

3D geodatabase design & MayaArch3D geo-browser

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Bundesministerium
für Bildung
und Forschung



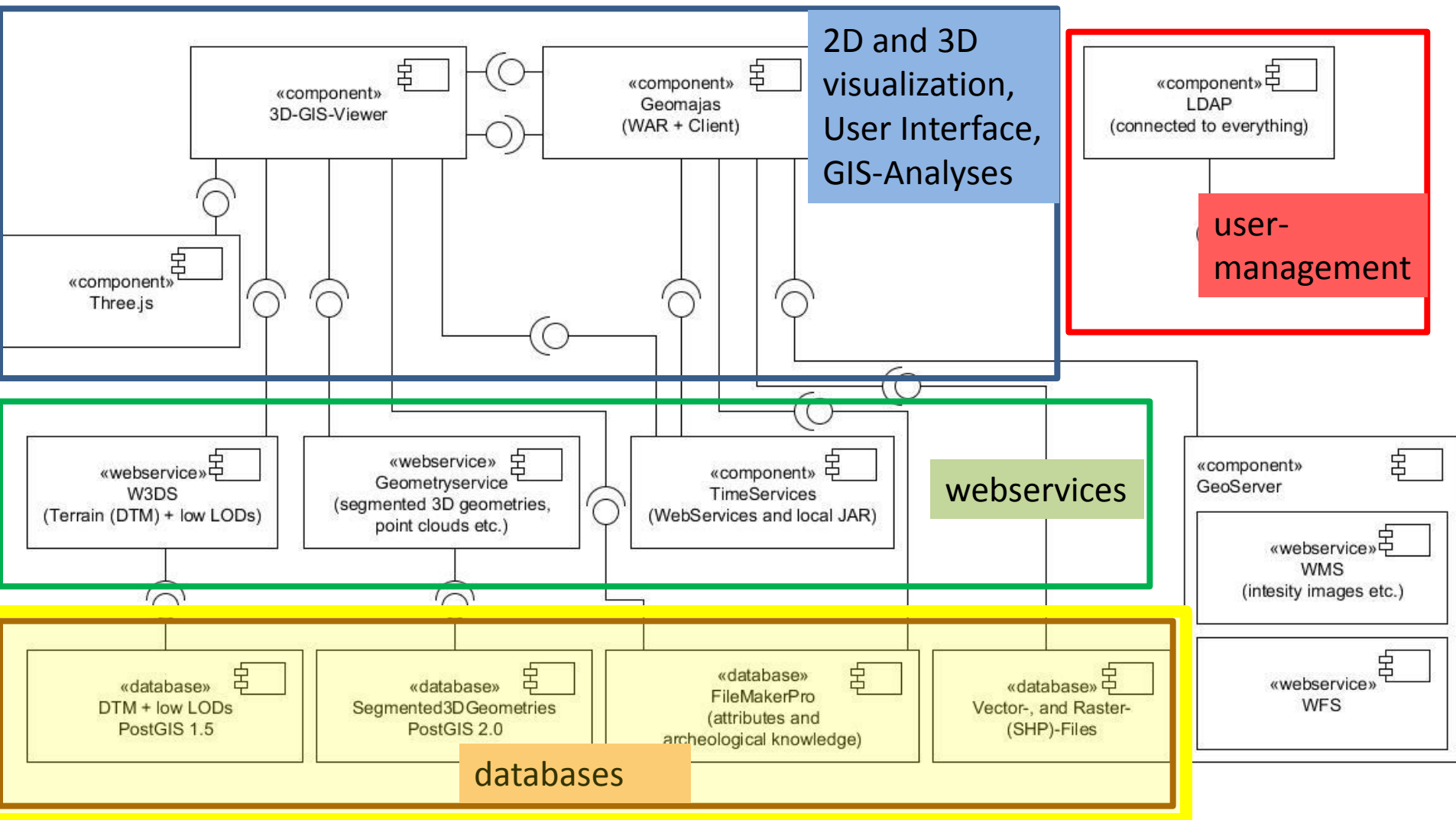
- Design and implementation of the 3D geodatabase
 - Underlying ideas & requirements
 - Implementation
 - Linkage to FileMaker Pro
- The MayaArch3D geo-browser
 - Architecture
 - Geomajas
 - Implementation & examples
- Conclusions and outlook

The **MayaArch3D** tool

- takes inspiration from previous experiences and existing approaches
- tailored to the needs of Copan

Development steps:

1. Design the database, definition of:
 - conceptual schema for LoDs,
 - geometric and semantic hierarchies,
 - interaction with existing (attributes) database
 - Interaction with other tools (geo-browser, 3D viewer, etc...)
2. Check & structure existing data accordingly
3. Data integration & homogenisation
4. Develop the management & visualisation & query front-ends



