Implementing GML, WMS and WFS in practice – a software provider's viewpoint

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Bentley
Sustaining Infrastructure

Bentley and OGC

- Bentley is an active OGC Principal member
  - Standards definition
  - Engagement in OGC
  - Promoting standards
- Being not only a GIS vendor
  - Hundreds of standards to follow
  - Almost impossible to be proactive
  - Development has to be dependent on customer's requirements

OGC Membership by Level & Region

All | List By Level | List By Region

Listed by Level

Strategic (5) Technical (61) Small Company (43) GovFuture-Local (7)
Principal Plus (2) Technical Aggregate (1) GovFuture-Subnational (14) University (104)
Principal (15) Associate (105) Research Institute / Not For Profit Institute (43) Individual (19)

Strategic (5 members) Top

Organization	Level	Region	URL
Lockheed Martin	Strategic	North America	
Northrop Grumman Corporation	Strategic	North America	
US Geological Survey (USGS)	Strategic	North America	
US National Aeronautics and Space Administration (NASA)	Strategic	North America	
US National Geospatial-Intelligence Agency (NGA)	Strategic	North America	

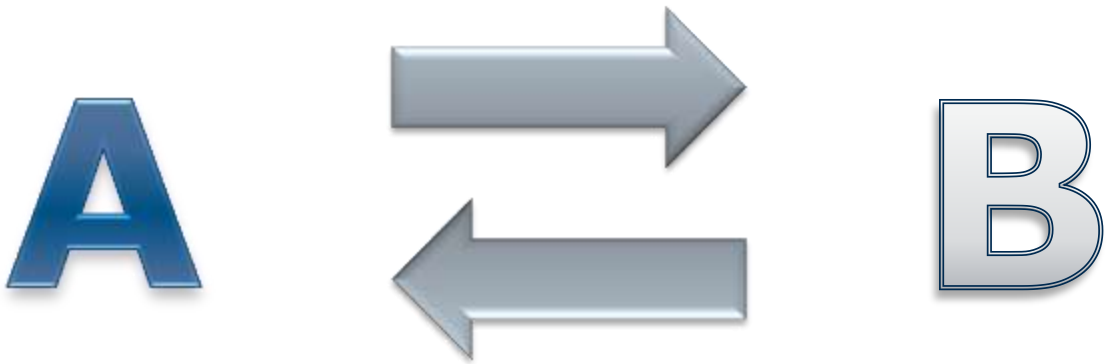
Principal Plus (2 members) Top

Organization	Level	Region	URL
ERDAS, Inc.	Principal Plus	North America	
PCI Geomatics Inc.	Principal Plus	North America	

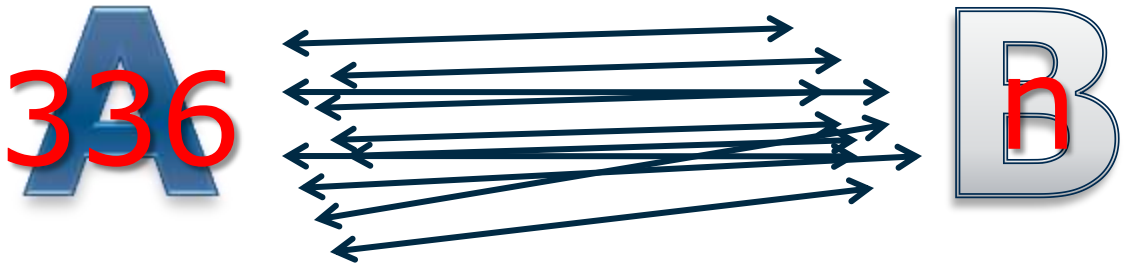
Principal (15 members) Top

Organization	Level	Region	URL
BAE Systems - C2I Systems	Principal	North America	
Bentley Systems, Inc.	Principal	North America	
Department of Science & Technology	Principal	Asia Pacific	
EADS ASTRIUM	Principal	Europe	
Esri	Principal	North America	
Feng Chia University	Principal	Asia Pacific	
GE Smallworld	Principal	Europe	
Google	Principal	North America	
Intergraph Corporation	Principal	North America	
Ist/ion GmbH	Principal	Europe	
Oracle USA	Principal	North America	
Rolta India, Ltd.	Principal	Asia Pacific	
SAIC	Principal	North America	
US Department of Homeland Security (DHS)	Principal	North America	
US National Oceanic and Atmospheric Administration (NOAA)	Principal	North America	

