UNIVERSITY OF TWENTE.

ADVANCING RESILIENCE IN LOGISTICS USING SMART IOT PALLETS

J.P.S. PIEST (SPEAKER), R.H. BEMTHUIS, M. KOOT, M.E. IACOB

INVITED TALK – 1ST AREADS WORKSHOP

IN CONJUNCTION WITH THE 32ND INTERNATIONAL CONFERENCE ON ADVANCED INFORMATION SYSTEMS ENGINEERING (CAISE)

OUTLINE

STRUCTURE AND CONTENTS

- Resilience in logistics
- Architecture for situation aware smart logistics
- Smart IoT pallets and scenario
- Advancing resilience
- Discussion

RESILIENCE

INTRODUCTION AND DEFINITION

- Resilience is emerging research area and relevant topic
- Multidisciplinary and multidimensional concept
- Gaining attention in IS research
- For this presentation, resilience is defined as the:
  - “capability of an element to return to a pre-disturbance, stable state after a disruption”
  - “ability to sense, recognise, adapt and absorb variations, changes, disturbances, disruptions and surprises”

Bhamra, Dani & Burnard (2011), Hollnagel et. al. (2006), Holling (1973)

MOTIVATION

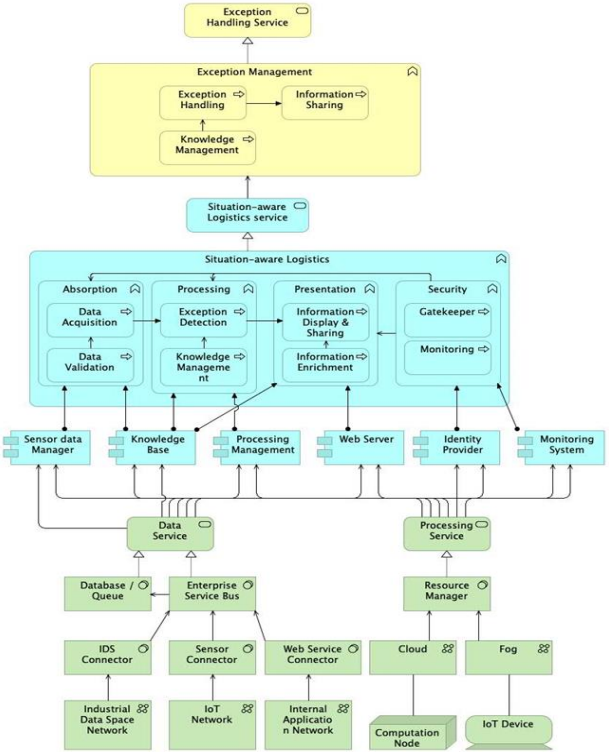
ADVANCING RESILIENCE IN LOGISTICS

- Disruptions and exceptions are important risk sources in logistics
- Need for situation-aware information systems and decision making
- IoT is capable of real-time monitoring and exception detection
- Enhancing and linking IoT data with internal and external data sources
- Taking available knowledge and detection by users into account
- **Goal:** achieving system-wide resilience

