

Systems of Systems Obstacles and Opportunities

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be
think
innovate

GRUNDFOS 

Quick bio:

33 years since graduation as an engineer, predominantly working for military customers (including SAAB Military Aircraft), spacecraft business, commercial aircraft, radar systems etc.

4 years with Grundfos, worlds largest pump manufacturer

25+ years of Senior engineering management + MBA.

Present challenge: “Digital products”.

More bio at <http://dk.linkedin.com/in/steenkhansen>



This presentation:

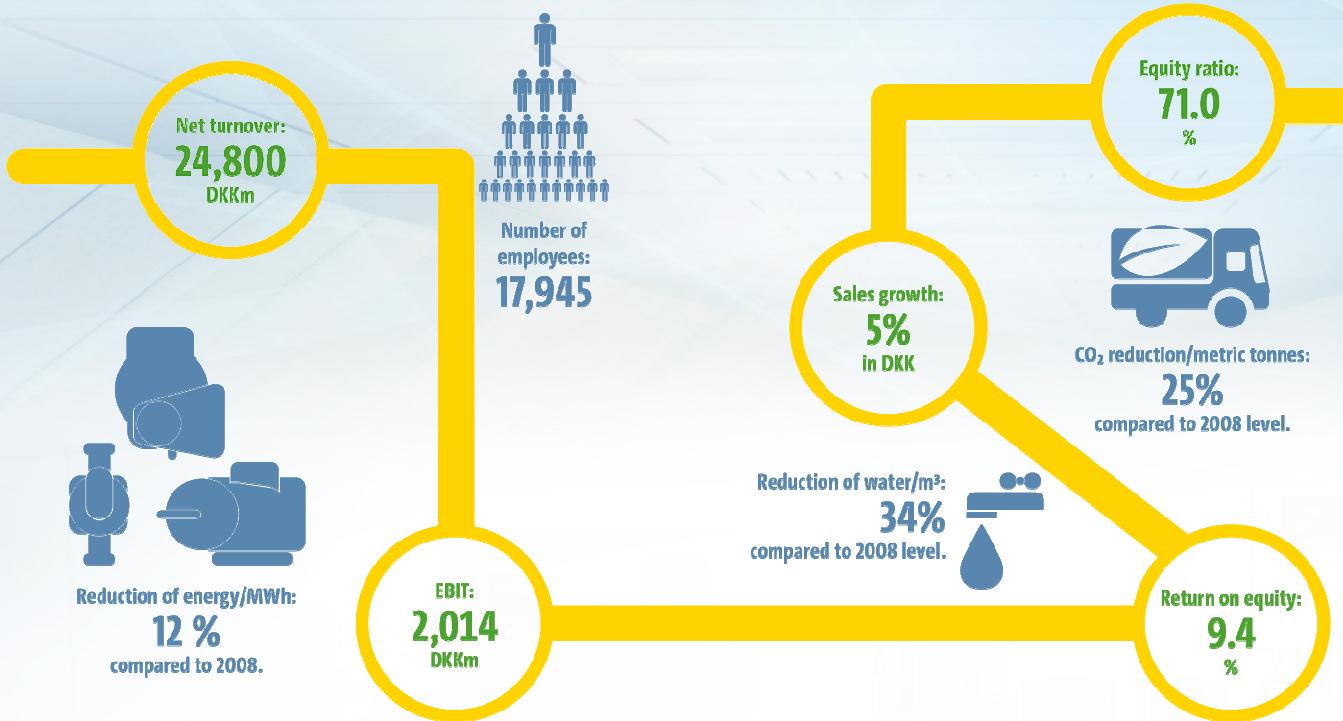
- Fast intro to Grundfos
- Going digital, problem domain
- How we address our challenges
- Hoping for your feedback

GRUNDFOS IN BRIEF

- The world's largest manufacturer of pumps and pump systems
 - Production and sale of electronic motors
 - Development, production and sale of electronics for the control of pumps and pump systems
-
- Social commitment
 - Environmental footprint
 - Profitable to remain in control