- **Requirements**

- Need to deal with B-Rep geometries
 - no CSG, no BIM approach
 - Both 2D and 3D geometries
- Need to deal with multi-resolution models
- Need to deal with multiple representations of the same object at the same resolution
 - E.g.: different hypothetical reconstruction models
- Need to deal with hierarchically segmented models
- Main focus on man-made structures (but not only: DTM, geographic features, etc.)
- Adopt FOOS software solutions (as much as possible)
- Obey to the rule of simplicity, avoiding data redundancy
- Allow for enough flexibility to be extended in future

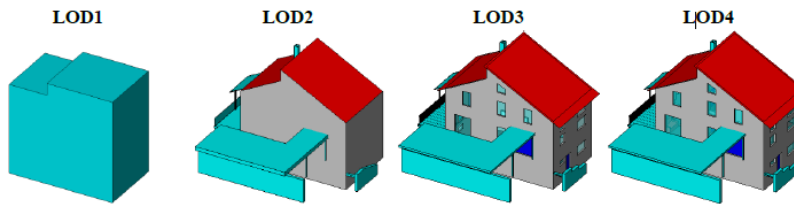
- **Wrt. data modelling:**
 - Need to deal with B-Rep geometries
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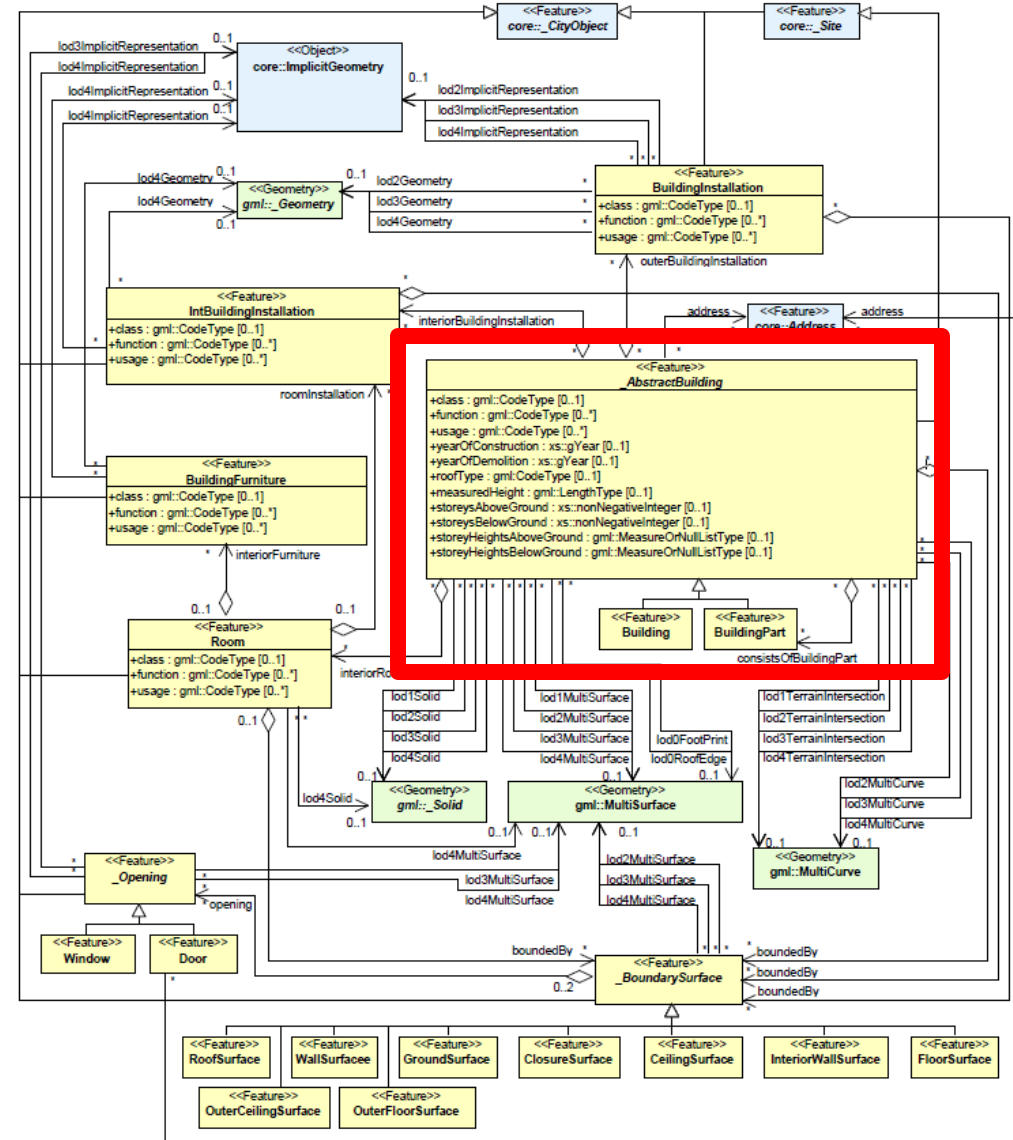
RED: already covered by CityGML (however: tailored to “modern” cities)

