Advanced Information Management Systems (for Decommissioning Knowledge Management)

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Overview

- State of the art decommissioning IT
- Decommissioning specific requirements
- Advanced systems
  - 3-D
  - AR/VR
  - Industry 4.0
  - Semantic systems

STATE OF THE ART DECOMMISSIONING IT

Common Decommissioning IT systems

- SAP
- Excel
- Powerpoint, Word
- Autocad
- Various databases
  - Oracle
  - Access (`98 version)
  - MySQL…
  - Home breed…

Commonly used sytems

- Are often remainders from operation
- Are not built for purpose
- Are on outdated infrastructure
- Are on outdated OS
- Are on outdated platforms
- May rely on exotic languages or development environments
- Are not up to date in terms of usability and ergonomy
- Are often built on ,,need to know‘‘ basis
- Are often built on security by obscurity basis

DECOMMISSIONING SPECIFIC REQUIREMENTS ON IT

Outside requirements – necessary interfaces

- Regulatory and licensing requirements
- Radiation protection requirements
  - State of science and technology
  - Differences compared to operation
- Reporting to existing national WIRKS system (waste inventory record keeping system)
- Additional reporting for 2011/70/Euratom

Data requirements for decommissioning & disposal

- Inventory data management now used for
  - (fuel)
  - Radioactive waste -> waste inventory records keeping system (WIRKS)
  - Clearance
  - Conventional waste
  - Recycling material
  - Hazardous waste
  - Hazardous substances in structures
  - Hazardous substances in soil & groundwater

- Decommissioning is a logistics driven project!

Budget and financing

- Decommissioning is not **revenue-** but **budget-financed**
- **Benefit** of knowledge management not easily measured – no serious **KPIs** besides the loss of knowledge cost
- **Avoidance** of investments for decommissioning
- **Duration** of decommissioning projects underestimated but a relevant **Cost Factor**

Generalistic tasks

- Decommissioning has many generalistic tasks, e.g.
  - Project Management
  - Radiation Protection
  - EHSQ
  - Logisitics

- Specialist tasks remain, some vanish, the data is often required to do the generalist‘s work properly

- Generalistic data access?

Requirements for IT in D&D

- Change Management compatible
  - Flexibility, your aims may and the state of the facility will change
  - Agility, you will need to adapt in short timeframes
- Project based
  - Organizational structure changes, thus your IT needs to adapt
  - Aims, risks, schedules and pathways will vary during the project
- Process oriented
  - Processes are still the basis in order to keep your integrated management alive
  - Unlike in operation, some processes will be carried out just once
- Motivating
  - Motivation is less natural in a decommissioning environment
  - IT will not directly motivate, but can be demotivating

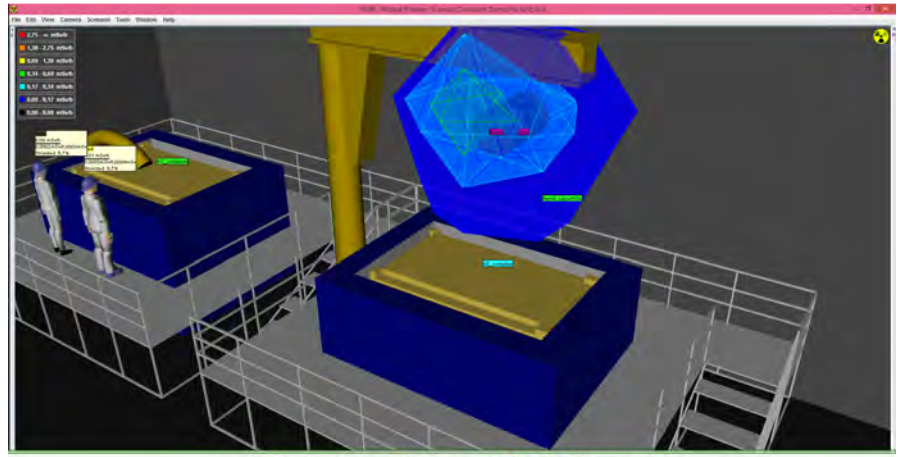
ADVANCED SYSTEMS

3-D Modelling

- Several different methods for point cloud generation
  - Laser scanning
  - Photogrametry
- Several steps to a fully featured 3-D-model
  - Scanning of point cloud
  - Aggregation of point cloud to mesh or grid
  - Corrections of grid model
  - Segregation into separate submodels for SSC
  - Compilation into 3-D-CAD model
- Alternatively: Direct generation from 2-D-plans

