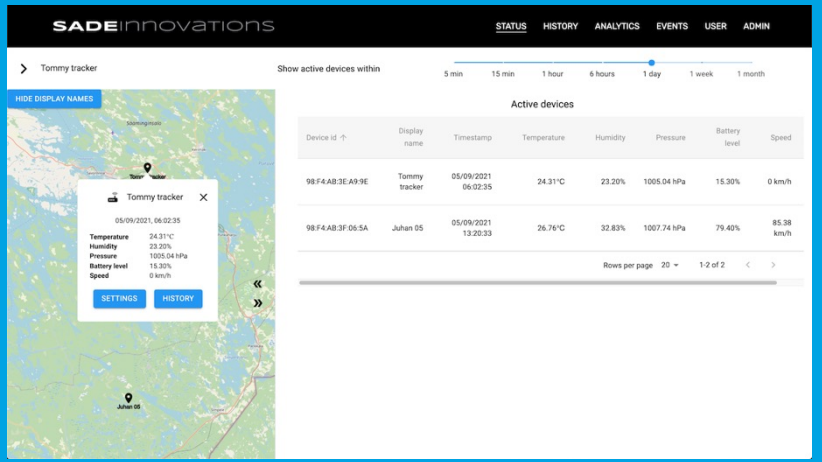


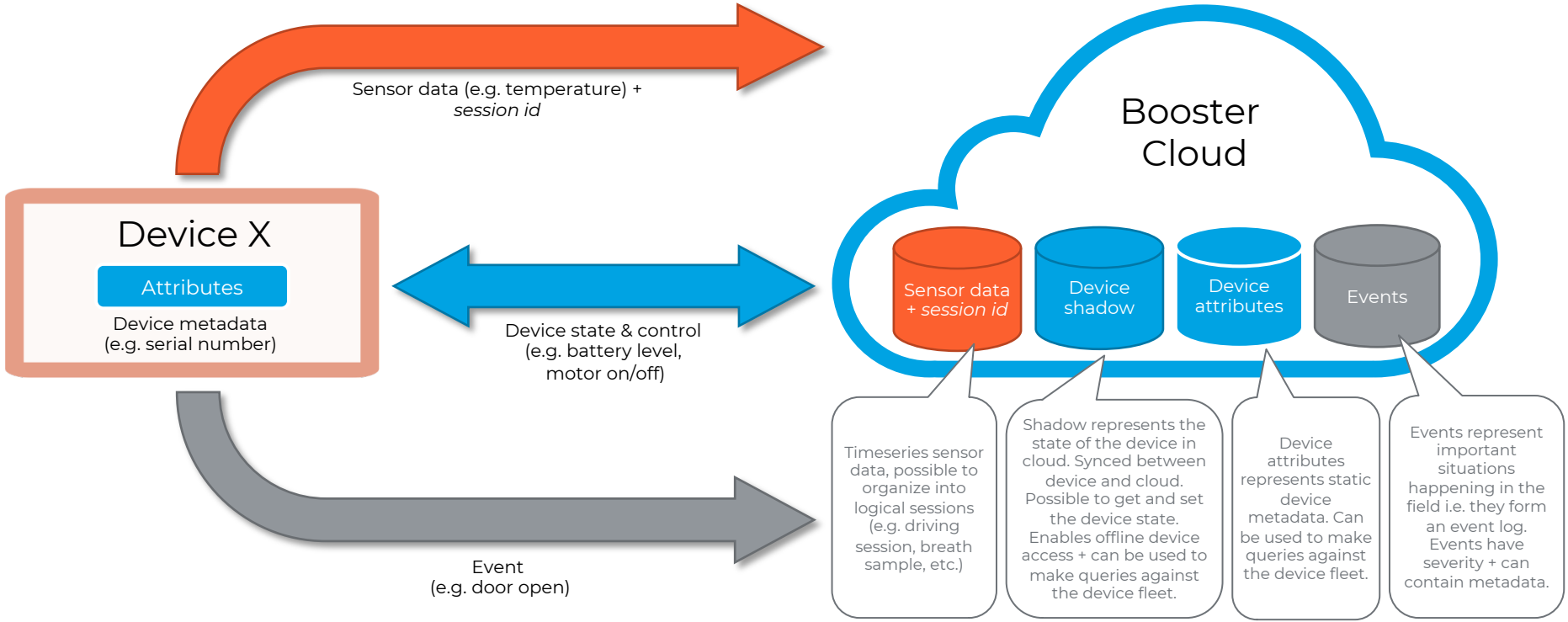




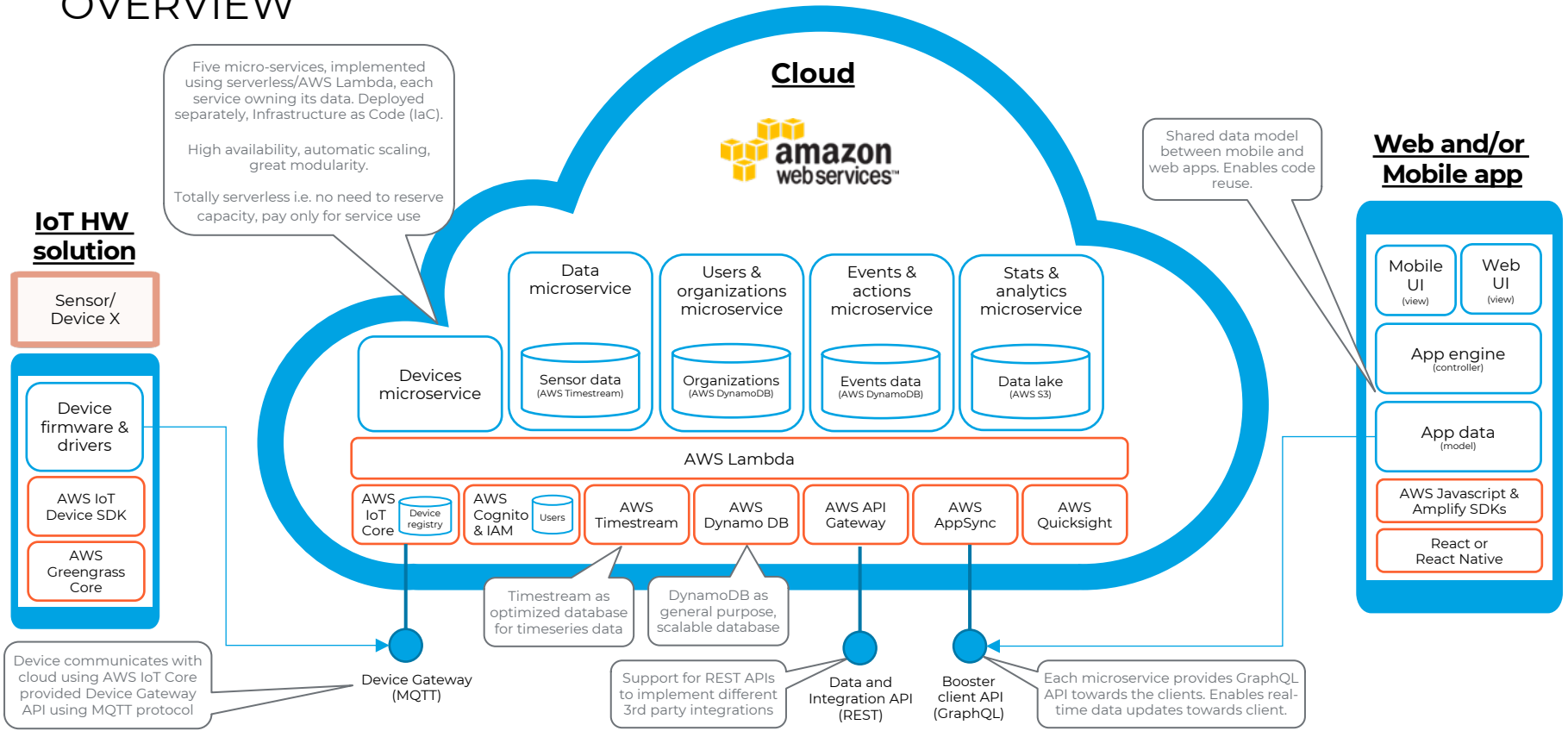


