

# Dataadministration af 3D bymodeller

BentleyUsers Årsmøde

7/11 2017



# Hvem er jeg?

Morten M. Sørensen (1974), [mmks@niras.dk](mailto:mmks@niras.dk)



- 2001 - Master of Science in Engineering from Technical University of Denmark (DTU). Master in Geography and Geology.
- 2001-2011. Blom ASA. Aerial Survey & Mapping.
- Since 2012. NIRAS. Geodata senior project manager and specialist.
- Geodata and GIS advisor.
- Spatial data management. Spatial ETL (Extract, Transform, Load). Data integration. Spatial IT infrastructure.
- Terrain models (UAV). 3D city models. Hydrological models. Climate Change Adaptation.
- Næstformand i GeoSpatial SIG'en BentleyUser
- Det Digitale Anlæg: Lagstrukturgruppen for TK-lag

# Agenda

- 3D bymodeller
- Case: Aarhus kommune
  - Problemstillingen
  - Analysen
  - Løsningsmodellen
- Perspektivering

# Først en tur op i helikopteren



# 01

---

3D bymodeller

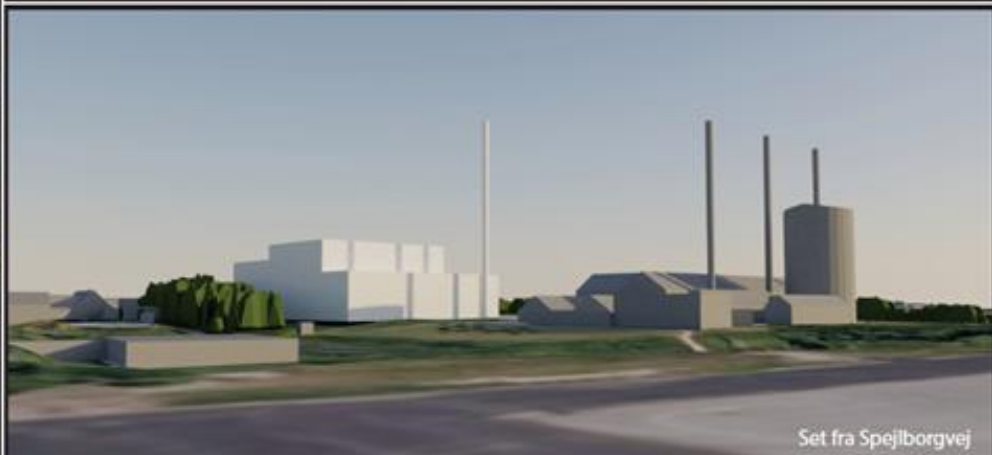
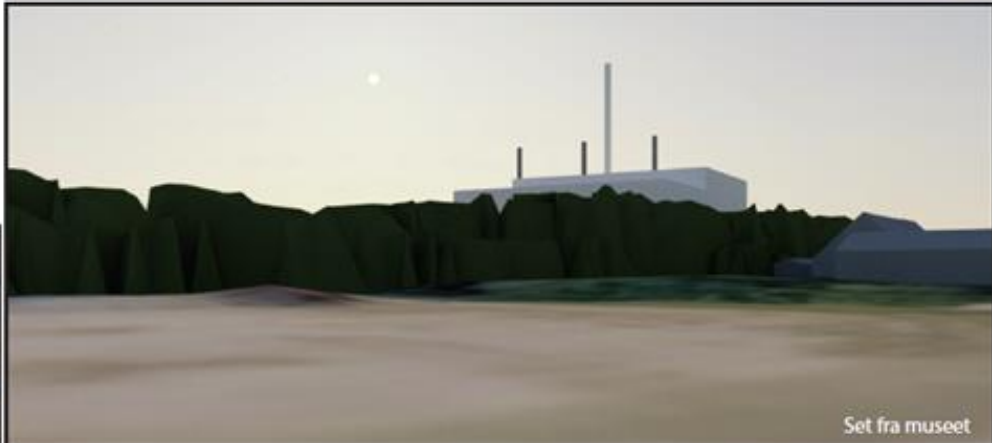
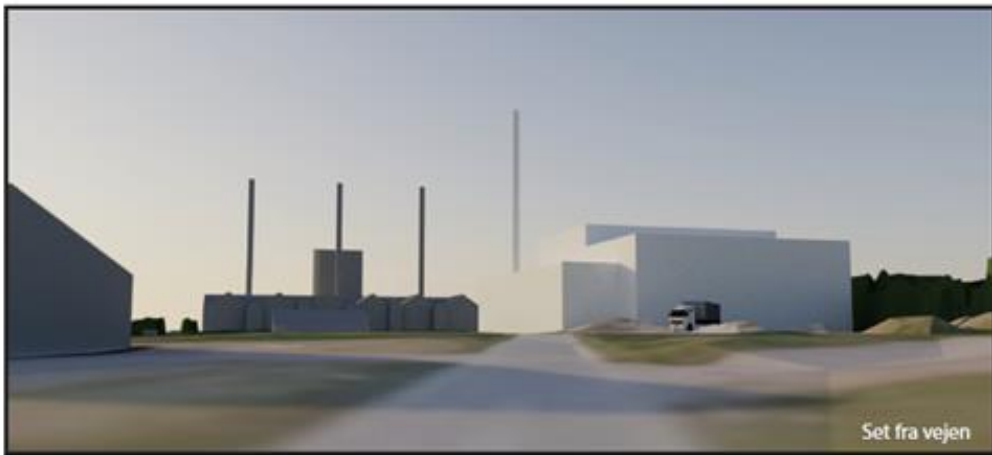
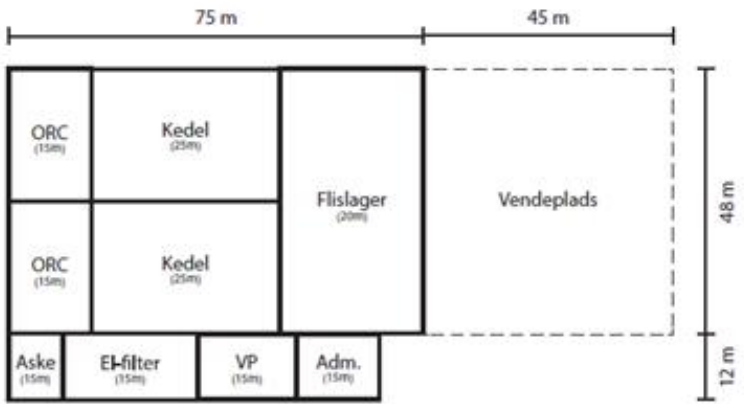
# Virtuelle 3D bymodeller

