

A HYBRID LINKED DATA APPROACH TO SUPPORT ASSET MANAGEMENT

MS5 BIM for the life-cycle | Bart Luiten, Michel Böhms (TNO), Aonghus O'Keeffe (ROD),
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TNO innovation
for life

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OVERVIEW

- › Challenges for information management
- › The essentials of Linked Data
- › Some first examples of successful application in practice
- › Why Linked Data?
- › Conclusion

CHALLENGES FOR INFORMATION MANAGEMENT

From the perspective of asset management at a National Road Authority:

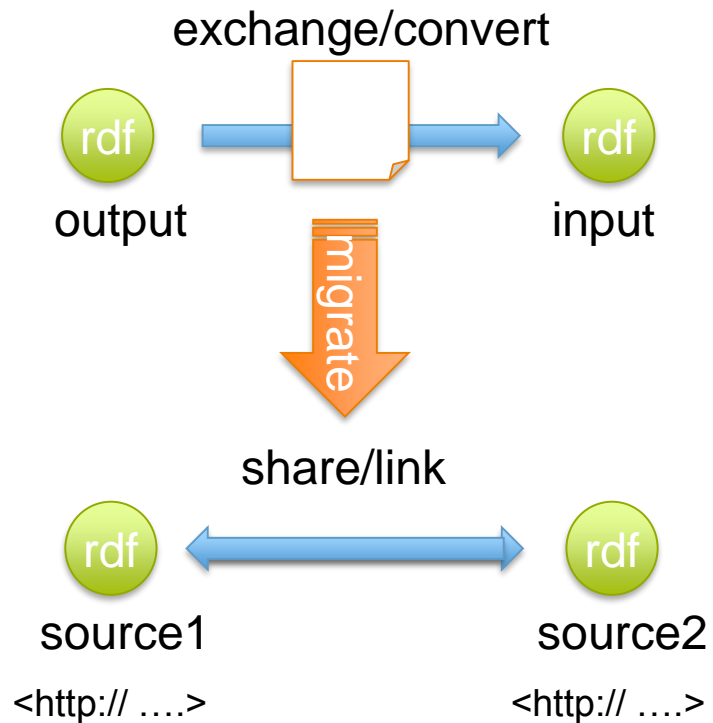
- › Asset management = managing the physical assets and asset information
- › Sharing information in stead of exchanging information
- › An international interoperability approach that makes use of commonalities and allows for differences
- › “Liberating data, imprisoned in legacy systems” (Phil Jackson)

SOME ESSENTIAL INGREDIENTS

- › Basis: data represented in triples, identified with a uri

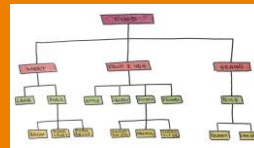


- › Data Sharing/Linking - beyond Data Exchange/Conversion
- › Linked Data - semantically enhanced
- › Hybrid Approach - multi-world/multi-standard
- › Multi-level Semantics - addressing end-user data needs
- › Innovation - new functionality beyond current borders



Semantic
Level

‘Internet 4.0’: Semantic Web (SW)



Linked Things =
Semantically-enhanced
Linked Data

‘Internet 3.0’: Linked Data (LD)



Linked Data

‘Internet 2.0’: World Wide Web (WWW)



Linked Documents

‘Internet 1.0’



Linked Computers

Multiple Worlds

BIM – Building Information Modelling
Objects (buildings, roads, bridges, tunnels)

GIS – Geo-spatial Information Systems
Areas (several LODs)

SE – Systems Engineering (PLM, PLCS)
Processes (LifeCycle, SupplyChain)

LD – Linked Data
Information (generic, open, web-based)

Organization Multiple Standards

bSI/ISO	IFC, ifcOWL, IDM, MVD, bSDD, ...
ISO STEP	EXPRESS, SPFF, ...
CEN	CEN/TC 442 (BIM)
Various (OTLs)	QUDT2.0, SAREF, CEDR INFRAOTL.EU, okstraOWL

