AN IOT PLATFORM AS THE BASIS FOR MONITORING AND AUTO-MATION IN THE SOLAR POWER PLANT

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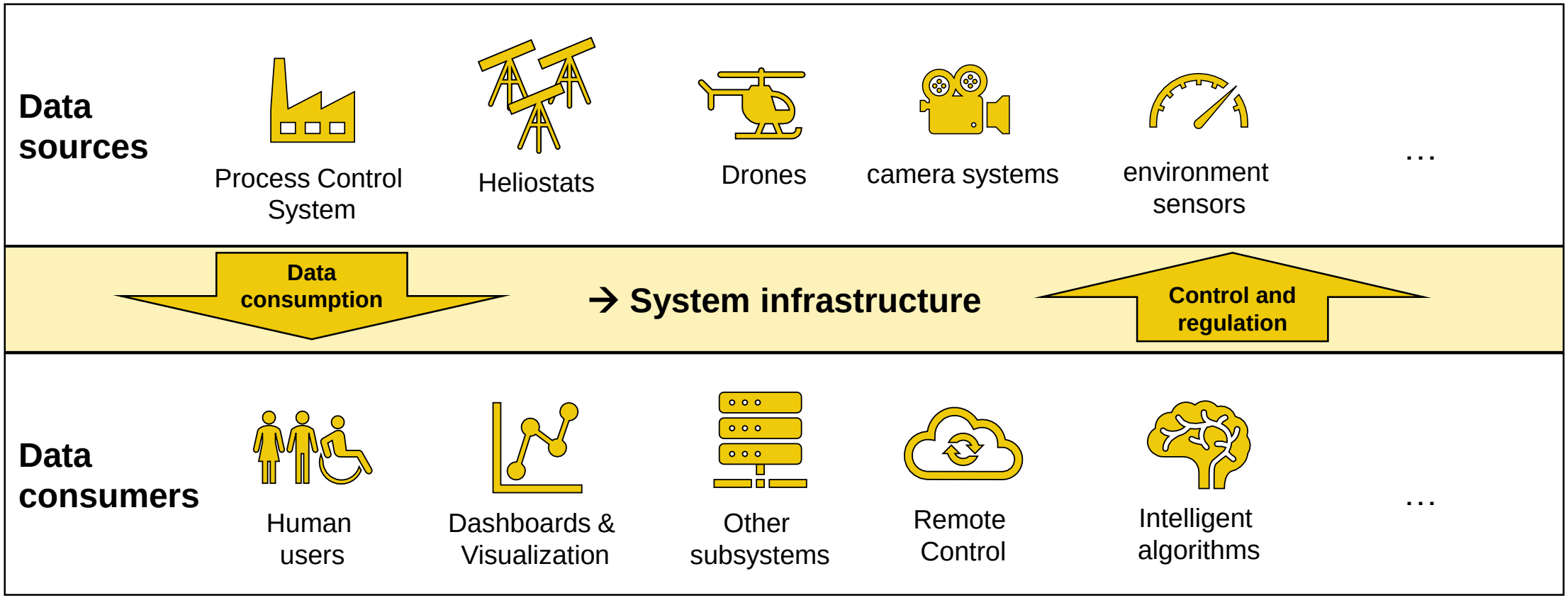
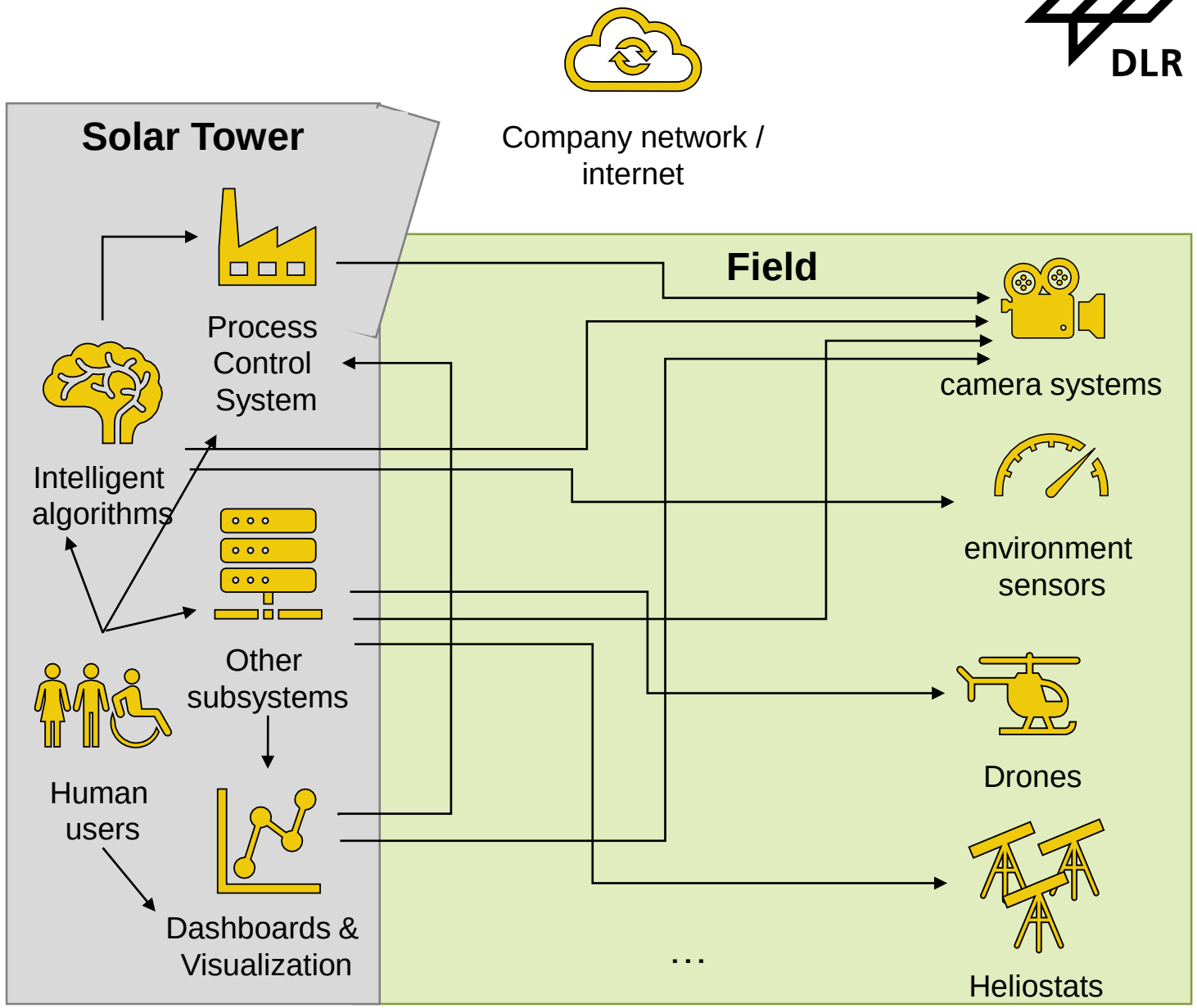
Motivation

