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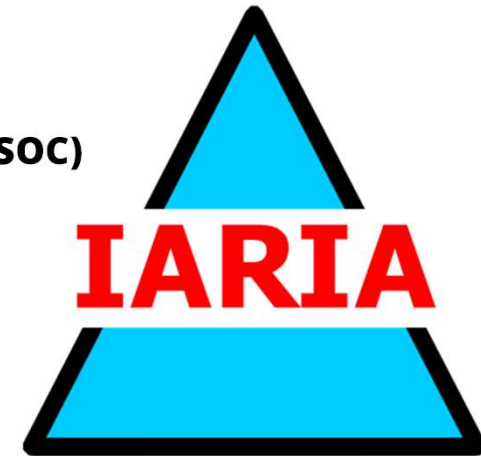
Software Engineering Excellence: The Backbone of Modern IT Service Management

Marko Jäntti (PhD., Docent), University of Eastern Finland, School of Computing (SOC)
Keynote speech at IARIA ICSEA event, Lisbon.



UEF// University of Eastern Finland

Green ICT from Eastern Finland
Vihreää ICT:tä Itä-Suomesta
VICTIS (A91631, ELY Centre)





About me (1/2)

- PhD., Docent, MSc. in Econ. & Bus. Adm.
- University Lecturer, Software Engineering
 - Design on Information Systems
 - Software Engineering
 - IT Service Management
- Work experience
 - 1.8.2023 – UEF SOC, University Lecturer
 - 19.3.2021-31.7.2023 Center for Measurement and Information Systems, director
 - 1.10.2001-18.3.2021 UEF SOC, Research Manager, Head of Research, Project Manager, University researcher etc.
 - 1.10.2000-30.9.2001 eHIT, Software Designer, trainee

ITSM



SE

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My research topics:

Digital Service Management	IT Service Management	IT Support
Software Engineering	Software Defect Management	Green ICT





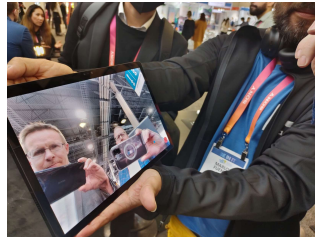
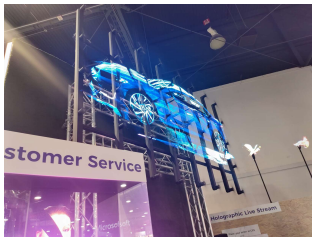
About me (2/2)



AWS Summit



CES 2023 in Las Vegas



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My certificates:

Software Engineering Professional Practice

- ITILV2 Foundation,
- ITILV3 Foundation,
- PRINCE2 Awareness
- ISO/IEC 20000 Auditor Requirements (FISMA),
- ITIL Service Transition,
- ITIL Service Strategy,
- ITIL Continual Service Improvement,
- ITIL Service Design,
- Scrum Master Training Course (Wakaru)
- Lean Six Sigma Yellow Belt 2018
- Certified Efecte Administrator 2018
- Certified Microsoft Innovative Educator
- Information Security ISO 27001 & ISO 27002 (KPMG)
- AWS Technical Essentials 2019
- ITIL4 Foundation,
- ITIL 4 Specialist: Create, Deliver and Support
- ITIL 4 Specialist: Direct, Plan and Improve

Proj.
Mgt

ITSM

Agile

Info
Sec

Cloud

Digital Innovation Hubs:





1. Introduction

- A Software Engineer's work has changed a lot in 25 years
- **Y2000:** A few main progr. languages (Java, C++, C, others) →
- **Y2025:** Explosion of languages, strong focus on cloud & web programming (JavaScript, Python, others), wide variety of tools (Github, Docker, Kubernetes), fast evolution of technologies

Personal Digital Assistant (PDA)



Azure services

Cloud services



Create a resource



Subscriptions



Carbon optimization



Stream Analytics jobs



Azure Data Explorer...



Sustainable IT?

Internet of Things (IoT)

Edge Computing

Blockchain

Metaverse

Extended Reality (XR)



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1. Introduction – Services Computing as a research field