EARLIER WORK

ARCHITECTURE FOR SITUATION-AWARE SMART LOGISTICS

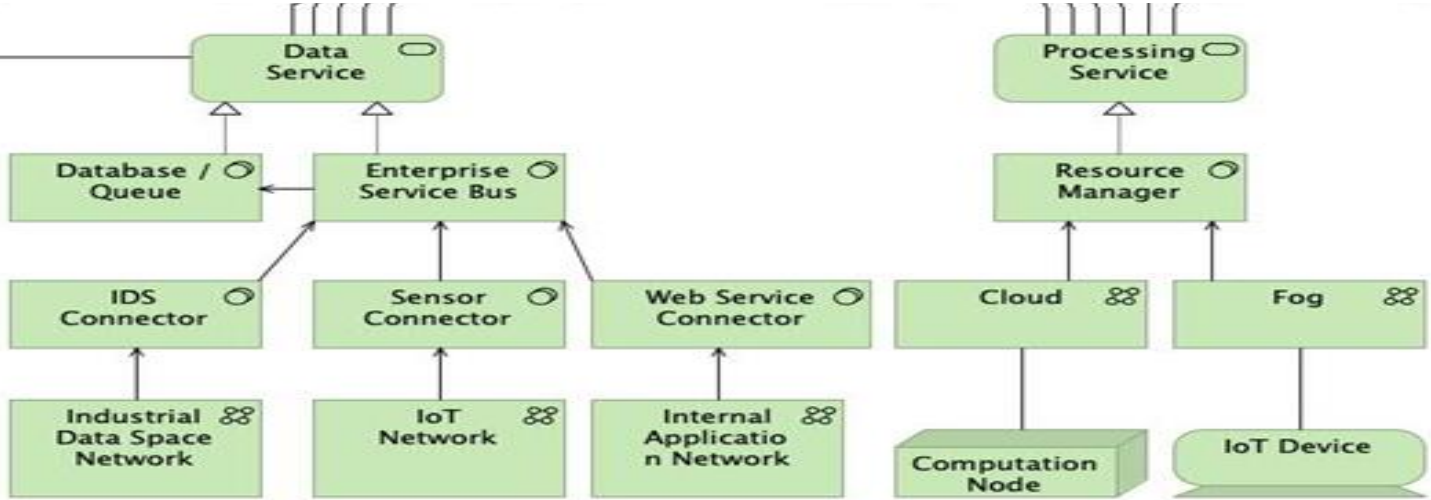
- <u>Layered viewpoint:</u>
  - Business processes
  - Application
  - Technology
- <u>Detailed viewpoints:</u>
  - Exception management functions
  - Case study for validation
  - Information system prototype



M. Iacob, G. Charismadiptya, M. van Sinderen and J. P. S. Piest (2019)

EARLIER WORK

ARCHITECTURE FOR SITUATION-AWARE SMART LOGISTICS



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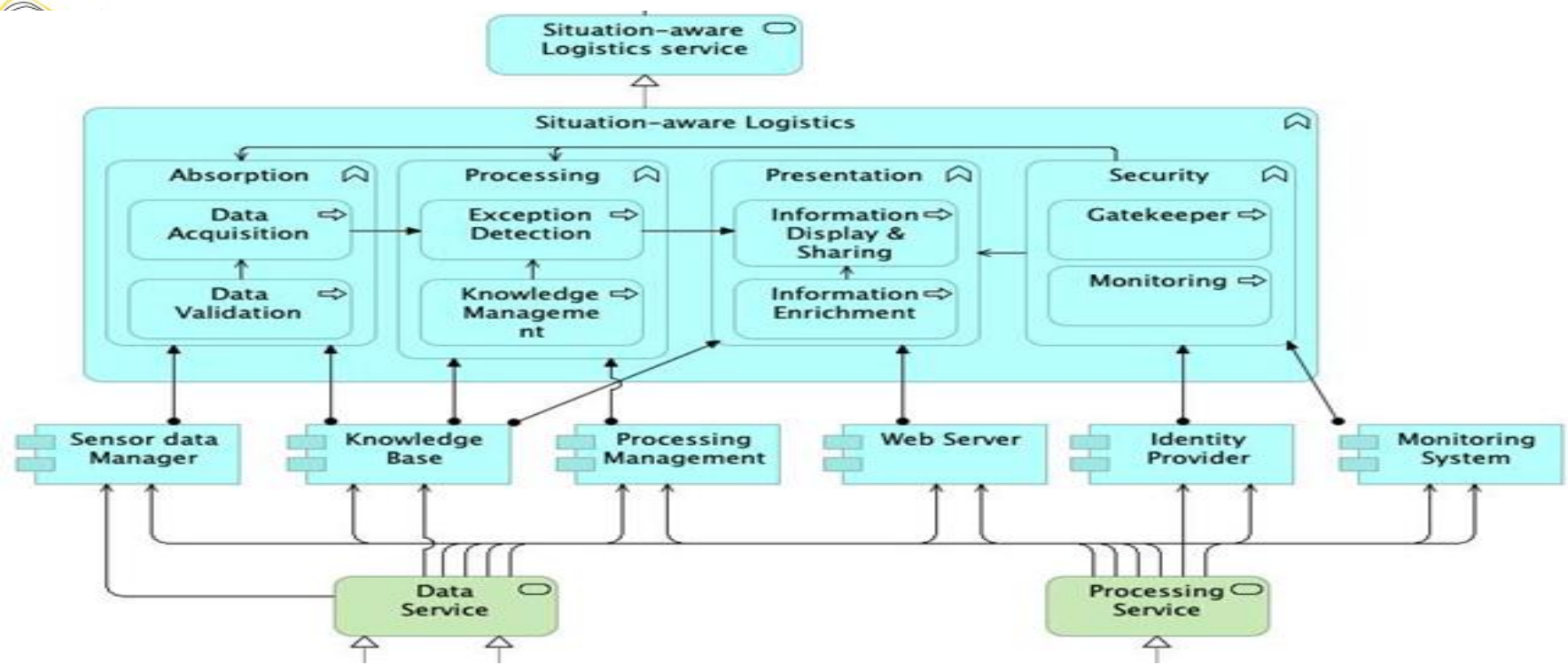

