

# Basic application development training for MindSphere (3 days)



# MindSphere Cloud Development

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# Cloud Essentials

## Learning Goals



**How can we build „cloud native applications“ & What has changed over the last 5 years?**

- Cloud Computing (NIST)
- 12 Factor APPs
- Javascript / node.js

# Cloud Essentials

## What is Cloud Computing?

### NIST\*-Definition

<http://nvlpubs.nist.gov/nistpubs/Legacy/SP/nistspecialpublication800-145.pdf>

#### Essential Characteristics:

- On-demand self-service
- Broad network access
- Resource pooling
- Rapid elasticity
- Measured service

FLEXIBILITY  
SCALABILITY  
TRANSPARENCY

Compared to  
traditional software business solutions



Technically, but also  
business-wise

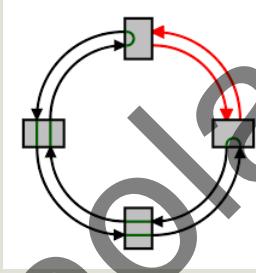
# Cloud Essentials

## Cloud Computing – Essential characteristics (NIST)

On-Demand Self-Service	Broad Network Access	Resource Pooling	Rapid Elasticity	Measured Service
Automatic provision of computing capabilities without human interaction with each service provider  e.g. server time, storage, virtual machines and services  <i>„Use what you need, when you need it“</i>	Capabilities available over the network, accessible via standard mechanisms  Use across mobile devices, laptops and workstations  <i>„One solution for each size of need“</i>	Multi-tenant model, dynamically assignment of physical and virtual resources  e.g. storage, processing, memory and network bandwidth  <i>„Tailor resources to what is required“</i>	Virtually unlimited resources, elastic provisioning and releasing  Manual or automatic provisioning inwards and outwards  <i>„React to changing demands with one click“</i>	Controlled and optimized resources by service metering  e.g. storage, processing, bandwidth and active user accounts  <i>„Pay per use, control your costs“</i>

# Cloud Essentials

## Cloud Computing – Additional Important Topics

Redundancy and Robustness	Self-Healing	Auto-Scaling
Avoidance of Single Point of Failure (SPOFs)	Monitoring ( <b>availability</b> ) + Automated provisioning = Self-healing	Monitoring ( <b>through-put</b> ) + Automated provisioning = Auto-scaling
Scalable architecture (load balancing)		
Robustness through clustering (Failover)		



<http://www.publicdomainpictures.net/view-image.php?image=66632>

# Cloud Essentials

## Cloud Computing - Service Models



# Cloud Essentials

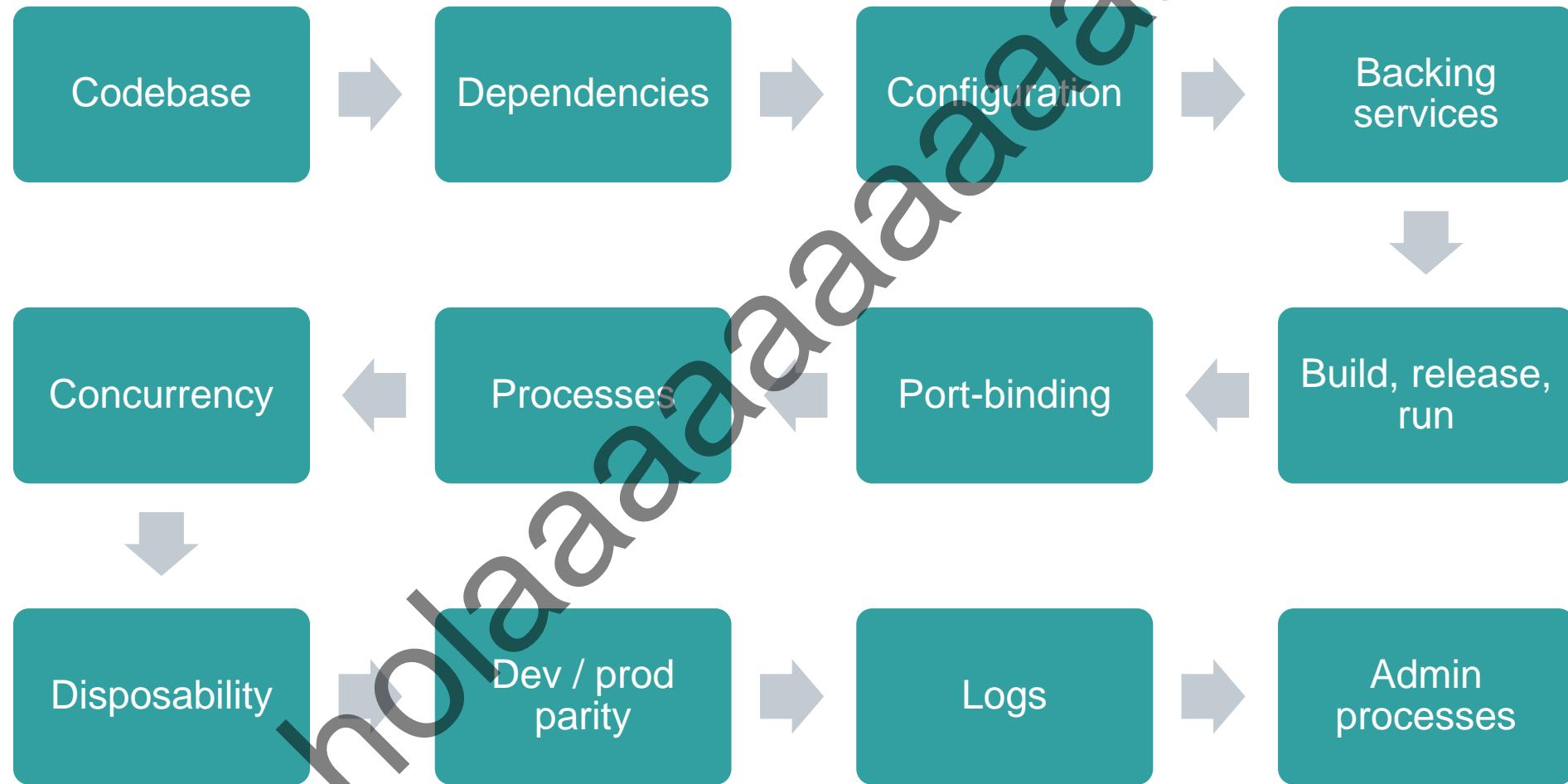
## Cloud Computing – Deployment Models (NIST)

Public Cloud	Private Cloud	Hybrid Cloud	Community Cloud
<ul style="list-style-type: none"><li>- Multi-tenant</li><li>- Open usage</li><li>- Publicly accessible</li></ul>	<ul style="list-style-type: none"><li>- Single tenant</li><li>- Exclusive usage</li><li>- Single organization</li><li>- Multiple consumers</li><li>- On and off-premise</li></ul>	<p>Private + public cloud-mix:</p> <ul style="list-style-type: none"><li>- Cloud bursting</li><li>- Untested workloads</li><li>- High availability</li><li>- Disaster recovery</li></ul>	<p>Private cloud for groups:</p> <ul style="list-style-type: none"><li>- Computing collaboration</li><li>- Multiple organizations</li><li>- Community</li><li>- Common concerns</li><li>- Shared interests</li></ul>
AWS, Cloud Foundry, Heroku	Oil & Gas, Governmental Services	<p>“Buy the base, rent the spike”</p> <p>“fail fast, fail cheap”</p>	Shared costs

# Cloud Essentials

## Cloud Computing – 12 factors in 5 minutes

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# Cloud Essentials

## Cloud Computing – 12 factors in 5 minutes

Config (Configuration)	Backing services	Disposability
<ul style="list-style-type: none"><li>- Vary between deploys</li><li>- Resource (service binding)</li><li>- Credentials</li><li>- Per-deploy values</li></ul>	<ul style="list-style-type: none"><li>- No distinction between local and third party services</li><li>- Services as a resource</li><li>- Access via URL</li></ul>	<ul style="list-style-type: none"><li>- Start / stop at a moment notice</li><li>- Minimized start time</li><li>- Shut down gracefully</li><li>- Stateless service</li></ul>
<ul style="list-style-type: none"><li>- Manifest file</li><li>- Environment variables</li><li>- Config files</li></ul>	<ul style="list-style-type: none"><li>- Easy swap of backing services</li><li>- Transparency of the provider and location</li></ul>	<ul style="list-style-type: none"><li>- Robustness against sudden death</li><li>- “Lift and Shift”</li></ul>

### Server Side Scripting

**Model-View-Controller Model (View = webpage)**

#### Examples

- SSI (Server Side Include) / CGI
- PHP (Original)
- JSP / JavaServer Pages
- JSF / JavaServer Faces
- ASP / Active Server Pages

Multi page application (MPA)

### SPA / Single Page Application

= a web application or web site that fits on a single web page with the goal of providing a user experience similar to that of a desktop application

#### Examples

angular	ember.js	backbone	knockout
Advantages		Disadvantages	
<ul style="list-style-type: none"><li>• Fast</li><li>• JS/CSS only load once</li><li>• Minimal data transfer</li><li>• Usability</li></ul>		<ul style="list-style-type: none"><li>• Slowly first pageload</li><li>• SEO (not relevant for us)</li></ul>	

### Progressive webapps

= Combination of webapps and native apps

- Fast
- Reliable
- Indexability
- Push notifications
- Can use device specific functions, e.g. camera, gps

### Cross-Platform Development

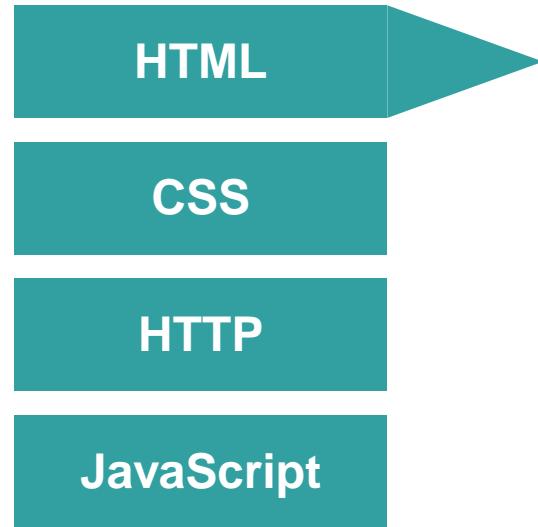
ionic	<a href="http://ionicframework.com">http://ionicframework.com</a>
NativeScript	<a href="http://docs.nativescript.org">http://docs.nativescript.org</a>
Xamarin	<a href="https://www.xamarin.com">https://www.xamarin.com</a>
Sencha Ext JS	<a href="https://www.sencha.com">https://www.sencha.com</a>
...	

Still the same basics



holaaaaaaaaaaaaaa

## Still the same basics

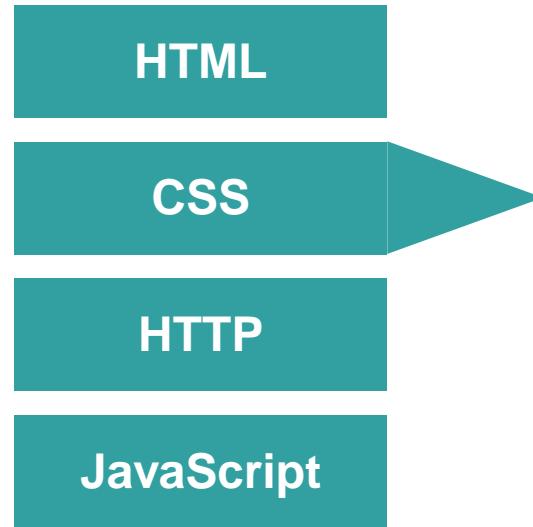


Current version: HTML 5.2 (27. March 2018)

### Latest features

- Canvas
- Drag&Drop
- Video
- Audio
- Markup
- Web Storage
- Geolocation

## Still the same basics



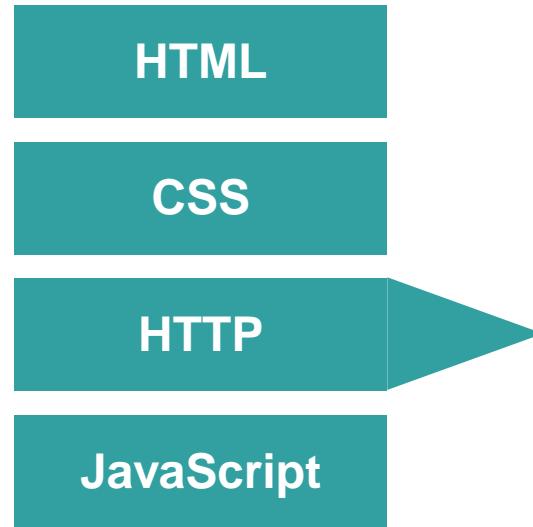
Current version: Level 2 Revision 1 (CSS 2.1)

CSS3 modules recommendations

- 2012-06-19: Media Queries
- 2011-09-29: Namespaces
- 2011-09-29: Selectors Level 3
- 2011-06-07: Color

Latest features	CSS Frameworks
• Media Queries	<ul style="list-style-type: none"><li>• Bootstrap</li><li>• Foundation</li><li>• YUI CSS grids</li></ul>

## Still the same basics



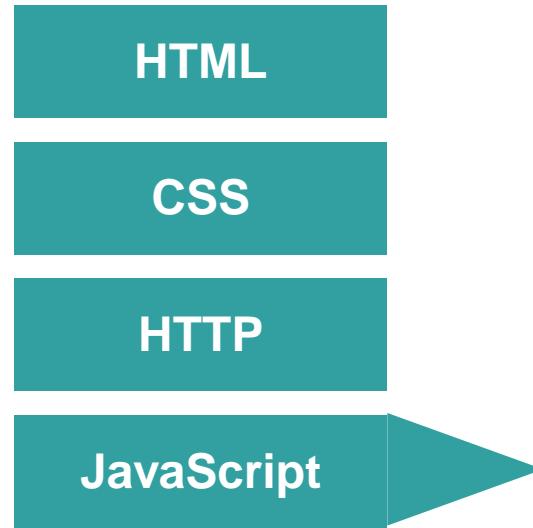
Current version: HTTP/2 (May 2015)

HTTP functions as a request–response protocol in the client–server computing model

### Latest features

- stateless
- Encrypted connections
- HTTP-Statuscodes
- HTTP-Authentication
- HTTP-Compression
- Encrypted connections (HTTPS)

## Still the same basics



JavaScript is a high-level, dynamic, weakly typed, object-based, multi-paradigm, and interpreted client-side programming language

Current version: **ECMAScript 2018** / June 2018

### Differentiation

- **ECMAScript** - standardized by Ecma International in ECMA-262 and ISO/IEC 16262
- **JavaScript** - generic term for different versions and implementations
- **TypeScript** - strict syntactical superset of JavaScript, and adds optional static typing - developed by Microsoft

### Node.js

an open-source, cross-platform JavaScript run-time environment for executing  
**JavaScript code server-side**

Current version: 11.4.x & 10.14.x (LTS) (Dez 2018)

Main features	Package Management
<ul style="list-style-type: none"><li>• event-driven architecture</li><li>• asynchronous I/O</li><li>• single threaded</li><li>• non-blocking I/O calls</li></ul>	<ul style="list-style-type: none"><li>• node package manager - npm</li><li>• dependency management</li><li>• package registry (online database of public packages)</li></ul>

**Angular** ([angular.io](https://angular.io)) is a framework for building client applications in HTML and JavaScript

Current Version: 7.1.x

- Maintained by Google
- Started 2009
- Angular 2 - completely rewritten in 2015 / Angular 1 still available as AngularJS

### Latest features

- Modules
- Components
- Templates
- Data binding
- Directives
- Services
- Dependency injection

### Official name: **Representational state transfer**

REST-compliant web services allow requesting systems to access and manipulate textual representations of web resources using a uniform and predefined set of stateless operations

#### Core ideas

- Performance
- Scalability
- Simplicity of a uniform Interface
- Visibility of communication between components by service agents
- Statelessness

*Important: REST is an architectural style, not a protocol*

*REST was defined by Roy Fielding in his 2000 PhD dissertation  
Roy Fielding is the co-founder of the Apache HTTP Server project*

# Web Development Basics

## REST



**HTTP-based RESTful APIs are defined with the following aspects:**

- base URL, such as `http://api.example.com/resources/`
- an internet media type that defines state transition data elements, for example JSON
- standard HTTP methods (e.g., OPTIONS, GET, PUT, POST, and DELETE)

Verb	Usage
GET	Used to retrieve a resource.
POST	Primarily used to create a new resource. It is also used to retrieve resources if the input for the retrieval request is so large that it has to be sent in the request body instead of the header.
PUT	Used to fully replace an existing resource.
PATCH	Used to partially update an existing resource.
DELETE	Used to delete an existing resource.

### HTTP status codes

Code	Status	Code	Status	Code	Status
200	OK	400	Bad Request	500	Internal Server Error
201	Created	401	Unauthorized	501	Not Implemented
204	No Content	403	Forbidden		
		404	Not Found		
		405	Method Not Allowed		
		406	Not Acceptable		

# Web Development Basics

## JSON

```
{  
    "firstName": "John",  
    "lastName": "Smith",  
    "isAlive": true,  
    "age": 27,  
    "address": {  
        "streetAddress": "21 2nd Street",  
        "city": "New York",  
        "state": "NY",  
        "postalCode": "10021-3100"  
    },  
    "phoneNumbers": [  
        {  
            "type": "home",  
            "number": "212 555-1234"  
        },  
        {  
            "type": "office",  
            "number": "646 555-4567"  
        },  
        {  
            "type": "mobile",  
            "number": "123 456-7890"  
        }  
    ],  
    "children": [],  
    "spouse": null  
}
```



JSON: JavaScript Object Notation

JSON is a **language-independent** data format.

It was derived from JavaScript, but as of 2017 many programming languages include code to generate and parse JSON-format data

# Cloud Essentials

## Summary

How can we build „cloud native applications“?

**Follow NIST, comply to the 12 factors and build upon Cloud Foundry**

What has changed over the last 5 years?

Node.js ecosystem has produced a lot of cool (=useful) tools



# MindSphere Architecture & API

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# Architecture & API

## Learning Goals

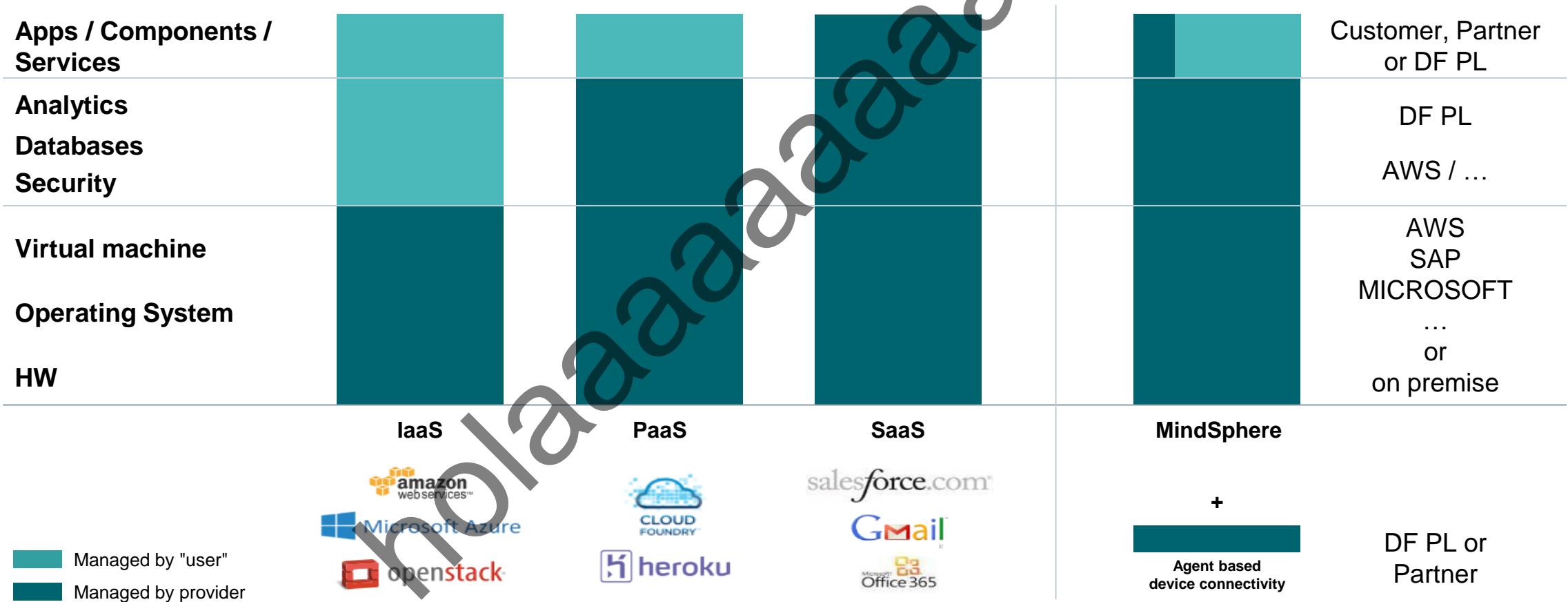
**How is MindSphere designed  
&  
how shall we develop  
applications for  
MindSphere?**

- MindSphere Architecture
- MindSphere APIs
- MindAccess Developer



# MindSphere is an end to end IoT operating system that enables a partner ecosystem

## Generic overview of different cloud models



# MindSphere Portfolio Overview

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## MindApps

Powerful industry applications and digital services for asset transparency and analytical insights



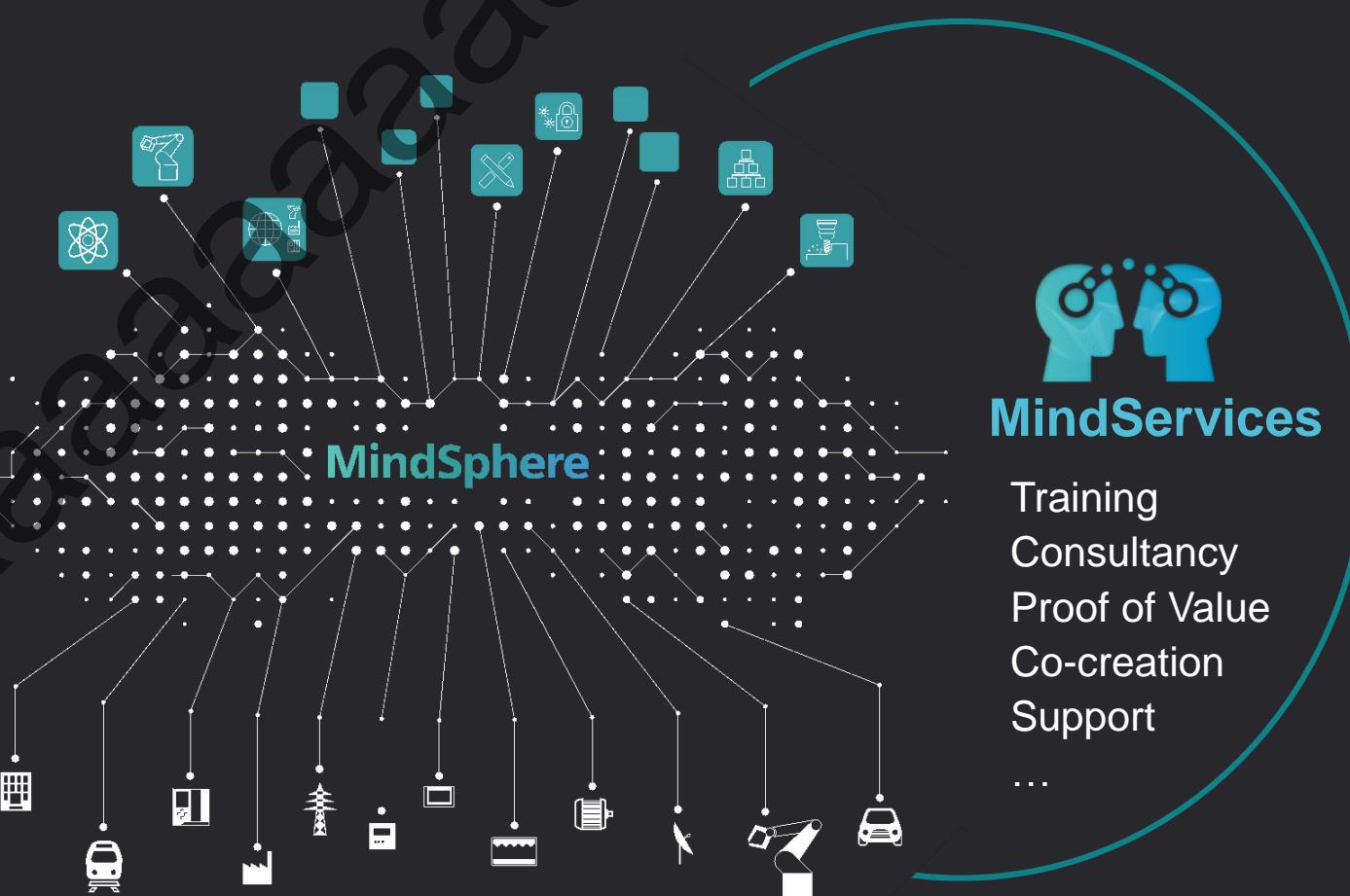
## MindSphere & MindAccess

Open Platform as a Service (PaaS) for scalable, global IoT connectivity and application development



## MindConnect

Secure plug and play connection of Siemens and third-party products and equipment

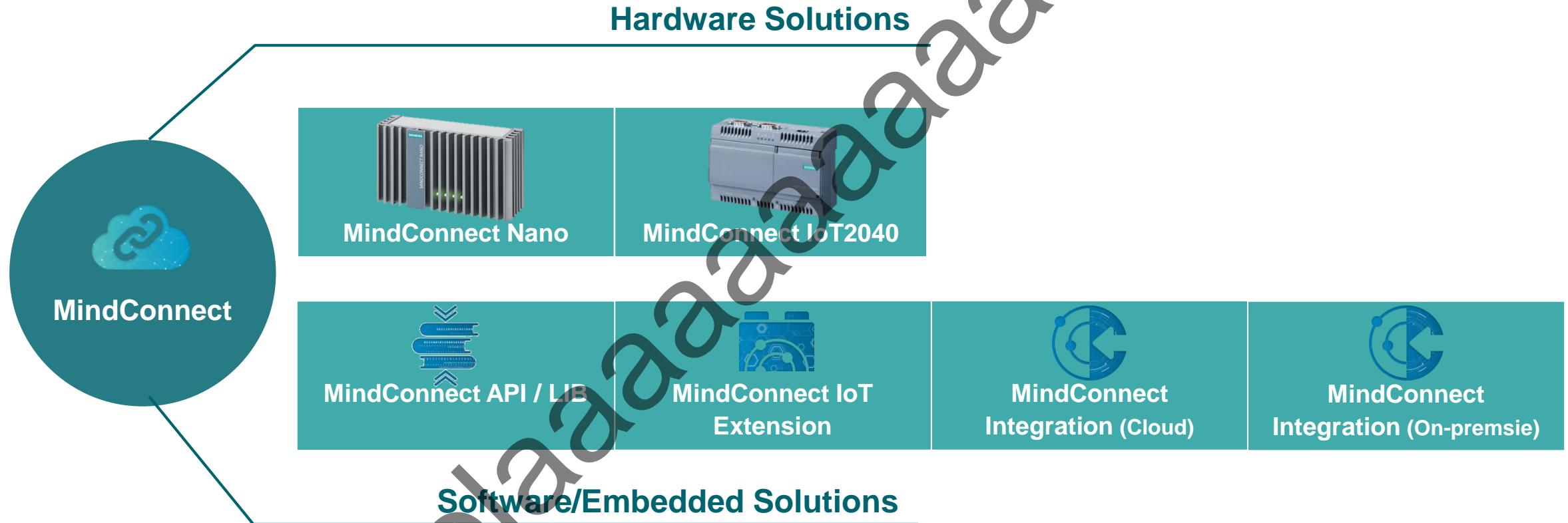


## MindServices

Training  
Consultancy  
Proof of Value  
Co-creation  
Support  
...

# Connecting Assets to MindSphere: MindConnect

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# Connectivity @ MindSphere

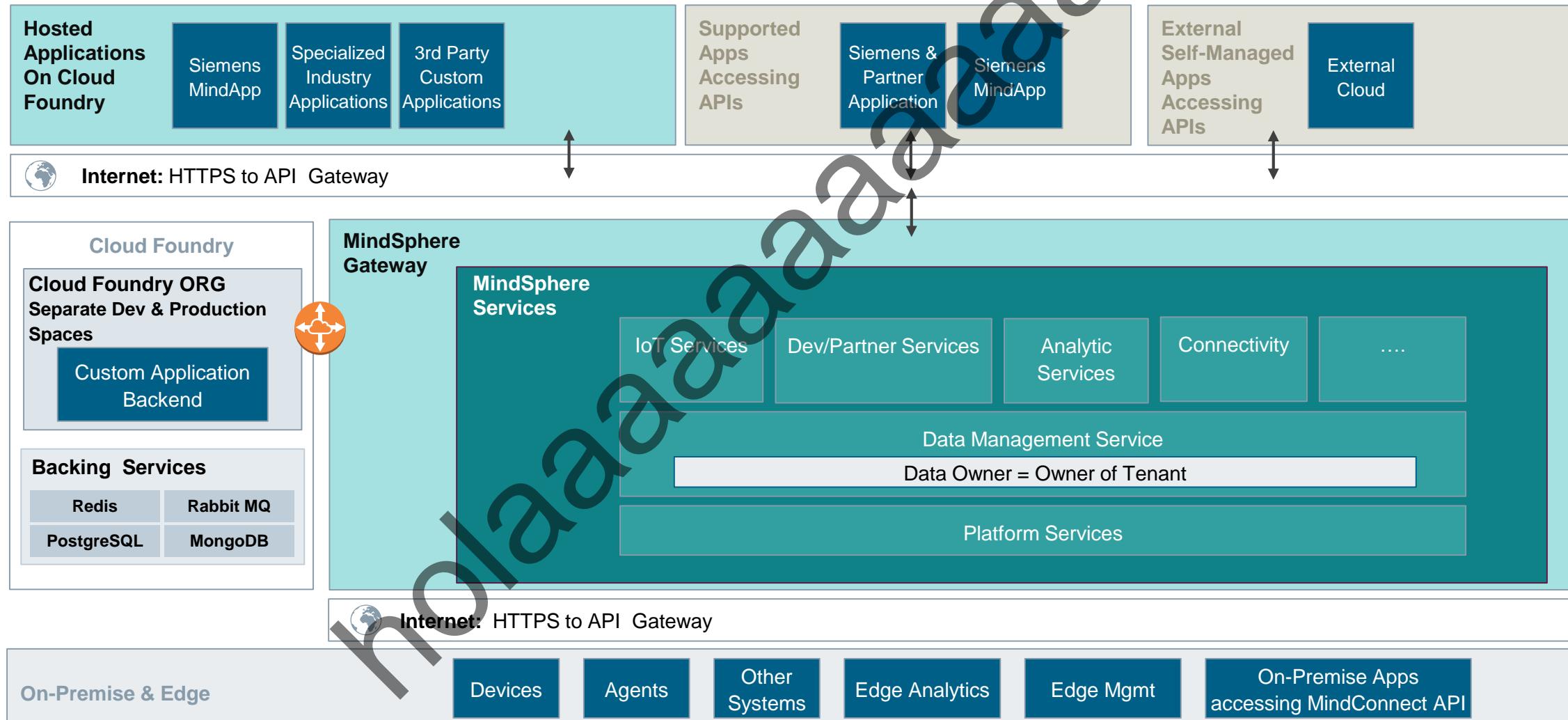
## MindConnect IoT Extension<sup>1</sup>



<b>Description</b>	MindConnect IoT Extension is a connectivity layer that expands the number of protocols that can communicate directly with MindSphere. Various field protocols are supported along with an increased range of hardware connectivity agents that create direct connection to assets in the production environment. Use the complete environment to create and manage agents and devices . MindConnect IoT Extension is included in MindAccess IoT Value Plan and Developer Plan with upgrades available for increases in data ingestion based on solution requirements.
<b>Benefits</b>	<ul style="list-style-type: none"><li>• Expands MindSphere connectivity to all machines across the production floor</li><li>• Supports various field protocols and software agents</li><li>• Supports a wide range of hardware connectivity devices</li><li>• Provides a complete environment for agent development and device management</li></ul>
<b>Scope<sup>2</sup></b>	<p><b>Software Agents:</b> MQTT Agent, Java Agent, C++ Agent</p> <p><b>Agent Development and SDKs:</b> REST API, Web SDK, Web SDK for AngularJS</p> <p><b>Supported field protocols:</b> HTTP/HTTPS, TCP, VNC, MQTT / MQTT+TLS, REST, SmartRest 1.0 / 2.0, OPC-UA, Modbus/RTU, Modbus/TCP, CAN bus, MMC, SPI, I2C, McASP, device specific protocols</p> <p><b>Compatible Devices:</b> Adeunis LoRAWAN, BeagleBone Black, Cinterion Java Modules, CloudGate, Dell Edge Gateway, INSYS Smart Devices – INSYS OS, INSYS Smart Devices – icom OS, Janz Tec emPC A/RPI, Libelium-Mesehlium, Mbed u-blox C027, Meitrack, Netcomm, OPCUA Java Gateway, OWA3x, QuecLink, RaspberryPi, Red Lion RAM, SMARTBox, Robustel, SIGFOX, SMARTBox IO, SMARTBox Mini, TC3G, Telic, TinkerForge, Tixi</p>

