Standardisering av geografisk informasjon

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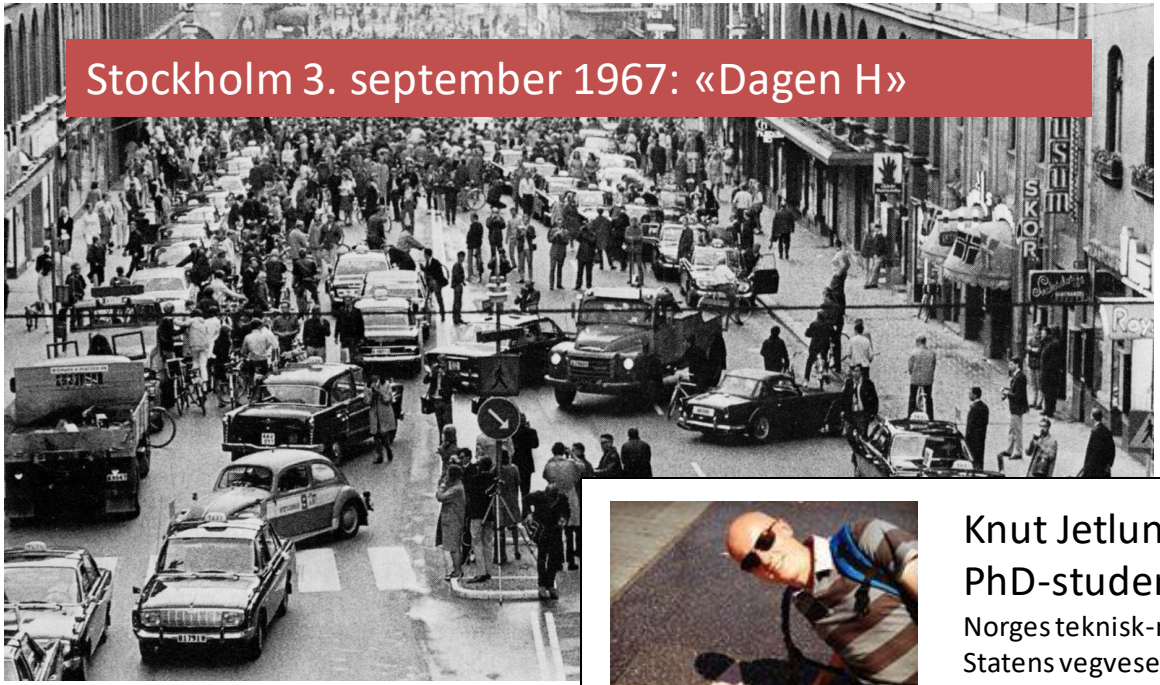
Norwegian University of Science and Technology

Statens vegvesen
Norwegian Public Roads Administration



Knut Jetlund
PhD-student og standardiseringsekspert
Norges teknisk-naturvitenskapelige universitet
Statens vegvesen
knut.jetlund@vegvesen.no
Twitter: @Jetgeo
LinkedIn: https://www.linkedin.com/in/knut-jetlund/

Standardisering av geografisk informasjon

- Grunnlaget for utveksling og bruk av data mellom
  - Ulike dataeiere og brukere
  - Ulike applikasjoner
  - Ulike lokasjoner
- Felles datamodeller
  - FKB
  - INSPIRE
- Tjenester for utveksling
  - WMS, WFS

ISO/TC 211

OGC

ISO/TC211 – Geographic information/Geomatics

- Opprettet i Oslo i 1994
- Sekretariat
  - 1994-2017: Standard Norge v/Bjørnhild Sæterøy
  - Fra 2017: SIS (Swedish Standards Institute)
- Leder (Chairman):
  - 1994-2017: Olaf Østensen, Kartverket
  - Fra 2017: Christina Wasström, Lantmäteriet

- Tung norsk og nordisk deltakelse

- Faste halvårlige plenumsmøter, pluss arbeidsmøter i prosjektene
- I overkant av 60 prosjekter totalt
- Periodiske revideringer av standardene

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OGC- Open Geospatial Consortium

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Norwegian Public Roads Administration

- Samarbeidsforum mellom programvareleverandører, universiteter, offentlige etater mm
- Etablert 1994
  - 8 medlemmer 1994
  - 500+ medlemmer nå
  - ESRI, Intergraph, Norkart, Kartverket
  - UCB, NMBU
- Kjente standarder:
  - WMS, WFS, GML

Samarbeid

- ISO/TC 211 har adoptert flere av OGC sine standarder, blant annet WMS, WFS og GML
- Flere standarder utvikles og revideres i samarbeid i ISO/TC 211 og OGC, med parallelle høringer
  - GML
  - Spatial schema
  - Spatial referencing by coordinates
- Flere medlemmer er aktive i både OGC og ISO/TC 211
- OGC-standarder er basert på grunnleggende ISO/TC 211-standarder

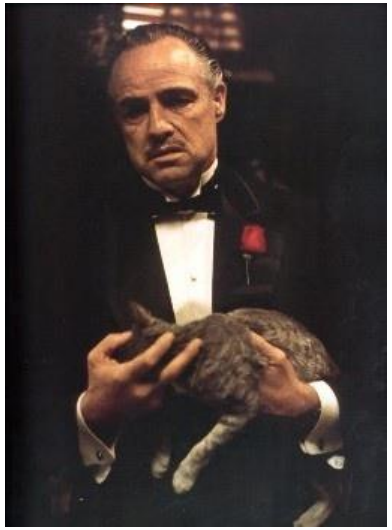
ISO/TC 211

OGC

Consensus

- Consensus:
  - **Consensus decision-making** is a group decision making process that seeks the consent of all participants. Consensus may be defined professionally as an acceptable resolution, one that can be supported, even if not the "favourite" of each individual.

- The core of consensus philosophy:
- "Never get angry. Never make a threat. Reason with people."
  - *Don Vito Corleone (The Godfather)*



Andre standardiseringsarena

- ISO/TC 204 og CEN/TC 278 – Intelligent Transport Systems
  - Flere standarder som omhandler geografisk informasjon for bruk i biler, vegutstyr og trafikksentraler
- buildingSmart
  - Tilsvarer OGC på BIM-siden
- ISO/TC 59 og TC 184
  - Tilsvarer ISO/TC 211 på BIM-siden
- INSPIRE – Infrastructure for Spatial Information in Europe
  - Basismodeller og tematiske modeller for felles europeiske datasett

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Tre domener, samme objekt

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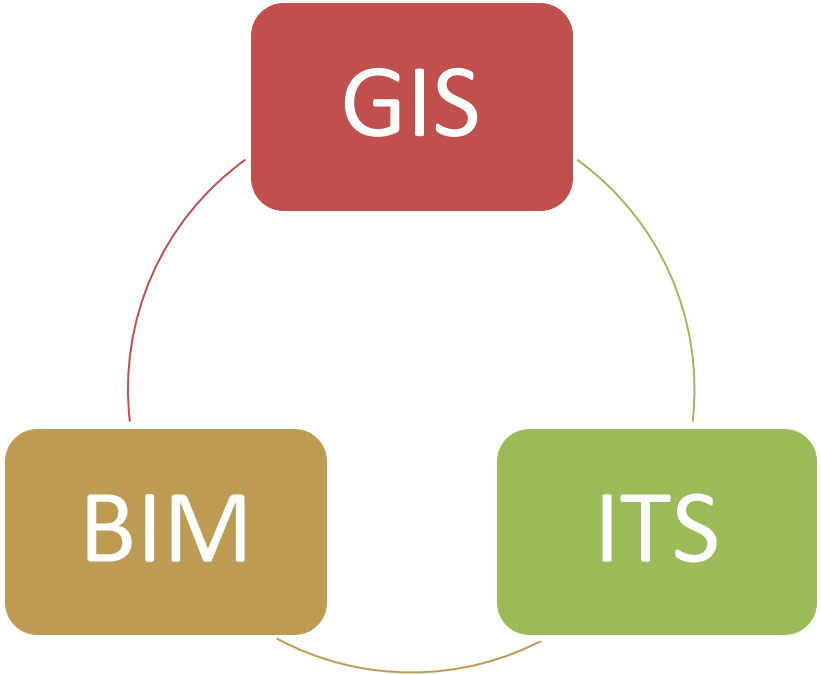
Norwegian Public Roads Administration



CEN/TC 278
ITS standardization

Navigation Data Standard

Statens vegvesen
Norwegian Public Roads Administration

OpenDrive

CAR 2 CAR
COMMUNICATION CONSORTIUM

ISO/TC 211

open tNf

ETSI

Noen aktører og

INSPIRE · Infrastructure for Spatial Information in Europe

buildingSI
International home

CityGML

DATEX II

<GML>

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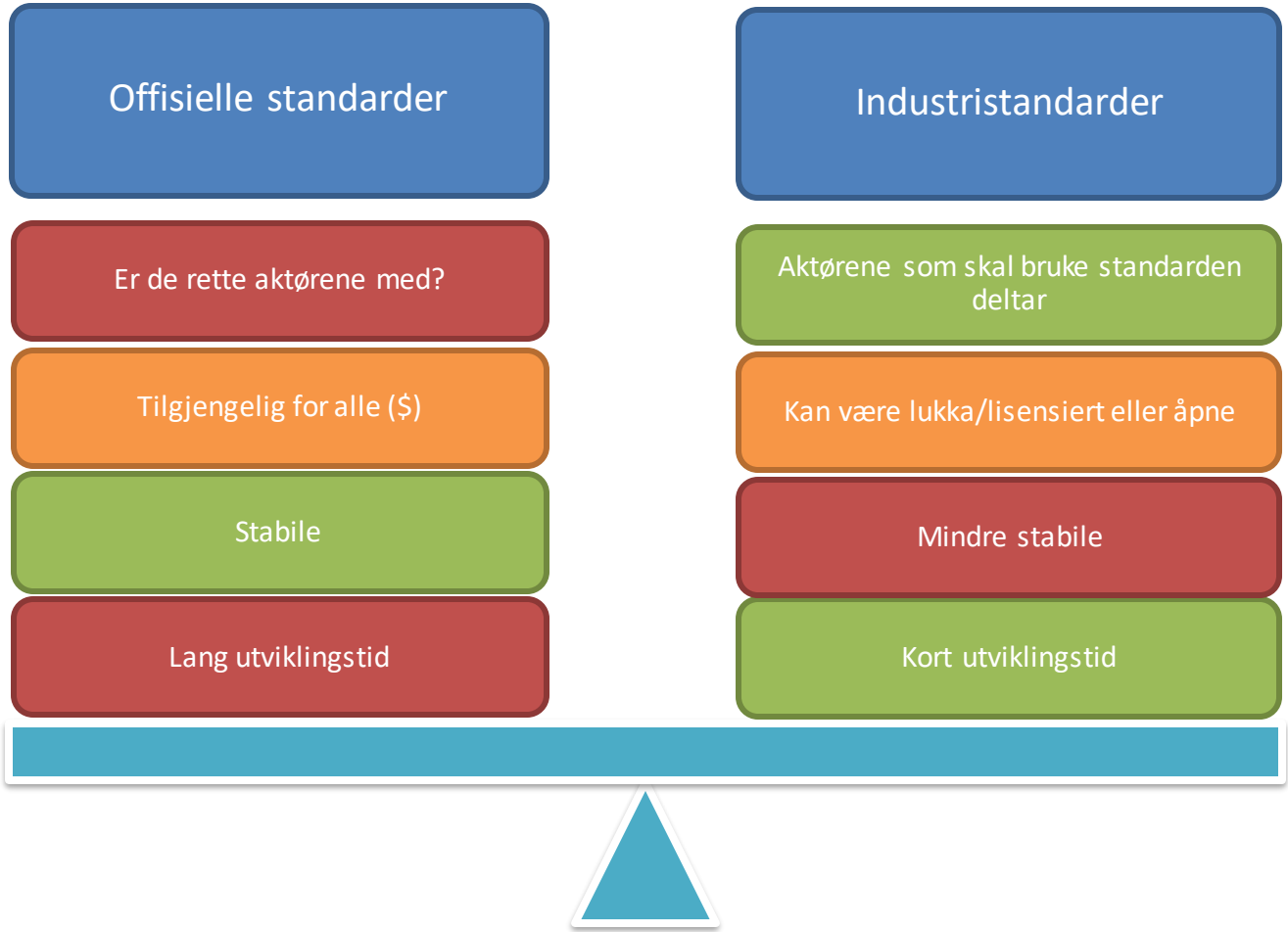

Standarder vs åpne spesifikasjoner

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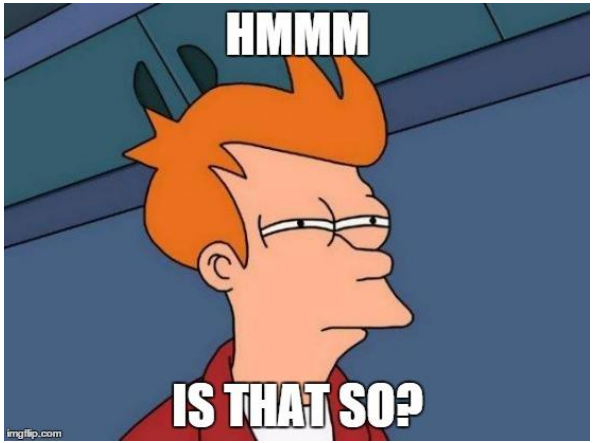
Statens vegvesen
Norwegian Public Roads Administration

Atle Frenvik Sveen @atlefren · 17. sep.
Sier mye #foss4gno



Tore Halset @torehalset · 17. sep.
@thematicmapping @atlefren @relet bra løsninger laget av doere, ikke komiteer.