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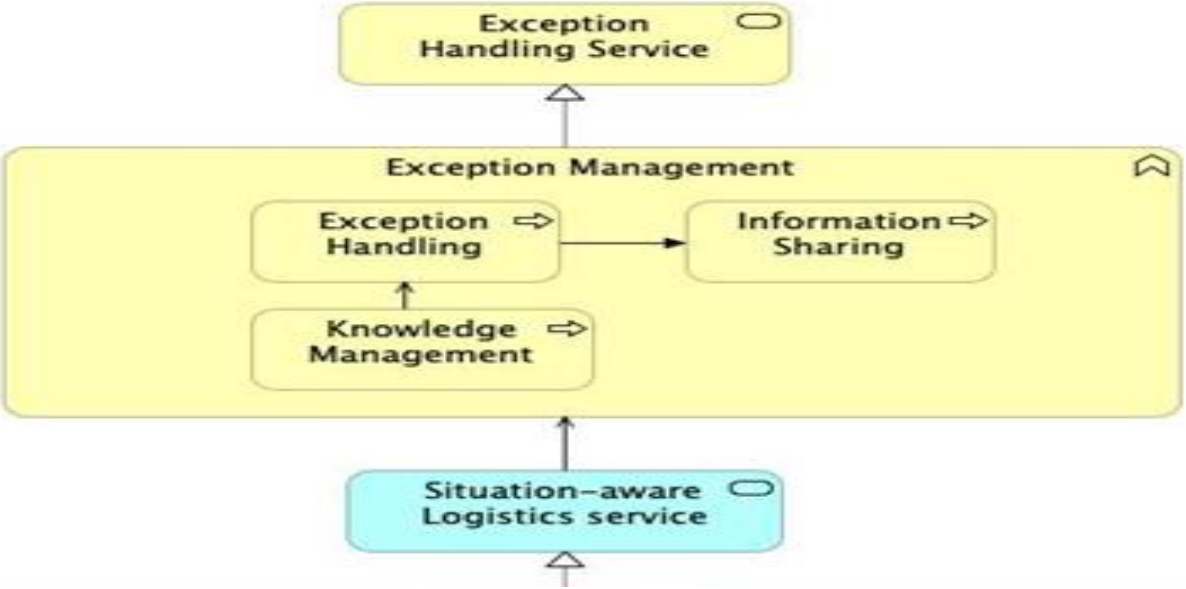