# MindSphere 3.0 Technical Architecture

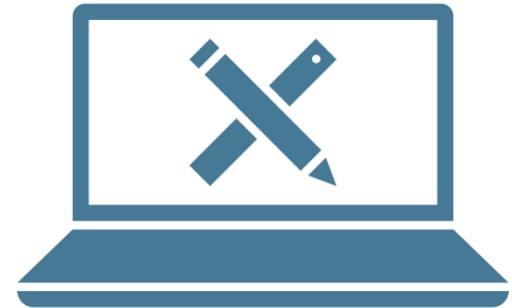
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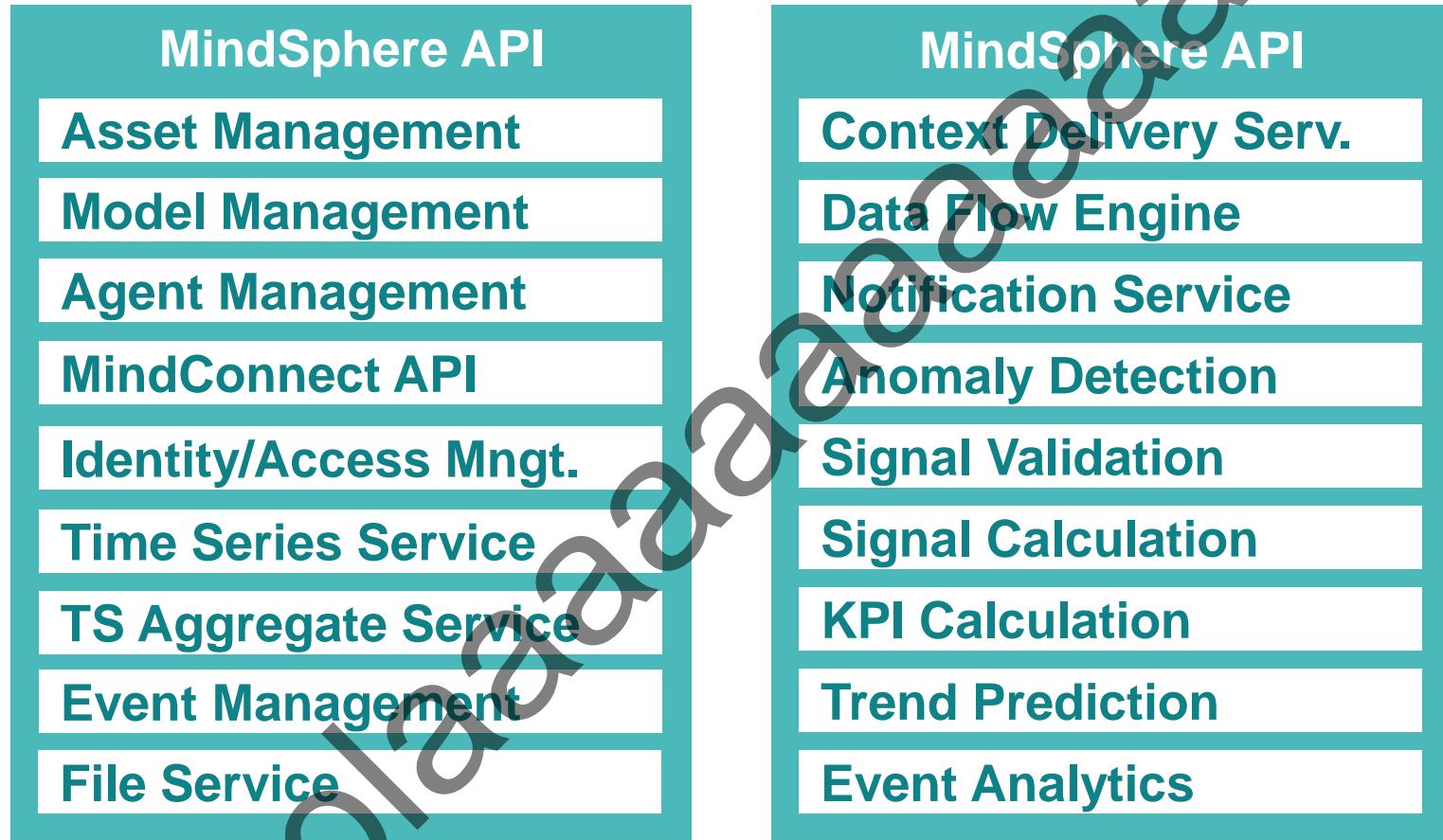


### API: Application Programming Interface

- A set of subroutines, protocols and tools to build application software  
= Building blocks that make the application development fast and easy
- MindSphere 3.0:
  - 18 API optimized for industrial IoT application development
  - Long term stability for min. 2 years to fulfill industrial needs (long product lifecycles)
  - API versioning and backward compatibility
  - Continuous demand-based functionality extension

Develop your own applications  
running on MindSphere





## REST based API

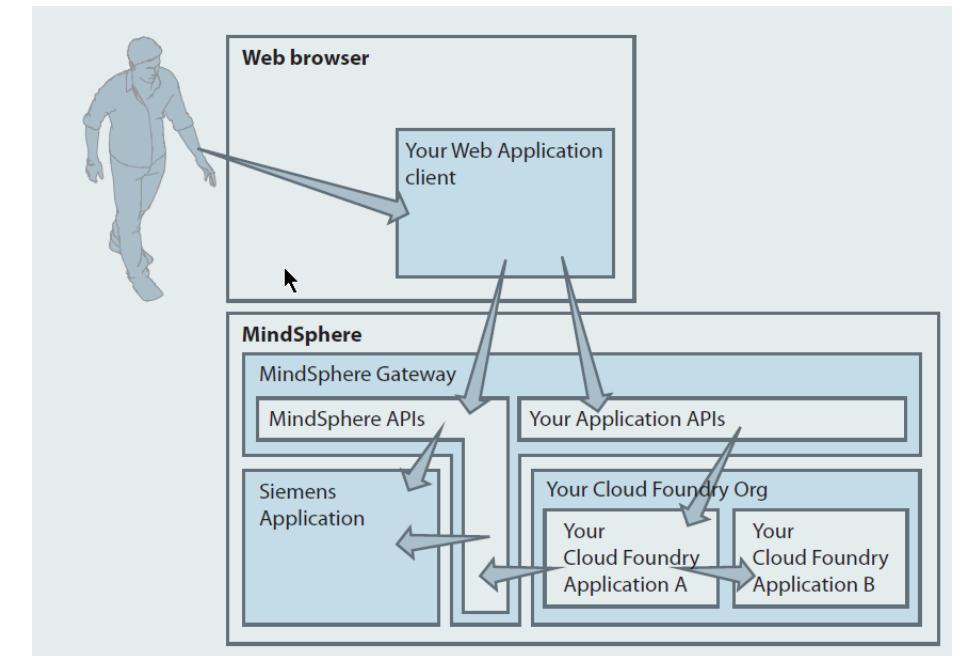
Usage over MindSphere Gateway:

`https://gateway.eul.mindsphere.io/api/...`

Or directly from a browser via a registered app:

`https://<app-url>.eul.mindsphere.io/api/...`

Content-Type: JSON



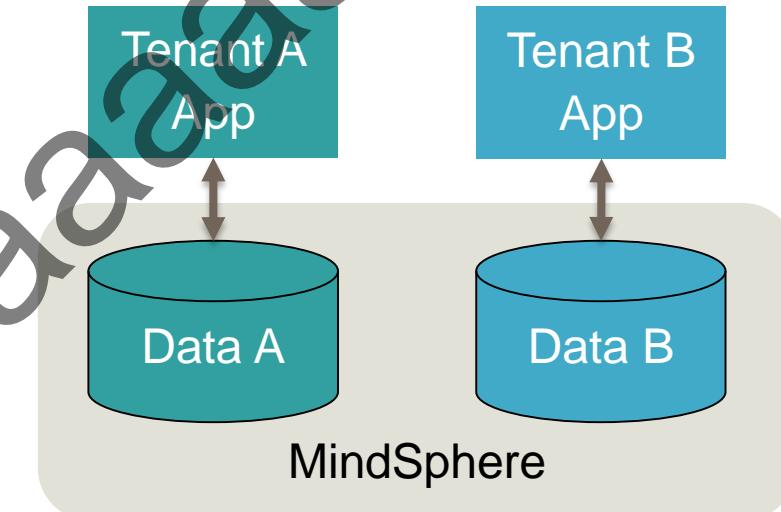
## Hypertext Application Language (HAL)

- Standard convention of defining hypermedia within JSON or XML code
- MindSphere API Users should not create URIs themselves  
→ they should use the links below to navigate from resource to resource instead

```
_links": {  
    "self": {  
        "href": "https://gateway.eu1.mindsphere.io/api/assetmanagement/v3/assets/db70d09526b34f20bdf3945517d67047"  
    },  
    "aspects": {  
        "href": "https://gateway.eu1.mindsphere.io/api/assetmanagement/v3/assets/db70d09526b34f20bdf3945517d67047/aspects"  
    },  
    "variables": {  
        "href": "https://gateway.eu1.mindsphere.io/api/assetmanagement/v3/assets/db70d09526b34f20bdf3945517d67047/variables"  
    },  
    "location": {  
        "href": "https://gateway.eu1.mindsphere.io/api/assetmanagement/v3/assets/db70d09526b34f20bdf3945517d67047/location"  
    },  
    "parent": {  
        "href": "https://gateway.eu1.mindsphere.io/api/assetmanagement/v3/assets/d724fb736bed492abce635e77d38b88d"  
    },  
    "children": {  
        "href": "https://gateway.eu1.mindsphere.io/api/assetmanagement/v3/assets?filter=%7B%22parentId%22:  
        :%22db70d09526b34f20bdf3945517d67047%22%7D"  
    }  
}
```

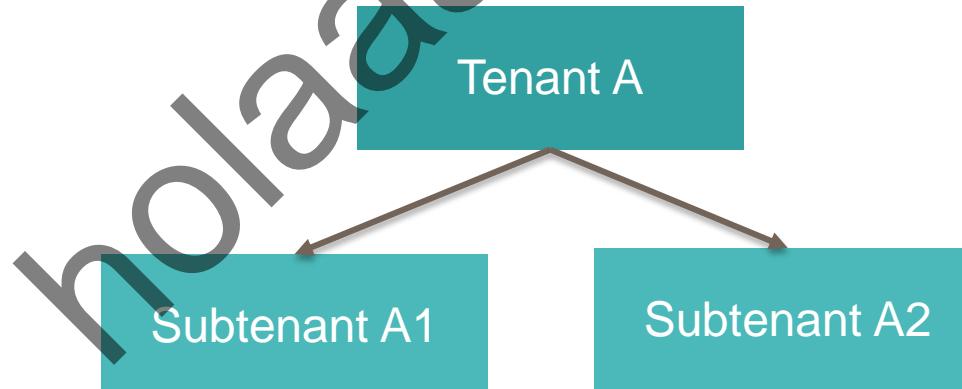
## Multitenant System

- Strict data separation between tenants
- Data access only for the assigned owner of the tenant (=data owner)

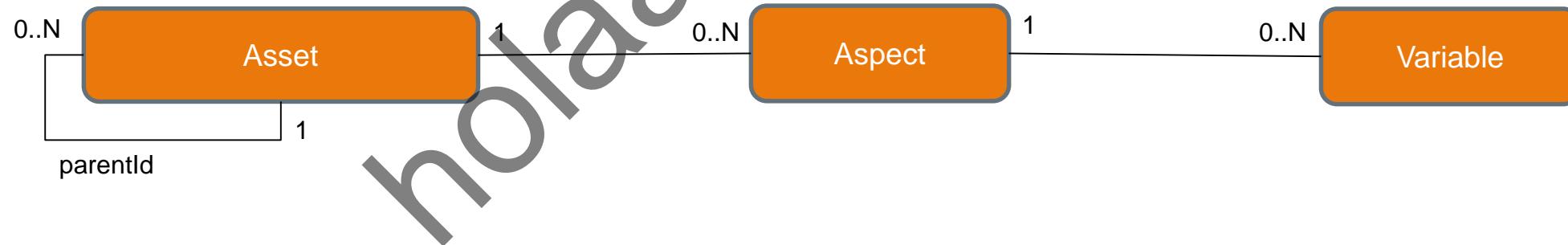


## Hierarchical tenant system ("OEM Usecase")

- Tenant
- Subtenant



Asset	Aspect	Datapoint / Timeseries
<ul style="list-style-type: none"> <li>“Asset” is a logical representation of a machine or any device that can provide data to the system</li> <li>Hierarchical relations possible</li> <li>Data sources, e.g. MindConnect Elements, are mapped to Assets</li> </ul>	<ul style="list-style-type: none"> <li>“Aspect” contains summarized data points from data sources for a specific evaluations</li> <li>Group of datapoints</li> <li>Aspect can define multiple variables with pre-defined units / data-types</li> </ul>	<ul style="list-style-type: none"> <li>Contains historical data from assets as defined by aspects</li> <li>Timestamp format: ISO 8601</li> </ul>



\* simplified

# MindSphere Time Format ISO 8601



## Typical usage

YYYY-MM-DDTHH:MM:SS . SSSZ

2015-12-21T08:03:34 . 123Z

## Complete syntax

[https://en.wikipedia.org/wiki/ISO\\_8601](https://en.wikipedia.org/wiki/ISO_8601)

<https://xkcd.com/1179/>

holaaaaaaaaaaaaaa

**PUBLIC SERVICE ANNOUNCEMENT:**

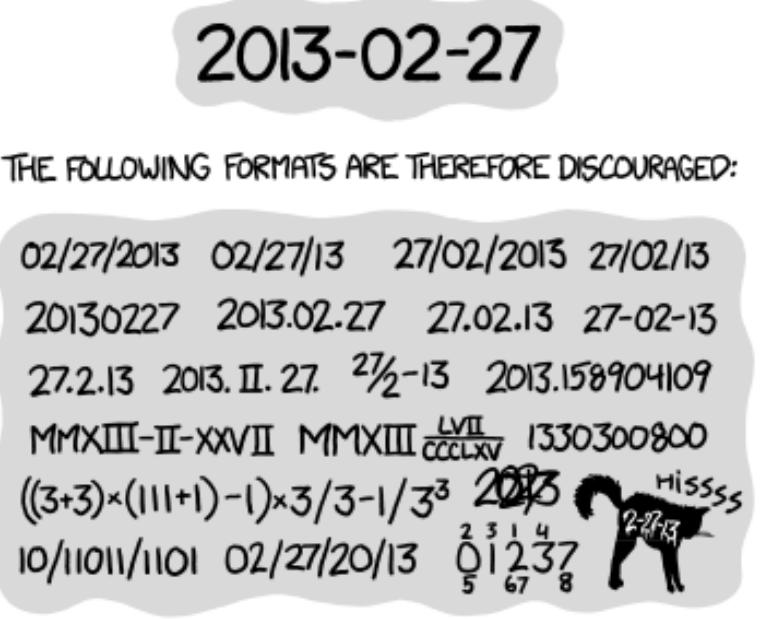
OUR DIFFERENT WAYS OF WRITING DATES AS NUMBERS CAN LEAD TO ONLINE CONFUSION. THAT'S WHY IN 1988 ISO SET A GLOBAL STANDARD NUMERIC DATE FORMAT.

THIS IS **THE** CORRECT WAY TO WRITE NUMERIC DATES:

**2013-02-27**

THE FOLLOWING FORMATS ARE THEREFORE DISCOURAGED:

02/27/2013 02/27/13 27/02/2013 27/02/13  
20130227 2013.02.27 27.02.13 27-02-13  
27.2.13 2013. II. 27. 2<sup>7</sup>/<sub>2</sub>-13 2013.158904109  
MMXIII-II-XXVII MMXIII <sup>LVII</sup><sub>CCCLXV</sub> 1330300800  
 $((3+3)\times(111+1)-1)\times3/3-1/3^3$  2013 Mississ 2-27-13  
10/11011/1101 02/27/20/13 01237 5 67 8



# MindSphere Offering Structure



Customers need to order at least one of the base plans...

## MindAccess IoT Value Plan

Use MindSphere applications based on ingested data – without development know-how

- Data ingest & storage
- Productive tenant
- Asset management
- User management
- Fleet Manager
- MindConnect IoT Extension
- Access to MindSphere Store

## MindAccess DevOps Plan

MindAccess Developer Plan  
Develop applications on a test system

- Cloud Foundry developer space
- Developer test tenant
- Basic APIs including analytics
- Test asset and user management
- Developer data storage
- Developer cockpit

## MindAccess Operator Plan

Operate applications on a productive system and offer them via MindSphere Store

- Cloud Foundry productive space
- Basic APIs including analytics
- Operator cockpit / access to MindSphere Store

# MindAccess IoT Value Plan

## Resources Overview

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IoT Value Plan	S small customers/ OEMs	M worldwide installed base	L big international plants
No. of users / Subtenants <sup>4)</sup>	50 / 10	150 / 40	500 / 80
Agents onboarded (MindConnect Elements or Lib)	10	25	100
Assets included (types/ instances)	5 / 50	10 / 250	50 / 1,000
Data ingest rate <sup>3)</sup> (time series)	2 KB/s	10 KB/s	100 KB/s
Data storage time series (cold storage)	60 GB	300 GB	3 TB
Data ingest via IoT extensions <sup>2)</sup> , monthly	5 GB	5 GB	5 GB
File storage	50 GB	100 GB	500 GB
User Management	✓	✓	✓
Asset Management	✓	✓	✓
Productive Tenant	✓	✓	✓
Access to MindSphere Store	✓	✓	✓
Fleet Manager Basic incl. rules and events <sup>1)</sup>	✓	✓	✓

1) Limited use of rules & events. one active concurrent rule included in all plan sizes; upgrade available 2) Part of overall data ingest

3) Based on no. of assets, no. of variables per asset, size per variable, read cycle interval and sending frequency; exemplary use case for M size: 200 assets with 10 variables each sending frequency 10s, 20 assets with 100 variables each sending frequency 10s, etc. (assumptions: 50 Bytes per variable including overhead – float from MindConnect Nano/ IoT2040 or S7-FB, read cycle equals sending frequency) 4) Release upcoming for MindSphere on Azure

Restricted © Siemens

# MindAccess Developer Plan

## Resources Overview

Developer Plan (Cloud Foundry)	S	M	L
<b>Test &amp; development resources (RAM)</b>	<b>2 GB</b>	<b>10 GB</b>	<b>20 GB</b>
Cloud Foundry development space	✓	✓	✓
Highly available system (several availability zones)	✓	✓	✓
Development tenant	✓	✓	✓
Developer cockpit	✓	✓	✓
Fleet Manager Basic incl. rules and events <sup>3)</sup>	✓	✓	✓
MindSphere APIs <sup>1)</sup>	✓	✓	✓
Unlimited no. of routes	✓	✓	✓
Included backing service instances (plan XS)	2	4	6
Number of developers/ test users	10	50	100
Connected assets types/ instances/ agents <sup>2)</sup>	5 / 20 / 1	25 / 100 / 5	50 / 200 / 10
Outbound traffic, monthly <sup>4</sup>	60 GB	300 GB	600 GB
New app transfers to operations system, monthly	1	5	10
Developer resources	Documentation, Getting Started, Community		
Supported Build Packs	Go, Java, Node.js, .Net core, PHP, Python, Ruby, Static File (s. <a href="#">Product Sheet</a> for always up-to-date information)		

1 Comprehensive set of MindSphere APIs e.g. analytics, notification service, context delivery service; number of calls limited, higher packages include more calls; upgrades available

2 Inbound traffic and respective storage for testing included (according to data sheet)

3 Limited use of rules & events; one active concurrent rule included in all plan sizes; upgrade available

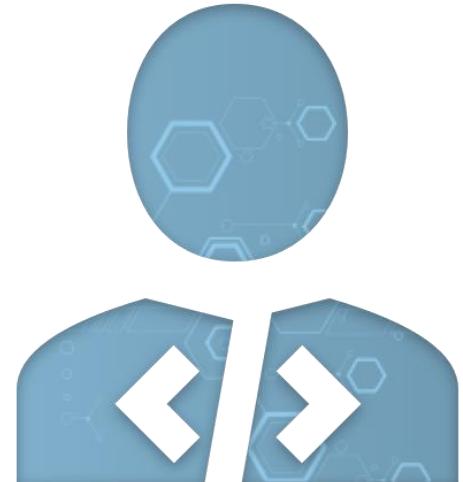
4 Release upcoming for MindSphere on Azure

# MindAccess Developer Plan (S, M, L)

## Administrative Tools

To **develop, test and manage** own applications in the **dedicated development environment**

Administrative Tools	Usage Transparency	User Management	Asset Manager
	<p>information regarding <b>resources consumption</b>, e.g.</p> <ul style="list-style-type: none"><li>• number of API calls</li><li>• numbers of users</li><li>• inbound and outbound traffic</li></ul>	<p>to manage <b>user rights, permissions and subtenants</b>:</p> <ul style="list-style-type: none"><li>• overview of all users of a specific tenant</li><li>• Manage users (adding and removing users)</li><li>• Assign groups and roles</li><li>• Manage access to applications for users group</li></ul>	<ul style="list-style-type: none"><li>• Onboard and offboard <b>connectivity agents</b></li><li>• <b>Configure</b> assets, asset types, aspects and aspect types</li></ul>



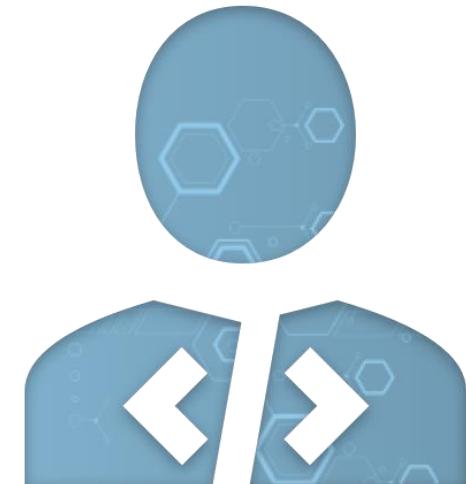
# MindAccess Developer Plan (S, M, L)

## Administrative Tools

To **develop, test and manage** own applications in the **dedicated development environment**

**Administrative Tools**

Developer Cockpit
<ul style="list-style-type: none"><li>• <b>Create applications</b></li><li>• <b>overview</b> of developed apps</li><li>• <b>Configure applications</b>, e.g. app icon or display name</li><li>• <b>Secure applications</b> on an endpoint level</li><li>• Bring applications to the developer Launchpad</li><li>• Manage application specific roles</li><li>• <b>Transfer</b> new or updated <b>applications</b> from developer <b>to</b> productive environment by assigning applications to a <b>MindAccess Operator account</b></li><li>• <b>Manage versions</b> of applications</li></ul>



# MindAccess Operator Plan

## Resources Overview

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Operator Plan (Cloud Foundry)	S	M	L
Productive system resources (RAM)	2 GB	10 GB	20 GB
Cloud Foundry productive space	✓	✓	✓
Highly available system (several availability zones)	✓	✓	✓
Productive tenant for monitoring & support	✓	✓	✓
Operator cockpit w/ access to MindSphere Store	✓	✓	✓
Fleet Manager Basic incl. rules and events <sup>3)</sup>	✓	✓	✓
MindSphere APIs <sup>1)</sup>	✓	✓	✓
Unlimited no. of routes	✓	✓	✓
Number of operator users	5	10	25
Connected assets types/ instances/ agents <sup>2)</sup>	5 / 20 / 1	25 / 100 / 5	50 / 200 / 10
Outbound traffic, monthly <sup>4)</sup>	60 GB	300 GB	600 GB
New uploads to MindSphere Store, monthly	1	5	10
Operator Resources	Documentation, Getting Started, Seller Guide		
Supported Build Packs	Go, Java, Node.js, .Net core, PHP, Python, Ruby, Static File (s. <a href="#">Product Sheet</a> for always up-to-date information)		

1 Comprehensive set of MindSphere APIs e.g. analytics, notification service, context delivery service; number of calls limited, higher packages include more calls; upgrades available

2 Inbound traffic and respective storage for testing included (according to data sheet)

3 Limited use of rules & events. one active concurrent rule included in all plan sizes, upgrade available

4 Release upcoming for MindSphere on Azure

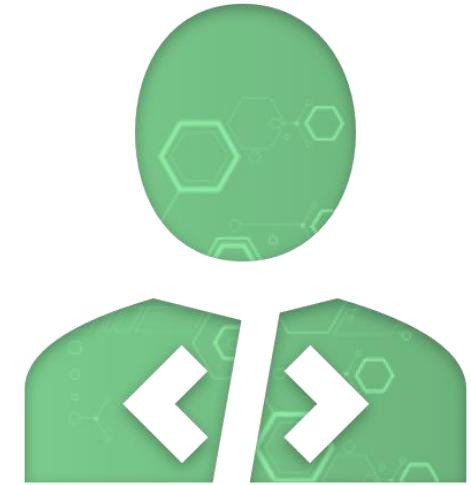
# MindAccess Operator Plan (S, M, L)

## Administrative Tools



To **operate** and **manage** applications in the **productive environment** and to publish **applications** in the MindSphere Store

Administrative Tools	Usage Transparency	User Management	Asset Manager
	<p>information regarding <b>resources consumption</b>, e.g.</p> <ul style="list-style-type: none"><li>• number of API calls</li><li>• numbers of users</li><li>• inbound and outbound traffic</li></ul>	<p>to manage <b>user rights, permissions and subtenants</b>:</p> <ul style="list-style-type: none"><li>• overview of all users of a specific tenant</li><li>• Manage users (adding and removing users)</li><li>• Assign groups and roles</li><li>• Manage access to applications for users group</li></ul>	<ul style="list-style-type: none"><li>• Onboard and offboard <b>connectivity agents</b></li><li>• <b>Configure</b> assets, asset types, aspects and aspect types</li></ul>



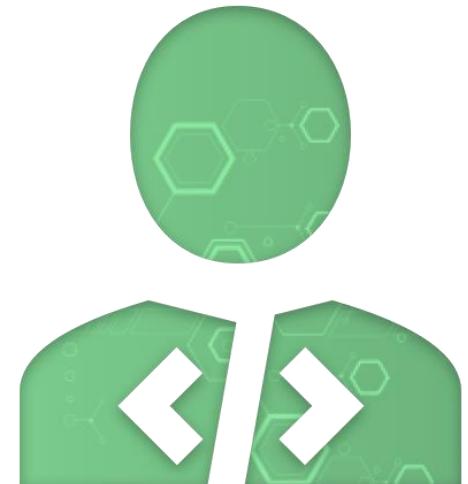
# MindAccess Operator Plan (S, M, L)

## Administrative Tools

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To **operate** and **manage** applications in the **productive environment** and to publish **applications** in the MindSphere Store

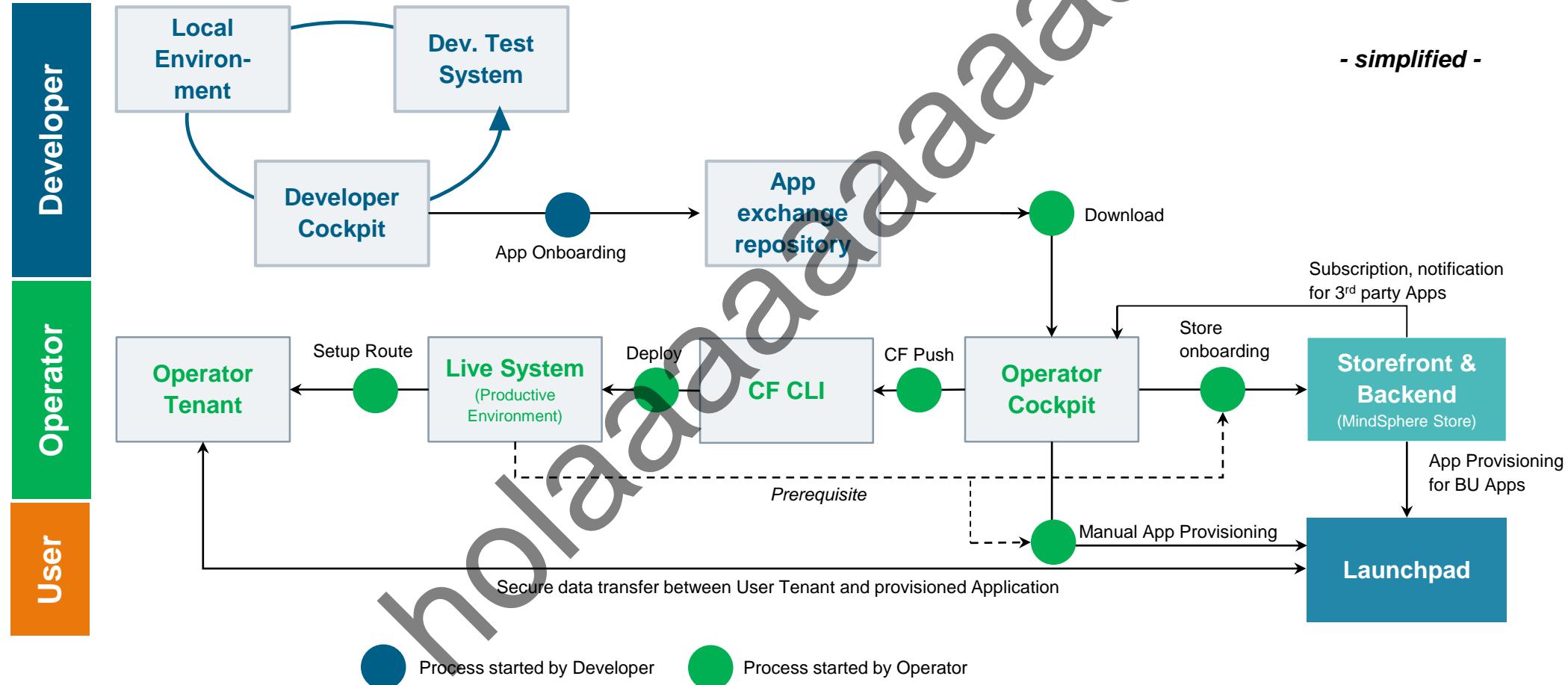
Administrative Tools	Operator Cockpit
	<ul style="list-style-type: none"><li>• <b>Overview</b> of all own <b>applications</b> running on their MindAccess Operator account</li><li>• Check <b>health status</b> of all their applications</li><li>• Receive and display <b>notifications</b> concerning theirs applications</li><li>• Get <b>information</b> on <b>usage</b> and <b>traffic</b></li><li>• Get information on <b>new subscriptions</b> from the MindSphere Store</li><li>• <b>Pull</b> applications from a MindAccess Developer account to their MindAccess Operator Account by deploying them to the productive environment and operating them</li><li>• <b>Publish</b> own applications to the <b>MindSphere Store</b> and make them visible to only certain customers or to the public (subscribers of a MindAccess IoT Value Plan)</li><li>• <b>Provide</b> applications to <b>new customers</b> that bought their app in the MindSphere Store</li></ul>



# Application Lifecycle

How to get an App from the Developer to the User?

