

EnergiForum - Nørdehjørnet

Linked Building Services

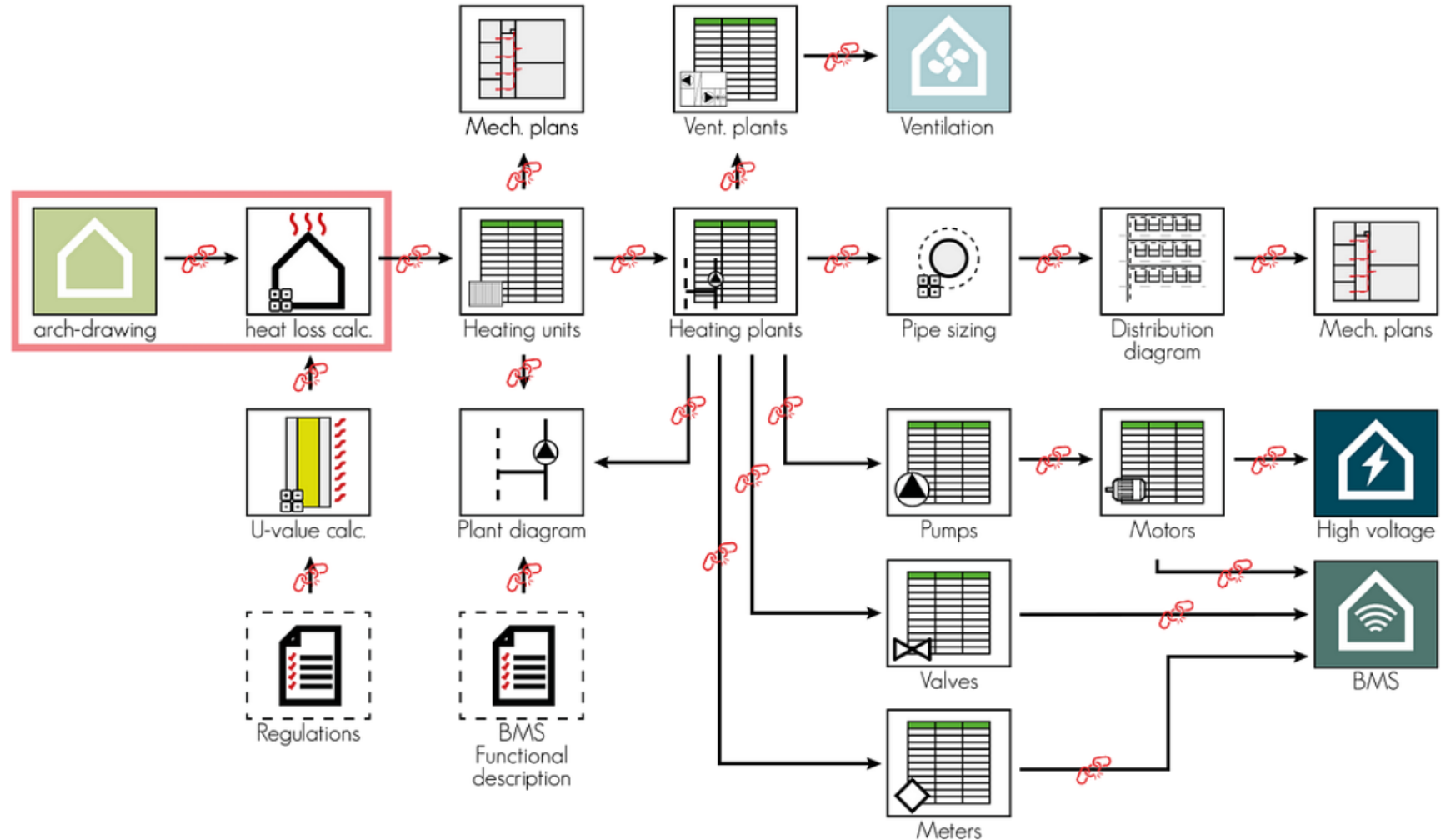
Christian A. Hviid

Associate Professor

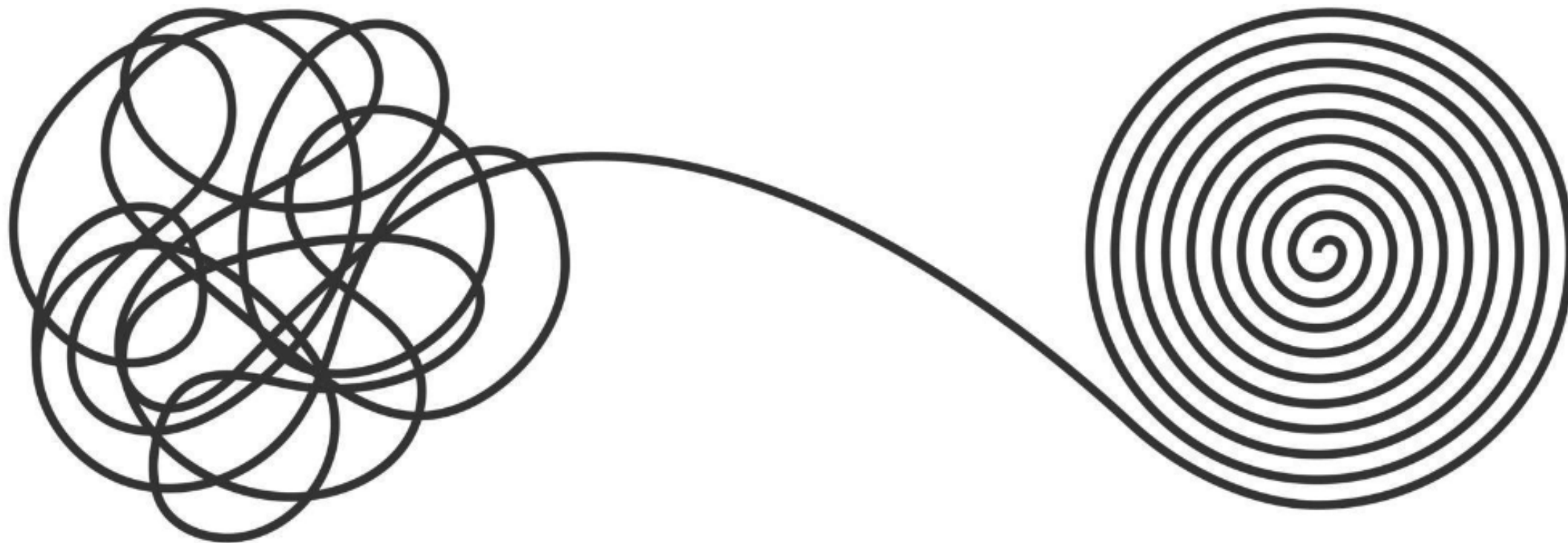
DTU Construct

Section for Energy and Services

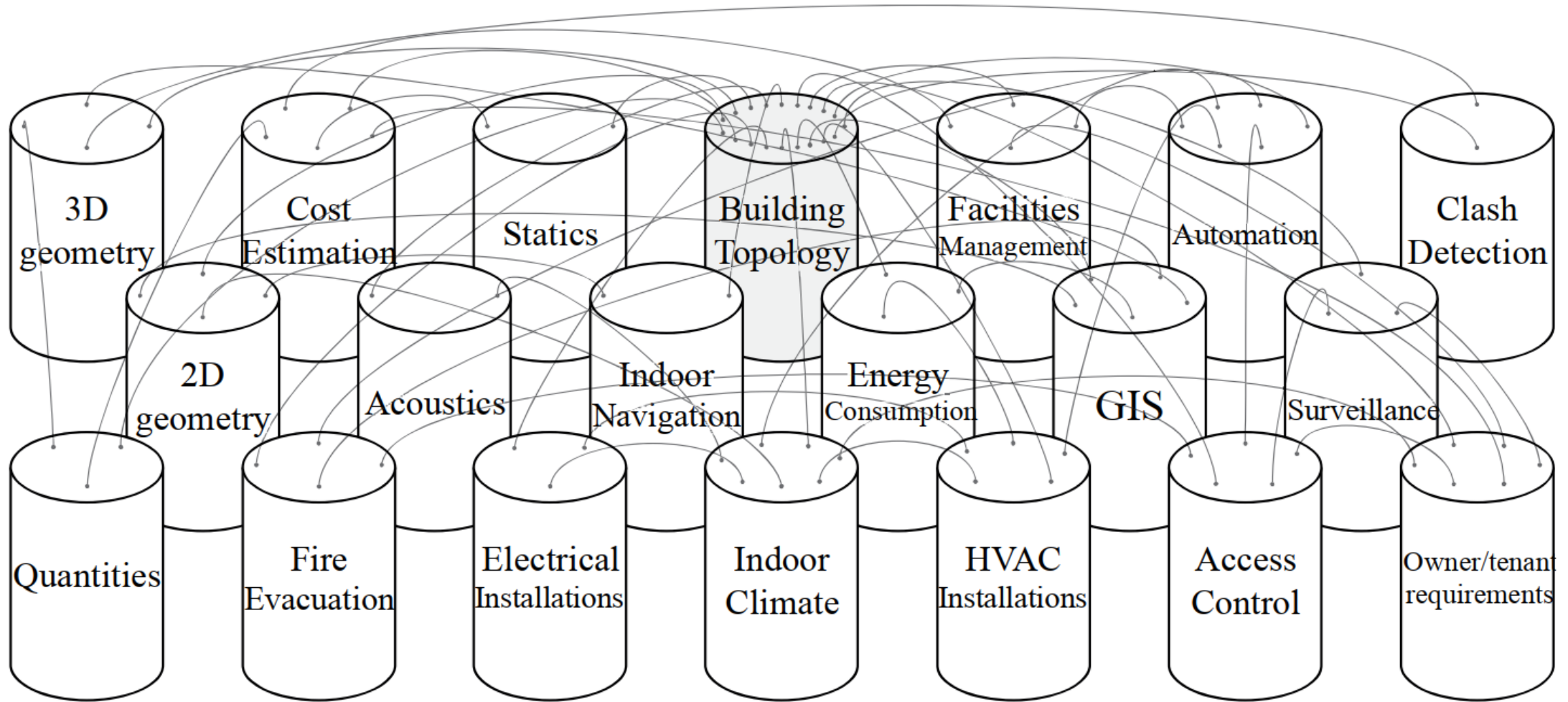
HVAC designproces



<https://www.oxfordsemantic.tech/blog/fully-interconnected-construction-projects-that-automatically-adjust-for-changes-but-how>

