

SAP Internet of Things – Webinar Series

Moderator: Jos Houben

SAP IoT Overview	Nils Herzberg	Mar 8
SAP HANA Cloud Platform & HANA Cloud Integration	Alex Braun / Piyush Gakhar	Mar 15
SAP Predictive Maintenance	Simon Lee	Mar 21
SAP Logistics Hub	Uwe Kürsten	Mar 22
Create new business models based on vehicle data analysis with SAP Vehicle Insight	Mirjam Metzler	Mar 29
SAP Asset Intelligent Network	Mathew Easley/Dirk Kempf	Apr 5
SAP IoT Application Services	Harry Lube	Apr 26

SAP IoT Application Services

Harry Lube, SAP SE
April 2016

The SAP logo is located in the bottom left corner of the slide. It consists of the letters 'SAP' in a bold, white, sans-serif font, set against a blue rectangular background with a white diagonal line.

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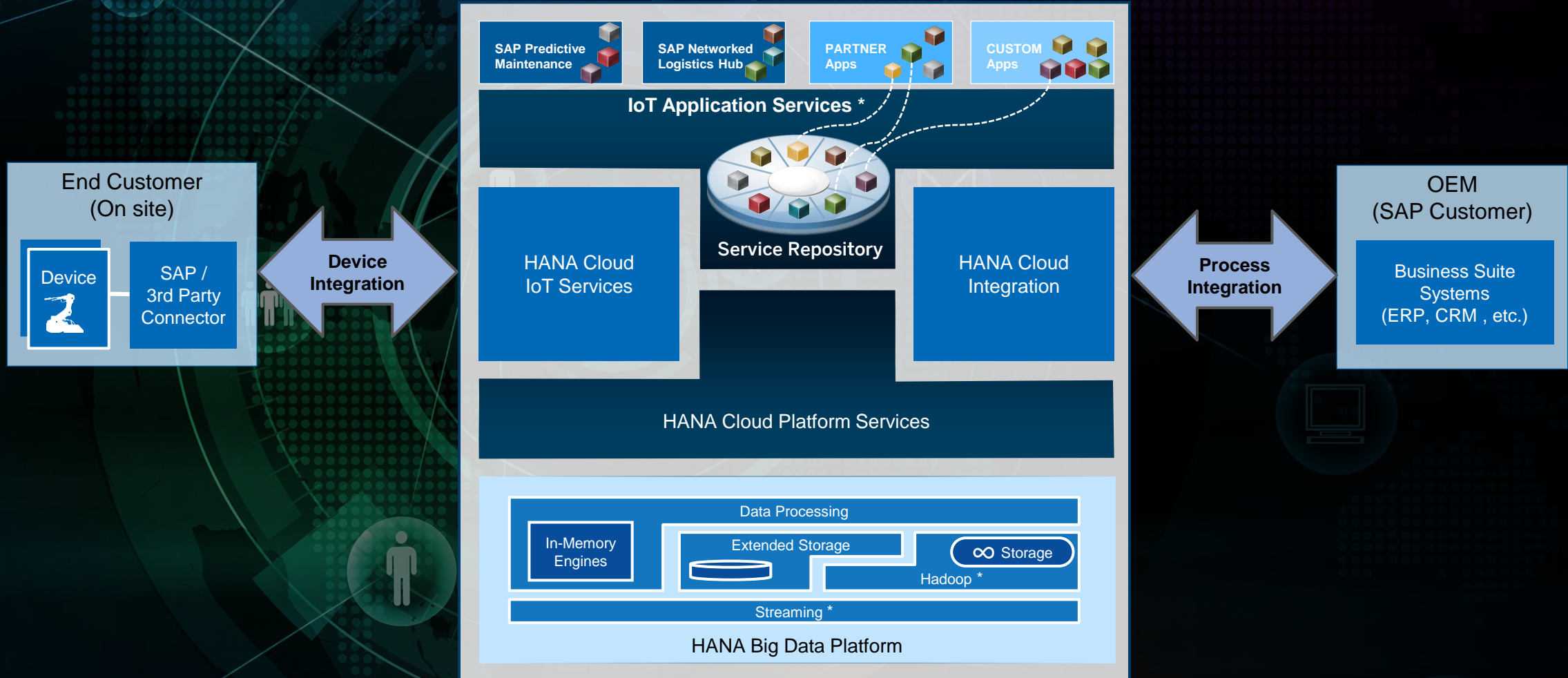
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SAP HANA Cloud Platform for the Internet of Things