CityGML class „Building“

Building

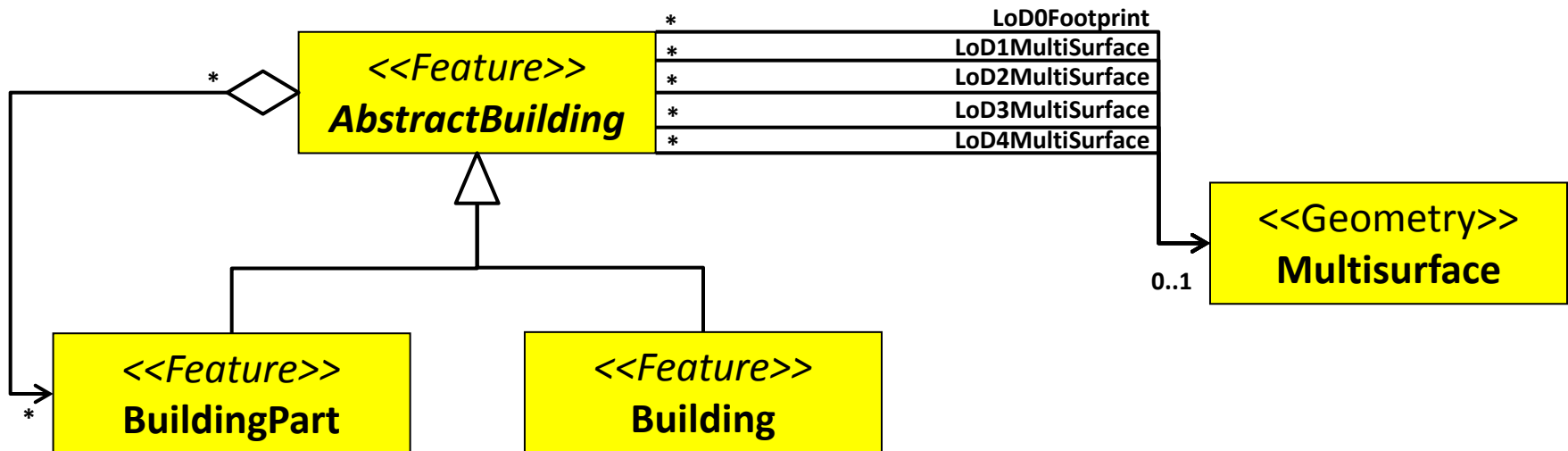


Building consisting of one part (represented as one *Building* feature)