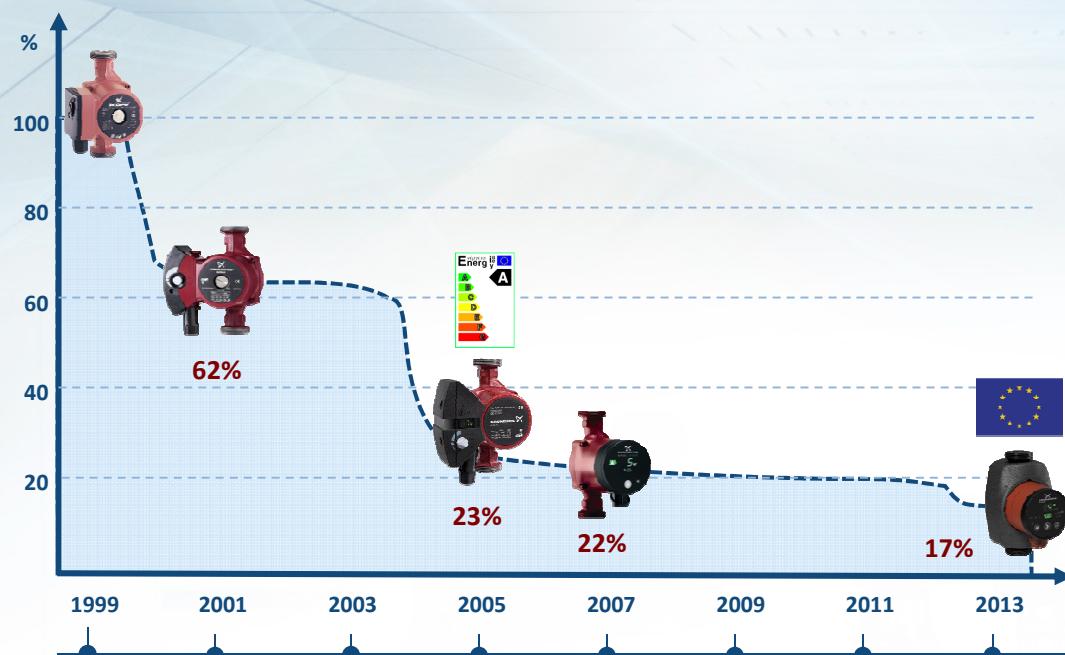
2015 Highlights



Typical products



ANNUAL REDUCTION OF ENERGY CONSUMPTION

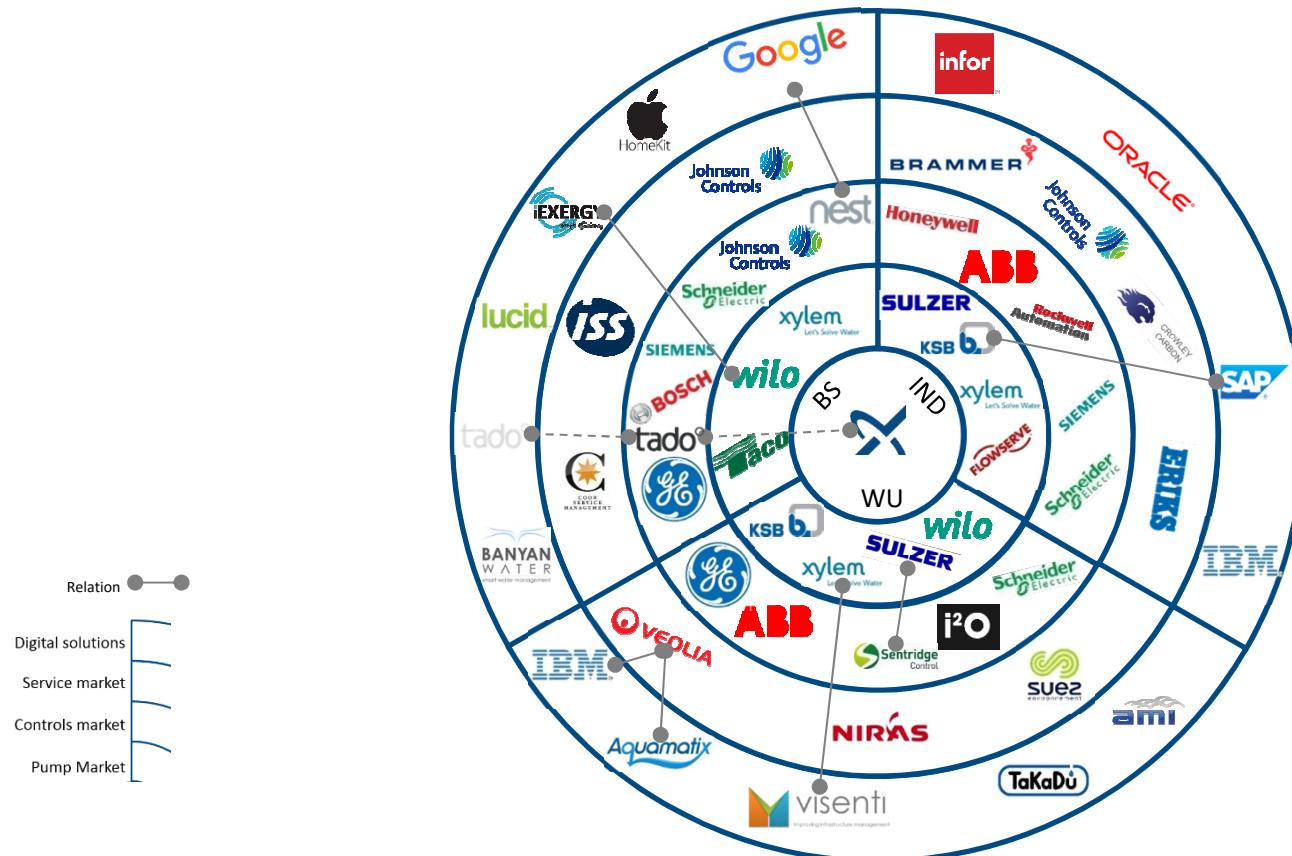


Grundfos pump competitors going digital

- Grundfos core and other pump competitors are not sleeping- **they are going digital too!**
- Business Digitization scope is broad but we see two main areas:
 - Digital business enablers- those are usually individual, simple digital products for improving the customer experience ; e.g. pipe selection online program (KSB), piping circulator app (KSB), through online mobile shopping (Xylem); Only on iTunes APP store we find 50+ apps related directly to pumps
 - More complex digital solutions; usually a combined hardware+ software+ service customer offerings such as e.g. The Flygt AquaView SCADA software and hardware package or dewatering solutions (both Xylem);