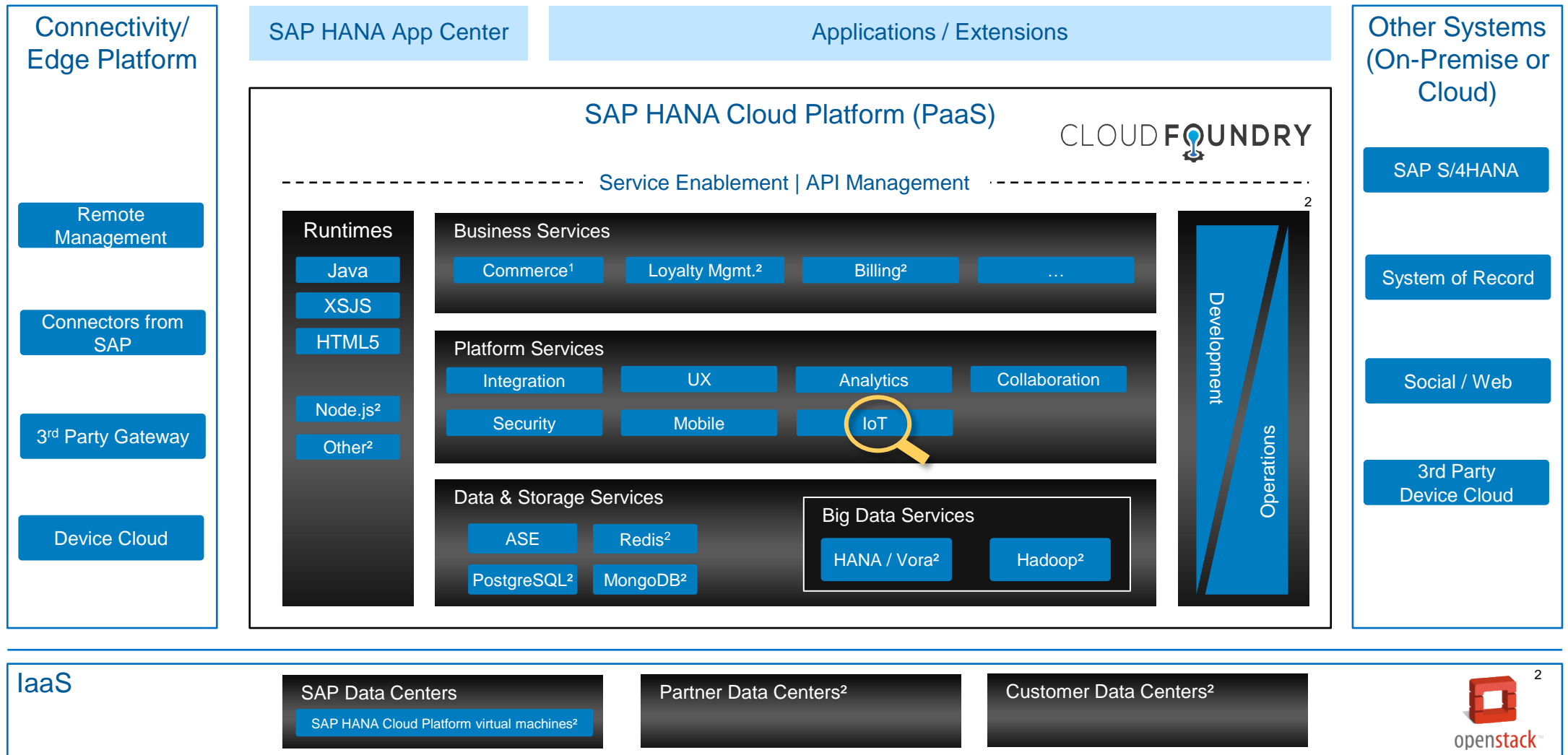
Device and process integration capabilities



* This is the current state of planning and may be changed by SAP at any time.