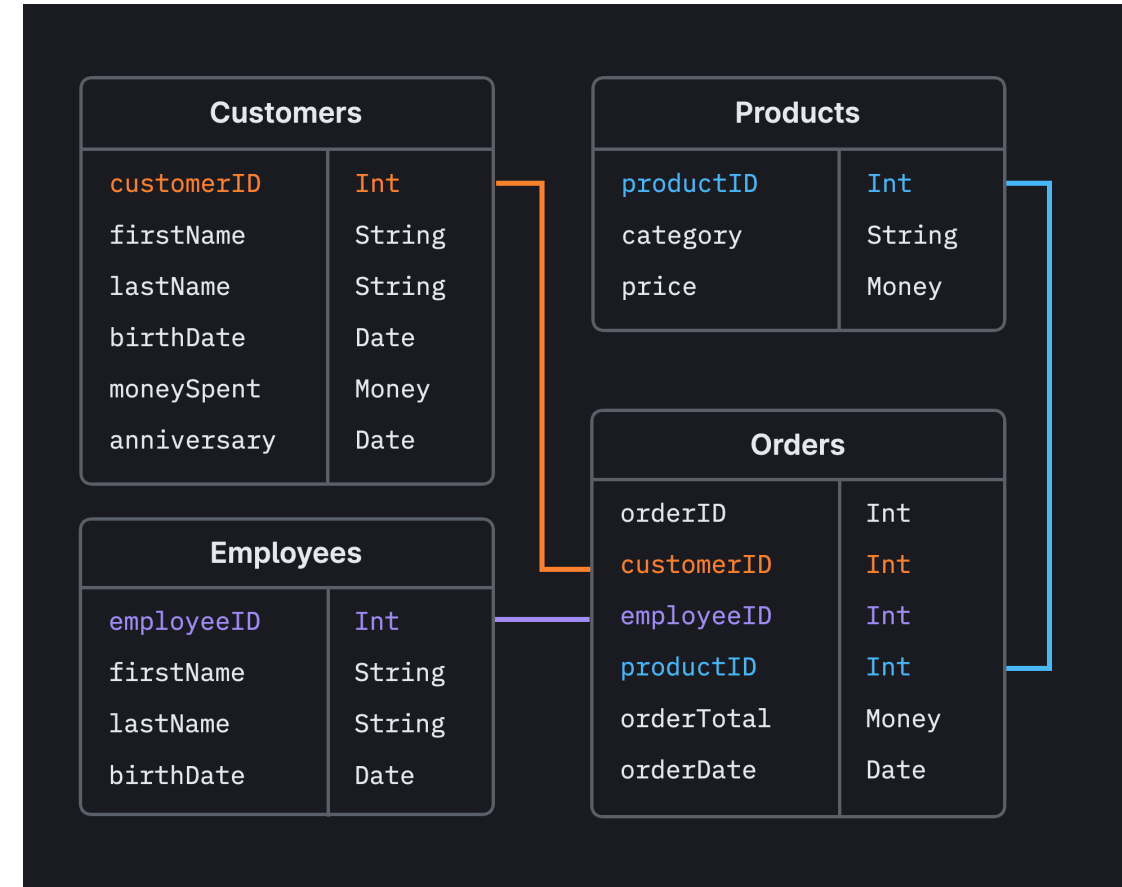


Indbyrdes afhængigheder i HVAC

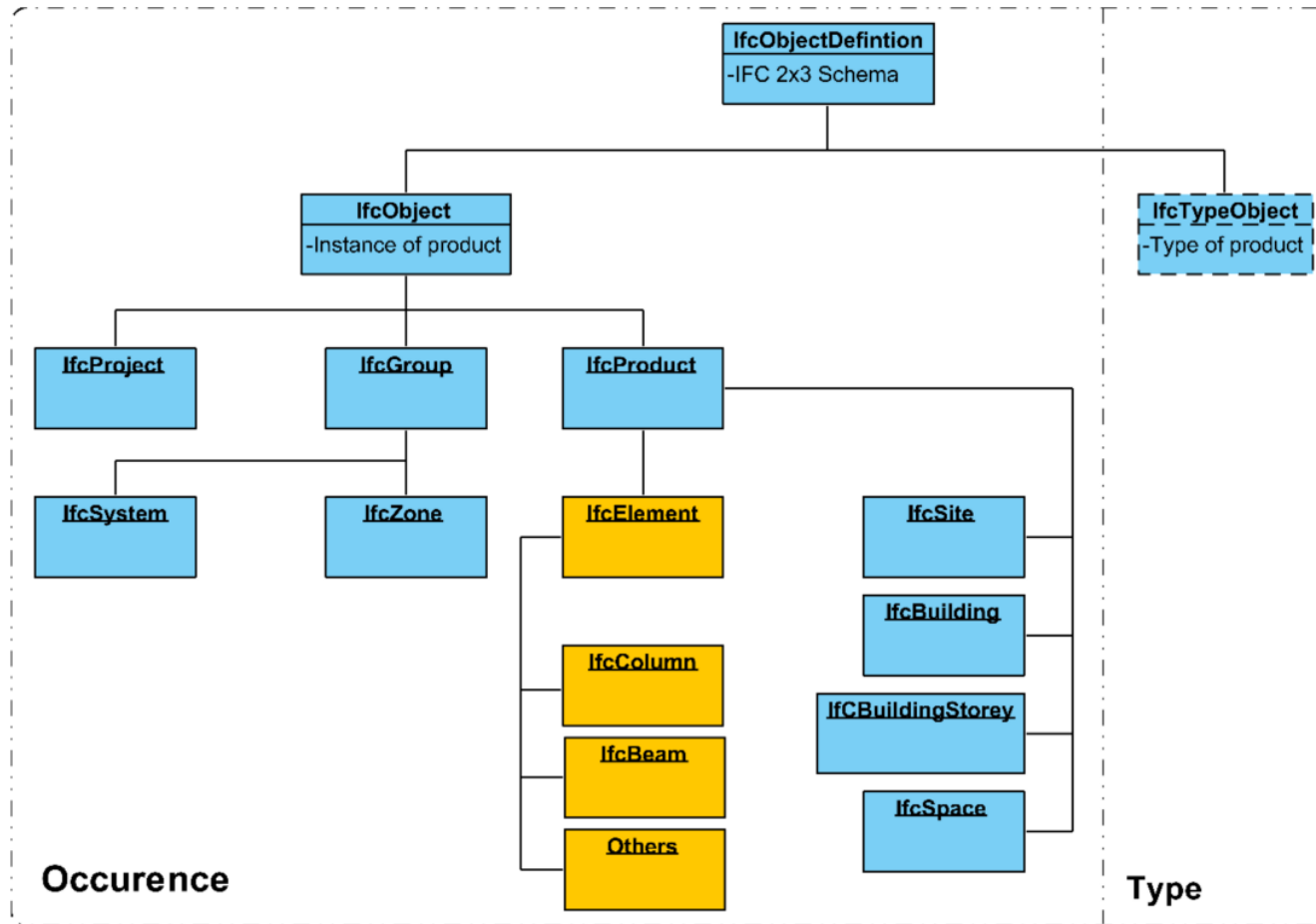


'Schemas'

- Skemaer strukturerer database-indhold, så andre mennesker (og computere) kan gøre brug af den
- Skemaer er dokumentation for
 - de enkelte tabellers indhold
 - tabellernes relationer
 - datakilde, navn, enhed, datatype etc