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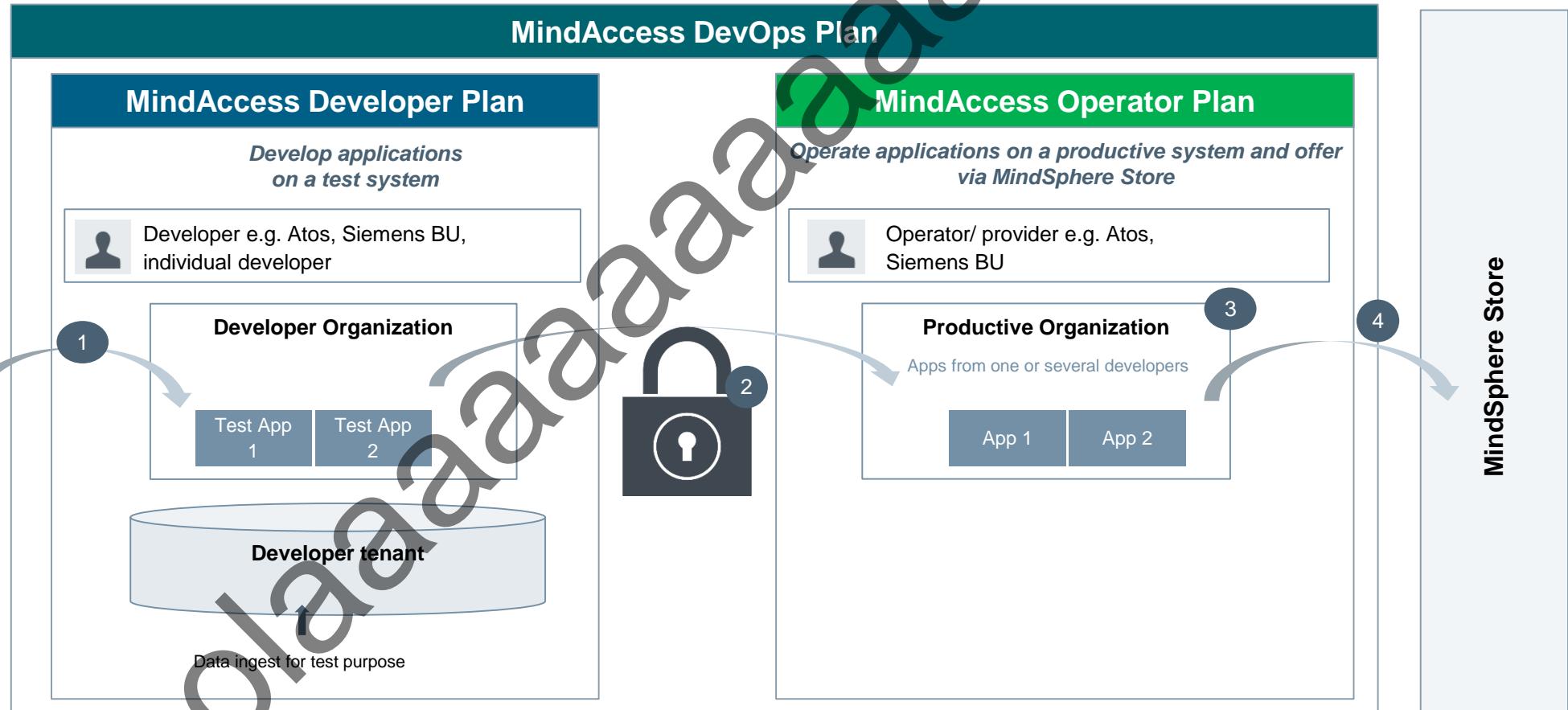


CLI = Command Line Interpreter

Restricted © Siemens

# How to Use MindSphere Platform?

## Develop and Operate Apps



Exemplary user journey:

1 Developer pushes App to development system

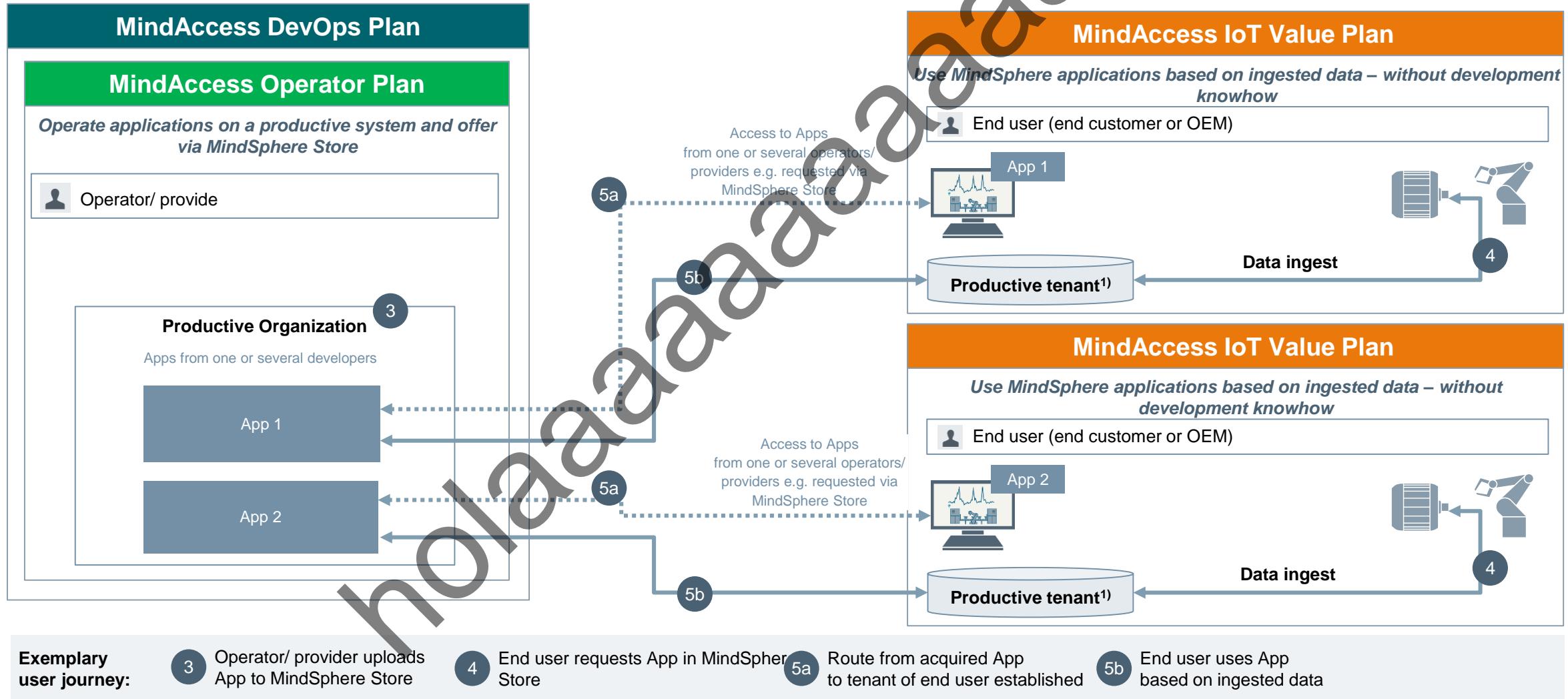
2 Developer transfers App to operations system

3 Operator/provider operates App

4 Operator/provider creates Offering in MindSphere Store

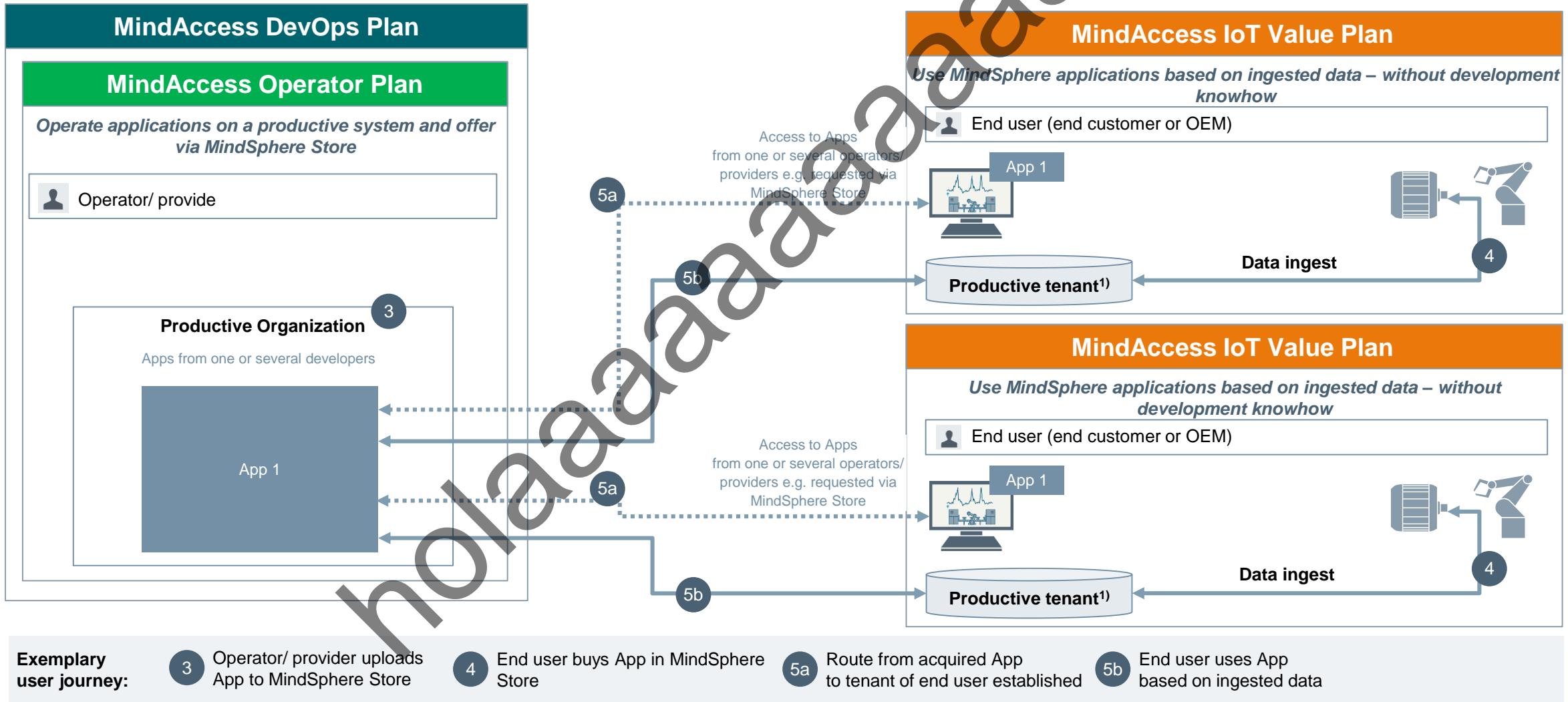
# How to Use MindSphere Platform?

## Consume App



# MindSphere 3.0

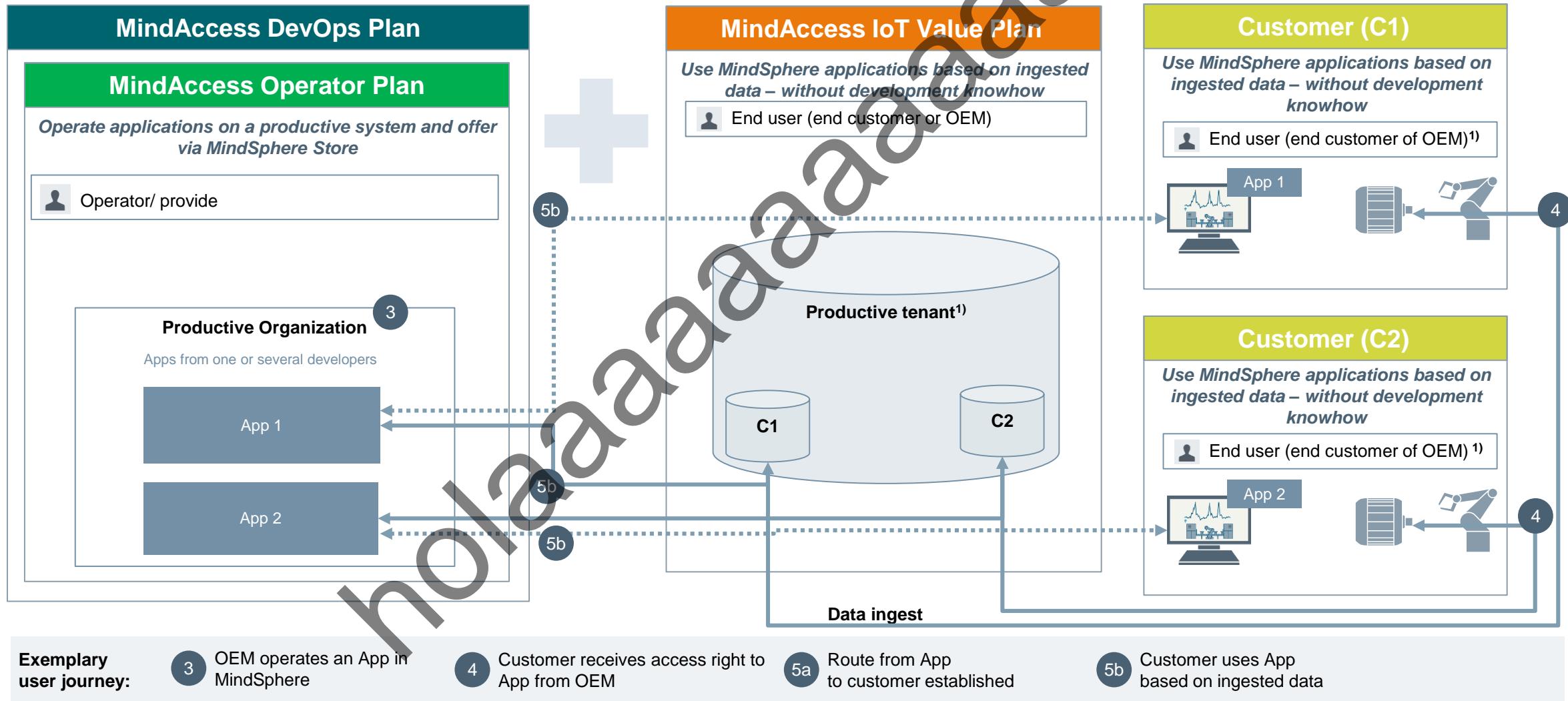
## Consume Multitenancy App



# How to Use MindSphere Platform?

## OEM Use case

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# Architecture & API Summary

How is MindSphere designed?

As an open platform as a service (PaaS) for scalable, global IoT connectivity and application development.

How shall we develop applications for MindSphere?

By getting MindAccess Developer plan (S, M, L), we can start using 18 different APIs to make the application development easy and fast.



# MindSphere Tools for Training

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# MindSphere - Tools for Training

## Learning Goals

Which tools do we use in the training?

- Virtual Box
- Ubuntu Linux
- Cloud Foundry CLI
- Visual Studio Code
- Postman



We use the following tools in the training:

- Ubuntu Linux
- CloudFoundry CLI
- Microsoft Visual Studio Code
- Postman
- Browser (Chrome)

**Where do you get these tools?**

### Preperations:

- Everybody should have already installed the Virtual Box on your notebook.
- BIOS flag for virtualization (VT-X) has to be enabled.

### What to do next:

- Copy the OVA file from the USB-Stick to you notebook.
- Import the OVA file to your Virtual Box (just double-click on the icon).
- Make sure you have internet access inside the linux box.
- Setup proxy (depends on location and internet connection).

### Linux Login

- Username: beta
- Password: workshop

# MindSphere - Tools for Training

## Summary

Which tools do we use in the training?

- Tools are provided
- Install Virtual Box and the latest OVA file



# MindSphere Cloud Foundry Essentials

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# Cloud Foundry Essentials

## Learning Goals

What is Cloud Foundry  
&  
what is its advantage?

- Cloud Foundry
- Cloud Foundry Foundation
- Build packs



- Multi cloud application platform as a service (PaaS)
- SpringSource, VMWare, EMC, Pivotal
- Development startet in 2009
- First version in 2012



Onsi Fakhouri, VP Cloud R&D, Pivotal

Cloud Foundry Foundation is a 501(c)(6) **nonprofit, open source** project.

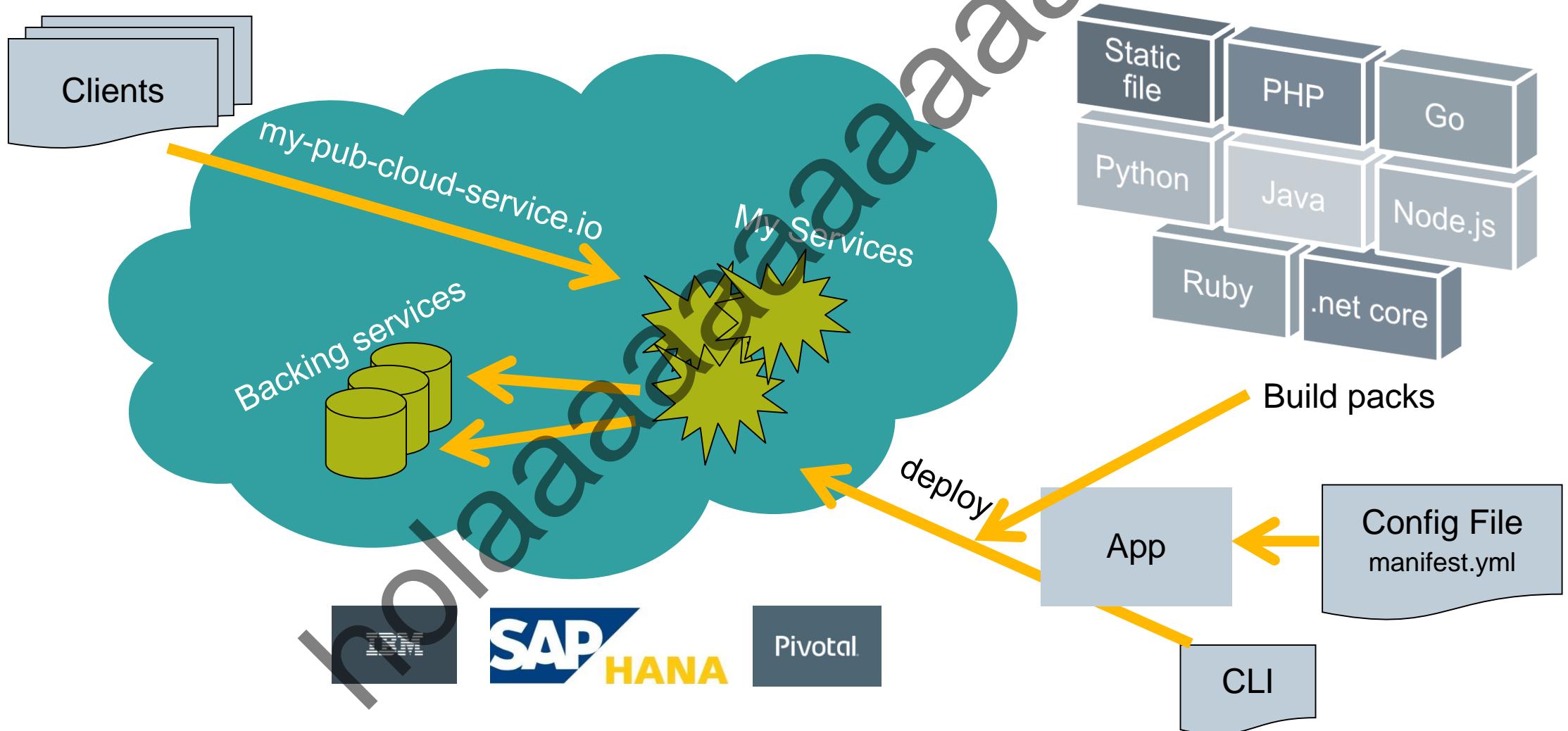
**"Our purpose is to make Cloud Foundry the leading application platform for cloud computing worldwide."**

Members (extract):

- Cisco
- IBM
- Pivotal
- SAP
- SUSE
- VMware

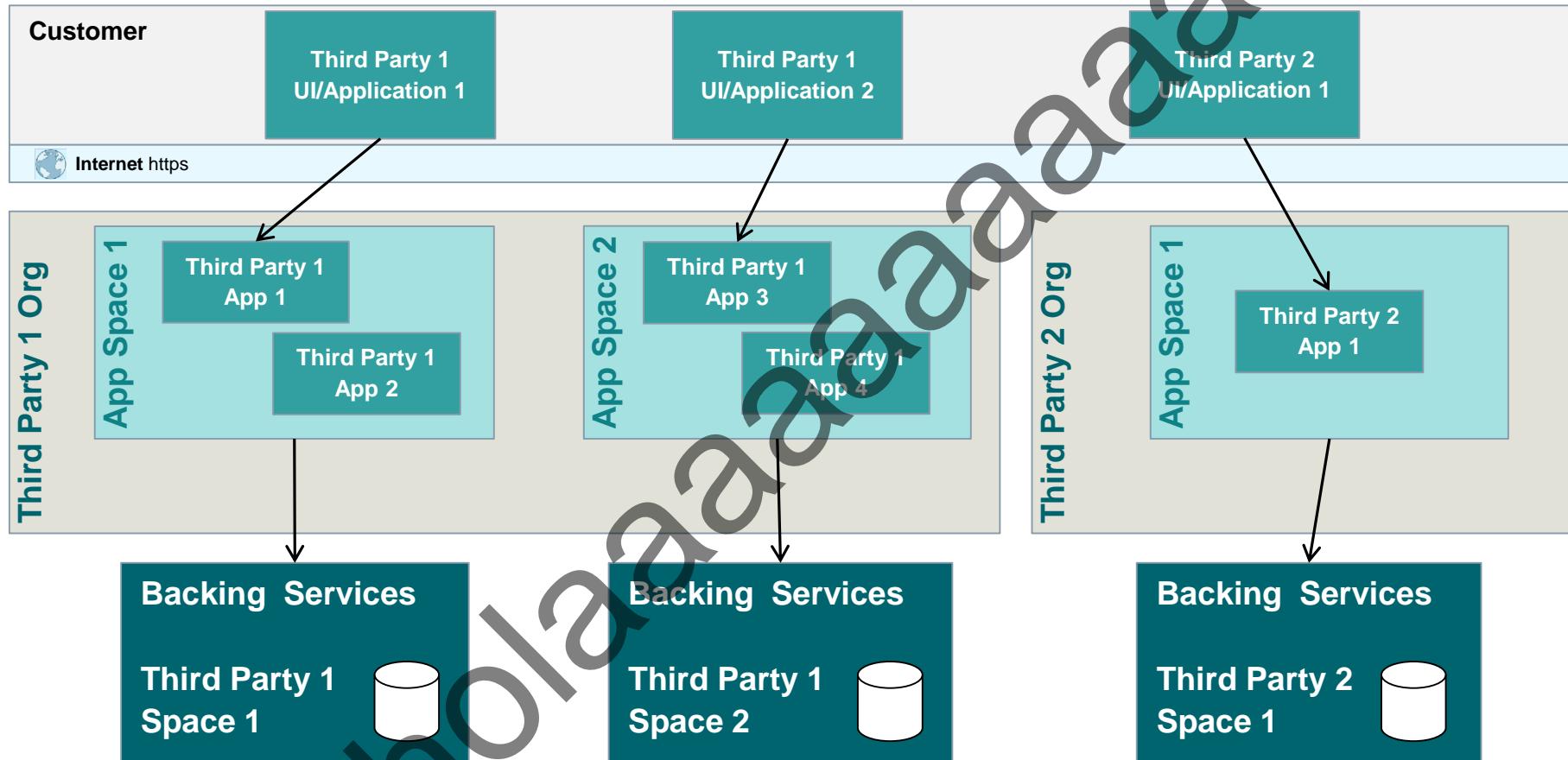
# Cloud Foundry Overview

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# Cloud Foundry

## Org-Space concept



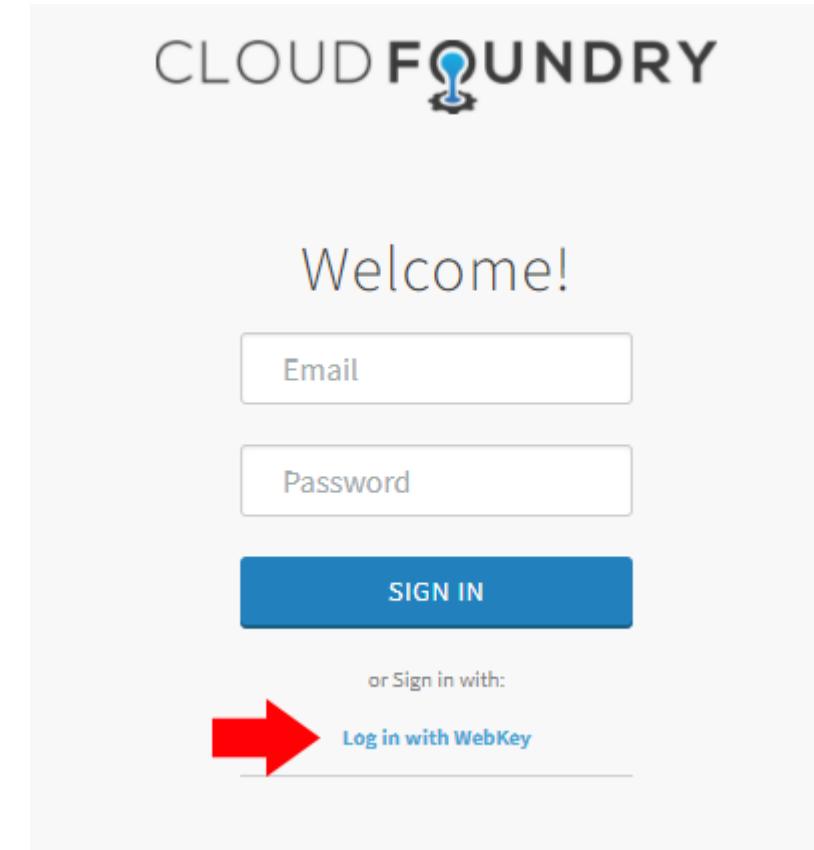
- Industrially hardened Stemcells
- Managed Buildpacks with a high level of security standard (e.g. CVE scanning)
- Managed Backing Services with automated backup capabilities (plan medium or higher)
- Separation of Concerns - clear separation of development and production environments)
- Positive Security Concept for Applications and APIs

# Cloud Foundry

## Step-by-step: Login

1. Optional: Set proxy configuration in CMD or bash
2. Define endpoint: cf api https://api.cf.eu1.mindsphere.io
3. Login using the command  

```
cf login -sso
```
4. Visit <https://login.cf.eu1.mindsphere.io/passcode> to get an One Time Code
5. Login using the WebKey Link below the Cloud Foundry Login Form
6. Type in your MindSphere Credentials
7. Copy the One Time Code and use in the CF CLI
8. Select your assigned Cloud Foundry ORG (if asked)
9. Select a Cloud Foundry Space (if asked)



# Cloud Foundry

## manifest.yml



```
applications:
  - name: tokenapp
    instances: 1
    random-route: true
    memory: 50MB
    buildpacks:
      - nodejs_buildpack
    command: node app.js
```

### Push your first app

1. `cd workshop\03_basic\010_token`
2. Edit the file **manifest.yml** file and change xx to your initials
3. Enter: `cf push`

**Exercise: Can you guess the task? Just execute it...**

```
cf api https://api.cf.eu1.mindsphere.io
```

```
cd 010_token
```

```
cf login --sso
```

```
cf marketplace
```

```
https://login.cf.eu1.mindsphere.io/passcode
```

```
cf push
```

```
cf services
```

```
cf logs mywebapp [--recent]
```

```
cf delete mywebapp
```

```
cf buildpacks
```

# Cloud Foundry Essentials

## Summary

What is Cloud Foundry?

**Cloud Foundry is the leading application platform for cloud computing worldwide.**

What is its advantage?

**With CloudFoundry you have an easy way to run your application inside MindSphere**



# MindSphere Authentication & Authorization

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# MindSphere - Authentication & Authorization

## Learning Goals

**How can I authenticate users  
in MindSphere  
&  
which rights do the users  
have?**

- MindSphere Access
- Token
- Security Workflow
- Roles & Scopes
- App registration



- MindSphere 3.0 authentication & authorization is based on **OAuth 2.0**
- OAuth 2.0 is a standard protocol for authorization, defined in misc. RFCs (details see <https://oauth.net/2/>)
- One part of the definition are: **JSON Web Token (JWT)**

# MindSphere - Authentication & Authorization

## JSON Web Token

- JSON Web Token / JWT
- Open standard (defined in RFC 7519) for access token for different claims
- Important fields
  - iss: issuer
  - aud: audience
  - exp: expiration time
  - iat: issued at time
  - scope

The screenshot shows a JSON Web Token (JWT) being analyzed by the jwt.io decoder. The token is split into three parts: Header, Payload, and Signature.

**Encoded:** eyJhbGciOiJSUzIiNiIiMtpZC16Imtle01oZ0x  
IiwidHlwIjoiSlIdUnhBeyJqYwxiO1I40tgnyGy  
ODIyZmU0OTE5YNIyZSG04ODYg5ABIIIZnIsInN1  
Yi16ImU4NT04YjhnlTh1Y70zNGMx0010DYZlThm  
ODRkZmI4ZTRhET1iNjb511i1m1kc3A6Y29y  
ZTphc3N1Zk81hbmcZ71bhndQYHmtaW41LCjtZHNw  
OmNvcmUva0udXlck1hbv5ZXdc1ciIsIm1kc3A6  
Y29vZTppb30mdNvXN1ciisIm1kc3AGY29yTpp  
08n0dG1tQWRva41c1c1zZHNw0mNvcmU6aW90LnRp  
bVvzZX1iLCJ0YmhcDeuWxsIiwbRzcDpj83J1  
OmYcmVmV2ZW5obWFyUWdlciidLCjbG1bnRfWaQi  
01...ym-w10Ety2Fzc2VzSIsImNpZC16InR1YXbw  
M51VYK6zW91IiwiYXpwIjoidgJhchAxLWNhc3N1  
b201C0ncmFudF90eXBljoiYXV0aG9yaXphdG1v  
b1...j02R1i1widXNlc19pZC16ImU4NT04YjhnlTh1  
Y10tNGMxOC1i0DYzLThmODRkZmI4ZTRjNCIsIm9y  
aDpbpi6ImNh3N1b2U1iCJ1c2VYX25hbWUi0iJ0  
aGLsby5ib2VobUBzaWVtZWSzLmNvbSIiInR1YXbw  
IjoidGhpB8guYm91aG1Ac21lbWVucy5jb20iLCJh  
dxRo3RpDWUj01E1MTkyDg4MjIsInJ1d19zaWci  
013NTYzZmZjN1i1e1m1hdC16MTUxOTIe0Dgyw1  
ZXhwIjoxNTE5MjEwNjIzLcJpc3Mi0iJodHRwczov  
L2Nh3N1b2UucGlnbSS1dTEewBuZHNwagVyzSp  
by9vYXV0a98b2tlbi1sInppZC16Im1Nh3N1b2U1  
LCJhdWQ101s1dGJhchAxLWNhc3N1b2U1LCjtZHNw  
OmNvcmU6aw98b1iwbRzcDpj83J10mFzc2V0bWFu  
YWD1bWVudCisIm1kc3A6Y29yZTppSIsInR1YXbw  
MS1sIm1kc3A6Y29yZTpbSJdLCJ1c2VYX25hbWUi0iJ0  
ZW911iwi2cNoZW1hcy16MyJ1cm46c21lbWVuczpt  
aW5kc38oZXJ10m1hbTp2MSJdLCJjYXQ1o1J1c2VY  
LXRve2VuOnYxIn0.T9GtZcc5\_PXtGxx7N4D5Q-  
SmIEw1SkSY-  
xz7f7MmegHtgjQE67jL1y1bGhipU3puwrV1k3Ig  
xq8aIdg521rk1tzqakm5e21Lq1VqB0KgCG0fGeu  
kgGzsyIAId70zg4uZbEgzwtYuQP5Z\_jyadhxFgld  
GmnosqyHTGzfDTTjWXXhxWgLSEgyqR01UU63e14k  
iUh6-Uh-\_z-  
P62auMhqibWchvyLcXhWm7cCANcmxDMS5KYHa6QZe  
XZKvW9vPt92UU0HSAsST4N47Yt1kw\_4h3DVqqH  
ASnff-LkNsKjTg2ZxZV6VC-  
ww91RxnQ1vs10Q1wT0j3V-QvovoJP44ba

**Decoded:** EDIT THE PAYLOAD AND SECRET (ONLY HS256 SUPPORTED)

**HEADER: ALGORITHM & TOKEN TYPE**

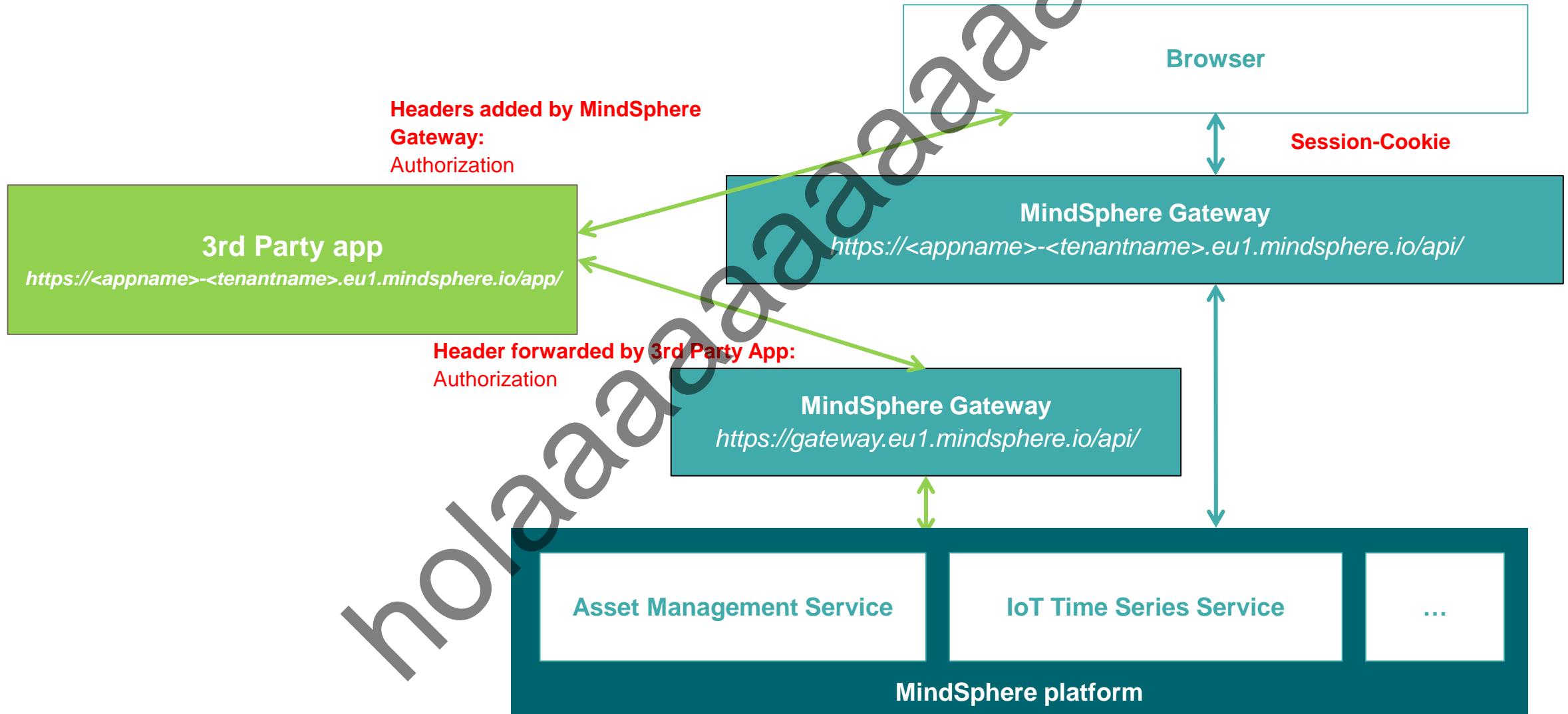
```
{  
  "alg": "RS256",  
  "kid": "key-id-1",  
  "typ": "JWT"  
}
```

**PAYLOAD: DATA**

```
{  
  "jti": "89824f2822fe4919ab2dd0860204eb66",  
  "sub": "e8548b8a-8ea4-4c18-b863-8f84dfb8e4c4",  
  "scope": [  
    "mdsp:core:assetmanagement.admin",  
    "mdsp:core:im.userIamViewer",  
    "mdsp:core:iot.tsaUser",  
    "mdsp:core:iot.timAdmin",  
    "mdsp:core:iot.timUser",  
    "tbapp1.all",  
    "mdsp:core:em.eventmanager"  
,  
    "client_id": "tbapp1-casseoe",  
    "cid": "tbapp1-casseoe",  
    "azp": "tbapp1-casseoe",  
    "grant_type": "authorization_code",  
    "user_id": "e8548b8a-8ea4-4c18-b863-8f84dfb8e4c4",  
    "origin": "casseoe",  
    "user_name": "thilo.boehm@siemens.com",  
    "email": "thilo.boehm@siemens.com",  
    "auth_time": 151928822,  
    "rev_sig": "7563ffc6",  
    "iat": 1519208823,  
    "exp": 1519210623,  
    "iss": "  
https://casseoe.piam.eu1.mindsphere.io/oauth/token",  
  ]  
}
```

# MindSphere - Authentication & Authorization Workflow

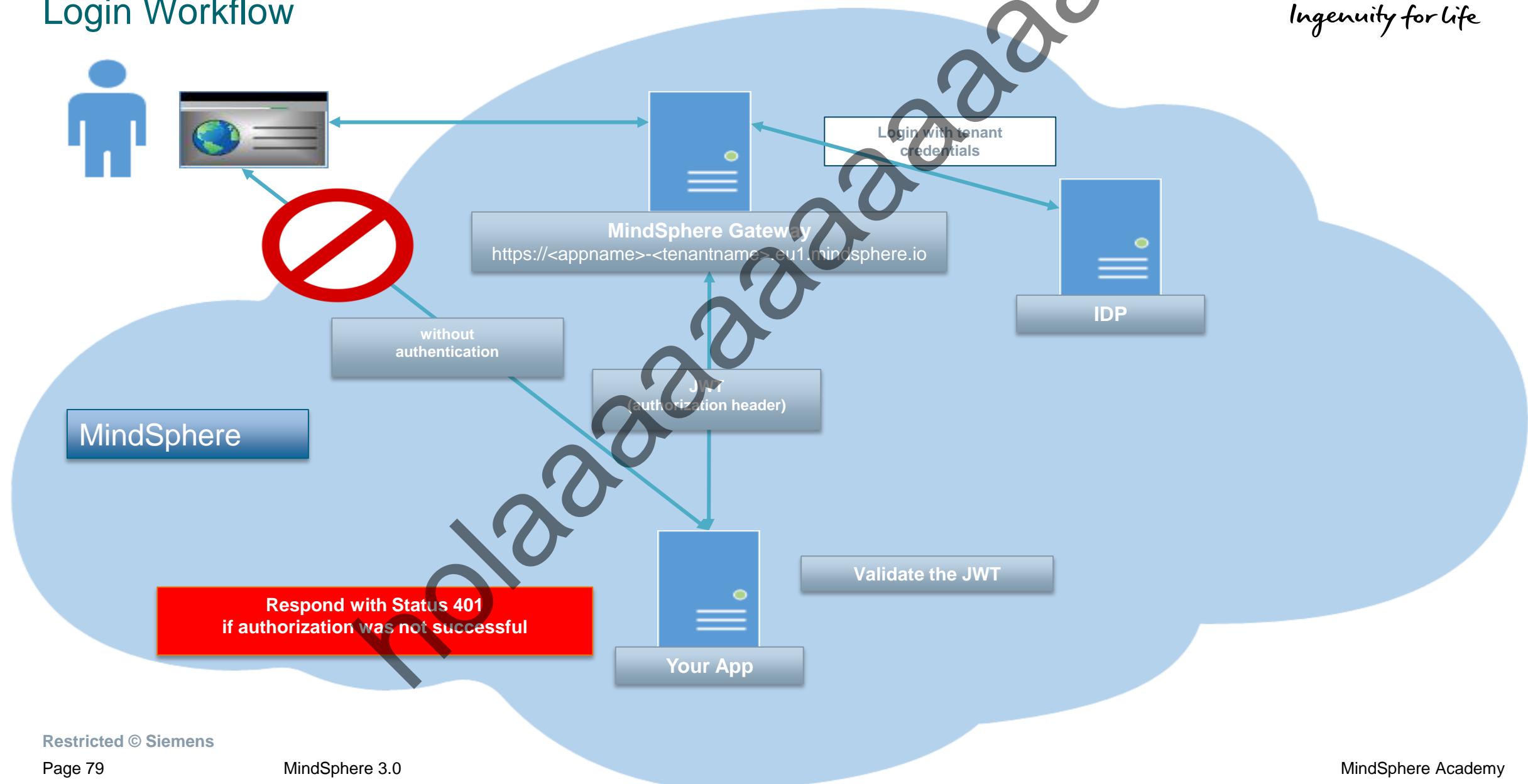
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# MindSphere - Authentication & Authorization