- Condition Monitoring & automization of a solar power plant



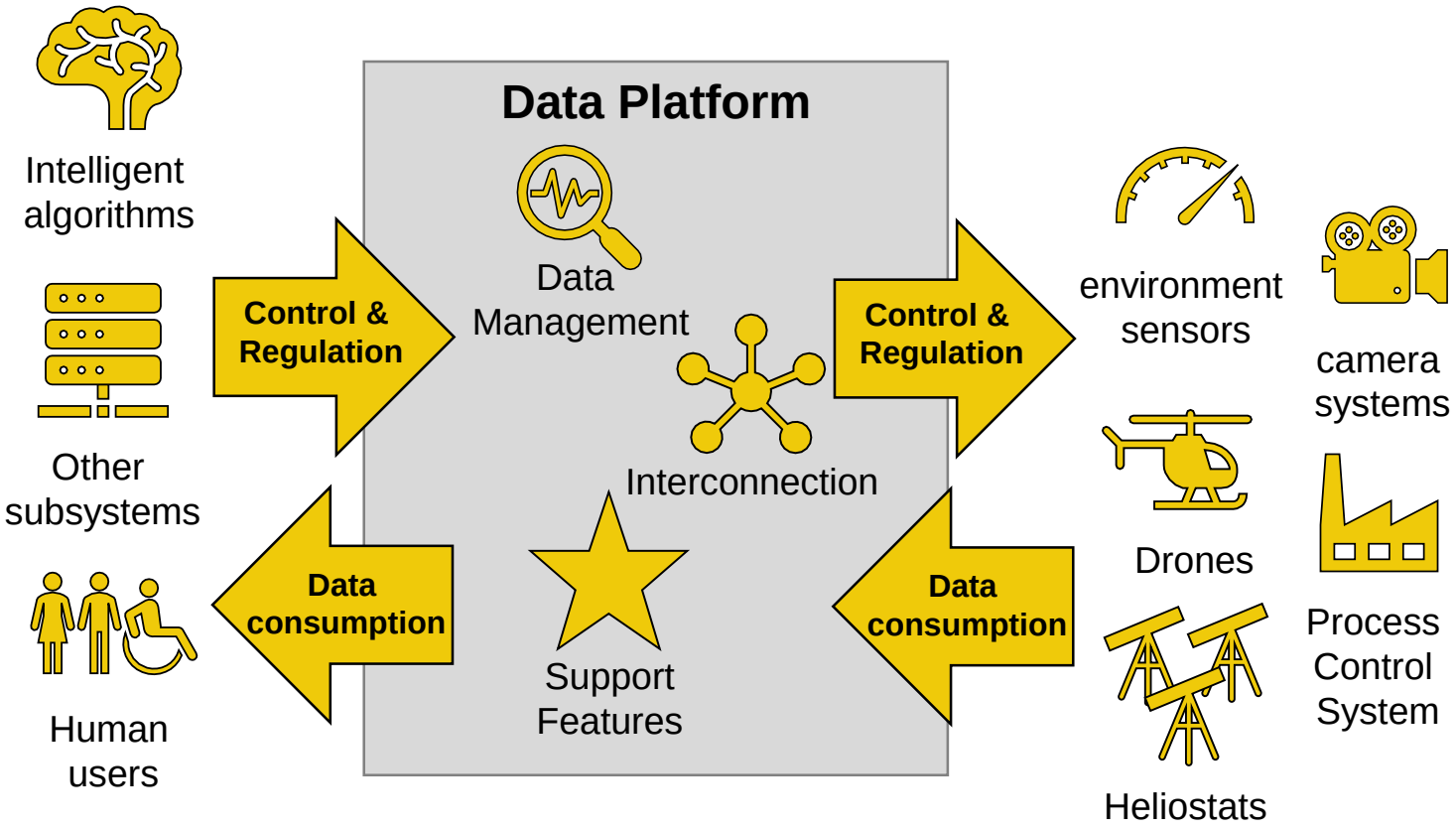
Motivation

- Actual situation
  - Series of distributed subsystems
  - Partly connected data silos
  - Airgapped high-security environment
- Challenges
  - Heterogeneous systems and interfaces
  - Performance, stability and security
  - Huge amount of data
    - ~ 5.5 TB to process per day
    - ~ 10 TB to store per year
  - Complexity of the overall system
  - Troubleshooting
  - …



Idea

- Data Platform as a centralized infrastructure for interconnection & data management
  - Collect & provide data from all sources and allow their control and regulation of system components
  - Break data silos and provide features for data-based applications and human users
  - Provide robust, secure, performant, flexible and scalable system infrastructure