IT Service Management

Services Computing

Software Engineering

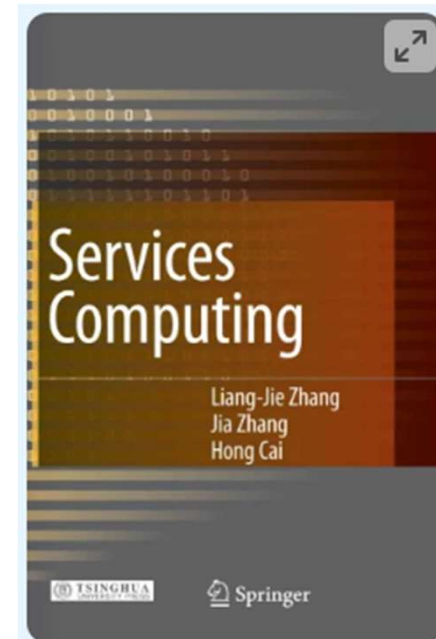
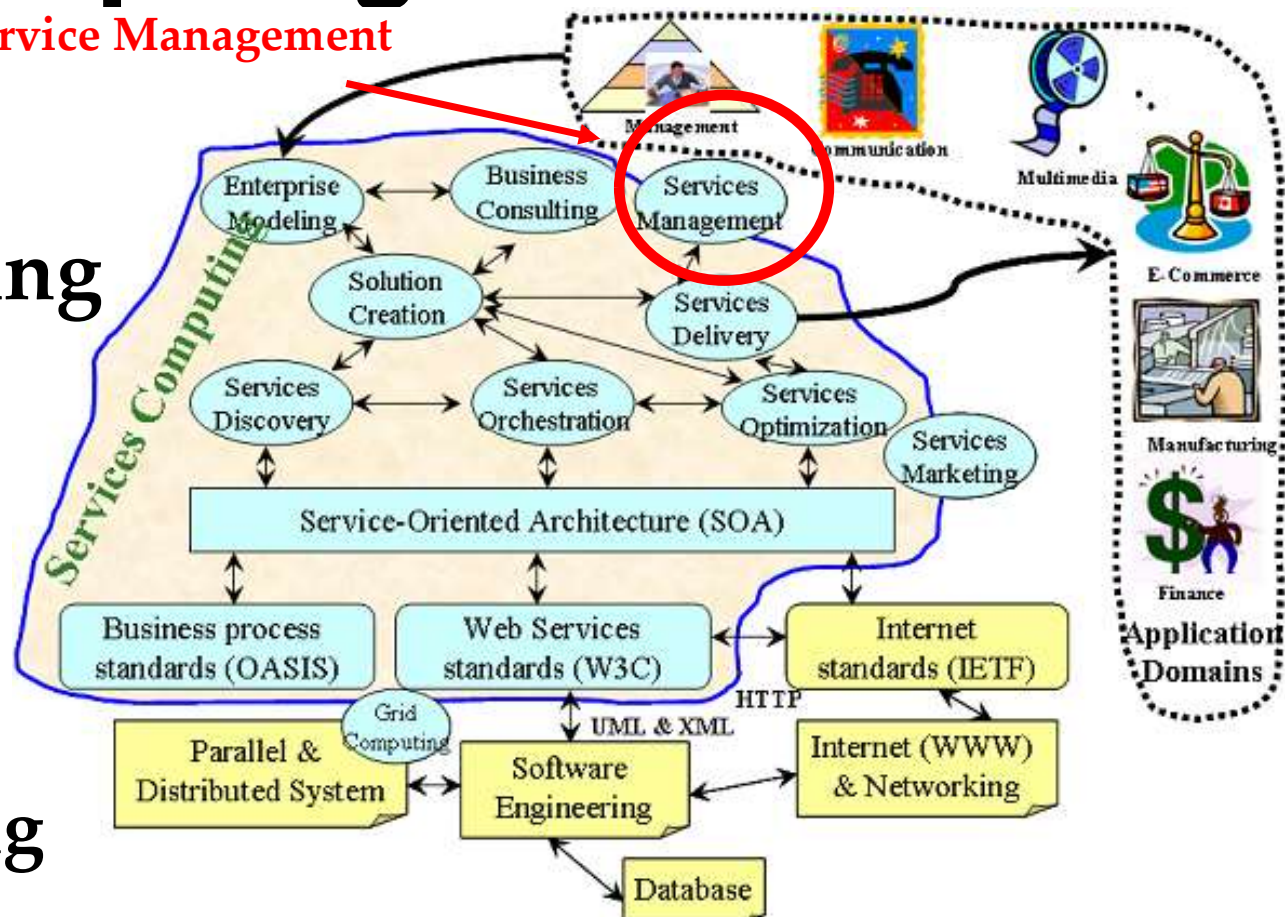


Figure: Services Computing book (<https://link.springer.com/book/10.1007/978-3-540-38284-3>)



1. Introduction – Benefits of IT Service Management

- Customer support
 - Less tracking of lost requests
 - Less angry phone calls from users & customers
 - Clear and more consistent classification & escalation rules
 - Well-documented permanent solutions and workarounds
- Service production
 - Less queries from customer support regarding the status of bug fixes
 - More time for building new features & properties
 - Decreased number of bug fixes to deliver



Software developer



1. Introduction – Benefits of IT Service Management

- Management and sales
 - Increased transparency of service production
 - More detailed and accurate information services and their utilization rate
 - Clear and up-to-date service descriptions