## Login Workflow

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# MindSphere - Authentication & Authorization

## Developer Cockpit

- Functions
  - Register applications
  - Manage application
  - Manage Roles & Scopes
  - Upload apps to store



The screenshot shows the 'Application Overview' section of the MindSphere Developer Cockpit. At the top, there are filters for 'Filter application by state' (dropdown) and 'Search application by name' (input field with a magnifying glass icon). Below these are two buttons: '+ Create new application' and '+ Create new version'. The main area displays three application cards:

Application	State	Version	Registration
SEW Drives	IN-DEVELOPMENT	1.0.0	Registered
100_00_simpl_myweb	IN-DEVELOPMENT	1.0.0	Registered
TBApp1	IN-DEVELOPMENT	1.0.0	Registered

- **Scopes**

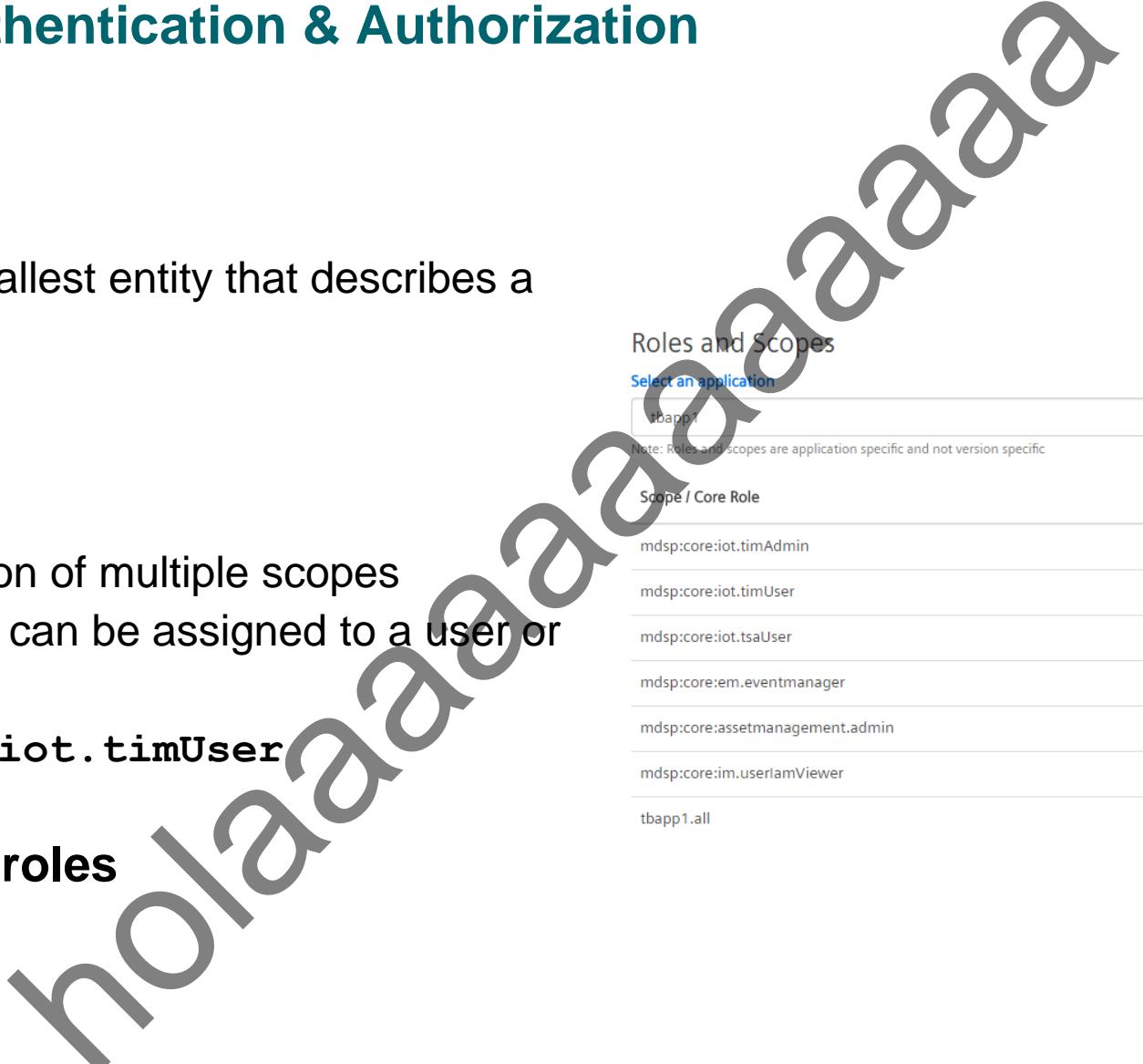
- A scope is the smallest entity that describes a single permission
- e.g. `iot.tim.r`

- **Roles**

- A role is a collection of multiple scopes (permissions) that can be assigned to a user or another role
- e.g. `mdsp:core:iot.timUser`

- **Predefined User roles**

- Admin
- User



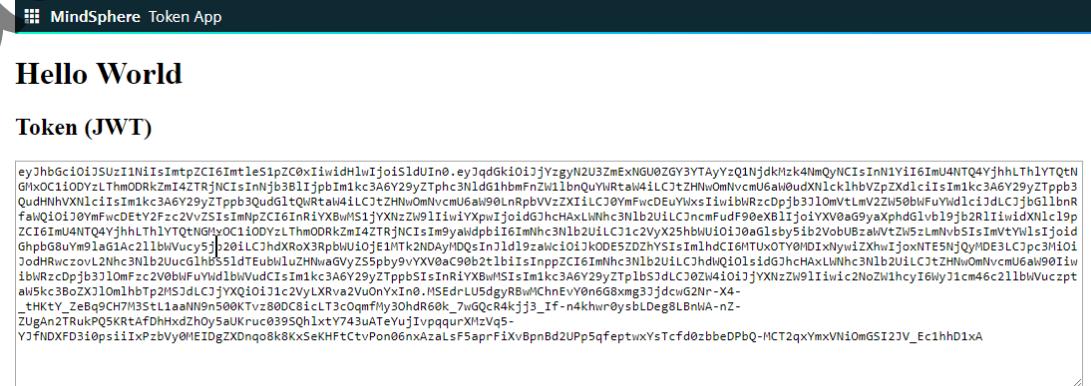
Scope / Core Role	user	admin		
mdsp:core:iot.timAdmin	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
mdsp:core:iot.timUser	<input checked="" type="checkbox"/>	<input type="checkbox"/>		
mdsp:core:iot.tsauUser	<input checked="" type="checkbox"/>	<input type="checkbox"/>		
mdsp:core:em.eventmanager	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		
mdsp:core:assetmanagement.admin	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		
mdsp:core:im.useriamViewer	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		
tbapp1.all	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		

[+ Add New Core Role](#)   [+ Create new scope](#)

# MindSphere - Authentication & Authorization Exercise

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- Directory: 010\_token
  - Push the application
  - Register the application
  - Find the bug



## Decoded token

# MindSphere - Authentication & Authorization

## Summary

How can I authenticate users against MindSphere and which rights do the users have?

**All calls have to go via MindSphere Gateway (direct or via 3rd party app).**

Which rights do users have?

**Application needs to be registered in MindSphere and has to have the right scopes**



# MindSphere Asset Management Service (Part I)

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# MindSphere API - Asset Management Service

## Learning Goals

**How do we read information  
of the asset  
&  
how can we navigate  
through the asset hierarchy?**

- Asset concept
- Requests to use



### Base endpoint methods

**GET:** /api/assetmanagement/v3/assets

#### Purpose:

- Read Assets
- Filter Assets
- Get Asset Children
- Get Asset Details

Read the tenant's assets and their details, and navigate through the hierarchy

### Roles / Scopes

Role	Description
<code>mdsp:core:assetmanagement.admin</code>	Admin role allows users to create, read, update or delete assets, asset types, aspect types and files in Asset Management Service
<code>mdsp:core:assetmanagement.reporter</code>	Reporter role allows users to read assets, asset types, aspect types and files in Asset Management Service
<code>mdsp:core:assetmanagement.standarduser</code>	StandardUser role allows users to read or update assets and files, and to read asset types and aspect types in Asset Management Service
<code>mdsp:core:assetmanagement.subtenantuser</code>	SubTenantUser role allows users to read asset- and aspect types, read or update assets, and read, update or delete files in Asset Management Service

### Get all assets - Request

**GET** /api/assetmanagement/v3/assets

Read all asset for the logged in tenant.

No parameters required:

Parameter Name	Description	Example	Optional
-	-	-	-

### Get all assets – positive Response

```
{ "_embedded": {  
    "assets": [  
        {  
            "assetId": "7e2f0e528e204c41bd5a503e1a94cd62",  
            "tenantId": "academy2",  
            "name": "Democase_Location",  
            "etag": 2,  
            "externalId": null,  
            "t2Tenant": null,  
            "description": "Democase with a PLC and 3 Data Points",  
            "parentId": "555a9bfdd7b94ade8116992f56807c0d",  
            "typeId": "academy2.democase1",  
            "location": {  
                "country": "",  
                "region": "",  
                "locality": "Erlangen",  
                "streetAddress": "Schuhstr. 60",  
                "postalCode": "91052",  
                "longitude": 11.008239,  
                "latitude": 49.589216  
            },  
            "variables": [],  
            "aspects": [],  
            "_links": {  
                <HAL INFORMATION>  
            }  
        },  
        {  
            "assetId": "<NEXT ASSET>",  
            "tenantId": "academy2",  
            "name": "Democase_Location",  
            "etag": 2,  
            "externalId": null,  
            "t2Tenant": null,  
            "description": "Democase with a PLC and 3 Data Points",  
            "parentId": "555a9bfdd7b94ade8116992f56807c0d",  
            "typeId": "academy2.democase1",  
            "location": {  
                "country": "",  
                "region": "",  
                "locality": "Erlangen",  
                "streetAddress": "Schuhstr. 60",  
                "postalCode": "91052",  
                "longitude": 11.008239,  
                "latitude": 49.589216  
            },  
            "variables": [],  
            "aspects": [],  
            "_links": {  
                <HAL INFORMATION>  
            }  
        }  
    ]  
}
```

holaaaaaaaaaaaaaa

truncated! there may follow more children  
with the same format like above

### Get all assets – positive Response

```
{ "_embedded": {  
    "assets": [  
        {  
            "self": {  
                "href": "https://<mdsp-url>/api/assetmanagement/v3/assets/7e2f0e528e204c41bd5a503e1a94cd62"  
            },  
            "parent": {  
                "href": "https://<mdsp-url>/api/assetmanagement/v3/assets/555a9bfdd7b94ade8116992f56807c0d"  
            },  
            "aspects": {  
                "href": "https://<mdsp-url>/api/assetmanagement/v3/assets/7e2f0e528e204c41bd5a503e1a94cd62/aspects"  
            },  
            "location": {  
                "href": "https://<mdsp-url>/api/assetmanagement/v3/assets/7e2f0e528e204c41bd5a503e1a94cd62/location"  
            },  
            "variables": {  
                "href": "https://<mdsp-url>/api/assetmanagement/v3/assets/7e2f0e528e204c41bd5a503e1a94cd62/variables"  
            }  
        },  
        {  
            "variables": [],  
            "aspects": [],  
            "_links": {  
                <HAL INFORMATION>  
            }  
        },  
        {  
            <NEXT ASSET>  
        }  
    ]  
}
```

HAL links section, important are parent, children, aspects, events ...

truncated! there may follow more children with the same format like above

### Find Assets

**GET /api/assetmanagement/v3/assets**

Parameter Name	Description	Example	Mandatory
<b>size</b>	Specifies the number of elements in a page. Default is 10	100	No
<b>page</b>	Specifies the requested page index. Default is 0	0	No
<b>filter</b>	Specifies the additional filtering criteria	see next slide	No
<b>sort</b>	Specifies the ordering of returned elementsAppend ,asc or ,desc for sorting direction. Default is timestamp descending order	status,asc	No

### Find Assets

**GET /api/assetmanagement/v3/assets?filter=<filter>**

Parameter Name	Description	Examples	Mandatory
<b>filter</b>	Supports all basic fields. Complex filtering possible.	{"typeld": "core.mcnano"}  {"name": {"startsWith": {"value": "MCN"}}}	No

### Find Assets – Examples

#### Filter by tenantId and type:

```
GET /api/assetmanagement/v3/assets?filter={"tenantId":"academy2", "typeId":"core.mcnano"}
```

#### Search in the name:

```
GET /api/assetmanagement/v3/assets?filter={"name": {"contains": {"value": "MCN"}}}
```

#### Or and And

```
GET /api/assetmanagement/v3/assets?filter={  
  "typeId": {  
    "or": [  
      {"eq": "core.mcnano"},  
      {"eq": "core.mclib"}]],  
  "parentId": "864e19ddf02b49f48f96244258a83e16"  
}
```

## Get root asset

**GET /api/assetmanagement/v3/assets/root**

Parameter Name	Description	Example	Mandatory
-	-	-	-

Read the asset root of the logged-in tenant. This is the first asset in the hierarchy.

### Get details for an asset

**GET /api/assetmanagement/v3/assets/{id}**

Parameter Name	Description	Example	Mandatory
<b>id</b>	Asset id of the asset you want to read the details for	7e2f0e528e204c41bd5a503e1a94cd62	Yes

**Get details for one asset. Response content is similar to the requests shown before.**

## Exercise

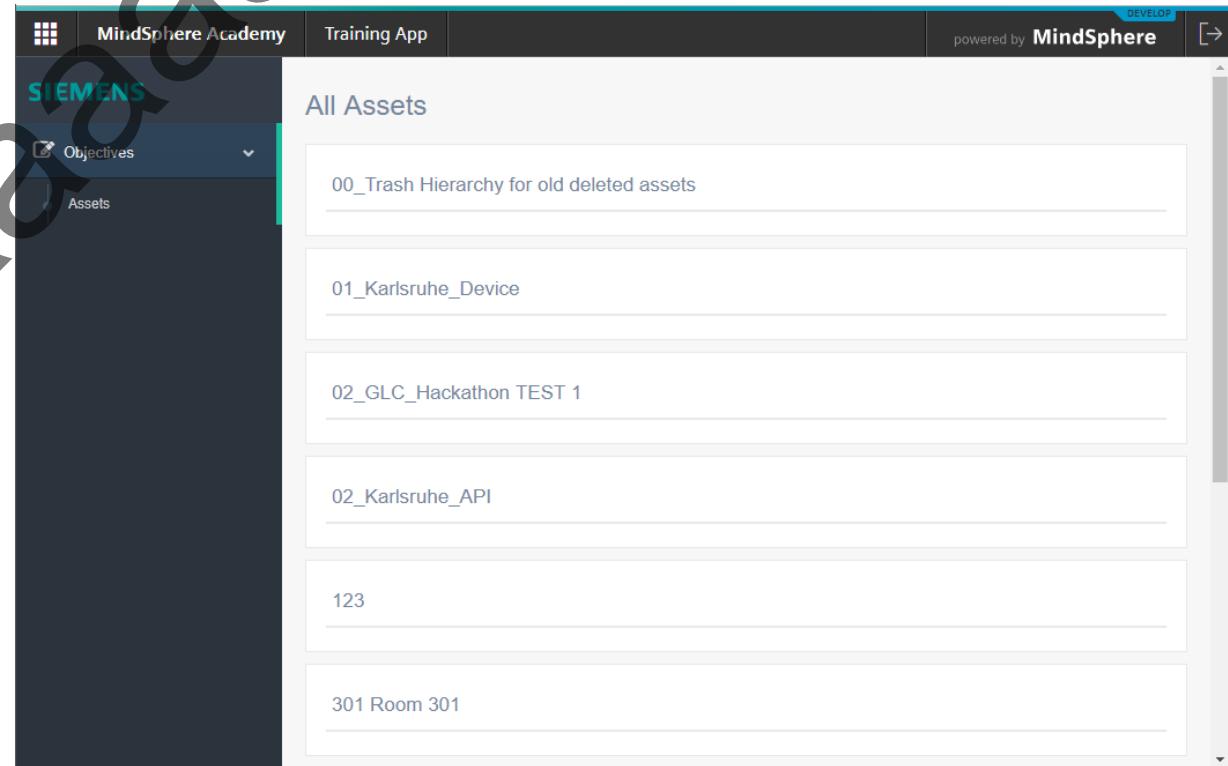
- Use the Postman Collection to investigate this API

holaaaaaaaaaaaaaa



### Exercise: 020\_assets

- Deploy and register the app
- Make it running



# MindSphere API - Asset Management Service

## Summary



How do we read information of the asset?

**There are several endpoints depending on the type of asset information requested**

How can we navigate through the asset hierarchy?

**The HAL structure tells from where to request e.g. parent and further information**

# MindSphere Asset Management Service (Part II)

**SIEMENS**  
Ingenuity for life

# MindSphere API – Asset Management Service (Part III)

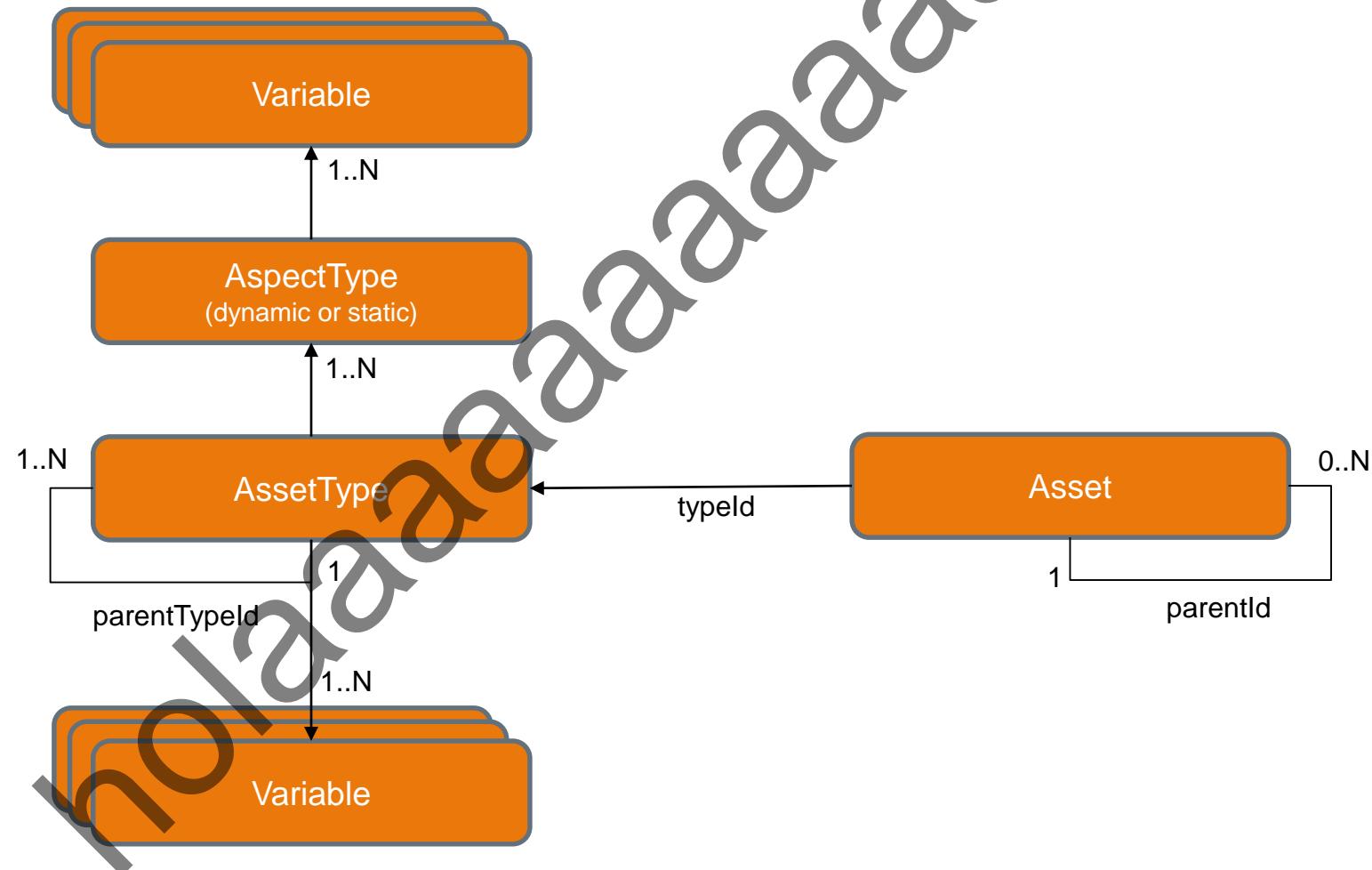
## Learning Goals

**How do we create and update assets and aspects in MindSphere 3.0?**

- Aspect concept
- Aspect type concept
- Asset type concept
- Requests



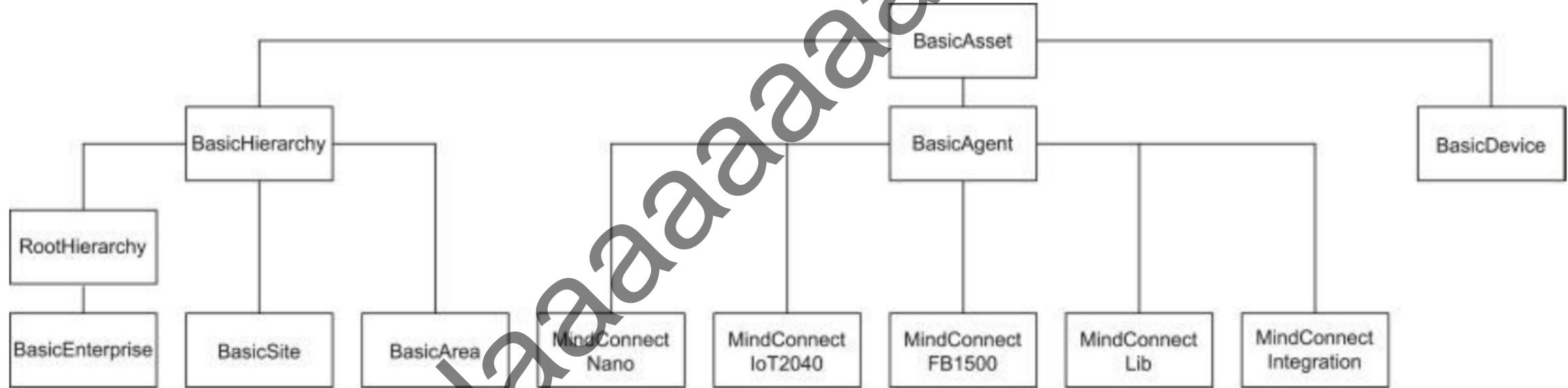
### Overview



# MindSphere API

## Asset Management Service

**SIEMENS**  
Ingenuity for life

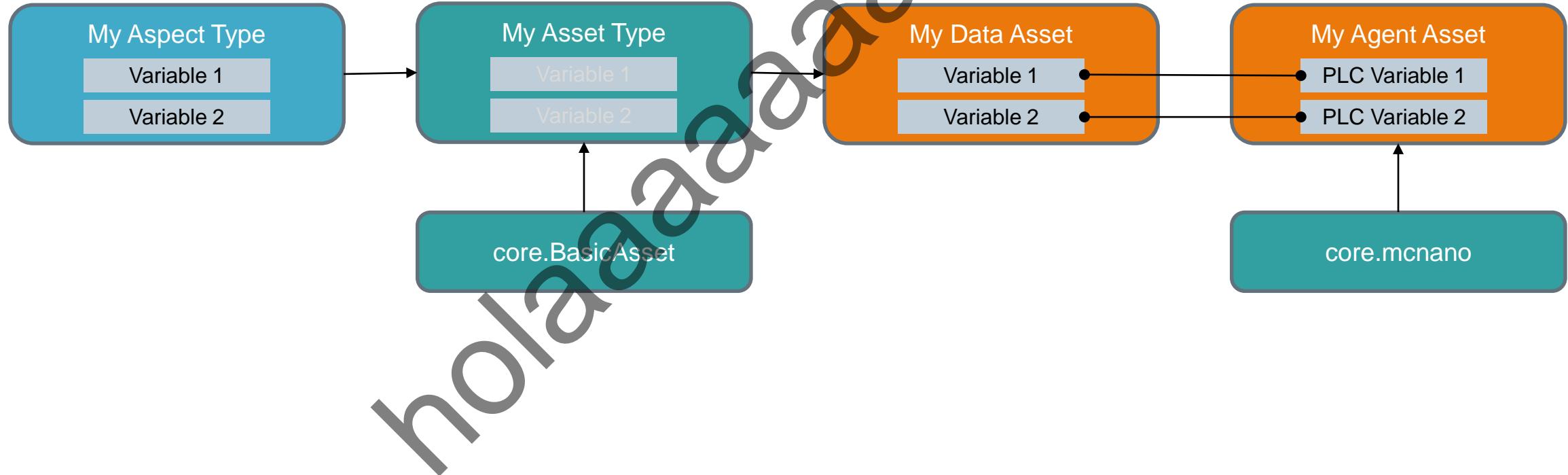


## Demokit as example

**SIEMENS**  
Ingenuity for life



### Minimal Asset Model with an Agent



## Base endpoint methods for aspect types

**GET:** /api/assetmanagement/v3/aspecttypes

### Purpose:

- Read all aspects types
- Paginate results
- Read single aspect type

Read the tenant's aspect types

### Get all aspect types - Request

**GET:** /api/assetmanagement/v3/aspecttypes

Read all aspect types logged-in tenant

#### Parameters:

Parameter Name	Description	Example	Mandatory
<b>page</b>	Specifies the requested page index	1	No
<b>size</b>	Specifies the number of elements in a page. Default 10	100	No
<b>sort</b>	Specifies the ordering of returned elements	'field1,field2,desc'	No
<b>filter</b>	Specifies the additional filtering criteria	tbd	No

### Get all aspect types – positive Response

```
{  
  "_embedded": {  
    "aspectTypes": [  
      {  
        "id": "academy2.plcvalues",  
        "tenantId": "academy2",  
        "etag": 0,  
        "name": "plcvalues",  
        "category": "dynamic",  
        "scope": "private",  
        "description": "PLC Values for a Democase",  
        "variables": [  
          <VARIABLES>  
        ],  
        "_links": {  
          "self": {  
            "href": "https://<mdsp-url>/api/assetmanagement/v3/aspecttypes/academy2.plcvalues"  
          }  
        }  
      },  
      <NEXT ASPECT-TYPE>  
    ]  
  },  
  <HAL INFORMATION>,  
  <PAGE INFORMATION>  
}
```

**truncated! there may follow more children  
with the same format like above**

### Get all aspect types – positive Response

```
{  
    "_embedded": {  
        "aspectTypes": [  
            {  
                "id": "academy2.plcvalues",  
                "tenantId": "academy2",  
                "etag": 0,  
                "name": "plcvalues",  
                "category": "dynamic",  
                "scope": "private",  
                "description": "PLC Values for a Democase",  
                "variables": [  
                    <VARIABLES>  
                ],  
                "_links": {  
                    "self": {  
                        "href": "https://<mdsp-url>/api/assetmanagement/v3  
                    }  
                }  
            },  
            <NEXT ASPECT-TYPE>  
        ]  
    },  
    <HAL INFORMATION>,  
    <PAGE INFORMATION>  
}
```



```
{  
    "name": "Pressure",  
    "dataType": "DOUBLE",  
    "unit": "hPa",  
    "searchable": false,  
    "length": null,  
    "qualityCode": false  
},  
{  
    "name": "Temperature",  
    "dataType": "DOUBLE",  
    "unit": "C",  
    "searchable": false,  
    "length": null,  
    "qualityCode": false  
}
```

### AspectType

Property	Type	Description
<b>name</b>	String	<i>Name of the aspect type</i> <i>maxLength: 128</i> <i>pattern: [a-zA-Z0-9_]+</i>
<b>category</b>	Enum	<i>[ dynamic, static ]</i>
<b>scope</b>	Enum	<i>[ public, private ]</i> <i>Visibility of aspecttype. Setting this property to public makes it available to other tenants. Private types are only visible to the user's own tenant</i>
<b>description</b>	String	<i>The description of the aspect type</i> <i>maxLength: 255</i> <i>pattern: [^\']*</i>

### AspectVariable

Property	Type	Description
<b>name</b>	String	<i>Name of the aspect type minLength: 1, maxLength: 64, pattern: [a-zA-Z0-9_]+</i>
<b>dataType</b>	Enum	<i>[ BOOLEAN, INT, LONG, DOUBLE, STRING, TIMESTAMP, BIG_STRING ]</i>
<b>unit</b>	String	<i>Unit of measurement maxLength: 32, pattern: [^\']*</i>
<b>searchable</b>	Boolean	<i>Indicates whether sorting and filtering is allowed on this variable. Only usable for static properties. default: false</i>
<b>length</b>	Integer	<i>The max length of the variable's value. The length field is only used for variables of string or big_string dataType. Max length for string is 255 and max length for big_string 100000.</i>
<b>qualityCode</b>	Boolean	<i>Indicates whether the variable has quality code</i>

## Base endpoint methods for aspect types

**PUT:** /api/assetmanagement/v3/aspecttypes/{id}

### Purpose:

- Create aspects types
- Update aspects types

Create or update tenant's aspect types

### Create or update (modify) aspect types - Request

**PUT:** /api/assetmanagement/v3/aspecttypes/{id}

#### Parameters:

Parameter Name	Description	Example	Mandatory
id	The type's id is a unique identifier. The id's length must be between 1 and 128 characters and matches the following symbols "A-Z", "a-z", "0-9", "_" and "." beginning with the tenant prefix what has a maximum of 8 characters.	ten_pref.type_id	YES
Body JSON object	aspect type	see next slide	YES

## Create or update (modify) aspect types - **Body**

```
{  
  "tenantId": "academy2",  
  "etag": 0,  
  "name": "opc_demo1",  
  "category": "dynamic",  
  "scope": "private",  
  "description": "Values from OPC Simulator",  
  "variables": [  
    {  
      "name": "sin1",  
      "dataType": "DOUBLE",  
      "unit": "",  
      "searchable": false,  
      "length": null,  
      "qualityCode": false  
    },  
    {  
      "name": "sin2",  
      "dataType": "DOUBLE",  
      "unit": null,  
      "searchable": false,  
      "length": null,  
      "qualityCode": false  
    } ]  
}
```

## Delete aspect types

**DELETE:** /api/assetmanagement/v3/aspecttypes/{id}

### Parameters:

Parameter Name	Description	Example	Mandatory
id	The type's id to be deleted	academy2.type_id	YES

Status Code 204 (No Content)

## Base endpoint methods for asset types

**GET:** /api/assetmanagement/v3/assettypes

- Read all asset types
- Paginate results
- Read single asset type

Read the tenant's asset types

### Get all asset types - Request

**GET:** /api/assetmanagement/v3/assettypes

Read all asset types logged-in tenant

#### Parameters:

Parameter Name	Description	Example	Mandatory
<b>page</b>	Specifies the requested page index	1	No
<b>size</b>	Specifies the number of elements in a page. Default 10	100	No
<b>sort</b>	Specifies the ordering of returned elements	'field1,field2,desc'	No
<b>filter</b>	Specifies the additional filtering criteria	tbd	No

### Get all asset types – positive Response

```
{ "_embedded": {  
    "assetTypes": [ {  
        "id": "academy2.democase1",  
        "parentType": "core.mcnano",  
        "tenantId": "academy2",  
        "name": "Democase1",  
        "description": "Democase 1",  
        "scope": "private",  
        "variables": [ <VARIABLES> ],  
        "aspects": [  
            <ASPECT TYPE>  
        ],  
        "etag": 0,  
        "_links": {  
            "self": {  
                "href": "https://<mdsp-url>/api/assetmanagement/v3/assettypes/academy2.democase1"  
            },  
            "parent": {  
                "href": "https://<mdsp-url>/api/assetmanagement/v3/assettypes/core.mcnano"  
            }  
        }  
    }  
],  
<HAL INFORMATION>,  
<PAGE INFORMATION>  
}
```

### Get all asset types – positive Response

```
{ "_embedded": {  
    "assetTypes": [{  
        "id": "academy2.democase1",  
        "parentType": "core.mcnano",  
        "tenantId": "academy2",  
        "name": "Democase1",  
        "description": "Democase 1",  
        "scope": "private",  
        "variables": [ <VARIABLES> ],  
        "aspects": [  
            <ASPECT TYPE>  
        ],  
        "etag": 0,  
        "_links": {  
            "self": {  
                "href": "https://<mdsp-url>/api/assetmanagement/v3/assettypes/academy2.democase1"  
            },  
            "parent": {  
                "href": "https://<mdsp-url>/api/assetmanagement/v3/assettypes/core.mcnano"  
            }  
        }  
    }],  
    <HAL INFORMATION>,  
    <PAGE INFORMATION>  
}
```

```
{  
    "name": "manufacturer",  
    "dataType": "STRING",  
    "unit": null,  
    "searchable": false,  
    "length": 255,  
}
```

