DATASAR IOT PLATFORM

Overview and Architecture

1 Document Control

Document Details

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Version Chart

Version	DOR	Author/ Review by	Comments
Draft	08/04/2019	KTPL	Initial/draft version

2 Introduction

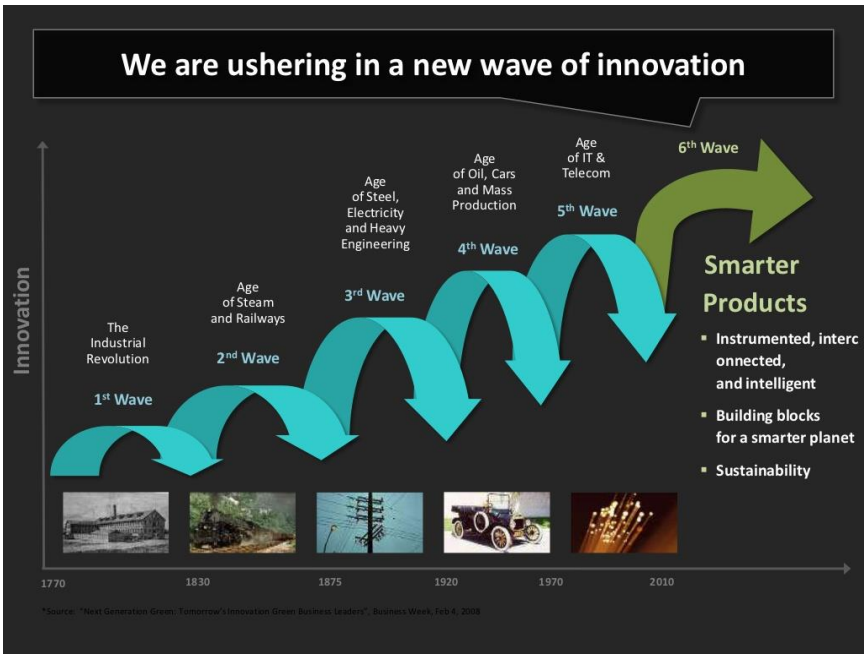
Purpose

The purpose of this document is to present a detailed description of the DATASAR IoT Platform. It will explain the purpose and features of the system, the interfaces of the system, what the system will do, the constraints under which it must operate and how the system will react to external stimuli. This document is intended for both the stakeholders and the developers of the system.

Business Context

Imagine a world in which every device in the home, workplace and car are connected. A world where the lights automatically turn on when the car approaches the driveway, the coffee starts brewing when the morning alarm goes off and the front door automatically unlocks when approached by a member of the household, but stays locked when a stranger arrives on the front step. That is the type of world the Internet of Things can create.

Currently, the "Internet of Things" is not a second Internet - rather it's a network of devices that are connected to the Internet that is used every day to search Google, upload images and connect with friends. It's a network of products that are connected to the Internet, thus they have their own IP address and can connect to each other to automate simple tasks.



The current state of the Internet of Things is very fragmented. There are different companies and organizations that are building out their own platforms for either their customers or their individual needs.

For the IoT to be fully realized all devices need to be able to connect to each other, regardless of what company manufactured the product or which companies have business relationships with each other. The true Internet of Things is when the users can simply buy the fire alarms and the baby jammies and as a consumer simply say,' I want to tie those two things together very easily. In order for that to happen, there needs to be a platform on which the devices can connect directly. Some companies have built their own platforms to connect devices manufactured within a single company, creating closed solutions to solve specific problems, but those closed solutions add to the fragmentation of the growing, and already crowded, industry. In order for all connected devices to communicate with one-another, they all must be connected on the standard platform.

The true value of the Internet of Things does not lay in the lights turning on when the car reaches the driveway, but rather the data that the connected devices collect about its users. Imagine a hospital with connected devices. The data collected from those devices outputs information on the status of patients and runs analytics on the various monitoring machine, helping the hospital to run as optimally as possible.

