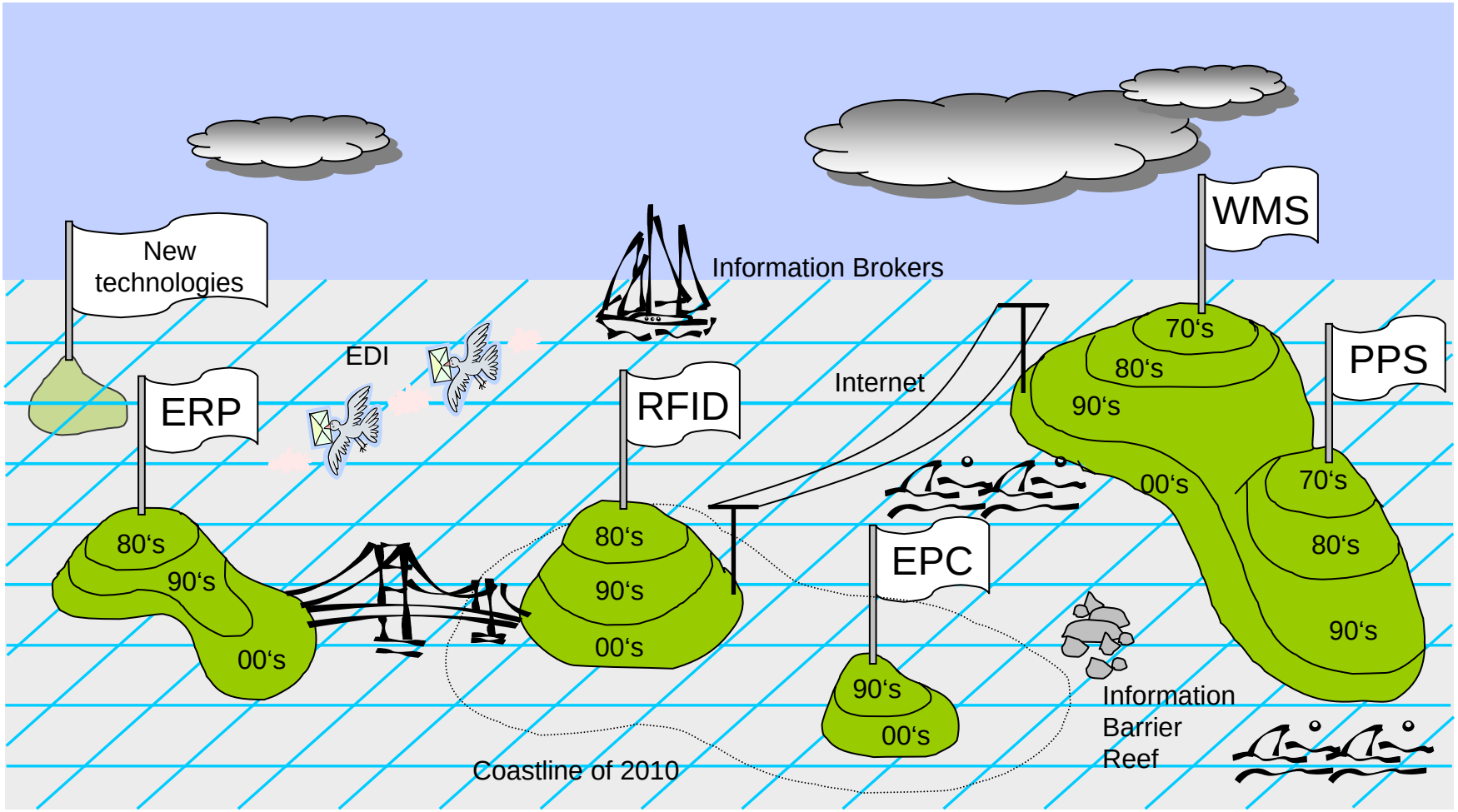
An Approach for the Integration of Data within Complex Logistics Systems

Carl Hans, Karl A. Hribernik, Klaus-Dieter Thoben

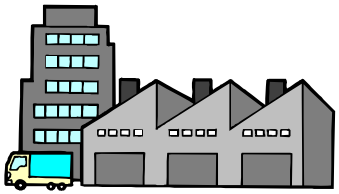
BIBA / University of Bremen
{han, hri, tho}@biba.uni-bremen.de

How to bridge Islands



Paradigm Shift in Manufacturing

Single Site Factory

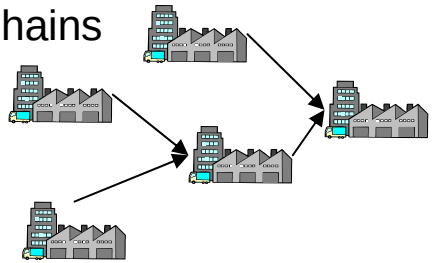


- Isolated manufacturing
- Independency from others – no cooperation
- Product-driven, bounded markets