SAP HANA Cloud Platform - Architecture

Current & Planned Innovations



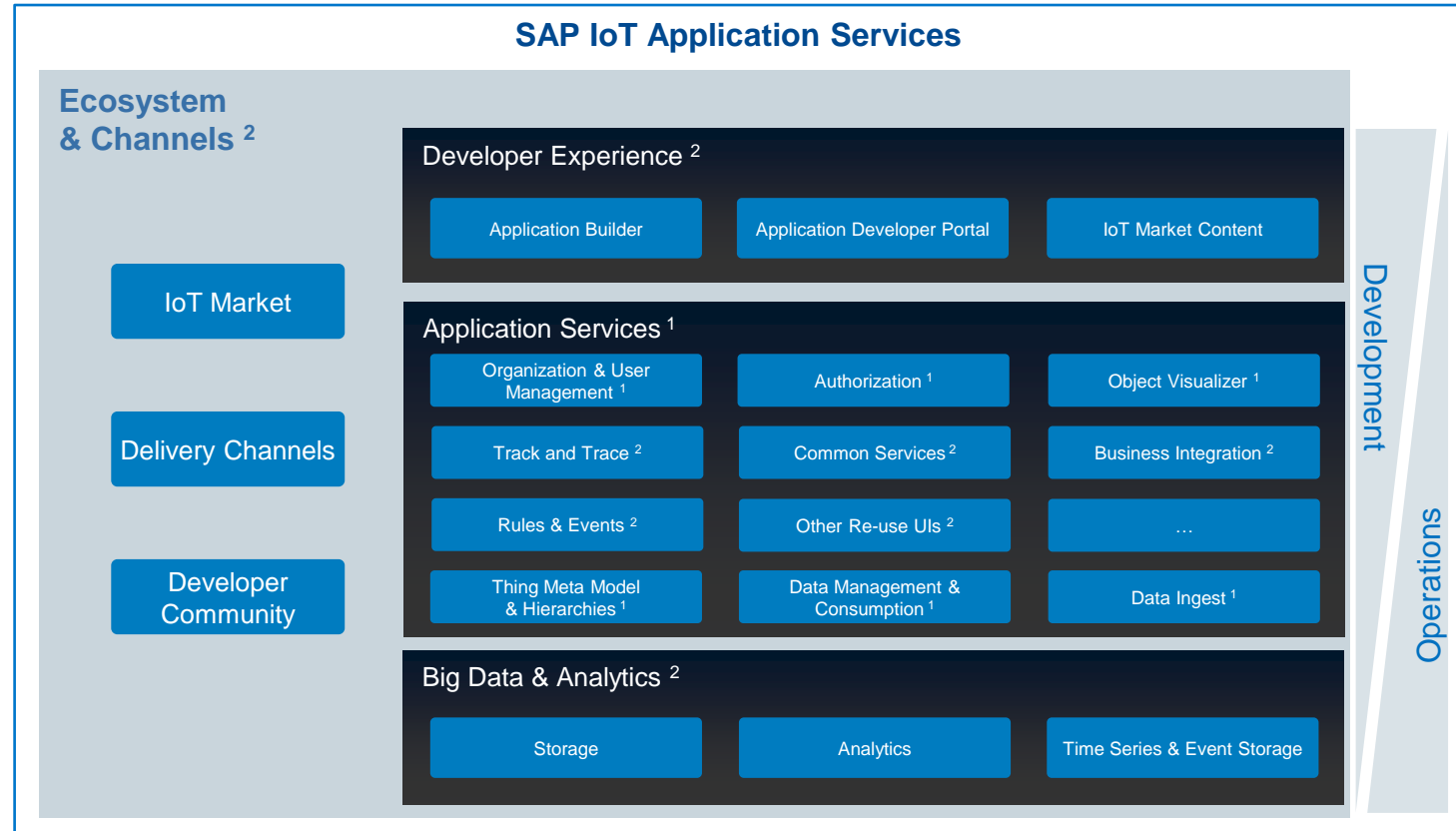
1) beta functionality, 2) planned innovations / future direction

SAP IoT Application Services

Future direction

SAP offers reusable **IoT Application Services** that enable our customers and the ecosystem to efficiently build new and expand existing IoT applications. The IoT Application Services are planned as a scalable offering, which is simple to use, leveraging big data capabilities and allows for easy integration with S/4 HANA.

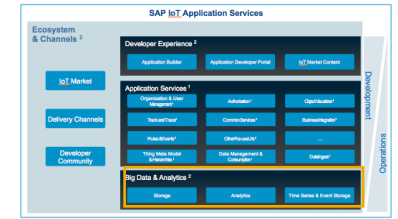
- SAP IoT Application Services are a powerful selection of micro-services and application components used to efficiently develop and run IoT scenarios for SAP, customers and partners supporting digitalization in all industries.
- SAP IoT Application Services will be easy to subscribe, simple to learn and allow everyone to develop, package, sell and run their own applications.
- Managing and storing things, track and trace capabilities, billing or rules management are just a few examples out of many planned micro services in this context.
- Intended part of this offering is the IoT Application Builder – a web-based IDE – supporting to easily model things and their properties and providing wizards and templates to build state of the art UI's leveraging reusable components as well as data connectivity to the respective services.



1) Phased Delivery, 2) planned innovations / future direction

This is the current state of planning and may be changed by SAP at any time.

Big Data & Analytics Overview



SAP provides dedicated capabilities for:

- Time-Series of numeric values and status data
- Events / Logs

The SAP-managed offering will include:

- Pre-defined analytics e.g. standardized time-series aggregates
- Statistics e.g. event counters, event frequency
- Search on events
- Limited set of built-in predictive services e.g. outlier detection
- Definition of rules which are run during the streaming process

For more specific analytical requirements, SAP will offer:

- Option to copy / extract data into customer-managed space where customer can choose toolset depending on HCP / 3rd party cloud available options