High-Level-Requirements

Data consolidation

Flexible interfaces to data sources

Big Data Processing & Storage

Scalable Deployment

Different interfaces for data access

Data consumer

Intelligent algorithms

Other subsystems

Human users

Data usage

Closed-Loop-Control

Nowcasting

Real-time-simulation

Heliostat calibration

Online Monitoring

Error search

Automatic O&M

System control

Data Management

CSP data platform

Data sources

environment sensors

Drones

Heliostats

Process Control System

camera systems

…

Stream / batch processing

Semantic interpretation of data

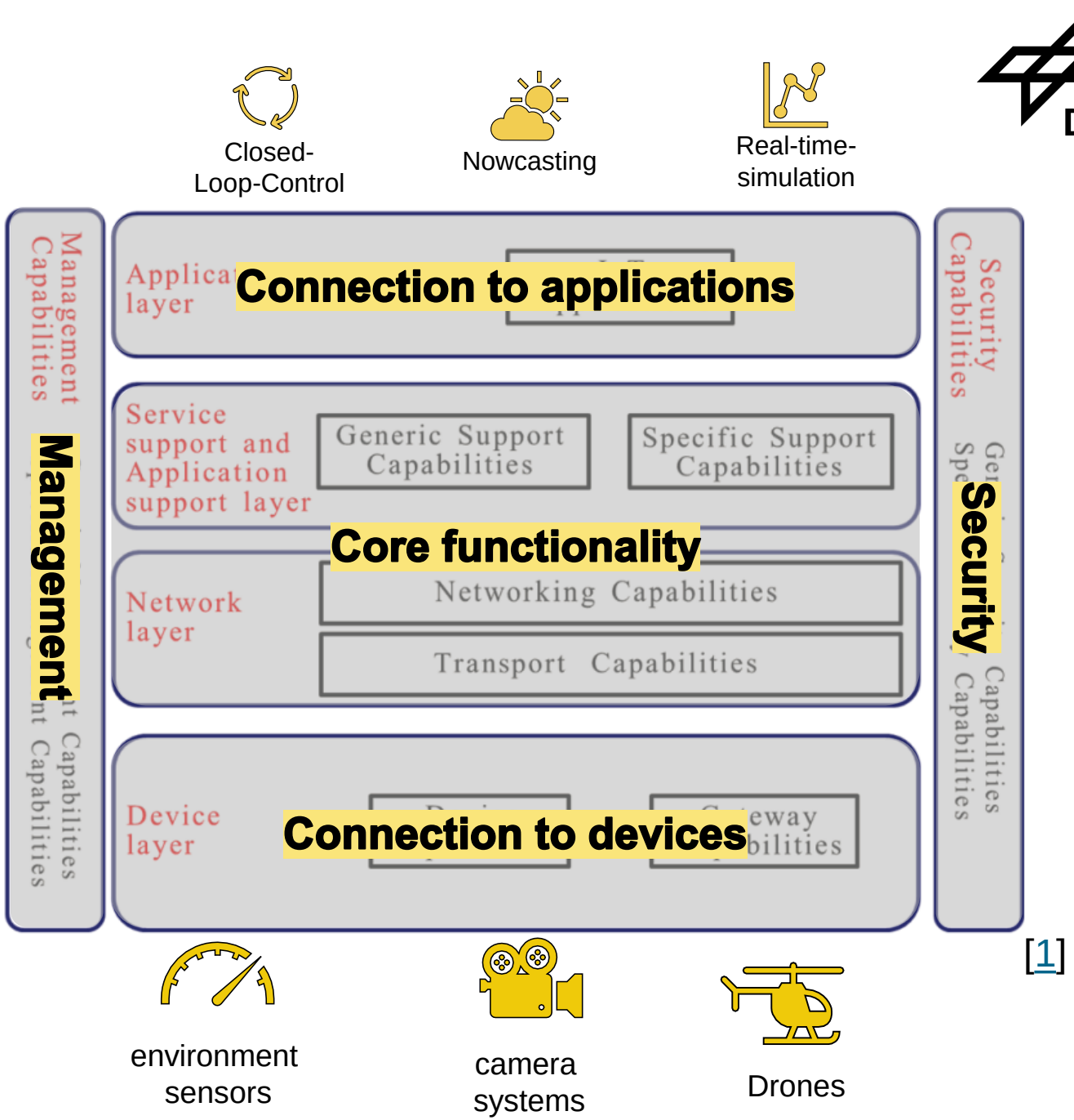
Visualization, Alerts & Dashboards

Monitoring of system health & Self-Healing

Comprehensive IT security protection

Concept

- (I)Iot-Solutions
  - *„The number of IoT platforms are increasing in rapid speed“*, [2]
  - Examples: Microsoft Azure IoT, AWS IoT Core, ThingsBoard, SAP Leonardo, FIWARE, …
- Reference Architectures for (I)IoT-Platforms
  - Consumes data at device layers and provides it to application layer
  - Core functionality for data management
  - Management and security services that provide functions for all layers