Happier sales staff



Happier CEOs



Happier Sustainability Managers

Cloud SaaS CO2 calculations

Summary of ITSM benefits

Increased Productivity & Transparency

Lower IT Costs

Improved Customer Satisfaction

Less Risks

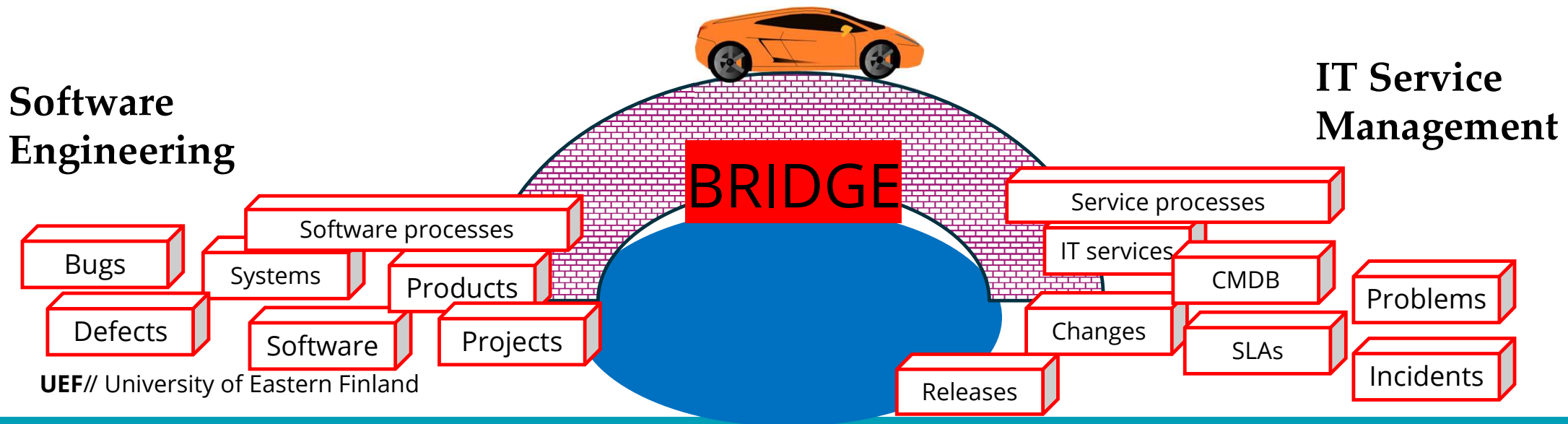


Everybody wins!!



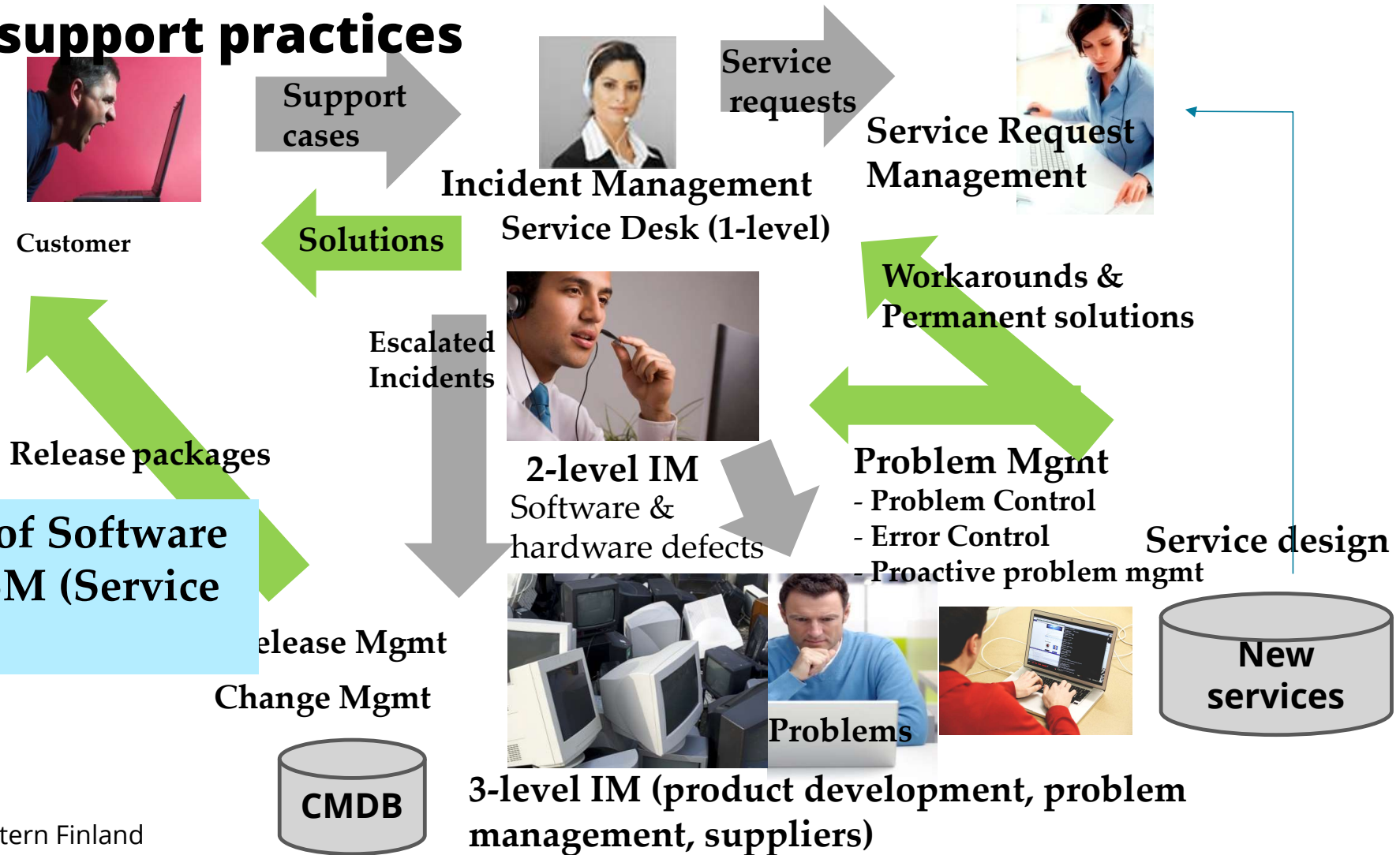
2. Bridging Software Engineering and ITSM