1

Standarderingsarbeid tar tid, men…

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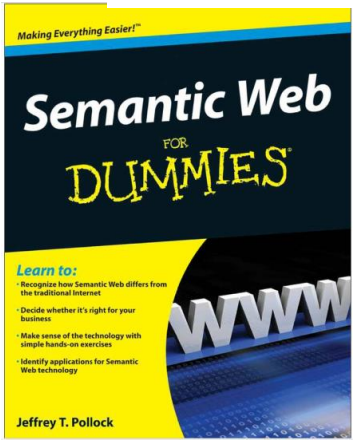
Politics of standards movements

Professional software engineers accept that committee-based designs are often the worst of all worlds. Although the W3C does a phenomenal job of avoiding "groupthink" and *anti-patterns* (common patterns of incorrect solutions) in their specifications, the Semantic Web is often rightly criticized as accepting design trade-offs intended to appeal to small minorities. In general, it's difficult to do anything when you depend upon consensus from a large and diverse committee. That's why it can take many years to design and approve even simple specifications. RDF, OWL, and other Semantic Web technology standards are not perfect by any means. But neither are any standards. In the software industry, consumers (like you and me) accept the slow and sometimes painful process of the standards groups because the outcomes are generally good for us in the end. By having a reference implementation and specification, you can go out and build your own part of the Semantic Web and have the confidence that it will work well with others — and that's worthwhile in my book.



Jeffrey T. Pollock • 3rd

Vice President Of Products
Oracle
Apr 2014 – Present · 4 yrs 11 mos

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Standarder vs åpne spesifikasjoner

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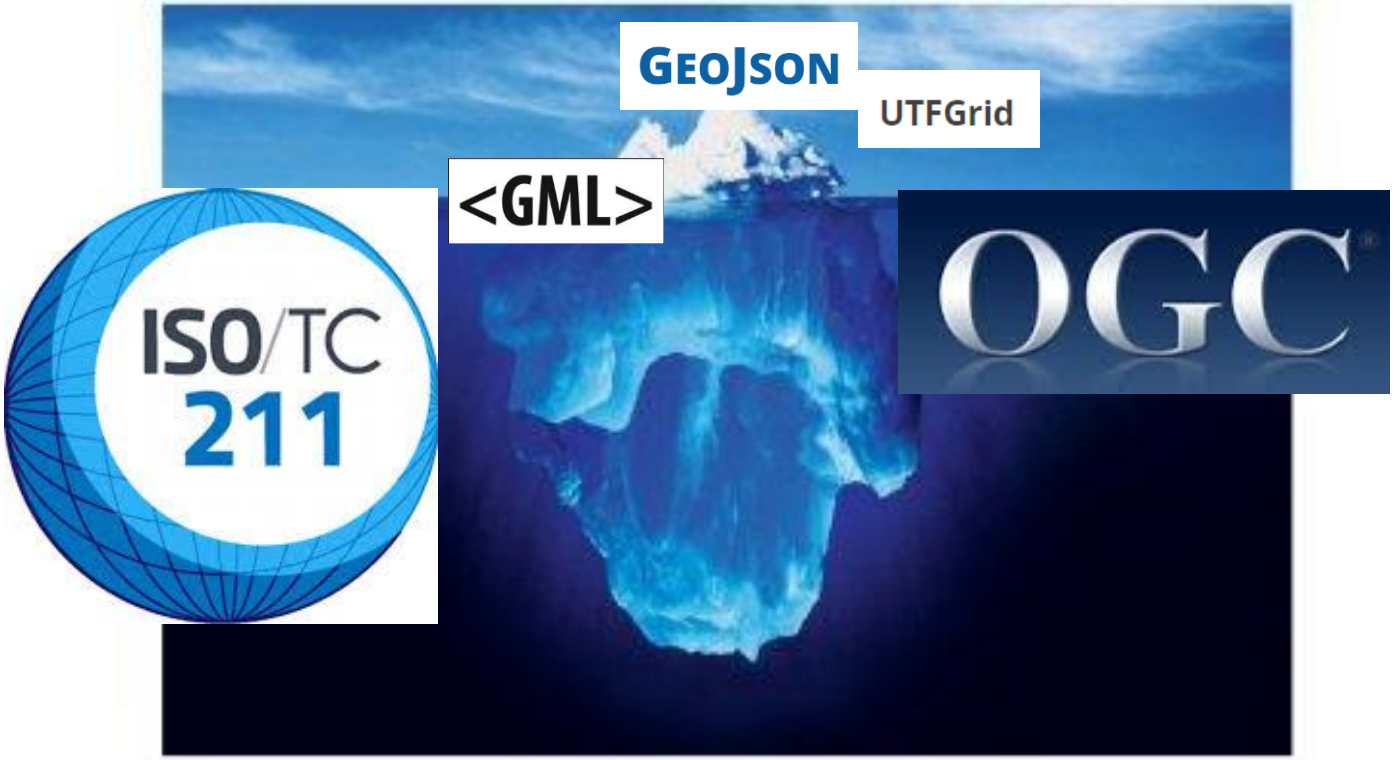
Norwegian Public Roads Administration



Uavhengig av ansvar og dom:
Motivasjon og verdi

Statens vegvesen
Norwegian Public Roads Administration

https://www.veier24.no/artikler/fikk-25-millioner-for-trobbel-med-stikningsdata-og-vegmodeller/456614

Riksveg 22 mellom Lillestrøm og Fetsund slik den så ut like før åpning høsten 2015. (Foto: Bjørn Olav Amundsen)

Fikk 25 millioner for trøbbel med stikningsdata og vegmodeller

Park & Anlegg krevde 56 millioner kroner ekstra for arbeidet med riksveg 22.

Retten sier at årsaken kan tilskrives at Cowi Norge brukte Cowi Danmark som underleverandør for prosjekteringen av fagmodellen veg – og at NovaPoint/VIPS-data er å betrakte som et særnorsk format.

Etter hvert forsto både Statens vegvesen og Park & Anlegg at datafilene som Cowi leverte var produsert i annen programvare og var såkalte «InRoads»-vegmodellfiler. Både entreprenøren og Statens vegvesen var visstnok usikre på hvordan det skulle håndteres.

«En vesentlig grunn til å velge en internasjonal aktør, er at dette kan gi lavere pris på prosjektet. Med dette valget har også byggherren skapt en usikkerhet ved dataflyten", heter det i dommen.

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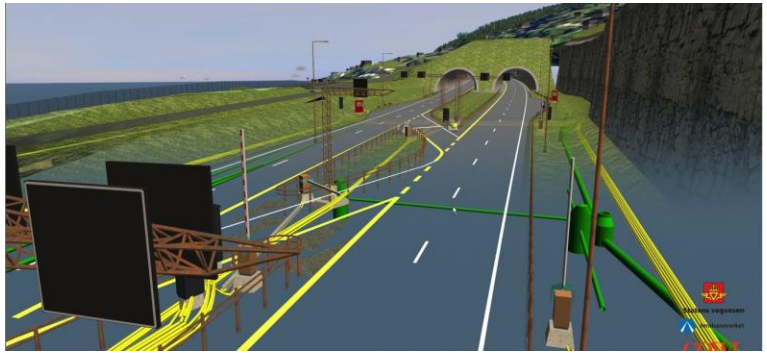
Norwegian Public Roads Administration

Informasjonsmodellering



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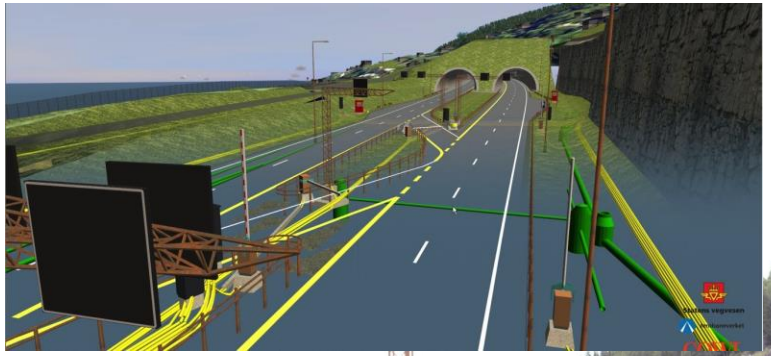
Den ubehagelige sannheten

Det finnes en virkelig verden der ute

Statens vegvesen

Norwegian Public Roads Administration



Hvordan lager vi modeller av virkeligheten?

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Statens vegvesen
Norwegian Public Roads Administration

De grunnleggende byggesteinene:

	Begreper	Modelleringsmetode
	19104 Terminology	19109 Rules for application schema
	19101 Refererence model	19103 Conceptual schema language
Tid og rom		19108 Temporal schema
		19107 Spatial schema
		19111 Spatial referencing by coordinates

Informasjonsmodellering

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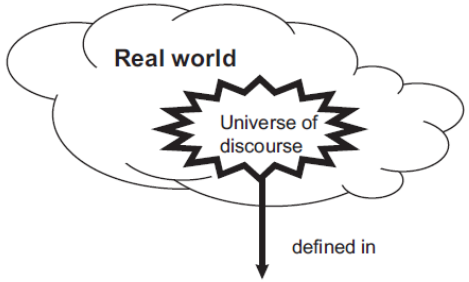
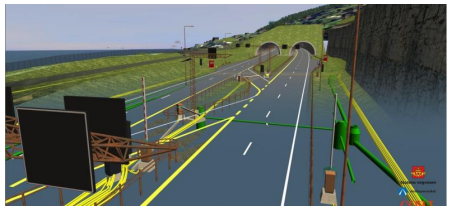
Statens vegvesen
Norwegian Public Roads Administration

19109 Rules for application schema

19103 Conceptual schema language





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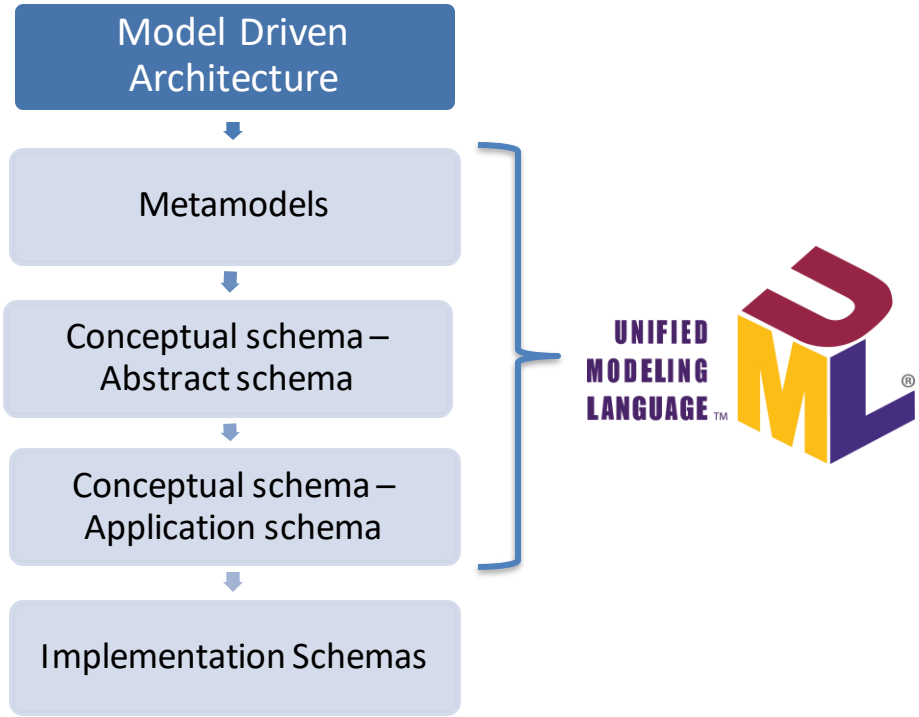
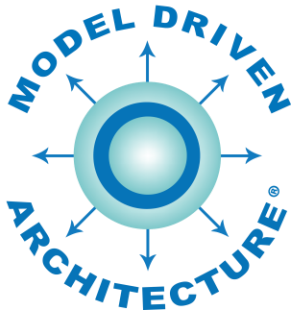
Object Management Group