Flere og flere anvender 3D bymodeller.

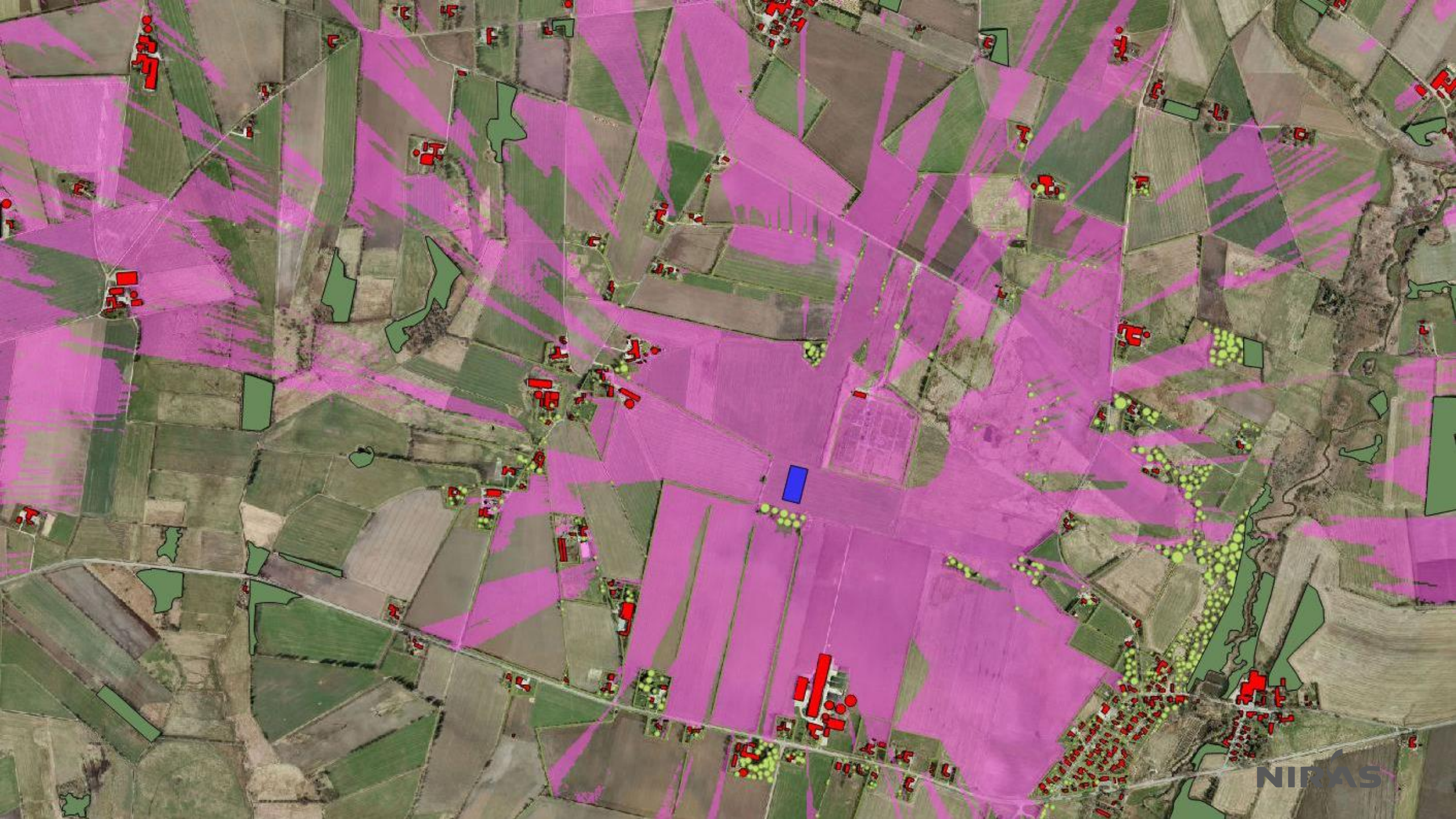
- Virtuelle bymodeller bruges af flere og flere faggrupper.
- De fremstilles på mange forskellige måder til mange forskellige formål.
- Modellerne anvendes i et stigende antal applikationer:
  - Visualiseringer
  - VR/AR
  - SmartCity
  - Planlægning
  - Analyser
  - Web, desktop, mobile, 3D prints