- **ITSM** is only as strong as the **systems** it manages
- High-quality engineering ensures scalability, maintainability, security, compliance of services and sustainability (**Green ICT**)
- Poor engineering -> Bottlenecks, outages & higher costs in service operation





2.1. Relationships between Software Engineering and ITSM support practices



What is the role of Software Engineers in ITSM (Service Support)?



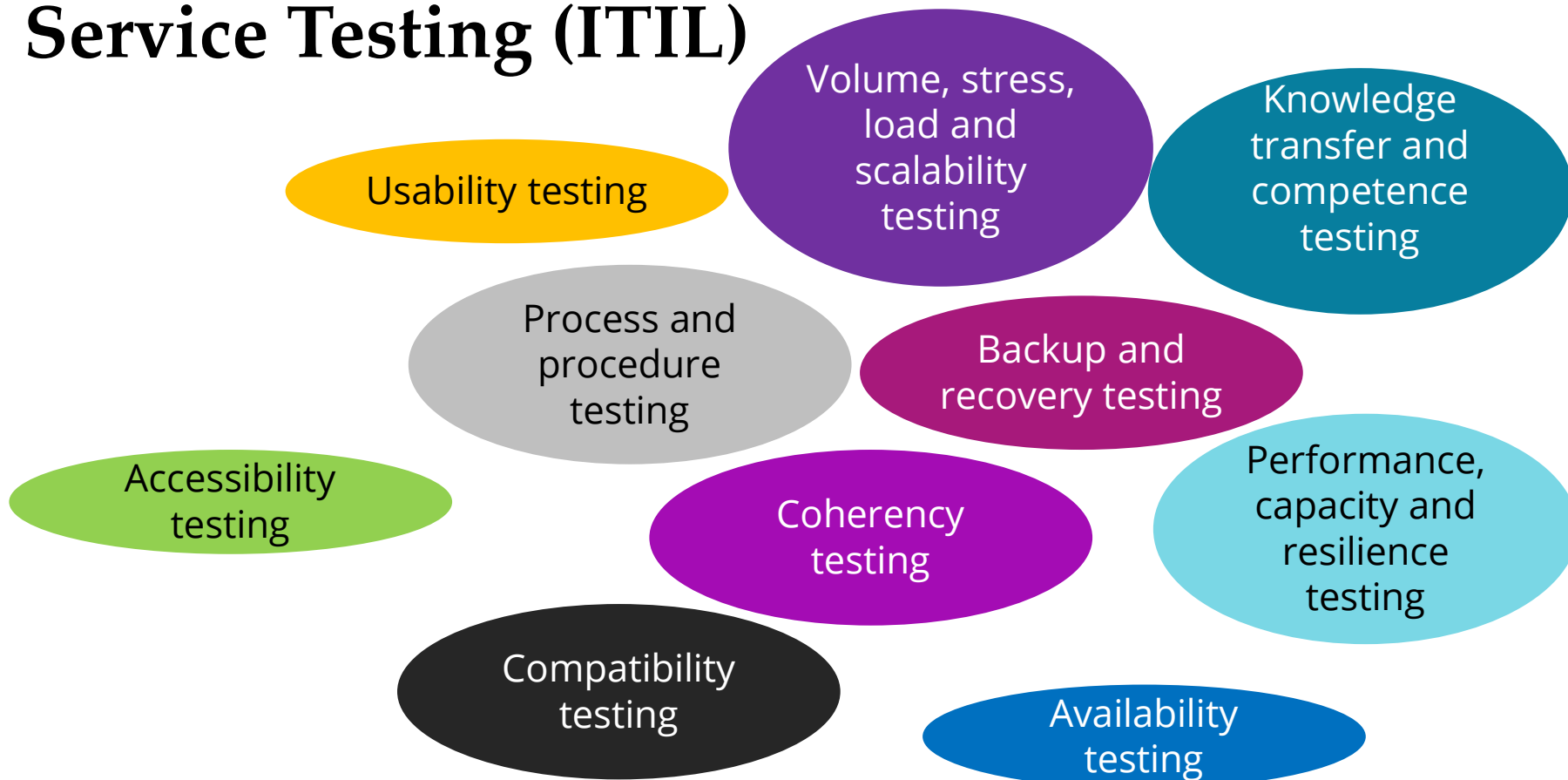
2.1. Relationships between Software Engineering and ITSM practices

- **Incident Management:** Quick resolution through root-cause-ready systems (product dev. = 3rd level IM)
- **Problem Management:** Produce engineering fixes, not just workarounds
- **Change & Release Management:** Build and deliver release packages
- **Knowledge Management:** Share best practices, reusable components
- **Service design and implementation** through software development lifecycle, increased sustainability of services through code optimization
- **Service Testing:** Use various types of software testing



