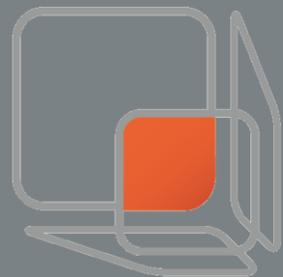


Oslo International Airport (OSL)

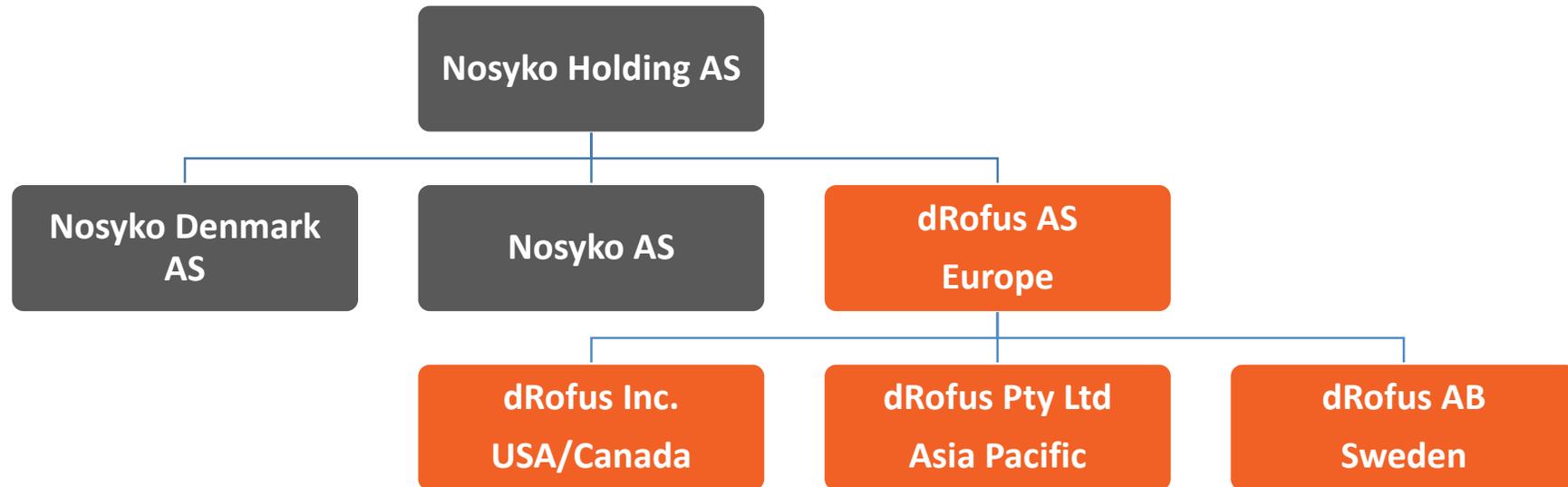
Sömlöst informationsflöde från
kravställning till förvaltning

BIM alliance – Stockholm 20. Oct.

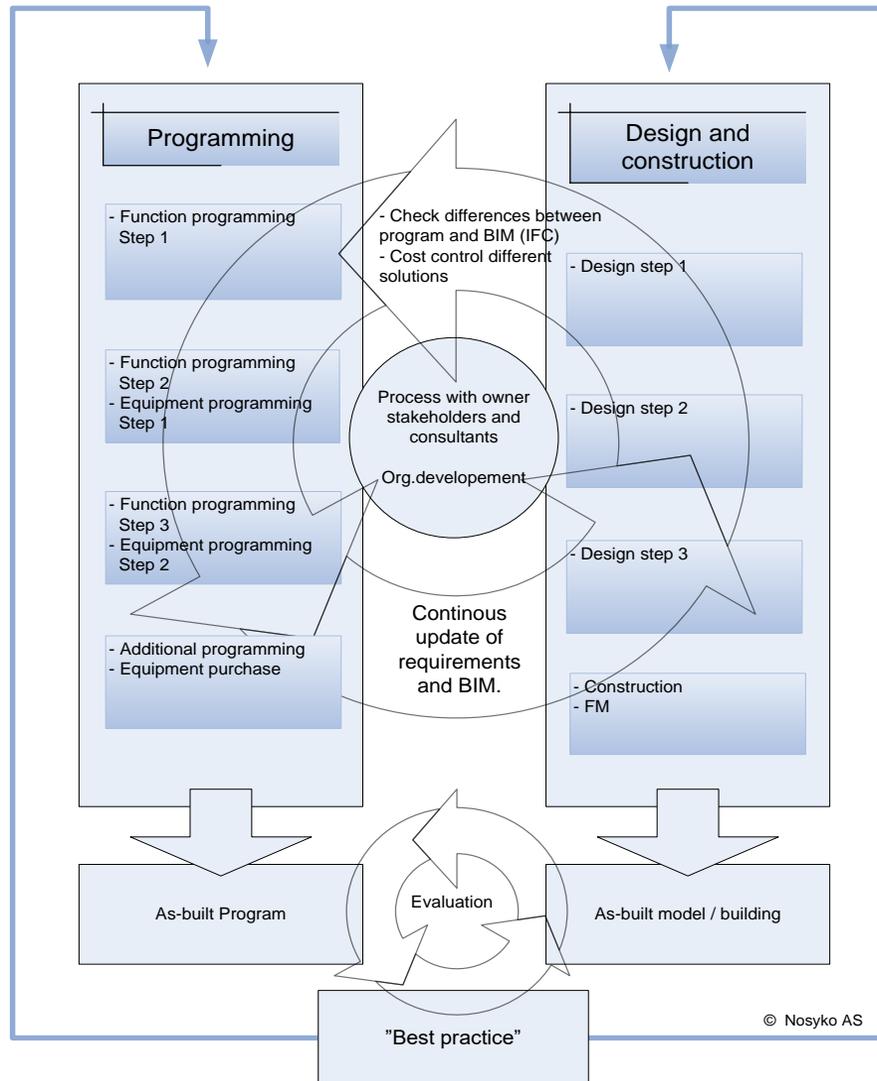


dRofus

dRofus



Client requirement management



The iterative process of client requirement management

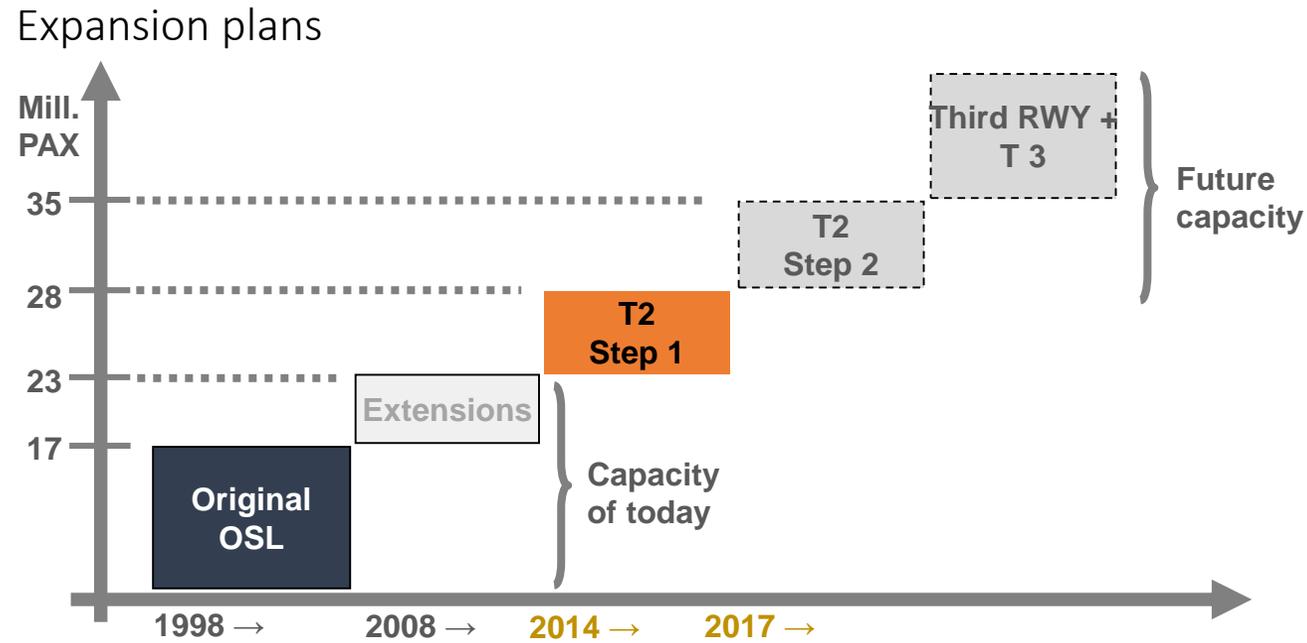
- Standardized Requirements model
- Exchange and present requirements in design tool
- Exchange and compare design to requirements
- Deviations trigger minimum one of the following actions:
 - Update design
 - Update requirements
 - Present delta
- At handover Requirement=Design=As Built
- All data exchange using open BuildingSMART standards