Pump industry is going digital, along with everyone else



"Competition within Digitalisation"

Key take-aways

- Pump companies are moving towards digital – **GF today following the market**
- Competitive situation is unique per BU
- New competitors will be met – with different backgrounds, starting points
- New market = new business model(s)
- New competitors are either experienced, or fast, or big
- We'll compete with our customers and suppliers
- Partnerships are happening, to speed up transition, along with investments in own resources

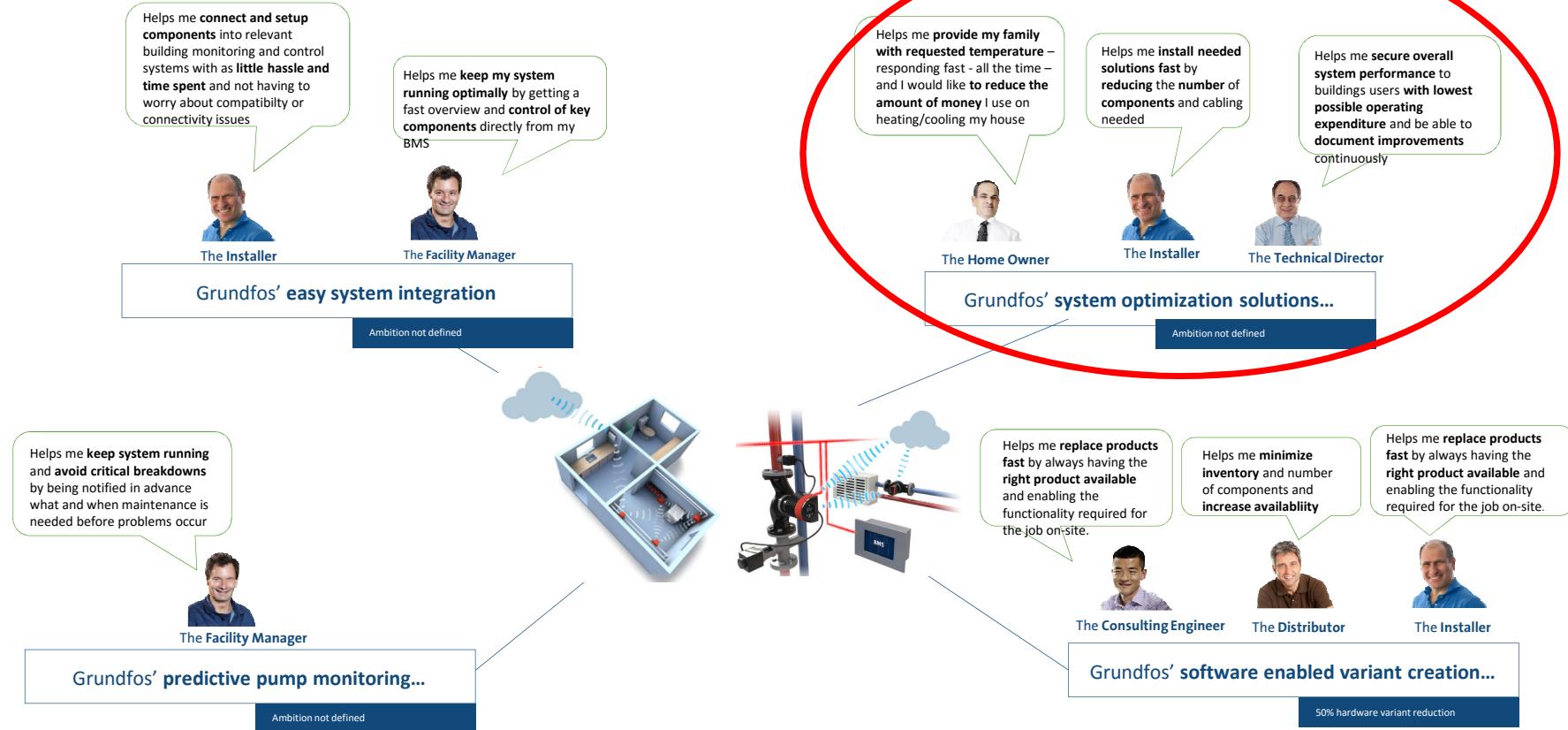
These categories are actually 4 different markets, and 4 different groups of players



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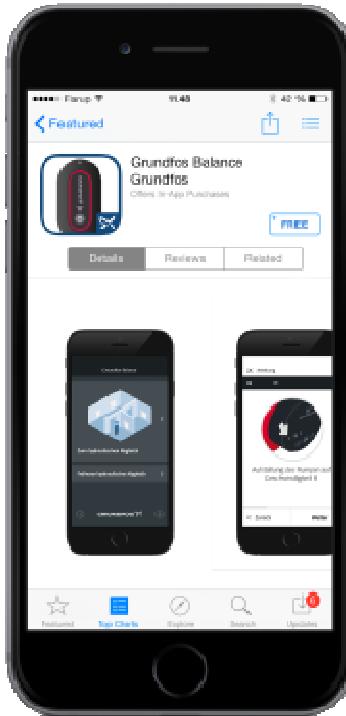
Circulator Product vision



Systems of Systems example (Blinke / UFH)

None of what is shown here is the product. All is only part of the product:

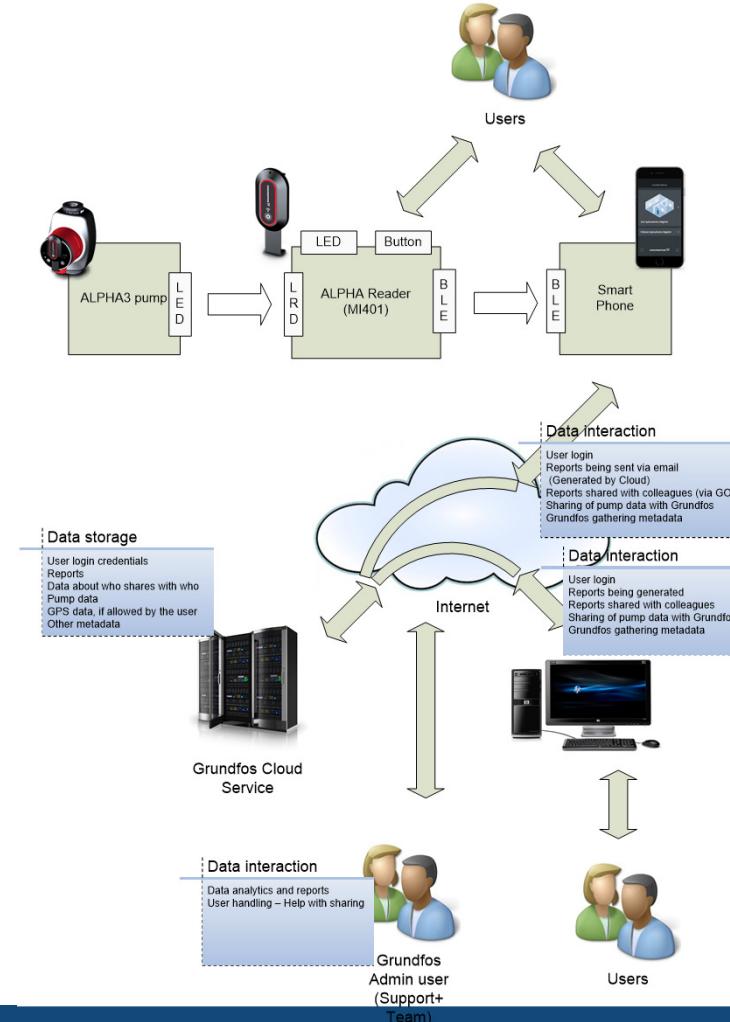
- ✓ House owner comfort
- ✓ Energy savings
- ✓ Ease of installation



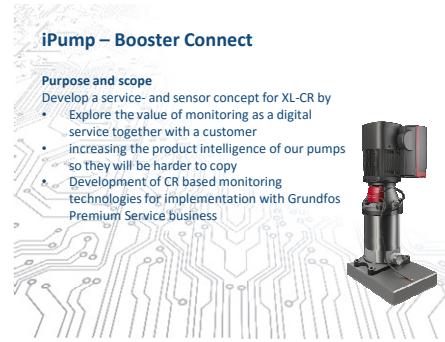
Systems of Systems example (UFH)

This constituents are:

- Product: The Alpha 3 pump
- System elements: GO Balance app, Alpha reader and IoT infrastructure
- Optical, wifi and bluetooth connections



World of Digital Projects in Grundfos/D&E/DSS

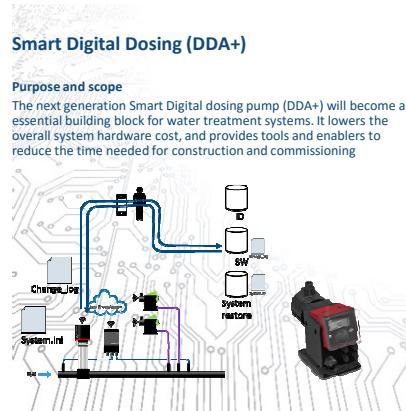
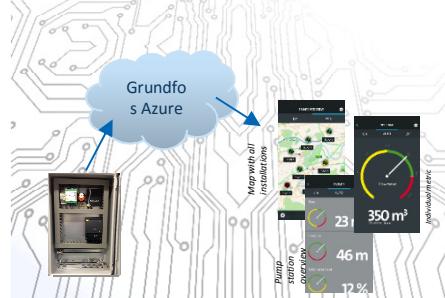


Irrigation Connect

Purpose and scope

Farmers need their crop to flourish – but have many concerns and problems. Remote monitoring can help.

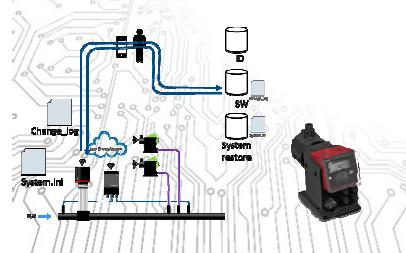
- Remote monitoring enabling them to only visit sites when needed
- Pumping at the most efficient times of day, with lowest costs and highest efficiency, through scheduling and efficiency monitoring
- Live monitoring of water consumption and better scheduling can lower water consumption
- Get alerts in off-power situations, and start up the pump remotely when the power is back online
- Continuous monitoring of efficiency means service is done at the right time, maintaining efficiency



Smart Digital Dosing (DDA+)

Purpose and scope

The next generation Smart Digital dosing pump (DDA+) will become an essential building block for water treatment systems. It lowers the overall system hardware cost, and provides tools and enablers to reduce the time needed for construction and commissioning