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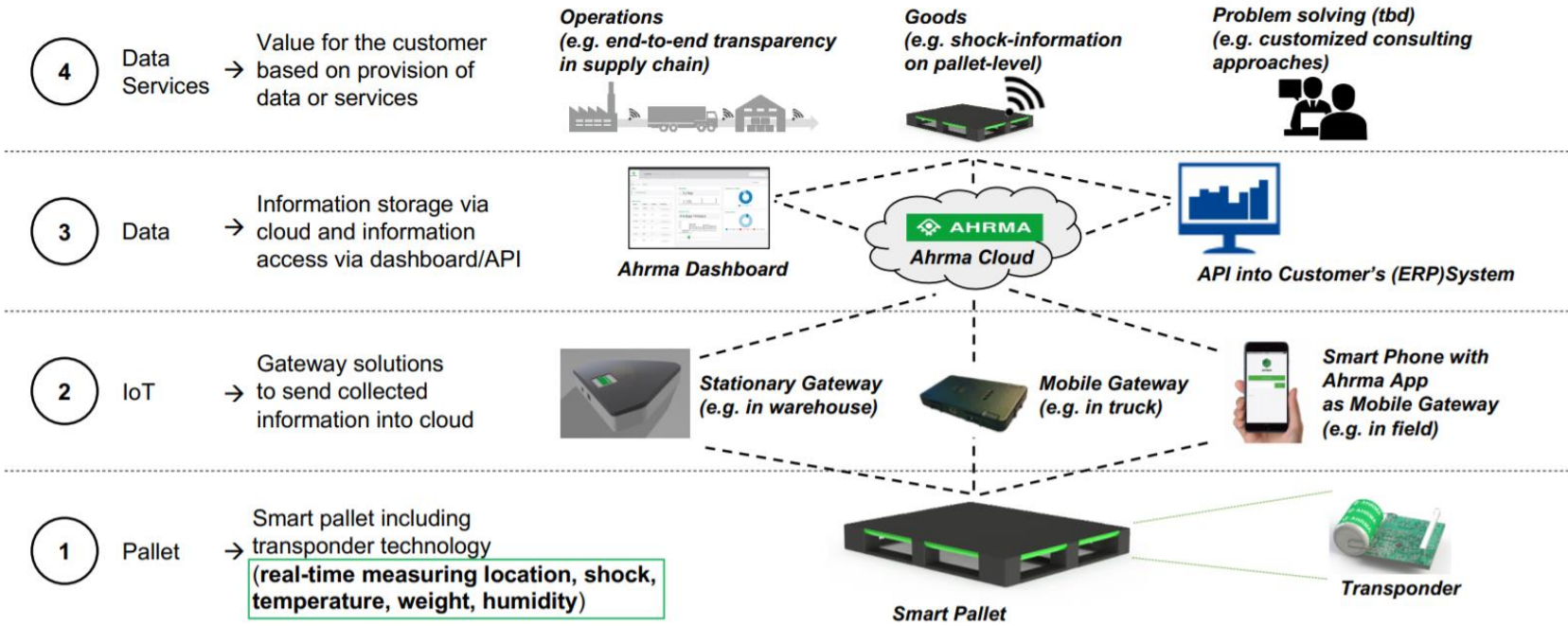
CURRENT WORK

IN THE DATAREL RESEARCH PROJECT

- Experiments and testing in real-life situations:
  - Multi-actor business process in logistics: product recall
  - Systems integration for real-time data streaming: condition monitoring
- Improve functionality and usability of the architecture:
  - Storage of historical data for data analytics and -mining
  - Connectors for ERP integration and APIs for third parties
- Incorporation of artificial intelligence:
  - Capture ‘situational data’: temperature, humidity, pressure, shock, …
  - Usage of machine learning and deep learning techniques
  - Enhanced decision making based on intelligence amplification