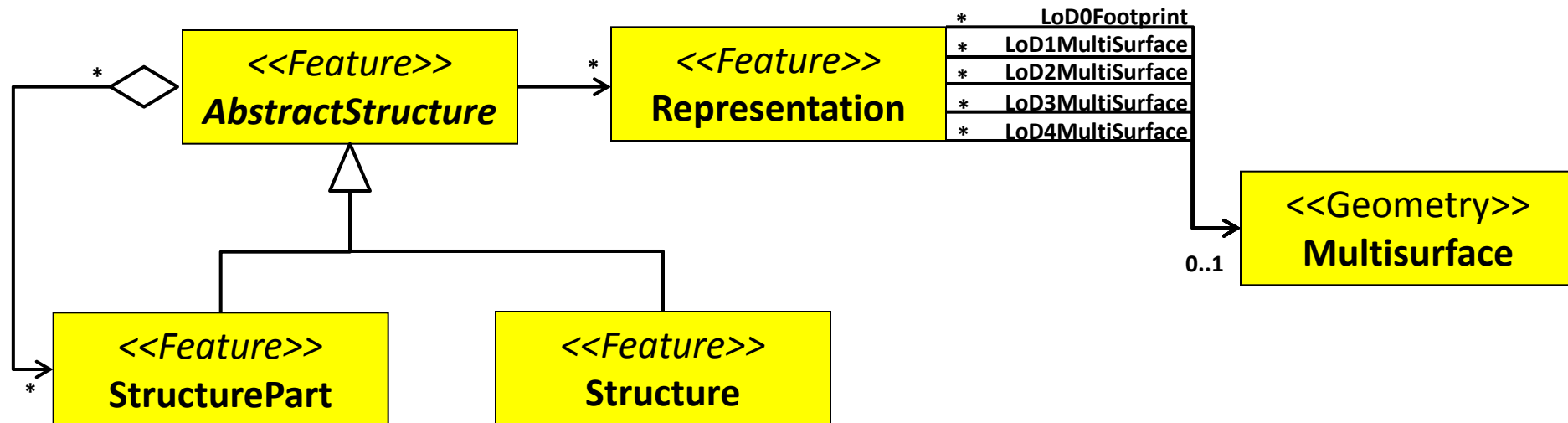


Source: CityGML 2.0 Specifications

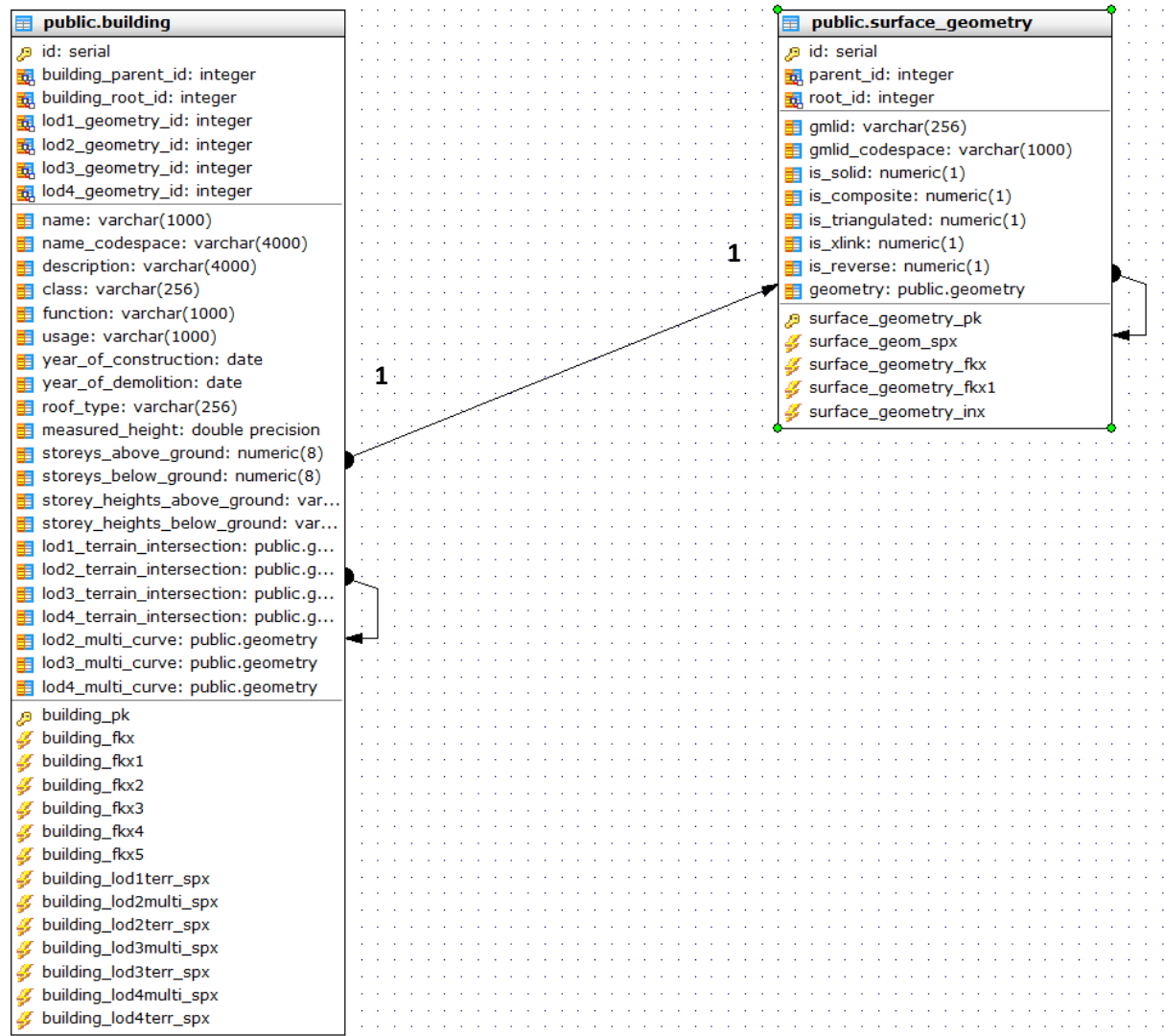
- CityGML class „Building“ (UML excerpt)