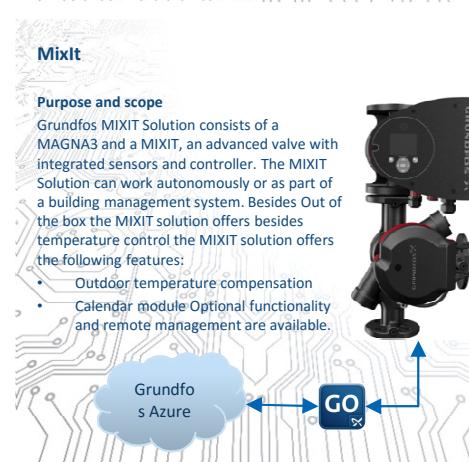


Chameleon

Purpose and scope

The purpose of the project is to explore the opportunities of Grundfos delivering a turnkey OEM system monitoring solution that our customers can brand and re-sell to their customers

- This will generate a new data-driven business and lead to unprecedented customer lock-in



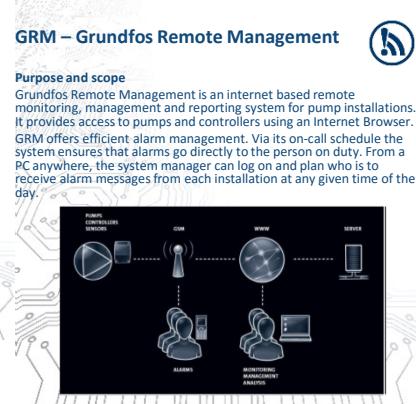
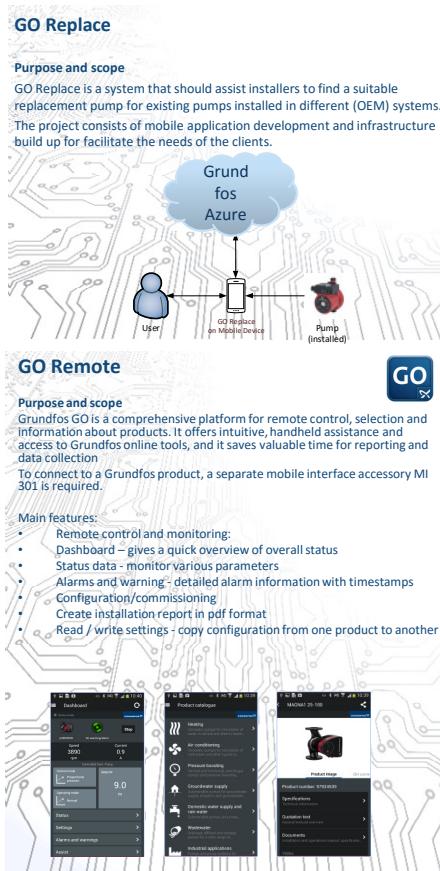
MixIt

Purpose and scope

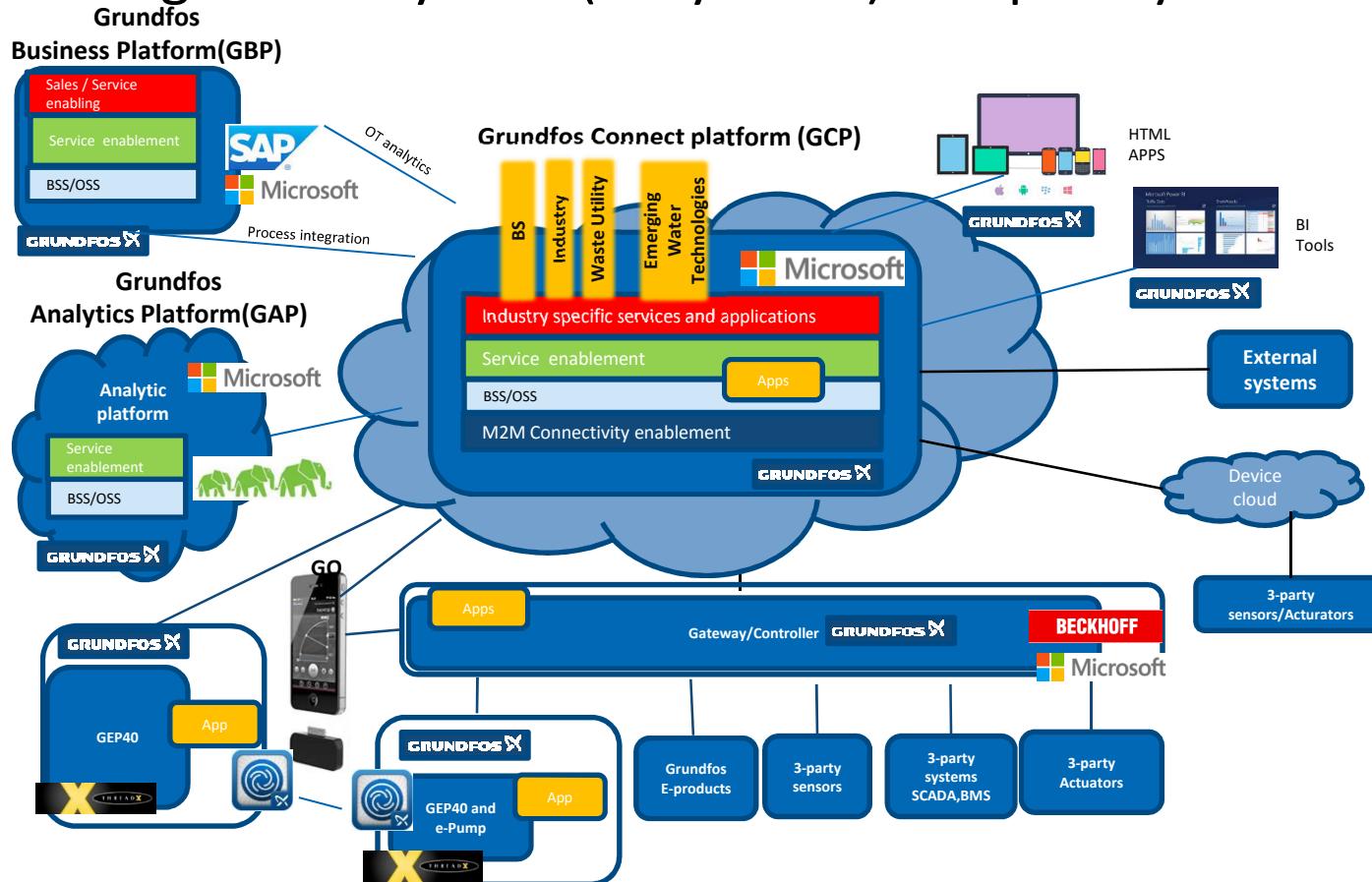
Grundfos MIXIT Solution consists of a MAGNA3 and a MIXIT, an advanced valve with integrated sensors and controller. The MIXIT Solution can work autonomously or as part of a building management system. Besides Out of the box the MIXIT solution offers besides temperature control the MIXIT solution offers the following features:

- Outdoor temperature compensation
- Calendar module Optional functionality and remote management are available.

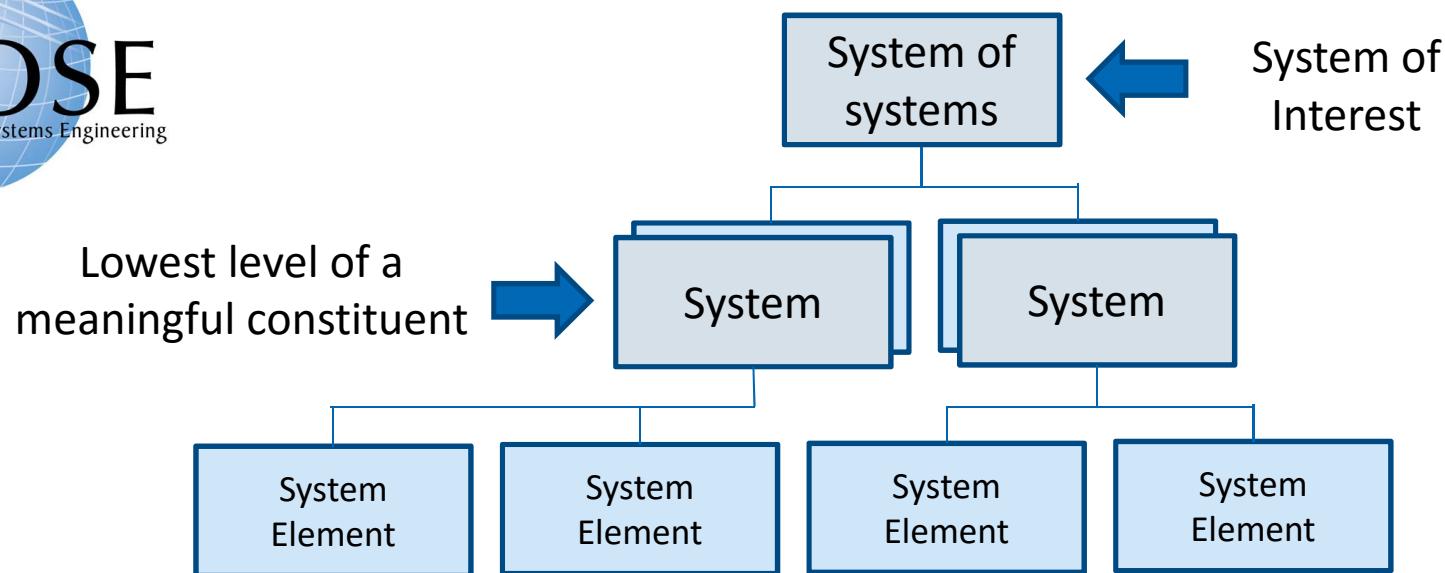
World of Digital Projects in Grundfos/D&E/DSS