Oslo International Airport (OSL)

- Opened 8th October 1998
 - Capacity 17 mill passengers
 - Designed with mainly Bentley products
 - As-built in dgn format.
 - Still uses BentleyFacilities for FM



Oslo International Airport (OSL)

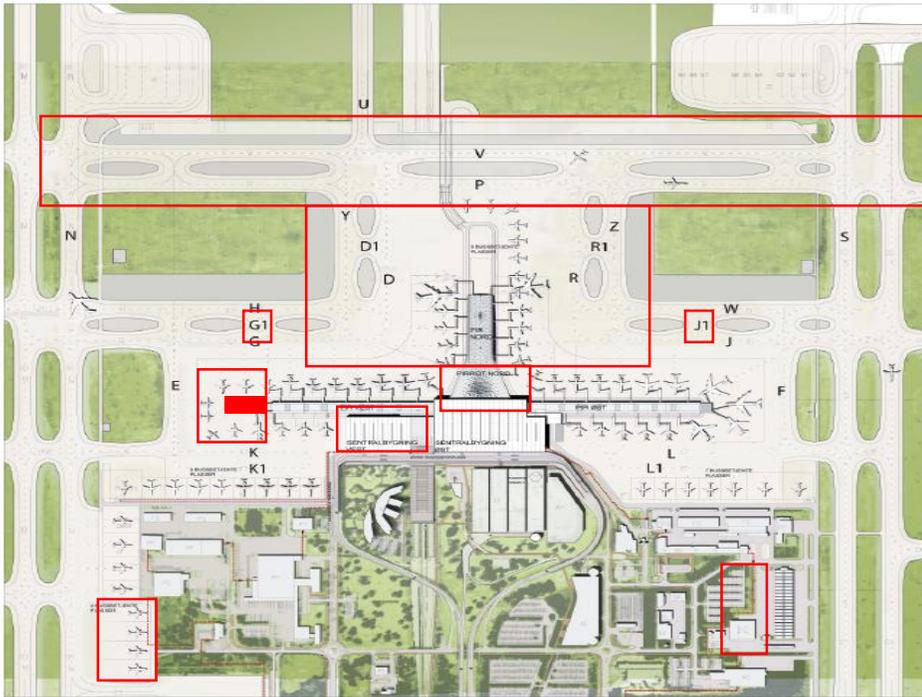


Oslo International Airport (OSL)

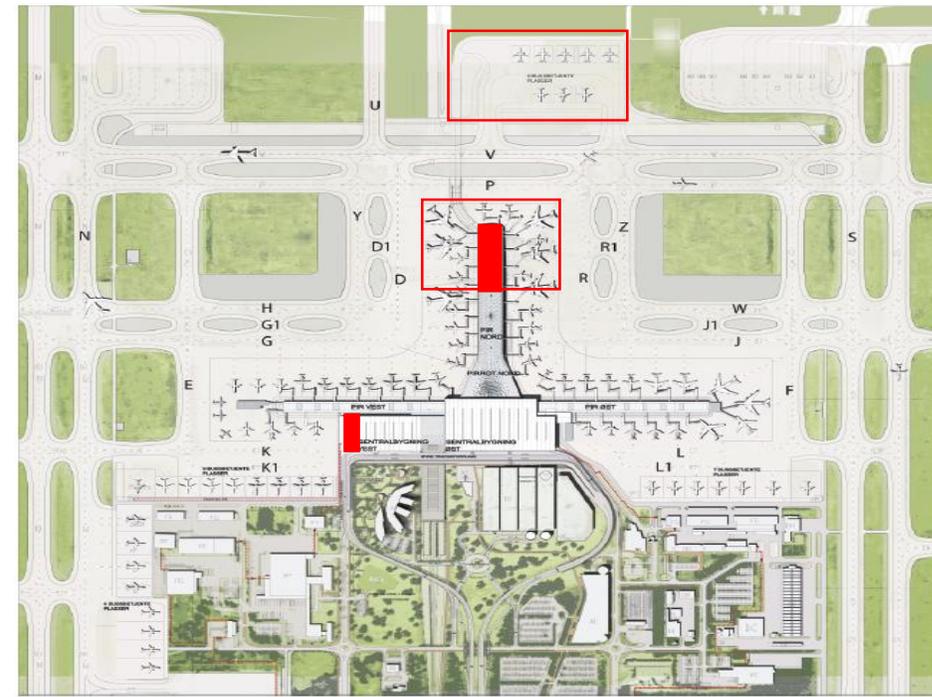


Oslo International Airport (OSL)

Phase 1



Phase 2



HARD FACTS – T2 PROJECT

Owner:

Avinor AS

Client:

Oslo Lufthavn AS (OSL)

Project management:

ÅF Advansia AS

New terminal area:

117 000 m²

Reconstruction:

25 000 m²

New airside area:

660 000 m²

Budget:

NOK 14+ billion

Kapacity:

28 million pax



On project initiation...

- The client realized they were heading against a “digital memory loss” for their as-built data.
 - The tools (and their native formats) were no longer used in on-shore AEC industry
 - They had 3 full time employees updating/converting as-built data.
- All contracts: *“Models produced in the project is owned by the client and is to be handed over in Native and ifc format”*
- Open standards/formats for:
 - Transport in- and between business processes (projects)
 - Archiving and FM
- The market leader at present, Revit, will not be around forever...

BIM authoring tools in design

PM – ProjectInformationManagement, PIM (+AIM):

- dRofus
- 1 db.

AA1 - ARCH- Nordic:

- Revit Architecture
- BIM Files: 14 Native, 145 Ifc

AB1 - STRU - Aas-Jakobsen:

- Tekla Structures
- BIM Files: 1 Native, 96 Ifc

AE1 - EL - Ingeniør Per Rasmussen:

- Revit MEP Magicad
- BIM Files: 9 Native, 19 Ifc

AV1 – MECH/PIPE - Cowi:

- Revit MEP Magicad
- BIM Files: 5 Native, 35 Ifc

AC1 - TECHN CONS - Norconsult (Airside/landside):