- Alle relationer skal defineres første gang og kan ikke ændres
- **Schemas = metadata-containers**

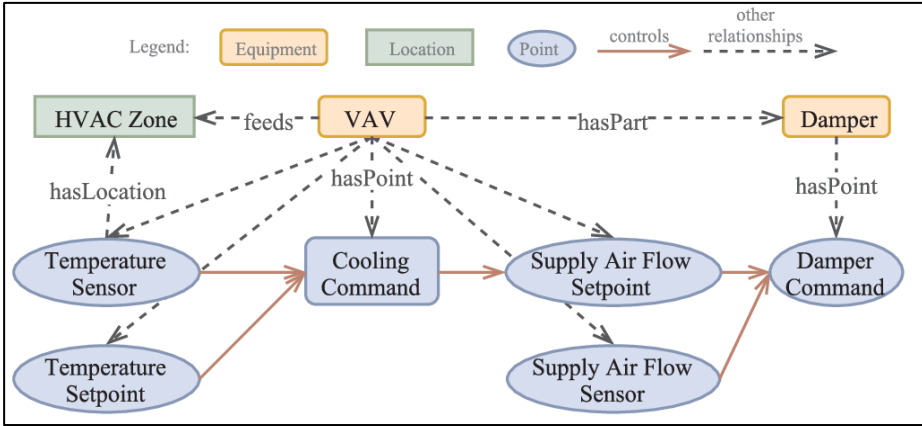


IFC er et officielt skema, som strukturerer (statisk) 3D bygningsinformation



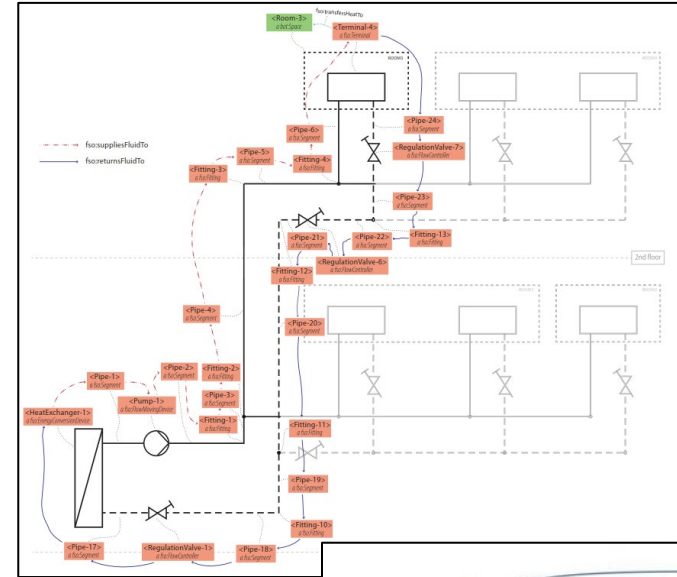
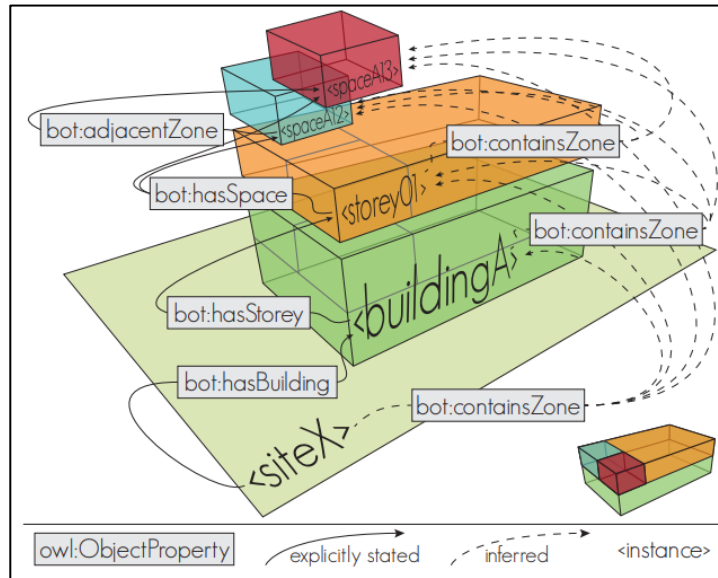
Ontologier