National challenge



National challenge

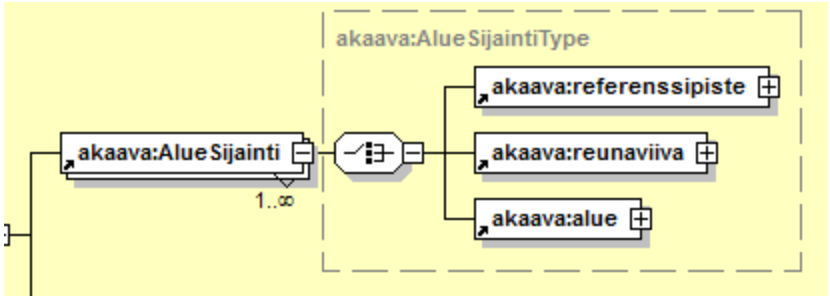


KuntaGML and KRYSP projects

- Association of Finnish Local and Regional Authorities started a harmonization process 2001
- Result KuntaGML and KRYSP harmonized data models for core municipal data
- Basic support for local applications used by municipalities was funded by AFLRA
  - GML IN and OUT
  - WMS and WFS services
- 7 vendors in KuntaGML and 11 in KRYSP

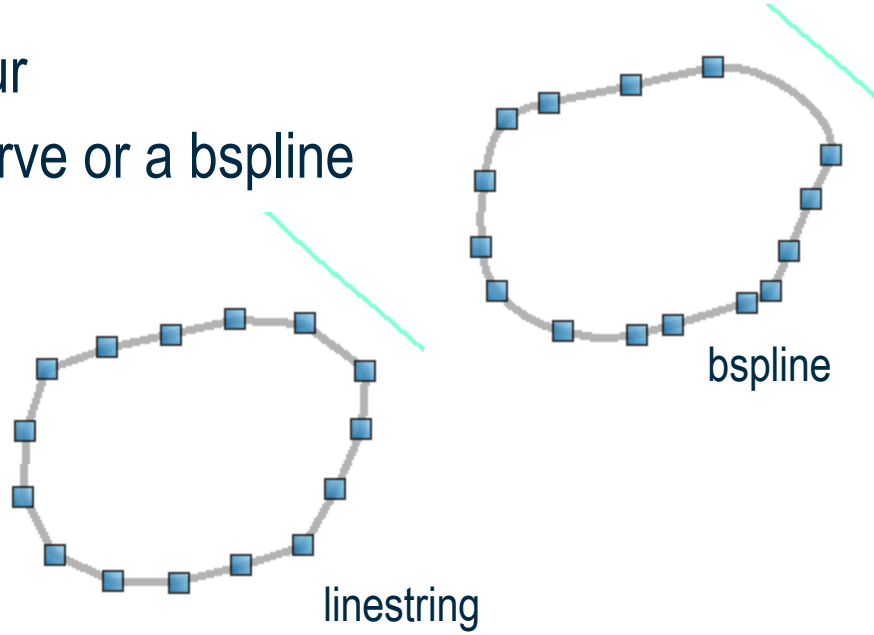
Bentley's Stella application

- 2000+ GIS features in the municipal core application
- Internal data model was a "trad" one
- Import and Export against KuntaGML = huge shema mapping effort > change of the internal model
- New model closer to the KuntaGML KRYSP models
  - Still a lot of customer specifig feature definitions etc.
- Schema mapping including a lot of vendor spesifig details
  - an example area defined by centroid and line vs. an area