BASIC CONCEPTS

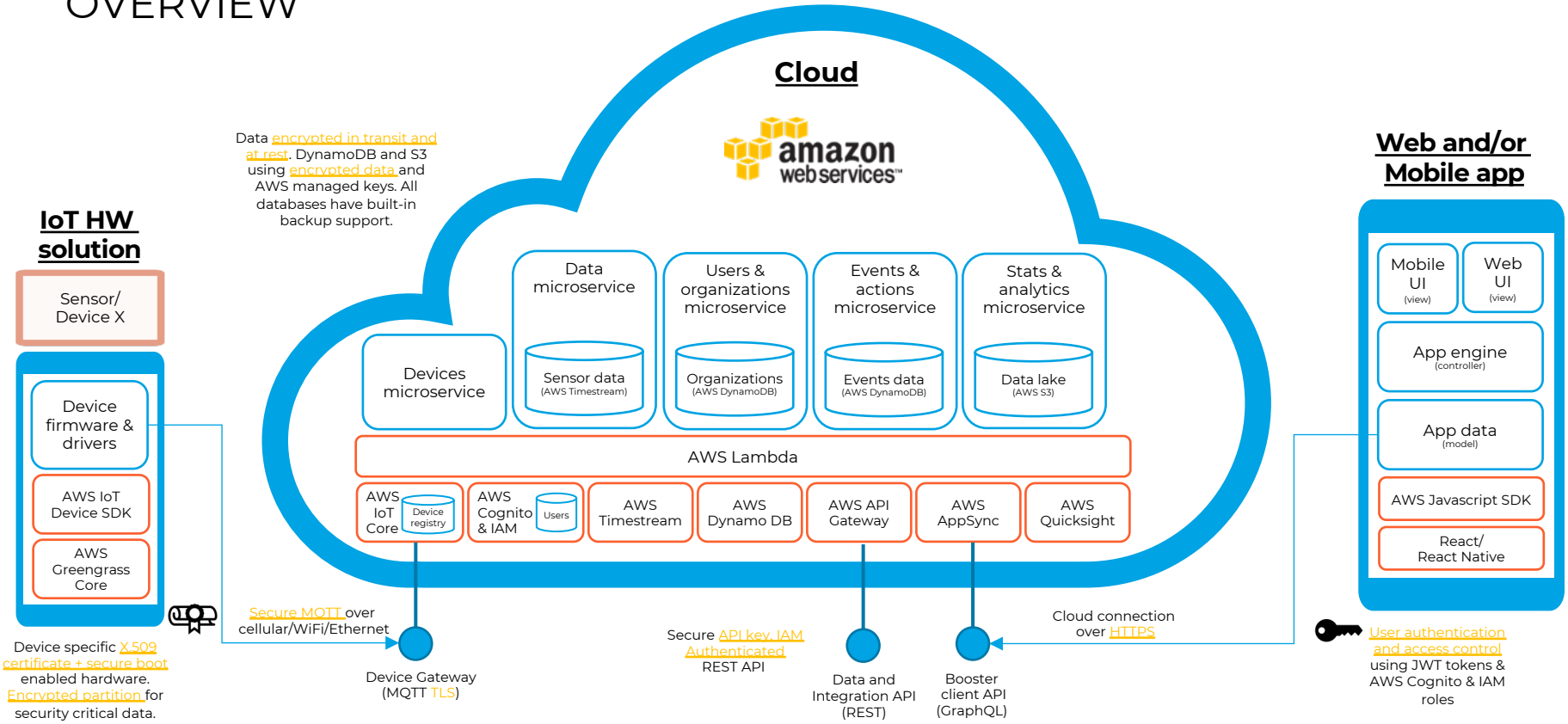
DATA FROM AND TO DEVICE



CLOUD ARCHITECTURE
OVERVIEW



SECURITY
OVERVIEW



CLOUD PRICE EXAMPLES

Usage costs dependant on the service usage (= pay per use)