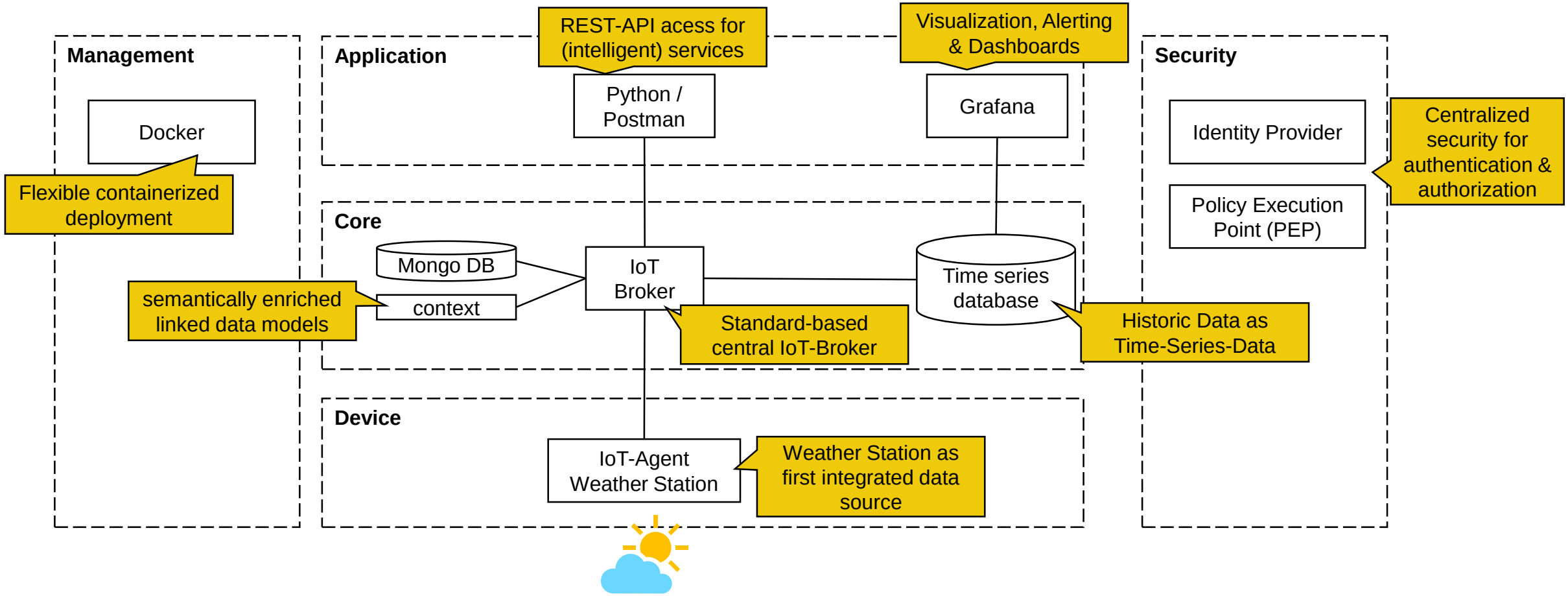


[1]

Realization

[3]

- Prototype 1.0 powered by open source solution FIWARE - Architecture



Realization

[3]

- Prototype 1.0 powered by open source solution FIWARE - Impressions

Outlook

FIWARE [3]