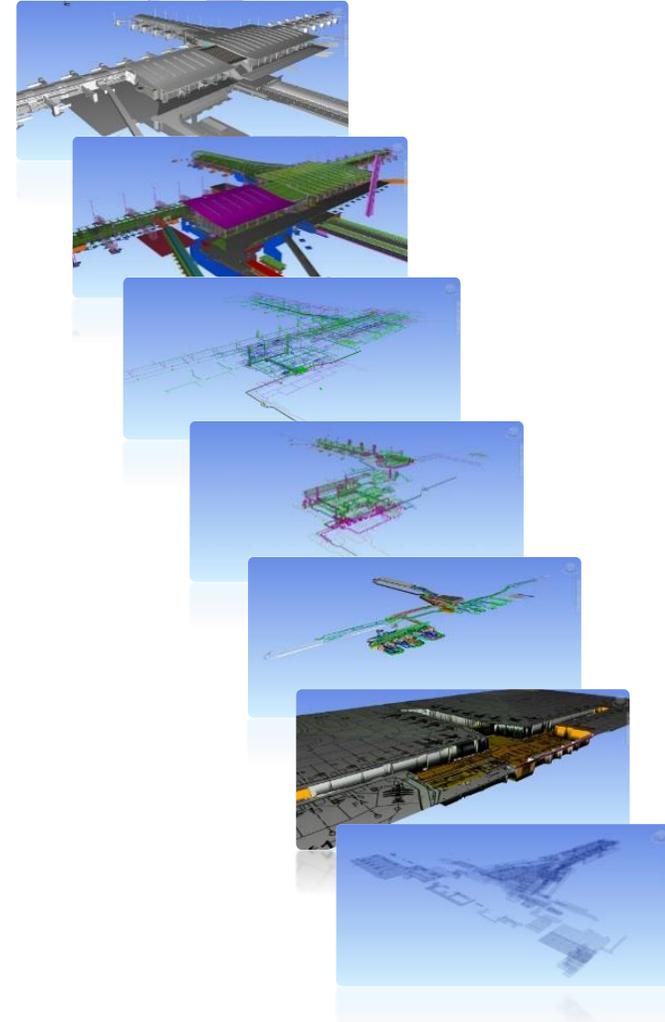
- Microstation / Autodesk Civil 3D / Novapoint / Revit

AC2 - LANDSCAPE - Bjørbekk og Lindheim:

- Autodesk Civil 3D / Revit

Contractors – Various use:

- BIM Files: Approx 20 Native files, 48 Ifc



Someone started thinking – getting worried

- Huge dataset coming in – “conservation”?
- Will BIM “die” like drawings do today

- Can it be handed over, and to what?
- ICT solutions...?
- Is the Client-/owner organization ready for it?
- The product we are looking for don’t exist...

- At the same time dRofus was used for room management and product documentation in the T2 project
 - To reserve O&M ID’s in use, all ID codes was imported to dRofus
 - (After a good clean up) dRofus was set as owner of the ID’s in the project
- It worked out well -> R&D project

R&D targets

- Improve FM&**OM** processes
 - Maintain all data one place
 - Better quality/trust in data
 - Distribution and availability
- ROI for «BIM» in the T2 project and all other projects currently using BIM.
 - ICT that can handle it...
 - Prepare the organization...
- Implement an asset database and ModelServer that communicates to each other and the FM processes/tools out there
- BIM for the masses...
 - BIM on site for maintenance operators – navigate from data to graphics and vice versa

Client-/owner organization

- A professional FM&OM organization
 - Well organized and a ton of applications to help (40+ syst.)
 - **Unique ID's** - the backbone of communication between applications (and humans).
 - Rooms, systems, components
 - They have a ton of routines etc. to make sure that any change in the facility is taken care of and reflected in the as-built documentation (ID's and drawings)
 - Still...

The challenge/pitfalls

- Very «dynamic» facility
- Mission critical ID's **MUST** be tracked due to security, efficiency in maintenance and operations, trust in data etc.
- Maintaining codes and their integrity
- Maintain data one place
- Transaction project to FM and vice versa
- Integrate BIM in FM/M&O or it will “die” ...
- The classification created in a time without BIM -> “BIMify”

Unique ID's – classifications/physical labeling

- Location code (+C)
- System classification
360 = Ventilation
- Type classification
RT = Temperature sensor
(RT50 – unique in system)
- +C=360.04-RT50
Project/facility unique ID
- Room ID – “TSDAL”
 - TS = Location code
 - D = Level
 - AL = Grid
 - 463 -> Makes it unique at location



Romoversikt

Funksjoner Grupper

OSL

- Terminal 2 / Pir
 - > 01 - Bagasjehåndtering
 - > 02 - Teknisk/Drift
 - > 03 - Administrative arealer
 - > 04 - Servicearealer
 - > 05 - Komerisielle arealer
 - 05.01 - Duty Free
 - 05.02 - Butikk
 - 05.03 - Servering
 - 05.06 - Toaletter personal
 - 05.100 - Duty-free (D) nå: Ny
 - 05.101 - Duty-free (F) nå: Duty-free
 - 05.102 - Duty-free (F) nå: Ny
 - 05.200 - Kiosk (D) nå: Bilulleie
 - 05.201 - Telekiosk (D) nå: 7-Eleven
 - 05.202 - Apotek (D) nå: 7-Eleven
 - 05.203 - Bokhandel (D) nå: Ark
 - 05.204 - Kiosk (D) nå: Narvesen
 - 05.205 - Reiseartikler (F) nå: Ny
 - 05.206 - Kiosk (F) nå: Ny
 - 05.207 - Elektronikk (F) nå: Ny
 - 05.208 - Bokhandel (F) nå: Ny
 - 05.209 - Kiosk (F) nå: Point
 - 05.210 - Parfymeri (F) nå: Ny IKKE
 - 05.211 - Fashion Herre (F) nå: Fas
 - 05.212 - Fashion Dame (F) nå: Acc
 - 05.213 - Fashion Dame (F) nå: Ele
 - 05.214 - Kiosk (F) nå: Travel Valu
 - 05.215 - Bokhandel (F) nå: Ny
 - 05.216 - Telekiosk (F) nå: Nv

Delfunksjon: 05.100 - Duty-free (D) nå: Ny

Rom Funksjonsprogram Bilder/Dokumenter Areal

Legg til rom Åpne... Skriv ut Vis BIM Søk

Romfnr:	Prosjekt/Ge...	Navn:	Prog areal:	Prosj areal:	RFP status	Utstyr
05.100.001	TIDAQ471	Butikk, duty free ankomst	0,00	807,19	Avledet fra SR.010	Ikke c
05.100.002	TSDAL463	Butikk, duty free ankomst	0,00	1 231,13	Avledet fra SR.010	Ikke c
05.100.003	TSDAL411	Kontor Duty Free	0,00	40,96	Unik	Ikke c
05.100.004	TIDAQ472	Butikk, duty free ankomst	0,00	886,33	Avledet fra SR.010	Ikke c
05.100.005	TSDAL426	Garderobe herre	0,00	13,36	Ikke opprettet	Ikke c
05.100.006	TIDBR511	Butikk, duty free ankomst	0,00	170,09	Ikke opprettet	Ikke c

05.100.002 - Butikk

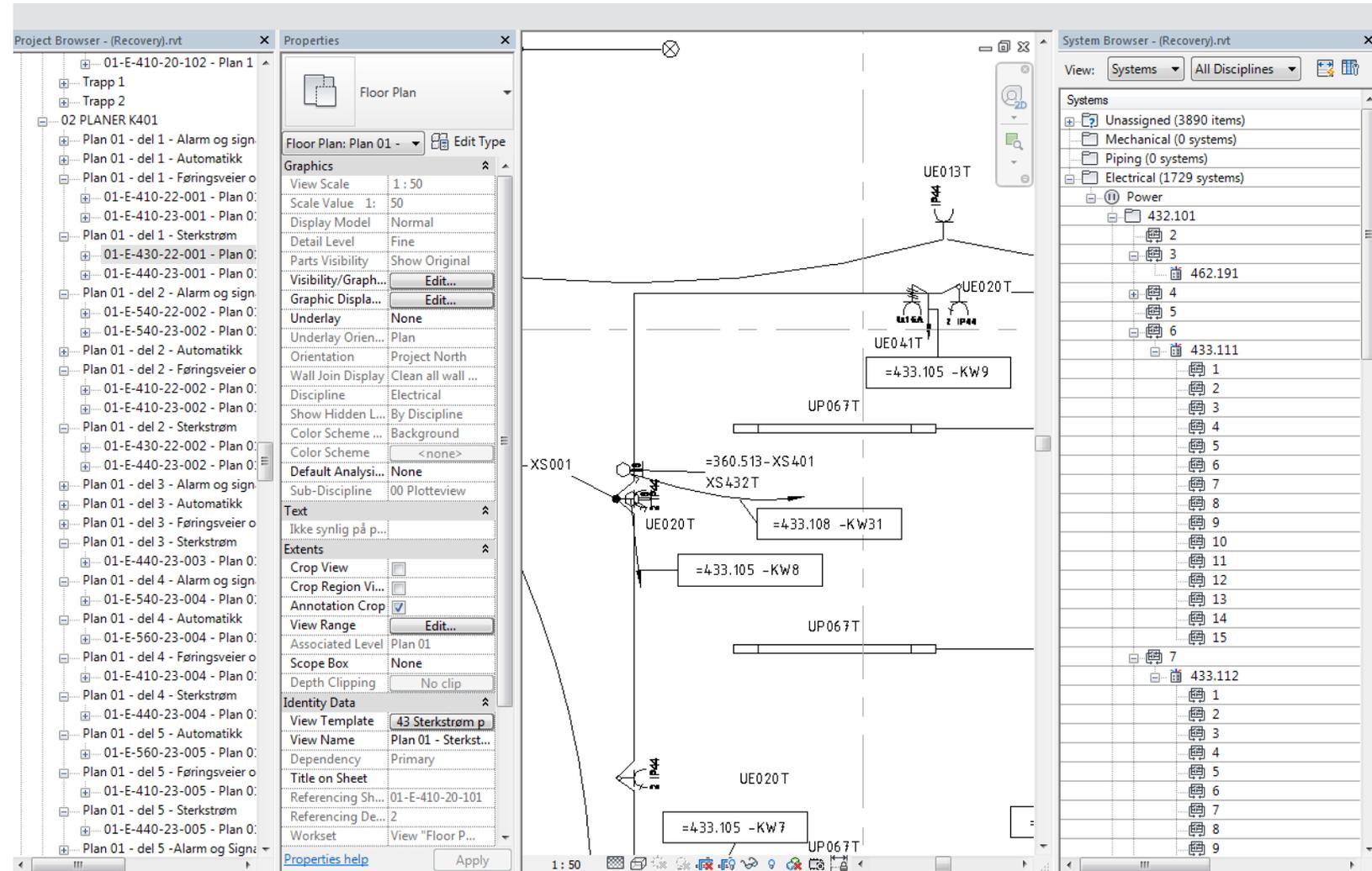
Romkjeme Notat Alt utstyr i rom Bilder/Dokumenter