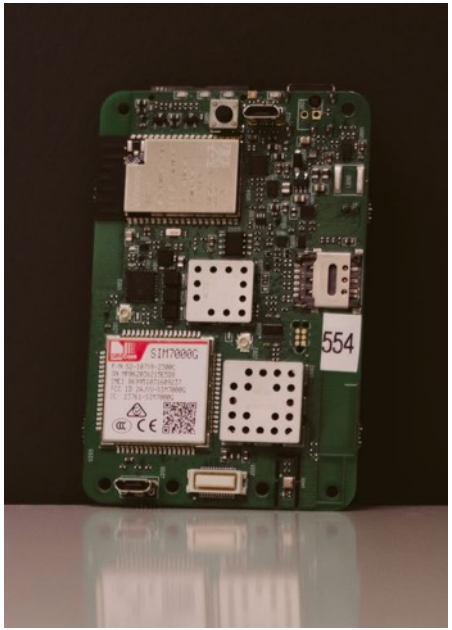
- Booster IoT asset itself has device amount specific license model
  - One time/perpetual license per device
  - No monthly fees
- AWS services used by Booster cause monthly service cost towards AWS
  - Cost level directly proportional to service usage & how much data is stored to the cloud (pay per use)
- Service cost per month is analyzed per concept
  - Example use case (see table):
    - Send 100 bytes of sensor data to cloud every x minutes using MQTT
    - Store data to AWS Timestream database for 1 year
  - AWS service cost depends on sending interval i.e. how often sensor data is sent to the cloud
  - Cost includes all AWS services needed to implement above use case
    - AWS IoT Core, AWS Lambda, AWS Timestream, AWS DynamoDB

Sending interval	Data in-take & Storage per device per year
1 sec	350$
1 min	5.83$
10 min	0.583$
60 min	0.097$
6 hour	0.016$
1 day	0.004$

HYPER GATEWAY

GENERAL PURPOSE IOT CONNECTIVITY HARDWARE

- Based on CoreNode hardware design & firmware
- CPU: Xtensa® dual-core 32-bit LX6 microprocessors @240MHz
- Memory: 520kB + 8MB RAM, 4-16MB of internal storage
- Connectivity
  - 2G/LTE-M/NB-IoT cellular modem + GNSS (GPS, Glonass, Beidu)
  - Wi-Fi: 802.11 b/g/n, 2.4GHz
  - Bluetooth: v4.2 BR/EDR and BLE
- Peripheral interfaces
  - Extension interface support I²C, UART, GPIOs and 3V3/5V power output
  - Connector interface with CAN bus 2.0, 1xI²C, 1xGPIO and 3V3/5V power output (3V3 with load switch)
  - USBs for ESP32 & modem flashing
  - NanoSIM holder
- Support for both battery and DC jack power input
  - Input voltage 8-30V & 5V (as variant)
  - Li-On battery with charger (500mA) and fuel gauge
  - Automatically switch between battery and DC jack
  - Power consumption: ~100uA/300uA (deep sleep, battery only / both battery + DC jack), ~80mA (4V, online/active)
- Antennas
  - Integrated BT & Wi-Fi antenna (2.4GHz), external antenna with variant
  - External cellular & GPS antennas
- Built-in sensor support
  - Temperature, humidity, barometer, accelerometer, gyroscope
- Three programmable leds and one button



SERENE GATEWAY MODULE

Power consumption optimized IoT Gateway module

- Based on Nordic nRF9160 IoT chipset
- Contains basic features to implement battery based, power optimized, cellular data based IoT devices
  - ARM® Cortex® -M33
  - 256kB RAM / 1 MB flash
  - 4G LTE-M & NB-IoT cellular modem
  - A-GPS
  - Optional Bluetooth support (nRF5340)
  - Connects with separate sensor board using PCI-E connector
  - ARM® Trustzone®
  - ARM® Cryptocell 310
  - Up to 4x SPI, 4 x I2C, 4 x UART
  - 32 general purpose I/O pins
  - Package: 10 × 16 x 1.04 mm LGA
  - Single supply voltage: 3.0 – 5.5 V