# Flisværk - Kompakt









KOPPLING TILL HJORTHAGEN

VATTENAVEN

KAJSTRÄK

STRECKEFRÄMME



STARTVY



VY VID VATTNET



VY FRÅN GÅ HJORTHAGEN



VY MOT HINGÖ



UTZOOMAD VY

NIRÁS

02

---

Case: Aarhus kommune

# 3D bymodel som grunddata

Aarhus kommunes ønske: En grunddata 3D bymodel.

- Krav til 3D bymodellen:
  - Løbende vedligeholdes
  - Kobles til BBR og GeoDanmark grundkortets bygninger.
  - Anvendes til sagsbehandling og byplanlægning
  - Planlægning og vurdering af nyt byggeri.
  - 3D visualiseringer til nabohøringer
  - Lokal-/helheds-planlægning
  - Analyser: afklaring af sigtelinjer, verificering af skyggediagrammer
  - Visuel kommunikation (internt og eksternt)



Hvordan administreres  
en 3d bymodel, når  
den skal anvendes til  
mange forskellige  
formål?

# Administration af 3d bymodeller

3D bymodel og hvad så?

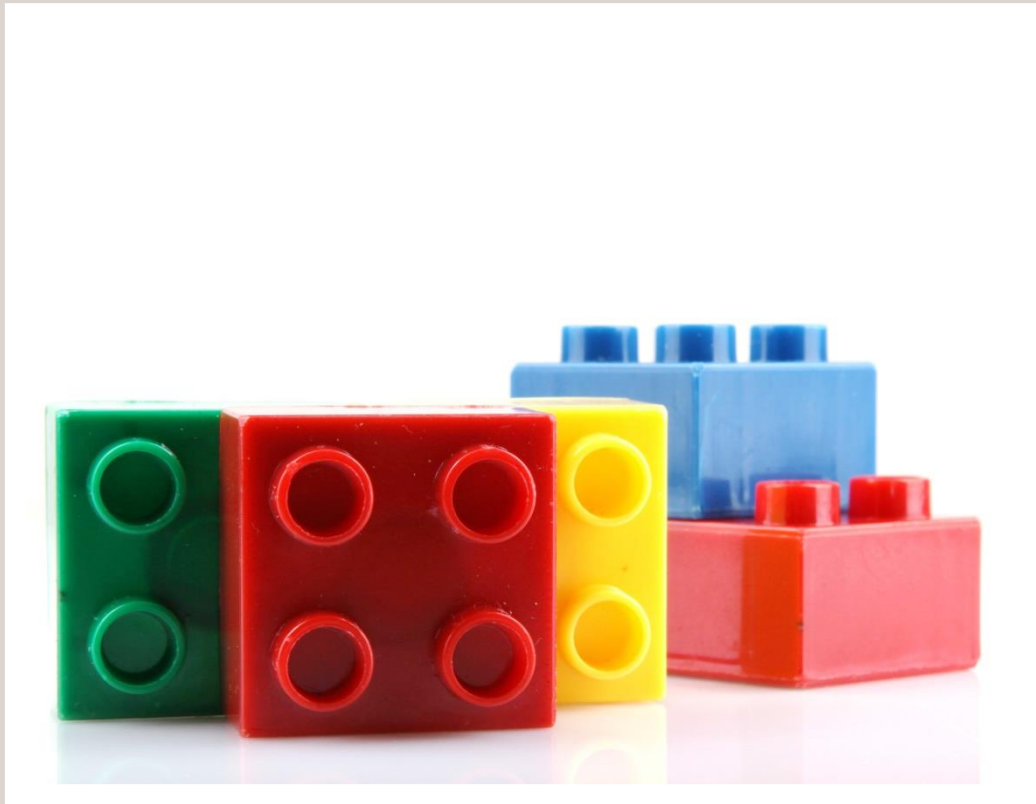
Hurtigt meldte der sig et væld af spørgsmål:

- Hvilke programmer skal bruges?
- Hvordan sikres at der anvendes de rigtige data på det rigtige tidspunkt?
- Hvordan skal sammenhængen mellem data sikres?
- Hvordan sikres at data bliver brugt?
- Hvad med brugervenligheden?

NIRAS blev spurgt om hjælp til at besvare disse spørgsmål.

# DataAdministrations håndbogen

Når data skal bruges af mange forskellige faggrupper til mange forskellige formål...