Plassering: Delfunksjon: 100 - Duty-free (D) nå: Ny / Delprosjekt: A - Terminal 2 / Pir / Hovedfunksjon: 05 - Komerisielle arealer
Status: Opprettet: 13.01.2010 10:27 av: hkr / Endret: 05.06.2016 22:59 av: morae

Navn og nummer	Grupper
Romfunksjonsnr: 05.100.002	Brann
Romnavn: Butikk	Bruker-gruppe: Dutyfree
Rombetegnelsen: duty free ankomst	Bygg: T2 ombygges
Prosj. romnr: TSDAL463	Delfunksjonsområder: 3.1.1
Bruksromnr:	Kontrakt nr.:
Tegningsnr.:	MVA-Gruppe: Ombygging eksistere
Tegningsnavn:	Nivå:
Kommersiell areal nr.:	Plan: D

Unique ID's – in the clean sheet industry

- Designed in Excel
- Schematics
- Drawings/BIM
- O&M



How ID's are defined and generated...

- CAD/BIM and project guidelines
- With a lot of human logic built in
- A lot of manually interpretation and punching involved
- Process
 - Punch in what you know (Excel, schematic, BIM)
 - Get some help concatenating parameters
 - Export schedule to Excel
 - Do some fixes
 - Import to dRofus...

36	Brannspjeld	<ul style="list-style-type: none"> • Nummereres unikt for hvert spjeld • Nummeret skal følge ventilasjonssystemets nummer. • <u>D</u>labcc BRANNSPJELD <u>DI</u>a--- 1=<u>Tilluft</u>, 2=<u>Avtrekk</u> DI-b—Antall spjeld i gruppe DI--cc Løpenummer
----	-------------	---

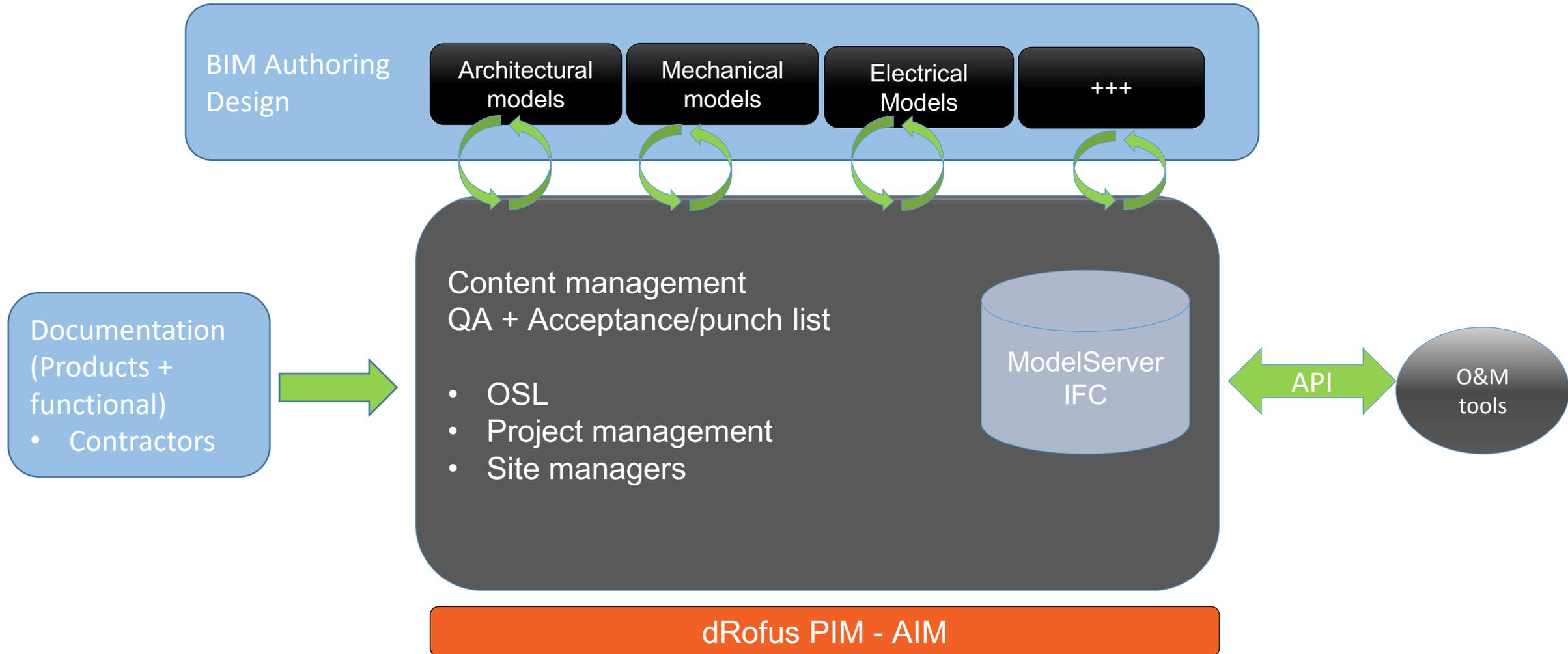
Eksempel: "Signalidentitet for operasjonell status for kjølemaskin":

+DE=393.001-AA0001D01	
+DE	Områdekode (Sentralt driftsområde, <u>energisentral</u>)
=393	Anleggsgruppe 393 (Fjernkjøling)
.001	Anleggsgruppe, løpenummer 001 (Anlegg nr. 1)
-AA	Komponenttypekode AA (Toveisventil)
0001	Løpenummer for komponenter (Toveisventil nr. 1)
D	Kode for punkttype (D=driftsindikering, se tabell 8.2)
01	Løpenummer for signalpunkt

Client, non-graphical data (Priority systems)