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BOOSTER IOT ASSET

CORE NODE TECHNICAL SPECIFICATION – Hyper HW

- CPU: Xtensa® dual-core 32-bit LX6 microprocessors
- Memory: 520kB-8MB RAM, 1-16MB of internal storage + SD card support
- Secure, MQTT based cloud connection implemented using device specific X.509 certificates
- Connectivity
  - 2G/LTE-M/NB-IoT cellular modem(s) + GPS
    - Market specific + global modem variants
  - Wi-Fi: 802.11 b/g/n, 2.4GHz
  - Bluetooth: v4.2 BR/EDR and BLE
  - Ethernet MAC interface with dedicated DMA
- Peripheral interfaces
  - 4 × SPI, 2 × I²S, 2 × I²C, 3 × UART
  - 12-bit ADC up to 18 channels + 2 × 8-bit DACs
  - 10 × touch sensors (capacitive sensing GPIOs)
  - CAN bus 2.0, Modbus master & slave (serial and TCP)
- Sensor measurement cache
  - Configurable measurement and sending intervals
  - Ability to store cached measurement data to persistent memory (internal or SD card)
- Touch display support
- Bluetooth LE based connectivity with Android and iOS applications + connectivity with wireless BT LE sensors
- Device state & control using AWS IoT Core shadow
  - Enables sleep optimizations to maximize battery life
  - Real-time control of the device also possible
  - Device configuration stored in shadow
- Device generated events
  - Possible for device to monitor state and generate events
  - Set of RnD events (e.g. reboot) to help development work
- Support for Firmware update Over-The-Air (FOTA)
- Li-ion battery support (USB charging & fuel gauge)
- Power over Ethernet (PoE) support
- Optimized power consumption
  - Max standby time 3000mAh battery 3 years
- SW framework and test asset for automated HW production testing with connectivity towards manufacturing PC
- Security
  - Secure data connectivity based on device specific X.509 certificates
  - Cryptographic hardware acceleration
  - Encrypted non-volatile storage for storing security critical data (e.g. certificates)

BOOSTER IOT ASSET

CLOUD TECHNICAL SPECIFICATION

- Device state and control based on device shadow
  - Supports both real-time and offline control use cases, customizable per device concept
  - Enables device concept specific connectivity pattern to minimize power consumption
- Optimized sensor data storage
  - AWS Timestream for frontend/fast access + AWS S3 basis for data lake implementations
- Wide range of data analytics services available to implement automatic business logic, business intelligence and machine learning use cases
  - AWS QuickSight, Sagemaker, Athena, EMR
- GraphQL based API for frontend
  - Queries and mutations
  - Subscriptions for real time data updates
- Possible to use & provide REST APIs to enable integration with external/3rd party backend systems
  - Support for IAM and API key based authentication
- Session support - measured data grouped into logical sets (e.g. driving session, breath sample)
  - Session logic implemented in IoT Core Node
- Serverless architecture
  - Built on AWS IoT Core, Lambda, DynamoDB, Timestream & S3
  - No infrastructure to manage i.e. no running costs
  - Scales automatically from hundreds to millions of devices
  - Security model built-in, based on AWS IAM (security roles & policies) and Cognito (users and groups) services
  - Possible to limit device and data visibility per user, group and organization. Multitenant cloud support.
  - Device provisioning for security certificates (X.509)
  - Cloud Infrastructure as Code (IaC), fully automated CI&CD pipeline
- Pricing based on service usage
  - Connection: $0.08 per million minutes
  - Messaging: $0.80 per million messages
  - Registry & shadow: $1.25 per million operations
  - Rules triggered: $0.15 per million rules triggered
  - AWS Free tier: almost free RnD phase, minimal cost for rollout phase
- Multi region & availability zone support enabling global and robust cloud implementation + meeting regulatory requirements (e.g. GDPR)

