



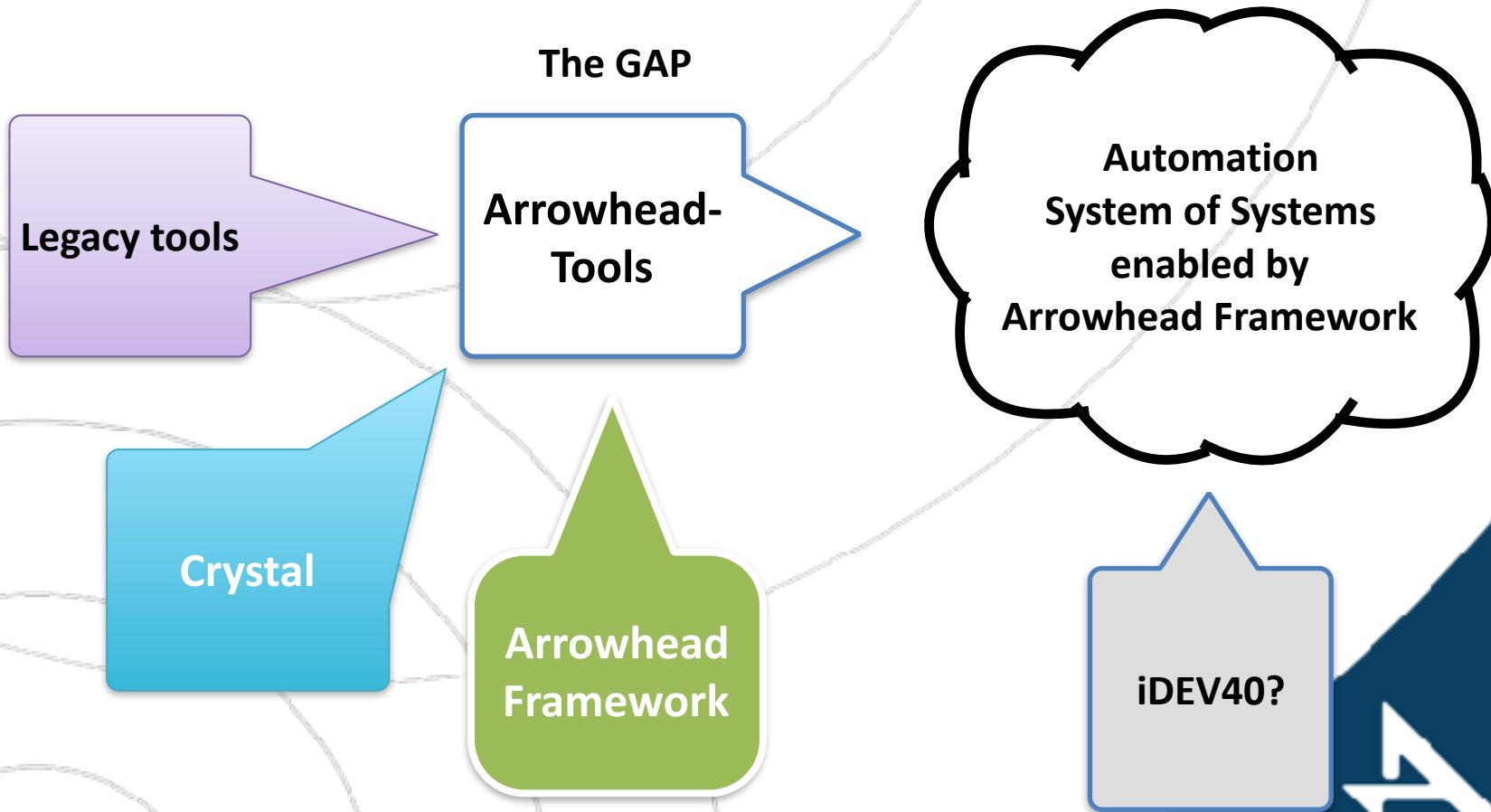
Arrowhead-T

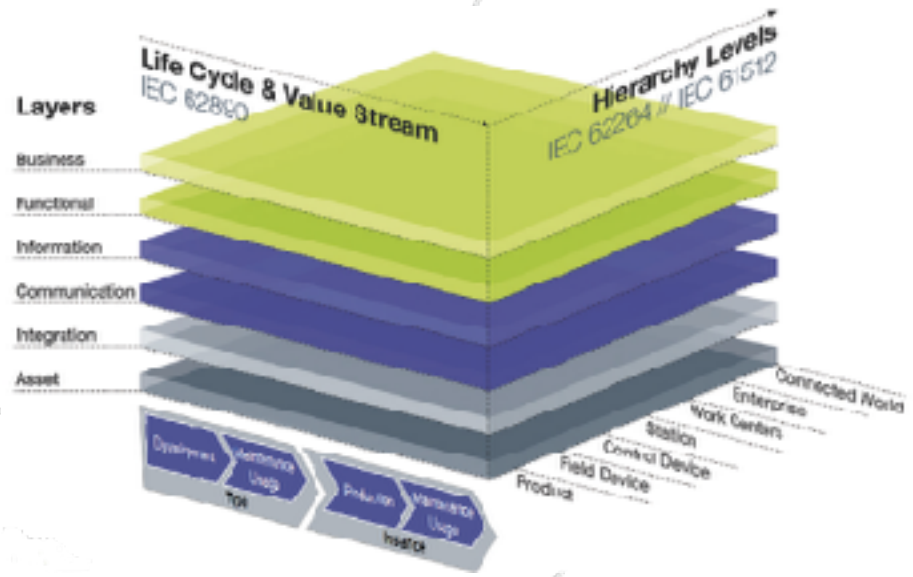
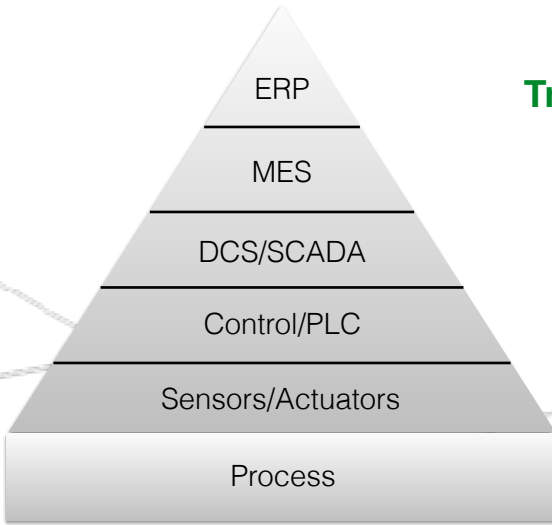
An early idea for ECSEL 2018