En formel beskrivelse af koncepter og relationer = schemas



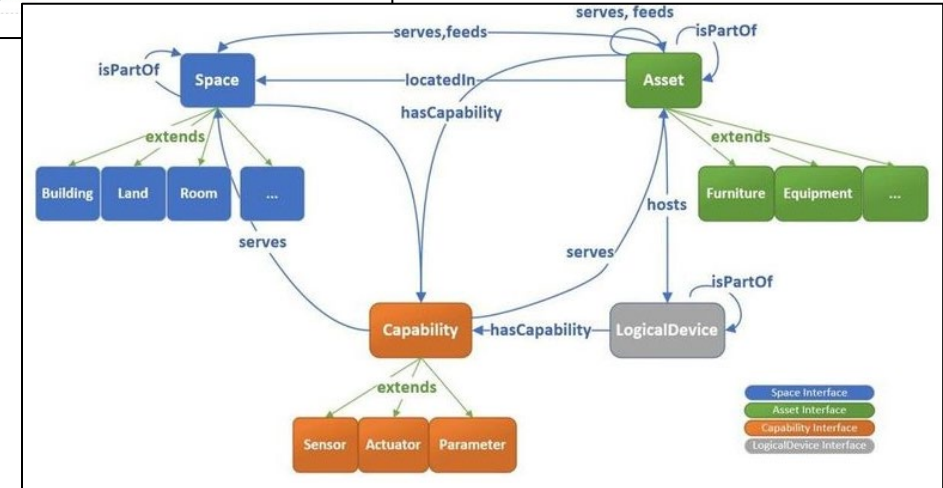
Brick

BOT



FSO

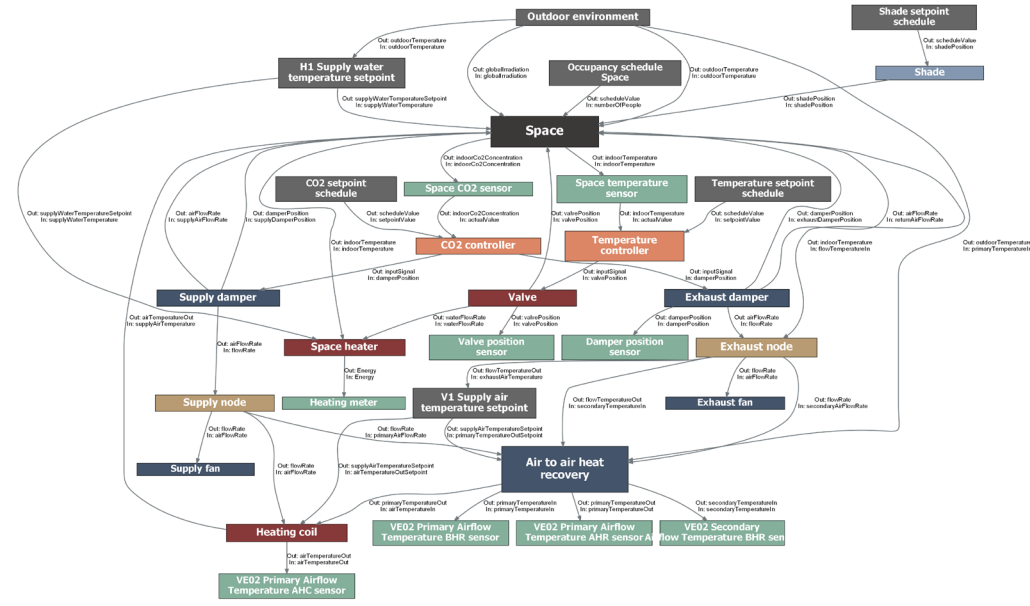
Realestatecore



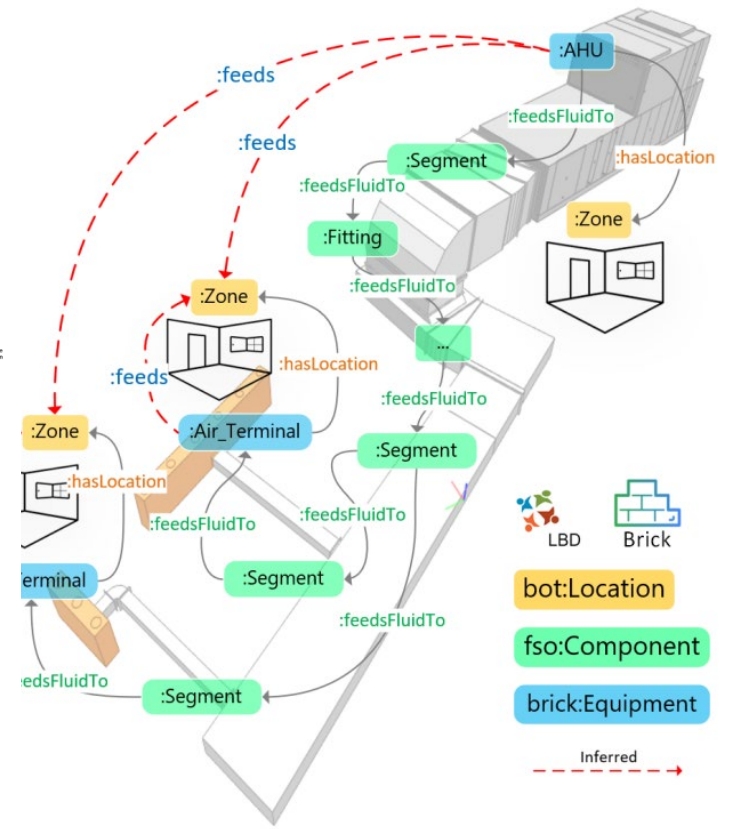
Via ontologier kan forskellige domæner bindes sammen i knowledge graphs