Model Driven Architecture

Statens vegvesen
Norwegian Public Roads Administration





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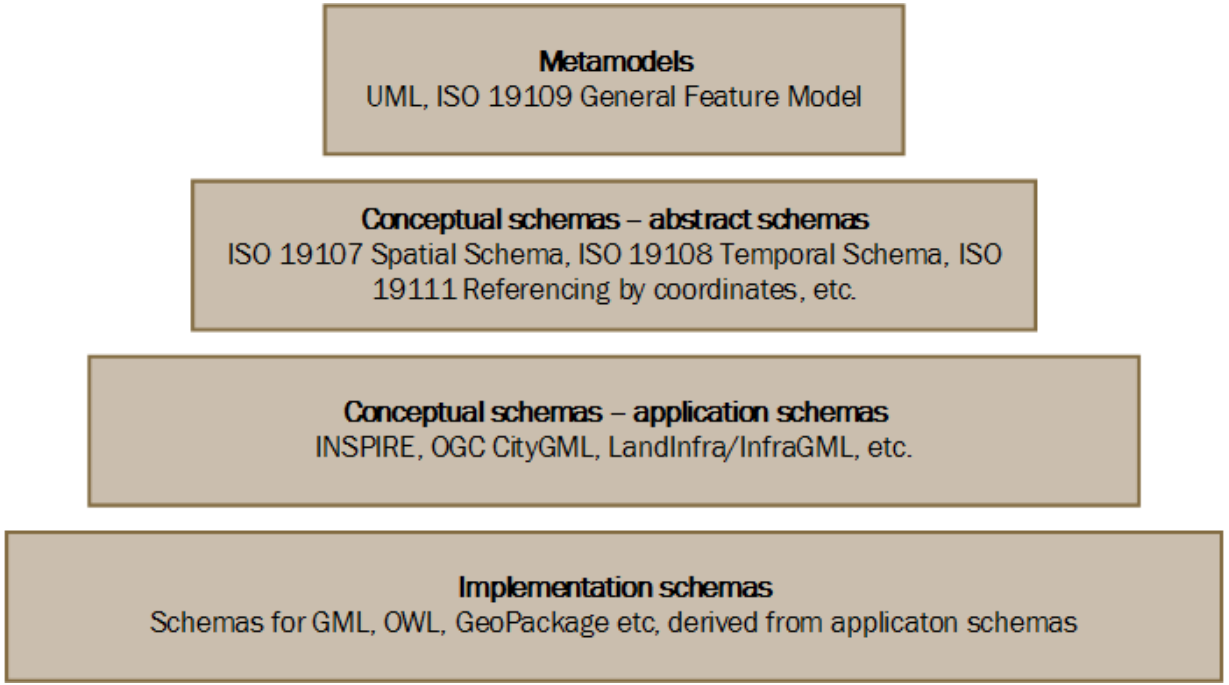
ISO/TC 211 og OGC
Model Driven Architecture

Statens vegvesen
Norwegian Public Roads Administration



Konseptuelle datamodeller

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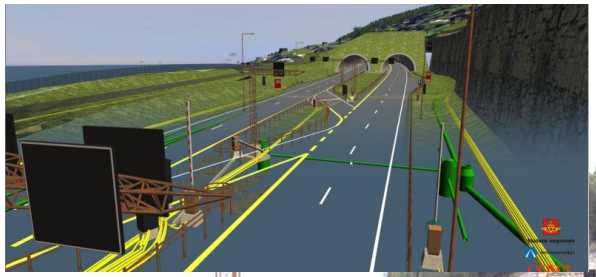
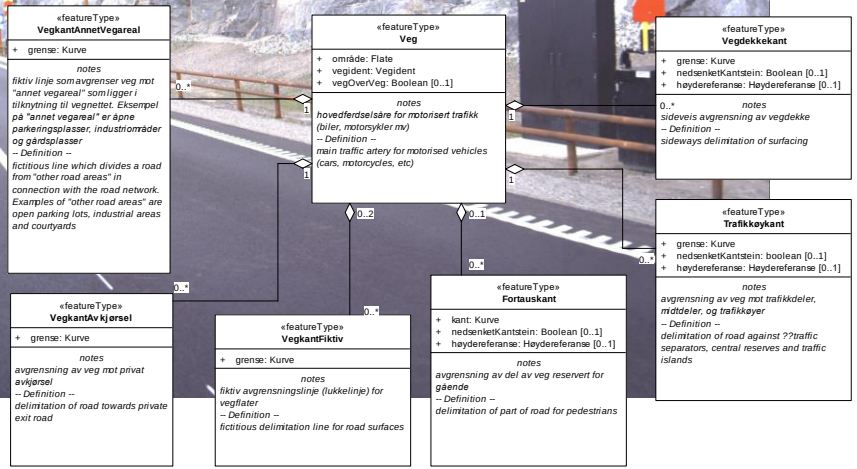
Norwegian Public Roads Administration



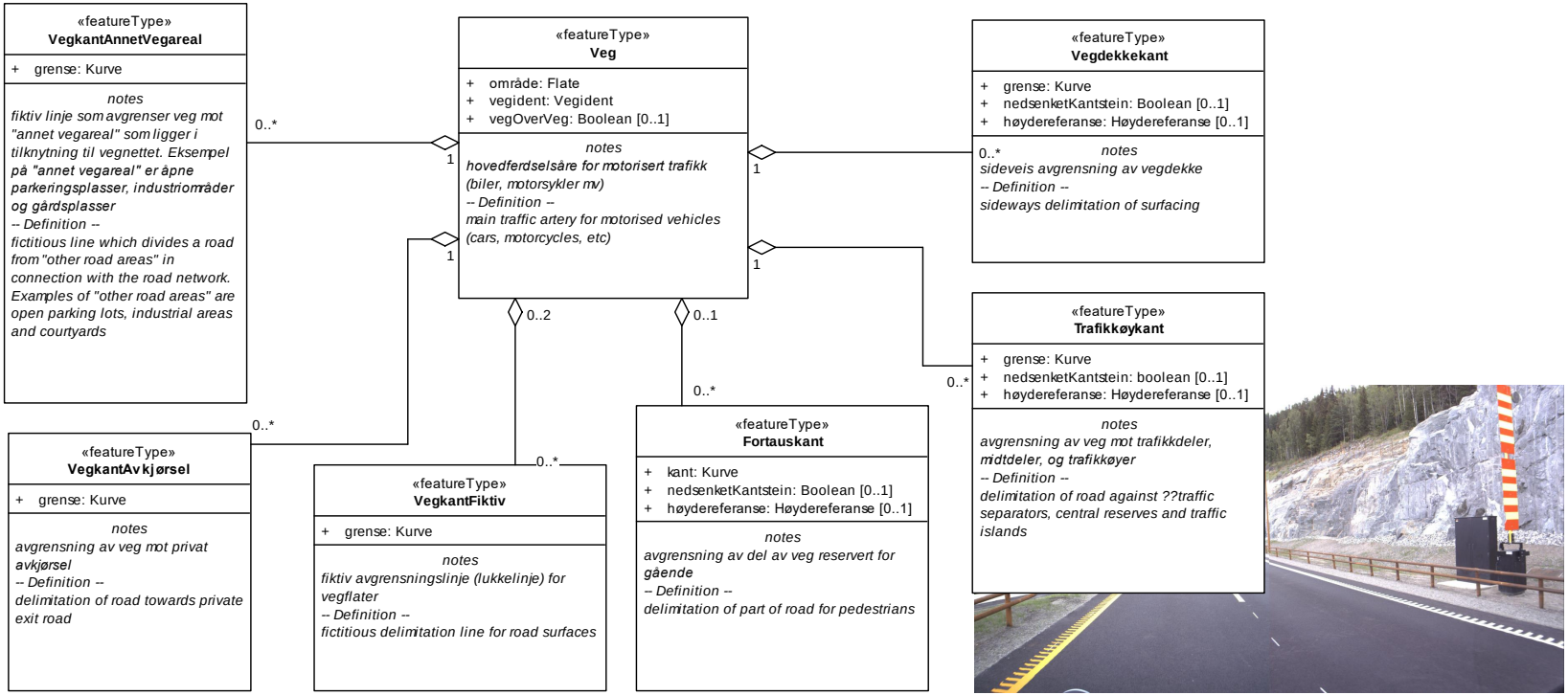
Konseptuelle datamodeller
definerer objekttyper, egenskaper, tillatte verdier og sammenhenger

19109 Rules for application schema

19103 Conceptual schema language



Eksempel fra FKB-Veg

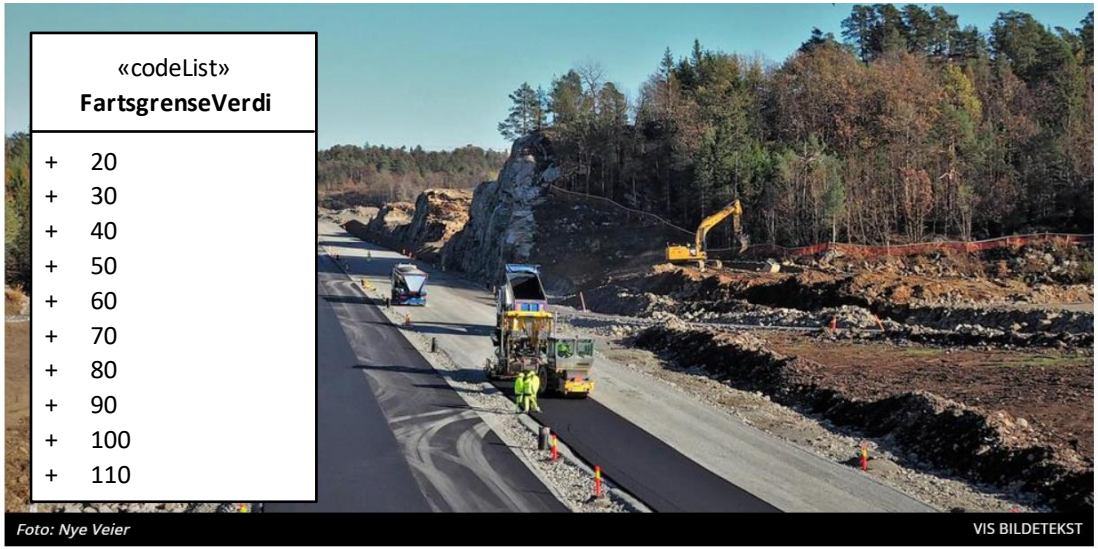


Klassifisering av virkeligheten

- Open World Assumption (OWA)
  - Ny informasjon kan finnes, som avviker fra det vi vet nå
- Closed World Assumption (CWA)
  - Informasjonsmodellen er komplett I den gitte konteksten
  - Ny eller avvikende informasjon er feil

From http://www.millennialplanners.com

Virkeligheten endrer seg



Vurderer 120 kilometer i timen

120 kilometer i timen? Vegdirektoratet vurderer nå dette på oppdrag fra Samferdselsdepartementet.

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https://www.tek.no/artikler/tesla-version-9-har-endelig-kommet-til-norge/449798

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Norwegian Public Roads Administration

Slik ser det nye grensesnittet ut, med betydelig bedre blindsonevarsling. (Foto: Ole Markus Helbo

Ingen «Navigate on Autopilot»

Det som *ikke* er tilgjengelig for norske Tesla-eiere ennå er den nye autopilot-funksjonen. Funksjonen heter «Navigate on Autopilot», og lar blant annet Teslaen ta avfarter på motorveien automatisk. I oppdateringen til Version 9 står det at Navigate on Autopilot vil komme en gang «snart».

Slik ser Navigate on Autopilot ut i praksis.

Navigate on Autopilot ble rullet ut til amerikanske brukere i forrige uke. Tesla er nødt til å implementere støtte for alle de forskjellige måtene vi merker veier i Europa, før de kan gjøre funksjonen tilgjengelig her. Teslasjefen Elon Musk har sagt dette vil ta flere måneder.

Tesla «Version 9» har endelig kommet til Norge

Men den største autopilot-oppgraderingen er fortsatt ikke tilgjengelig i Europa.