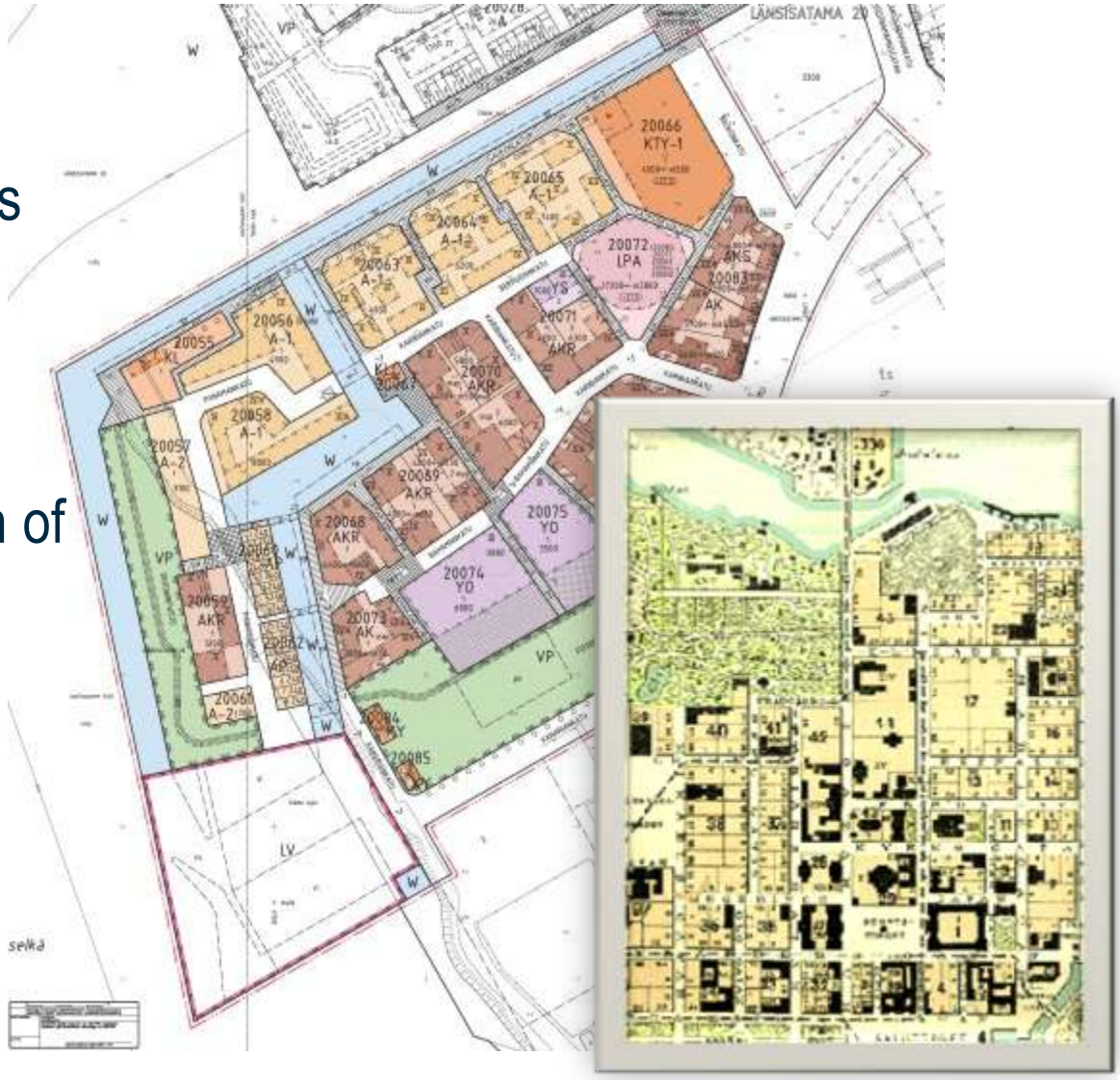
Implementing GML 3.1.1 in KuntaGML

- 550+ pages of specs to be intepreted
- A lot of ways to describe simple features
- All CAD and GIS systems define feature geometries in their own way
  - An example – a contour
  - Can be a linestring, curve or a bspline



Finnish City Plan = a GML challenge

- Complex areas
- Areas with symbol fills
- Symbolized lines
- Text and labels
- Flexible interpretation of Ministry rules
- History effect
- …



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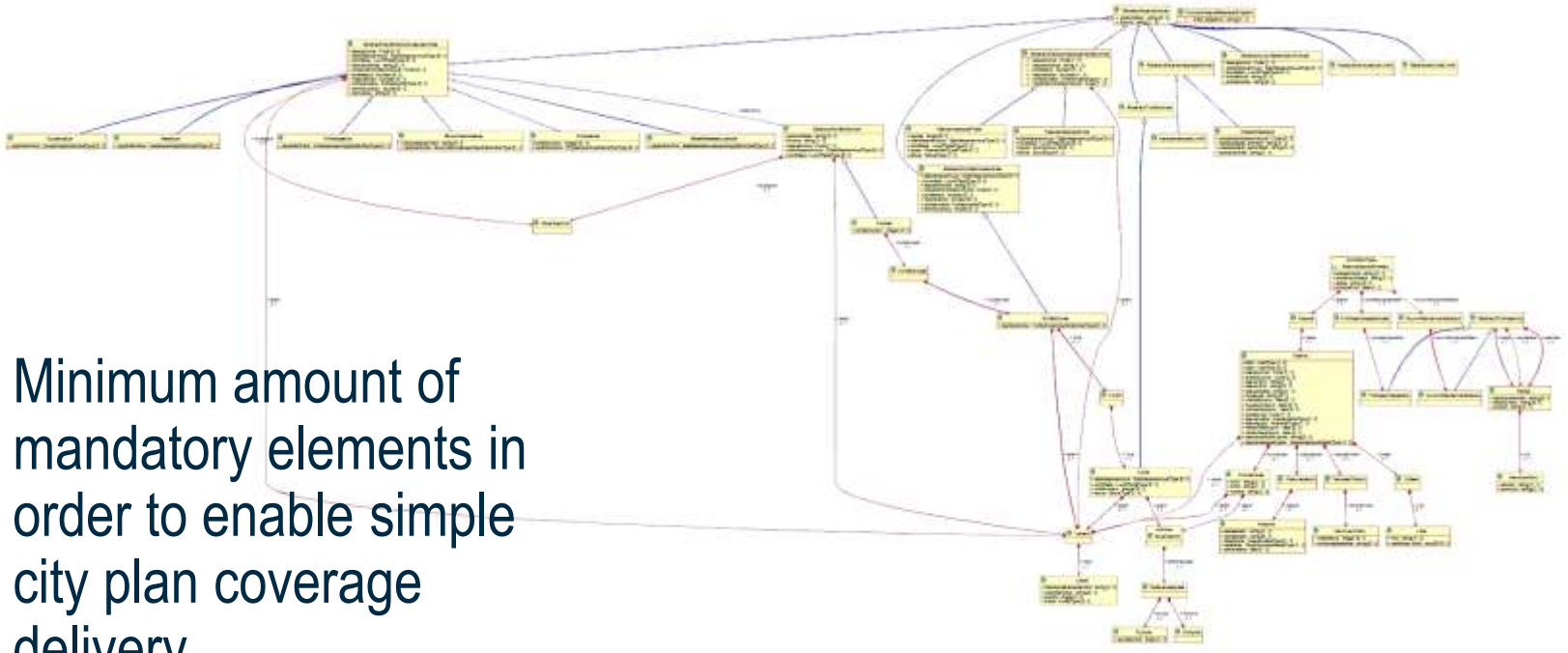
City Plan KuntaGML harmonized schema UML