“My factory is my castle”

1950

Supply Chains

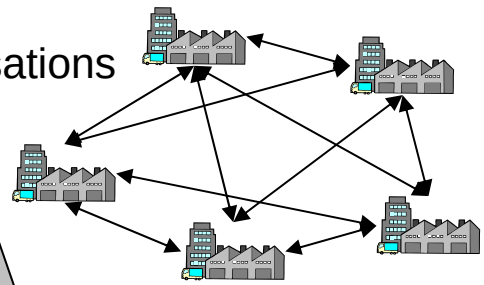


- Distributed manufacturing
- Hierarchical organisation
- Stable, long-term cooperation
- Customer-driven, selected markets worldwide

“Do what you can do best and let the others do the rest”

1980

Virtual Organisations



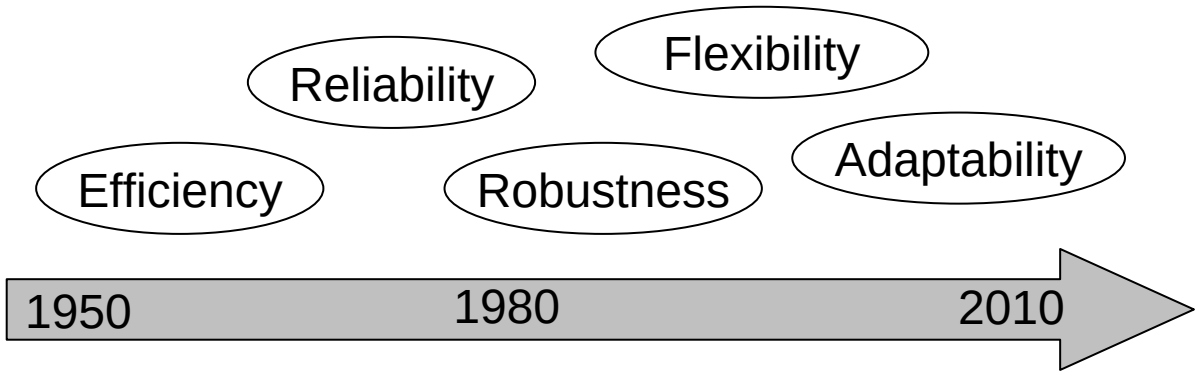
- Networked manufacturing
- Heterarchical organisation
- Temporalisation, digitization, individualisation
- Customer-driven, global markets

“Cooperate with others for a given business purpose”