OGC	GML, CityGML, InfraGML, GeoSPARQL
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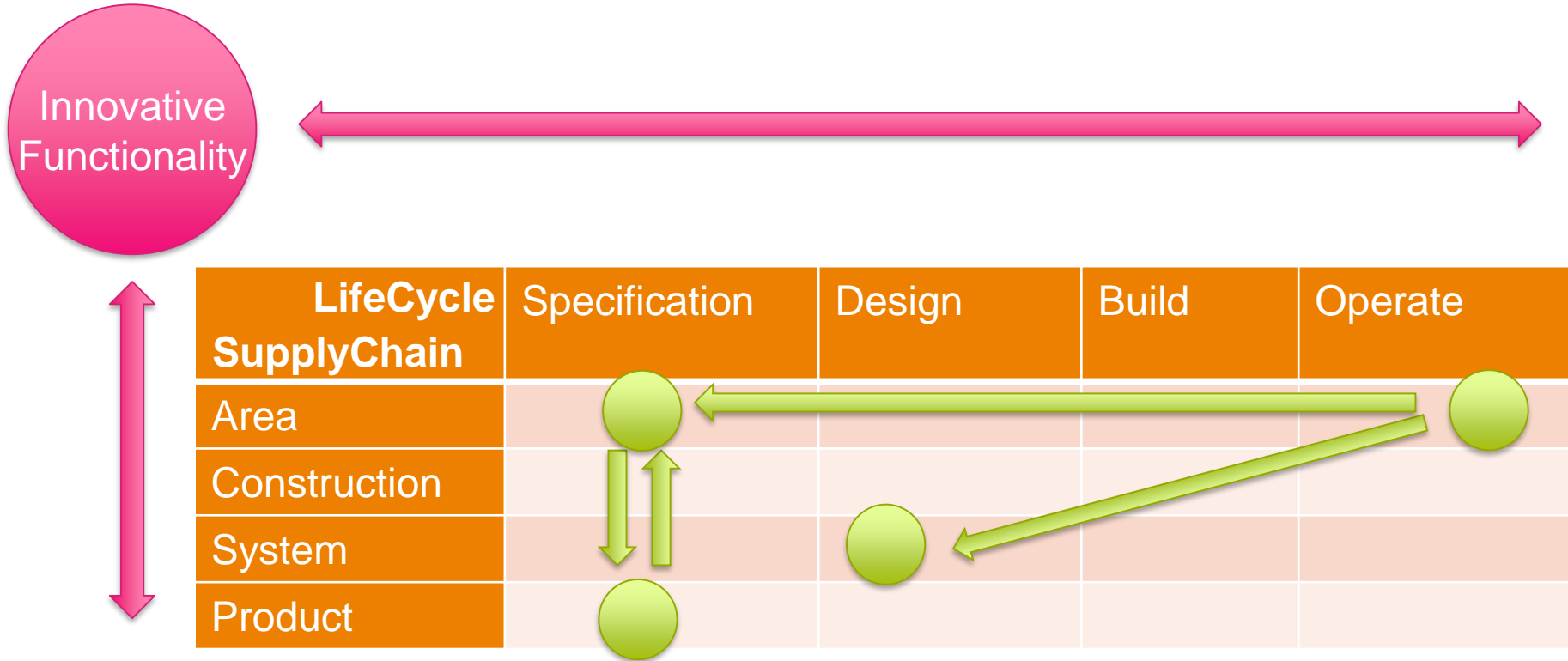
OMG, ISO, ...	BPMN, BPEL, ...
NL VISI/COINS	CBIM, ...

W3C	LDP, OWL, RDFS, RDF, SHACL, SPARQL, SPIN, RDF-XML, Turtle HTML, XML, XSD
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JSON-LD.com	JSON-LD
IETF	TCP/IP, DNS, HTTP, JSON, GeoJSON

Level / World	BIM	GIS	SE
International	ifcOWL alignmentOWL BSDD ROADOTL.EU COBieOWL SAREF, SSN, ...	infraGML CityGML ...	PLM PLCS ...
Country-specific	okstraOWL (DE) BSAB (SE) CBNL (NL), ...	IMgeo (NL) ...	COINS (NL) ...
Company-specific	RWS-OTL BAM-OTL,
Project-specific	SAA Road, Zuid-As OTL,

LD



SOME CURRENT LINKED DATA INITIATIVES

- › V-Con for Roads: specifying and developing two linked data information management solutions for National Road Authorities following a hybrid approach
- › buildingSmart: Linked Data Working Group, with application in the InfraRoom
- › CEDR BIM 2015: INTERLINK
- › Many national initiatives, e.g. OKSTRAowl, CB-NL, BSAB, COINS

WHY LINKED DATA FOR END-USERS?

With 'Linked Data' we can:

- Share data without conversion: define once, link & (re)use multiple times
 - Note: Conversion == Trouble
- Configure your own optimal 'standard' from relevant proven partial standards
- Easy reuse from and delivery to (up to date) 'external' data resources and legacy systems

WHY LINKED DATA FOR MODELLERS?

With 'Linked Data' we can:

- Use BIM, GIS and SE* open standards seamlessly together
 - Maximise reuse of each others work
 - Focus on your own 'core modelling business'
- Add National and Company-specific semantics to generic, international standards and compliant software
- Reap the benefits of all Internet/Web developments, now and in the future

CONCLUSIONS

- › Many initiatives are exploring the possibilities of linked data and are implementing it in practice
- › Linked data approach is a promising approach towards solving the challenges of information management
- › A hybrid approach, which allows for using current and linked data formats, is essential for acceptance in practice

A nighttime photograph of a city street. In the foreground, a modern, curved pedestrian bridge or walkway with a glass railing is illuminated. The background shows a city street with buildings, some of which have lit-up windows. There are prominent green and white light trails from moving vehicles or lights, creating a sense of motion and energy. The overall scene is a mix of urban architecture and dynamic light effects.

› **THANK YOU FOR YOUR
ATTENTION**

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