2.1. Relationships between Software Engineering and ITSM practices

Service Testing (ITIL)





2.2. Why Software Engineering is not adequate for managing IT services?

Aspect	Software Engineering	IT Service Management (ITSM)
Focus	Building software systems	Delivering and supporting IT services
Primary Goal	Functional, scalable, maintainable code	Reliable, efficient, customer-focused service
Methodologies	Agile, DevOps, Waterfall	ITIL, COBIT, ISO/IEC 20000
Scope	Development lifecycle	Full service lifecycle: strategy to improvement
Stakeholders	Developers, testers, product managers	End users, service desk, operations, business



3. Software Engineering Excellence: the backbone of modern IT Service Management

- Software Engineering is “the application of a **systematic, disciplined**, quantifiable approach to the development, operation, and maintenance of software”.
- Service management is “the implementation and management of **quality IT services** that **meet** the **needs** of the **business**”.
- There are 3 main reasons why software engineering excellence is the backbone of modern IT service management
- Software Engineering Excellence makes ITSM
 1. **Systematic**
 2. **Agile & Scalable**
 3. **Holistic**



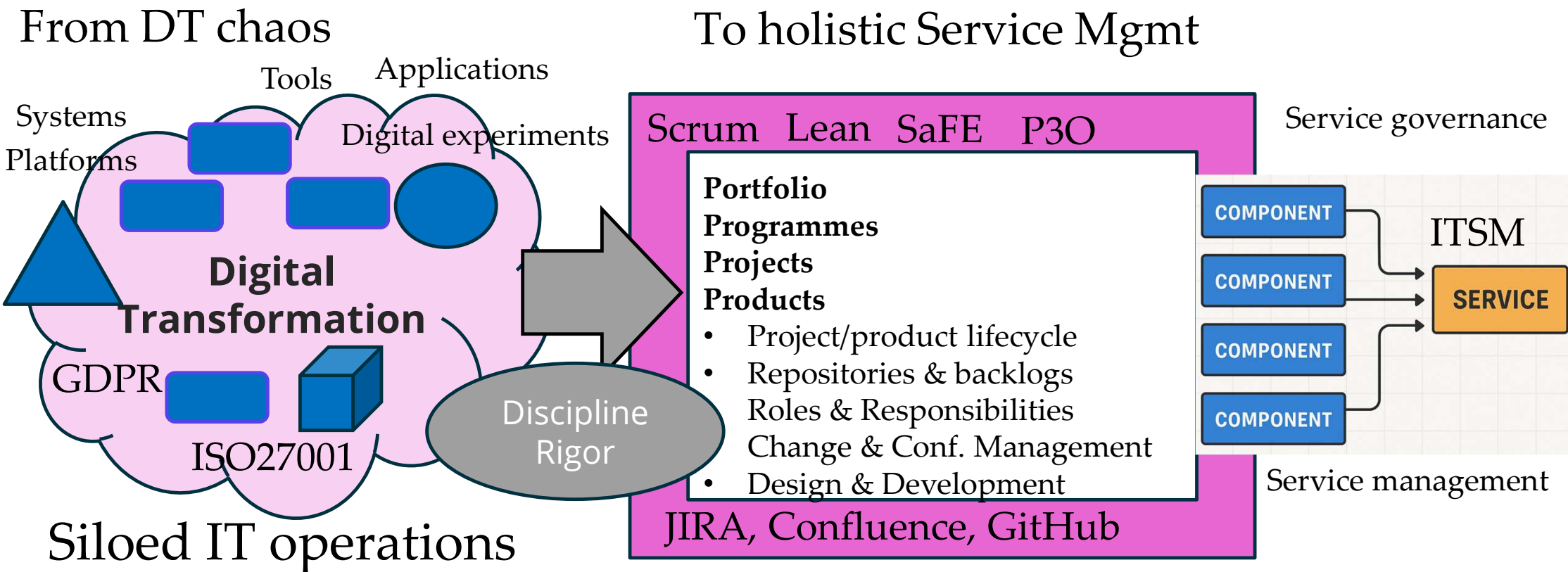
Engineering Excellence of Netflix¹:

- **Architectural excellence**
- **Culture of experimentation**
- **Scalable leadership (end-to-end ownership of services)**



3.1. Systematic approach (1/2)

- Software Engineering brings **discipline and rigor** to digital transformation and design, development & management of services





3.1. Systematic approach (2/2)



- **Discipline** refers to the **consistent application of best practices, standards, and processes**.
 - Mindset and behavior of developers and teams
- **Rigor** refers to the **thoroughness, precision, and analytical depth** with which software is designed, implemented, and validated.
 - Using formal methods, ensuring correctness, applying sound engineering principles.



ISO27001

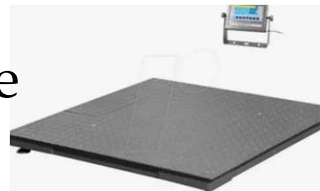
GDPR

Web
accessibility

NIS2

Sustainability

Rigor: Calibration of the smart scale



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3.2. Agile & scalable approach (1/2)

Project status?