- **IFS – M&O-system** (User: OSL)
Contains Object-Id – **synchronized from dRofus** (ID's that require maintenance)
- **GIS –** Registration of room. E.g. in the Terminal - roomshape
 - Rooms containing:
number, name, floor finish, cleaning frequency, etc., Data **synchronized with FM system** "ISY Eiendom"
- contains **Object-ID – manually entered**, contains **room number – manually entered**
- **Gemeni VA –** GIS-system for infrastructure(Users: OSL)
 - contains **Object-ID – From dRofus (Excel)**
- **Telemator –** Design, documentation and M&O cables and IT-networks (Users: OSL and consultants)
 - contains **Object-ID – manually entered** (created here)
 - contains **room-ID – manually entered**
- **Starwatch: –** Surveillance doors with alarm (Users: OSL)
 - contains **Object-ID – manually entered**
- **Firewin: –** Fire Surveillance (12 buildings) (Users: OSL)
 - contains no Object ID, **room number – manually entered**
- **Autronica: –** Fire Surveillance (remaining buildings) (Users: OSL)
 - contains **Object ID – manually entered**
 - contains **room number – manually entered**
- **SD/SRO: –** Building Automation systems– (Users: OSL)
 - contains **Object-ID – manually entered**

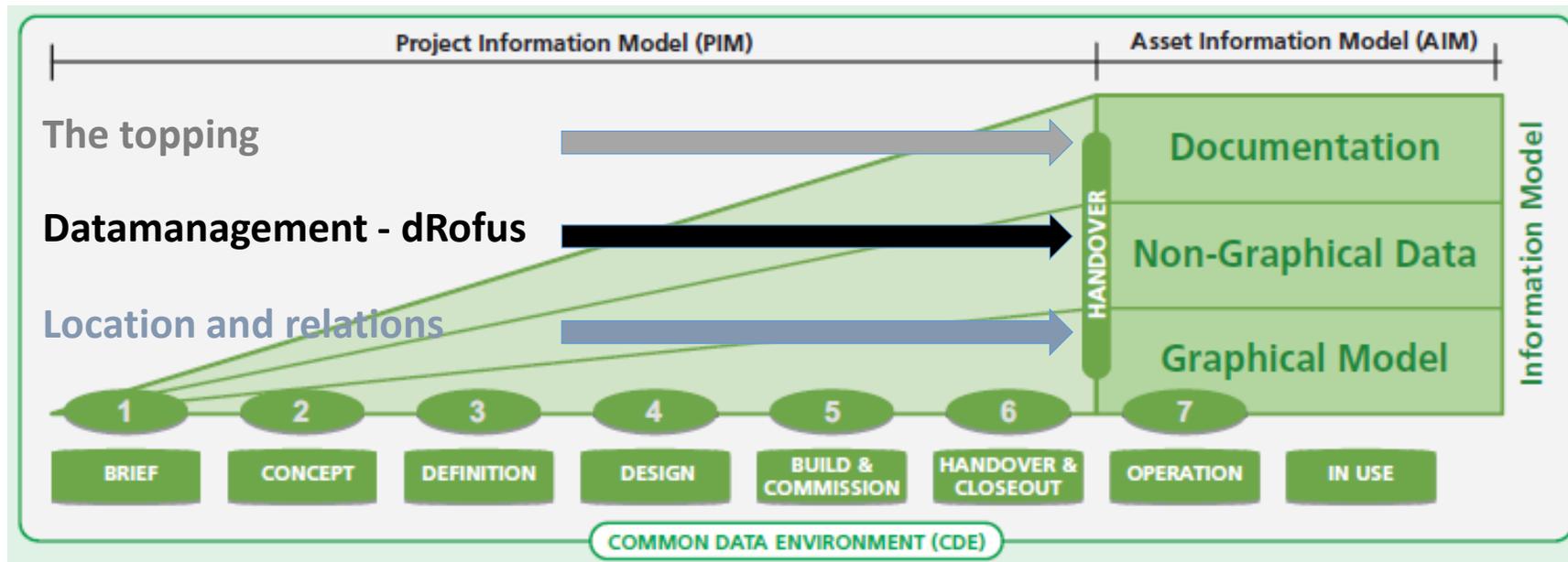
The new set up - simplified



Why this is a good idea

- Database rules ensures ID integrity across all models and all domains
 - Less human logic -> Can simplify project guidelines
- The Design team (primarily engineers) gets help for their process of ID tagging and documenting the designed systems and components
 - Data is captured when it's created rather than retrospective
 - You can choose when you want to push back the ID's to BIM/Tags in drawings
- The contractor documents the same place (at the type level)
- The ID's are maintained one place and can be distributed...
- BIM gives all the data a location

BS 1192

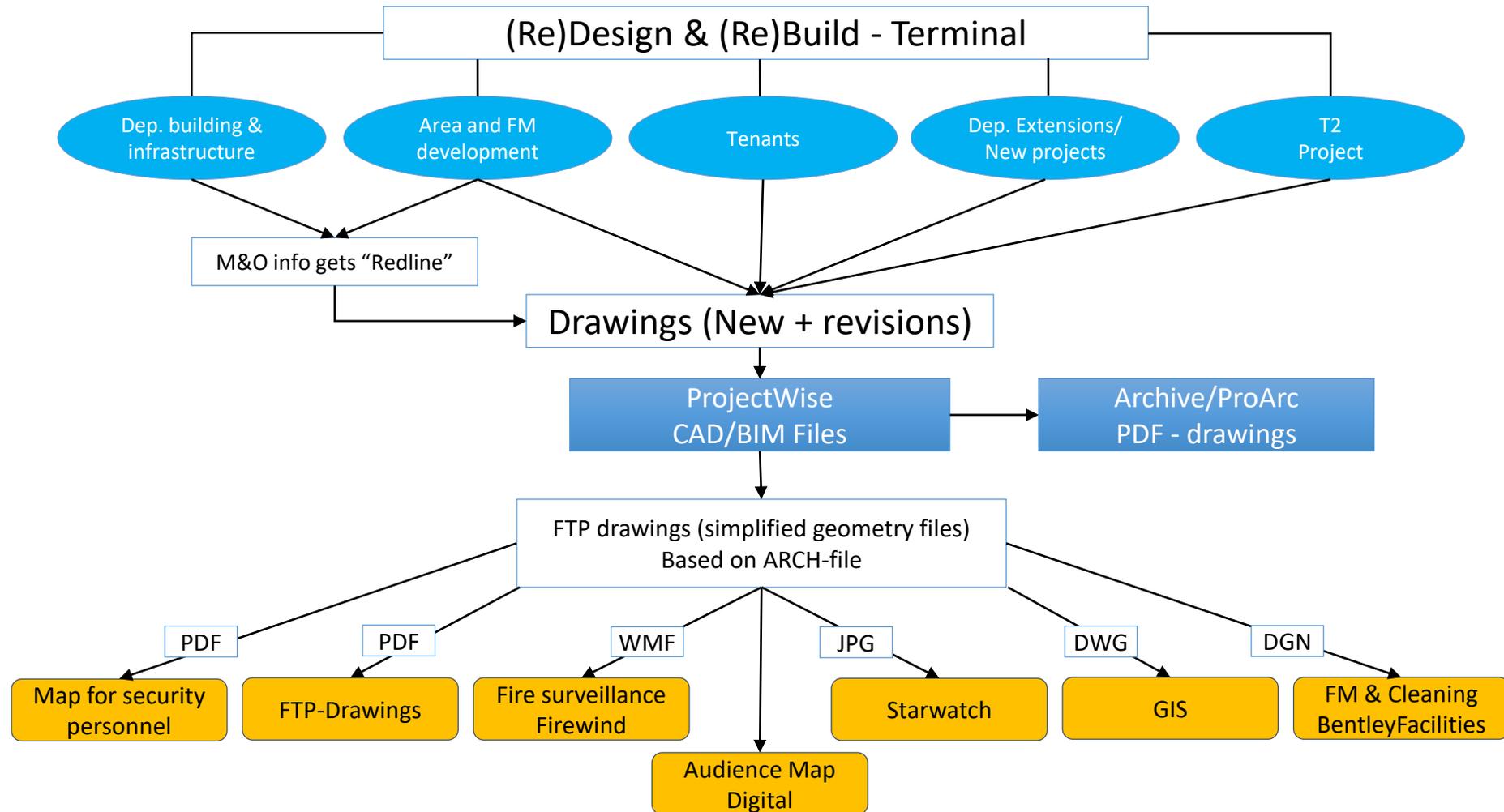


The non-graphical is “Solved”