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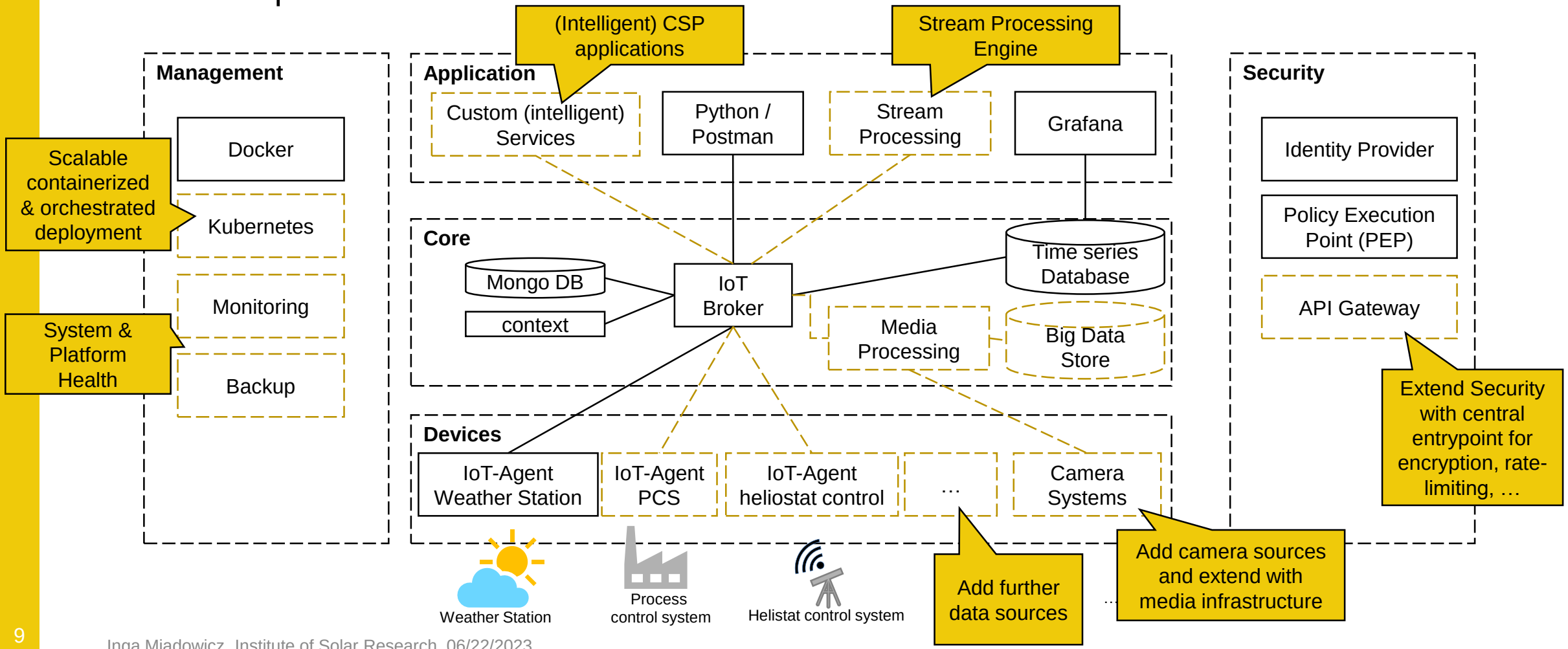
- Planned platform solution



Summary

- The **amount of data** and the **need for processing methods** is growing

- **Solar power plants have high requirements on technical infrastructure** like huge amount of subsystems and data, high degree of heterogeneity, sensitive control processes, low latency requirements…

- A **qualitative system infrastructure for data management and interconnection** of system components is important as a **basis for condition monitoring and automization**

- A **data platform** can be used as **a middleware for interconnection and data management** of the system and its components

THANK YOU.

Solar Colloquium | Inga Miadowicz

Literature

[1] International Electrotechnical Comission (IEC): *“IoT 2020: Smart and secure IoT platform”*, 2016, Geneva, Schweiz, https://www.iec.ch/basecamp/iot-2020-smart-and-secure-iot-platform (visited at 18.10.2022), p. 24

[2] M. Ullah and A. Narayanan and A. Wolff and P. H. J. Nardelli: „*Unified Framework to Select an IoT Platform for Industrial Energy Management Systems*“, MIPRO 2021, Opatija, Kroatien, p. 953

[3] FIWARE Foundation e.V.: *„FIWARE, the Open Source Platform for Our Smart Digital Future“*, 2022, Online: https://www.fiware.org/ (visited at 02.05.2023)