3-D-Modelling / Multidimensional Models

- Usable as basis for
  - Visualisation
  - Geometric/static evaluations
  - Dose calculation
  - Physical inventory assessment
  - Radiological inventory assessment
  - Activation calculation



Beladen Konrad-Container

- Difficulty lies in different, partially incompatible systems and in different requirements in terms of accuracy and correctness of the model
- Common basis for an advanced is so far missing, first steps towards standardization have been taken

Virtual Reality Systems

- Based on 3-D-Model
- Allowing to move inside the 3-D-Model
- Allow to examine the model (not reality!)
- Give a better understanding on later doing
- Allow changing the perspective and looking from ,,impossible‘‘ viewpoints
- Allow to use avatars and to inspect processes from different roles
- Allows discussions without entering controlled areas

Source: Wikimedia Commons
Maurizio Pesce / cc-by-2.0

Augmented Reality Systems

- Superposition of model and data into real environments
- Allows to transport the model into reality
- Allows to visualise invisible/insensible features
- Allows to understand hidden features and risks
- Allows to understand correctness of model

- Are dependent on accuracy and correctness of model
- Are dependent on accuracy of scene and SSC recognition

Augmented Reality

By Carlos Fy - Own work, CC BY-SA 4.0,
https://commons.wikimedia.org/w/index.php?curid=75242078

Artificial Intelligence Systems

- Are intended to support decision making
- Definition of AI is often not clear
  - Reasoning
  - Machine learning
  - Scene recognition

Merriam Websters:
The capability of a machine to imitate intelligent human behavior

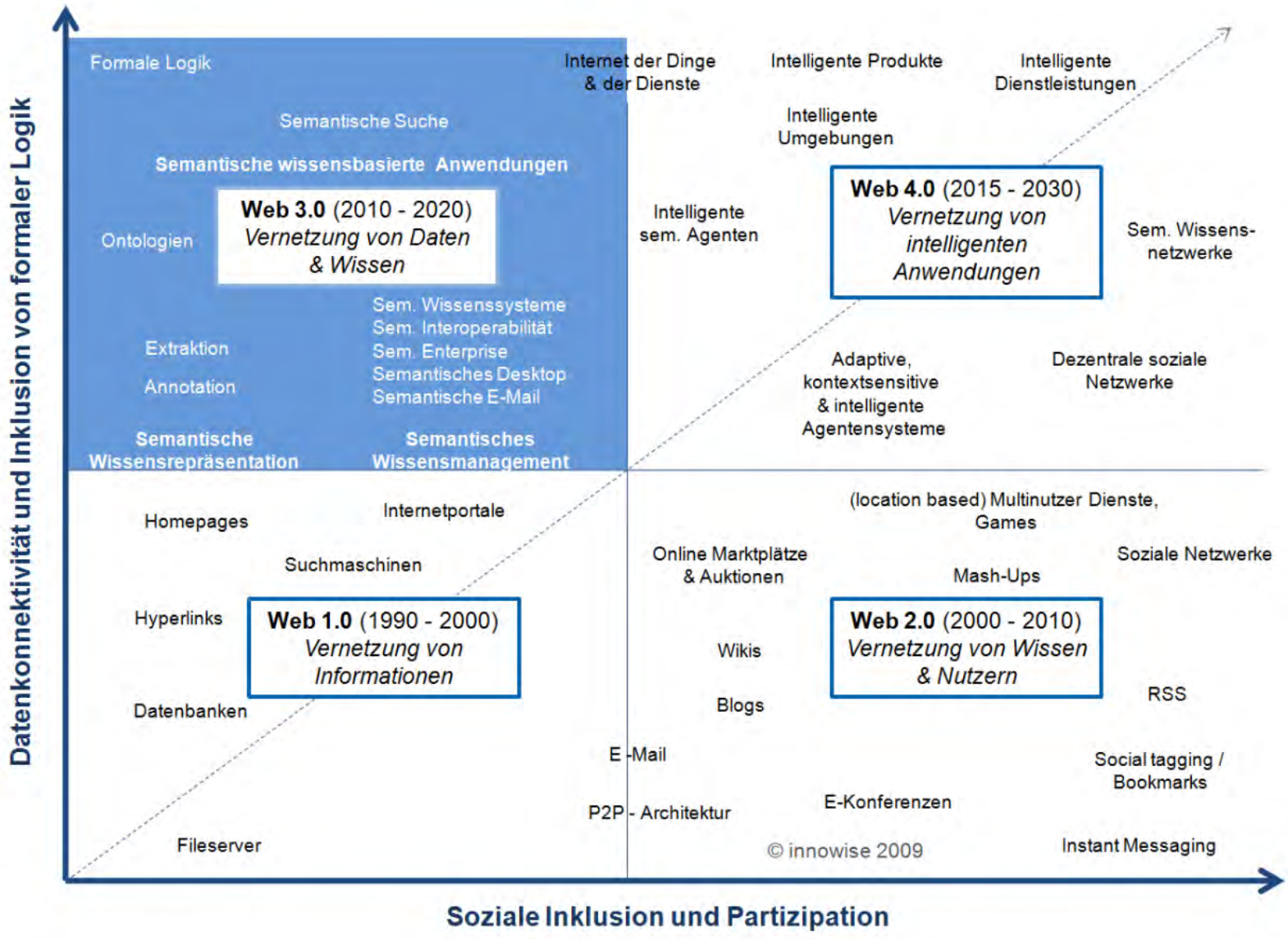
- Usually based on neural networks
- Training based decisions, only work in simple environments so far
- Decision making process is often unclear