Categorization of related ontologies

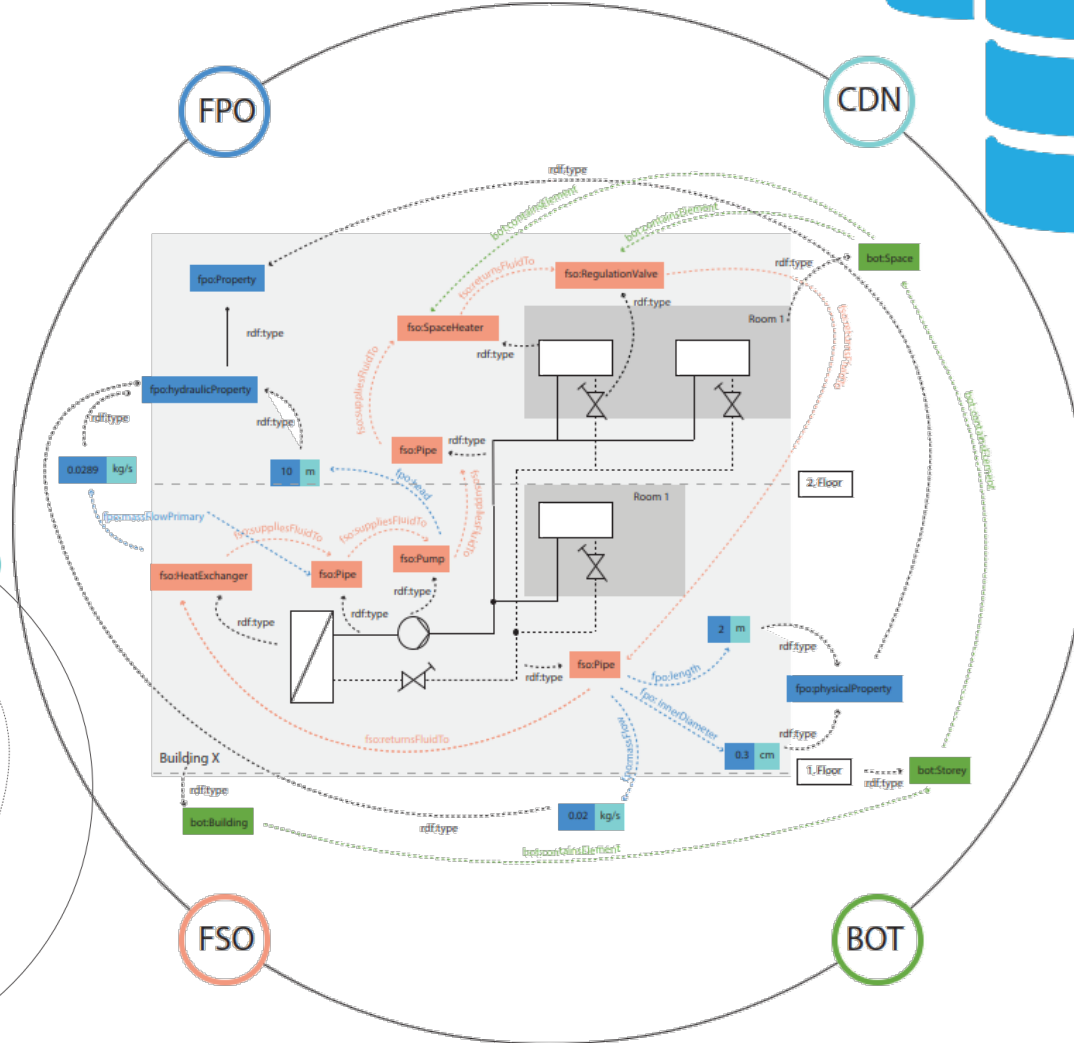
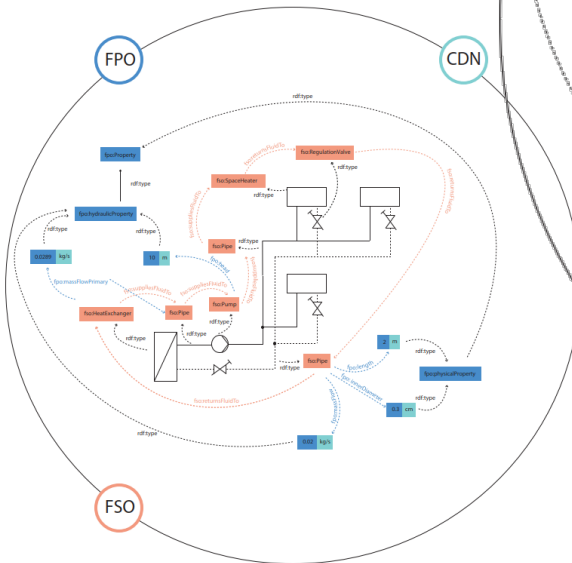
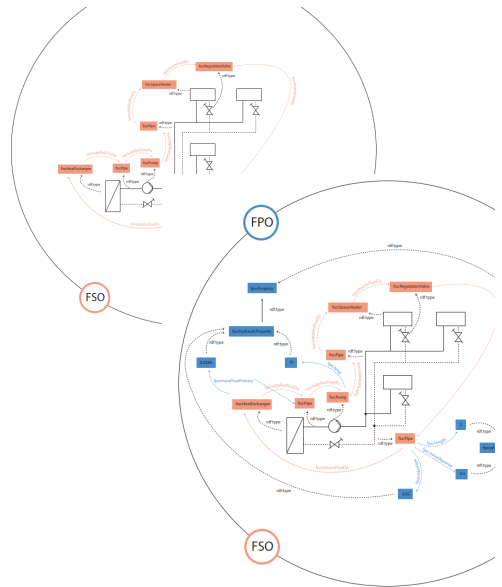
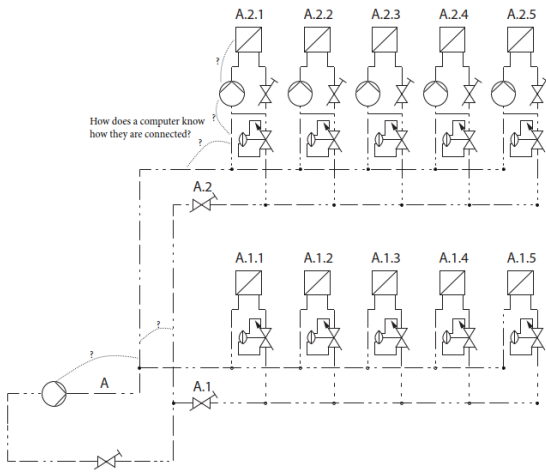
Domain	Sub-domain	Ontology
Assets & Topology	Building Topology	BOT
	Metadata & Tagging	HTO Brick REC4
Modeling & Analysis	Energy System	OEO
	BIM	ifcOWL
	BEM	SimModel
Smart Building	Energy Consumption	PowerOnt
	Device Modeling	DogOnt
	Energy Information	ThinkHome
	Assets & Applications	SAREF
	Ambient Intelligence	BONSAI
Building Management	Monitoring & Automation	DigitalBuildings PA ontology
	Energy Management	BEMS NewOSEIM
Building-to-Grid Integration	Demand Response	DELTA OpenADR
	Assets & Applications	SARGON
	Prosumer Coordination	SG-Ont SG BEMS
Energy Flexibility	Power System	SSG
	EF Description	Mirabel