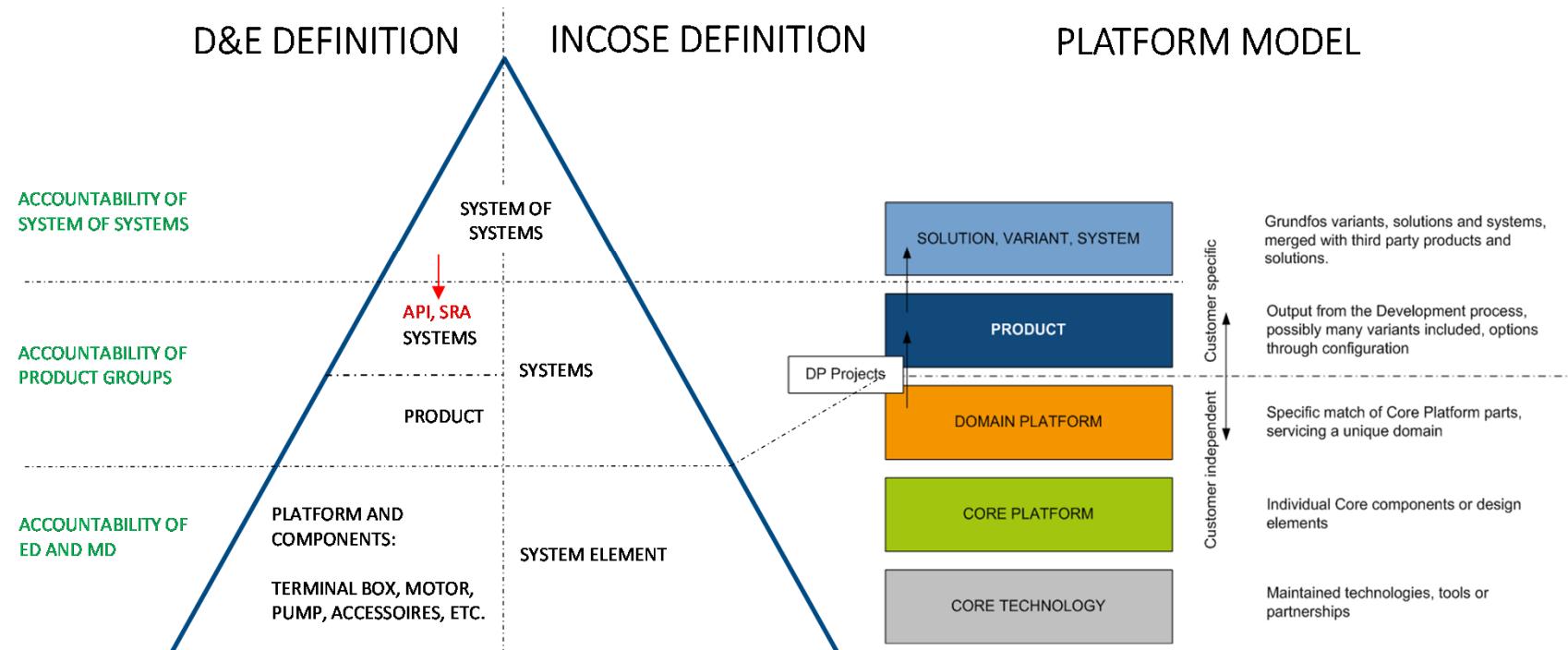
Grundfos Digital Eco system (of systems) complexity



Complexity...