- dRofus used in T2 project
 - “Reserve” used ID’s from M&O -> dRofus
- January 2015 – dataflow reversed -> IFS gets correct ID’s from dRofus
 - 270 000 ID’s various “status”.
 - Approx. 70 000 (Status «45 In operations») synchronizes to IFS (M&O) every 15 minute
- ID’s owned/maintained one place
- API for data distribution in place

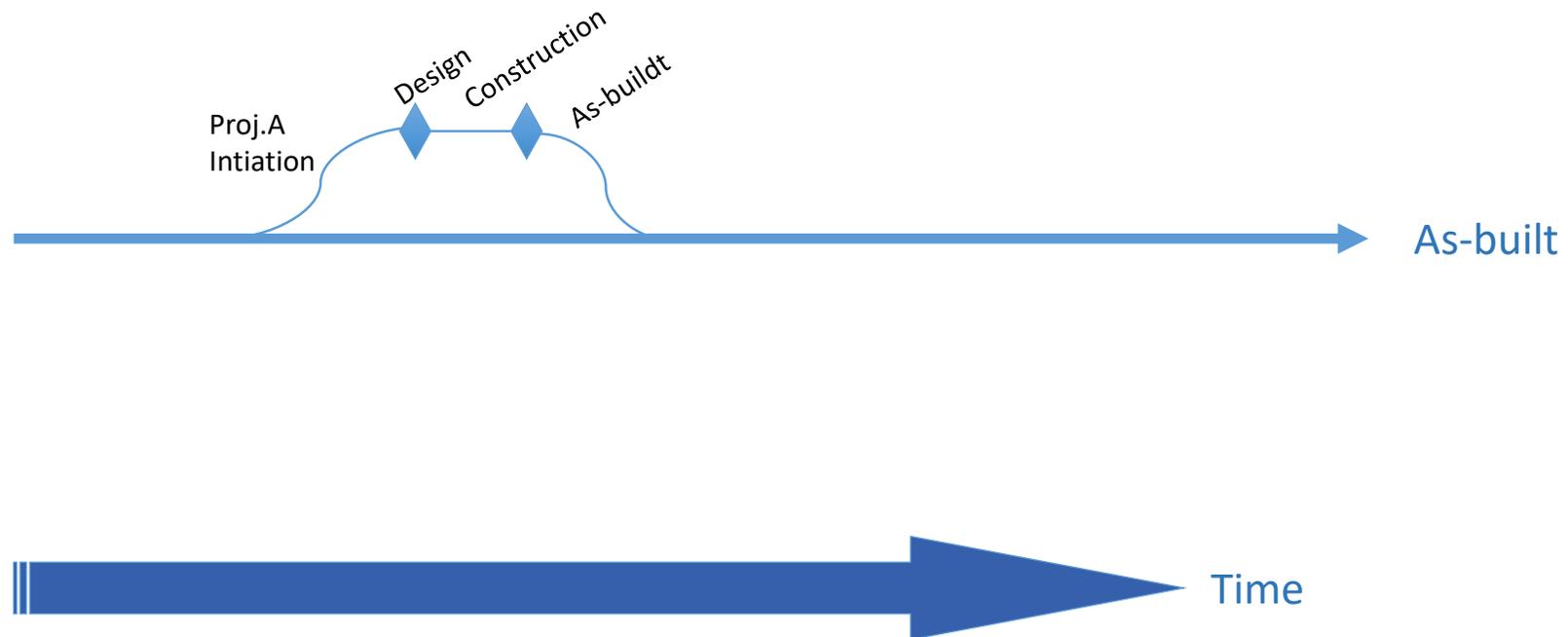
00 - Under arbeid
10 - Oversendt OSL for godkjenning
15 - Godkjent av OSL
20 - Klar for tvenfaglig bruk
25 - Overført til Entreprenør
27 - Utstyrinfo klar for annen entreprise
30 - Som bygget
40 - Oversendt OSL for godkjenning
41 - Ikke godkjent av OSL. Mangler data/dokumentasjon
42 - Entreprenør har komplettert
43 - Godkjent av OSL
44 - Midlertidig driftsassistanse
45 - I drift
R00 - Under arbeid
R10 - Oversendt OSL for godkjenning
R15 - Godkjent av OSL
R25 - Overført entreprenør
R30 - Som revet fra entreprenør
R45 - Kassert
45 - I drift

Client organization – Graphical data



The nature of the (airport) facility

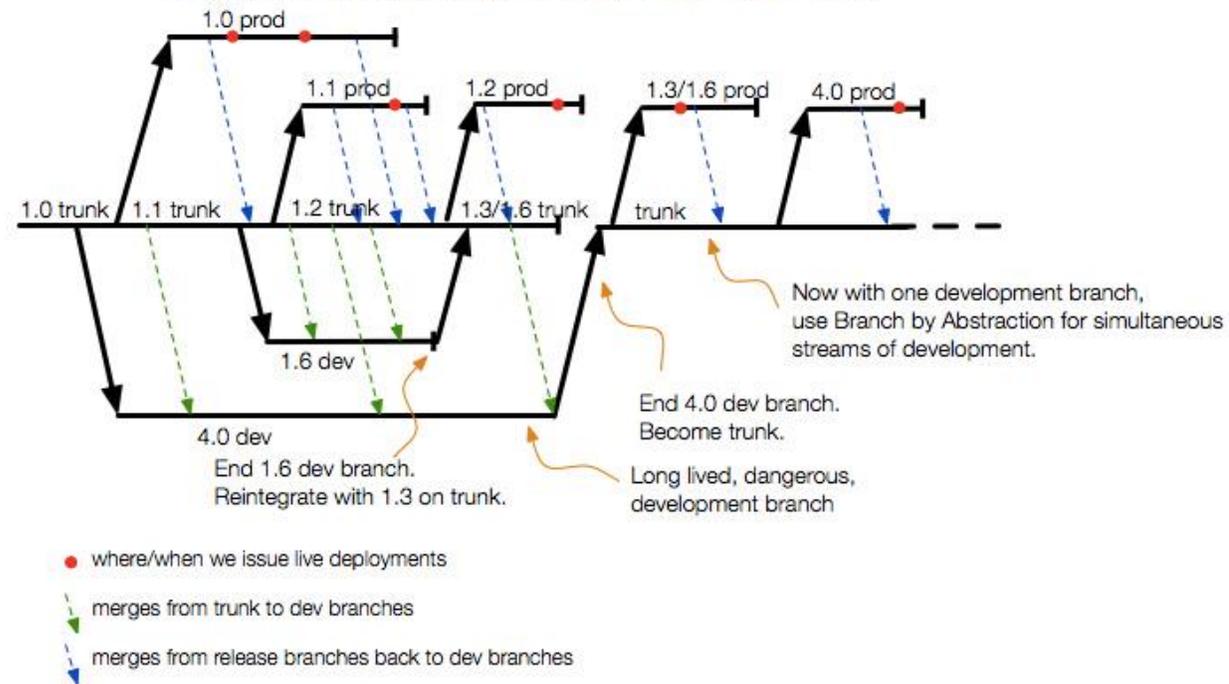
- Branching and merging...