- Agile software development approach enables success in Service Design / Development or Digital Transformation projects
- Several agile methodologies available (XP, Scrum, SaFE etc.)
- Scrum is a lightweight framework that
 - helps people, teams and organizations **generate value**
 - through **adaptive solutions** for complex problems.
- Key benefits in the context of service mgmt
 1. Increased transparency to service development
 2. Splits large projects into manageable tasks

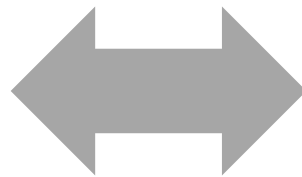


Schwaber, K. and Sutherland, J. (2020) The Scrum Guide - The Definitive Guide to Scrum: The Rules of the Game



3.2. Agile & scalable approach (2/2)

- Agile addresses facing uncertainty
- "Welcome changes, we are living (=developing software) in a **VUCA** world!!!"
- **Agile + Scalable:** Software engineers play a crucial role in planning scalability of systems (f ex. architecture that supports scalability)



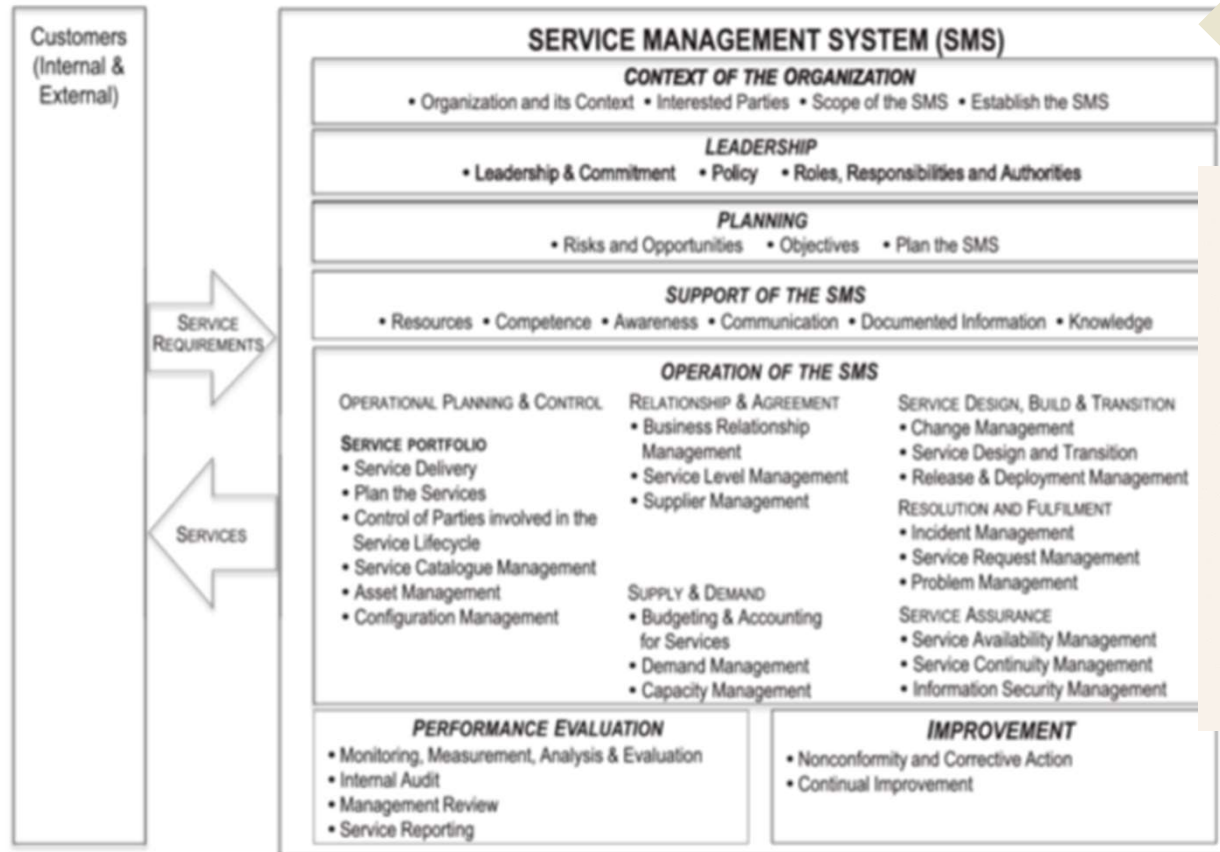
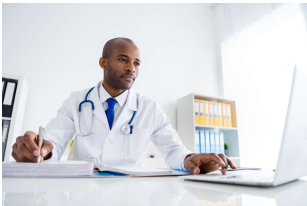
VUCA = Volatile, Uncertainty, Complexity, Ambiguity