- Minimum amount of mandatory elements in order to enable simple city plan coverage delivery

Had to agree on common rules

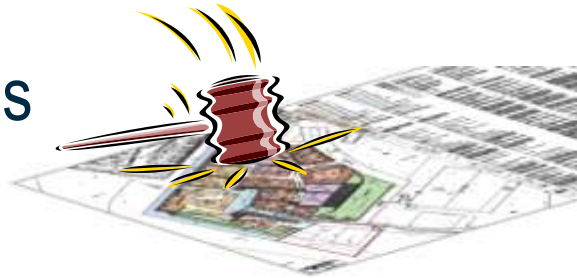
- Missing mandatory date should be replaced with : 1.1.1001
- Missing number replaced with XML-attribute "nil" for example <rakval:vakuudenmaara xsi:nil="true"></rakval:vakuudenmaara>
- Coordinate unit used is meter in East, North order, maximum 10 numbers after decimal point
- If Z coordinate present srsDimension="3", otherwise srsDimension="2".
- Angle unit is radian with 0-direcdtion always to North (used for labels and symbols) going to clockwise direction
- Default Angle is 0
- Label (text) default direction is to East
- Point symbol default direction is to North, with CC X,Y point except arrow symbol where X,Y point is in the arrow head
- Arc feature is always defined as gml:Arc, full circle with same start and end point, but middle point at the centre of the circle
- Symbolized line should have symbols always on the righthand side of the line, if not equally symbolized
- Recommendations about GML geometry usage for example
  - **Area (simple):** Polygon/LinearRing/pos
  - **Area (complex):** PolyhedralSurface/PolygonPatch/Ring/Curve/LineStringSegment/pos or Arc/pos

WMS

- Easy – just have to harmonize the layer content
  - 1) Kantakartta – Municipal map
  - 2) Pohjakartta – Base Map
  - 3) Rakennukset - Buildings
  - 4) Kiinteistötiedot - Cadastre
  - 5) Johtotiedot - Utilities
  - 6) Asemakaavayhdelmä – Combined City Plan
  - 7) Asemakaavan käyttötarkoitusalueet – City Plan Land usage

WFS in KuntaGML and KRYSP

- Tought task
- Agreed on WFS 1.0.0 and GML 3.1.1 combination
- WFS is actually a simple feature service method
- Finnish data sets are complex and hierarchical
- Moving a legal document via WFS/GML is almost an impossible task



- Includes embedded INSPIRE data (protected sites) in a form that is impossible to extract

GML - every day problems

- Many ways of defining a feature
- Unlimited amount of servers and data sets
- Unlimited amount of clients
- gml:ArcString ” *The number of arcs in the arc string* ***can*** *be explicitly stated in the attribute “numArc”. The number of control points in the arc string shall be 2 * numArc + 1.*”
- What if you don’t use numArc how does the client interpret an area having several joined arcs?
- Or shoud you use just **gml:Arc** instead?

WFS - every day problems

- Who are the users?
- What versions do their clients support?
- Data vendor creates a service, but the potential users can’t take advantage of it.

Implementing a municipal SDI

- How to motivate 300+ municipalities?
- By default it is not a win-win situation,
- It is an investment without a know ROI
- How to explain this to the decision makers?
- In large cities the biggest advantage has been in the internal processes where vector data has been replaced with always up to date WMS services.

Good web services example

National Land Survey web services

- WMS
- WFS
  - Cadastre
  - Address
- Cadastre documents