BOOSTER IOT ASSET

WEB UI TECHNICAL SPECIFICATION

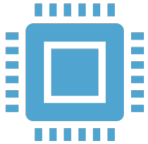
- Web UI enabling data analysis & manual device control
- Five views: Status, History, Analytics, Events and Admin
- Status
  - Map and table views showing latest measurement data for active devices
  - Device remote control performed from this view
- History
  - Diagram showing measurement data for a single device
  - Ability to select custom time range, show live data or select a session containing a logical set of measurements (e.g. driving session)
  - Data points can be shown also in map (if GPS location available for measurement)
  - Ability to export data .csv format
- Events & Actions
  - Trigger events when special situation happens (e.g. temperature limit reached, door opens, etc.)
  - Events can be connected to actions, e.g. send SMS when alarm event happens.
  - Set of basic actions (SMS, email, push notifications) in place, extendable with AWS Lambda functions
- Analytics
  - Embedded Quicksight dashboards
  - Enables custom data processing and data visualizations using terabytes of data
- Admin functionality
  - Manage users, devices and customer organizations
  - Ability to define different user roles/policy groups (user, admin, etc.) and their access rights towards GraphQL API
  - Register user to receive notifications (sms, email) when certain events occur
- Customizable sign-in and signup UIs
  - Including all basic features like login,signup, password change & reset, multi-factor authentication, etc.
- Group and device selection & status overview
  - Shows devices as hierarchical tree based on groups
  - Ability to filter devices & groups using quick search
- Authentication & authorization
  - AWS Cognito user pools supporting individual users and organization support with ability to limit data visibility
  - 3rd party identity providers support (FB, Google) + OpenID & SAML providers

BOOSTER IOT ASSET

MOBILE APP TECHNICAL SPECIFICATION

- Basis for implementing end user facing mobile apps
  - Both consumer and maintenance user type of apps
- Supports both remote connectivity using Booster cloud GraphQL API + local connectivity using Bluetooth LE
- Customizable sign-in and signup UIs
  - Including all basic features like login, signup, password change & reset, multi-factor authentication, etc.
- Extensive support for implementing easy to use device out-of-the-box experience/setup
  - Ability to pair devices using QR code based tags, no need to use device identifiers or to search for nearby devices
  - Setting up device initial connectivity settings over BT LE (WiFi access point, mobile APN)
  - Customizable promotion/on-boarding screens
- Status view
  - Basis for implementing application view for visualizing data from a device (sensor or events) + controlling devices remotely
  - Current status of device + short term history of the sensors (e.g. temperature during last 24h)
- Maps view
  - See location and status of your device(s) in map
- Settings view
  - Basic device info (HW & SW versions, serial number, etc.)
  - Connectivity settings (WiFi, cellular)
  - User profile/settings
    - Change user specific settings & password
- Device selector screen
  - Easily switch between your existing devices + add new devices
  - See basic status of the selected device (e.g. battery level)
- Support for mobile push notifications
  - Cost efficient way of receiving notifications on events & alarms generated by the device fleet
- Cross platform implementation using React Native
  - Same code base supporting both Android and iOS
  - Fast and easy application development environment
  - Shares the application engine/data model with web UI => code reuse between mobile and web UIs

EVOLUTION OF CLOUD ARCHITECTURES



Virtual machines

"I want to configure machines, storage, networking and my OS"

Machine as the unit of scale, abstracts the hardware

AWS compute solution
Elastic Compule Cloud (EC2)

Containers

"I want to run servers, configure applications and control scaling"

Application as the unit of scale, abstracts the OS

AWS compute solution
EC2 Container Service (ECS)

Serverless

"Run my code when it's needed"

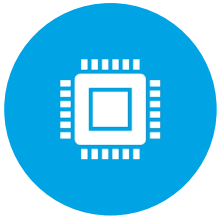
Functions as the unit of scale, abstracts the language runtime

AWS compute solution
AWS Lambda

WHY SERVERLESS

Benefit #1
No infrastructure to maintain

Benefit #2
Pay per use



Benefit #3
Automatic scaling, high availability

Benefit #4
Drives towards modular & extendable architectures