### Asset type

Property	Type	Description
<b>name</b>	String	<i>Name of the asset type</i> <i>minLength: 1, maxLength: 128, pattern: [A-Za-z_0-9\.\-\_]+</i>
<b>description</b>	String	<i>The description of the asset type</i> <i>maxLength: 255</i> <i>pattern: [^\n]*</i>
<b>parentTypeld</b>	String	<i>unique identifier of the parent asset type</i>
<b>scope</b>	Enum	<i>[ public, private ]</i> <i>Visibility of assettype. Setting this property to public makes it available to other tenants. Private types are only visible to the user's own tenant</i>

### Asset variable

Property	Type	Description
<b>name</b>	String	<i>Name of the aspect type</i> <i>minLength: 1, maxLength: 64, pattern: [a-zA-Z0-9_]+</i>
<b>dataType</b>	Enum	<i>[ BOOLEAN, INT, LONG, DOUBLE, STRING, TIMESTAMP, BIG_STRING ]</i>
<b>unit</b>	String	<i>Unit of measurement</i> <i>maxLength: 32, pattern: [^\']*</i>
<b>searchable</b>	Boolean	<i>Indicates whether sorting and filtering is allowed on this variable. Only usable for static properties.</i> <i>default: false</i>
<b>length</b>	Integer	<i>The max length of the variable's value. The length field is only used for variables of string or big_string dataType. Max length for string is 255 and max length for big_string 100000.</i>

## Base endpoint methods for asset types

**PUT:** /api/assetmanagement/v3/assettypes/{id}

### Purpose:

- Create asset types
- Update asset types

Create or update tenant's asset types

### Create or update (modify) asset types - Request

**PUT:** /api/assetmanagement/v3/assettypes/{id}

#### Parameters:

Parameter Name	Description	Example	Mandatory
id	The type's id is a unique identifier. The id's length must be between 1 and 128 characters and matches the following symbols "A-Z", "a-z", "0-9", "_" and "." beginning with the tenant prefix what has a maximum of 8 characters.	ten_pref.type_id	YES
Body JSON object	asset type	see next slide	YES

## Create or update (modify) asset types - Body

```
{  
  "parentTypeId": "core.basicasset",  
  "tenantId": "academy2",  
  "name": "Democase1",  
  "description": "Democase v1",  
  "scope": "private",  
  "aspects": [  
    {  
      "name": "demo-sensors",  
      "aspectTypeId": "academy2.democasetype"  
    }  
  ]  
}
```

## Delete asset types

**DELETE:** /api/assetmanagement/v3/assettypes/{id}

### Parameters:

Parameter Name	Description	Example	Mandatory
id	The type's id to be deleted	academy2.type_id	YES

Status Code 204 (No Content)

## Base endpoint methods

**GET:** /api/assetmanagement/v3/assets/{id}

### Purpose:

- Read Assets
- Filter Assets
- Get Asset Children
- Get Asset Details

Read asset details

### Get details for an asset

**GET /api/assetmanagement/v3/assets/{id}**

Parameter Name	Description	Example	Mandatory
<b>id</b>	Asset id of the asset you want to read the details for	7e2f0e528e204c41bd5a503e1a94cd62	Yes

### Get asset – positive Response

```
{  
  "assetId": "7e2f0e528e204c41bd5a503e1a94cd62",  
  "tenantId": "academy2",  
  "name": "Democase_Location",  
  "etag": 2,  
  "externalId": null,  
  "t2Tenant": null,  
  "description": "Democase with a PLC and 3 Data Points",  
  "parentId": "555a9bfdd7b94ade8116992f56807c0d",  
  "typeId": "academy2.democase1",  
  "location": {  
    "country": "",  
    "region": "",  
    "locality": "Erlangen",  
    "streetAddress": "Schuhstr. 60",  
    "postalCode": "91052",  
    "longitude": 11.008239,  
    "latitude": 49.589216  
  },  
  "variables": [],  
  "aspects": [],  
  "deleted": null,  
  "_links": {  
    <HAL INFORMATION>  
  }  
}
```

## Base endpoint methods for assets

**POST:** /api/assetmanagement/v3/assets

### Purpose:

- Create asset

Create asset

### Create asset - Request

**POST:** /api/assetmanagement/v3/assets

#### Parameters:

Parameter Name	Description	Example	Mandatory
Body JSON object	asset	see next slide	YES

### Create asset - Body

```
{  
  "name": "Millenium Falcon",  
  "externalId": "SN 123456-123-123456",  
  "description": "The ship of Han Solo and Chewbacca",  
  "parentId": "396698dd71304003993f7bbf97dc1dda",  
  "location": {  
    "country": "Austria",  
    "region": "Tyrol",  
    "locality": "Innsbruck",  
    "streetAddress": "Industriestraße 21 A/II",  
    "postalcode": "6020",  
    "longitude": 53.5125546,  
    "latitude": 9.9763411  
  },  
  "typeId": "core.basicasset"  
}
```

## Base endpoint methods for assets

**PUT:** /api/assetmanagement/v3/assets/{id}

### Purpose:

- Update asset

Update asset

### Update asset - Request

**PUT:** /api/assetmanagement/v3/assets/{id}

#### Parameters:

Parameter Name	Description	Example	Mandatory
id	Unique identifier	90848ae7f2304ef38caa016e57dafadc	Yes
Body JSON object	asset	see next slide	Yes

### Update asset - Body

```
{  
  "name": "Millenium Falcon",  
  "externalId": "SN 123456-123-123456",  
  "description": "The ship of Han Solo and Chewbacca",  
  "parentId": "396698dd71304003993f7bbf97dc1dda",  
  "location": {  
    "country": "Austria",  
    "region": "Tyrol",  
    "locality": "Innsbruck",  
    "streetAddress": "Industriestraße 21 A/II",  
    "postalcode": "6020",  
    "longitude": 53.5125546,  
    "latitude": 9.9763411  
  },  
  "typeId": "core.basicasset"  
}
```

### Asset variable definitions for one asset - Request

**GET** /api/assetmanagement/v3/assets/{id}/variables

#### Parameters:

Parameter Name	Description	Example	Mandatory
<b>page</b>	Specifies the requested page index	1	No
<b>size</b>	Specifies the number of elements in a page. Default 10	100	No
<b>sort</b>	Specifies the ordering of returned elements	'field1,field2,desc'	No
<b>filter</b>	Specifies the additional filtering criteria	tbd	No

### Get asset variable definitions – positive Response

```
{  
    "_embedded": {  
        "variables": [  
            {  
                "name": "manufacturer",  
                "dataType": "STRING",  
                "unit": null,  
                "searchable": true,  
                "length": 255  
            },  
            {  
                "name": "externalId",  
                "dataType": "STRING",  
                "unit": null,  
                "searchable": true,  
                "length": 255  
            },  
            {  
                "name": "t2Tenant",  
                "dataType": "STRING",  
                "unit": null,  
                "searchable": true,  
                "length": 36  
            }  
        ]  
    },  
    <HAL INFORMATION>,  
    <PAGE INFORMATION>  
}
```

### Asset aspect definitions for one asset - Request

**GET** /api/assetmanagement/v3/assets/{id}/aspects

#### Parameters:

Parameter Name	Description	Example	Mandatory
<b>page</b>	Specifies the requested page index	1	No
<b>size</b>	Specifies the number of elements in a page. Default 10	100	No
<b>sort</b>	Specifies the ordering of returned elements	'field1,field2,desc'	No
<b>filter</b>	Specifies the additional filtering criteria	tbd	No

### Get asset aspect definitions – positive Response

```
{  
    "_embedded": {  
        "aspects": [  
            {  
                "name": "Simulation",  
                "holderAssetId": "37b7cf99d221495fb631684ee1358b1d",  
                "aspectTypeId": "academy2.opc_demo2",  
                "aspectTypeName": "opc_demo2",  
                "category": "dynamic",  
                "description": "Simulation Values",  
                "variables": [  
                    {  
                        "name": "sin1",  
                        "dataType": "DOUBLE",  
                        "unit": "one",  
                        "searchable": false,  
                        "length": null,  
                        "qualityCode": false  
                    } ]  
                },  
                <ADDITIONAL ASPECTS>  
            ]  
        },  
        <HAL INFORMATION>,  
        <PAGE INFORMATION>  
    }  
}
```

### Delete an asset - Request

**DELETE:** /api/assetmanagement/v3/assets/{id}

#### Parameters:

Parameter Name	Description	Example	Mandatory
id	Asset id of the asset you want to delete	0281D4001C544AC0B62B4CCF549AC0D0	Yes

Status Code 204 (No Content)

### Exercise: 030\_aspects

- Deploy and register the app
- Make it running

The screenshot shows the MindSphere Academy Asset Management Service interface. At the top, there's a navigation bar with 'MindSphere Academy', 'Training App', and 'powered by MindSphere'. A large watermark reading 'holaaaaa' is diagonally across the page. On the left, a sidebar has 'SIEMENS' at the top, followed by 'Objectives' and 'Assets'. The main area is titled 'All Assets' and contains a search bar with 'KarlsruheData' and a 'Search' button. Below the search bar, a card for an asset named 'TrainingBoxNanoKarlsruheData' is shown, with details like 'Asset-ID: 01c3636d75f242cb828af1a87e1a1860' and 'Location: Siemensallee 84 76187 Karlsruhe Germany'. A section titled 'Aspects for Asset: 01c3636d75f242cb828af1a87e1a...' lists 'Sensors' with an aspect type 'academy2.DemokitV2Sensors'. It shows two variables: 'Pressure' with unit 'hPa' and 'Temp' with unit 'C'.

### Exercise

- Use the Postman Collection to investigate this API
- Create your own asset under the hierarchy for this training
- Map datapoints from the existing agent to your asset



# MindSphere API – Asset Management Service (Part III)

## Summary

How do we create and update assets and aspects in MindSphere 3.0?

**We can create and update asset types and aspect types with a put request**

&

**we can create assets with a post call and update them with a put request**



# MindSphere IoT Time Series Aggregates Service

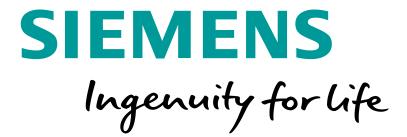
**SIEMENS**  
Ingenuity for life

# Aggregate Services

## Learning Goals

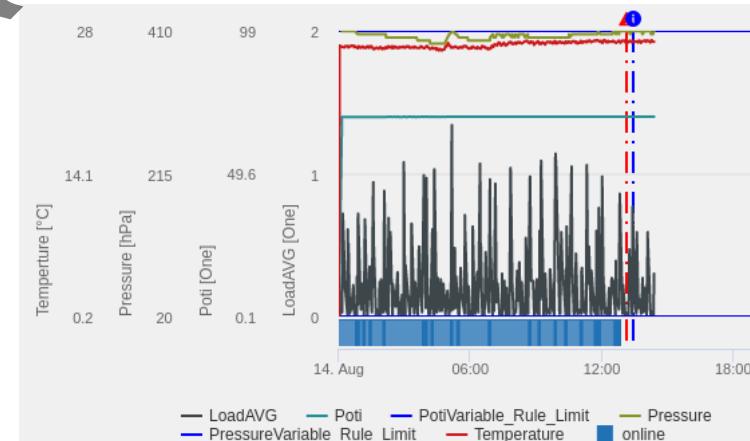
How can we fetch timeseries data efficiently for visualization from MindSphere?

- Use Aggregate Service



- Retrieving aggregated data
- Precalculated aggregates
- Aggregation according to various values e.g.: *min, max, first, last, count*

Retrieve aggregated timeseries data suitable for e.g., visualization



For running analyses, use timeseries raw data instead!

### Endpoints

Request Method	Description	End Point
GET	/api/iottsaggregates/v3/aggregates	Aggregated timeseries with an assortment summary of information

## Roles / Scopes

Role	Description
mdsp:core:iot.tsaUser	Granting access to time series aggregates.

### Aggregated Data

... is available in precalculated intervals

2 minute    1 hour    1 day

... supports the following intervals

1-120 seconds    1-60 minutes    1-24 hours    1+ days    1+ weeks    1+ months

... should be an exact multiple of a precalculated aggregation interval (for best performance)

... is wall clock aligned

... is created based on arrival of data and time logic

### Returned data

minimum value    maximum value    average    sum    count    first value    last value

### Aggregated Data

1 hour interval

5:00 – 10:00

60-minute interval

5:30 – 10:30

an interval duration of  
1 week must start and  
end on a Monday

An interval duration of 7  
days could start on any day  
of the week

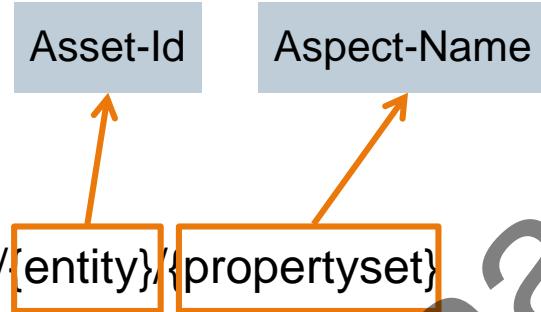
two-minute aggregated data is  
created within two minutes  
after the two-minute interval  
has finished

hourly data is created within  
eight minutes after the end of  
the hour

daily data is created within fifteen  
minutes after midnight in UTC time for  
this release

### Get aggregated Timeseries

**GET** /api/iottsaggregates/v3/aggregates/{entity}/{propertyset}



Parameter Name	Description	Example	Mandatory
from	Beginning of the time range to read	2018-01-31T00:00:00Z	Yes
to	End of the time range to read	2018-01-31T20:00:00Z	Yes
intervalValue	Interval duration for the aggregates in intervalUnits	1	Yes
intervalUnit	Interval duration unit for the aggregates	hour	Yes
select	Properties and fields to select	Temperature	No

select parameter can be used to select certain fields with `variableName.fieldName`

### Get aggregated Timeseries Response (Body)

```
[{ "Memory": {  
    "minvalue": 3236,  
    "maxvalue": 3554,  
    "mintime": "2018-01-31T02:50:00Z",  
    "maxtime": "2018-01-31T00:10:00Z",  
    "firstvalue": 3554,  
    "lastvalue": 3301,  
    "firsttime": "2018-01-31T00:10:00Z",  
    "lasttime": "2018-01-31T04:00:00Z",  
    "average": 3320.125,  
    "sum": 79683,  
    "countuncertain": 0,  
    "countbad": 0,  
    "countgood": 24  
},  
    "starttime": "2018-01-31T00:00:00Z",  
    "endtime": "2018-01-31T04:00:00Z"  
}]
```

## Exercise

- Use the Postman Collection to investigate this API

holaaaaaaaaaaaaaa



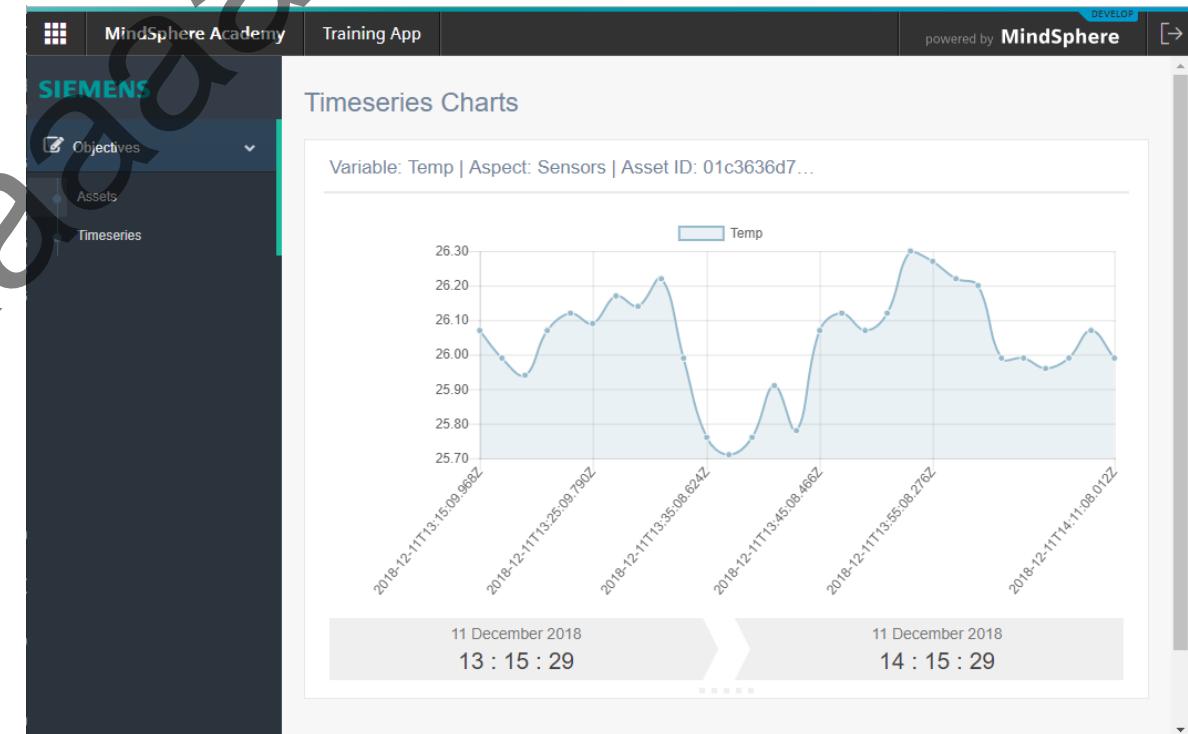
# MindSphere API

## Aggregate Service



### Exercise: 040\_aggregated\_timeseries

- Put the code snippet in the appropriate place
- Fill in the missing parts



# Aggregate Service

## Summary

How can we fetch timeseries data efficiently for visualization from MindSphere?

**With Aggregate Service we can reduce the amount of data points.**



# MindSphere IoT Time Series API

**SIEMENS**  
Ingenuity for life

# IoT Time Series API

## Learning Goals

**How can we search for raw  
data  
&  
how can we create or update  
data?**

- Search endpoint
- Result structure
- Create or update data
- Delete data

holaaaaaaaaaaaaaa



## Basic Endpoint

/api/iottimeseries/v3/timeseries

### Purpose:

- Retrieve raw data
- Filter on time range
- Filter specific aspect values

- Investigate on raw data
- Write your own analytics
- Export

*Don't mix with aggregated  
time series methods*

## Roles / Scopes

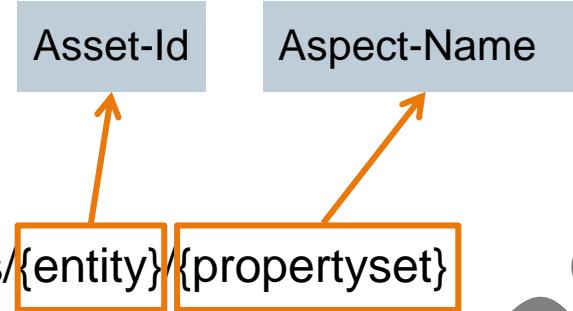
Role	Description
<b>mdsp:core:iot.timUser</b>	Granting read access to time series.
<b>mdsp:core:iot.timAdmin</b>	Granting read, write and delete access to time series.

### Endpoints

Request Method	Description	End Point
GET	/iottimeseries/v3/timeseries	Query time series data with a precision of 1 millisecond

### Get timeseries

**GET** /api/iottimeseries/v3/timeseries/{entity}/{propertyset}



Parameter Name	Description	Example	Mandatory
<b>from</b>	Beginning of the time range to read (exclusive)	2018-01-31T00:00:00Z	No
<b>to</b>	End of the time range to read (inclusive)	2018-01-31T20:00:00Z	No
<b>limit</b>	maximum number of entries to read	1	No
<b>select</b>	select fields to return	Temperature	No

### Get raw timeseries

Response (Body)

Returns maximum  
**2000 records** in a  
response

```
[  
  {  
    "_time": "2018-02-22T00:50:10.607Z",  
    "sin1": 25.815107,  
    "sin2": -44.914648427989135,  
  },  
  {  
    "_time": "2018-02-22T00:50:25.614Z",  
    "sin1": 30.61933,  
    "sin2": -44.454259707516634,  
  }]  
]
```

Paging is implemented as a header called "link" (see RFC 5988)

**link** →<<https://gateway.eu1.mindsphere.io/api/iottimeseries/v3/timeseries/01c3636d75f242cb828af1a87e1a1860/Sensors?from=2018-12-01T05:33:13.332Z&limit=2000&to=2018-12-10T23:50:00Z>>; rel="next"

### Endpoints

Request Method	Description	End Point
PUT	/api/iottimeseries/v3/timeseries	Write or update time series data for a single entity and propertyset.

### Create or update timeseries

**PUT** /api/iottimeseries/v3/timeseries/{entity}/{propertyset}

Parameter Name	Description	Example	Mandatory
entity	unique identifier of the entity	b75549b996014c60809902662df158c7	Yes
propertyset	name of the propertyset	simulation	Yes
body	timeseries data	see next slide	Yes

### Create timeseries

Request (Body)

```
[  
  {  
    "_time": "2018-02-22T00:50:10.607Z",  
    "sin1": 25.815107,  
    "sin2": -44.914648427989135,  
  },  
  {  
    "_time": "2018-02-22T00:50:25.614Z",  
    "sin1": 30.61933,  
    "sin2": -44.454259707516634,  
  }  
]
```

## Endpoints

Request Method	Description	End Point
<b>DELETE</b>	/api/iottimeseries/v3/timeseries	Delete time series data for a single entity and propertyset within a given time range

### Delete timeseries

**DELETE** /api/iottimeseries/v3/timeseries/{entity}/{propertyset}

Parameter Name	Description	Example	Mandatory
from	Beginning of the time range to read (exclusive)	2018-01-31T00:00:00Z	Yes
to	End of the time range to read (inclusive)	2018-01-31T20:00:00Z	Yes

Status Code 204 (No Content)

## Exercise

- Use the Postman Collection to investigate this API

holaaaaaaaaaaaa



# IoT Time Series API

## Summary

**SIEMENS**  
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How can we search for raw data?

**GET request on the endpoint**

How can we create or update data?

**DELETE or PUT request on the endpoint**

# MindSphere Event Management Service

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# MindSphere API – Event Management Service

## Learning Goals

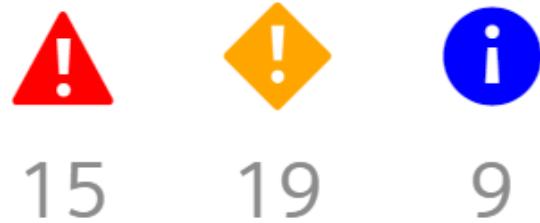
**How can we view and create events in MindSphere?**

- Event data structure
- Request end points
- Read and write data



# MindSphere API – Event Management Service

## Overview



**Representation of events that occur associated to assets**

*E.g. a measured characteristic of an equipment has reached a threshold indicating a failure*

### Tasks:

- Retrieve events
- Store events
- Modify events
- Understand event types

- Display Events in your app
- Acknowledge events in your app and change their status in MindSphere accordingly
- Create new events

# MindSphere API

## Event Management Service

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### Event type hierarch



## Event types

- are assigned to a custom event
- define a set of custom fields representing additional properties of the custom event
- custom fields have a data type and can be defined as **required** and **filterable**
- inheritance hierarchy of up to **4 levels**
- Scope: **global** or **local**
- **TTL: time to live** (after this number of days the event will be **automatically** deleted)

### Roles / Scopes

Role	Description
<b>mdsp:core:em.eventcreator</b>	Role granting access to create events (create, read and update) in eventmanagement system
<b>mdsp:core:em.eventmanager</b>	Role granting access to manage everything in eventmanagement system
<b>mdsp:core:em.eventviewer</b>	Role granting access to read events and eventTypes in eventmanagement system

### Standard event data structure

```
{  
  "id": "9f3795fb-dfa3-447b-936c-a63f716d2686",  
  "typeId": "b7f9a843-a530-4159-989e-20645e2b647d",  
  "correlationId": "85ba8d01-f831-4354-94d0-354759e91de5",  
  "timestamp": "2018-02-01T11:00:00Z",  
  "entityId": "b75549b996014c60809902662df158c7",  
  "etag": 0,  
  "_links": {  
    "self": {  
      "href": "<base-url>/api/eventmanagement/v3/events/9f3795fb-dfa3-447b-936c-a63f716d2686"  
    }  
  },  
  "severity": 30,  
  "code": "",  
  "acknowledged": false,  
  "description": "Memory high",  
  "source": "Manual"  
}
```

Internal ID, required for retrieving/updating a specific event

### Endpoints

Request Method	Endpoint	Description
GET	/api/eventmanagement/v3/events	Find events based on a request filter
GET	/api/eventmanagement/v3/events/{eventId}	Get a specific event
POST	/api/eventmanagement/v3/events	Create a new event
PUT	/api/eventmanagement/v3/events/{eventId}	Update an existing event

### Find Events

**GET /api/eventmanagement/v3/events**

Parameter Name	Description	Example	Mandatory
<b>size</b>	Specifies the number of elements in a page. Default is 20	100	No
<b>page</b>	Specifies the requested page index. Default is 0	0	No
<b>filter</b>	Filter parameter	{"severity": 1}	No
<b>sort</b>	The order in which the elements are returned. Specify status, severity or timestamp for the field to sort by. Append ,asc or ,desc for sorting direction. Default is timestamp descending order	status,asc	No

## Find Events – Examples

### Filter by entityId ("Asset"):

```
GET /api/eventmanagement/v3/events?filter={"entityId": "b75549b996014c60809902662df158c7"}
```

### Filter by timestamp:

```
GET /api/eventmanagement/v3/events?  
filter={"timestamp": {"between": "[2018-01-31T00:00:00Z,2018-01-31T23:59:59Z]"}}
```

### Get all events:

```
GET /api/eventmanagement/v3/events
```

## Get an Event by ID

**GET /api/eventmanagement/v3/events/{eventId}**

Example:

GET /api/eventmanagement/v3/events/fa884d56-0570-4e0c-8c12-dbcc8e7c780c

## Create a new Event

**POST /api/eventmanagement/v3/events**

Example request (body):

```
{  
  "typeId": "com.siemens.mindsphere.eventmgmt.event.type.MindSphereStandardEvent",  
  "timestamp": "2018-01-31T11:00:00.000Z",  
  "entityId": "b75549b996014c60809902662df158c7",  
  "severity": 1,  
  "description": "Test event via API call",  
  "code": "TestCode01",  
  "acknowledged": false  
}
```

### Update an existing event

**PUT /api/eventmanagement/v3/events/{eventId}**

Example request (body):

```
{  
  "id": "60d73e4e-5aac-4098-bb87-2be0577f8a66",  
  "typeId": "com.siemens.mindsphere.eventmgmt.event.type.MindSphereStandardEvent",  
  "correlationId": "0ccd7c42c0114dde8ed199f9bef64fe6",  
  "timestamp": "2018-01-31T11:00:00Z",  
  "entityId": "b75549b996014c60809902662df158c7",  
  "severity": 1,  
  "code": "TestCode01",  
  "acknowledged": true,  
  "description": "Test event via API call"  
}
```

### Add historic data to an existing event

**POST** /api/eventmanagement/v3/events

Example request (body):

```
{  
  "typeId": "com.siemens.mindsphere.eventmgmt.event.type.MindSphereStandardEvent",  
  "correlationId": "0ccd7c42c0114dde8ed199f9bef64fe6",  
  "timestamp": "2018-01-31T11:00:00Z",  
  "entityId": "b75549b996014c60809902662df158c7",  
  "severity": 1,  
  "code": "TestCode01",  
  "acknowledged": false,  
  "description": "Test event via API call"  
}
```

Listing events will return only the **latest** of an event's history. But we can list the whole history of the event with **'history' query parameter set to true**.

The original event remains in the database and a new event is created with the same **entityId** and **correlationId** but a **different id**

## Endpoints for bulk create events

Request Method	Endpoint	Description
POST	/api/eventmanagement/v3/createEventsJobs	Create events (asynchronous)
GET	/api/eventmanagement/v3/createEventsJobs/{jobId}	Get information about a create job

### Create events

**POST /api/eventmanagement/v3/createEventsJobs**

Example request (body):

```
{  
  "events": [  
    {  
      "typeId": "com.siemens.mindsphere.eventmgmt.event.type.MindSphereStandardEvent",  
      "timestamp": "2018-07-06T11:01:00.000Z",  
      "entityId": "b43703b007924c2889adc9da9f818a5b",  
      "severity": 1,  
      "description": "TB Bulk event 1",  
      "code": "tbe1",  
      "acknowledged": false  
    },  
    [...]  
  ]  
}
```

Result:

```
{  
  "id": "566a320e-c762-42f0-86c4-6249b0eedc27",  
  "state": "ACCEPTED"  
}
```

## Create events (check status)

**GET /api/eventmanagement/v3/createEventsJobs/{jobId}**

Example response:

```
{  
  "id": "ce464d4f-59a7-4bb3-815b-9b70fe3931ac",  
  "state": "FINISHED",  
  "details": {  
    "resultDescription": [  
      [...]  
    ]  
  }  
}
```

## Endpoints for deleting events

Request Method	Endpoint	Description
POST	/api/eventmanagement/v3/deleteEventsJobs	Delete events (asynchronous)
GET	/api/eventmanagement/v3/deleteEventsJobs/{jobId}	Get a information about a delete job

### Delete events

**POST /api/eventmanagement/v3/deleteEventsJobs**

Example request (body):

```
{  
  "filter": {  
    "typeId": "com.siemens.mindsphere.eventmgmt.event.type.MindSphereStandardEvent",  
    "timestamp": {"between": "[2018-06-10T03:24:41.052Z,2018-06-22T23:59:59Z]"}  
  }  
}
```

Result:

```
{  
  "id": "566a320e-c762-42f0-86c4-6249b0eedc27",  
  "state": "ACCEPTED"  
}
```

## Delete events (check status)

**GET /api/eventmanagement/v3/deleteEventsJobs/{jobId}**

Example response:

```
{  
    "id": "566a320e-c762-42f0-86c4-6249b0eedc27",  
    "state": "FINISHED",  
    "details": {  
        "resultCode": "200",  
        "resultDescription": "18482 events deleted."  
    }  
}
```

### Endpoints for Event Types

Request Method	Endpoint	Description
GET	/api/eventmanagement/v3/eventTypes	Find events based on a request filter
GET	/api/eventmanagement/v3/eventTypes/{eventId}	Get a specific event type
POST	/api/eventmanagement/v3/eventTypes/	Create a new event type

### Find Event Types

**GET /api/eventmanagement/v3/eventTypes**

Parameter Name	Description	Example	Mandatory
<b>size</b>	Specifies the number of elements in a page. Default is 20	100	No
<b>page</b>	Specifies the requested page index. Default is 0	0	No
<b>filter</b>	Filter parameter: id, name, owner, scope	{"owner": "academy2"}	No
<b>sort</b>	Sorting field Append ,asc or ,desc for sorting direction. Default is name ascending order	id,asc	No

### Create a new event type

**POST** /api/eventmanagement/v3/eventTypes

Example request (body):

```
{ "name": "MindSphereAcademyTrainingEvent",
  "ttl": 7,
  "scope": "LOCAL",
  "parentId": "com.siemens.mindsphere.eventmgmt.event.type.BaseEvent",
  "fields": [
    {
      "name": "courseId",
      "filterable": true,
      "required": true,
      "updatable": true,
      "type": "STRING"
    }
  ]
}
```

### Restriction for event types

Field	Restriction
ttl	max. 1825 (5 years)
name of the event type	max. 64 characters
field name	max. 64 characters
number of fields	max. 100
inheritance depth	max. 4
filterable fields	max. 10

## Exercise

- Use the Postman Collection to investigate this API

holaaaaaaaaaaaa



# MindSphere API – Event Management Service

## Summary

How can we view and create events in MindSphere?

**Use Event Management Service for getting the state of the assets**



# MindSphere Express

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# Express

## Learning Goals

How to use Express to set up a simple REST API?