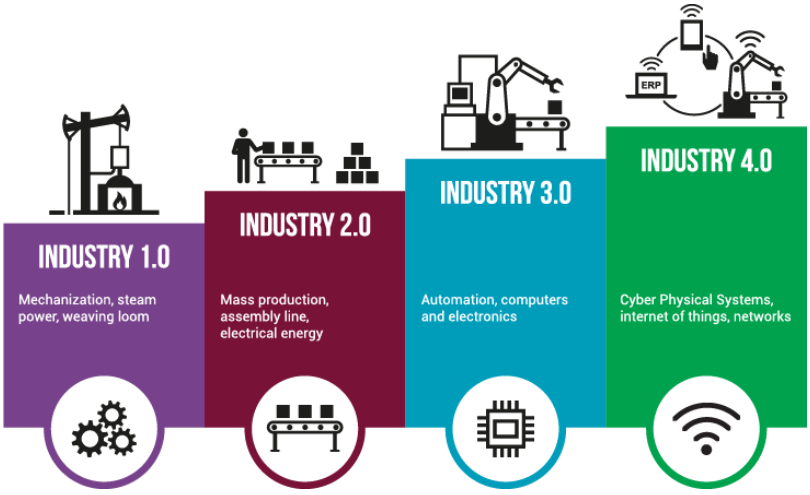
The collection of data from devices will allow consumers, businesses and even entire connected cities to run more efficiently. However, collecting large amounts of data presents challenges. Some of the challenges that still need to be figured out are partially around the algorithms that can process the data and give you something valuable out of it. With the collection of data come major privacy and security concerns for consumers.

Despite security concerns, data collection is a key component of the realization of the Internet of Things and is embedded in the end goal of the IoT. The goal would be for all these devices to talk to each other and people to have access to this information depending on the value they can device from it.

The value derived from collected data can range from saving a few seconds turning on the lights to saving a baby's life to a huge financial savings for a connected city. The Internet of Things will allow more information about the world to be gathered, thus allowing users to interact and react to the changing environment and bring about "drastic economic impact."

When it comes to placing a number of the economy of the IoT, different experts have different predictions some experts call it $1.2 trillion by 2025, while Cisco estimates the industry to reach $14.4 trillion in the same time frame.

Industry 4.0



First came steam and the first machines that mechanized some of the work our ancestors did. Next was electricity, the assembly line and the birth of mass production. The third era of industry came about with the advent of computers and the beginnings of automation, when robots and machines began to replace human workers on those assembly lines.
And now we enter Industry 4.0, in which computers and automation will come together in an entirely new way, with robotics connected remotely to computer systems equipped with machine learning algorithms that can learn and control the robotics with very little input from human operators.

Industry 4.0 introduces what has been called the "smart factory," in which cyber-physical systems monitor the physical processes of the factory and make decentralized decisions. The physical systems become Internet of Things, communicating and cooperating both with each other and with humans in real time via the wireless web.
For a factory or system to be considered Industry 4.0, it must include:

- Interoperability – machines, devices, sensors and people that connect and communicate with one another.
- Information transparency – the systems create a virtual copy of the physical world through sensor data in order to contextualize information.
- Technical assistance – both the ability of the systems to support humans in making decisions and solving problems and the ability to assist humans with tasks that are too difficult or unsafe for humans.

- Decentralized decision-making – the ability of cyber-physical systems to make simple decisions on their own and become as autonomous as possible.

But as with any major shift, there are challenges inherent in adopting an Industry 4.0 model:

- Data security issues are greatly increased by integrating new systems and more access to those systems. Additionally, proprietary production knowledge becomes an IT security problem as well.
- A high degree of reliability and stability are needed for successful cyber-physical communication that can be difficult to achieve and maintain.
- Maintaining the integrity of the production process with less human oversight could become a barrier.
- Loss of high-paying human jobs is always a concern when new automations are introduced.
- And avoiding technical problems that could cause expensive production outages is always a concern.

Additionally, there is a systemic lack of experience and manpower to create and implement these systems not to mention a general reluctance from stakeholders and investors to invest heavily in new technologies.

But the benefits of an Industry 4.0 model could outweigh the concerns for many production facilities. In very dangerous working environments, the health and safety of human workers could be improved dramatically. Supply chains could be more readily controlled when there is data at every level of the manufacturing and delivery process. Computer control could produce much more reliable and consistent productivity and output. And the results for many businesses could be increased revenues, market share, and profits.

Reports have even suggested that emerging markets like India could benefit tremendously from Industry 4.0 practices, and the city of Cincinnati, Ohio has declared itself an “Industry 4.0 demonstration city” to encourage investment and innovation in the manufacturing sector there.

The question, then, is not if Industry 4.0 is coming, but how quickly. As with big data and other business trends, I suspect that the early adopters will be rewarded for their courage jumping into this new technology, and those who avoid change risk becoming irrelevant and left behind.

This document will be divided into

- DATASAR IoT Platform (It is introduction of platform and features)
- DATASAR IoT Architecture & Modules

3 DATASAR IoT Platform

Generic platform to address following concerns / pain areas, focused on manufacturing and smart cities.