Dependable „Workhorse“ for IoT applications

Time-Series

Events

SAP's choice of SAP and open-source tools



Kafka



SAP HANA



Spark

Swift / Object Store



hadoop



Cassandra

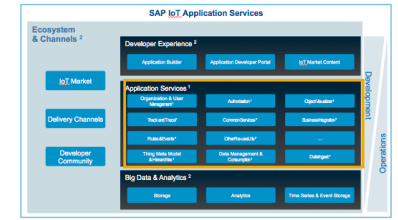
Enabler for the data scientists

API access and data extracts

Customer's / Application's choice

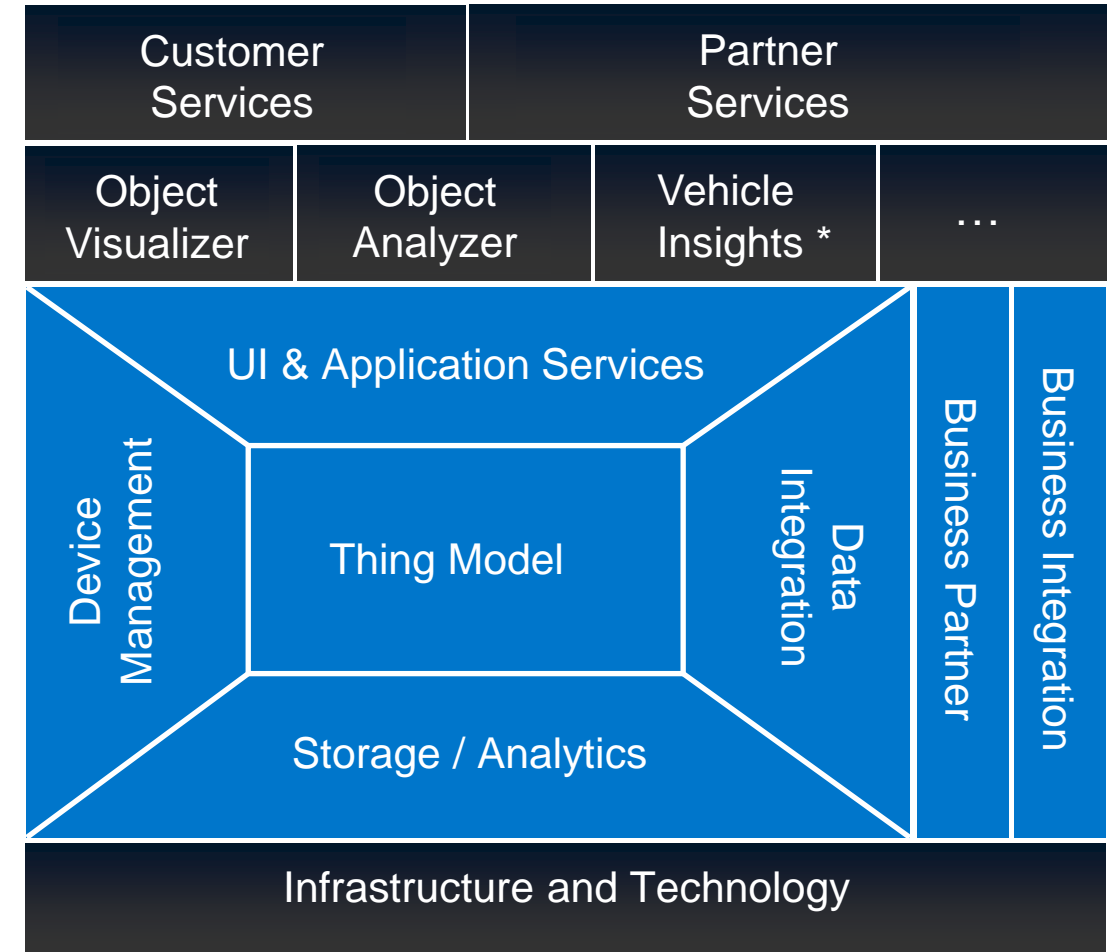
any (HCP or else)

Application Services Overview



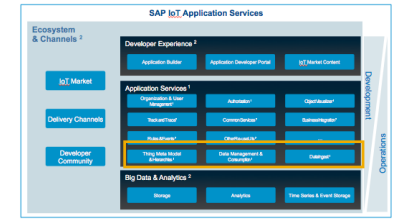
Basic capabilities:

- **Understand** things and their properties
- **Organize** things in groups & hierarchies
- **Shield** from storage complexity
- **Control** data access
- **Simplify** IoT application development
- **Enable** reuse
- **Support** Business Integration
- **Facilitate** co-deployment of IoT applications and partner services



* This is the current state of planning and may be changed by SAP at any time.