The nature of software development

Scenario involving multiple streams of work in same codebase, with merging

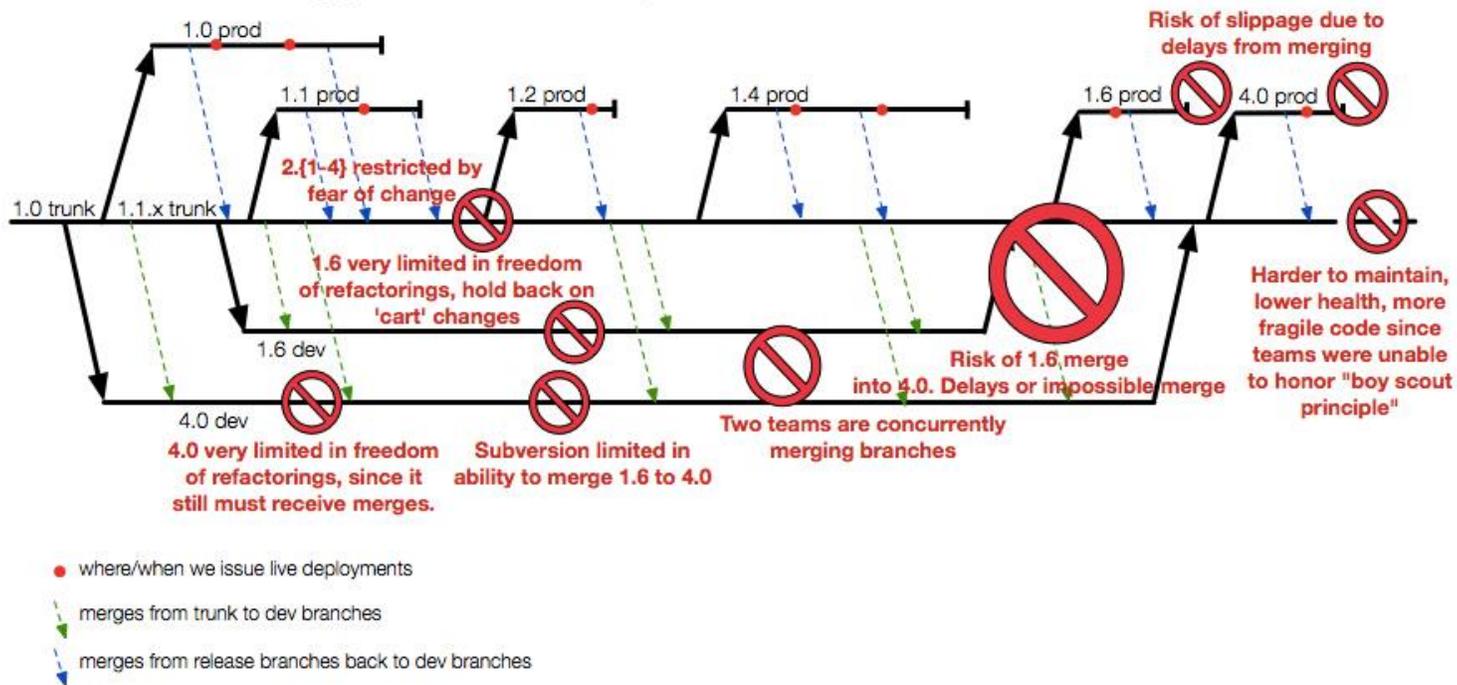
Sometimes business requirements will necessitate working with multiple teams on different branches, in parallel.
Ideally use Feature Toggles / Branch By Abstraction in one mainline (trunk).



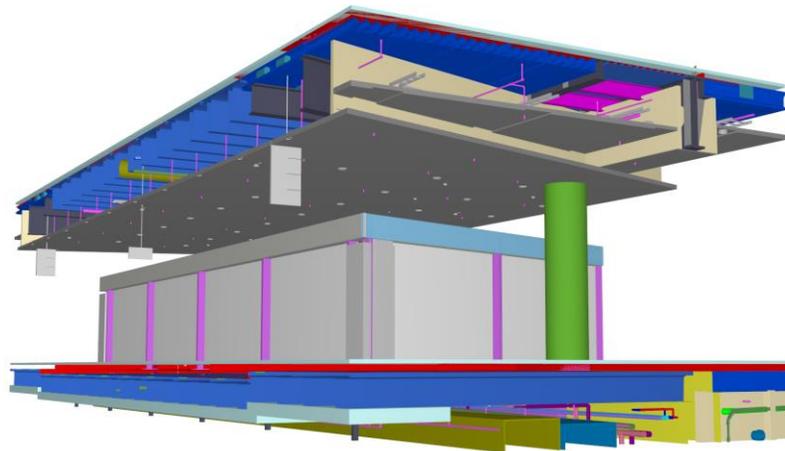
And challenges...

Dangers in Multiple Branch Parallel Development

Sometimes business requirements will necessitate working with multiple teams on different branches. If this involves merging, there are some risks that are important to be aware of.



Why the comparison...



=

```

1 ISO-10303-21:
2 HEADER:
3 FILE_DESCRIPTION(('ViewDefinition [CoordinationView, QuantityTakeOffAddOnView]', '2:1:');
4 FILE_NAME('T:\72101_BIM\T\ABI-20\02-IFC\Script\72101-ab-tio-20-0001.ifc', '2011-09-19T18:46:25', ('NSWNET',
5 FILE_SCHEMA (('IFC2X3'));
6 ENDSEC;
7
8 DATA:
9 #1= IFCPERSON('NSWNET/bjmar', 'Undefined', $, $, $, $, $);
10 #3= IFCORGANIZATION($, 'Tekla Corporation', $, $, $);
11 #7= IFCPERSONANDORGANIZATION(#1, #3, $);
12 #8= IFCAPPLICATION(#3, 'Next', 'Tekla Structures', 'Multi material modeling');
13 #9= IFCOWNERHISTORY(#7, #8, $, .NOCHANGE., $, $, 1316450720);
14 #10= IFCARTESIANPOINT((0., 0., 0.));
15 #14= IFCDIRECTION((1., 0., 0.));
16 #18= IFCDIRECTION((0., 1., 0.));
17 #22= IFCDIRECTION((0., 0., 1.));
18 #26= IFCAXIS2PLACEMENT3D(#10, #22, #14);
19 #29= IFCGEOMETRICREPRESENTATIONCONTEXT('Body', 'Model', 3, 1.0000000E-5, #26, $);
20 #32= IFCGEOMETRICREPRESENTATIONCONTEXT('BoundingBox', 'Model', 3, 1.0000000E-5, #26, $);
21 #35= IFCSIUNIT(*, .LENGTHUNIT., .MILLI., .METRE.);
22 #36= IFCSIUNIT(*, .AREAUNIT., ., .SQUARE_METRE.);
23 #37= IFCSIUNIT(*, .VOLUMEUNIT., ., .CUBIC_METRE.);
24 #38= IFCSIUNIT(*, .MASSUNIT., .KILO., .GRAM.);
25 #39= IFCSIUNIT(*, .TIMEUNIT., ., .SECOND.);
26 #40= IFCSIUNIT(*, .PLANEAANGLEUNIT., ., .RADIAN.);
27 #41= IFCSIUNIT(*, .SOLIDANGLEUNIT., ., .STERADIAN.);
28 #42= IFCSIUNIT(*, .THERMODYNAMICTEMPERATUREUNIT., ., .DEGREE_CELSIUS.);
29 #43= IFCSIUNIT(*, .LUMINOUSINTENSITYUNIT., ., .LUMEN.);
30 #44= IFCUNITASSIGNMENT((#35, #36, #37, #38, #39, #40, #41, #42, #43));
31 #46= IFCPROJECT('1SH8avTb3khYorwzIP3a', #9, 'T2', 'Description', 'Object type', 'LongName', 'Phase', (#29, #32), #44);
32 #53= IFCLOCALPLACEMENT($, #26);
33 #56= IFCSITE('OvErFkxDaCull1vIQ5ALHW', #9, 'Gardemoen', $, $, #53, $, $, .ELEMENT., $, $, 0., $, $);
34 #66= IFCLOCALPLACEMENT(#53, #26);
35 #69= IFCBUILDING('3Y7ncHSzG7kw3MxKglai', #9, 'TI', $, $, #66, $, $, .ELEMENT., $, $, $);
36 #79= IFCLOCALPLACEMENT(#66, #26);
37 #82= IFCBUILDINGSTOREY('5GFEC2RfDKDPevalGH_nyk', #9, 'K', $, $, #79, $, $, .ELEMENT., $);
38 #92= IFCARTESIANPOINT((578683.73, 725300., 224774.52));
39 #96= IFCDIRECTION((0., -1., 0.));