- Quick Start (Plug and Play devices)
- Absorption of device integration complexities and easy access to WEB / REST API
- Secure
- Data Analytics support
- Monitoring of Machine Data
- Monitoring of process and Quality Data
- Predictive maintenance
- Scalable PAAS
- High availability
- Real time information on figure tips to assist decision policy
- Connectivity with various platforms
- Data export as when needed
- Interoperability
- Cost effective
- Open and Flexible architecture
- Sensors connectivity with 3rd Party systems like SAP and ERP.

Customer Segment

Security

- Data encryption: Hardware to customer application cloud layer is encrypted
- Authentication and Authorization: Multi level authentication to access raw and processed data after applying predictive algorithms. Device and Data access rules framework is designed and can be customized based customers business.
- Defense in depth: Specific sophisticated security at every layer and touch point like hardware, communication and software.

Architecture flexibility

- Agnosticism: Plug and play integration comprehensive protocol support.
- Interfaces : Open API, Lib, SDK , Gateway SW bungles
- 3rd Party Integration: Integration support to various standard platform LoRaWAN, AWS IoT,Sigfox.
- Modular Approach: Open and Modular platform to customize as per business use cass.

Manageability

- Visual backend: User friendly, multiform factor visual backbends
- User Management: multi-user / group/ division rights and access management support

Robustness and Scalable Infrastructure

- Server network: Dedicated & redundant servers that handle peak demand and assure uptime and performance level.
- Databases: Distributed, state of the art IoT databases that handles real-time data ad can be scaled to big data volume.

Hardware

- Device integration: Wireless long range protocol support with Device Management mobile and Cloud software support.
- White labeled mobile App provided to customer for device registration.

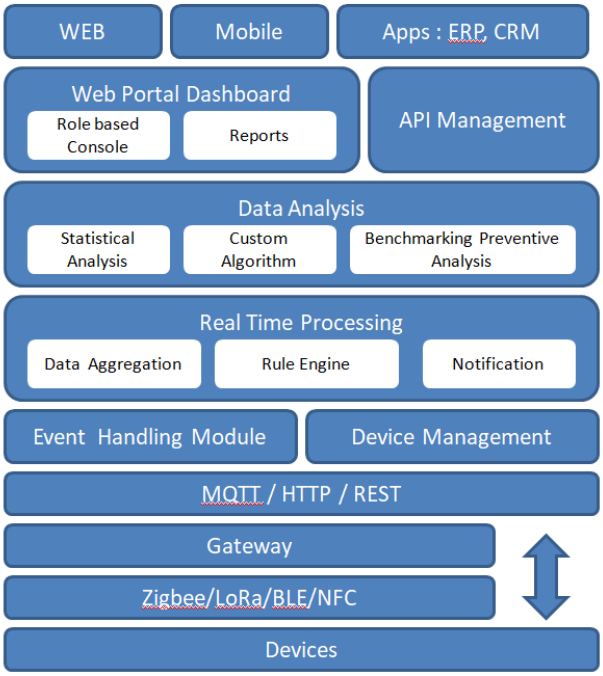
Implementation and integration support

- Developer's documents: Manual, Wiki, Blogs and live development community to support
- Tech Support Service: Experienced technical expert team with easy reach
- Development partnership: Dedicated team for consulting, conception, Prototyping hardware and software, Testing, Roll-out and handover training.

4 DATASAR IoT Architecture & Modules

IoT Platform Layers

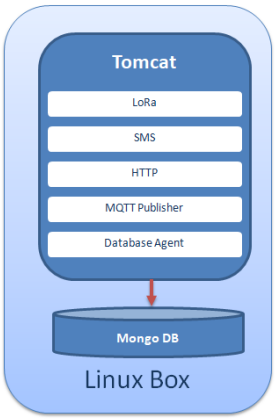
- Application
  - Data Visualization of real time device status as well as dashboards for consolidated view
- Device API
- Rule Engine
  - Real time event processing based on rules engine.
- Data Analysis
  - Algorithm for advanced calculations and machine learning
  - Pattern discovery / model retracing
  - Predictive Analysis
  - Batch Processing
  - Data enrichment
  - Driving force identification
- 3rd Party API integration
- Security
- Communication
- Wireless
  - RF
  - LoRa
  - NBIoT
- Wired
- HTTP
  - REST
  - MQTT
  - COAP



IoT Platform Modules

DS-SW-SS-0001: DataSar-CSR Software Services

DATASAR CSR (Collect-Store-Report) / Receiver is a metric collection cloud solution that can collect metrics from a wide array of inputs and write them into a wide array of outputs. It is make sure that data is stored and also forwarded to DATASAR Core Engine for processing



DS-SW-SU-0002: DataSar-IoT Platform Core Software Services

Core module will provide functionality about device (edge & fog), User and Subscription management.