Application Thing Services Overview



Meta Model & Hierarchies

- Thing types and properties, master data and time series
- Thing relations, structure and time dependency
- Asset structure modeling

Data Ingest

- The process of importing, transferring, loading and processing high volume data for later use or storage in a database
- High-volume ingestion service (messaging) incl. queuing capability
- Auto-scaling infrastructure & monitoring
- Cleansing & validation possibilities
- Option to run rules on the incoming data e.g. for generating events
- Option for customer-specific parsing logic to transform the data
- Seamless integration between IoT Services and IoT Application Services
- Support / clear interfaces for 3rd party device management

Data Management & Consumption

- Big data management – cheap/hot/warm/cold storage
- Org and tenant on- and off-boarding (configuration, data, events ...)
- Multiple data types (integer, unsigned integer, double, time span, geo location)
- REST & OData API support, other protocols tbd
- Extensibility & UI configuration service
- Snapshot and historical time series data queries
- Optimal access APIs for charts (M4 algorithm)
- Analytical APIs on time series
- Events and correlation configuration
- Document services

Application Service Documentation

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1.1.3.2 Onboarding Organizations

Describes services used for onboarding and offboarding an organization into an IoT Application Services landscape

In the context of an IoT Application Services landscape, the terms "onboarding" and "offboarding" are used in the following sense:

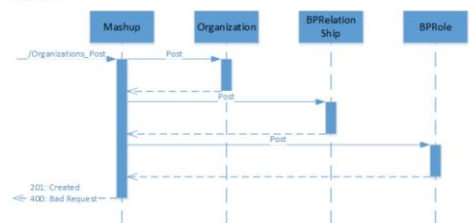
- Onboarding:** The Cloud Platform Host that is responsible for operating the platform makes sure that an organization or a person is made known to the platform, maintains a set of master data for them, assigns them to an ObjectGroup defining their access rights within the platform. In case there is a business relationship between the newly created organization and an organization that already exists in the system, that relationship is also modeled in the data model of the platform.
- Offboarding:** Whenever an organization does no longer require access to the services offered via the platform, it is up to the Cloud Platform Host to make sure that all relationships between this organization and other organizations are deleted, all access rights are revoked, and finally the organization is deleted from the system.

With these services, a business partner acting in the role of a Cloud Platform Provider can grant an organization access to the IoT Application Services landscape as a Cloud Platform Consumer or as a Cloud Platform Consumer (2nd level). Likewise, the cloud platform provider can decide to revoke an access already granted to an organization.

The structure of this service is very similar to the one described as [Organization](#) [page 16]. The main differences are the following:

- The payload of the Onboarding services is a superset of the Organization payload. In addition, it comprises data sections used to indicate the assigned object group and the onboarding organization.
- An organization is either on board or not. Consequently, there is no need for the full CRUD method set that is offered for most of the other services. Creating and deleting the assignment of an organization to the platform is therefore sufficient.

The following interaction diagram illustrates the various steps that are processed during onboarding of an organization:



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Base URI:

- Formal description: `http://<server address>[:<port number>]/<path>/Organizations`
- Example for a base URI in a cloud foundry environment: `http://tenant-administration.cfapps.neo.ondemand.com/Organizations`

Permissions: The following permissions are needed for using the organization onboarding services:

- tenant-auth.Read
- tenant-auth.Create
- tenant-auth.Delete
- tenant-bp.Read
- tenant-bp.Create

1.4 Thing

The Thing services allow you to model objects that you created using the Configuration service. You can create a thing instance which constitutes to an individual tangible object. You can associate properties to a propertySetType. You can also associate a propertySetType to thingType.

IoT applications usually deal with very high volumes of data. To be able to handle data in a uniform and cost-effective way, the thing service consists of two main parts:

- Storage and retrieval of the thing configuration
This corresponds to the thing types and property set type details.
- Storing and reading data specific to a thing based on the definitions in the thing configuration.
This corresponds to services such as creating data for a thing, and reading data such as properties, timeseries and so on.

Base URI

- Formal description: `http://<server address>[:<port number>]/<path>/Things`
- Example for a base URI in a cloud foundry environment: `http://apiot-mds.cfapps.neo.ondemand.com/Things`

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SAP IoT Application Services
SAP IoT Application Services

Methods

Table 249: Thing Configuration APIs

HTTP Method	Action	URI	Scope to Operation Assignment
GET	Read ThingType Details [page 203]	/Configuration/ThingTypes/{<thingTypeID>}	<MdsApp-Name>-Configuration-Read
GET	Read All ThingType Details [page 204]	/Configuration/ThingTypes	<MdsApp-Name>-Configuration-Read
GET	Read PropertySetType Details [page 207]	/Configuration/PropertySetTypes/{<cid>}	<MdsApp-Name>-Configuration-Read
GET	Read All PropertySetType Details [page 209]	/Configuration/PropertySetTypes	<MdsApp-Name>-Configuration-Read

Table 250: Model APIs

HTTP Method	Action	URI	Scope to Operation Assignment
POST	Create a Thing [page 213]	<Thing Application URL>/Things	<ul style="list-style-type: none"> <MdsApp-Name>-Create <AuthApp-Name>-Create
GET	Read a Thing [page 215]	<Thing Application URL>/Things/{<thingID>}	<MdsApp-Name>-Read
GET	Read All Things [page 216]	<Thing Application URL>/Things	<MdsApp-Name>-Read
POST	Update a Thing [page 218]	<Thing Application URL>/Things/{<thingID>}	<ul style="list-style-type: none"> <MdsApp-Name>-Create <AuthApp-Name>-Update <AuthApp-Name>-Update

1.4.1 Read ThingType Details

This thing configuration service is used to read the details of the specified thing type.