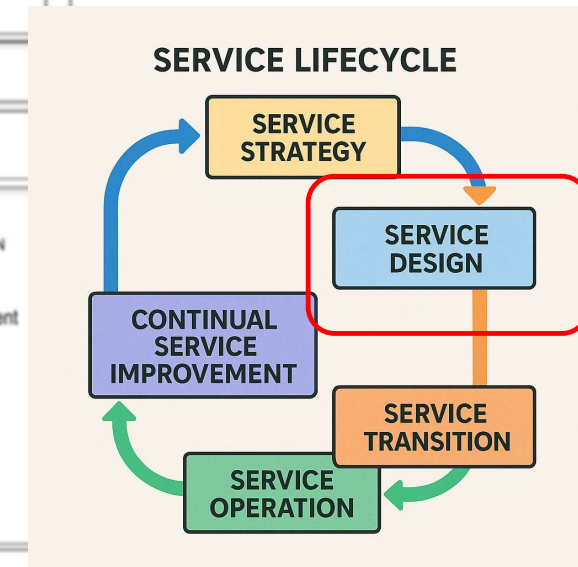
3.3. Holistic approach

Engineering excellence supports a shift from siloed IT operations to holistic service management. **Figure 1 – Service management system**

Service users



Other management systems (e.g. ISO 14001 env mgmt)





4. Case: Creating a tank level monitoring service for a forest machine operator with agile software development approach



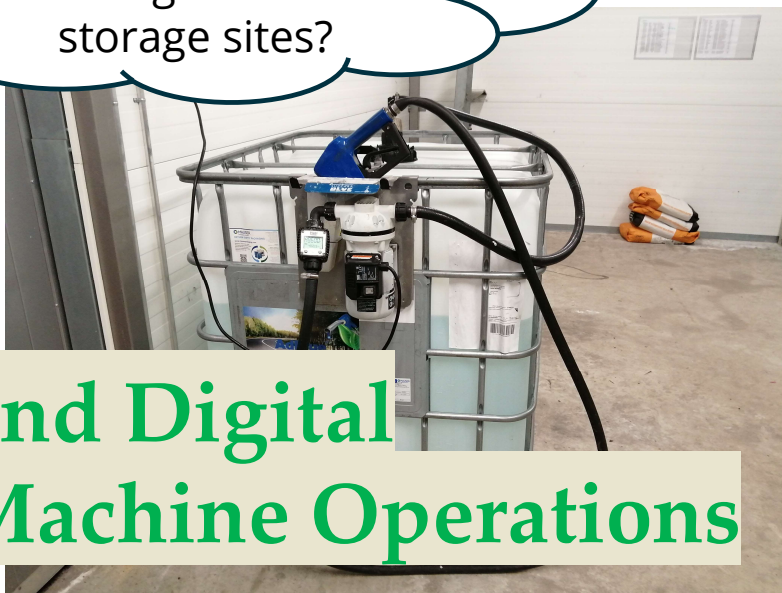
4.1. Requirements

How many litres of marking dye we have in remote storages?

Could we minimize traveling to remote storage sites?



"Monitoring of liquids has been challenging, especially in remote storages. We would like to monitor them remotely to ensure that there is enough stuff for the machines. If we lack critical liquids, the machines cannot get into the forest," the CEO of Motoajo.



**Green and Digital
Forest Machine Operations**



The marking color is used to indicate different types of timber.



4.1. Requirements

- The project team gathered requirements by
 - interviewing Motoajo's employees
 - visiting the main warehouse & remote warehouses (fall, winter)
 - getting familiar with the different types of containers
 - gathering additional information about Motoajo's operational processes,
 - having discussions with several sensor manufacturers





4.2. Design and Development

- Trial handbook (part 1) to EU project coordinator (1.-15.11)
- User stories (19.11.2021)
- Tech specification & purchase of IoT sensors (November)
- Development of mobile application (2 sprints), IoT dashboard, configuration & coding
- Delivery of tank level sensors to Motoajo (22.12)
- UI Design review (5.1.2022)

Etäisyys nesteen pintaan säiliön ollessa TYHJÄ (cm)

100

Etäisyys nesteen pintaan säiliön ollessa TÄYSI (cm)

5

Annetaan "neste vähissä" -ilmoitus, kun säiliössä on jäljellä %

30

Annetaan "neste loppu" -ilmoitus, kun säiliössä on jäljellä %

5





4.2. Design and Development

The Nerviot service was acquired from Secora Oy for the collection of IoT data from the containers.

IoT Data Browser

Show 25 entries

Search:

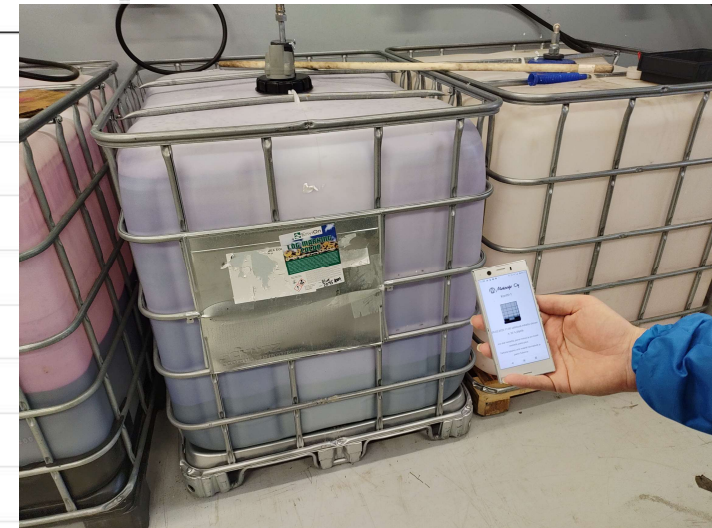
Copy

CSV

Excel

Device	Date	Key	Value
Joensuu Hydraulioljy 2EDB	12.02.2022 15:48	distance	65
Joensuu Hydraulioljy 2EDB	12.02.2022 15:48	temp	18
Joensuu Hydraulioljy 2EDB	12.02.2022 15:48	rss	-116
Nurmes väri sininen 32DD	12.02.2022 21:39	rss	-115
Nurmes väri sininen 32DD	12.02.2022 21:39	temp	25
Nurmes väri sininen 32DD	12.02.2022 21:39	distance	77
Joensuu Hydraulioljy 2EDB	12.02.2022 22:26	distance	65
Joensuu Hydraulioljy 2EDB	12.02.2022 22:26	temp	18
Joensuu Hydraulioljy 2EDB	12.02.2022 22:26	rss	-114
Nurmes väri sininen 32DD	13.02.2022 03:33	rss	-95

Risk management:
Global supply chain challenges affected availability of IoT components





4.3. System testing

Table 3: Calibration of sensors



Test case input	Expected result	Actual result	Deviation	Notes												
Create a new container Product code <u>Tuotekoodi</u>, Product name <u>tuotenimi</u> Product info <u>Tuoteinfo</u> Link product to the test company <u>Minkä yrityksen alle tulee</u> Volume of container: 1500 liter Luo uusi laatikko tai säiliö * Laatikon tai säiliön nimi tai yksilöllinen koodi	New container exists in database	New container created <table><tr><td>Laatikon koko</td><td>Muu</td></tr><tr><td>Säiliön tilavuus, litraa</td><td>1500 l</td></tr><tr><td>Sisältää nestettä</td><td>Olut - Karhu</td></tr><tr><td>Anturin url</td><td>Ei määritetty</td></tr><tr><td>PIN-koodi asetettu</td><td>Kyllä (<u>Väläytä laatikon PIN</u>)</td></tr><tr><td>Kuuluu varastoon</td><td>Aika_dih_kajaani Kajaani, 34433 Kajaani</td></tr></table>	Laatikon koko	Muu	Säiliön tilavuus, litraa	1500 l	Sisältää nestettä	Olut - Karhu	Anturin url	Ei määritetty	PIN-koodi asetettu	Kyllä (<u>Väläytä laatikon PIN</u>)	Kuuluu varastoon	Aika_dih_kajaani Kajaani, 34433 Kajaani	Unique id was not linked correctly to a <u>company</u> in system admin vie	Ok
Laatikon koko	Muu															
Säiliön tilavuus, litraa	1500 l															
Sisältää nestettä	Olut - Karhu															
Anturin url	Ei määritetty															
PIN-koodi asetettu	Kyllä (<u>Väläytä laatikon PIN</u>)															
Kuuluu varastoon	Aika_dih_kajaani Kajaani, 34433 Kajaani															

System testing revealed some improvement areas in the system:

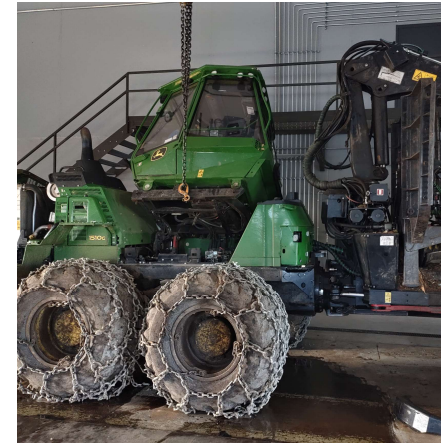
- The system should inform the user about a password that is too short.
- A customer should not be able to view other customer's containers



4.4. Deployment

- Three tank level sensor modules were deployed to Motoajo.
- Motoajo can use information from tank level sensors
 - to make informed decisions about when to order more fluids and
 - to ensure the availability of fluids for the machines.
- The service also enables **significant CO2 savings** due to reduced traveling to remote sites
- Motoajo has identified several further improvement ideas and extension points for IoT-based monitoring (e.g. waste recycling)

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Motoajo is part of Green ICT project VICTIS





4.5. How Software Engineering skills enabled success in service development?

- **Multiple requirements gathering techniques** were applied and provided a rich view of the business environment of the service.
- **Agile approach** enabled us to focus on **value** and deliver the service in time & within budget despite the changes in monitoring target.
- **System testing** with good old test cases improved the quality of the service.
- **AWS cloud** provides scalability



Figure: Celebrating a project milestone: the first tank level sensor has been deployed



6. Conclusion

Software Engineering Excellence

1. Brings rigor and discipline to service development & management
2. Provides agile mindset (complex projects split into sprints & tasks, changes welcome)
3. Ensures holistic, reliable, end-to-end service management

Transforms ITSM from a reactive support function into a proactive, strategic enabler of digital transformation.



**Everybody
wins!!**

Thank you! Questions / Comments?

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 University of Eastern Finland



**We are in the middle
of knowhere. UEF.**



Euroopan unionin
rahoittama
Funded by
the European Union