- Kortlægning af:
  - Brugergrupper
  - Arbejdsprocesser
  - Krav til data: ajourføring, historik, versionering, sammenhænge
  - Krav til applikationer: funktionaliteten pr. brugergruppe
  - Hvilke applikationer anvendes allerede i organisationen
  - Rettigheder på tværs af data og applikationer



# Brugertyper

Primær brugerne blev delt i brugertyper efter deres behov



- Sagsbehandlere, planlæggere m.m. (brugere)
- Superbruger
- Data administrator
- Modtagere af 3D information

# Applikationer

Baseret på kortlægningen blev der identificeret følgende applikationstyper



- Applikationstyper og valg af applikation:
  - Data administration (få brugere)
    - Bentley Map Enterprise
  - Visualiserings, planlægning og analyse værktøj (flere brugere)
    - SketchUp Pro
  - Web applikation til masse kommunikation og projekt kommunikation
    - Agency9 CityPlanner

# Hvad er Agency9 CityPlanner?

3D WebGIS platform



- 3D visualisation solution for urban planning and platform for dialogue with stakeholders and citizens. 100% web – easy to use, update and share.

- <https://youtu.be/txpL3fYeFS8>

- Se mere her: <http://www.Agency9.com>

-

# Hvorfor Bentley Map Enterprise?

Data administratorens primære værktøj



- Descartes: Terræn og punktskyer
- Native GIS understøttelse (OGC)
- GIS datamodeller
- 3D modellering
- Microstation bruges allerede i organisationen.
- Bentley Map: Spatiale databaser

# Spatial database

Hvad er en spatial database?

- **A spatial database is a database that is optimized for storing and querying data that represents objects defined in a geometric space.** Most spatial databases allow representing simple geometric objects such as points, lines and polygons. Some spatial databases handle more complex structures such as 3D objects, topological coverages, linear networks, and TINs. While typical databases have developed to manage various numeric and character types of data, such databases require additional functionality to process spatial data types efficiently, and developers have often added geometry or feature data types. **The Open Geospatial Consortium developed the Simple Features specification and sets standards for adding spatial functionality to database systems.**
- Kilde: Wikipedia

## System Requirements

Refer to the "Requirements" section of the Bentley Map's ReadMe file:

[www.bentley.com/BentleyMap-Spac](http://www.bentley.com/BentleyMap-Spac)

Find out about Bentley at: [www.bentley.com](http://www.bentley.com)

Contact Bentley  
1-800-BENTLEY (1-800-236-8539)  
Outside the US +1 610-458-5000

Global Office Listings  
[www.bentley.com/contact](http://www.bentley.com/contact)

## Bentley Map Enterprise At-A-Glance

### Engineering Workflows

- Clash detection with point clouds
- Extract pipe runs with single click
- Create and adjust elbows
- Raster digital elevation model export
- Drape element and contour export for scalable terrain models
- Raster editing tools

### Mapping and GIS

- Compile and edit data efficiently
- Build and publish accurate maps and infrastructure models
- Enforce business and topological rules
- Brings CAD accuracy and ease to GIS
- Cartographic line symbology

### All the Power of MicroStation

- Smart, quick drawing, and editing of GIS features
- Raster management
- AccuSnap, AccuDraw®
- Display priority, transparency
- Coordinate system assignment and on-the-fly re-projection
- Full 3D modeling

### Map Manager

- Intuitive, easy-to-use, persisted map definitions
- Drag-and-drop layers to control display order
- Control all aspects of map display
- Automatic creation of thematic map from template
- Export of layers to MicroStation elements

### XML Feature Modeling

- XML metadata-driven GIS
- Property-based symbology and annotation
- Convert simple elements to smart GIS features

### Geospatial Administrator

- Manages the XFM framework through one interface
- Runs outside MicroStation
- Defines and maintains XFM project files
- Defines features, properties, and the tools used to build those features

### Choice of Data Stores

- Three-tier connection to Esri ArcGIS
- Self-contained XFM DGN files
- Any RDBMS/DGN supported by MicroStation

### Data Capture and Maintenance

- 3D geometry cleanup
- Polygon parallel creation
- Dynamic domain lists

### Geographic Coordinate Systems

- Custom datum/ellipsoid
- Create custom grid/graticule definitions
- Integrated alternate coordinate system (ACS) input and readout

### Oracle Spatial Editing

- Fully Oracle Spatial compliant
- Two- or three-tier connection
- 3D object support including textures
- Adherence to native Oracle Spatial feature and topology models
- Support for GeoRaster, long transactions, valid time and historical tables

### SQL Server Spatial Editing

- Two-tier direct connection
- 3D object support

### Topology Modes

- Workflows for cadastre management (split, merge, build)
- Topology maintained while editing

### Integrated COGO Editor

- Input precision coordinate geometry
- Create parcels from legal descriptions

### Measurement Tools and Linear Adjustment

- Place points through radial or rectangular measurements from a baseline
- Create list of radial or rectangular staking measurements
- Perform linear adjustments on inaccurate data

### Point-cloud Processing

- Drape and snap elements
- Classification editing
- Smart snap
- Visual explorer
- Batch tile export
- Export to POD, LAS, and XYZ files
- Extraction of planar and cylindrical elements including pipes and elbows