Jerker Delsing

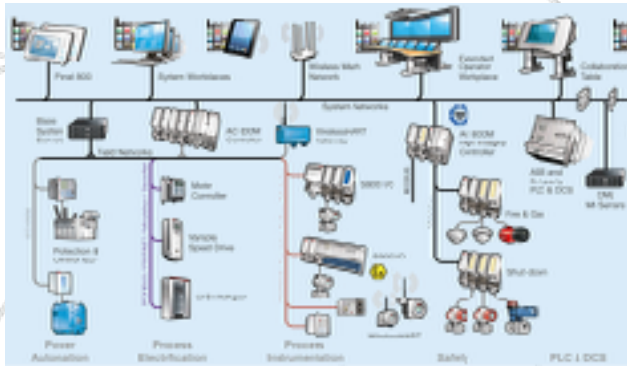


# System of Systems tool gap

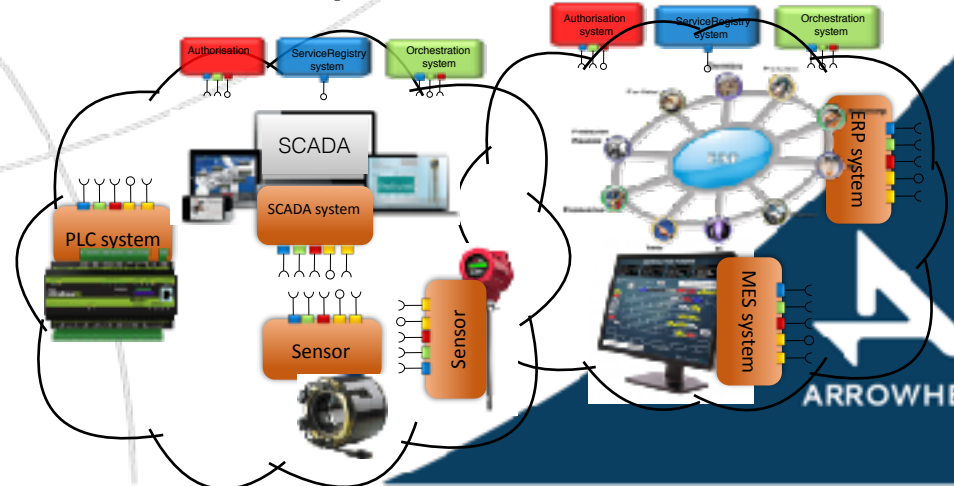




**Hierarchical system implementation**

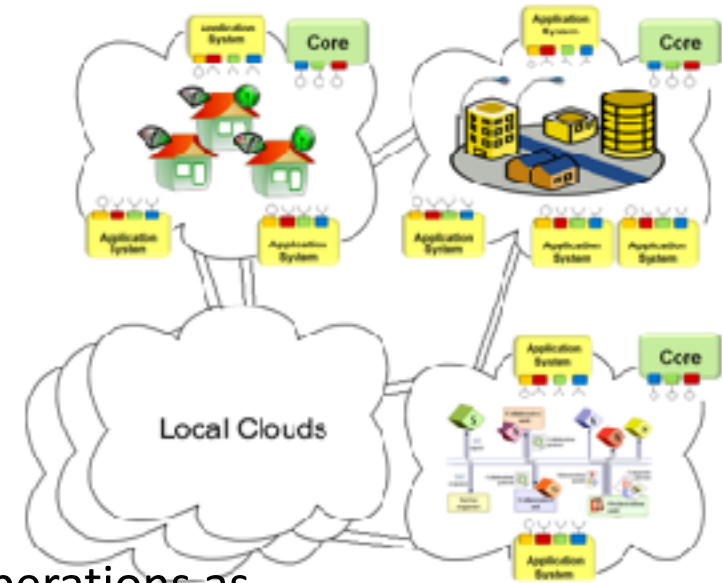


**Local automation cloud implementation**

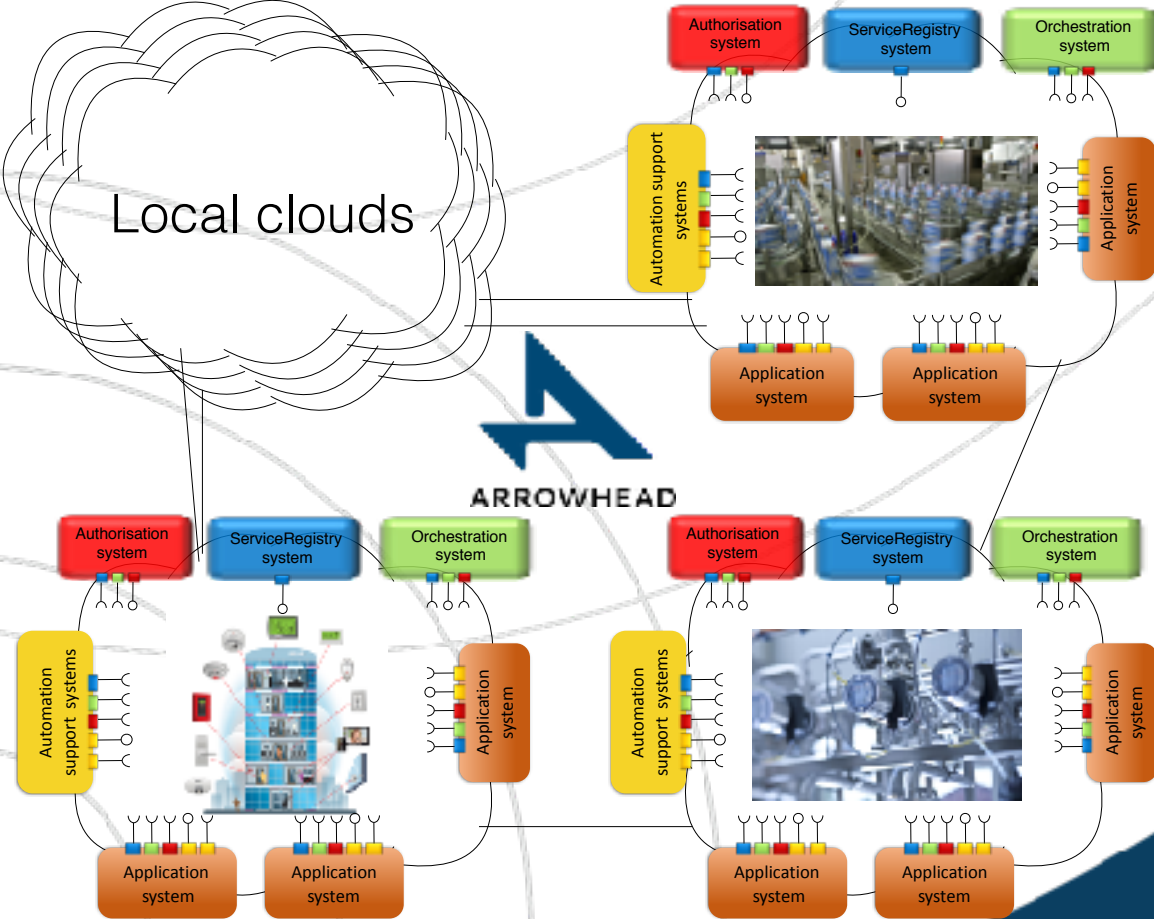


# Local cloud meeting automation requirements

- Automation is local
- Local clouds shall provide
  - A protective fence
    - Against external communication
  - Inter cloud service exchange
- Thus protecting sensitive automation operations as
  - Real time closed control loops
  - Safety critical operations



# Automation systems based on Arrowhead Framework



# Can we build Arrowhead automation systems today?

Robust communication

IoT sensors, actuators, PLC:s, etc.

DCS and SCADA functionality

MES and ERP functionality

Cloud integration technology

**Engineering tools cloud automation**

Test tools and simulators

**Migration to cloud automation**

Suitable security

➔ **Products on the market**

➔ **Some products on the market**

➔ **First products on the market**

➔ **First product on the market**

➔ **Some products on the market**

➔ **Demonstrated in industrial env.**

➔ **First products on the market**

➔ **Demonstrated in industrial env.**

➔ **Some products on the market**

## First idea of work content

- Requirements
- Integration to Legacy automation system engineering
- Work flow
  - Design time
  - Run-time
- Tools set and partitioning
- Tool architectures
- Integration approach/methodology OSCAL (Crystal)



# System of Systems services

## Arrowhead Framework SoTA

PlantDescription system

Configuration system

Authorisation system

Orchestration system



# System tools

## Arrowhead Framework SoTA

MMI-Orchestration  
MMI-Authorisation

Management tool  
TestTool



# Engineering of System of Systems automation

## Legacy tools

- Product design
- Manufacturing recipe
- Part supply
- Production infrastructure
  - Communication topology
  - Process design
  - Equipment location
  - Equipment capability/configuration

# Legacy tools - system services

## System services

- Codesys,
- Siemens Step7, DCS-7
  - TIA portal
- ABB Control builder, 800XA

# Legacy tools - Communication topology

Comm topology

Eplan-98,  
ElproCAD

Electrical wiring

AutoCAD  
Solidworks

# Legacy tools - Process design/Manf. recipe

ProDesign, PI&D      Process design

MES tools

Manufacturing recipe