NVDB Datakatalogen

- Restriksjoner
  - Fartsgrenser, bruksklasser, svingerestriksjoner…
- Andre egenskaper
  - Trafikkmengde, vegbredder…
- Objekter langs vegen
  - Skilt, stikkrenner, rekkverk…
- Hendelser
  - Ulykker, skred…

- Totalt ca 370 ulike objekttyper
  - NVDB Datakatalogen

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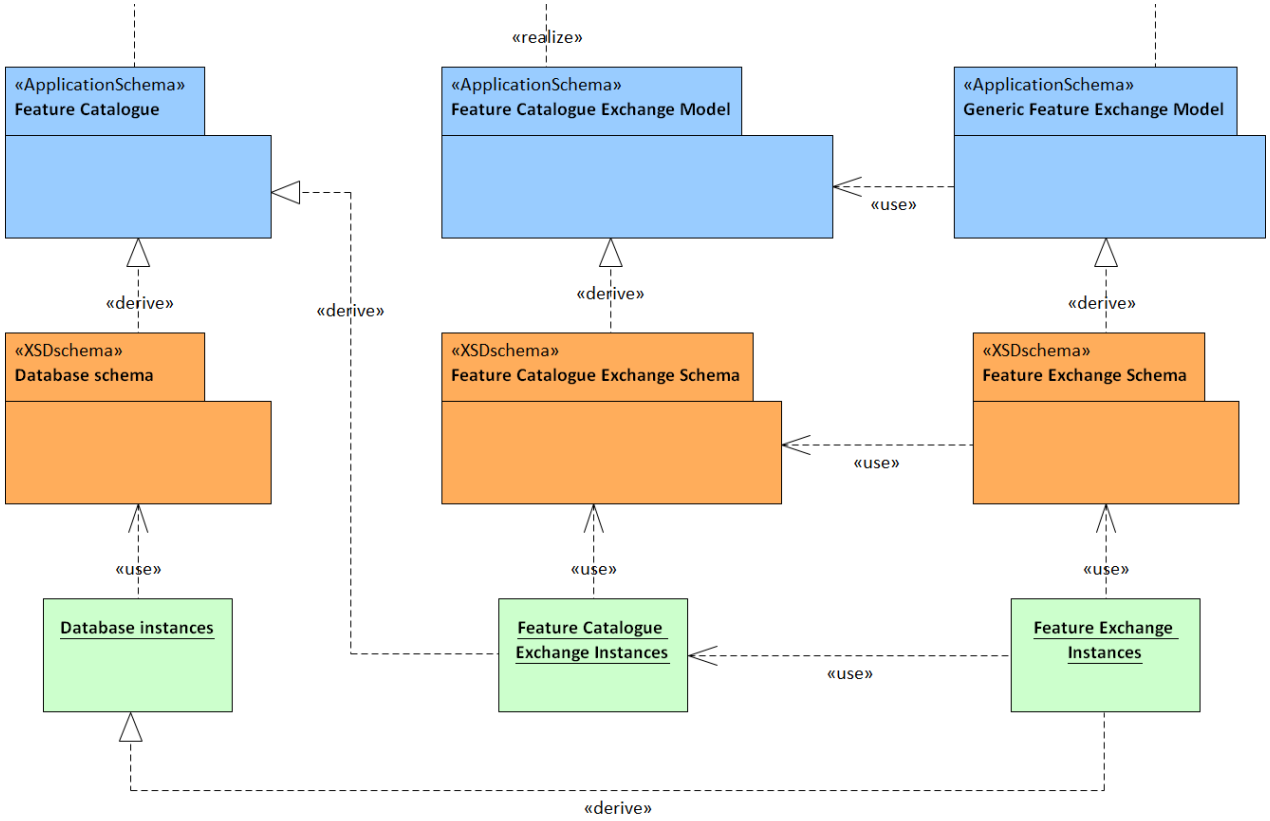
Generiske modeller



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opentnf

TN-ITS
Map Update Exchange

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Hvordan forteller vi hverandre hva vi har av data og hvordan de kan brukes?

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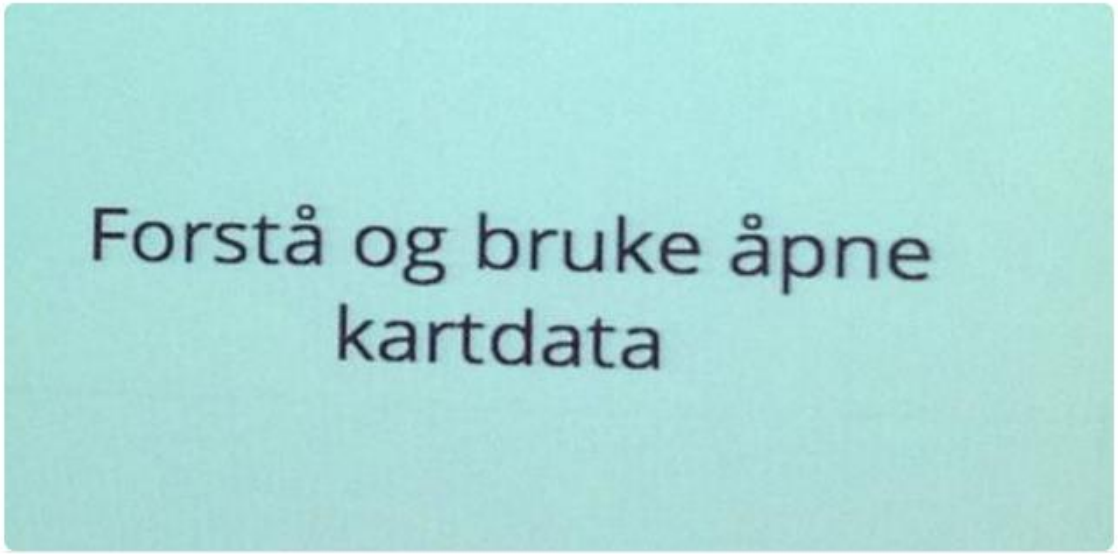
Norwegian Public Roads Administration

Knut Jetlund @jetGeo · 17. sep.

Derfor trenger vi kjedelige ting som produktspesifikasjoner og metadata #foss4gno



Hvordan forteller vi hverandre hva vi har av data og hvordan de kan brukes?

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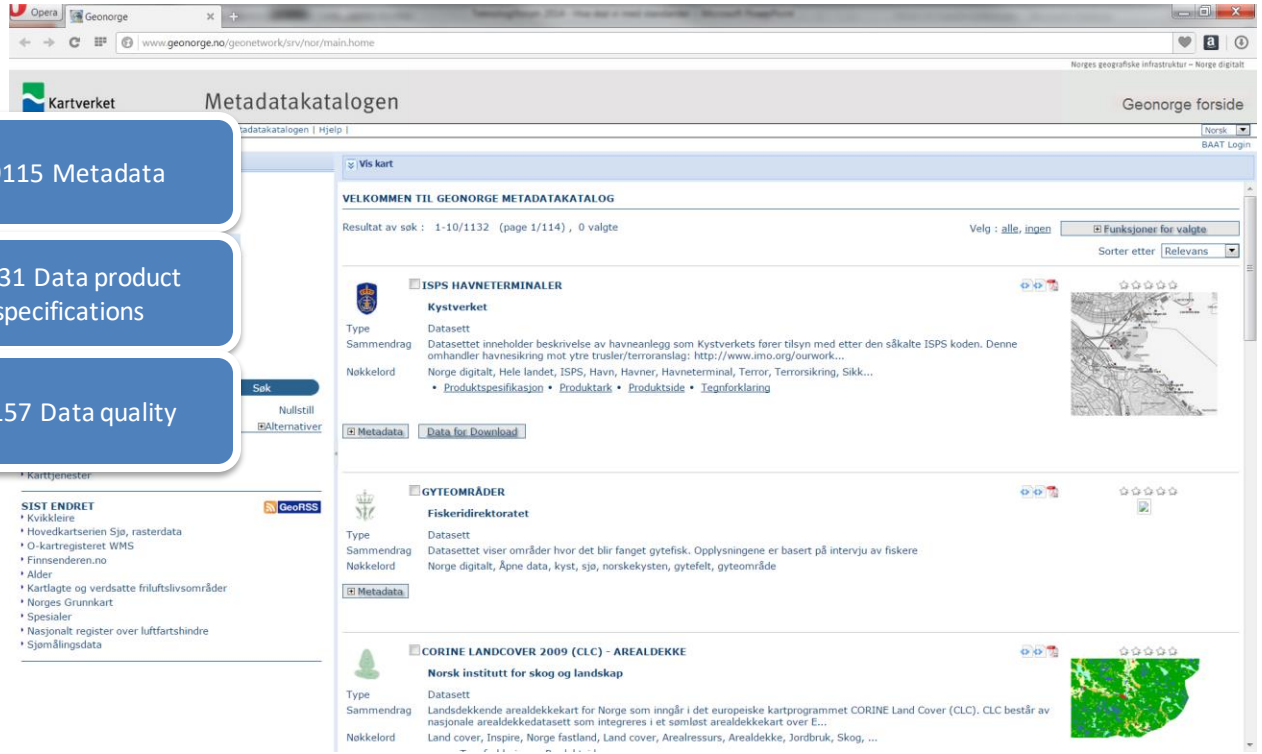
19115 Metadata

19131 Data product specifications

19157 Data quality



Hvordan utveksler vi informasjon om virkeligheten?

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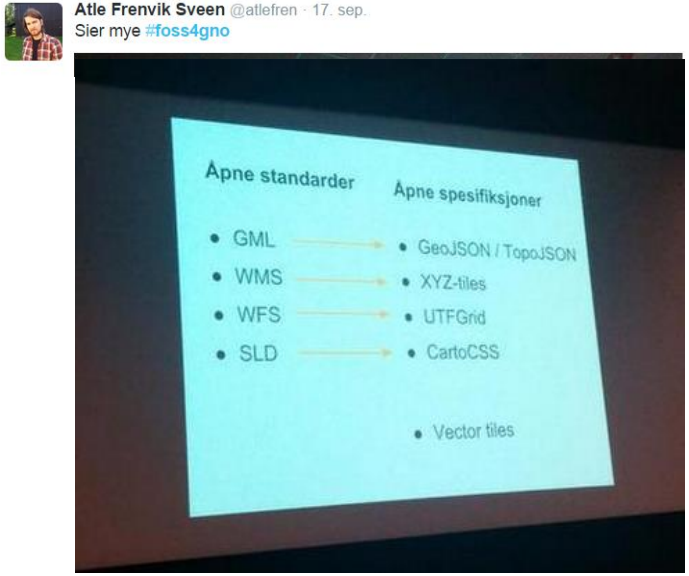
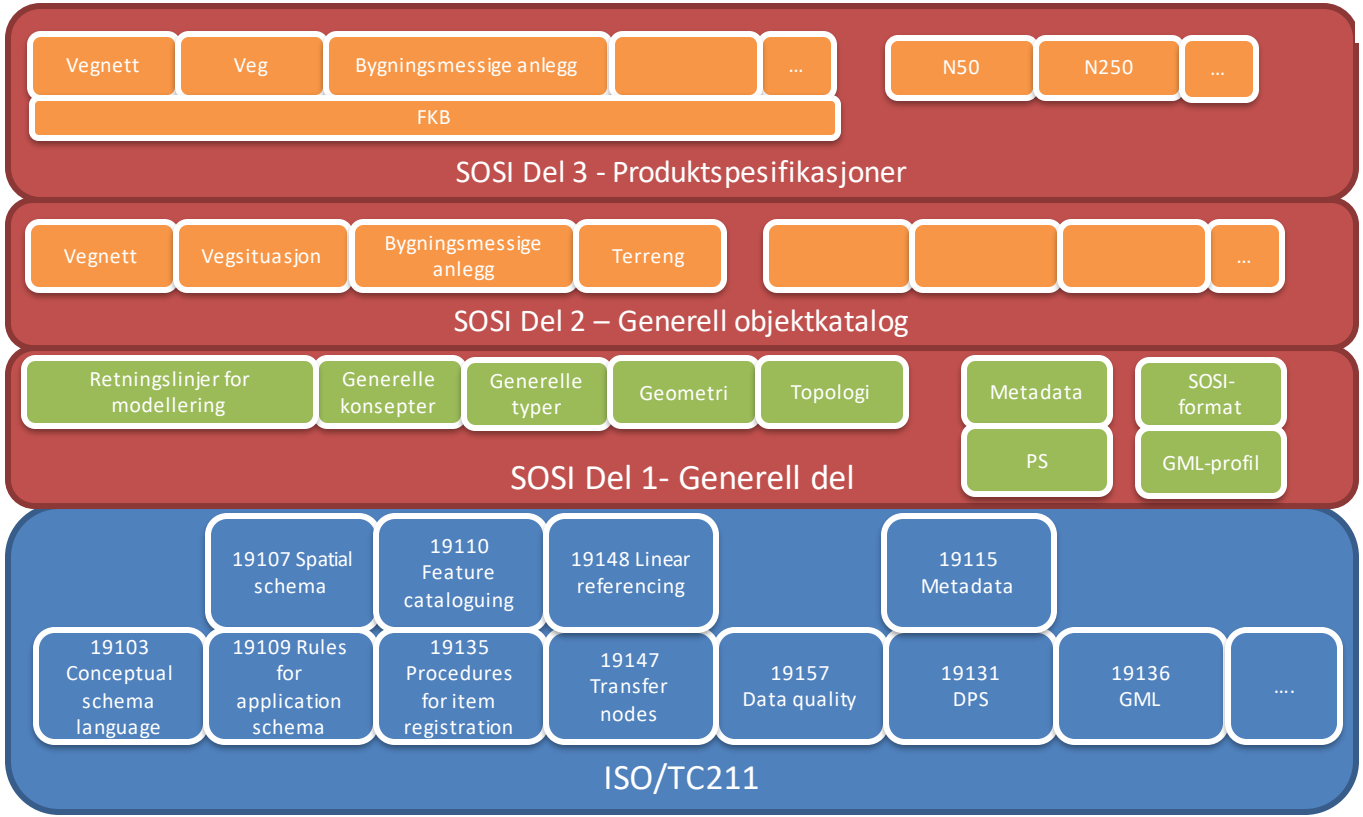
Statens vegvesen
Norwegian Public Roads Administration