Request

URI: <Thing Application URL>/Configuration/ThingTypes/{<thingTypeID>}

HTTP Method: GET

Request Header Parameters

Table 251:

Parameter	Required	Description
Accept-Language	No	Language of the Thing Type description. The default language is en.

Request Example

```
GET
<Thing Application URL>/Configuration/ThingTypes/{core.automobiles:ABC2Series*}
```

Response

Format: JSON

Response Status and Error Codes

Table 252:

Status Code	Response Description
2[x]	Indicates the action requested by the client was received, inferred, accepted and processed successfully.
4[x]	Indicates that there might have been an error from the client side.
5[x]	Indicates that the server has encountered an error or is otherwise incapable of processing the request.

Response Example

```
{
  "name": "core.automobiles:ABC2Series",
  "description": {
    "en": "ABC2Series electric car"
  },
  "propertyTypes": [
    {
      "id": "engine",
      "propertySetType": "core.automobiles:Engine"
    },
    {
      "id": "drive_fc",
```

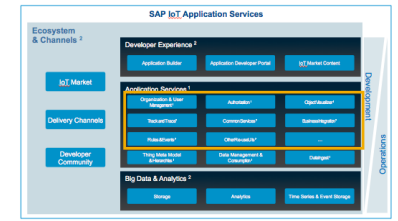
SAP IoT Application Services
SAP IoT Application Services