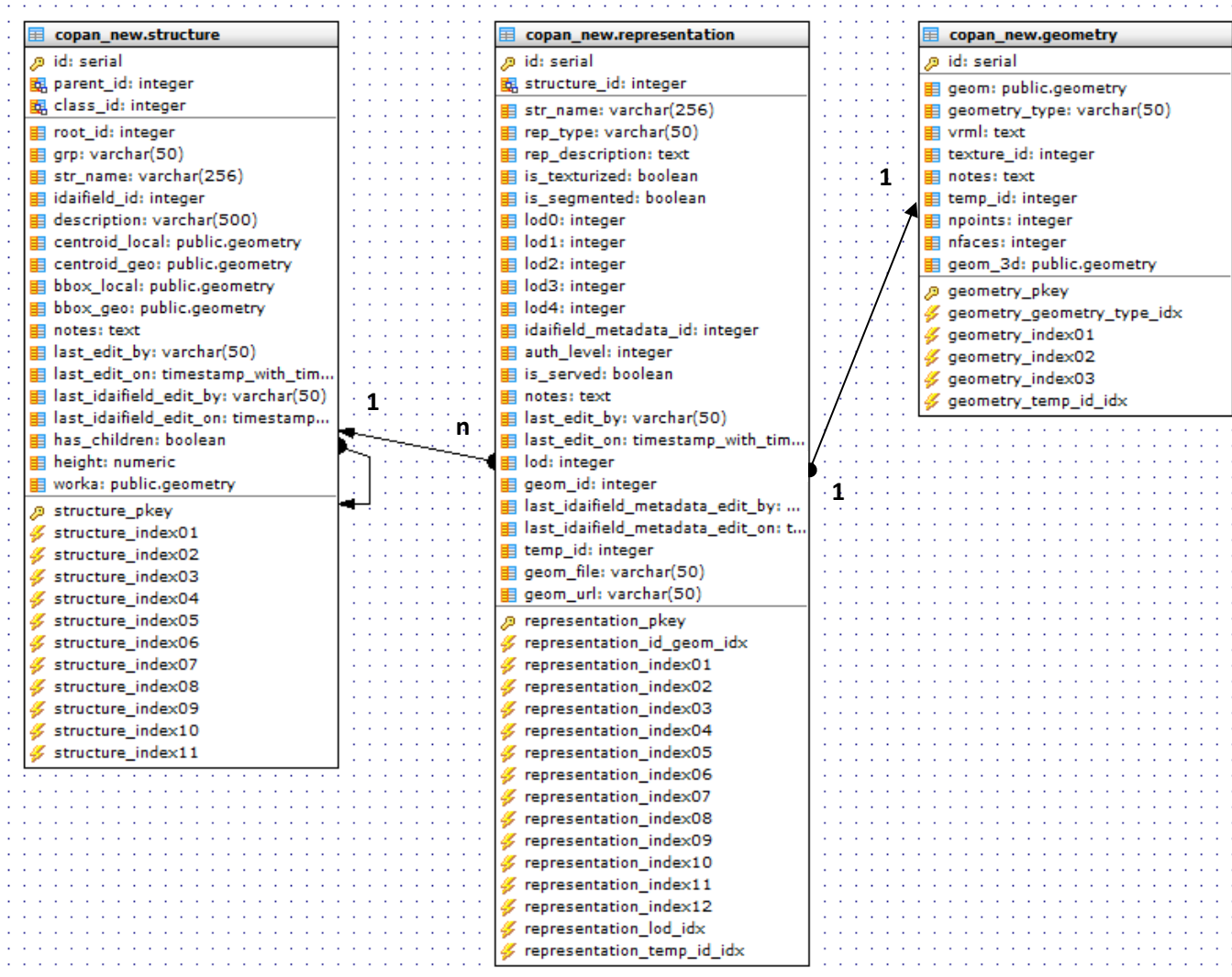
- MayaArch3D class „Structure“ (UML excerpt)



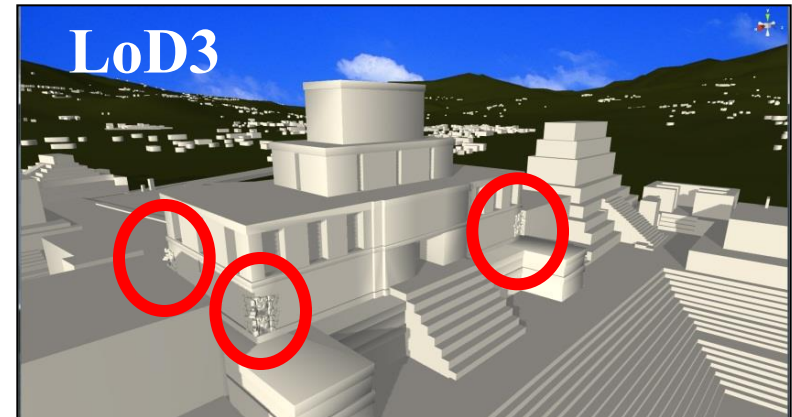
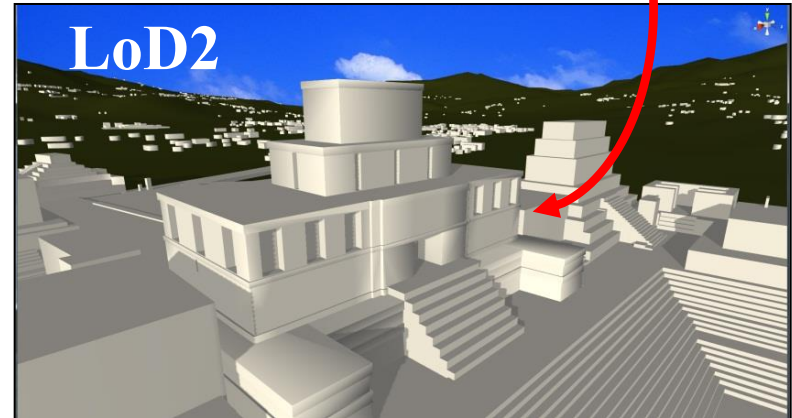
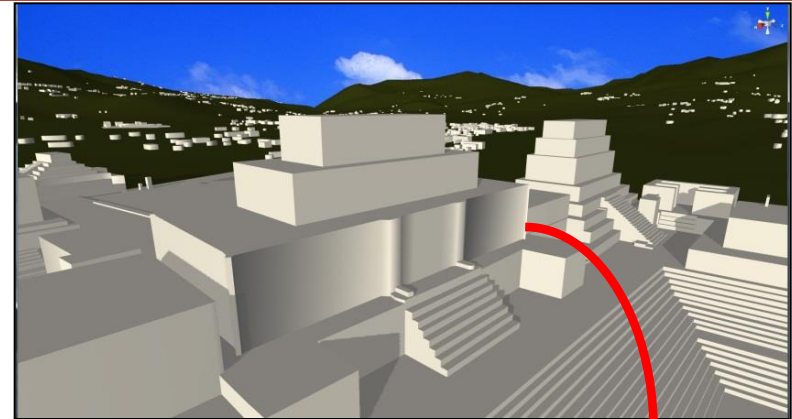
- ER Model for „Building“ (excerpt)