- REST Methods
- Query Parameters
- Middleware (e.g. for Authentication)



- Web application framework
- Thin layer upon Node.js for best performance
- Basic routing and static file delivery
- HTTP utility with middleware implementation to create robust APIs
- Most used framework for JavaScript web servers

holaaaaaaaaaaaaaa

# Express

## Support of REST methods

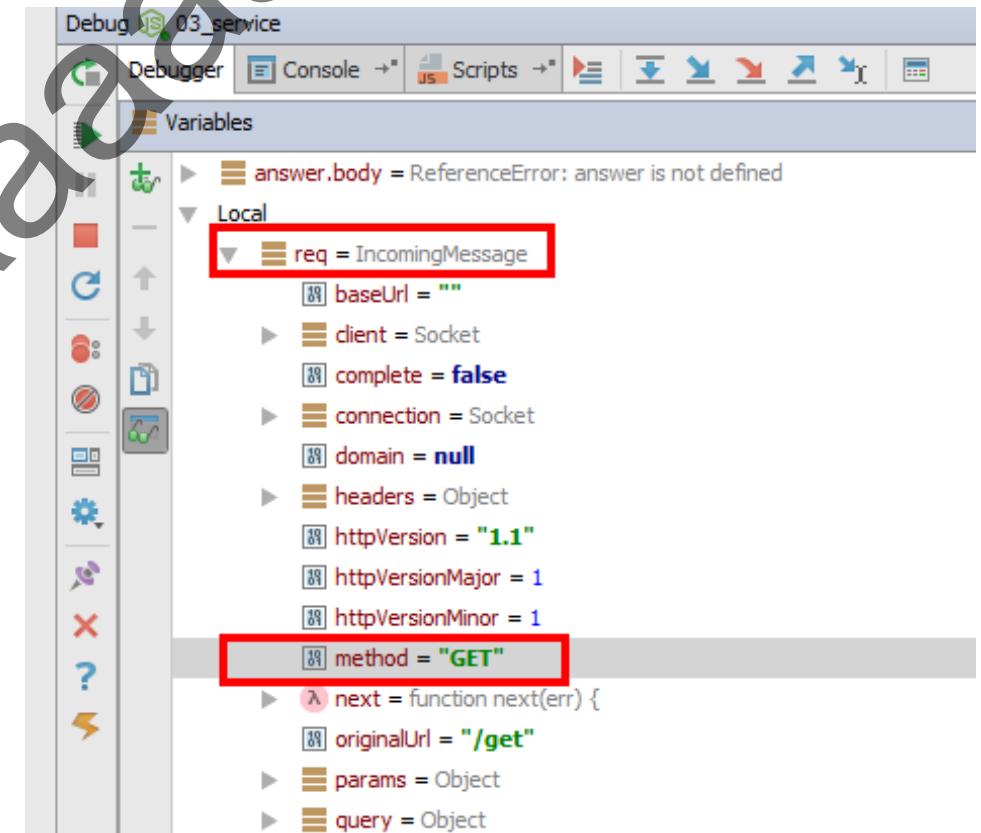
Detect the method of the incoming REST call easily by defining the endpoints

### POST Request

```
app.post('/', function (req, res) {  
  res.send('Got a POST request')  
})
```

### GET Request

```
app.get('/', function (req, res) {  
  res.send('Hello World!')  
})
```



# Express

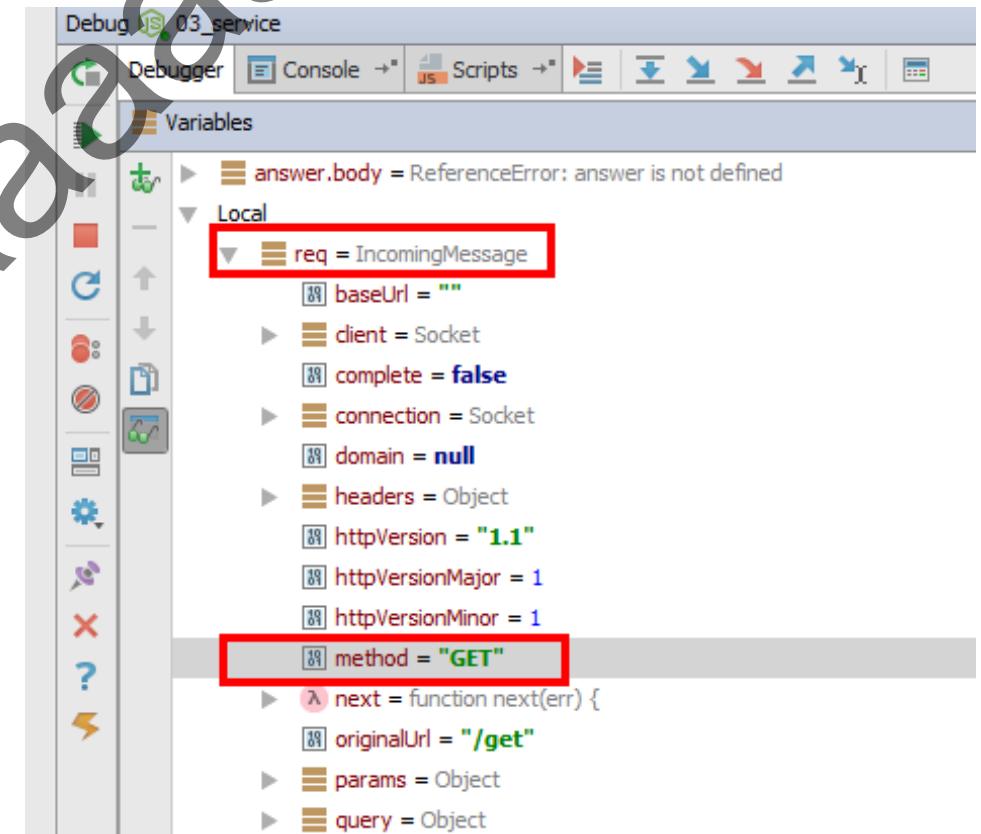
## req and res

```
app.get('/', function (req, res) {  
  res.send('Hello World!')  
})
```

**req** contains all information of the incoming request  
(e.g. parameters)

**res** can be used to send a response:

- res.end(<object>);
  - res.send(<object>);
  - res.json(<object>);
- sends as string
  - sends as string
  - sends as JSON



### Req.param

```
app.get("/get/:param1/:param2", function(req, res, next) {
```

- http://localhost:6004/get/**value1**/**value2**
- req.param.**param1** = **value1**
- req.param.**param2** = **value2**

### Req.query

```
app.get("/write", function(req, res, next) {
```

- http://localhost:6004/write?**name=peng**
- req.query.**name** = **peng**

More Information regarding express API and routing:

- <http://expressjs.com/en/4x/api.html>
- <http://expressjs.com/en/guide/routing.html#routing>

Supports static file hosting:

```
app.use(express.static('public'))
```

*This serves all files which are located in the folder „public“.*

```
app.use('/static', express.static('public'))
```

*This serves all files which are located in the folder „public“ with <your URL>/static.*

# Express

## Support of Auth Middleware



- Using **Express** middleware to distinguish between accessible and non accessible content
- The auth-middleware in this example validates the JWT token with the public-Key

```
// comment: /Status accessible without authentication
app.use('/Status', statusHandler);
// comment: middleware to check for authentication
app.use(authMiddleware.verifyReq);
// comment: /Config is only accessible if authentication via middleware was successful
app.use('/Config', configHandler);
```

# Express Summary

How to use Express to set up a simple REST API?

**Create endpoints for the different REST methods, fetch the query parameters of the incoming request, use the middleware feature to secure specific parts of your app**

holaaaaaaaaaaaaaa



# MindSphere Backing Services

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# Backing Services

## Learning Goals

How can we use Backing Services within MindSphere?

- Available Services within MindSphere
- Create Service Instance
- Service Bindings



## Cloud Foundry Marketplace

Get all available services:

> *cf marketplace*

service	plans
<code>elasticsearch5</code>	<code>elasticsearch-m*</code> , <code>elasticsearch-xs*</code>
<code>logme</code>	<code>logme-m*</code> , <code>logme-xs*</code>
<code>mongodb32</code>	<code>mongodb-m*</code> , <code>mongodb-xs*</code>
<code>mongodb34</code>	<code>mongodb-m*</code> , <code>mongodb-xs*</code>
<code>postgresql10</code>	<code>postgresql-xs*</code> , <code>postgresql-m*</code>
<code>postgresql194</code>	<code>postgresql-m*</code> , <code>postgresql-xs*</code>
<code>rabbitmq36</code>	<code>rabbitmq-m*</code> , <code>rabbitmq-xs*</code>
<code>redis32</code>	<code>redis-m*</code> , <code>redis-xs*</code>
<code>redis40</code>	<code>redis-xs*</code> , <code>redis-m*</code>

## Backing Services

### MongoDB

#### MongoDB

Detailed Serviceplan Info:

```
> cf marketplace -s mongodb32  
> cf marketplace -s mongodb34
```

MongoDB 3.2 & 3.4service

**NO-SQL** Database:

- No table- relations
- Easy to use with JSON documents
- Mongo -> use MyMongoDb -> db.mycollection.find()
- Fields can be added or removed, there is no object-relation



<https://www.anynines.com/>

## Backing Services

### PostgreSQL

#### PostgreSQL

Detailed Serviceplan Info:

```
> cf marketplace -s postgresql194  
> cf marketplace -s postgresql110
```

PostgreSQL 9.4 & 10.x service

**SQL** Database:

- Related Database
- For applications where data-relations are helpful (double-entry bookkeeping system)



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## Backing Services

### RabbitMQ

#### RabbitMQ

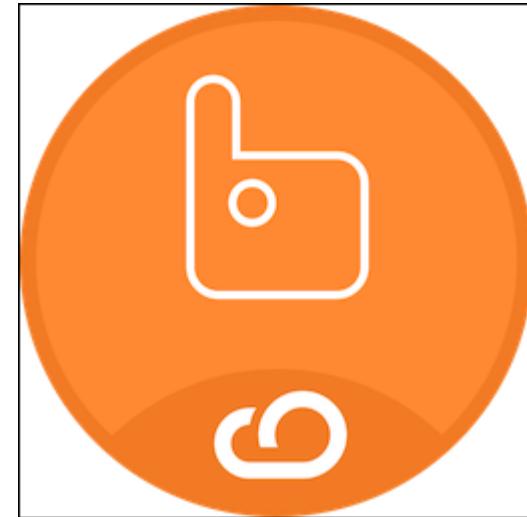
Detailed Serviceplan Info:

```
> cf marketplace -s rabbitmq36
```

RabbitMQ 3.6 service

#### Message Broker:

- Exchanging messages between services
- Create distribution system for worker threads
- Multiple sender / receiver possible
- Complex request and reply patterns



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## Backing Services

### Redis

#### Redis

Detailed Serviceplan Info:

```
> cf marketplace -s redis32  
> cf marketplace -s redis40
```

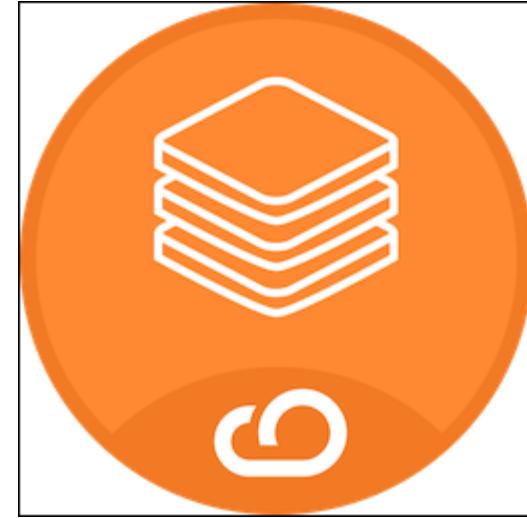
Redis 3.2 & 4.0 service

In-memory DB:

- Used as Database
- Cache
- Message Broker

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## Backing Services

logme

logme

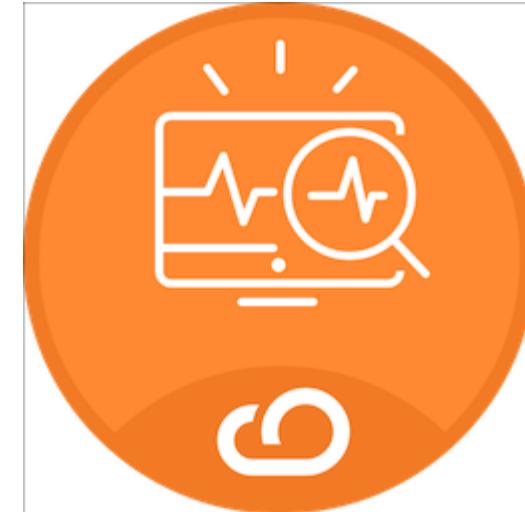
Detailed Serviceplan Info:

> *cf marketplace -s logme*

Dedicated ELK stacks to monitor applications and service instances

### Elastic stack

- Elasticsearch
- Logstash
- Kibana



## Backing Services

### Elasticsearch

#### Elasticsearch

Detailed Serviceplan Info:

```
> cf marketplace -s elasticsearch5
```

Elasticsearch 5.x service

#### Elasticsearch

- Distributed search engine
- RESTful API
- Analytics engine

holaaaaaaaaaaaaaa



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# MindSphere 3.0

## Upgrades for MindAccess Plans – Backing Services

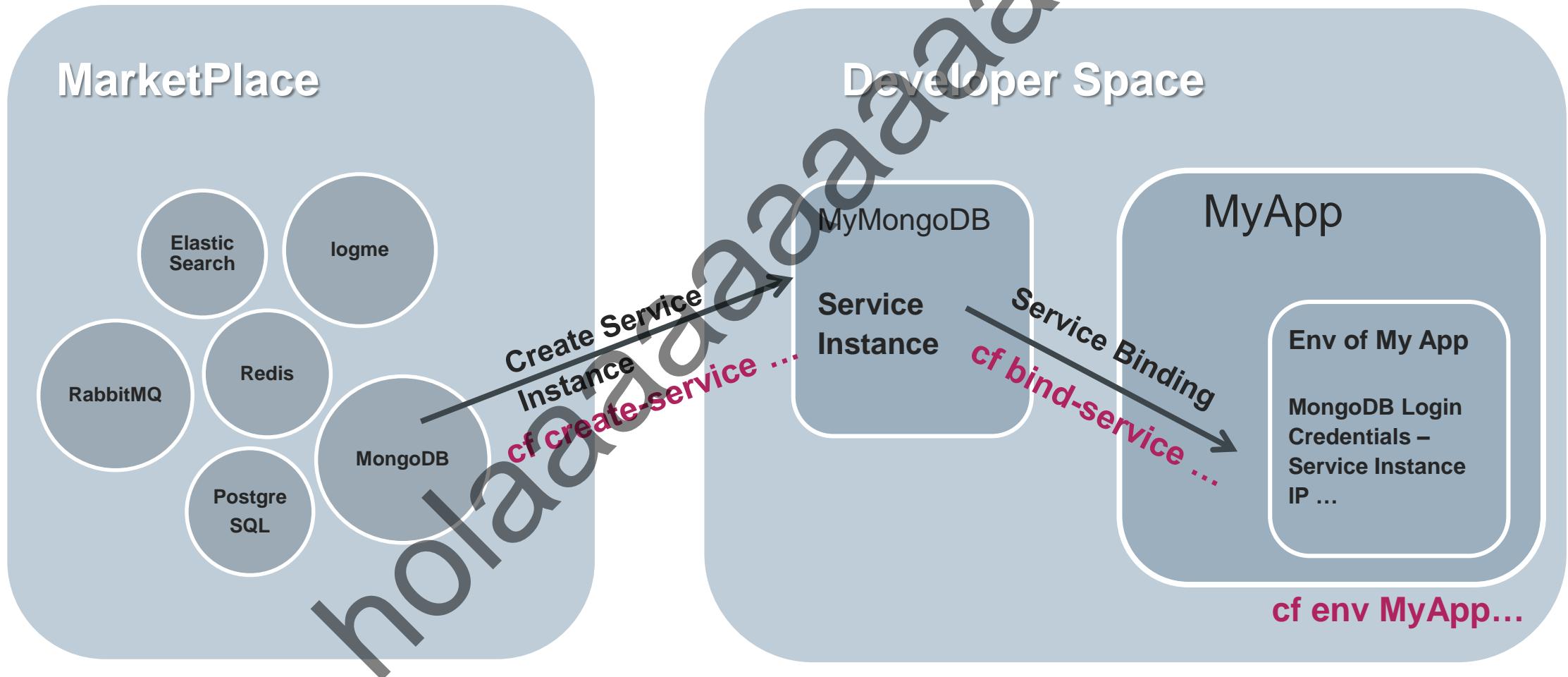
**Backing Services** comprise the following service types: PostgreSQL, Redis, RabbitMQ, MongoDB, ElasticSearch, LogMe and others<sup>1</sup>. There are 2 Upgrade packages available in 2 different plan sizes, XS and M.

		Highly Available	Redundancy Instances	vCPU	RAM	Disk
Backing Services XS	ElasticSearch	No	1	1	2 GB	4 GB
	LogMe	No	1	1	2 GB	4 GB
	MongoDB	No	1	1	0,5 GB	3 GB
	PostgreSQL	No	1	1	0,5 GB	3 GB
	RabbitMQ	No	1	1	0,5 GB	3 GB
	Redis	No	1	1	0,5 GB	3 GB
Backing Services M	ElasticSearch	Yes	3	2	4 GB	50 GB
	LogMe	Yes	3	2	4 GB	50 GB
	MongoDB	Yes	3	2	4 GB	50 GB
	PostgreSQL	Yes	3	2	4 GB	50 GB
	RabbitMQ	Yes	3	2	4 GB	6 GB
	Redis	Yes	3	2	4 GB	50 GB

1) Please see MindAccess DevOps Product Sheet and corresponding Supplemental Terms

# Backing Services

## Instances and Service Binding



# Backing Services

## Instances and Service Binding



```
System-Provided:  
{  
  "VCAP_SERVICES": {  
    "mongodb34": [  
      {  
        "binding_name": null,  
        "credentials": {  
          "default_database": "mod81ed27",  
          "dns_servers": [  
            "172.16.30.15"  
          ],  
          "hosts": [  
            "mod81ed27-mongodb-0.node.dc1.a9ssvc:27017"  
          ],  
          "password": "REDACTED2697171cbc8ac82734fa23c",  
          "uri": "mongodb://a9s-brk-usr-2a7e893b6b45425d6d78ec2fcdf4691b6329ee68:REDACTED2697171  
cbc8ac82734fa23c@mod81ed27-mongodb-0.node.dc1.a9ssvc:27017/mod81ed27",  
          "username": "a9s-brk-usr-2a7e893b6b45425d6d78ec2fcdf4691b6329ee68"  
        },  
        "instance_name": "mongo",  
        "label": "mongodb34",  
        "name": "mongo",  
        "plan": "mongodb-xs",  
      }  
    ]  
  }  
}
```

# Backing Services



## Step-by-Step

Get all available services

```
> cf marketplace
```

Create service instance

```
> cf create-service mongodb34 mongodb-xs mymongodb
```

Bind service to an app

```
> cf bind-service mywebapp mymongodb
```

<https://www.anynines.com/>

### Exercise: 130\_mongodb

- Push the app and try to write and read data from a mongoDB

holaaaaaaaaaaaaaa



# Backing Services Summary

How can we use Backing Services within MindSphere?

Create a Services Instance  
and do a Service Binding  
against your app



holaaaaaaaaaaaaaa

# MindSphere Background processes

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# Background processes

## Learning Goals

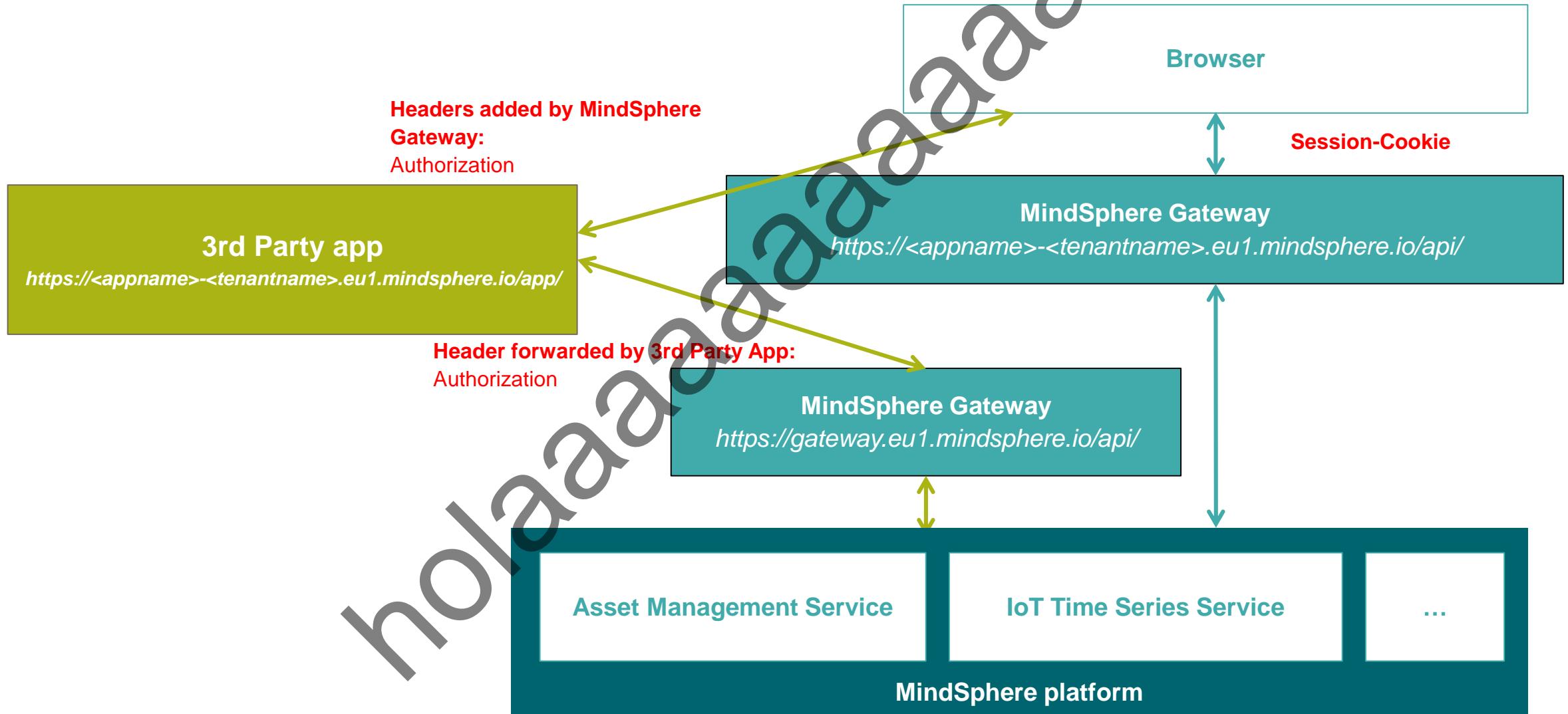
**How can a backend App get access to the API without being called by a Browser & why is this an important topic?**

- Get ClientID
- Get ClientSecret
- Fetch JWT Token



# MindSphere - Authentication & Authorization Workflow

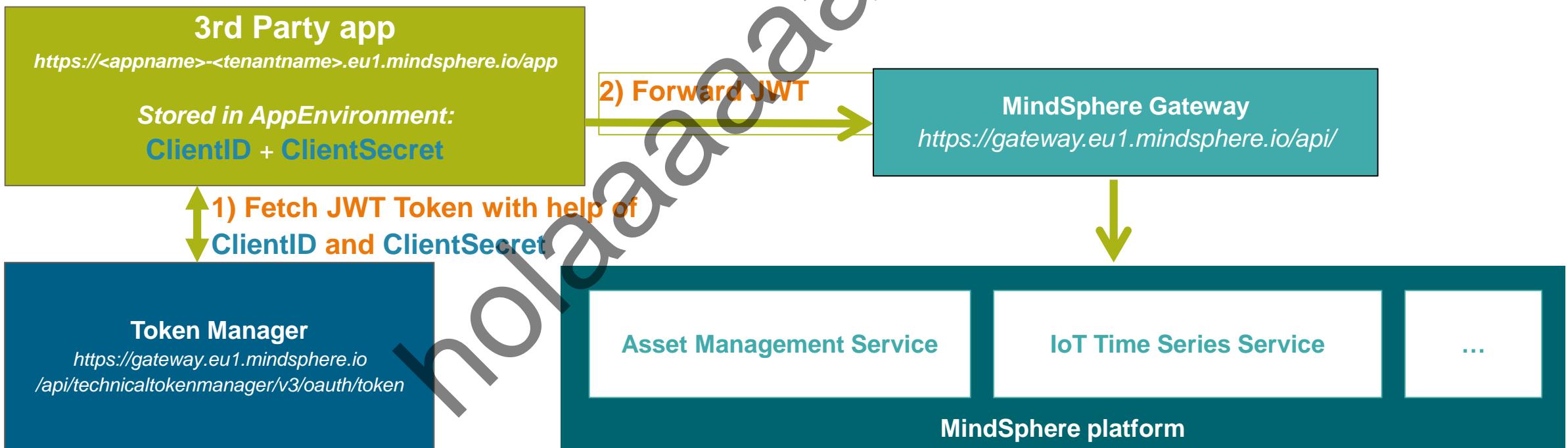
**SIEMENS**  
Ingenuity for life



## Background processes

### Background process without Browser Call

App is running independently without any Browser Call



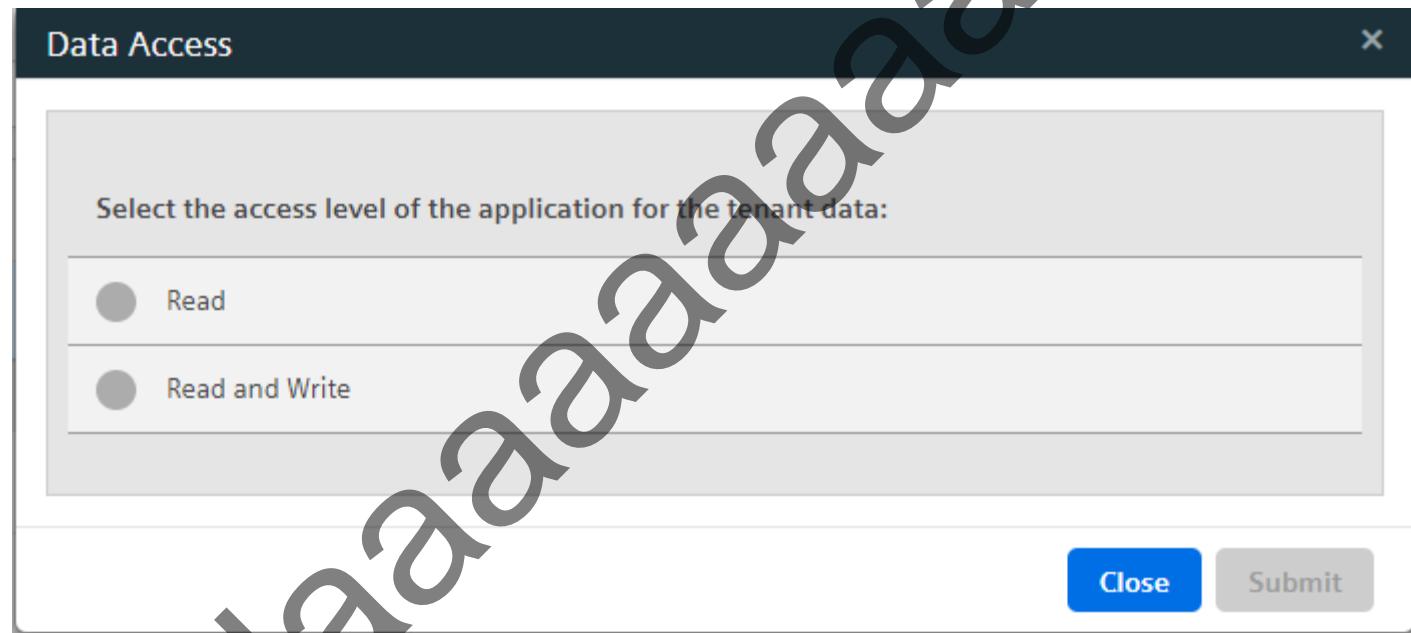
# Background processes

Where do I get my Service credentials?

The screenshot shows the MindSphere Academy Developer Cockpit interface. The top navigation bar includes 'MindSphere Academy', 'Developer Cockpit', 'powered by MindSphere', and a user icon. The main menu has tabs for 'Dashboard', 'Promoted Apps', and 'Authorization Management', with 'Authorization Management' being the active tab. On the left, a sidebar lists 'App Roles', 'App Credentials' (which is highlighted in yellow), and 'External App 1'. The main content area displays 'External App 1' with version '1.0'. A large warning message box contains an exclamation mark icon and the text 'No access has been issued'. Below this, a note says: 'Use the Token Manager API to grant your application access to data of other tenants. This is relevant if an application needs to access data of a different tenant, e.g. to perform frequent data processing without any user interaction.' A blue button labeled 'Issue access' with a key icon is at the bottom of the message box.

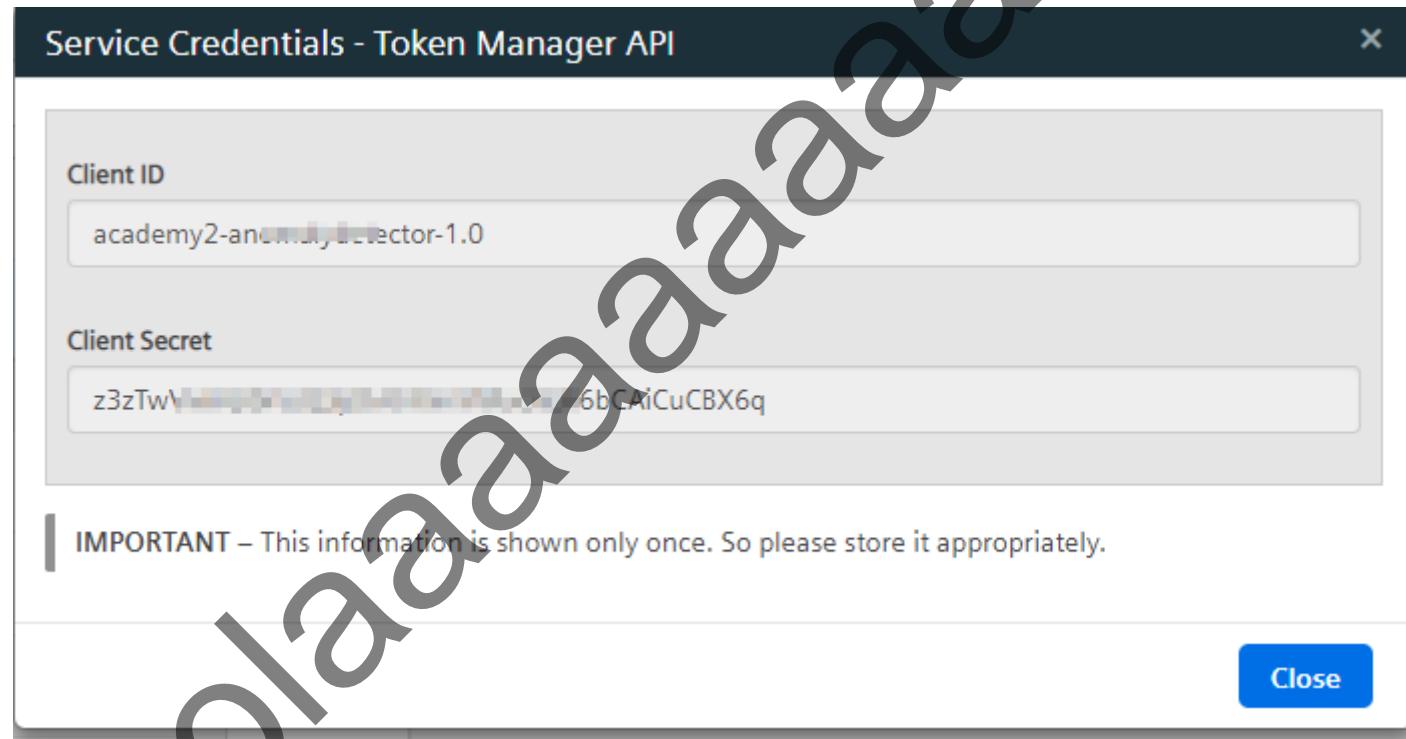
# Background processes

## Service credentials



# Background processes

## Service credentials



# Background processes

## Service credentials

The screenshot shows the MindSphere Academy Authorization Management interface. The top navigation bar includes 'MindSphere Academy', 'Developer Cockpit', 'powered by MindSphere', and a user icon. The 'Authorization Management' tab is active, highlighted in yellow. On the left, a sidebar lists 'App Roles' and 'App Credentials'. The 'App Credentials' section is selected and shows a list of credentials for the 'Academy Background App'. One credential is selected, displaying its details: 'Academy Background App' (version 1.0), 'Access Level' (Read), 'Created By' (user icon and email address), 'Created At' (Mon, Feb 11, 2019 04:55 PM), and 'Modified At' (Mon, Feb 11, 2019 04:55 PM). A 'Revoke access' button is also visible.