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```
    "propertySetType": "core.automobiles:DriveUnit"
  },
  {
    "id": "drive_fl",
    "propertySetType": "core.automobiles:DriveUnit"
  },
  {
    "id": "car",
    "propertySetType": "core.automobiles:Car"
  },
  {
    "id": "wheel_fr",
    "propertySetType": "core.automobiles:Wheel"
  },
  {
    "id": "wheel_fl",
    "propertySetType": "core.automobiles:Wheel"
  },
  {
    "id": "wheel_rr",
    "propertySetType": "core.automobiles:Wheel"
  },
  {
    "id": "wheel_rl",
    "propertySetType": "core.automobiles:Wheel"
  }
}]
```

Further Application Services (1/2)

Overview



Organisation & User Management

- Realizes an IoT BP, compatible to the SAP BP Model (MDG)
- BP types (categories) and BP roles
- Organizations and persons
- Relating a BP person to a business user with authorizations on the cloud system (□ authorization)
- BP relationships to set up BP networks
- Organization and person onboarding with admin self services
- Combination of postal addresses with GPS coordinates
- Reuse object for BPs, things and any other objects on the platform
- Different objects can share a location

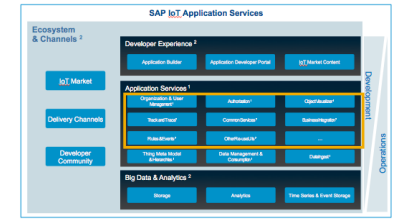
Authorizations:

- Tenant concept for data separation
- Object group hierarchy to bundle business objects like things, business partners, etc. where users have the same authorizations on
- Capabilities to define instance authorizations of user groups on object groups
- Inheritance of capabilities along the object group hierarchy
- Capabilities to define authorizations along attribute conditions
- Authorizations on thing properties
- Cross tenant authorizations enabling business processes along BP* relationships between different tenants
- Guarantee that persons/users can only access data along their individual authorizations
- Tenant onboarding to create a tenant with an owning organization, an initial object group and an administrator to run any further activities on the tenant
- Organization onboarding to create a BP of type organization with its initial object group in a tenant
- Person onboarding to create a BP of type person and assign it to a user and a user group for proper authorizations

* BP = Business Partner

Further Application Services (2/2)

Overview



Common Services

- Value help services for Units of Measure, languages, countries, ...
- Conversion services (UoM, currency, address, date,...)
- Language support
- Where used services

Business Integration

- Business data integration like business partner, equipment master, asset structure,...
- Business process integration like CRM service order creation, PM work order creation,...

Track & Trace

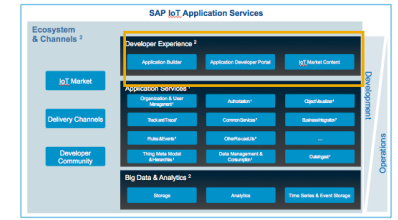
- Management and administration of generic objects (things, transportation assets, ...)
- Management of time dependent hierarchies and relationships between generic objects
- Complex processing of logistics events
- Rules management for track and trace
- Condition monitoring for transported goods

Rules Management / Alerting & Notification

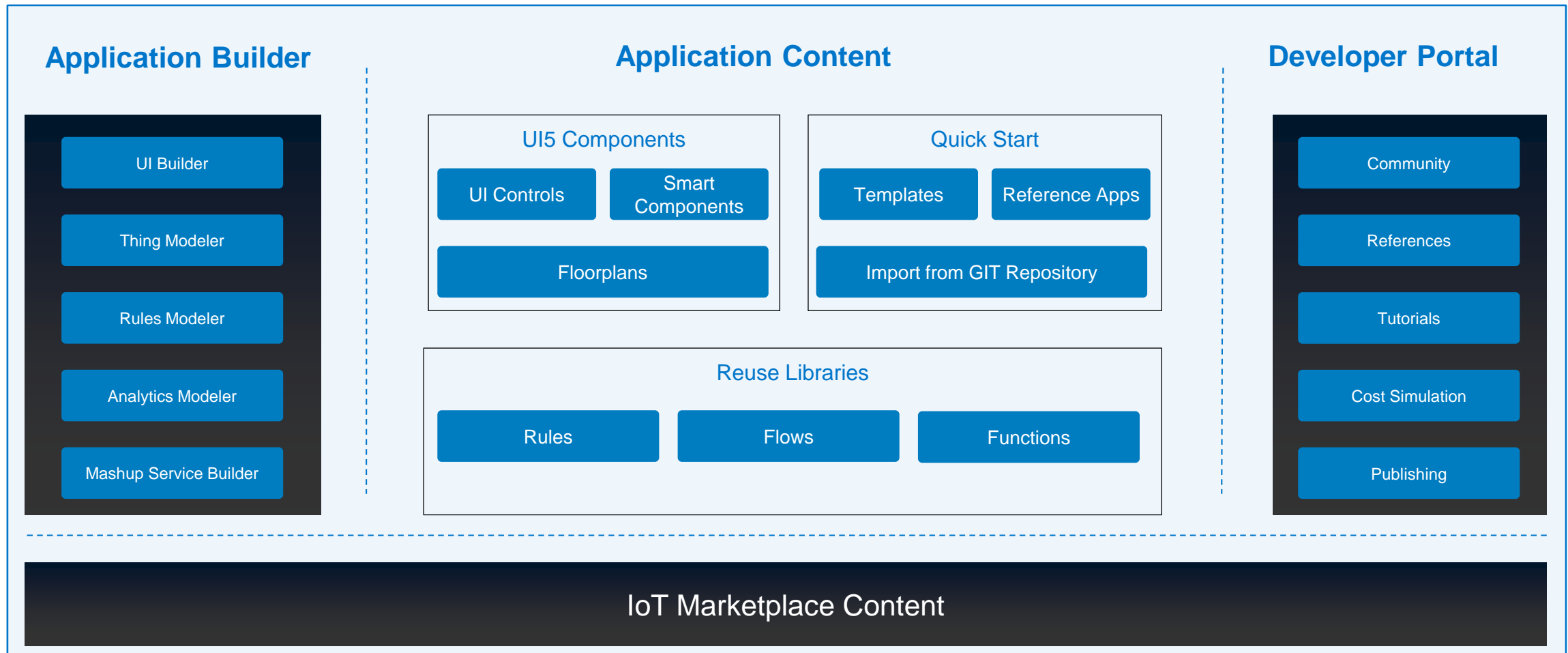