- AI implementation in safety relevant systems seems not very likely in the near future, except some very specific applications

Industry 4.0

- Systematic collection of machine data
  - Documentation of processes
  - Predictive maintenance
  - Process and process failure analysis
  - „Big data“ approach often applied
- Requires machine data to be available
- Refurbishment of existing systems may be necessary
  - Reaction free implementation of documentation
  - Variety of control and reporting systems on the market
  - Security aspects

Semantic systems



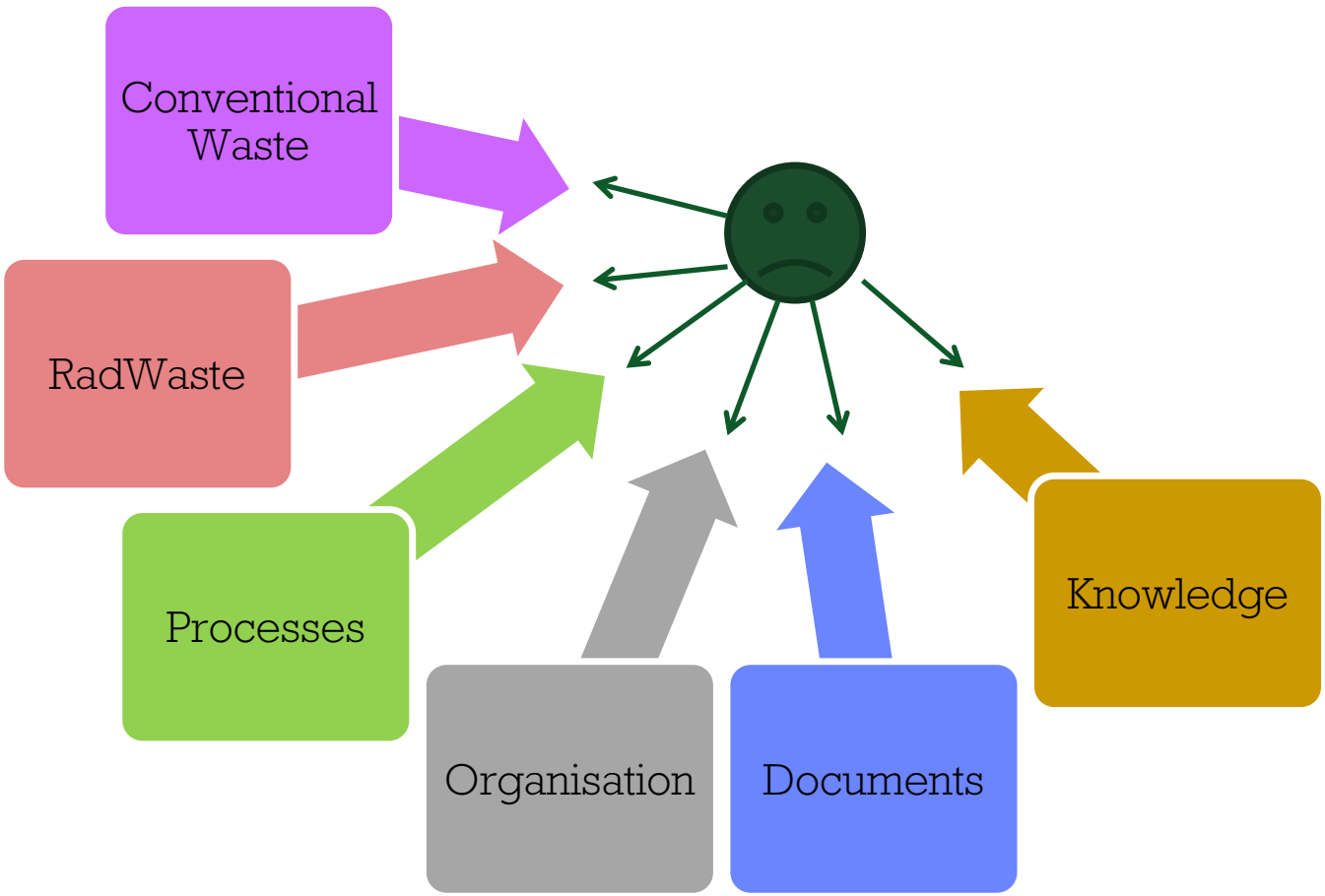
Ontology driven Information systems

Source: Thinkinnowise Trend Report Die Zukunft des Semantic Web Thinkinnovise, Duisburg, 2009

Re-Contextualisation

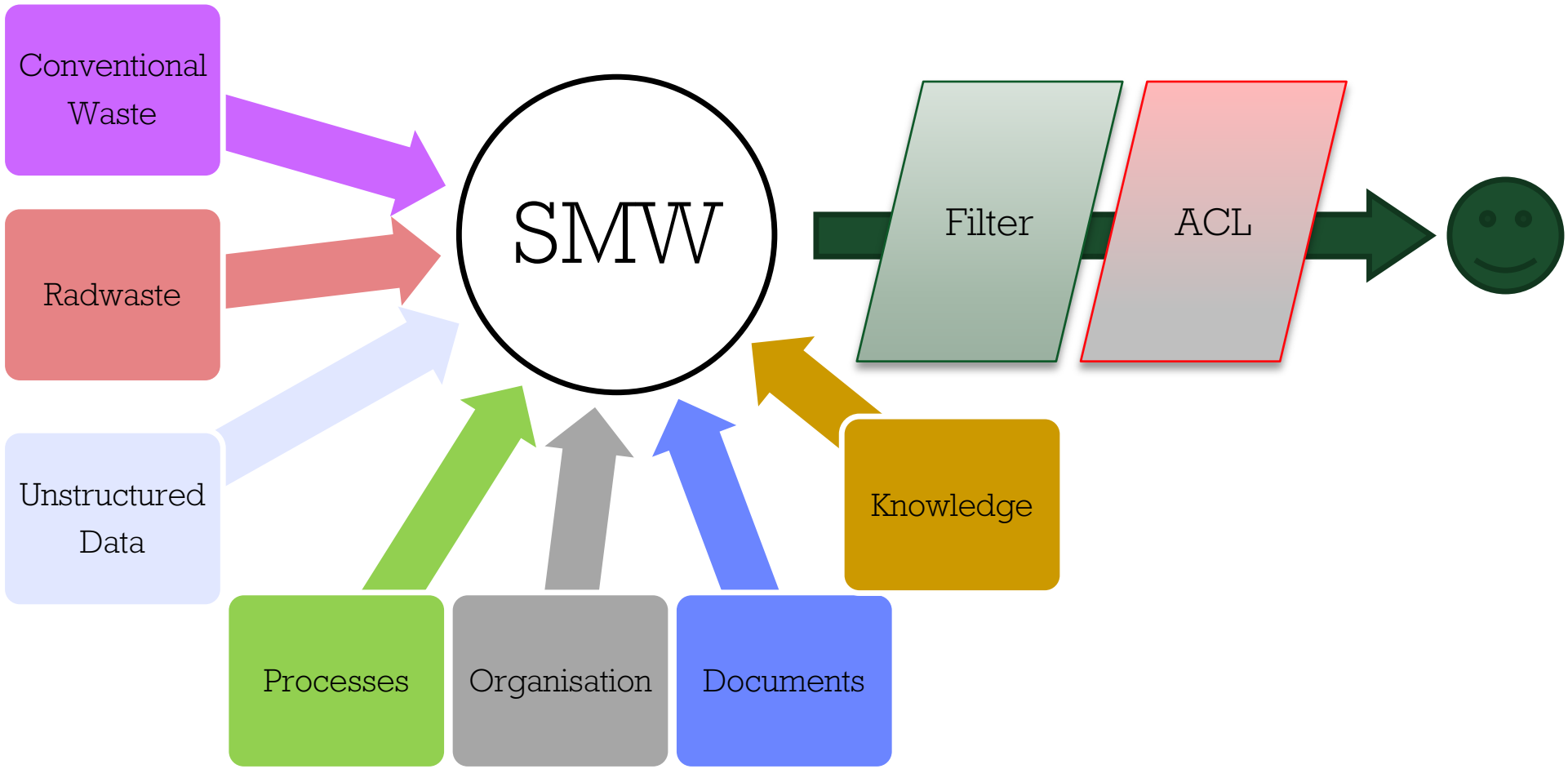
- Tell the **story** behind the pure facts
- Allow users to add their own **experience**, allow various points of view
- **Personalise** & foster interaction – who wrote this, can I ask her/him directly?
- Allow some kind of **recognition and reputation** building – this is a very important means of **motivation**!