## Background processes

Store ClientID and ClientSecret to App Env

Store the ClientID and the ClientSecret into the Application Environment Variables

### 3rd Party app

<https://<app-url>.eu1.mindsphere.io/app>

*Stored in AppEnvironment:*

**ClientID + ClientSecret**

```
applications:  
  - name: techuser  
    buildpack: nodejs_buildpack  
    memory: 50MB  
    disk_quota: 250MB  
    command: node app.js  
    env:  
      "MDSP_KEY_STORE_CLIENT_ID": "app-demo1-1.0"  
      "MDSP_KEY_STORE_CLIENT_SECRET": "fgsdfgsdgsdfgsdgsdsdfgb3099"
```

manifest.yml of your App

### Get a JWT

**POST** /api/technicaltokenmanager/v3/oauth/token

Parameter Name	Description	Mandatory
X-SPACE-AUTH-KEY	This a header field. "Basic " + Base64 encoded string: "clientId:clientSecret" Like "Basic YWNhZGVteLjA6Y0ljUkMT3Rk1XaUJkNTZXdQ=="	Yes
Body	{ "appName": "testapplication", "appVersion": "1.0.0", "hostTenant": "testhosttenant1", "userTenant": "testusertenant1" }	Yes

## Background processes

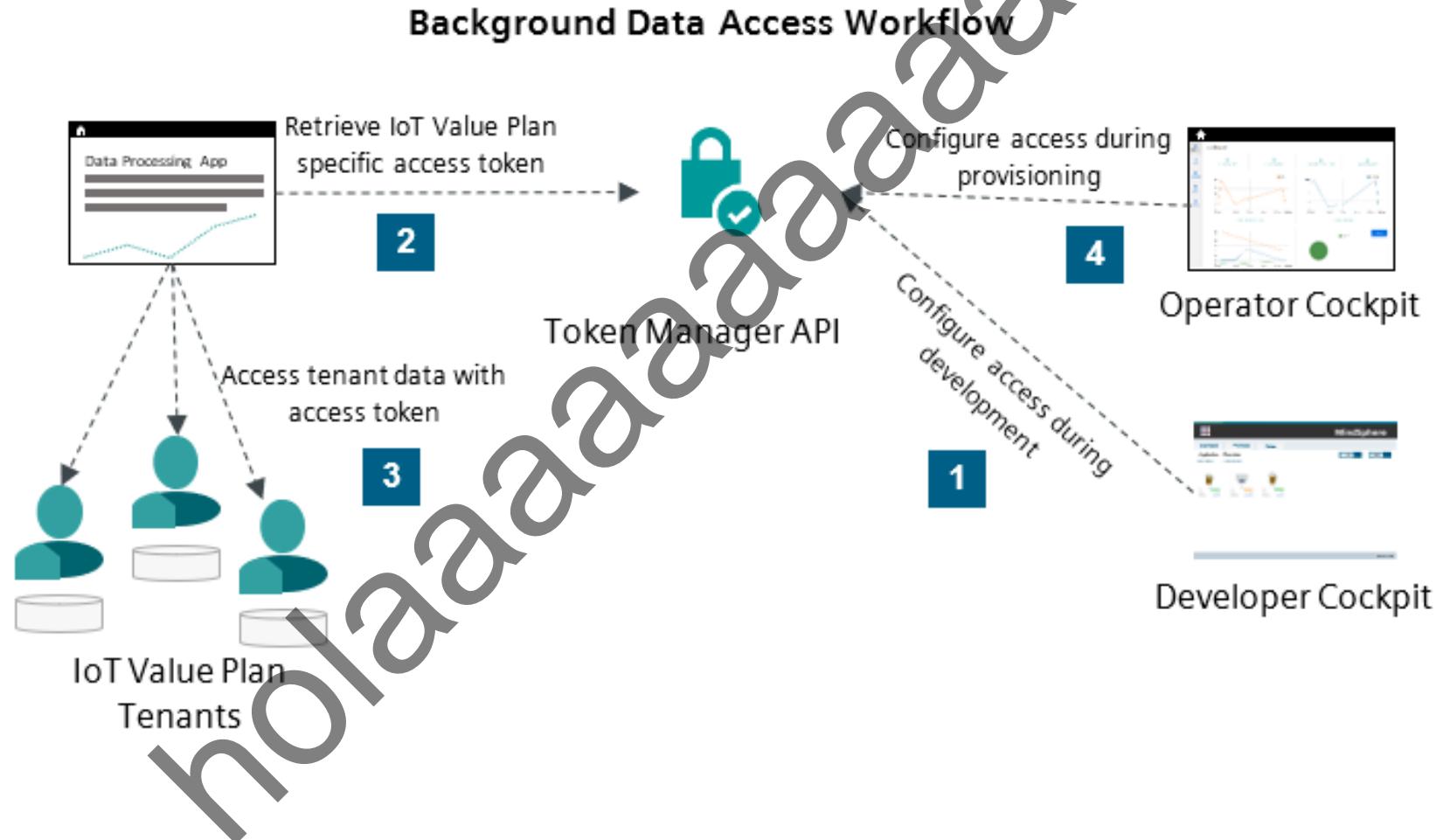
### Fetch JWT with help of ClientID and ClientSecret

Response of this call

```
{  
    "access_token":  
        "eyJhbGciOiJSUzI1NiIsImtpZCI6ImtleS1pZC0xIiwidHlwIjoiSldUIh0.eyJqdGkiOiI4YTZjm2Y5ODM0NGE0MjhjOTYwNTlkNDViZTM2MjdjOCIsInN1YiI6ImEwNTgyNjA0LTJlZmEtNDEzM040DcwLWI5NzI3ZTA4ZWI0OCIsImF1dGhvcml0aWVzIjpbInVhYS5ub25lI10sInNjb3BlIjpbInVhYS5ub25lI10sImNsawVudF9pZCI6ImEwNTgyNjA0LTJlZmEtNDEzM040DcwLWI5NzI3ZTA4ZWI0OCIsImNpZCI6ImEwNTgyNjA0LTJlZmEtNDEzM040DcwLWI5NzI3ZTA4ZWI0OCIsImF6cCI6ImEwNTgyNjA0LTJlZmEtNDEzM040DcwLWI5NzI3ZTA4ZWI0OCIsImdyYW50X3R5cGUIoIjbg1lbnRfY3J1ZGVudGlhbHMiLCJyZXZfc2lnIjoiYjJhNTY1ZmEiLCJpYXQiOjE1MDQ3NDM5NjEsImV4cCI6MTUwNdc0NzU2MSviaXNzIjoiaHR0cHM6Ly9zYWctZGVsMi4zcmRwlhbWRldi5taW5kc3BoZXJlLmlvL29hdXR0L3Rva2VuIwiemlkIjoic2FnLWR1bDIiLCJhdWQiolsiYTA1ODI2MDQtMmVmYS00MTMyLTg4NzAtYjk3Mjd1MDh1YjQ4I119.F8P6JYK6pIYknjuN-2H8jOrIEMuRF41XgEmvDVpQH71BnRqxoS2sOpJ7cVr5Suc-7P-  
5gvLC19bDo0VaC4sgkGfkTKnZKevL9TaKQalr8C1TkzbYIN7WIHe_wDGesyPMKm51tm6NpJ1XwXNIMdzfFK65_zliop201UOOQTMwozp  
zQP2S-HhjDf4VDOql1V5e_wmP_5ug7TDYqAmb9VqXI3BNELtVi-iA3i5PrJG47-pmmzsHjTIpd8MUJLeG-17tYW18MdwRn-  
jE9VOazVtSKvbvaTvEBinDaku1DsOGipf5Wi_kZNX1Hdahhv1PNt.84muHkSJGiF5OfW9mPHvV1a",  
    "token_type": "bearer",  
    "expires_in": 3599,  
    "scope": "mdsp:core:Default3rdPartyTechUser",  
    "jti": "8a6c3f98344a428c96059d45be3627c8",  
    "timestamp": 1550072054141  
}
```

**Example Response. Forward the JWT as a Authorization Header with the API Request**

# Background processes



# Background processes



## Exercise: 160\_technicalUser

- Create app
- Create token
- Check logfiles



```
2017-10-13T15:24:57.32+0200 [RTR/0] OUT
2017-10-13T15:24:57.52+0200 [RTR/0] OUT mybackendapp-tb-sag-del2.appsdev.mindsphere.io - [2017-10-13T13:24:57.519+0000] "GET /write12 HTTP/1.1" 404
146 "-" "Mozilla/5.0 (Windows NT 10.0; Win64; x64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/61.0.3163.100 Safari/537.36" "192.168.0.126:54312" "10
.9.38:61846" x_forwarded_for:"213.70.98.21, 192.168.0.129, 155.56.80.250" x_forwarded_proto:"https" vcap_request_id:"fed93c6b-ae14-4b2e-55ff-1cf58bb031
" response_time:0.002799308 app_id:"61bcda05-e6c2-415c-8e99-24a8f5f9b092" app_index:"0" x_b3_traceid:"3a45d1d9a8952c78" x_b3_spanid:"3a45d1d9a8952c78"
b3_parentspanid:"-"`
2017-10-13T15:24:57.52+0200 [RTR/0] OUT
2017-10-13T15:24:57.68+0200 [RTR/0] OUT mybackendapp-tb-sag-del2.appsdev.mindsphere.io - [2017-10-13T13:24:57.678+0000] "GET /write12 HTTP/1.1" 404
146 "-" "Mozilla/5.0 (Windows NT 10.0; Win64; x64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/61.0.3163.100 Safari/537.36" "192.168.0.126:47350" "10
.9.38:61846" x_forwarded_for:"213.70.98.21, 192.168.0.129, 155.56.80.250" x_forwarded_proto:"https" vcap_request_id:"6ba970c9-6d24-4f86-5cca-ef13010c10
" response_time:0.002033824 app_id:"61bcda05-e6c2-415c-8e99-24a8f5f9b092" app_index:"0" x_b3_traceid:"a93cbc0204d51dc1" x_b3_spanid:"a93cbc0204d51dc1"
b3_parentspanid:"-"`
2017-10-13T15:24:57.68+0200 [RTR/0] OUT
2017-10-13T16:19:24.82+0200 [APP/PROC/WEB/0] OUT Assets successfully fetched
2017-10-13T16:19:24.82+0200 [RTR/0] OUT mybackendapp-tb-sag-del2.appsdev.mindsphere.io - [2017-10-13T14:19:24.707+0000] "GET /assets HTTP/1.1" 200 0
2857 "-" "Mozilla/5.0 (Windows NT 10.0; Win64; x64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/61.0.3163.100 Safari/537.36" "192.168.0.129:50752" "10
.9.38:61846" x_forwarded_for:"213.70.98.21, 192.168.0.126, 155.56.80.250" x_forwarded_proto:"https" vcap_request_id:"ff5f711f-825a-4c7b-7ea9-4620be9c1c
" response_time:0.116217062 app_id:"61bcda05-e6c2-415c-8e99-24a8f5f9b092" app_index:"0" x_b3_traceid:"76d101ab824c292c" x_b3_spanid:"76d101ab824c292c"
b3_parentspanid:"-"`
2017-10-13T16:19:24.82+0200 [RTR/0] OUT
2017-10-13T16:19:43.96+0200 [APP/PROC/WEB/0] OUT Assets successfully fetched
2017-10-13T16:19:43.98+0200 [APP/PROC/WEB/0] OUT database connected
2017-10-13T16:19:44.00+0200 [RTR/1] OUT mybackendapp-tb-sag-del2.appsdev.mindsphere.io - [2017-10-13T14:19:43.871+0000] "GET /assets?filter=Asset&pr
etty HTTP/1.1" 200 0 490 "-" "Mozilla/5.0 (Windows NT 10.0; Win64; x64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/61.0.3163.100 Safari/537.36" "192.1
.0.129:47146" "10.1.9.38:61846" x_forwarded_for:"213.70.98.21, 192.168.0.126, 155.56.80.250" x_forwarded_proto:"https" vcap_request_id:"11c63d13-2f9a-4
f-5990-ad868d88feba" response_time:0.132341021 app_id:"61bcda05-e6c2-415c-8e99-24a8f5f9b092" app_index:"0" x_b3_traceid:"36b411de9f676a6e" x_b3_spanid:
6b411de9f676a6e" x_b3_parentspanid:"-"`
2017-10-13T16:19:44.00+0200 [RTR/1] OUT
```

## Background processes

3rd Party App view without Browser Call



## Other („old“) way

Disclaimer:

Only possible on developer tenants

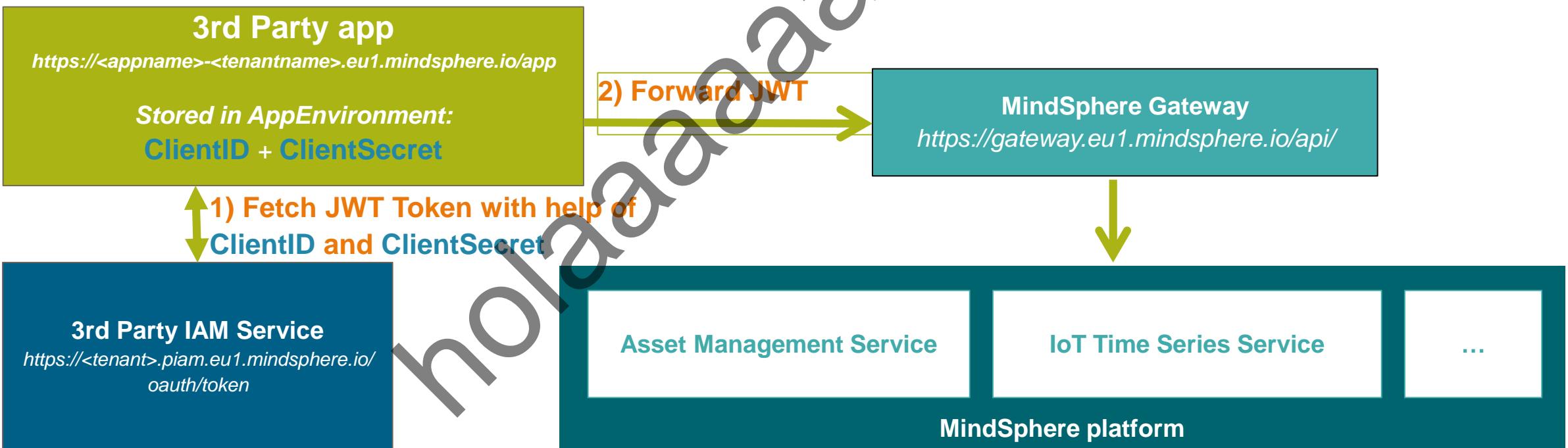
No way to connect to data in IoT value plans

holaaaaaaaaaaaaaa

## Background processes

### 3rd Party App view without Browser Call

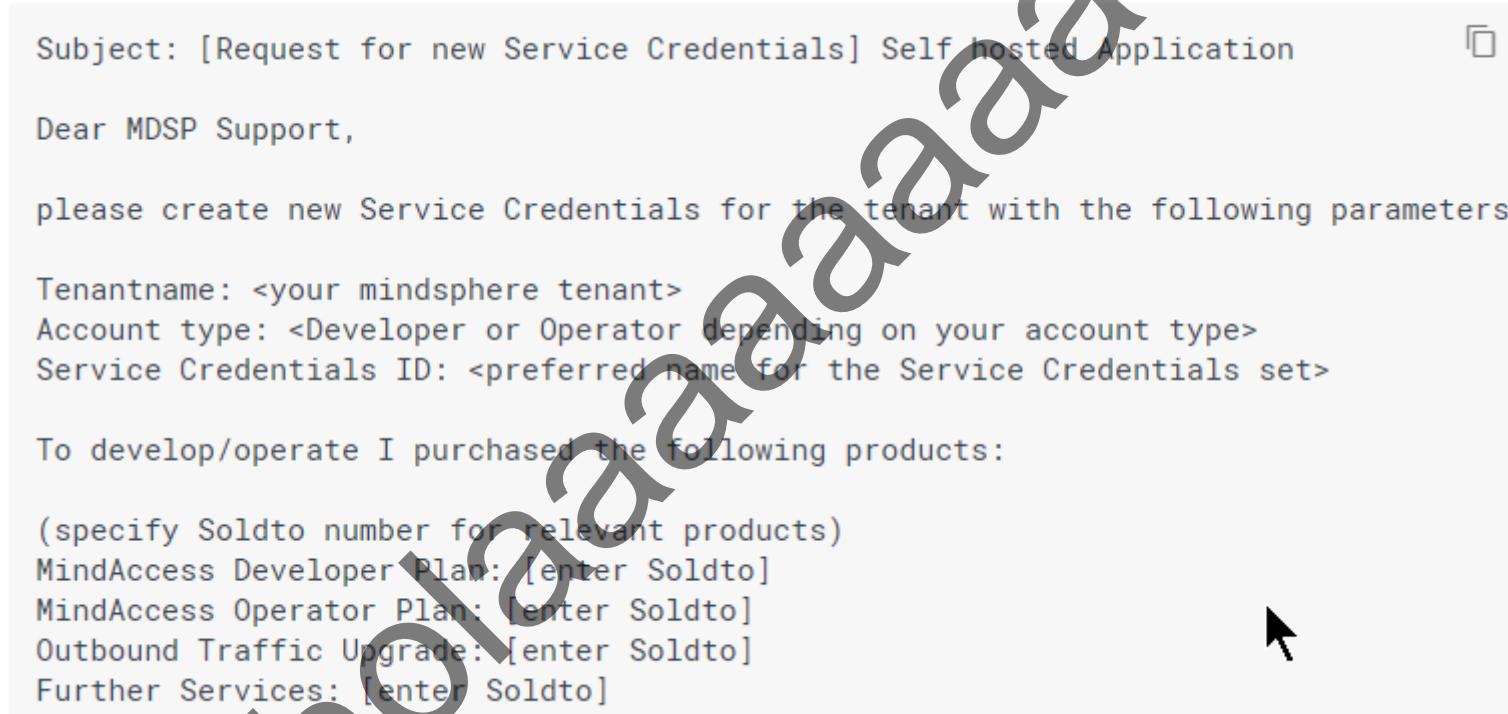
App is running independently without any Browser Call



# Background processes

## Service credentials

In order to create *Service Credentials*, you have to generate a service request via GTAC with following content:



## Background processes

### Store ClientID and ClientSecret to App Env

Store the ClientID and the ClientSecret and (optional) the 3rd Party IAM into the Application Environment Variables

#### 3rd Party app

<https://<app-url>.eu1.mindsphere.io/app>

*Stored in AppEnvironment:*

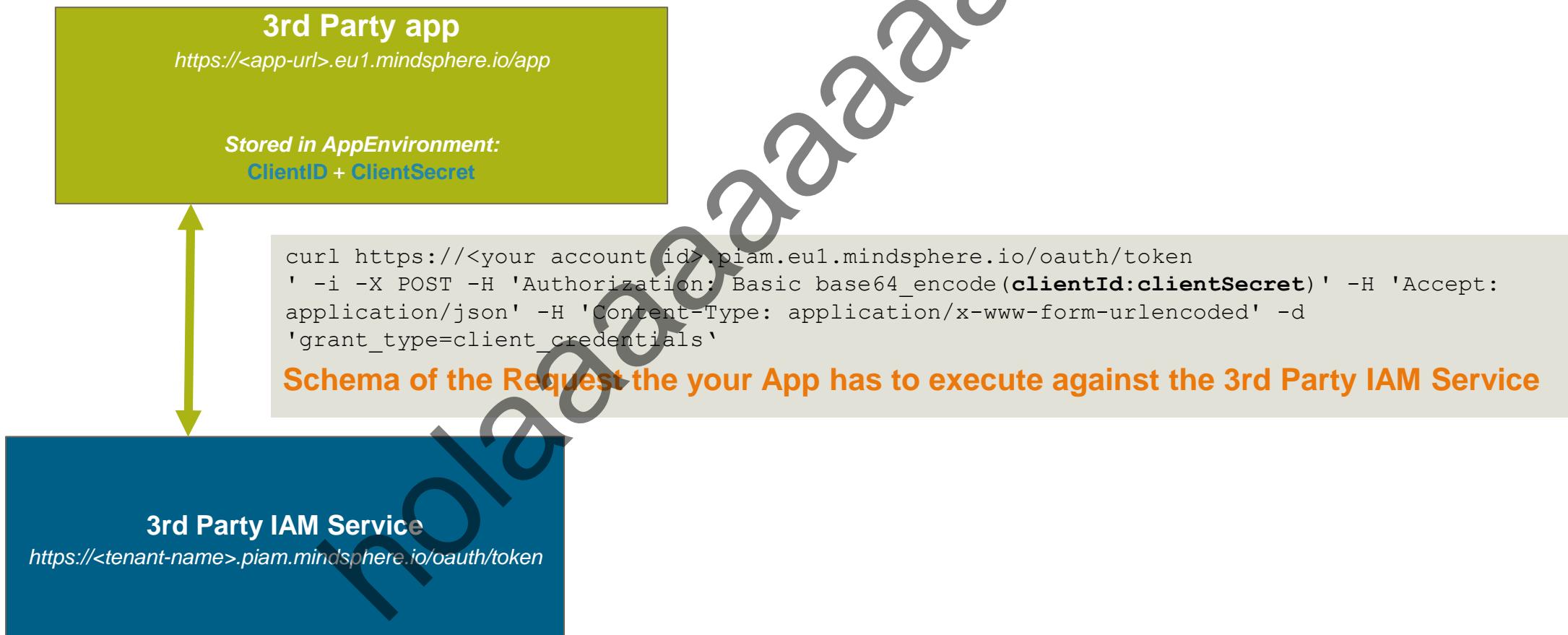
**ClientID + ClientSecret + (optional) IAM URL**

```
applications:  
  - name: techuser  
    buildpack: nodejs_buildpack  
    memory: 50MB  
    disk_quota: 250MB  
    command: node app.js  
env:  
  CONFIG: '{  
    "clientSecret": "tfE3RJzR3jdAxH3mvJPRbDPuUvW=",  
    "clientId": "sb-na-cba9d0a7-ab23-4fc8-95f4-673a024b3099",  
    "securityServiceUrl": "https://<tenant-name>.piam.eu1.mindsphere.io/oauth/token?grant_type=client_credentials"  
  }'
```

## Background processes

### Fetch JWT with help of ClientID and ClientSecret

Your App should execute this fetch JWT Job and take the JWT out the response and forward this JWT as a Authorization Header to get access to the API



## Background processes

### Fetch JWT with help of ClientID and ClientSecret

Response of this call

```
{  
    "access_token":  
        "eyJhbGciOiJSUzI1NiIsImtpZCI6ImtleS1pZC0xIiwidHlwIjoiSldUIh0.eyJqdGkiOiI4YTZjm2Y5ODM0NGE0MjhjO  
        TYwNTlkNDViZTM2MjdjOCIsInN1YiI6ImEwNTgyNjA0LTJlZmEtNDEzMj04ODcwLWI5NzI3ZTA4ZWI0OCIsImF1dGhvcmI  
        OaWVzIjpbInVhYS5ub25lI10sInNjb3B1IjpbInVhYS5ub25lI10sImNsawVudF9pZCI6ImEwNTgyNjA0LTJlZmEtNDEzM  
        i04ODcwLWI5NzI3ZTA4ZWI0OCIsImNpZCI6ImEwNTgyNjA0LTJlZmEtNDEzMj04ODcwLWI5NzI3ZTA4ZWI0OCIsImF6cCI  
        6ImEwNTgyNjA0LTJlZmEtNDEzMj04ODcwLWI5NzI3ZTA4ZWI0OCIsImdyYW50X3R5cGUIoIjbg11bnRfY3J1ZGVudG1hb  
        HMiLCJyZXZfc2lnIjoiYjJhNTY1ZmEiLCJpYXQiOjE1MDQ3NDM5NjEsImV4cCI6MTUwNDc0NzU2MSviaXNzIjoiaHR0cHM  
        6Ly9zYWctZGVsMi4zcmRwLwlhbWRldi5taW5kc3BoZXJ1ImlvL29hdXRoL3Rva2VuIiwiemlkIjoic2FnLWRlbDIiLCJhd  
        WQiOlsiYTA1ODI2MDQtMmVmYS00MTMyLTg4NzAtYjk3Mjd1MDh1YjQ4Ii19.F8P6JYK6pIYknjuN-  
        2H8jOrIEMuRF41XgEmvDVpQH71BnRqxoS2sOpJ7cVr05SUc-7P-  
        5gvLC19bDo0VaC4sgkGfkTKnZKevL9TaKQalr8C1TkzbYIN7WIHe_wDGesyPMKm51tm6NpJ1XwXNIMdzFFK65_zliop201  
        UOOQTMwozpzQP2S-HhjDf4VDOql1V5e_wmP_5ug7TDYqAmb9VqXI3BNELtVi-iA3i5PrJG47-pmmzsHjTIpd8MUJLeG-  
        17tYW18MdwRn-jE9VQazVtSKybygIvEBinDqku1DsQGjPf5Wj_kZNXLhdahhpy1Pnt84muHkSJGjF50fW9mPHyV1g",  
    "token_type": "bearer",  
    "expires_in": 3599,  
    "scope": "uaa.none",  
    "jti": "8a6c3f98344a428c96059d45be3627c8"  
}
```

**Example Response. Forward the JWT as a Authorization Header with the API Request**

# Background processes

## Summary

How can a backend App get access to the API without called by a Browser?

**Use ClientID and ClientSecret to fetch JWT which can then be used to access the API.**

Why is this an important topic?

We can use the service credentials for analytic app which have to run independently in the background.



# MindSphere Debugging applications

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# Debugging applications

## Learning Goals

How can I debug my  
MindSphere applications?

- Remote Debugging
- Tipps for running apps locally



# Debugging SSH Access



Connect to your running CloudFoundry applications directly via SSH

SSH Access is by default **disabled**, but can be enabled per space

Role Space Manager is required to enable it

```
vcap@9936b32a-92b3-4083-5fa2-9b3f: ~
Using username "cf:b60c8670-040e-455e-a11e-e1bbc17f5393/0".
cf:b60c8670-040e-455e-a11e-e1bbc17f5393/0@ssh.cf.eu1.mindsphere.io's password:
vcap@9936b32a-92b3-4083-5fa2-9b3f:~$ ls -l
total 4
drwxr-xr-x 1 vcap root 38 Jul 4 10:23 app
drwxr-xr-x 3 vcap vcap 14 Jul 4 10:22 deps
drwxr-xr-x 2 vcap vcap 6 Jul 4 10:23 logs
drwxr-xr-x 2 vcap vcap 124 Jul 4 10:23 profile.d
-rw-r--r-- 1 vcap vcap 60 Jul 4 10:23 staging_info.yml
drwxr-xr-x 2 vcap vcap 6 Jul 4 10:23 tmp
vcap@9936b32a-92b3-4083-5fa2-9b3f:~$
```

# Debugging

## SSH Access - Step by step

1. Log into Cloud Foundry by using the CLI:

```
cf login --sso
```

2. Check if SSH is enabled:

```
cf space-ssh-allowed {SPACE_NAME}
```

3. (If not): Enable SSH per space with:

```
cf allow-space-ssh {SPACE_NAME}
```

4. Enable SSH for your application:

```
cf enable-ssh {APP_NAME}
```

5. Connect to your application:

```
cf ssh {APP_NAME}
```



# Debugging

## SSH Access - Step by step with proxy

1. Log into Cloud Foundry by using the CLI:

```
cf login --sso
```

2. Check if SSH is enabled:

```
cf space-ssh-allowed {SPACE_NAME}
```

3. (If not): Enable SSH per space with:

```
cf allow-space-ssh {SPACE_NAME}
```

4. Enable SSH for your application:

```
cf enable-ssh {APP_NAME}
```

5. Get your application identifier:

```
cf app {APP_NAME} --guid
```

6. Retrieve the SSH endpoint:

```
cf curl /v2/info
```

In our case: ssh.cf.eu1.mindsphere.io:8443

7. Get your one-time-password:

```
cf ssh-code
```

8. Build your SSH connection string:

```
cf:{APP_GUID}/{APP_INSTANCE_INDEX}  
@{SSH_ENDPOINT}
```

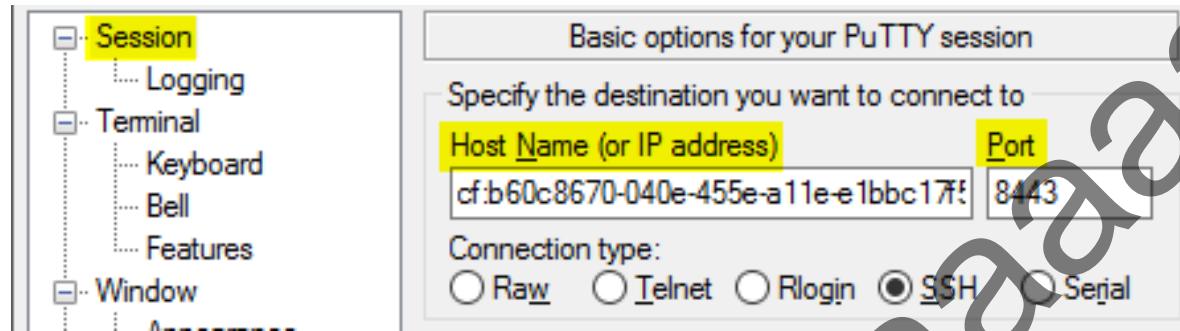
e.g.

```
cf:b60c8670-040e-455e-a11e-  
e1bbc17f5393/0@  
ssh.cf.eu1.mindsphere.io:8443
```

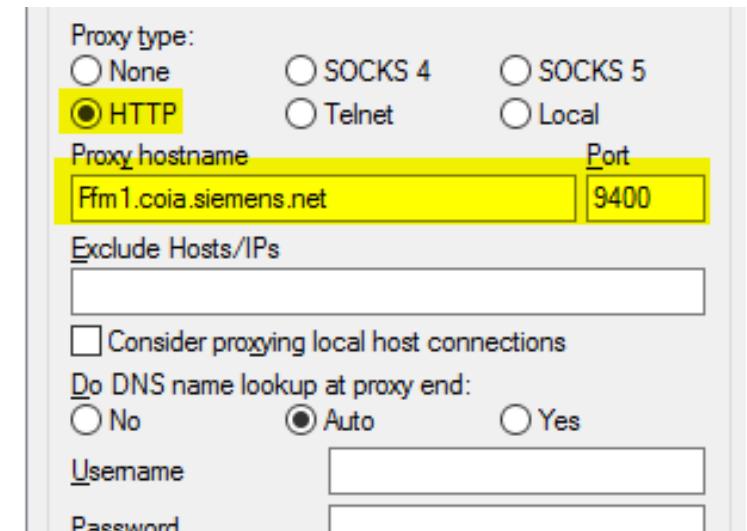
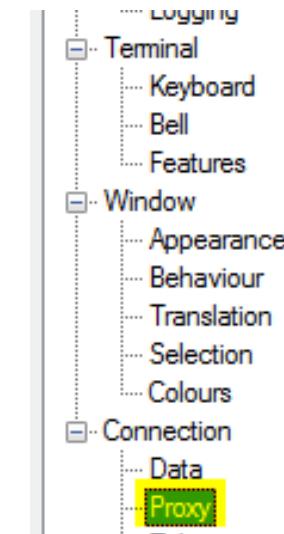
# Debugging

## SSH Access - Step by step with proxy

### Session Configuration (from last steps):



### Proxy configuration:

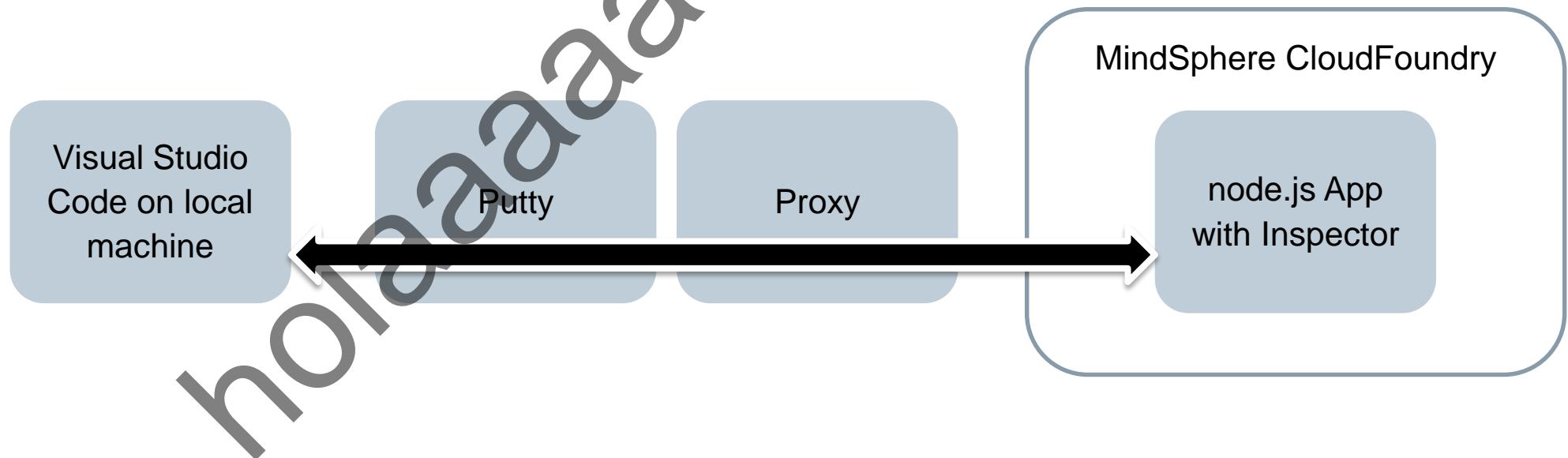


# Debugging

## Remote debugging

Example:

Remote debugging of node.js application with Visual Studio Code via Proxy



# Debugging

## Remote debugging

1. Enable Inspector in your nodejs application

```
node --inspect app.js
```

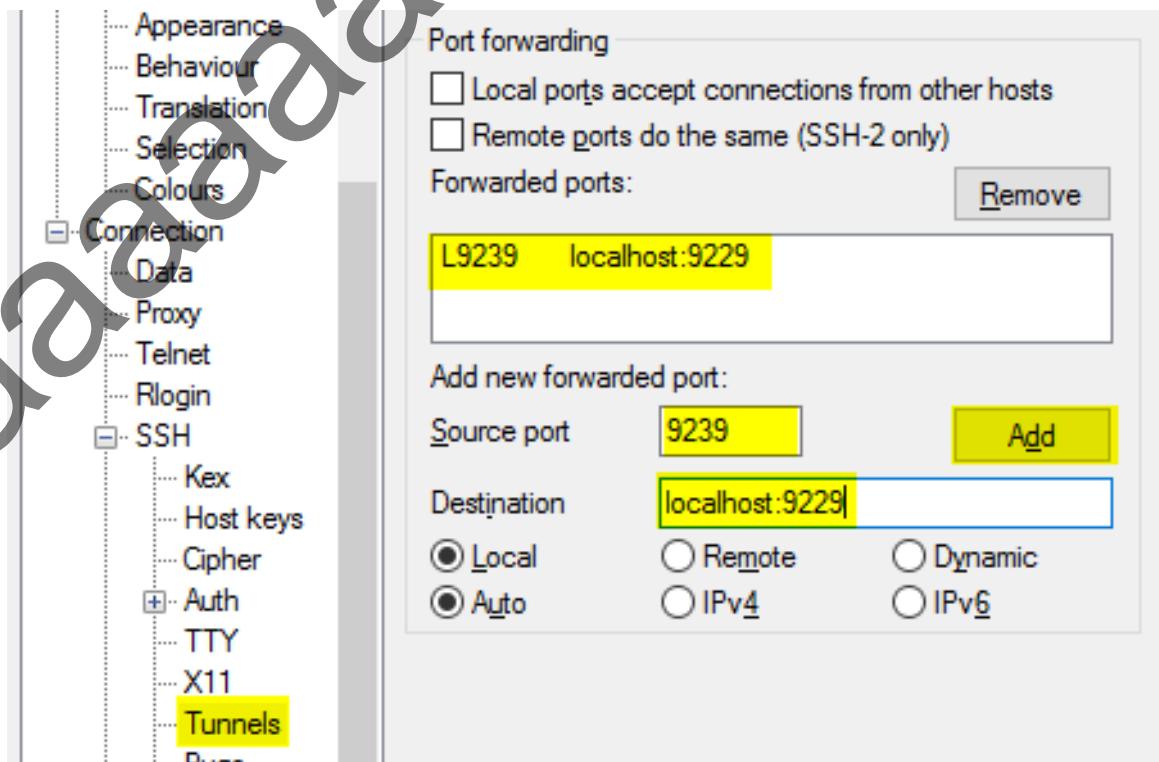
2. Check the port from the logfile

3. Create a SSH tunnel with Putty

4. Configure Visual Studio Code:

```
launch.json
```

```
"configurations": [  
  {  
    "type": "node",  
    "request": "attach",  
    "port": 9239,  
    "name": "Remote debugger",  
  }]
```



# Debugging applications

## Summary

How can I connect to a running CloudFoundry App?

**Use SSH to connect**

How can I debug my apps?