- 19118 Encoding
- 19119 Services
- 19142 WFS
- 19128 WMS



- 19109 Rules for application schema
- 19136 GML

ISO/TC211 og SOSI



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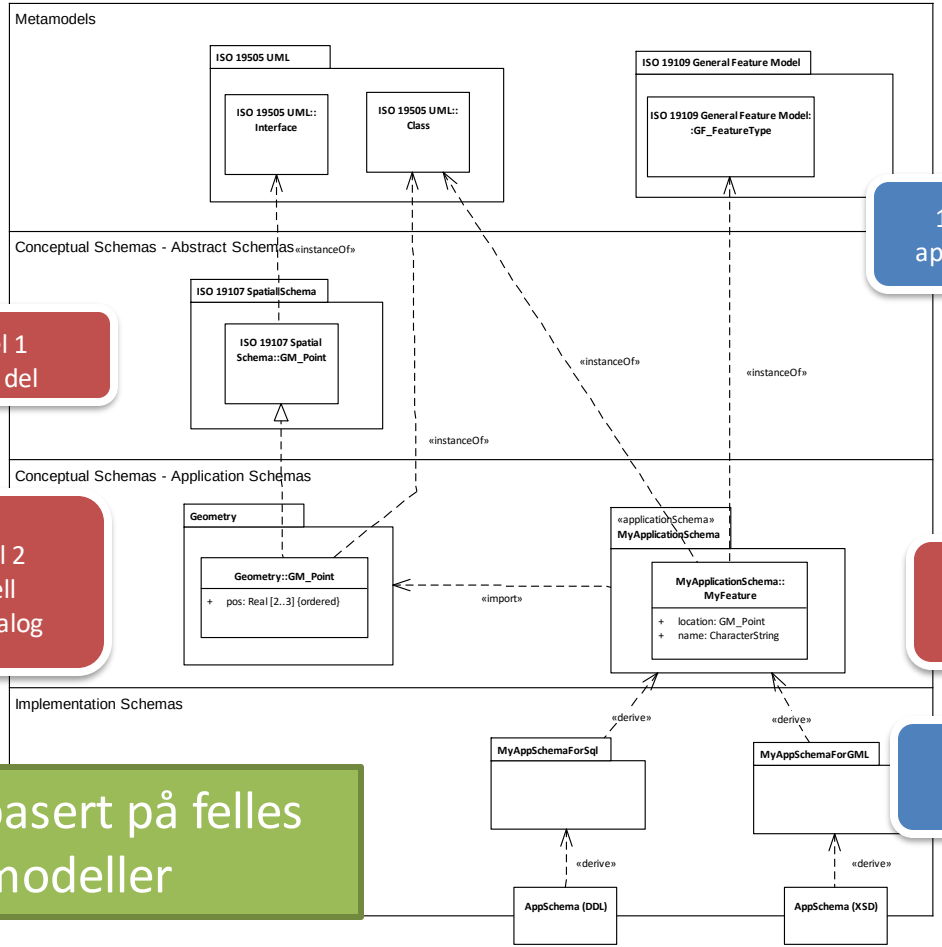
Norwegian Public Roads Administration



19109 Rules for application schema

SOSI Del 1 Generell del

SOSI Del 2 Generell objektkatalog

SOSI Del 3 Produkt-spesifikasjoner

19136 GML

Alt er basert på felles modeller

Hva er en standard?

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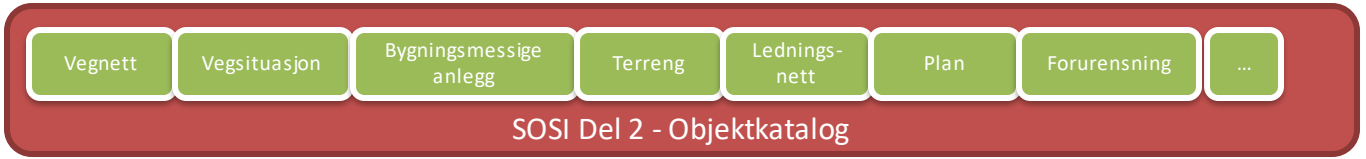
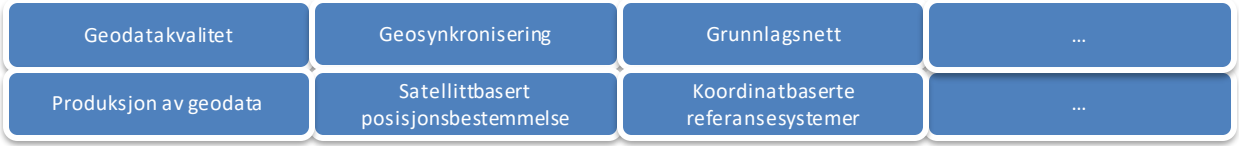
Norwegian University of Science and Technology
Statens vegvesen
Norwegian Public Roads Administration

- Bransjestandard, ikke offisiell Norsk standard (NS)
- Ett fagområde i SOSI Objektkatalog = En standard



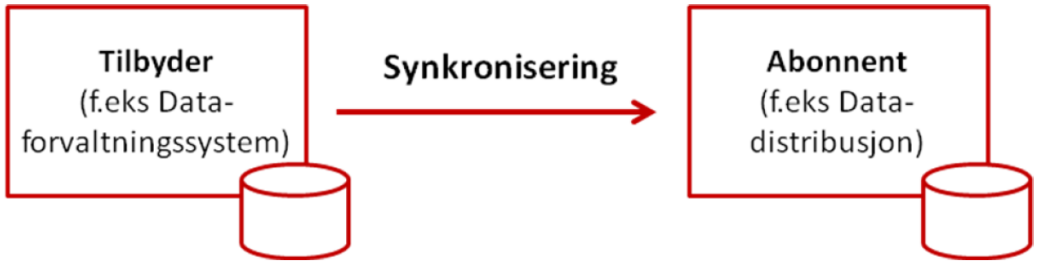
- Andre nasjonale bransjestandarder for geografisk informasjon



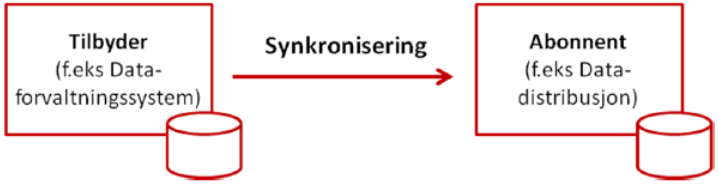
http://www.statkart.no/Standarder/Standarder-for-geografisk-informasjon/

Geosynkronisering

- Synkronisering mellom databaser
  - Endringsdata transportert på GML-format
- Samarbeid mellom systemleverandører og Kartverket
- Versjon 1 Juli 2013
- Begrenser behovet for utveksling via store filer



Geosynkronsiering



19118 Encoding	Koderegler for overføring av geografisk informasjon
19109 Rules for application schema	Hvordan applikasjonskjema skal spesifiseres
19142 WFS	Hvordan data og applikasjonsskjema utveksles
19136 GML	Filformat som utveksles

SOSI-standard vs SOSI-format

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UML

«featureType»
Veglenke

+ typeVeg :TypeVeg
+ detaljNivå :Vegdetaljnivå [0..1]
+ konnekteringslenke :Boolean [0..1]
+ veglenkeadresse :Veglenkeadresse [0..1]
+ brøytes :Boolean [0..1]
+ trafikkreguleringer :Trafikkreguleringer [0..1]
+ feltoversikt :CharacterString [0..1]
+ vegident :Vegident [0..1]
+ vegparsell :Vegparsell [0..1]
+ veglenkeFraDato :Date [0..1]
+ veglenkeTilDato :Date [0..1]
+ senterlinje :Kurve

::SOSI_Objekt

+ identifikasjon :Identifikasjon [0..1]
+ datafangstdato :DateTime [0..1]
+ kvalitet :Posisjonskvalitet [0..1]
+ medium :Medium [0..1]

::LineærtObjekt

+ identifikasjon :Identifikasjon
+ standardLRM :LineærReferanseMetode [0..1]
+ måltLengde :Real [0..1]
+ startVerdi :Real [0..1]
+ sluttVerdi :Real [0..1]