D&E VERSUS INCOSE AND PLATFORM DEFINITIONS



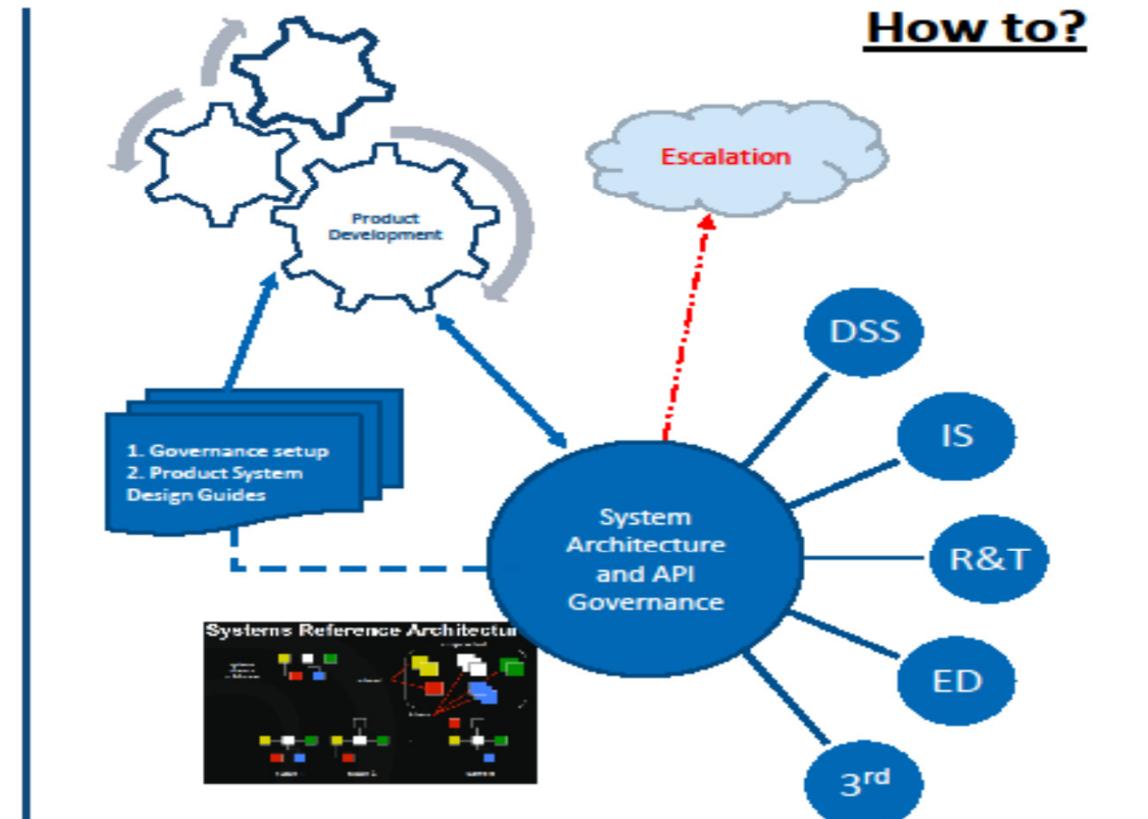
Architecture and API Governance

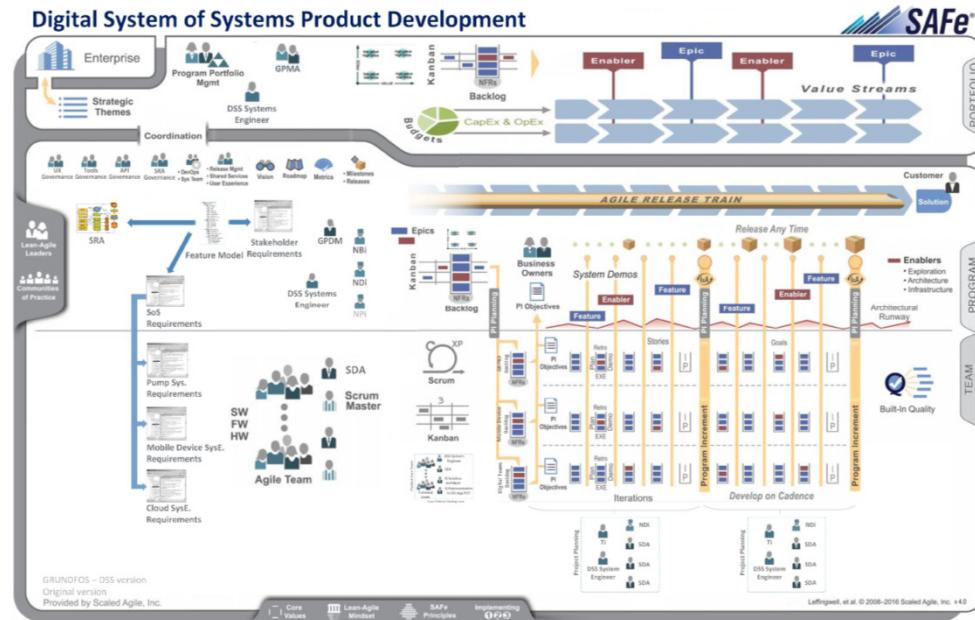
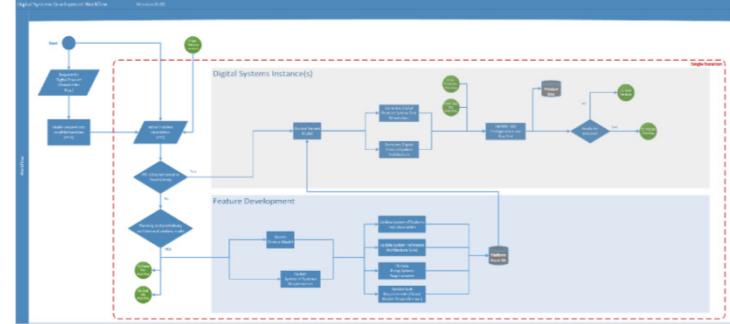
Objectives

- Streamlined architecture design and interface maintenance process
- Common language in architecture and interface design across the organization
- Defined tools set for architecture and interface management



How to?





SAFe model applied on Digital Systems of Systems Product Development

PORTFOLIO:

- Portfolio management together with GPMAs analyse opportunities and prioritize projects based on Value/Effort map and strategic decisions
 - DSS System Engineer provide technical support to help making portfolio decisions

PROGRAM (Product Development)

- Products are developed incrementally (iterative development)
 - GPDM, NDI, NBi, NPI, and DSS System Engineer plan the increments (Program Increments)
 - DSS System Engineer develop Feature Model, Requirement Specifications, and System Reference Architecture for the requested product

TEAM(s)

- Teams commit to Product Increments
 - Teams develop their own plans to secure on time deliveries
 - DSS System Engineer and the Teams work together to specify requirements for the pump system and/or system elements

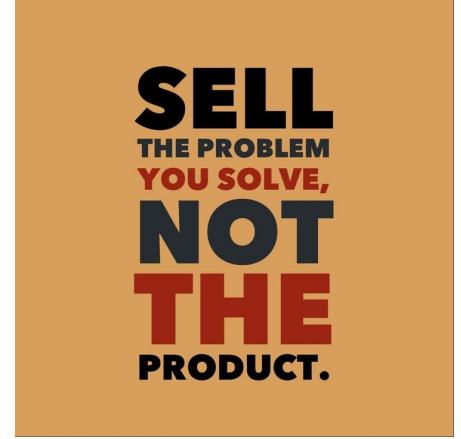
Systems of Systems challenges

Ecosystem: How do we make the right architectural choices, in a fragmented external ecosystem?

Is the right answer always, to be open and flexible? When do the costs of this exceed the benefit?

Strategy: How do we balance and prioritize on a strategy calling for action and risk taking, in unchartered waters?

Organization: Too much technology focus



**SELL
THE PROBLEM
YOU SOLVE,
NOT
THE
PRODUCT.**