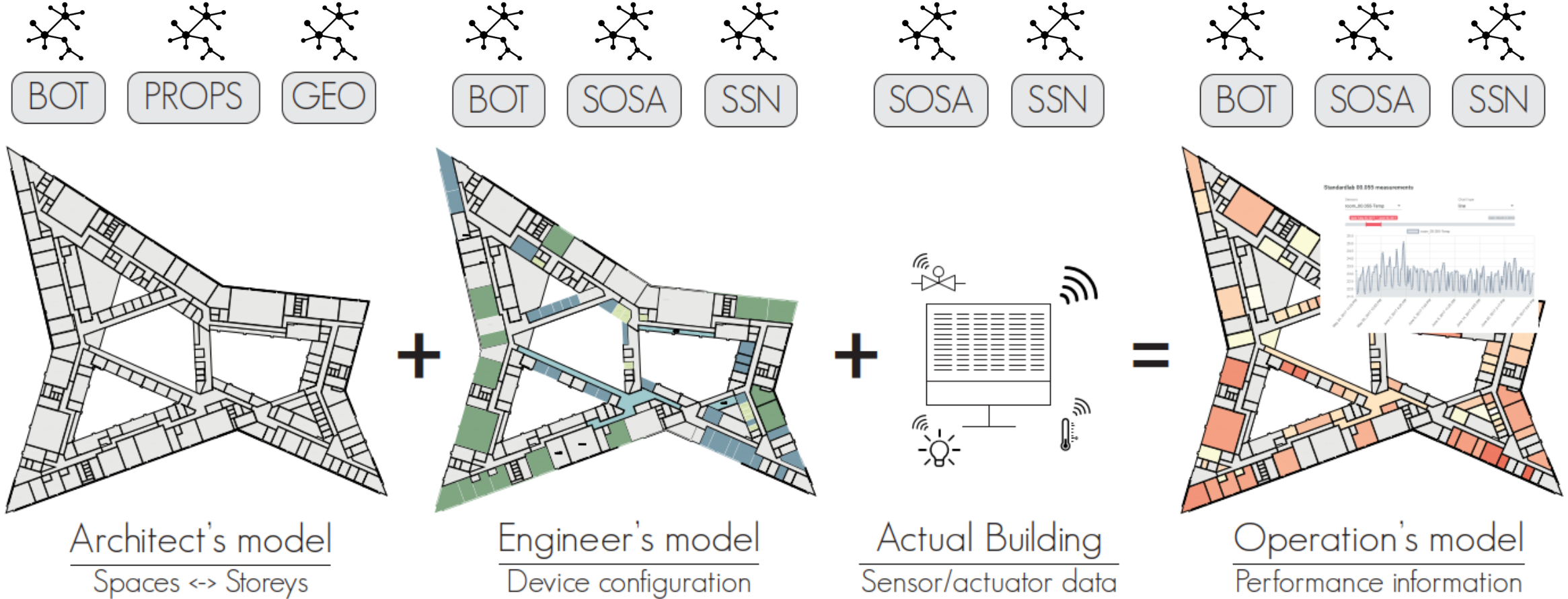


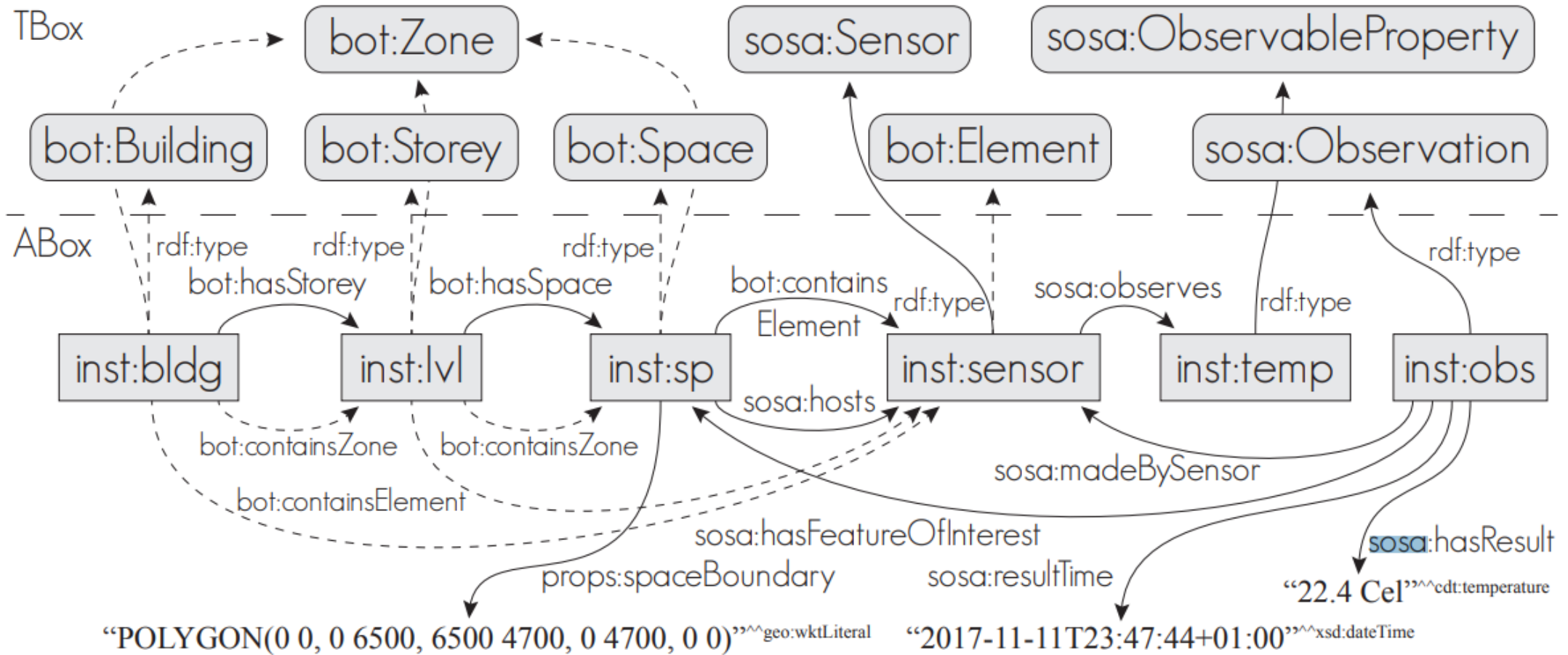
Bjørnskov & Jradi (2023)