Realisering

```
.KURVE 3958:
..OBJTYPE Veglenke
..TYPEVEG "Enkel bilveg"
..KONNEKTERINGSLENKE JA
..KVALITET 60 90
..DATAFANGSTDATO 19990617
..IDENT
...LOKALID 247739951
...NAVNEROM NVDB_Transportlenker
..LRLRM 1
..KOMM 0403
..VNR E V 6
..VPA 80 12255 12303
..VKJORFELT 1#1H1
..VFRADATO 20020501
..NØH
674675141 28886570 13230 ...KP 1
..NØH
674676850 28886170 13240
674678030 28885890 13250
674679812 28885373 13294 ...KP 1
.KURVE 3959:
..OBJTYPE Veglenke
..TYPEVEG "Enkel bilveg"
..KONNEKTERINGSLENKE JA
..LTEMA 7001
..KVALITET 60 90
..DATAFANGSTDATO 19990617
..IDENT
...LOKALID 247739952
...NAVNEROM NVDB_Transportlenker
..LRLRM 1
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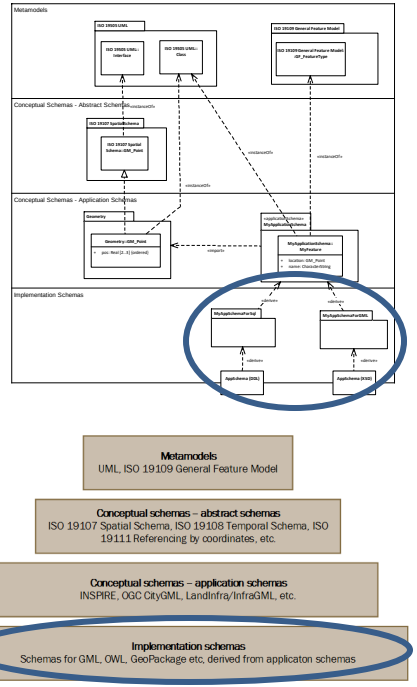

SOSI-standard i framtiden

- Videreutvikles og vil leve videre
  - Trenger en norsk objektkatalog
  - ISO-standardene er kun rammeverk, ikke selve objektkatalogen
- INSPIRE:
  - Dekker bare deler av utvalgte fagområder
- Aktuelle utviklingsområder for SOSI-standard:
  - Revidering av hele del 1
  - Harmonisering med INSPIRE for enkelte fagområder
  - Harmonisering med NVDB
  - Harmonisering med BIM

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Forsvinner SOSI-format?

Statens vegvesen
Norwegian Public Roads Administration

- SOSI-format har vært en avgjørende del av suksessen med Geovekst, FKB og Norge digitalt

- Men: Bruken vil gå ned
- Geosynkronisering bør bli nådestøtet for filbasert oppdatering av hele datasett
  - Geosynkronisering baseres på endringsdata i GML
  - Tvinger fram bruk av GML
- SOSI-format har gjort sitt, nå bør vi satse på GML som utvekslingsformat

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Hvorfor GML?

Statens vegvesen
Norwegian Public Roads Administration

- Offisiell internasjonal standard
- **Støttes av mange systemer, uten norsk tilpasning**
- Direkte basert på UML-modeller
- Nært knytta til applikasjonsskjema
- **Fleksibelt – flere muligheter enn SOSI-format**
- **Bedre realisering av komplekse modeller: assosiasjoner, lineære referanser mm**
- Enkel validering av filinnhold - standard XML

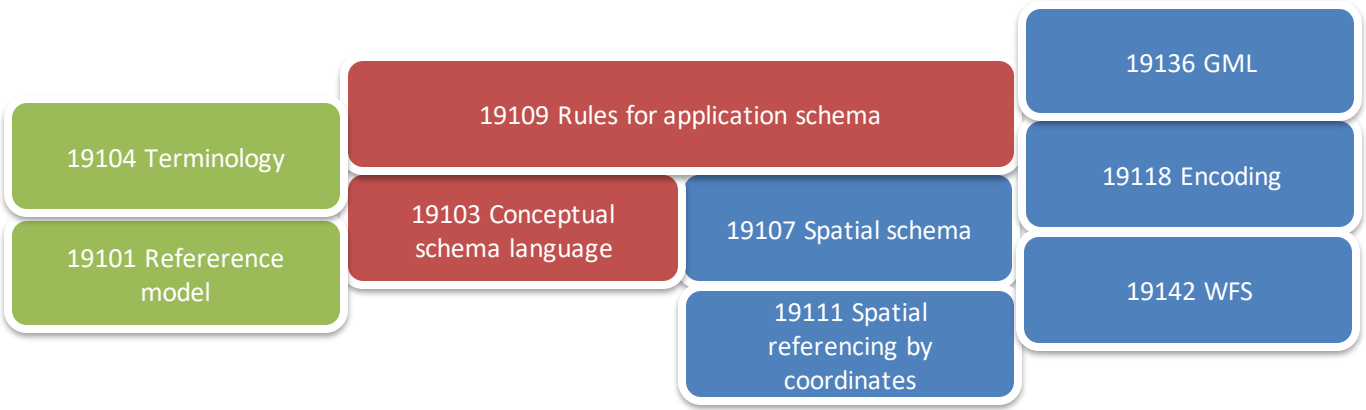
ISO/TC 211

<GML>

OGC®
Making location count.
www.opengeospatial.org

Oppgave

- Se liste over alle ISO/TC211-standarder: https://www.iso.org/committee/54904/x/catalogue/p/1/u/0/w/0/d/0
- Ut fra tittel på standarden
  - Hvilke ISO/TC211-standarder er minimum grunnlaget for at en GML-fil nå kan etableres og utveksles via Geosynkronisering?



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Standarder vs åpne spesifikasjoner

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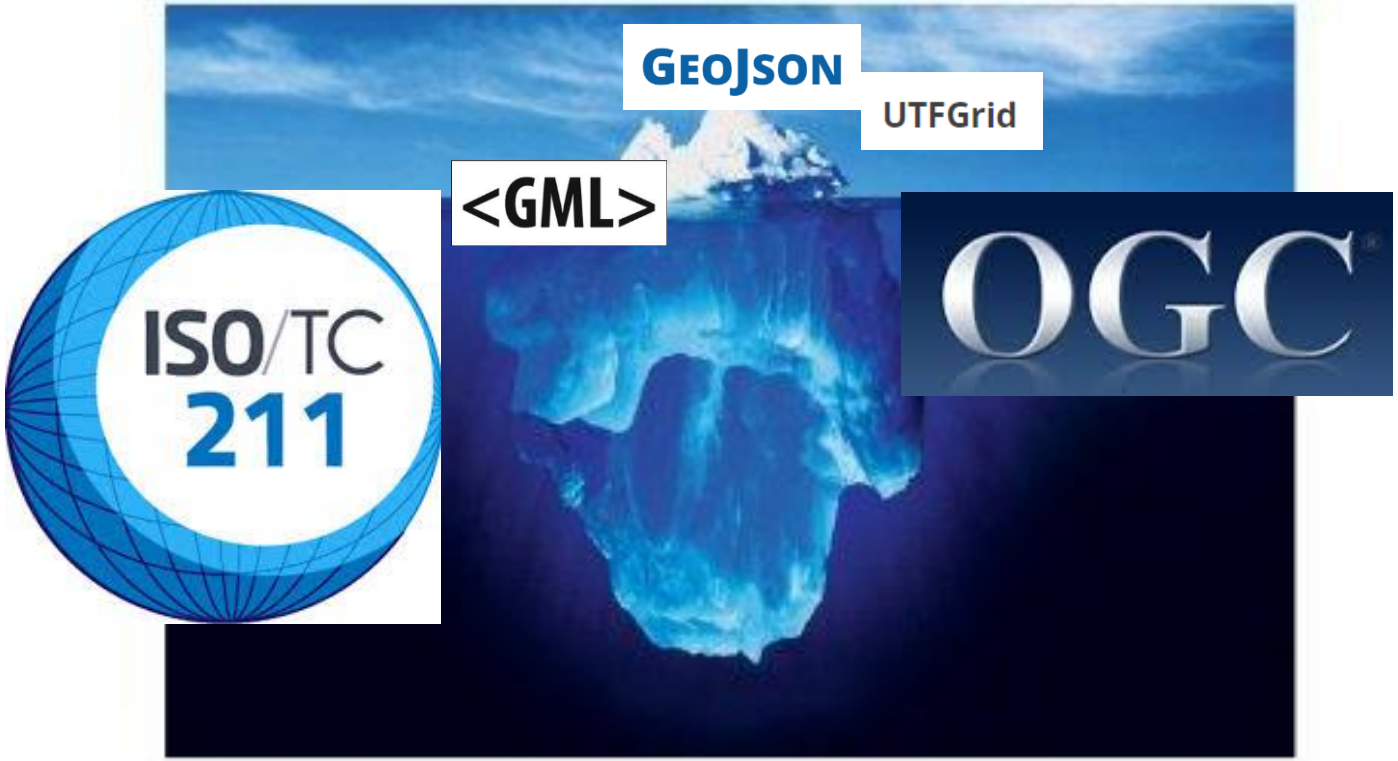

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UML for modellering av geografisk informasjon

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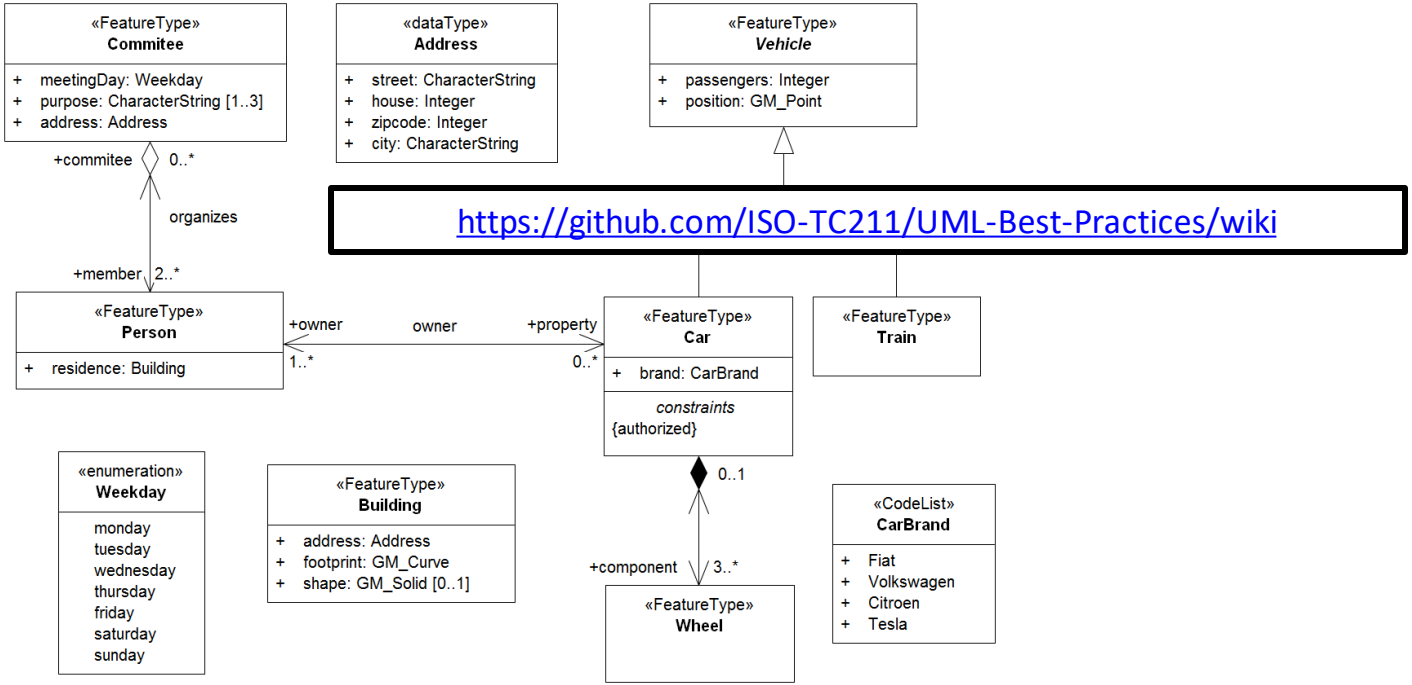
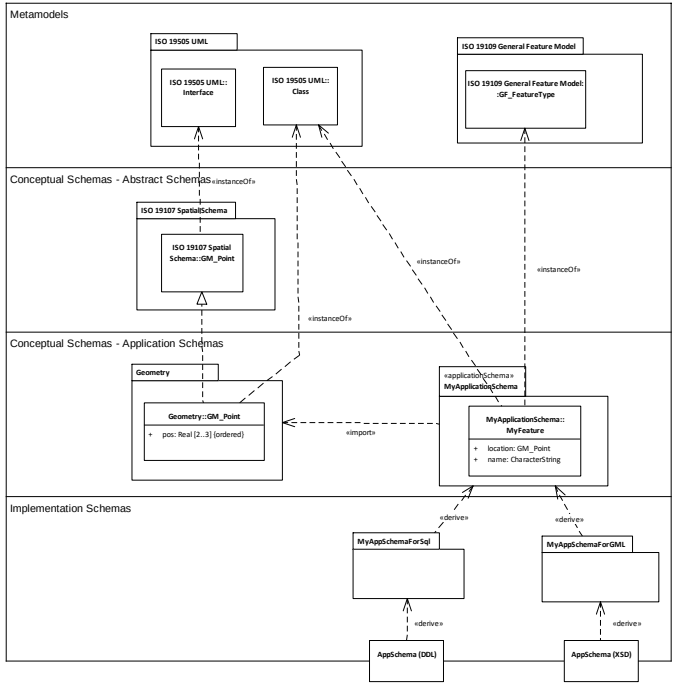


Alt er basert på felles modeller



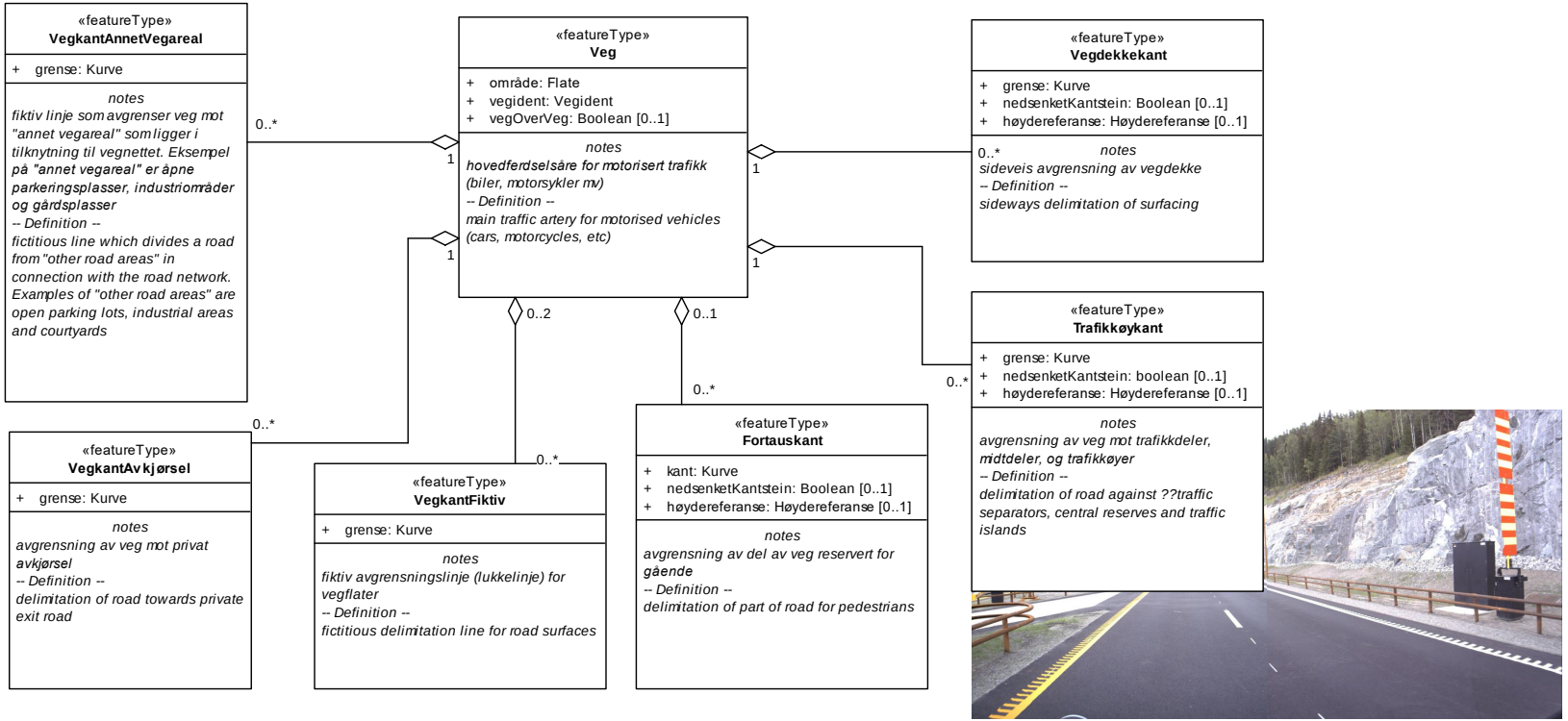
Metamodels
UML, ISO 19109 General Feature Model

Conceptual schemas – abstract schemas
ISO 19107 Spatial Schema, ISO 19108 Temporal Schema, ISO 19111 Referencing by coordinates, etc.

Conceptual schemas – application schemas
INSPIRE, OGC CityGML, LandInfra/InfraGML, etc.

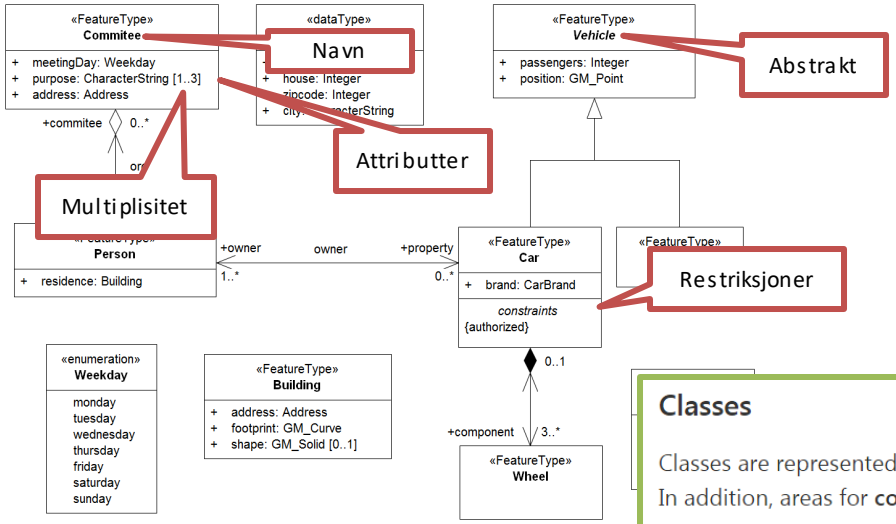
Implementation schemas
Schemas for GML, OWL, GeoPackage etc, derived from applicaton schemas

Eksempel fra FKB-Veg



Klasser

https://github.com/ISO-TC211/UML-Best-Practices/wiki/Introduction-to-UML#classes



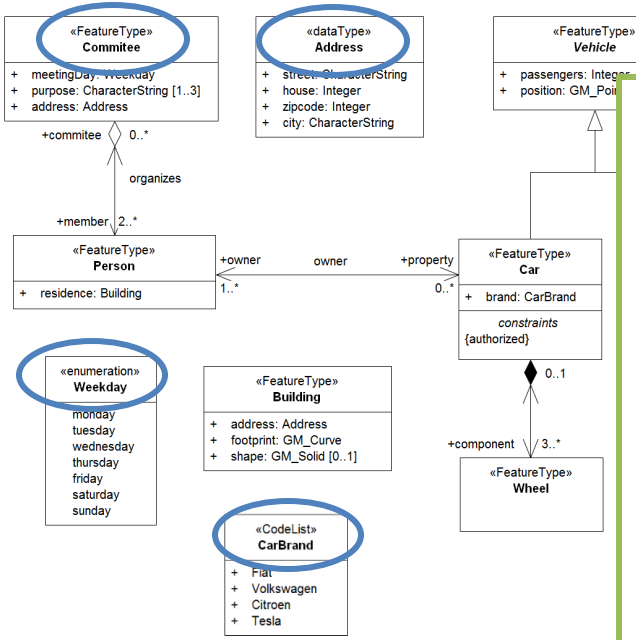
Classes

Classes are represented in diagrams as rectangles with areas for **name**, **attributes** and **operations**. In addition, areas for **constraints** and **tagged values** may also be shown.

- **Abstract classes** have their name written in *Italic*. Such classes can not be instanciated.
- Attributes are presented with **attribute name**, **data type** and **mulitplicity** - the number of possible occurences - in brackets
- Multiplicity [0..1] means none or one, [0..*] means none to many, etc. No value means exactly one.

Stereotyper

https://github.com/ISO-TC211/UML-Best-Practices/wiki/Introduction-to-UML#stereotypes



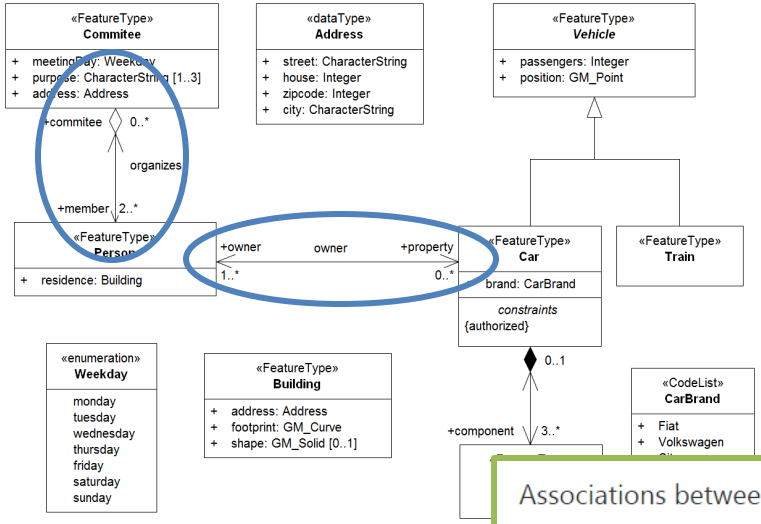
Stereotypes

Above the name of classes and packages there may be a stereotype name in quotes. Stereotypes are used to extend the basic UML elements and give them different meanings. ISO19103 - Conceptual Schema Language and ISO19109 - Rules for application schemas defines the stereotypes that are to be used for models of geographic information. Stereotype names are not case sensitive, but the style used in ISO19103 and ISO19109 should be used:

- Packages with stereotype "**ApplicationSchema**" contains feature types. This stereotype is important for realization in GML.
- Classes with stereotype "**FeatureType**" represent geographic objecttypes. This stereotype is important for realization in GML.
- Classes with stereotype "**dataType**" are sets of properties without identity. Such classes can not exist as single instances, only as attributes or components in other classes.
- Classes with stereotype "**enumeration**" are fixed lists of possible values. Attributes that use such lists may only take values from the list.
- Classes with stereotype "**CodeList**" are extendable lists of possible values.
- Classes with stereotype "**interface**" are conceptual classes. Such classes can not be used directly in data sets, they must be realized in other classes
- Classes with stereotype "**Union**" contains a list of types where only one may be used in one instance.

Assosiasjoner – retning, rolle og multiplisitet

https://github.com/ISO-TC211/UML-Best-Practices/wiki/Introduction-to-UML#associations



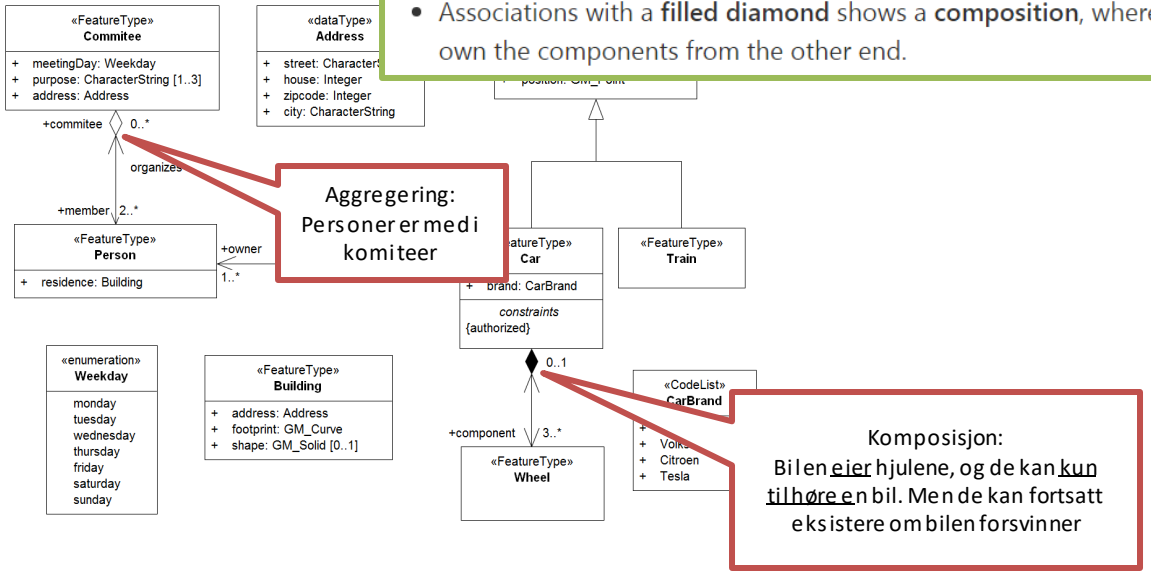
Associations between classes are represented with lines that connect the classes

- Associations may have **association names**.
- Associations may also have a given **direction**. This is illustrated with arrows that show the direction the association is navigable.
- **Each navigable end shall have a role name and multiplicity** (number of possible instances of the connection).

Assosiasjoner – aggregering og komposisjon

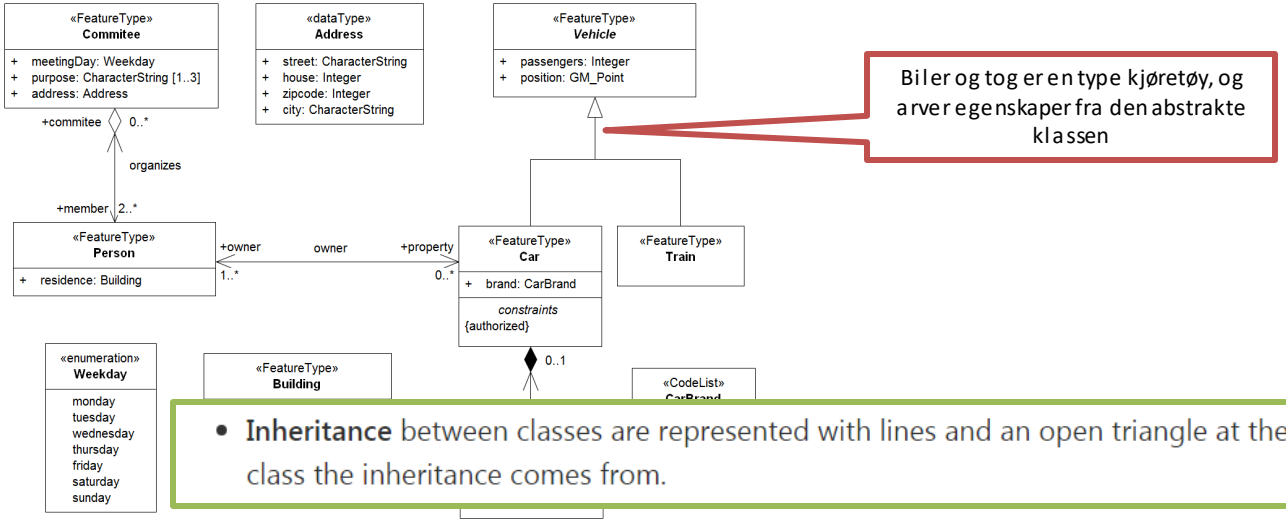
https://github.com/ISO-TC211/UML-Best-Practices/wiki/Introduction-to-UML#associations

- Associations with an **open diamond** shows an **aggregation**, where the class on the diamond side have a collection of individual components from the other end.
- Associations with a **filled diamond** shows a **composition**, where the class on the diamond side own the components from the other end.



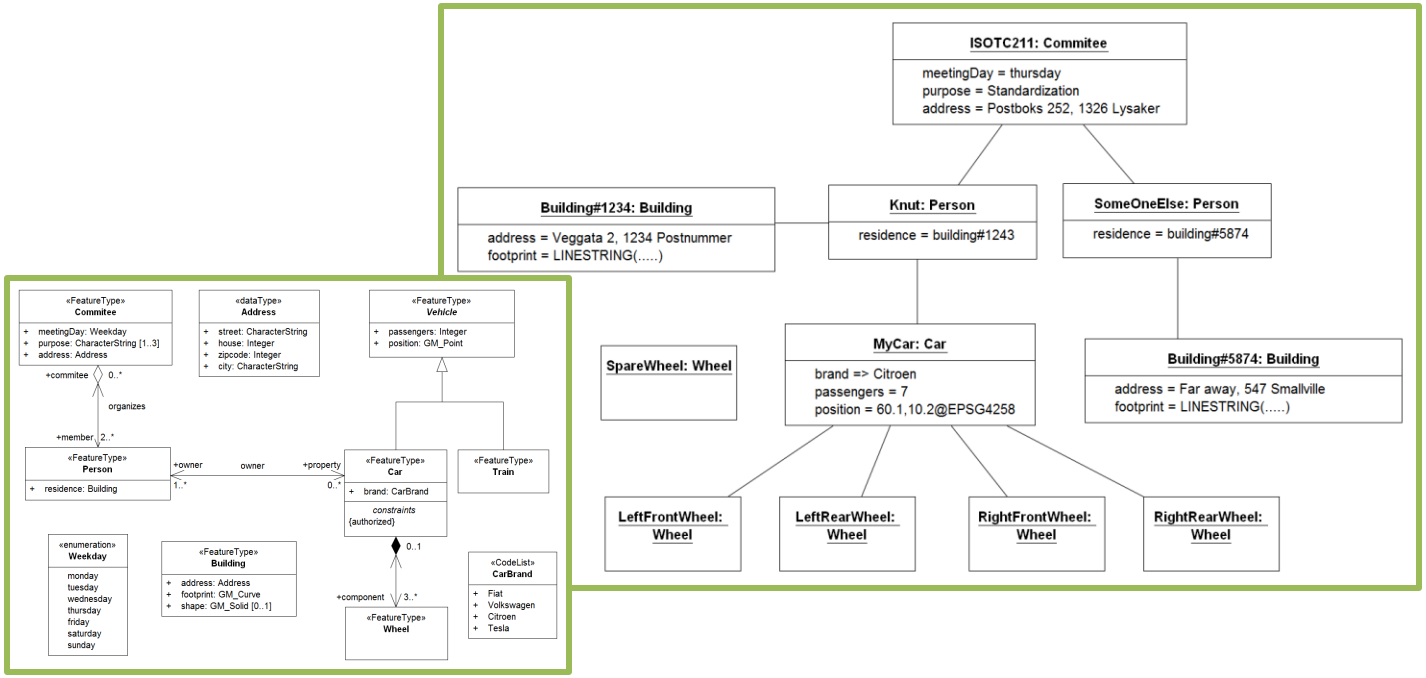
Assosiasjoner – arv

https://github.com/ISO-TC211/UML-Best-Practices/wiki/Introduction-to-UML#associations



Objektdiagram - instanser

https://github.com/ISO-TC211/UML-Best-Practices/wiki/Introduction-to-UML#model-elements-in-object-diagrams



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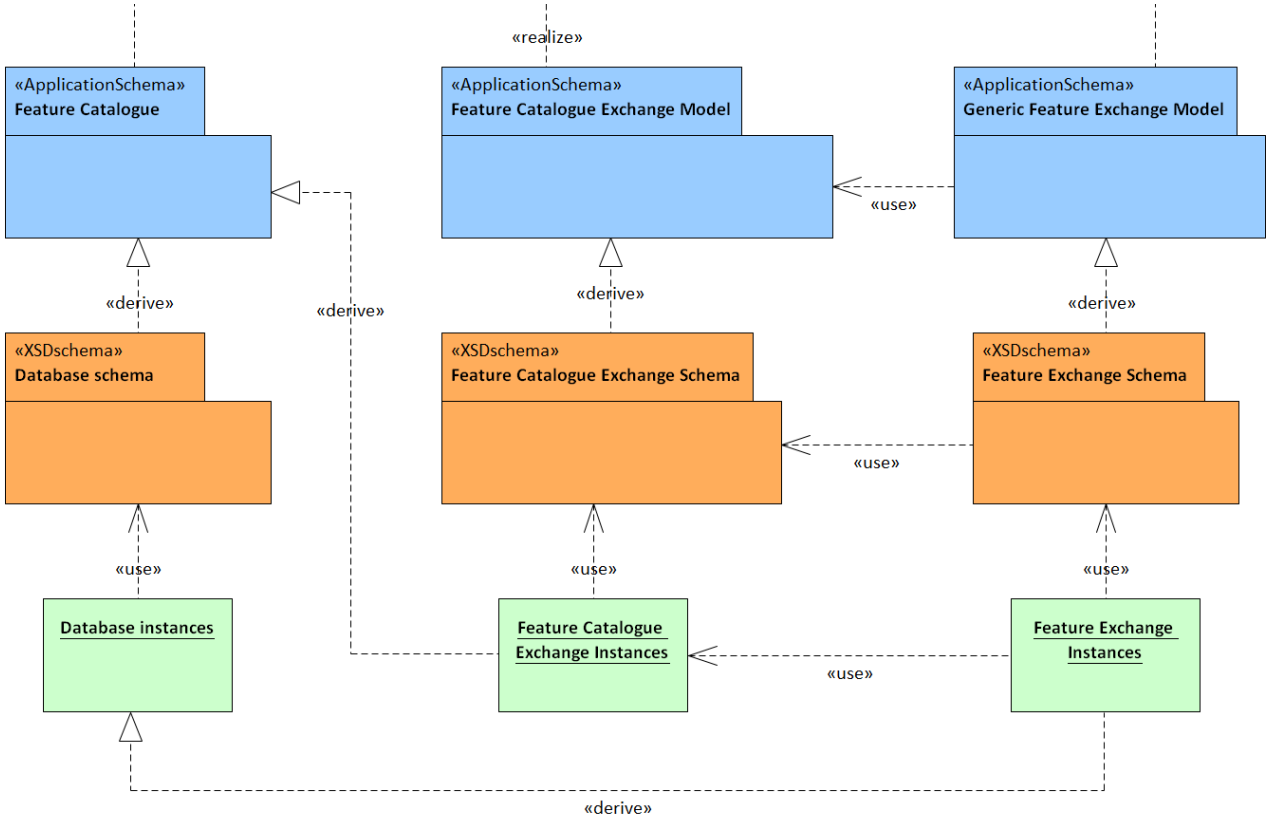
Generiske modeller



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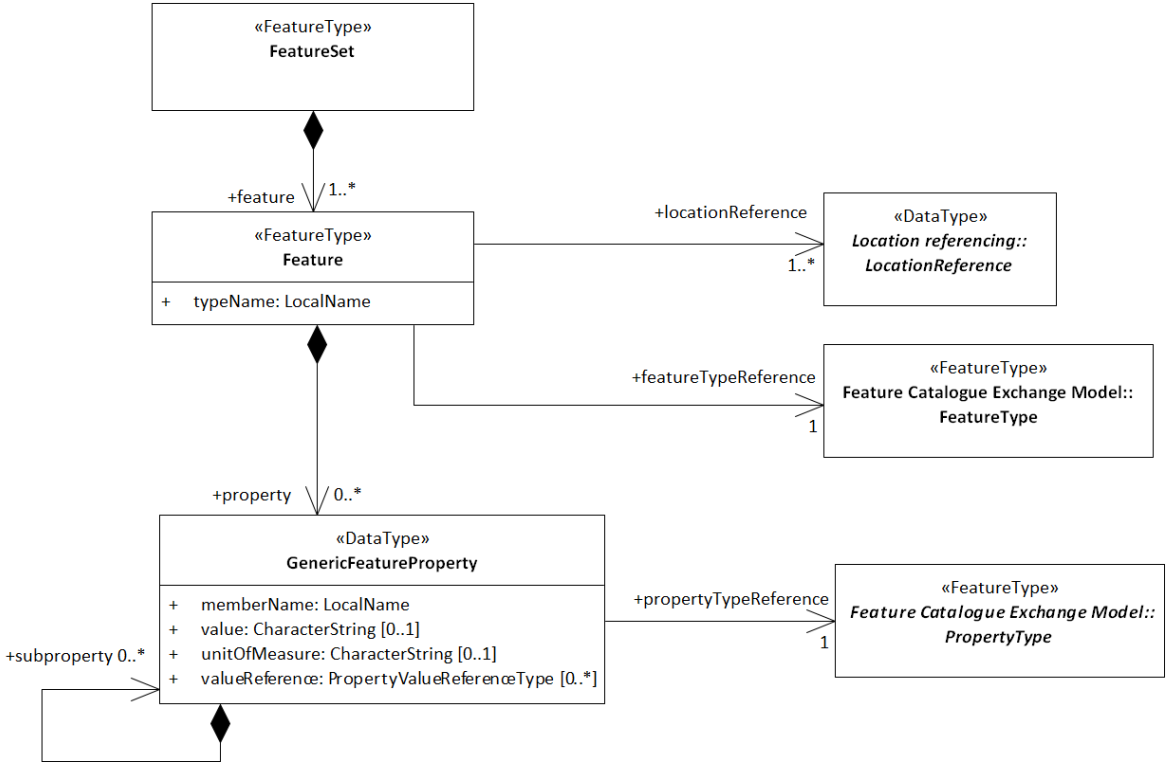
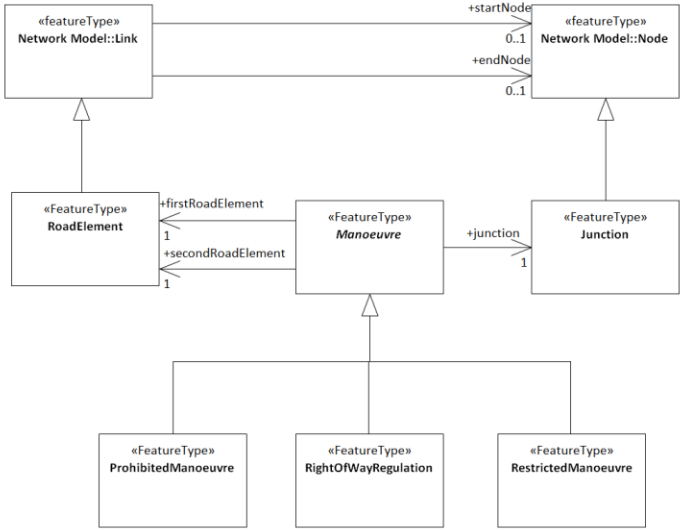
opentnf

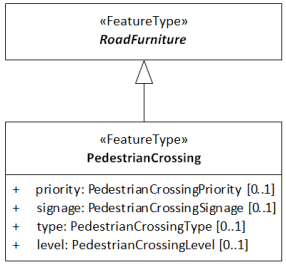
TN-ITS
Map Update Exchange

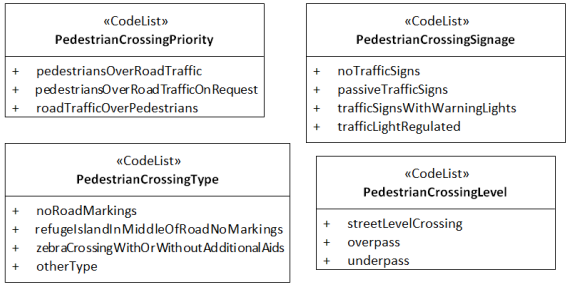
Generiske modeller



Objektkataloger – eksempel: GDF







GML-fileksempler…

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<itsgml:classifier>
    <itsgml:FeatureType gml:id="GDF.Manoeuvre">
        <itsgml:typeName>Manoeuvre</itsgml:typeName>
        <itsgml:isAbstract>true</itsgml:isAbstract>
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        <itsgml:property>
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        </itsgml:property>
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</itsgml:classifier>
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        <itsgml:typeName>ProhibitedManoeuvre</itsgml:typeName>
        <itsgml:isAbstract>false</itsgml:isAbstract>
        <itsgml:inheritsFrom xlink:href="GDF.gml#GDF.Manoeuvre" />
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</itsgml:classifier>
```

```
<gml:featureMember>
    <itsgml:Feature gml:id="vegvesen.no.nvdb.114168011_1">
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        <itsgml:validFrom xsi:nil="true"/>
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        <itsgml:property>
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                <itsgml:memberName>firstRoadElement</itsgml:memberName>
                <itsgml:propertyStructure>association</itsgml:propertyStructure>
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            </itsgml:GenericFeatureProperty>
        </itsgml:property>
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            </itsgml:GenericFeatureProperty>
        </itsgml:property>
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```