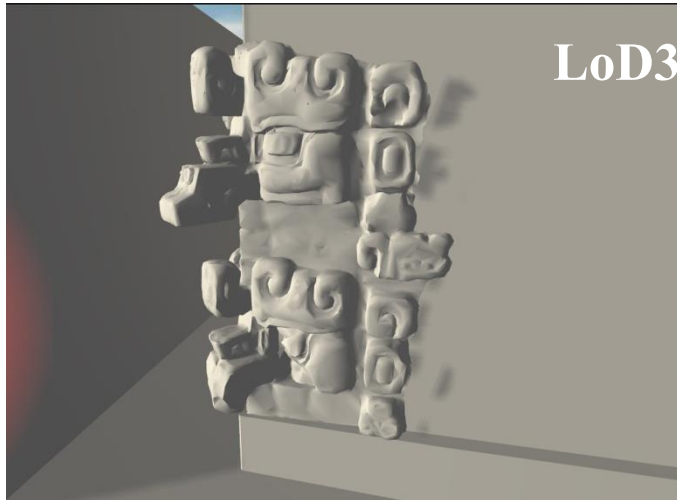


- ER Model for „Structure“ (excerpt)



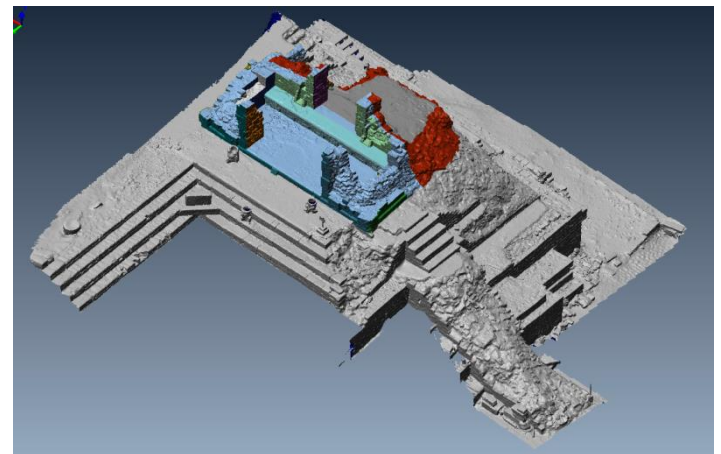
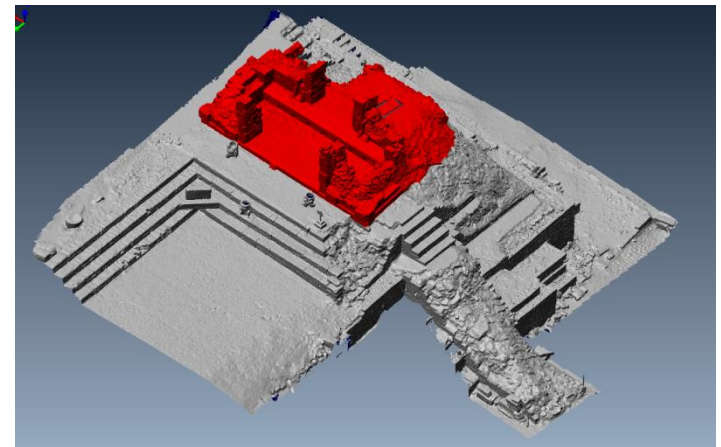
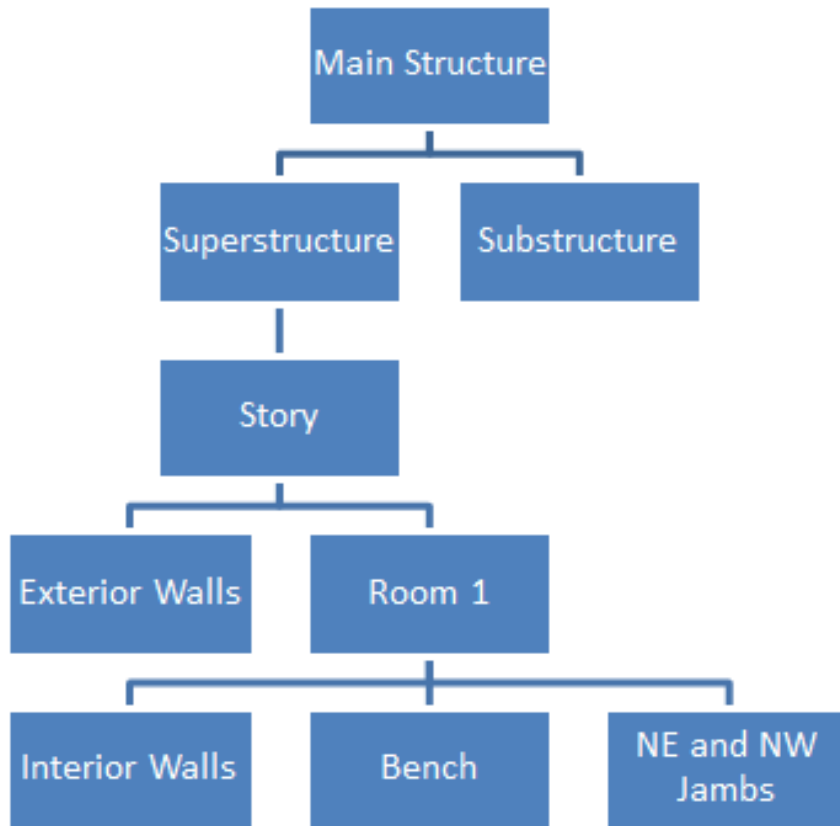
- 5 Levels of Detail
 - **LoD0**: 2D (multi)polygons, as in “classical” GIS
 - **LoD1**: Single (or set of) prismatic geometries
 - **LoD2**: 3D models (only exteriors)
 - **LoD3**: 3D models (with interiors)
 - Some elements can be (simplified) reality-based models
 - **LoD4**: 3D high-resolution models or architectonic details (reality-based)







- Adding semantics (as shown in previous ppt)
(example of a temple segmentation tree)



- All geometries aligned and geo-referenced
- All data imported and stored in PostgreSQL 9.2/PostGIS 2.0
- Geometries linked to attributes in FileMaker Pro by means of external IDs
- PHP-based webGUI for data management



Structure

localhost:8080/projects/copan/index.php

PAGE LIST

- Structure
- Representation
- Geometry
- Classes
- Reference System

Structure

Export

1 Define page size

Refresh

Quick search

Children	Id	Root Id	Parent Id	Class Id	Grp	Str Name	Description	Idafield Id	Notes
abc	3052	abc	=	=	abc	abc	abc	abc	abc
✓	3052	10L-18	NULL	NULL	10L-1	10L-18	10L-18 - Grp. 10L-1	2526	NULL

Children by Structure Representation by Structure

Shown first 2 of 2 records (full view)

Has Children	Id	Parent Id	Class Id	Str Name	Description	Idafield Id	Notes
✓	4263	10L-18	Temple Substructure	10L-18 - Substructure	NULL	16809	NULL
✓	4262	10L-18	Temple Superstructure	10L-18 - Superstructure	NULL	16730	NULL

Children by Structure

Shown first 1 of 1 records (full view)