### Scalable Terrain Modeling (STM)

- High performance display of very large digital terrain models
- High resolution image draping on STM
- Display modes: smooth shading with shadows, aspect angle, elevation, slope, contours
- STM synchronization with DGN, Civil DTMs, point clouds, and XYZ files

### Presentation and Analysis

- Spatial, solar/shadow analysis
- Thematic display
- Buffer creation
- Dynamic labeling

- Curved text placement
- Text and element halo tools
- Direct data access (DDA)
- Automatic geo-location of features\*

### Map Generation and Printing

- Interactive location map index with references
- WYSIWYG plot generation with user-defined templates and legends
- Publishing to intelligent PDF, PostScript, color separates
- Data cleanup and integrity tools
- Solve integrity problems with imported or legacy data
- Easily adopt XFM schema for imported or legacy data through Dynamic Feature Scoring

### Interoperability

- Direct reference geospatial formats
- Support for Bing Maps\*\*
- MapInfo (TAB, MID/MIF), SHP files, Oracle Spatial, CSV, GML, Esri File Geodatabase, SQL Server Spatial, and ODBC sources
- Import/export tools
- Integration with Safe Software's FME
- Publish i-models with RDBMS properties
- Spatial data streaming
- Web feature service client - read (query) access

### Image Editing Tools

- Clean up and vectorize scanned documents
- Convert, edge match, and rectify many formats of aerial imagery
- Rectify and texture 3D models with digital photographs
- Display DEMs in various shading modes
- Publish to Bentley Map Mobile

### GIS Development Platform

- Utilize Open API, C/C++, C#, .NET other modern programming languages

### Field AccessSupport

- Support for Bentley Map Mobile and Bentley Map Mobile Publisher.
- Android and iOS Tablets
- Fast access to large geospatial databases
- Easy to use with standard tablet-based gestures
- Simple query tools
- GPS integration
- Google Maps integration
- Apple Maps integration
- Disconnected, view-only operation for access without a network connection

## Support for Leading Spatial Databases

Bentley Map Enterprise supports Oracle Spatial and Microsoft SQL Server Spatial databases that allow organizations to store and manage very large volumes of spatial data. Bentley Map Enterprise can edit 2D and 3D data directly in any standard Oracle Spatial environment. Bentley Map Enterprise's connection to Oracle enables raster and vector data to be stored in a centralized database using native Oracle Spatial object definitions. Spatial data is streamed to the desktop to improve productivity. Bentley Map Enterprise supports Oracle Spatial textures, non-top view queries of 3D data, B-Spline curves and non-circular arcs in Oracle 12c.

## Oracle Spatial Editing

- Fully Oracle Spatial compliant
- Two- or three-tier connection
- 3D object support including textures
- Adherence to native Oracle Spatial feature and topology models
- Support for GeoRaster, long transactions, valid time and historical tables

## SQL Server Spatial Editing

- Two-tier direct connection
- 3D object support

## Interoperability

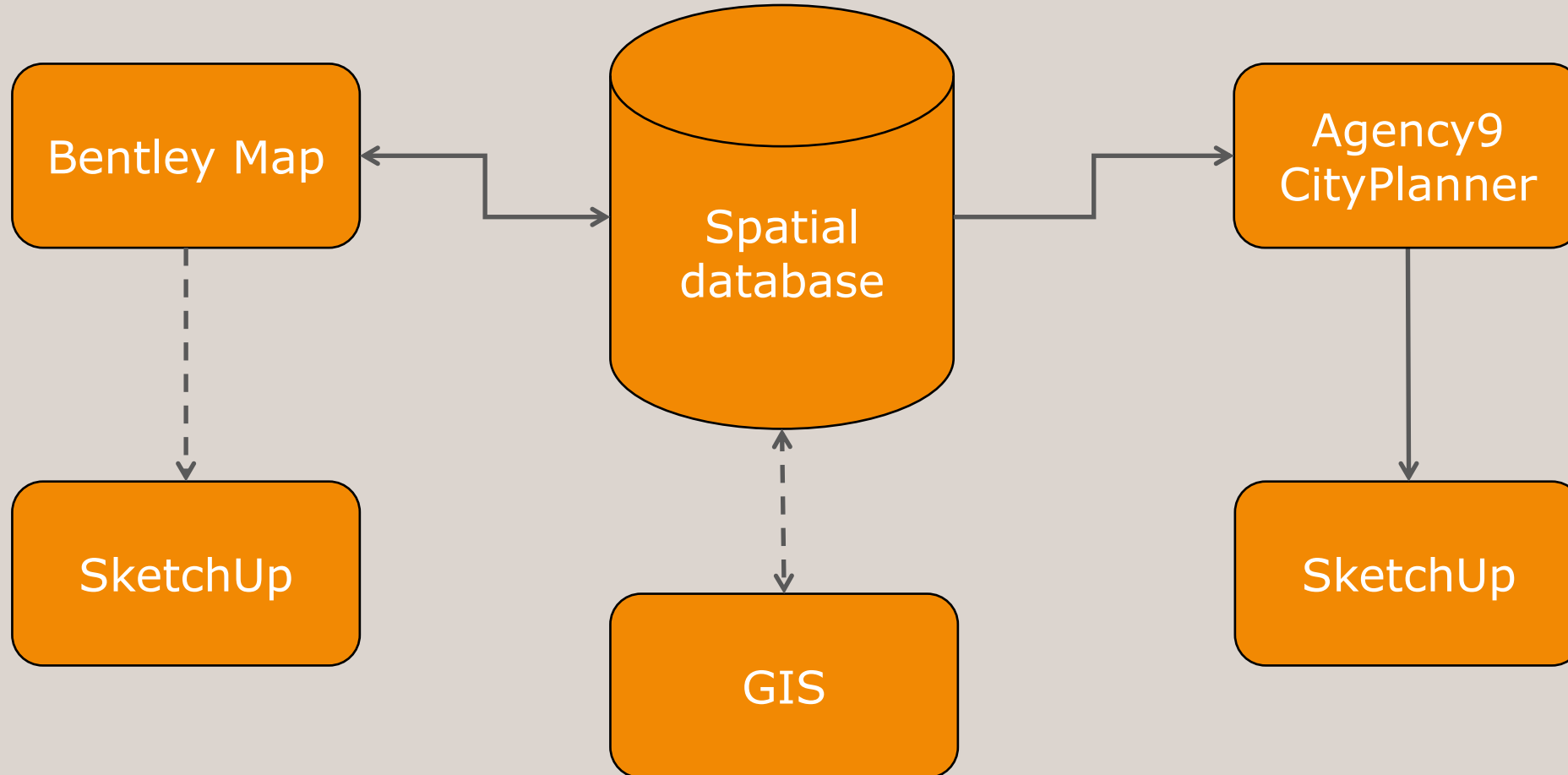
- Direct reference geospatial formats
- Support for Bing Maps\*\*
- MapInfo (TAB, MID/MIF), SHP files, Oracle Spatial, CSV, GML, Esri File Geodatabase, SQL Server Spatial, and ODBC sources
- Import/export tools
- Integration with Safe Software's FME
- Publish i-models with RDBMS properties
- Spatial data streaming
- Web feature service client - read (query) access