Status Quo using multiple systems



- User has to query several systems,
- may have different roles and rights,
- Has to be competent in all systems,
- has to filter in all systems and the information structure is given by the Systems.
- After that the User has to bring information together, aggregate and filter manually

Integrated approach – example semantic wiki



- User queries the wiki page connected to the content and has all data delivered.
- Dashboards can be adapted to users (and not the system`s) requirements
- Drilldown allows to go into Details.
- Access Control is Centralised.

ETL-Software

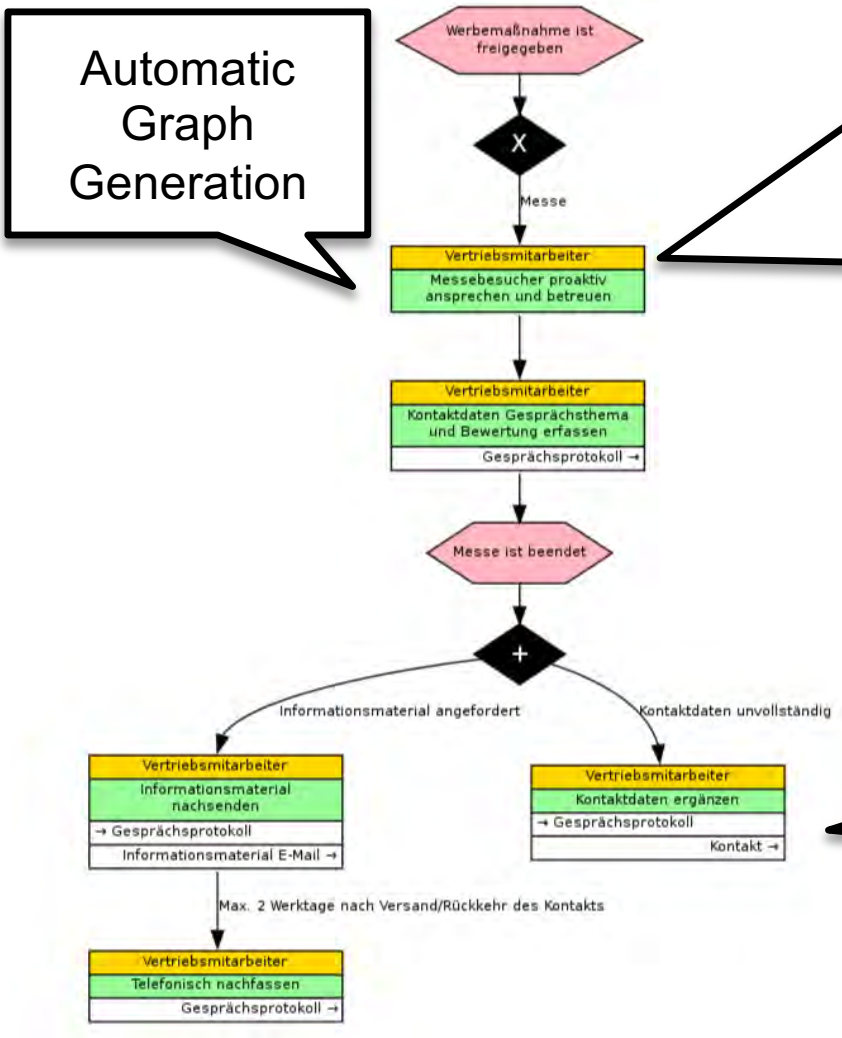
- Extract – Transform – Load – Software is available from **Business Intelligence Solutions**
- Data can be Extracted from nearly **every** Database Format
- Data can be **Transformed**
  - Calculations
  - Complex Adaptions e.g. for new Threshold Values or Limits
- Direct **Interfaces** for Semantic Information Systems available

