SERVICE ENGINEERING FOR THE DIGITALIZATION IN FUTURE SEAPORTS

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Maritime Supply Chains
Container Logistics

- ISO intermodal containers

standardization

- Container ships with cargo capacities up to 20,000 TEU

repetitive processes

- Standardization and repetitive processes enable a

high automation
Digitalization in Container Logistics

- **Partial automation** and manual process steps along entire supply chain

- Internal **automation** in terminals using automatic guided vehicles

- Internal digital information flows

- Disruptions in information flows
Project Logistics

- Main frames, towers, blades etc. with varying sizes

**individual components**

- Varying conditions and individual processes

**low automation**
Iterative Process and Requirements Assessment

- Change the system boundaries
  - Logistic Systems
  - Critical Incidents
  - What if …
  - Stakeholders
  - Greenfield

- Process modeling (BPMN 2.0)
  - Weather, delays etc.
  - … the container ship is delayed
  - Varied views and interfaces

Planning from scratch and variance comparison
Initial Situation in Container Logistics

- Decentralized and nontransparent availability of ship schedules and cargo closing deadlines
- Automatic identification and fleet management systems allow localization of ships and trucks
Service Ideation for Container Logistics

- Collect and integrate ship schedules and cargo closing deadlines from various sources
- Intelligent tracking data processing and comparison with schedules
- Centralized and transparent distribution to all stakeholders
Initial Situation in Project Logistics

- Long handling operations at distributed locations
- Experts and certifiers are required at each location
- Expert knowledge and experience is only available at one location at the same time
- Individual and no collective knowledge and experiences
Service Ideation for Project Logistics

- Centralized supervision and controlling of complex handling operations in a virtual control center
- Intelligent processing of video and sensor data streams
- Collection and distribution of experiences and expert knowledge
Portfolio for Evaluation and Selection

- Make data available (2)
- Implement (1)
- Do not implement (4)
- Wait until data become relevant (3)
System Architecture (I)

- Microsoft Azure Cloud Services enable high service availability and scaleability

- Local data selection and preprocessing is required

- Data encryption and protection is required
System Architecture (II)

Data sources

Transport

Processing

Presentation

Devices (IP)
Libs: Agent

Devices (IoT)
Libs: Agent

Devices (Low Power)

Cloud Gateway

Provisioning API

Identity & Registry Stores

Device State Store

Solution Portal

Stream Event Processor

Storage

Analytics/Machine Learning

Control System Worker Role

Presentation Portal
Iterative Implementation and Evaluation

Continual improvement

Initial situation

Other capability levels

„Smart Vision“
Capability Level A in Container Logistics

- Collect and integrate ship schedules and cargo closing deadlines from various sources
- Collect automatic identification system and tracking data
- Compare schedules and actual data to identify conflicts
Capability Level B in Container Logistics

- Intelligent calculation of dynamic cargo closing deadlines

ATD = Actual time of departure, PTA = Planned time of arrival, ETA = Estimated time of arrival, PTD = Planned time of departure
Nowadays, cargo closing is confirmed when a container is at the terminal.

- **Location and state tracking** allow cargo closing confirmations when containers are closed and in a defined area.
Capability Level C in Container Logistics (II)

- Nowadays, one cargo closing deadline for documents and containers

- Separating the information and material flows leads to multiple cargo closing deadlines and savings
„Smart Vision“ in Container Logistics

- **Smart Containers** interact and with other containers, vehicles and parties autonomously

  Container2X communication

- Containers **autonomously agree individual processes** with other parties according to destination and content
Capability Level A in Project Logistics (I)

- Remote supervision of handling operations using modern communication and video systems
- Parallel streaming in a virtual control center
Nowadays, experts and certifiers are required at each location

Remote supervision allows parallel handling operations

<table>
<thead>
<tr>
<th>Handling Operation A</th>
<th>Handling Operation C</th>
<th>Handling Operation B</th>
<th>Further handling operations possible</th>
</tr>
</thead>
<tbody>
<tr>
<td>Travel time and cost</td>
<td>Add. handling operation</td>
<td>Operation time and cost</td>
<td>Savings</td>
</tr>
<tr>
<td>Operation time and cost</td>
<td></td>
<td>Operation time and cost</td>
<td></td>
</tr>
</tbody>
</table>
„Smart Vision“ in Project Logistics

- **Intelligent personal assistants** provide state dependent decision support and operation guidelines

- Additional information via **Augmented Reality**

- Combining video and sensor stream analytics with experiences and expert knowledge
Conclusion – The Service Engineering Process

Continual improvement

Service ideation
- Collection of ideas
- Evaluation of ideas

Service requirements
- Process assessment
- Requirements assessment

Service design
- Product model
- Process model
- Resource model
- IT architecture

Service implementation
- Business Model implementation
- Organisational measures
- Human resources measures
- IT implementation

Service test
- Product test
- Process test
- Resource test
- IT test

Market introduction
- Marketing activities
- Roll out
- User feedback
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