2010

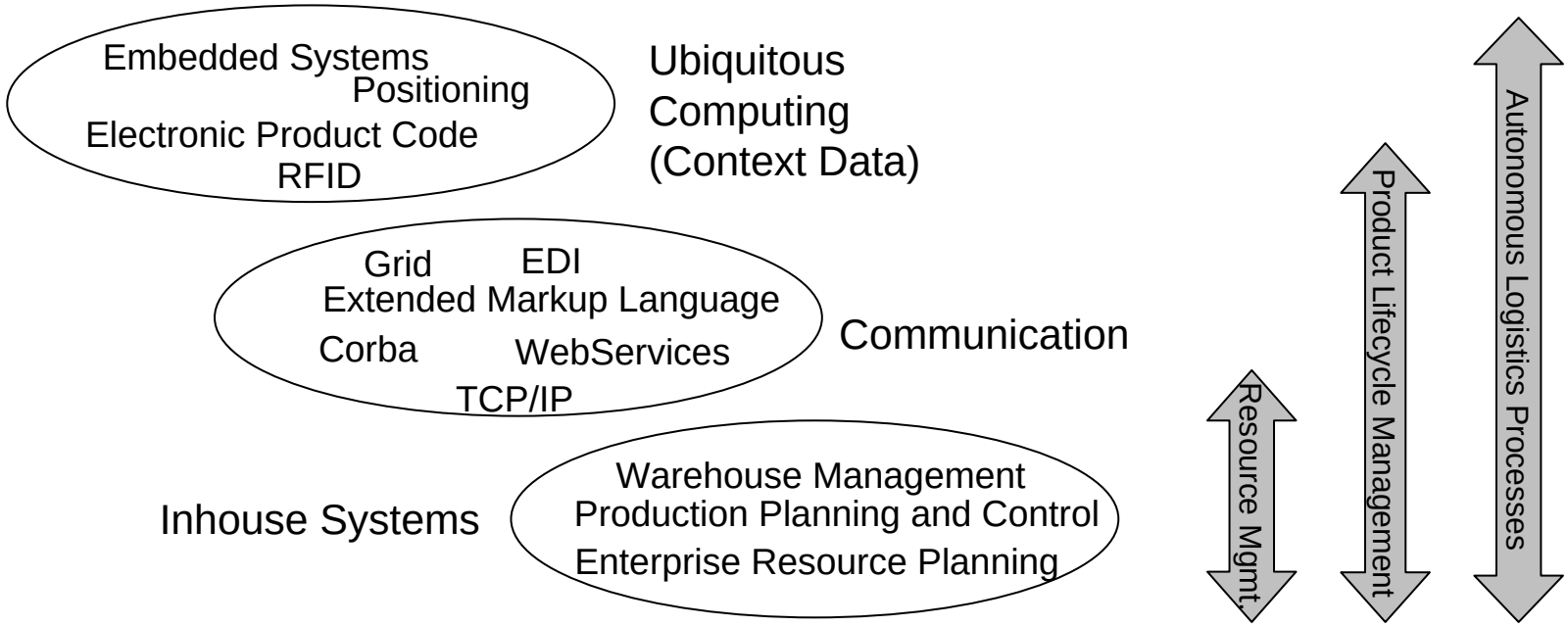
Relevance of Logistics in VOs

- Integral part of the value creation
- Highest requirements concerning:



- Strong need for a seamless information chain
- Application of latest technologies and organisational approaches

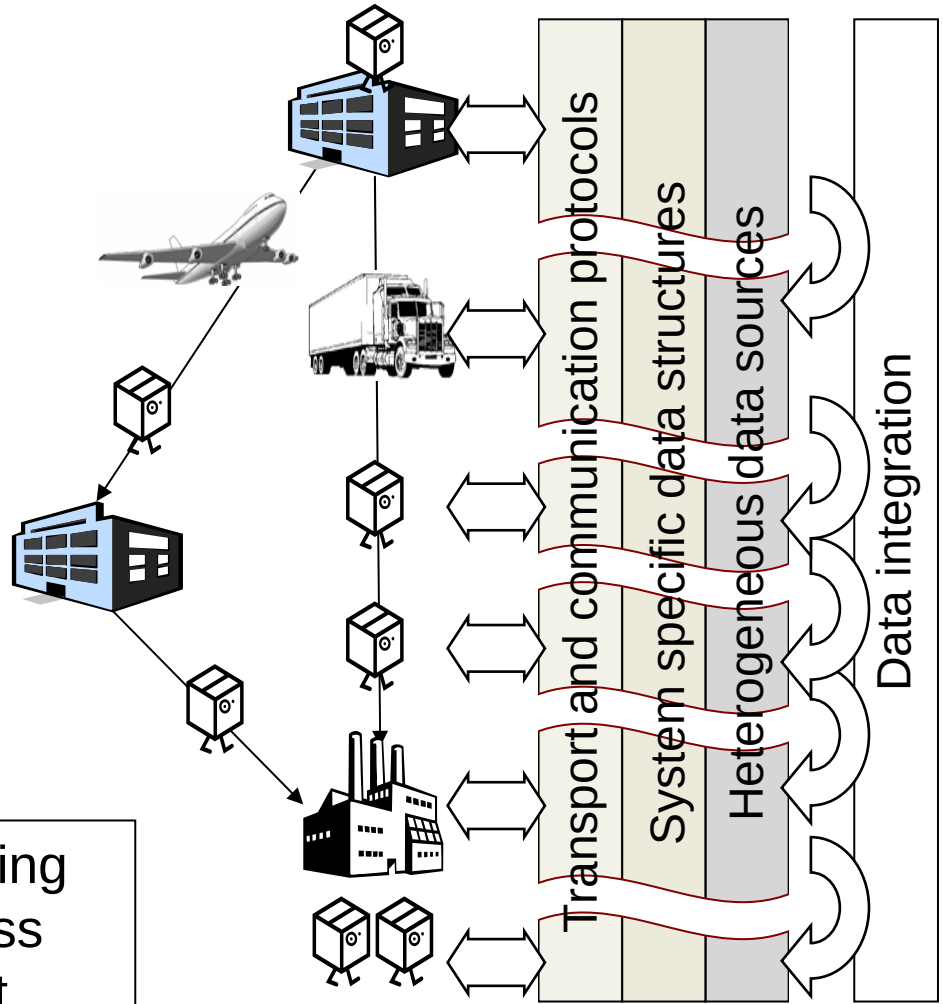
Advancements in Technology



- Most of the technologies are used or implemented as **isolated solutions** supporting **local efficiency**
- Today logistics is not as adaptable, flexible, efficient, robust and reliable as it could be
- Logistics systems of tomorrow require a **holistic view** on the underlying processes