Process Management Today

- Document management systems have a certain likelyhood to end as data graves
- Process management systems add a process number to each tombstone
- Usually an (electronic) list of processes, their description and related documents on a separate system
- Process management 2.0 – more user interaction –may bring some benefits in terms of perception

Semantic Process Management

Automatic Graph Generation



Responsibilities, Information, Support

Vertriebsmitarbeiter | Verantwortlichkeiten | Akteure

	Vertriebsmitarbeiter
Auf Gespräch vorbereiten (Process Step)	R
Informationsmaterial nachsenden (Process Step)	R
Kontaktdaten Gesprächsthema und Bewertung erfassen (Process Step)	R
Kontaktdaten ergänzen (Process Step)	R
Mailing durchführen (Process Step)	R
Messebesucher proaktiv ansprechen und betreuen (Process Step)	R
Produkt ist fertiggestellt (Process Step)	R
Rule-Definition und Freigabe (Process Step)	I
Telefonisch nachfassen (Process Step)	R

R: Responsible, **A**: Accountable, **S**: Supporter, **C**: Consulted, **I**: Informed

Kategorie: Role

Ressources:

- Norms, Directives, Documents
- Structures, Systems, Components, Waste Packages etc.

Process binding in semantic systems

- Processes can be linked to **any** entity and vice versa
- **Entities comprise**: documents, records, organisations, persons, items, issues, structures, systems, components, measurement values etc.
- Process description has history, remarks, media, is **integrated** in **daily work**, never more than a few clicks away
- See obstacles, get **feedback immediately** from those carrying out the processes

Summary - Requirements

- Decommissioning is essentially part of the life cycle of **each** facility; Change from operation is a **major challenge**
- Decommissioning is a phase that has some **duration** (10-15 years at least)
- **Vision**, organisation and tasks change dramatically
- Systems must be **fit for purpose** to do the job effectively and not de-motivate personnel
- **Knowledge conservation** and **retainment** are very important to overcome **personnel drain**

Summary - Solutions

- **Agility is key** as change becomes a constant
- Use **existing systems** and data as long as possible on **specialist level**
- Use **new**, **integrative** systems on **generalist level**
- **Optimised systems** are paid by **efficiency gain**
- Bring processes and knowledge into **daily life** of personnel
- Think about **necessities of restrictions** – knowledge management and paranoia do not go together well

Benefits of Semantic KM Systems

- System can integrate multiple data sources in a common surface
- Machine can gather, aggregate and present data
- Multidimensional approach makes information available from various aspects
- User can adapt interface to own needs and built dashboards for certain tasks
- Dashboards allow drilldown to data
- Zero coding approach

Next step: Semantics & 3-D

- Coupling of a semantic information system with 3-D-modelling and physics engine
- Combines easyness of use of the semantic system and its powerfull data retrieval service with the extended capabilities of the 3-D-system and the physics engine including radiation calculations
- Allows the risk-aware management of inventory
- Allows the rich documentation of processes and calculated scenarios
- Allows to have a consistent plant model based on semantic data that can vary in depth from simple data form down to sophisitcated 3-D-model, where required
- Integrative nature of semantic system allows easy integration of existing data in various formats