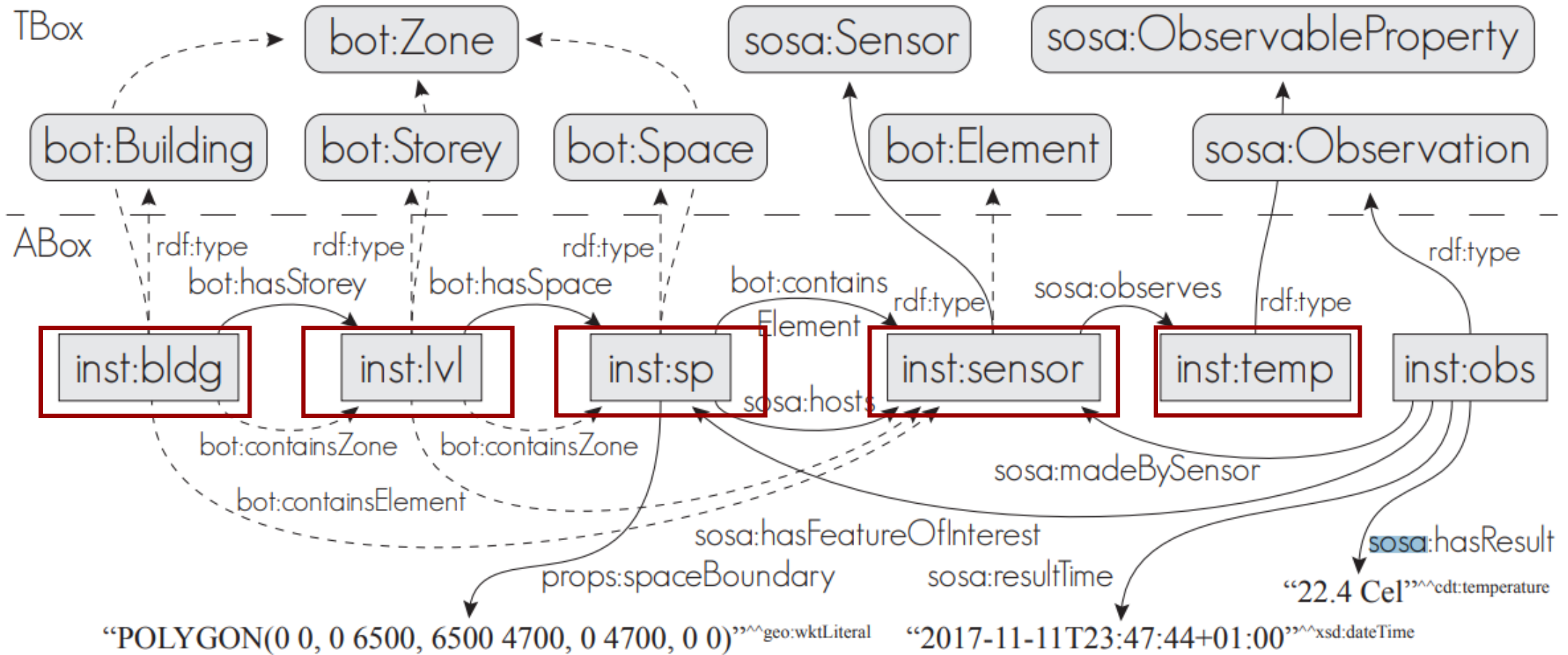


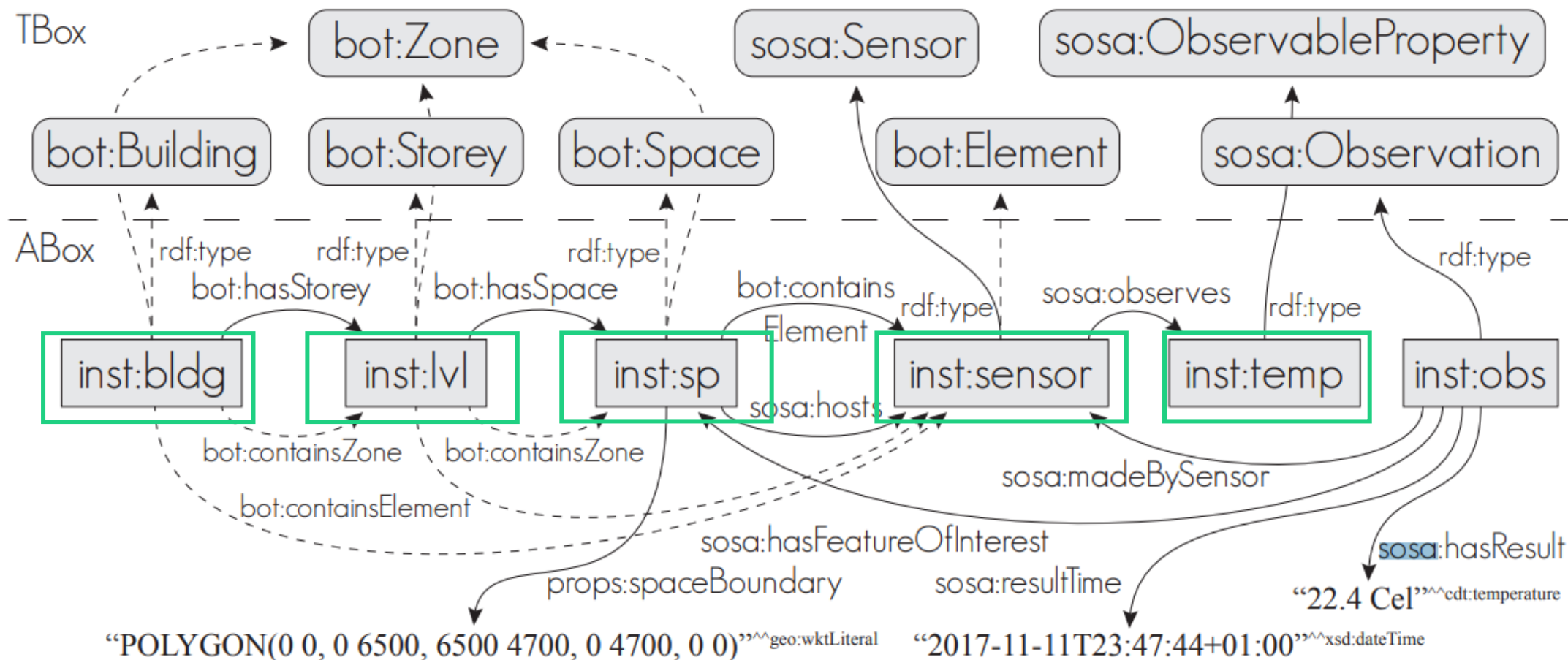
Knowledge graphs can be extended and updated continuously





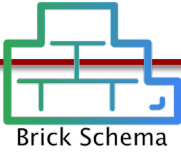




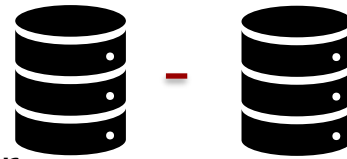


Fra CTS

Is Shorthand?	New Copy	History Name	Icon	History Display	Type	Device Name
false	/HTRK_UC10/S3dVvX01_PV01_A	S3dVvX01_PV0	module://icons	=VvX01_PV01	history:History	HTRK_UC10
false	/HTRK_UC10/EM01_VEN01_E	EM01_VEN01_E	module://icons	EM01_VEN01_E	history:History	HTRK_UC10
false	/HTRK_UC10/EM01_VEN01_P	EM01_VEN01_P	module://icons	EM01_VEN01_P	history:History	HTRK_UC10
false	/HTRK_UC10/EM01_VEN02_E	EM01_VEN02_E	module://icons	EM01_VEN02_E	history:History	HTRK_UC10
false	/HTRK_UC10/EM01_VEN02_P	EM01_VEN02_P	module://icons	EM01_VEN02_P	history:History	HTRK_UC10
false	/HTRK_UC10/EM01_VEN03_E	EM01_VEN03_E	module://icons	EM01_VEN03_E	history:History	HTRK_UC10
false	/HTRK_UC10/EM01_VEN03_P	EM01_VEN03_P	module://icons	EM01_VEN03_P	history:History	HTRK_UC10
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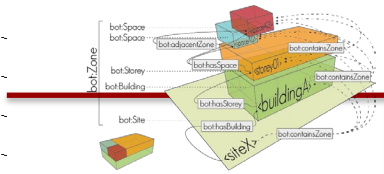
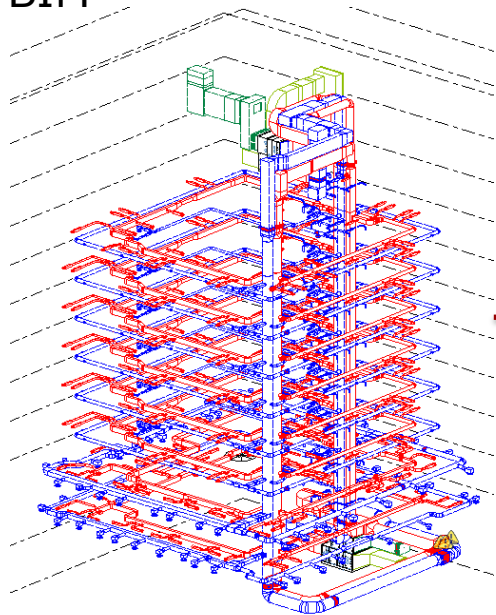
Brick Schema