\* Only applies to direct data access (DDA) graphical source connections (e.g. Oracle Spatial, SQL Server, WFS, etc.).

\*\*User provides Bing Map licenses.

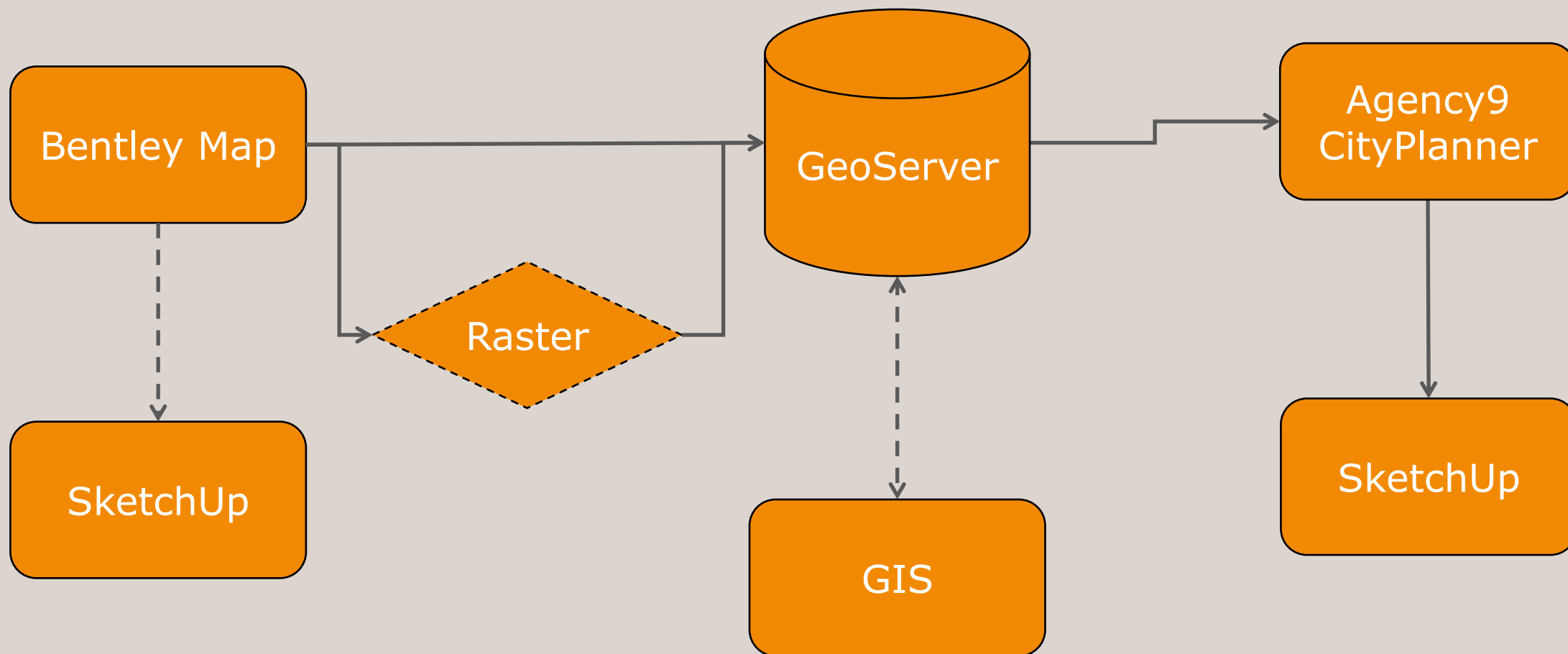
# Systemlandskabet

Elementerne – gældende for bygninger, broer og vegetation



# Systemlandskabet

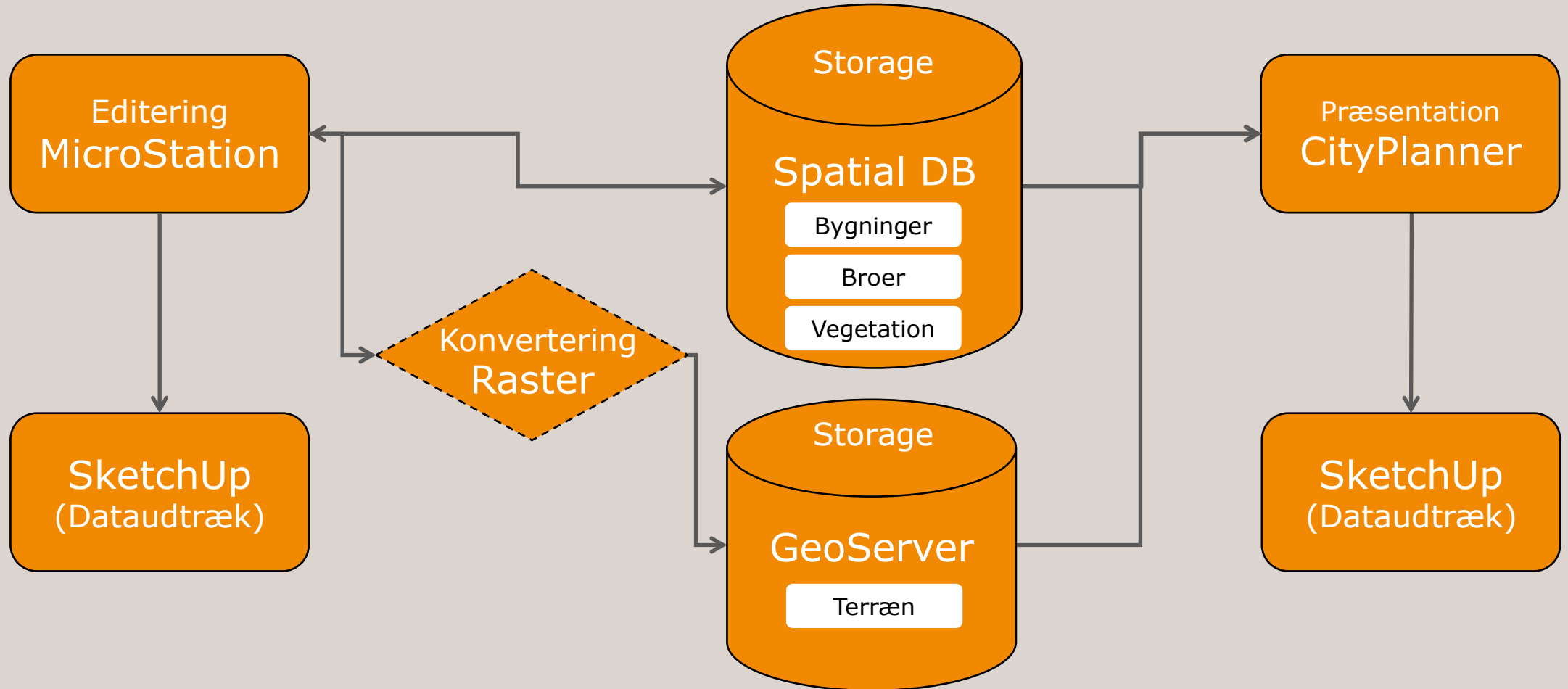
Terræn





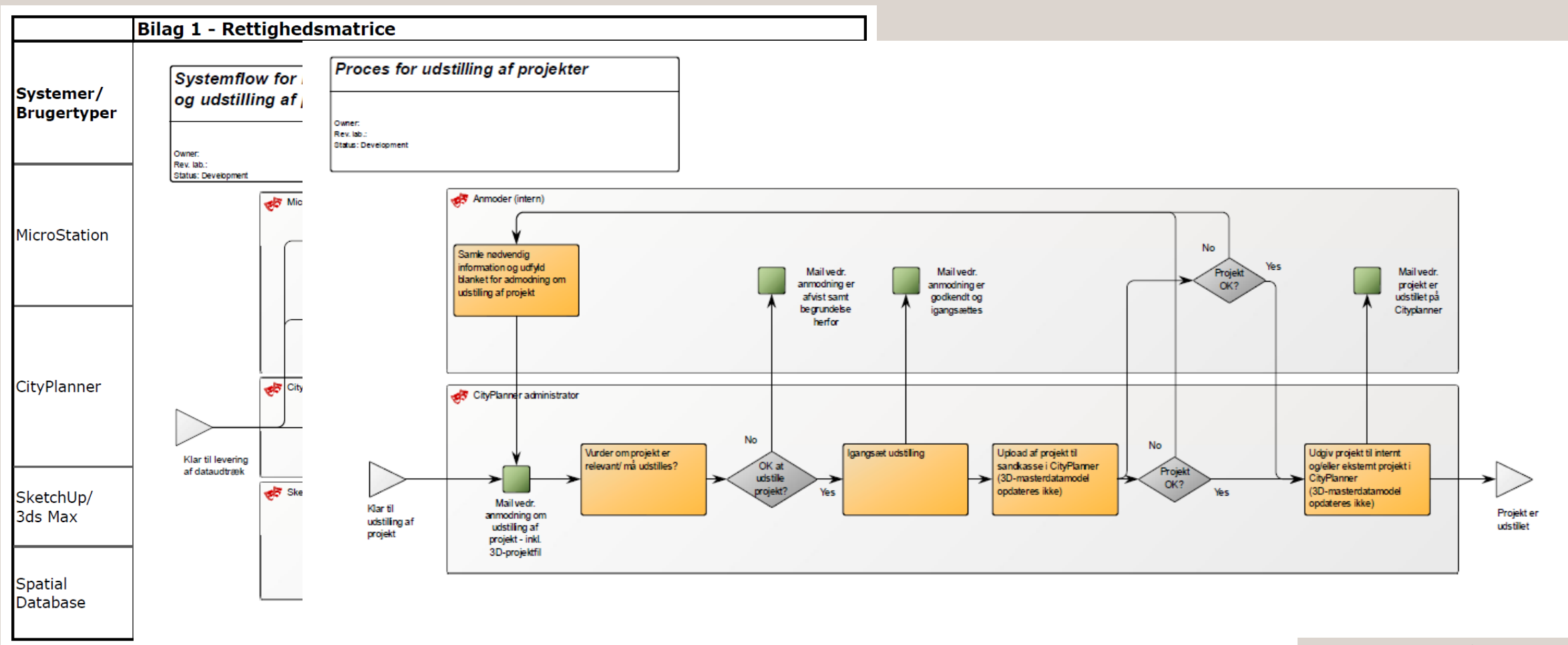
# Systemlandskabet

Samlet



# Rettigheder og processer

Data administrations håndbogen – synliggørelse af systemflow, processer og rettigheder.



# Læs mere her

<http://www.niras.dk/projekter/aarhus-kommune-dataadministrationshaandbog/>

## Datahåndbog hjælper Aarhus Kommune med at håndtere 3D-data

En ny detaljeret 3D-model over Aarhus Kommune hjælper kommunen med at planlægge nye udbygninger, infrastruktur og byomdannelse. For at vedligeholde alle dele af 3D-datamodellen har NIRAS leveret en dataadministrationshåndbog, der klæder medarbejdere på til løbende at opdatere nye data til 3D-modellen.