- Rule builder: environment to manager (create, read, update, delete) a set of rules
- Rule conditions
 - Basic: condition on a single property (e.g. threshold exceeded – min/max)
 - Complex: conditions based on a set of properties
- Rule conclusion
 - Trigger service execution (backend)
 - Create and visualize notification (frontend)
 - Create and visualize event

SAP IoT Developer Experience - DevX (1/2)

Overview

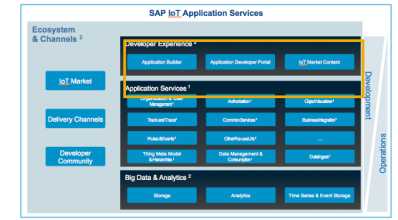


Provide many single components with each having its own value and can be freely combined



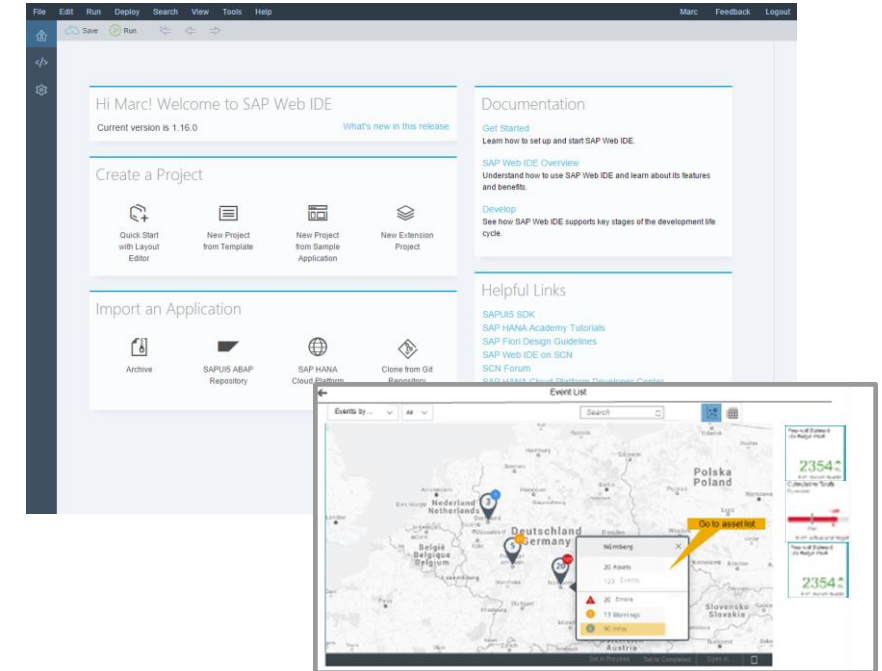
SAP IoT Developer Experience - DevX (2/2)

based on SAP Web IDE *



SAP Web IDE is a powerful web-based integrated development tool to support the end-to-end application development lifecycle for the UI5 library

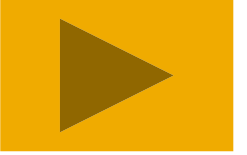
- Browser-based (**Web**) toolkit available on SAP HANA Cloud Platform
- An **Integrated Development Environment** to
 - ✓ create new SAPUI5/HTML5 IoT apps
 - ✓ extend SAPUI5/HTML5 IoT apps
- Quickly prototype, develop, test, package, and deploy applications. Supports the **end-to-end application development lifecycle**
- Leverage existing components, **templates** and sample apps for accelerating your development
- Deploy apps to HCP@Cloud Foundry*
- Enhance SAP Web IDE with additional **plug-ins**



* planned

MindSphere – Siemens Cloud for Industry

First reference customer using HCP IE and SAP IoT Application Services



MindSphere –
Siemens Cloud for Industry
Industry Services

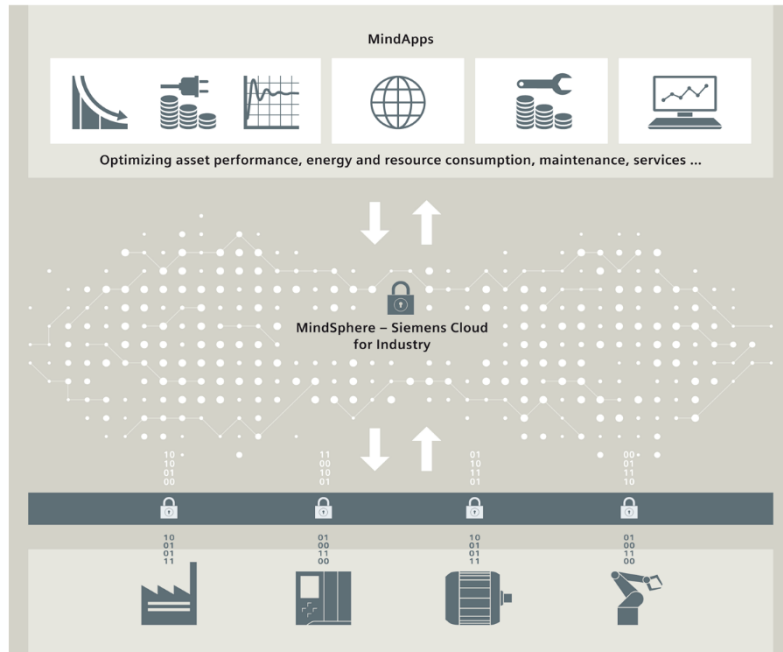
MindSphere - Siemens Cloud for Industry

The MindSphere - Siemens Cloud for Industry interlinks physical products and production facilities with digital data, enabling innovative solutions and getting products onto the market faster, better and more efficiently. That's why MindSphere - Siemens Cloud for Industry is a key element of the Digital Enterprise Software Suite, the solution to the demands of Industrie 4.0. MindSphere - Siemens Cloud for Industry offers industrial enterprises an **open infrastructure based on SAP HANA** and allows the creation of new digital services.

Siemens to build open cloud platform for industrial customers

Nuremberg, 2015-Mar-12

- Platform for data-based services such as predictive condition monitoring or energy data management
- Platform for analyzing "big data" from industrial applications
- **Solution will be based on the SAP HANA® Cloud Platform**
- Platform as a Service offering for OEMs and application developers



Siemens Plant Cloud Services

- World leader in industrial automation and drive technology
- Access to unique pool of practical experience & profound industry expertise
- Easy connectivity leveraging open standards
- Fast data processing on global large scale data storage
- Pro-active condition monitoring & energy data management
- Web based visualization of analytical insights
- Open development environment for OEM's and their customers to develop and market their own applications
- Creating new business models

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