**Use remote debugging and tunnel the connection through SSH**



# MindSphere Notification Services

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# Notification Services

## Learning Goals

**How can we send messages from MindSphere?**

- Understand the concept
- Know the needed elements
- Learn how to send a message in a simple way



### Endpoint methods **GET**, **POST**, **PUT**, **DELETE**

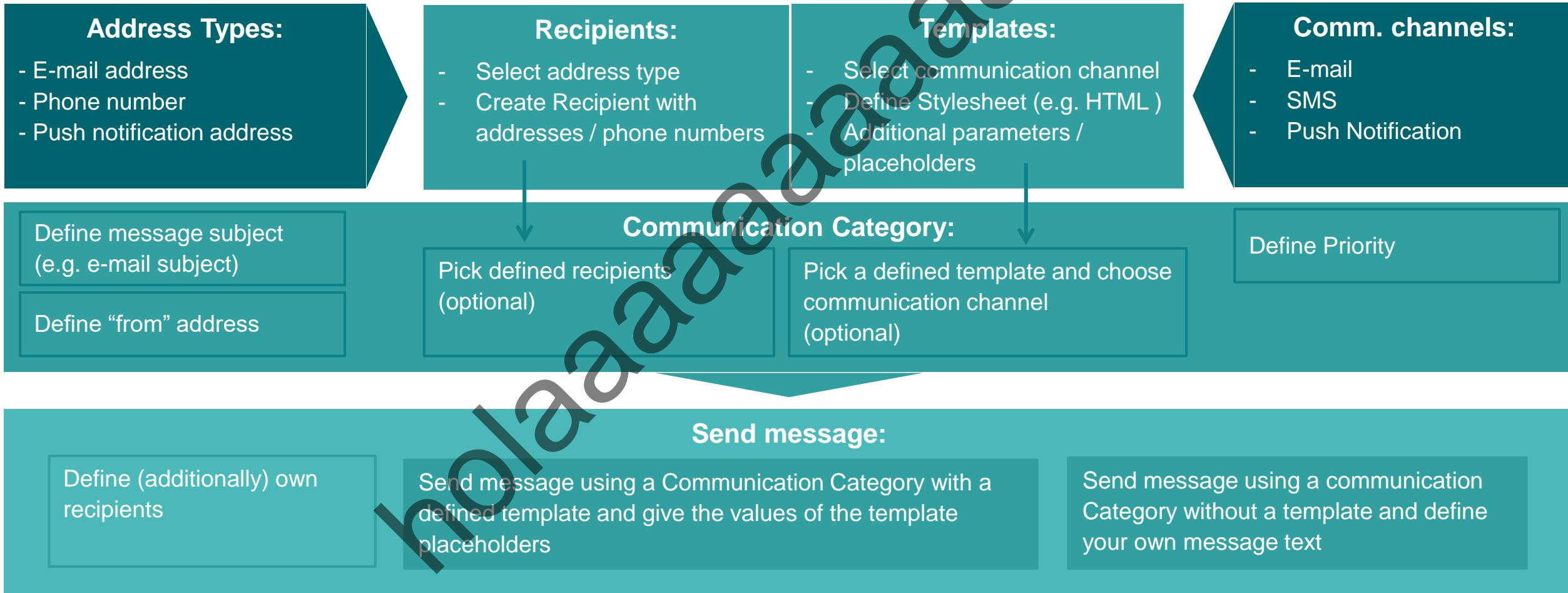
Different endpoints to use

#### Purpose:

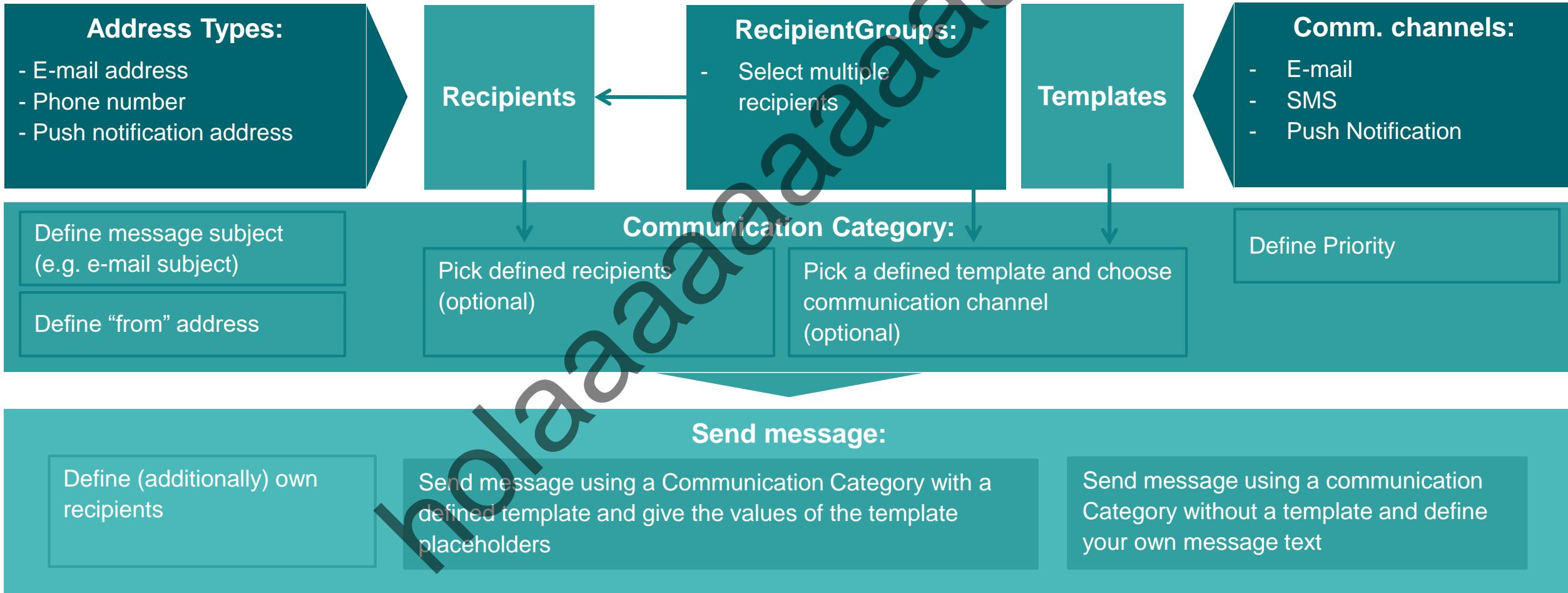
- Define recipients
- Define templates
- Define communication categories
- Send messages
- Check message status

Send messages via different communication channels

### Schematic overview



### Schematic overview



## Roles / Scopes

Needed scope to use Notification services:

**mdsp:core:nose.user**

This scope is only available for service credentials (background processes).

### Get Address Types - Request

**GET:** /api/notification/v3/recipient/addressstype

No parameters required:

Parameter Name	Description	Example	Optional
-	-	-	-

### Get Address Types – positive Response

JSON format

```
[  
  {  
    "id": 1,  
    "recipientAddressTypeName": "Personal Mail"  
  },  
  {  
    "id": 2,  
    "recipientAddressTypeName": "Office Mail"  
  },  
  ...  
  {  
    "id": 5,  
    "recipientAddressTypeName": "Office Number"  
  },  
  {  
    "id": 6,  
    "recipientAddressTypeName": "Other Number"  
  },  
  {  
    "id": 7,  
    "recipientAddressTypeName": "Push Notification"  
  }  
]
```

# MindSphere API

## Notification Services – Recipient

### Create Recipient – Request

**POST:** /api/notification/v3/recipient

Parameter with JSON format

Parameter Name	Description	Type	Optional
recipientname	Name of the recipient.	String	No
recipientdetail	Recipient details	Array of objects	No
recipientdetail.[].address	Recipient address, like email, telephone number, push notification configuration details etc.	<i>user@siemens.com</i>	No
recipientdetail.[].addresstypeid	Recipient address type. Use the 'List Address Types' API to get the appropriate address type ID.	<i>1 (stands for e-Mail)</i>	No

### Create Recipient– positive Response

42  
Recipient ID, needed for later usage

holaaaaaaaaaaaaaa

### Get Recipient - Request

**GET:** /api/notification/v3/recipient/{id}

Parameter with JSON format

Parameter Name	Description	Example	Optional
id	Recipient ID	1	NO

### Get Recipient – positive Response

JSON format

```
{  
  "recipientid" : 1,  
  "recipientname" : "MindsphereUser",  
  "isactive" : "Y",  
  "recipientdetail" : [ {  
    "address" : "user@siemens.com",  
    "addresstypeid" : 1  
  } ]  
}
```

### Search Recipient - Request

**POST:** /api/notification/v3/recipient/search

Parameter with JSON format

Parameter Name	Description	Example	Optional
name	Recipient name to be matched	{ "name" : "user" }	NO

### Search Recipient – positive Response

JSON format

```
[ {  
    "recipientid" : 1,  
    "recipientname" : "MindsphereUser",  
    "isactive" : "Y",  
    "recipientdetail" : [ {  
        "address" : "user@siemens.com",  
        "addresstypeid" : 1  
    } ]  
} ]
```

Found string within the recipient name

# MindSphere API

## Notification Services – Recipient

### Update Recipient - Request

**PUT:** /api/notification/v3/recipient

Parameter with JSON format

Parameter Name	Description	Type	Optional
recipientid	Id of the recipient to be updated	Number	No
recipientdetail	Recipient details	Array of Object	No
recipientdetail.[].address	To update the recipient address details like email, telephone etc. To delete address, include the address with actual address type and "" as value for address. E.g.: <pre>{   "address": "",   "addresstypeid": 1 }</pre>	Object	No
recipientdetail.[].addresstypeid	Recipient address type. Use the 'List Address Types' API to get the appropriate address type ID.	1 (stands for e-Mail)	No

### List communication Channels - Request

**GET:** /api/notification/v3/communicationchannel/

Lists all available communication channels. Needed for template creation.

No parameters required:

Parameter Name	Description	Example	Optional
-	-	-	-

### List communication Channels – positive Response

JSON format

```
[  
  {  
    "commChannelId": 1,  
    "commChannelName": "Email"  
  },  
  {  
    "commChannelId": 2,  
    "commChannelName": "SMS"  
  },  
  {  
    "commChannelId": 3,  
    "commChannelName": "Push Notification"  
  }  
]
```

### Create Template - Request

**POST:** /api/notification/v3/template/

2 parameters: File (e.g. html file) and template information as with JSON format

Parameter Name	Description	Example	Optional
templateFiles	Template as html file	<i>see next slide</i>	NO
templateInfo	Template description as JSON object	<i>see next slide</i>	NO

### Create Template - Request

**POST:** /api/notification/v3/template/

Example html file

```
<html>

  <head>
    <title>Mail from MindSphere</title>
  </head>

  <body>
    Hello <span th:text="${firstName}"></span> <span th:text="${lastName}"></span>.<br/>
    Welcome to MindSphere.
  </body>

</html>
```



### Create Template - Request

**POST:** /api/notification/v3/template/

Example JSON data

```
{ "templateParam": [
    {
        "paramName": "firstName",
        "defaultValue": "Firstname",
        "placeHolderName": "firstName",
        "paramTypeId": 4
    },
    {
        "paramName": "lastName",
        "defaultValue": "Lastname",
        "placeHolderName": "lastName",
        "paramTypeId": 4
    }
],
"templateSetName": "EMail Test",
"templateChannelAndFile": [
{
    "communicationChannel": 1,
    "fileName": "mail.html",
    "operation": "ADD"
}
]} ]}
```

### Create Template – positive Response

Status 201 created

```
{  
  "templatesetId": 21,  
  "templatesetName": "EMail Test",  
  "templateList": [  
    {  
      "templateId": 61,  
      "commChannelId": 1,  
      "commChannelName": "Email"  
    }  
  ]  
}
```

### Additional API calls to work with templates

<b>POST</b>	<code>/template/</code> Use this api to create templates for a new template set using templateFiles and templateInfo.	
<b>GET</b>	<code>/template/templatecontent/{templateId}</code> Use this api to get template content for a requested template ID.	
<b>GET</b>	<code>/template/templateidlist/{templatesetId}</code> Use this api to get list of template IDs for a requested template set.	
<b>GET</b>	<code>/template/templatelistdetails</code> Use this api to get all template sets along with associated template details.	
<b>GET</b>	<code>/template/templatesets</code> Use this api to get list of templateSetDTOs for matching template set name.	
<b>GET</b>	<code>/template/templatesets/{templatesetId}</code> Use this api to get templateSetDTO for a requested template set Id.	
<b>DELETE</b>	<code>/template/{templatesetId}</code> Use this api to delete a template set for a requested template set Id.	
<b>PUT</b>	<code>/template/{templatesetId}</code> Use this api to update details of a template set.	
<b>GET</b>	<code>/paramtype/</code> Use this api to get all available param types.	
<b>GET</b>	<code>/templateparam/{templatesetId}</code> Use this api to get available template params for a requested template set id.	

### **Listing Communication Categories - Request**

**GET:** /api/notification/v3/communicationcategories/

Lists all Communication Categories of the tenant.

**No parameters required:**

Parameter Name	Description	Example	Optional
-	-	-	-

### Listing Communication Categories – positive Response

JSON format

```
[  
  {  
    "msgCategoryId": 662,  
    "msgCategoryName": "Training Team Test with template and recipients",  
    "priority": 5,  
    "recipients": [],  
    "templates": []  
  },  
  {  
    "msgCategoryId": 672,  
    "msgCategoryName": "VisualFlowCreatorTestCategory",  
    "priority": 5,  
    "recipients": [],  
    "templates": []  
  }  
]
```

### Fetching Communication Categories - Request

**GET:** /api/notification/v3/communicationcategories/{id}

Lists details of a specific Communication Category.

Parameter Name	Description	Example	Optional
id	Catergory ID of the category you want to fetch the details for	662	NO

### Fetching Communication Categories – positive Response

JSON format

```
{  
    "msgCategoryId": 662,  
    "msgCategoryName": "Training Team Test with template and recipients",  
    "subject": "This is a test message from training team",  
    "from": "training-team.test.tenant-id@mindsphere.io",  
    "priority": 3,  
    "recipients": [  
        {  
            "recipientId": 1443,  
            "position": "TO",  
            "recipientName": "User",  
            "recipientDetails": [  
                {  
                    "recipientId": 1443,  
                    "address": "user@siemens.com",  
                    "recipientAddressTypeName": "Office Mail",  
                    "commChannelName": "Email"  
                }  
            ]  
        }  
    ],  
    "templates": [  
        {  
            "templateId": 961,  
            "commChannelName": "Email",  
            "templatesetId": 968,  
            "templatesetName": "Training Notification 1"  
        }  
    ]  
}  
"createdby": "tenant-id"
```

### Create a new Communication Category - Request

**POST:** /api/notification/v3/communicationcategories/

Creates a new Communication Category. Parameters with JSON format:

Parameter Name	Description	Example	Optional
msgCategoryName	Name of the category	<i>Training Team Test with template and recipients</i>	NO
subject	Subject / Description of the category	<i>This is a test message</i>	NO
from	Source of the message. E.g. for E-mail it will be extended with <tenant-id>.mindsphere.io	<i>training-team.test</i>	NO
priority	Communication Category Priority(Values : 1,3,5)	<i>3</i>	YES
Recipients[]	Fixed recipient(s)	<i>"recipients": [ { ... } ],</i>	YES
templates[]	Templates to be used for this category and communication channel	<i>"templates": [ { ... } ],</i>	YES

### Create a new Communication Category - Request

POST: /api/notification/v3/communicationcategories/

JSON data

```
{  
    "from": "academy2",  
    "msgCategoryName": "trainingCategoryWithoutRecipientWithTemplate",  
    "priority": 1,  
    "subject": "MindSphere Academy Training please ignore",  
    "templates": [  
        {  
            "commChannelName": "EMail",  
            "templateId": 50,  
            "templatesetId": 20,  
            "operation": "ADD"  
        }],  
        "recipients": [  
            {  
                "position": "TO",  
                "recipientGroupId": 0,  
                "operation": "ADD",  
                "recipientId": 42  
            }]  
    }  
}
```

PUT request also available

### Unsubscribe recipient from Communication Category - Request

**POST:** /api/notification/v3/communicationcategories/unsubscribe/recipients

```
{  
  "msgCategoryId": 0,  
  "recipients": [  
    {  
      "recipientId": 0  
    }]  
}
```

### Send message without Template - Request

**POST:** /api/notification/v3/publisher/messages

Sends a message depending on the data in the body.

Very flexible call, see examples

Parameters with JSON format:

Parameter Name	Description	Example	Optional
body	Message data	<i>see next slides</i>	NO

### Send message without Template - Request

**POST:** /api/notification/v3/publisher/messages

Example 1: Plain text, recipients configured in MessageCategory

```
{  
  
  "body": {  
    "message": "This is a test message"  
  },  
  
  "messageCategoryId": 653  
}
```

### Send message without Template - Request

**POST:** /api/notification/v3/publisher/messages

Example 2: Template with placeholders, recipients configured in MessageCategory

```
{  
  "body": {  
    "firstName": "Jon",  
    "lastName": "Doe"  
  },  
  
  "messageCategoryId": 91  
}
```

### Send message without Template - Request

**POST:** /api/notification/v3/publisher/messages

Example 3: No MessageCategory, everthing defined in the call

```
{  
  "body": {  
    "message": "Sample message as mail body"  
  },  
  "recipientsTo": "user1@siemens.com",  
  "from": "academy2",  
  "subject": "MindSphere Academy Training (please ignore)",  
  "priority": 3  
}
```

### Get message status - Request

**POST:** /api/notification/v3/audit/searchauditstatus

Find out the message status for messages of a specified ID and a specified timerange

Parameters with JSON format:

Parameter Name	Description	Example	Optional
messageCategoryId	Communication Category you want to check the status for	653	NO
startTimeRange	Start time range you want to check the status for	"2017-05-30 16:40:05"	NO
endTimeRange	End time range you want to check the status for	"2017-08-31 11:25:20"	NO

### Get message status - Request

**POST:** /api/notification/v3/audit/searchauditstatus

Find out the message status for messages of a specified ID and a specified timerange

Parameters with JSON format:

Parameter Name	Description	Example	Optional
messageCategory	{ "messageCategoryId" : 653, "startTimeRange" : "2018-03-27 00:00:00", "endTimeRange" : "2018-03-27 10:00:00"	How a real request JSON parameter could look like.	NO
startTimeRange			NO
endTimeRange			NO

### Get message status – positive Response

Get back the status of the single messages within the given time range

JSON format

```
{  
    "messageCategoryId": 91,  
    "startTime": "2018-03-27 07:57:54",  
    "endTime": "2018-03-27 07:57:55",  
    "status": "COMPLETED",  
    "fromUser": "Academy2TU",  
    "fromApp": "",  
    "recipients": []  
},  
{  
    "messageCategoryId": 91,  
    "startTime": "2018-03-27 08:03:55",  
    "endTime": "2018-03-27 08:03:55",  

```

### How to send SMS messages?

You need:

- a communication category
- a template
- recipients with phone numbers

"html" template with Plain  
Text

```
{ "msgCategoryId": 90,  
  "msgCategoryName": "trainingCategorySMS",  
  "from": "academy2.academy2@mindsphere.io",  
  "recipients": [{"  
    "recipientId": 34,  
    "position": "TO",  
    "recipientName": "Thilo Boehm",  
    "recipientDetails": [{"  
      "recipientId": 34,  
      "address": "+491732325250",  
      "recipientAddressTypeName": "Office Number",  
      "commChannelName": "SMS"  
    }]}],  
  "templates": [{"  
    "templateId": 49,  
    "commChannelName": "SMS",  
    "templatesetId": 19,  
    "templatesetName": "SMS Test"  
  }],  
  "createdby": "academy2"  
}
```

### Exercise

- Use the Postman Collection to investigate this API

holaaaaaaaaaaaaaa

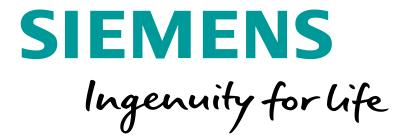


# Notification Services

## Summary

How can send notifications from my application?

**Create a Communication Category and send the message.** Optionally, you can create Recipients and Templates to use them within the Communication Category



# MindSphere Data Flow Engine

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# Data Flow Engine

## Learning Goals

How can we implement data workflows?

- Data Flow Engine API
- Workflow concept
- Workflow steps



### Endpoint methods **GET**, **PUT**, **DELETE**

Different endpoints: /api/dataflowengine/v3/

#### Tasks:

- GET dataflow
- PUT dataflow
- DELETE dataflow

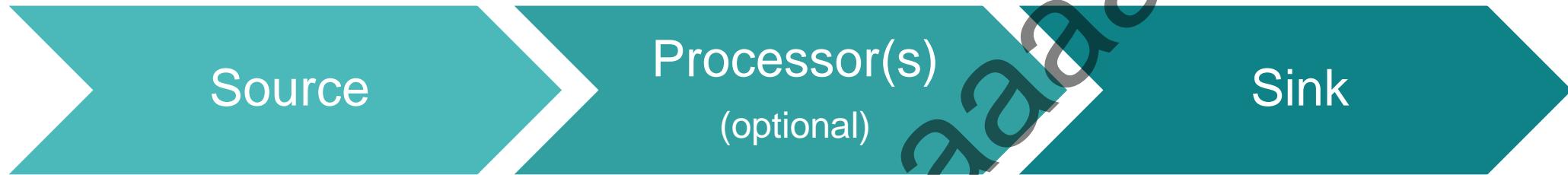
Get informed  
Analyze incoming data  
React on conditions

The engine implemented based on the Spring Cloud Dataflow architecture  
Check: <https://docs.spring.io/spring-cloud-dataflow/docs/current/reference/htmlsingle/>

# MindSphere API

## Data Flow Engine Steps

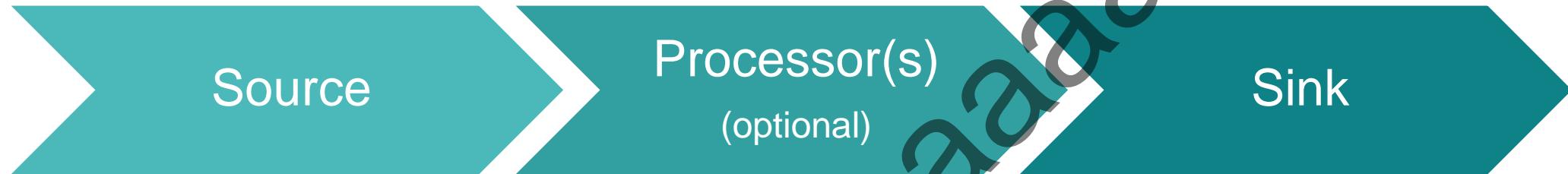
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# MindSphere API

## Data Flow Engine Steps

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### TimeSeries

- Trigger on change
- Trigger on condition

### Timer

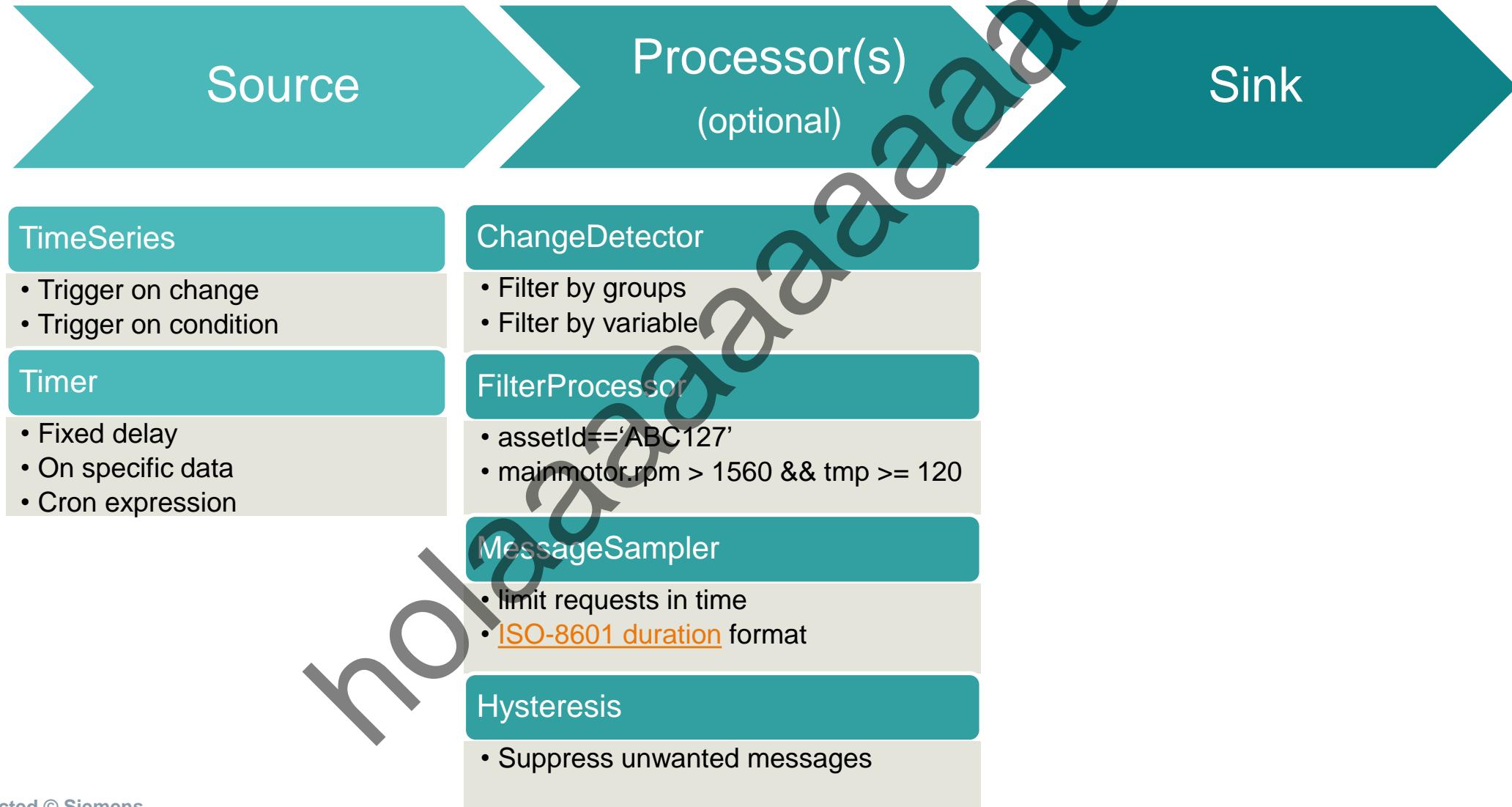
- Fixed delay
- On specific data
- Cron expression

holaaaaaaaaaaaaaa

# MindSphere API

## Data Flow Engine Steps

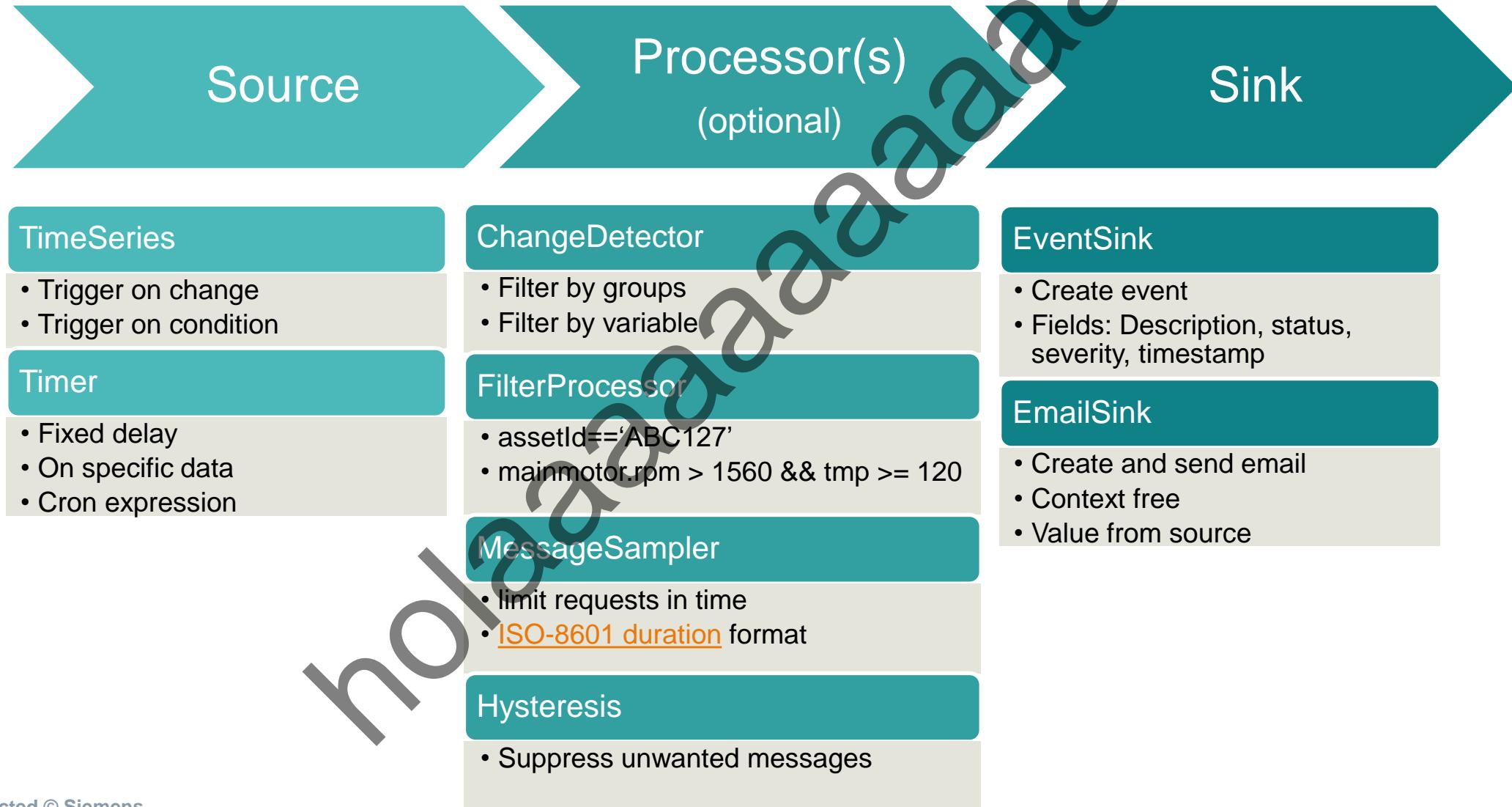
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# MindSphere API

## Data Flow Engine Steps

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### Stream definitions - Request

GET: /api/dataflowengine/v3/streams/definitions

Lists all streams (workflows) of the tenant.

No parameters required:

Parameter Name	Description	Example	Optional
-	-	-	-

### Stream definitions

JSON format

```
{  
  "_embedded": {  
    "streamDefinitionResourceList": [  
      {  
        "name": "TBStream4",  
        "dslText": "TimerSource --fixed-delay=60 | EventSink --entity-id-path=\"'01c3636...828a860'\"",  
        "status": "deployed",  
        "statusDescription": "All apps have been successfully deployed",  
        "_links": {  
          "self": {  
            "href": "https://gateway.eul.mindsphere.io/api/dataflowengine/v3/streams/definitions/TBStream4"  
          }  
        }  
      }  
    ]  
  },  
  "_links": {},  
  "page": {}  
}
```

## Create events

**POST /api/dataflowengine/v3streams/definitions**

Example request (body):

```
{  
  "name": "Stream1",  
  "definition":  
    "TimeSeriesSource --entities='[{"id": \"524c43829a934509b5389d3f352f9ac9\"}]' |  
    FilterProcessor --expression='newProperties.Temp > 30' |  
    EventSink --entity-id-path=\"524c43829a934509b5389d3f352f9ac9\""  
      --timestamp-path=_time",  
  "deploy": true  
}
```

### Delete streams

**DELETE: /api/dataflowengine/v3streams/definitions/{name}**

#### Parameters:

Parameter Name	Description	Example	Mandatory
name	The stream name to be deleted	Stream1	YES

## Roles / Scopes

Role	Description
<code>mdsp:core:dataflowengine.standarduser</code>	DataflowEngine standard user role with all read scopes

<https://developer.mindsphere.io/>

## Data Flow Engine - Apps

### Sources

TimeSeriesSource 

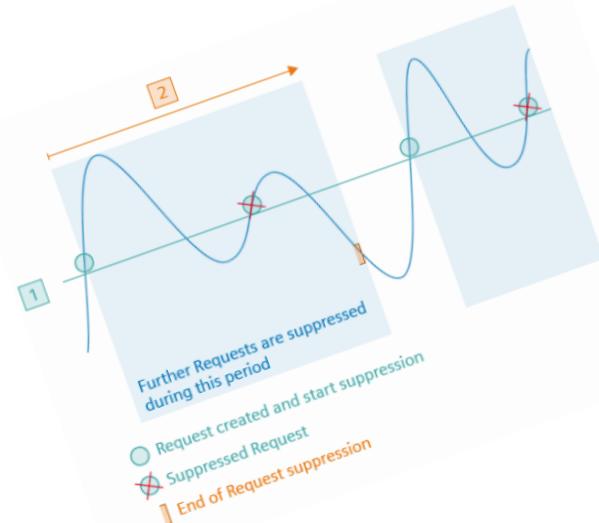
App name: TimeSeriesSource

App type: source

Property	Type	Description	Example
entities	String(JSON)	ID set of entity or entities to subscribe for.	<pre>--entities= [{"id":"f7012b9215b448228de f9726deffcf9"}]</pre>

**Note**

Those messages are in exactly the same format as time series data arrives from IoT through TimeSeriesSource. The `entityId` refers to the ID of the asset and the `propertySetName` refers to the name of aspect. The aspect variables are collected in an array under `newProperties`.



# Data Flow Engine

## Summary

How can we run workflows in the background?

**We build a data workflow that subscribes to a data source, processes the data and passes it to a sink.**

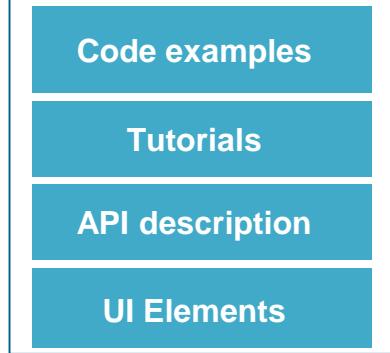
holaaaaaaaaaaaaaa



# MindSphere Documentation

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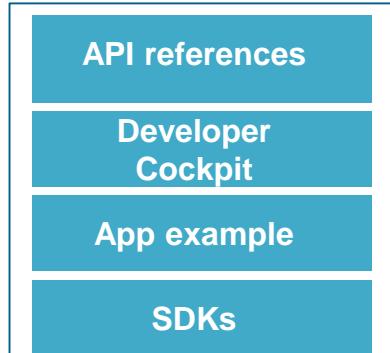
Developer documentation at [www.mindsphere.io/developer](http://www.mindsphere.io/developer)



MindSphere is a distributed, flexible and open platform to connect the IT and IIoT layers. It provides you with a wide range of standards and protocols to access and log your own products and services. It also provides you with a full stack technology and security standards.

The platform consists of three different parts:

- the MindSphere Application Patterns which provides a message "MindSphere as a Service (MaaS)" to host your applications directly on MindSphere
- the MindSphere Services Platform which allows you to reuse the service step by step in your applications and
- the MindSphere Connectors which provide you with plug-and-play hardware and software components to connect your existing applications.



DataflowServer

This is the DataflowServer. DataflowServer can be used to create, deploy, undeploy and run streams on MindSphere.

Billboard : List of default endpoints.

Runtime apps : Runtime applications. On this endpoint the deployed and running stream application can be listed or deleted.

Annotations

Implementation table

Resource class (0000 100)

Successor (0000 100)

Initial ParameterValue

Element : Stream application

Deployment

Deployment ID : 1448

Deployment Date : 2019-07-10T10:20:00Z

Deployment Task : 1448

Deployment Type : Deployment

User documentation at [www.mindsphere.io/documentation](http://www.mindsphere.io/documentation)

Getting connected to MindSphere

How to Use FleetManager

How to use Developer Cockpit

How to use Asset Management

How to Operator Cockpit

Connectivity

MindSphere Documentation Area

On this page you will find all relevant documents about MindSphere. On the left side you can find the documentation for the MindSphere products. On the left "Documentation" you will find documents with information for the operation of your own projects in MindSphere. The previous document contains the basic information about MindSphere.

Product Information Guidelines

MindSphere Das offene IoT Plattform  
Fleet Manager Systemhandbuch  
Visual Flow Creator built on Node-RED  
Operator Cockpit System Manual  
Notification Service System Manual  
Getting connected to MindSphere