```
<itsgml:Feature gml:id="vegvesen.no.nvdb.159605145_0">
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</itsgml:Feature>
```

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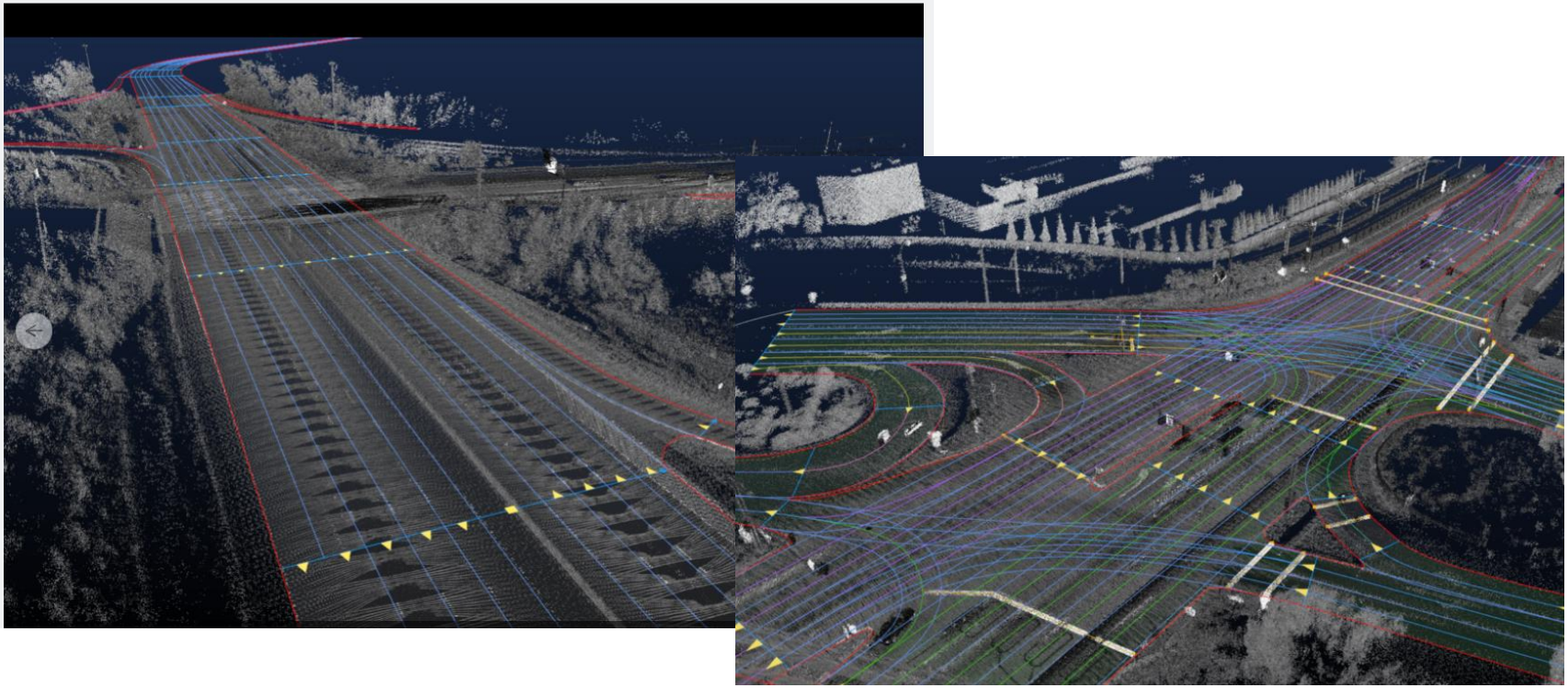
The most detailed maps of the world will be for cars, not humans

Here, Civil Maps, and even Nvidia are all working on a new kind of cartography.

JONATHAN M. GITLIN - 3/11/2017, 6:00 PM



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Takk for oppmerksomheten!

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Twitter: @Jetgeo
LinkedIn: https://www.linkedin.com/in/knut-jetlund/