SMART IOT PALLETS

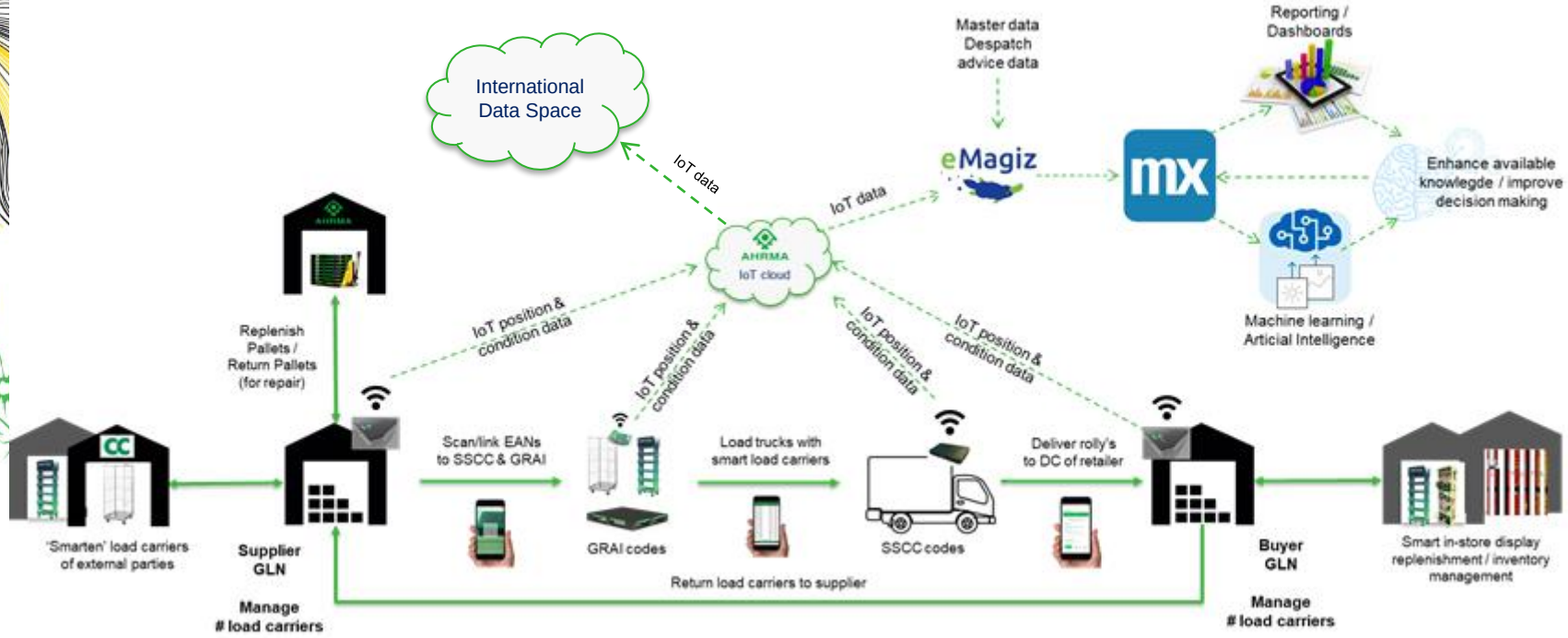
AHRMA'S SMART PALLET, IOT TECHNOLOGY AND DATA SERVICES



Sourc: Ahrma Infographic, http://ahrmagroup.com/downloads/ahrma_infographic.pdf

SCENARIO

ADVANCING RESILIENCE IN LOGISTICS WITH SMART PALLETS



THOUGHTS ON ADVANCING RESILIENCE

HOW SMART IOT PALLETS CONTRIBUTE TO RESILIENCE IN LOGISTICS

- Using Smart IoT Pallets extends the data coverage in the supply chain
- IoT actively transmits events, barcoding / RFID are passive
- IS contributes to resilience:
  - Faster exception detection
  - Event processing and presentation in context
  - Information sharing with supply chain partners and 3rd parties
- Individual and organization resilience for response and readiness

FUTURE WORK

WHAT ARE THE NEXT STEPS FORWARD?

- Assessment and modelling of resilience in enterprise architectures
- Development of demonstrator based on IDS for secure data sharing
- Deployment of business logic and –rules: edge, fog and/or cloud
- Algorithms for event detection, prediction and decision support
- Measurement of intelligence amplification

DISCUSSION

PLEASE SHARE YOUR THOUGHTS AND ASK YOUR QUESTIONS

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