Aarhus Kommune udvikler sig konstant, og en digital 3D-bymodel fungerer som et værktøj til projektplanlægning, da den gør det muligt at se byen fra oven med eksisterende og kommende bygninger.

For at 3D-datamodellen fungerer optimalt, er det nødvendigt løbende at opdatere dataene - når nye boliger og arbejdspladser tilføjes til bybilledet, eller gamle bygninger rives ned. Til at effektivisere den proces har NIRAS udarbejdet en dataadministrationshåndbog, der sætter rammerne for, hvordan Aarhus Kommune i fremtiden opdaterer, ajourfører og vedligeholder alle dele af 3D-modellen.

### Løbende opdatering skal sikre 3D-data

Dataadministrationshåndbogen klæder medarbejderne i Aarhus Kommune på til at håndtere og prioritere hvilke nye byggerier, der løbende skal tilføjes modellen. For at gøre processen så simpel som mulig beskriver dataadministrationshåndbogen rammer, processer og ansvar for at opdatere alle dele af 3D-modellen, så modellen altid er aktuel.

”Udfordringen er at definere, hvad der udløser en opdatering af bymodellen og hvilke ændringer, der ikke skal opdateres.”

- Morten Stig Baden, projektleder, NIRAS



**Morten Stig Baden**

Bygningskonstruktør  
+45 60384212

[mn@niras.dk](mailto:mn@niras.dk)



**Morten Michael Kohave Sørensen**

Projektleder  
[mmks@niras.dk](mailto:mmks@niras.dk)



## Digital 3D-bymodel af Aarhus Kommune

- NIRAS har produceret og leveret 3D-modellen til Aarhus Kommune. [Læs mere om projektet her](#)
- Desuden har NIRAS arbejdet med 3D-bymodeller i en tredjedel af de danske kommuner - dog primært som producent af 3D-bymodeller

Relateret projekt

[Styr på byggedata for Danmarks største hospitalsbyggeri](#)



# Projektstatus

Hvor i processen er projektet nu?

- 3D bymodellen færdig.
- Undervisning af brugerne i SketchUp, CityPlanner og Microstation / Bentley Map
- Data administrationshåndbogen færdig
- Implementering af systemlandskabet i gang.



03

---

Perspektivering



# Kan data flyde frit?

Buildings are not build on the moon