- Device registration and management
- http://wso2.com/ (IoT as well as Analytics server)
- SDK
- Sense
- Connect

DS-SW-SU-0003: DataSar Visualizer / Dashboard

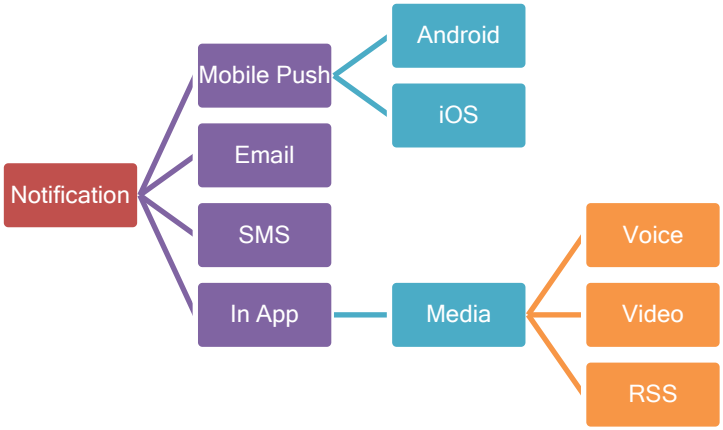
This module will Data visualization for industry 4.0 focusing on downtime, energy consumption, machine temp, machine utilization, and OEE and rejection raw material visual reports.

Data visualization is helping companies worldwide to identify patterns, predict outcomes, and improve business returns. Visualization is an important aspect of data analysis. Simply put, data visualization conveys outcomes of tabular or spatial data in a visual format. Images have the power to capture attention and convey ideas clearly. This aids decision-making and drives action for improvements.
With the use of the right tools, you can sketch a convincing visual story from your raw data.

- D3.JS , Highcharts JS, Fusion, Angular 7
- Visualize
- Automatic inspection process
- Monitoring Production, Loss and Quality process in real-time.
- Audit module for product as well as process

DS-SW-SU-0004: Datasar Notification Gateway

Data Notification Gateway will provide API for email, SMS, Android / iOS, Notification and report analysis. Email, SMS and Mobile Notification will be provided in first Phase of product module.



DS-SW-SS-0005: DataSar DEI

Edge and fog will communicate information to DATASAR IoT Platform. DataSar DEI export data to third party applications in various formats like CSV, excel, PDF and Database to ERP systems like SAP, Infor, Odoo or customers proprietary software.

- Spoon Data structure
- Data integration (Hadoop , spark)
- SAP connectivity

DS-SW-SU-0006: DataSar ServMon

DataSar ServMon module will provide Server Monitoring functionality to assure high availability of deployed application /servers. Distributed system has pros and cons. Distributed system is highly scalable but at the same time it is difficult to maintain it. ServMon will help to monitor and report alarms/faults.

This is a pull service which will pull server information on regular interview and in case on alarm/fault, it will report. This module will be important for AMC of DATASAR IoT Platform.

DS-HW-ED-0007: DataSar RF Edge

DataSar RF Edge node is battery operated RF Device. Each node needs 4 AAA batteries each of 1.5V DC. This node collects data from connected RJ11 supported sensor /device as well as other sensors data like temperature, moisture and battery status. It sends to the DataSar RF Fog through 868MHz RF Link. DataSar RD Edge can be connected to any external device by using RJ11.

DS-HW-FG-0008: DataSar Gateway

Electronics of DataSar RF Fog / Gateway basically consists two parts RF Board and Raspberry Pi3. Raspberry Pi 3 has inbuilt Wi-Fi capability and powered by a 5V DC Power Supply.

DS-SW-SU-0009: DataSar Data Flow

DataSar Data Flow is a visual tool for wiring the Internet of Things, but it can also be used for other types of applications to quickly assemble flows of services. The name is not the most intuitive name. The reason why 'Node' is in the name is because the tool is implemented as Node application but from a consumer point of view that's really only an internal implementation detail.

DS-SW-SS-0010: DataSar ETL

With an intuitive, graphical, drag and drop design environment and a proven, scalable, standards-based architecture, Data Integration is increasingly the choice for organizations over traditional, proprietary ETL or Data Integration tools. Data Integration (or Kettle) delivers powerful Extraction, Transformation, and Loading (ETL) capabilities, using a groundbreaking, metadata-driven approach.

DS-SW-SM-0011: DataSar Mobility

DataSar mobility will provide real time node, alert, critical alarm notification for Industry 4.0 use case with Android and iOS support.

DS-SW-HW-0012: DataSar Data warehouse DW

- SQL,AS, LO (10GB)
- Check Kepware
- MySQL
- Mango DB