```

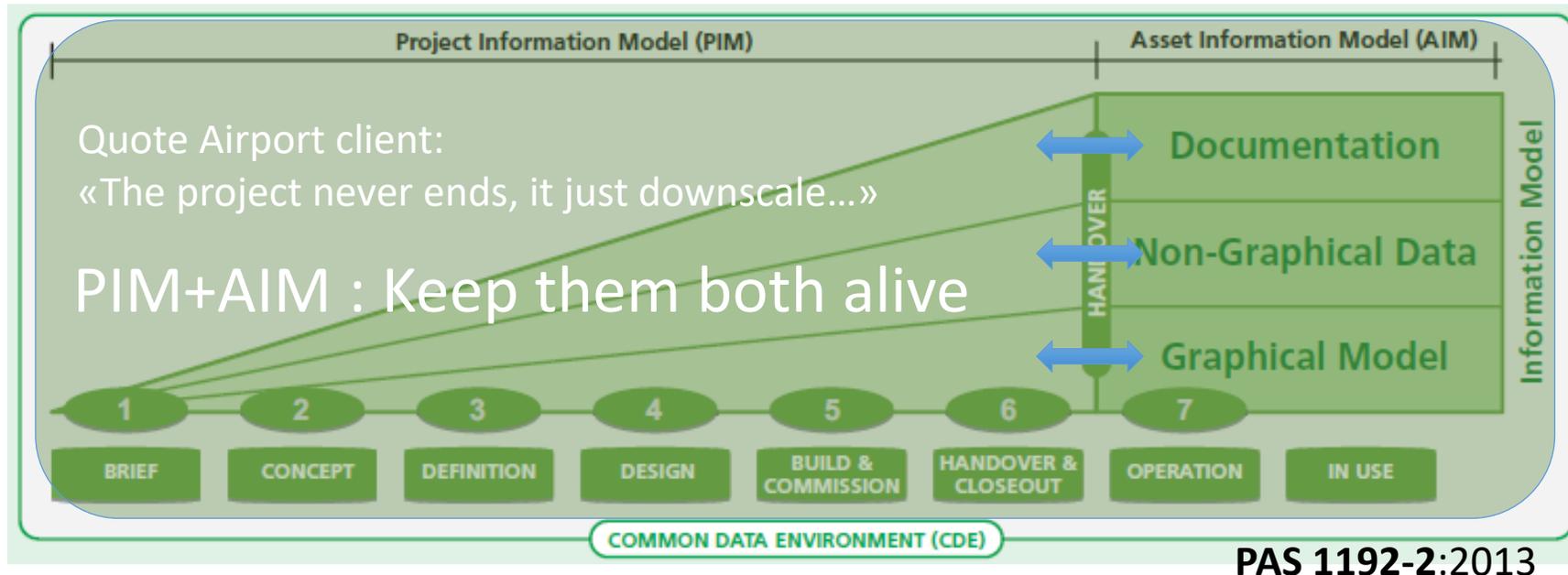
- One BIM “replacing” 1000 drawings

Graphical data - status

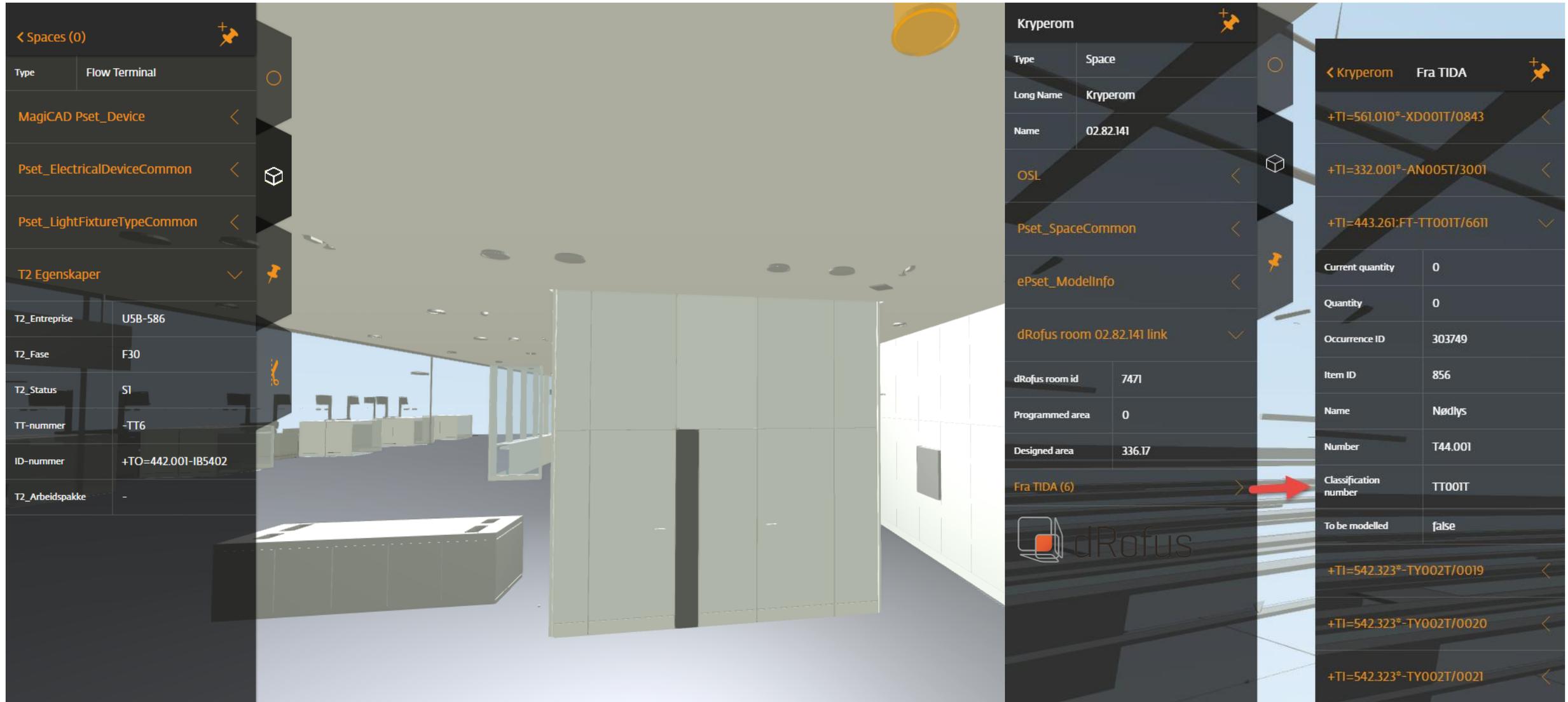
- As-built BIM – in place
- BIM for the masses – piloted
- The cut out for design starting point – in place
- They will (for now) keep both Revit models and ifc models alive
 - Due to better export functionality than import...
- Hope to see roundtrip
- Targets:
 - Graphical distribution from one central (merged) model - not in place yet
 - Full ifc based roundtrip – not robust enough
 - Merge of delta – Not robust enough yet

The key to success

- PIM and AIM is connected



Tack!



The screenshot displays a 3D architectural rendering of a room with a long desk and a wall of lockers. The interface is divided into several panels:

- Left Panel (Properties):**
 - Spaces (0)
 - Type: Flow Terminal
 - MagiCAD Pset_Device
 - Pset_ElectricalDeviceCommon
 - Pset_LightFixtureTypeCommon
 - T2 Egenskaper
 - T2_Entreprise: U5B-586
 - T2_Fase: F30
 - T2_Status: S1
 - TT-nummer: -TT6
 - ID-nummer: +TO=442.001-IB5402
 - T2_Arbeidspakke: -
- Right Panel (Kryperom):**
 - Type: Space
 - Long Name: Kryperom
 - Name: 02.82.141
 - OSL
 - Pset_SpaceCommon
 - ePset_ModelInfo
 - dRofus room 02.82.141 link
 - dRofus room id: 7471
 - Programmed area: 0
 - Designed area: 336.17
 - Fra TIDA (6)
 - +TI=561.010*-XD001T/0843
 - +TI=332.001*-AN005T/3001
 - +TI=443.261:FT-TT001T/6611
 - Current quantity: 0
 - Quantity: 0
 - Occurrence ID: 303749
 - Item ID: 856
 - Name: Nødlys
 - Number: T44.001
 - Classification number: TT001T
 - To be modelled: false
 - +TI=542.323*-TY002T/0019
 - +TI=542.323*-TY002T/0020
 - +TI=542.323*-TY002T/0021