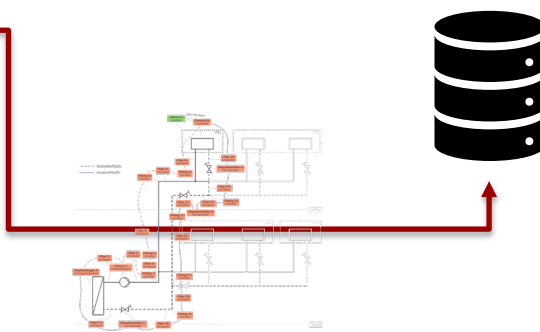
Tidsserier

Metadata

Fra BIM



BIM



Digital twins of systems, buildings & cities

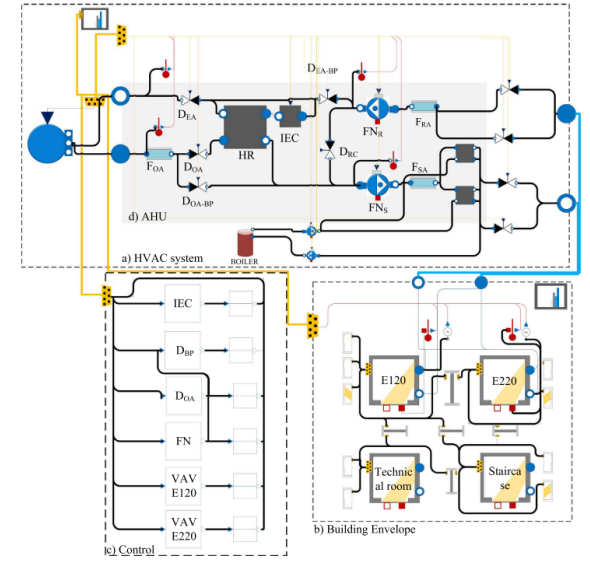
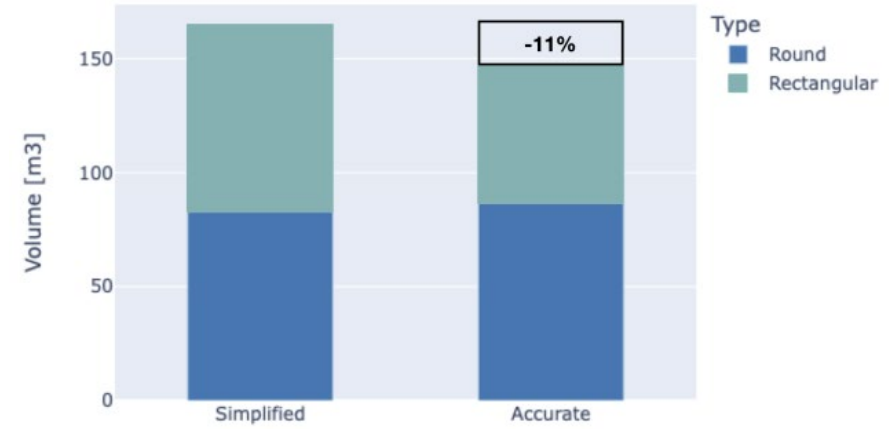
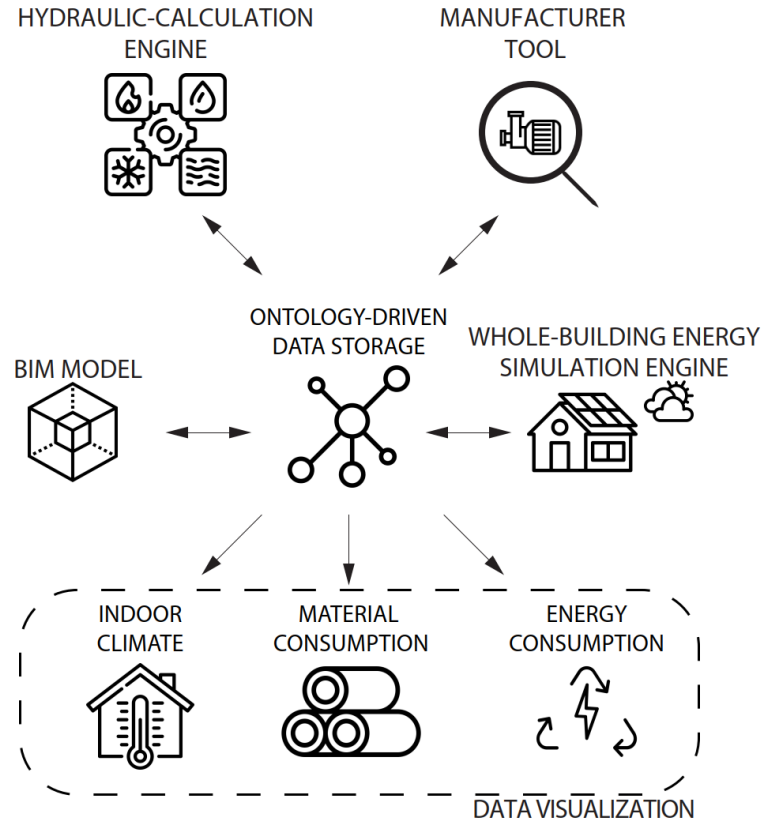
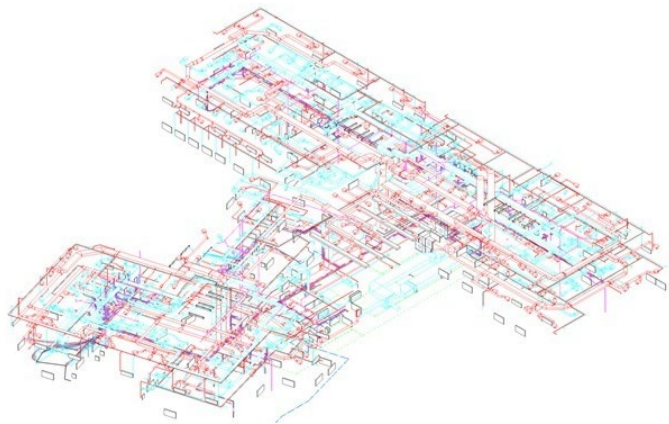
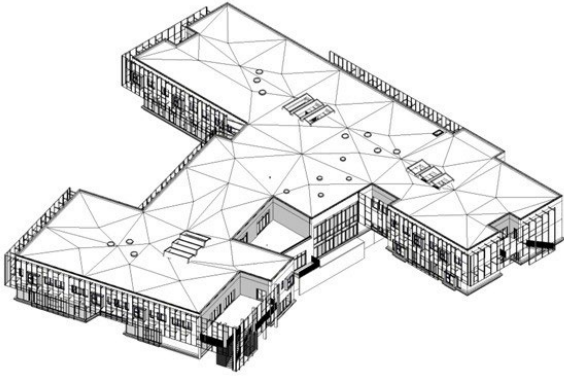


Fig. 9. Resulting BEPS Model. a) ventilation system model, b) building envelope, c) Control and d) Air Handling Unit.

- Detailed performance benchmarking
- Rule-based fault detection
- Model-based control optimization
- Load balancing
- Cross-sectorial optimization



Condition	AHU Type	Energy Cons. [kW]
Peak-load cond. with existing system	Geniox27	128,245
Peak-load cond. with new system	Geniox22	96,400
Part-load cond. with new system	Geniox18	89,369

Kucukavci, DTU, 2023

At bringe orden til kaos og lukke informationshuller

- Stil krav til din CTS leverandør
- Anvend Bygningsstyrelsens sensorbestyknings-paradigme
- Data skal logges i database udenfor CTS system
- Simple navngivning af datapunkter er ikke nok som metadata

- Anvend IFC+BOT+BRICK(+FSO) til at beskrive komponent-interrelationer

- Egen IT afdeling kan lave db-queries, webpages, opsætte regel-baseret monitorering, binde information fra forskellige databaser sammen

- Digital standardisering er på vej. Bygninger ligner mere og mere computere.

- **Software er den eneste skalérbar ressource vi har**

Mange tak

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