Motivation

- Context data may be stored **centrally** (inhouse systems) or **decentrally** (RFID tags or embedded systems)
- System independent **data access** and **exchange** may prove difficult
- No **generic approach** for cross-platform data integration



A holistic view on the underlying processes requires a seamless information chain which is not available yet

Challenge

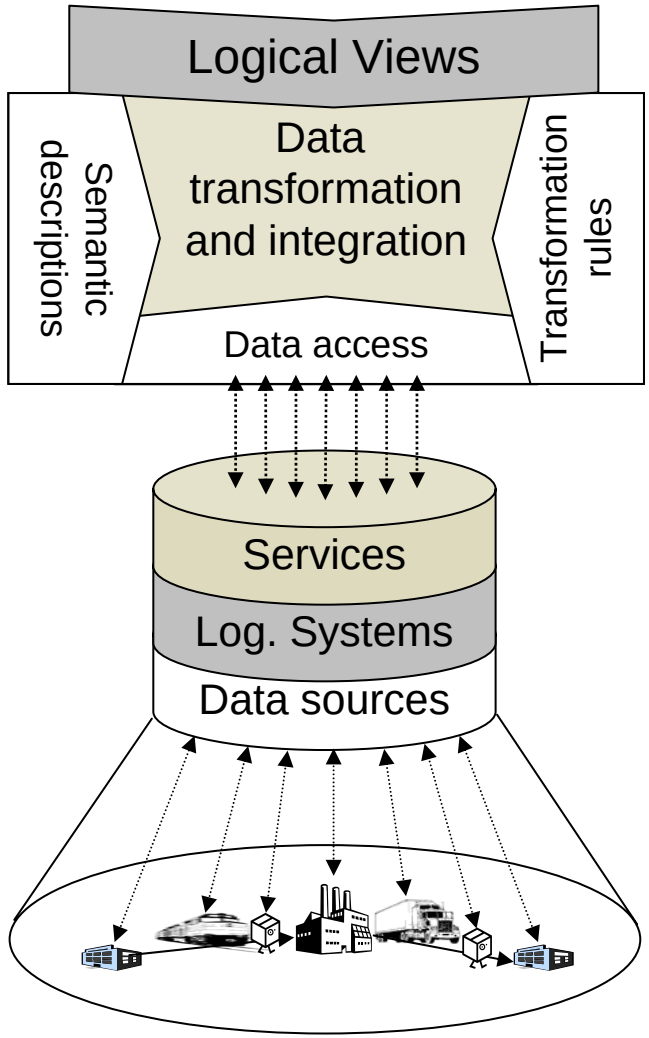
- Management of logistics systems requires high quality information
- Data are the basis for information
- Complex logistics systems consists of a multitude of different entities (transport goods, carriers, facilities etc.)
- Relevant data can be found within a multitude of different systems:
  - Inhouse systems (ERP, WMS, PPS etc.)
  - Context data (sensors, embedded systems, positioning, RFID etc.)

State of the Art

- Other approaches to data integration in related fields:
  - EPC / EPCIS (Electronic Product Code Information Services)
    - Concentrates on establishing an interface to product-instance specific views upon context data within supply chains
    - Certain logistics entities modelled, others can be integrated via user vocabularies
  - Seeburger (Enterprise Integration)
    - Concentrates on the optimisation of trade relationships within a supply chain
    - Classic enterprise integration – logistics entities out of scope
  - PMI (Promise Middleware Interface)
    - Concentrates on providing access to product throughout the product lifecycle
    - Logistics processes can be integrated but not specifically supported

Approach to Data Integration

- Research and develop a **platform independent** data integration approach
- **Service-oriented** system architecture
- **Logical views** upon arbitrary data sources
- Transparent mechanisms for the **transformation** between different standards and data structures
- Procedures for the **identification** of data sources and the **synchronisation** of data access

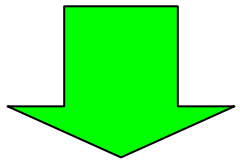


Realisation

- Establish state-of-the-art in relevant technological areas (ontologies, semantic description languages, etc.)
- System architecture conception
- Sub-component conception:
  - data source identification,
  - transformation,
  - logical views,
  - synchronisation
- Modelling of required knowledge base (ontologies and rules)
- Software development

Conclusion

- Today's logistics systems do not fulfill the requirements of tomorrows dynamic logistics systems
- Powerful technology is already available but leads to local optima
- Promising organizational approaches (e.g. Autonomous Cooperating Logistics Processes) are under research
- Main problem is the lack of a seamless data integration



- Development a service-based approach towards seamless data integration
  - Can improve existing logistics systems significantly
  - Is the basis in order realize future logistics concepts