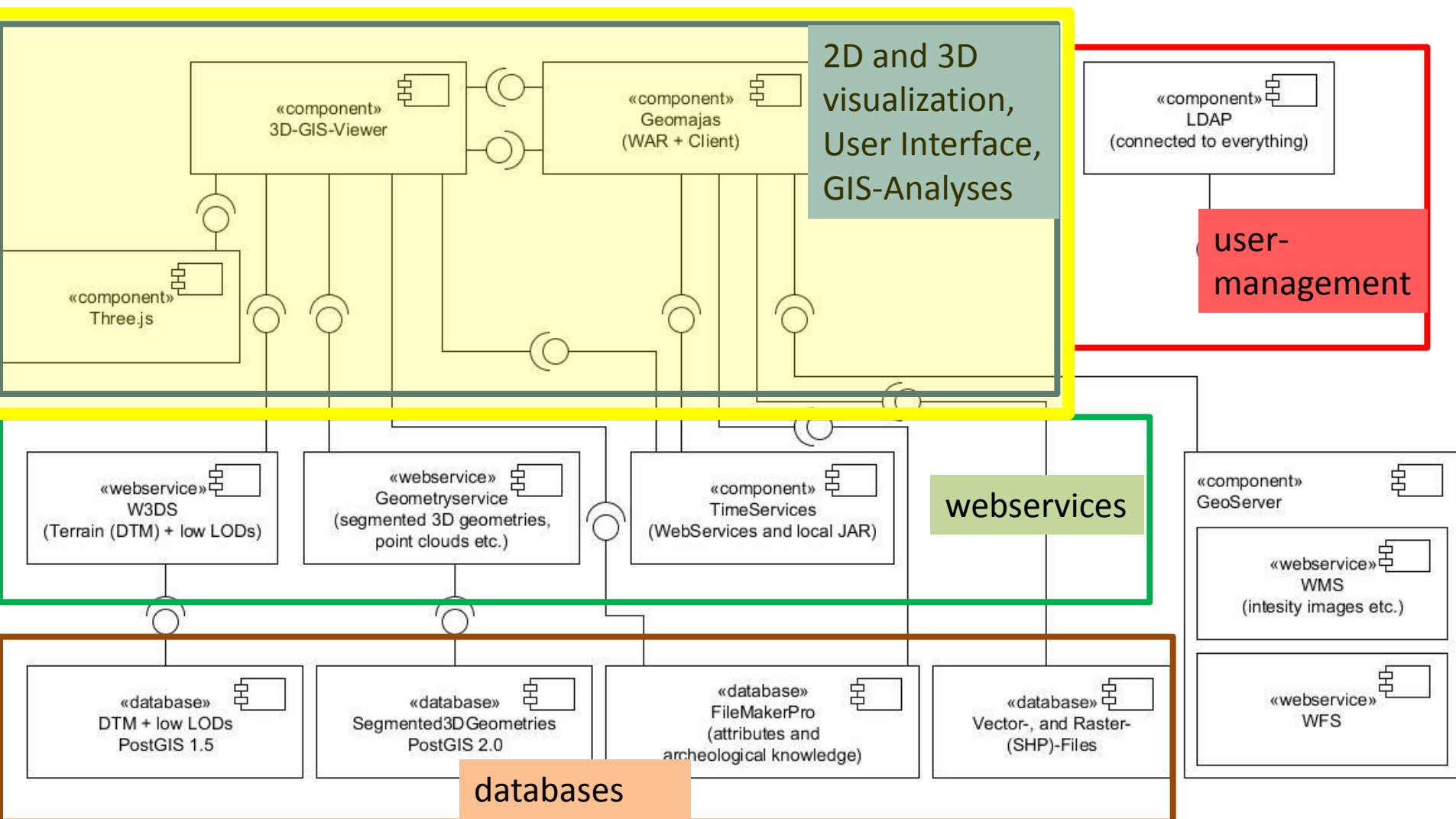
Has Children	Id	Parent Id	Class Id	Str Name	Idafield Id	Description	Notes
✓	4265	10L-18 - Superstructure	Temple super. Storey	10L-18 - Sup. Storey 1	NULL	NULL	NULL

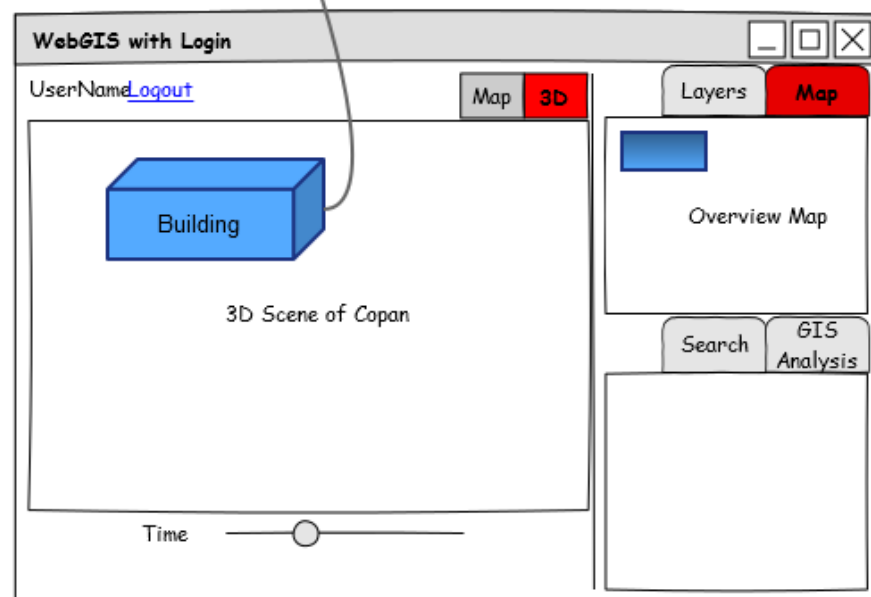
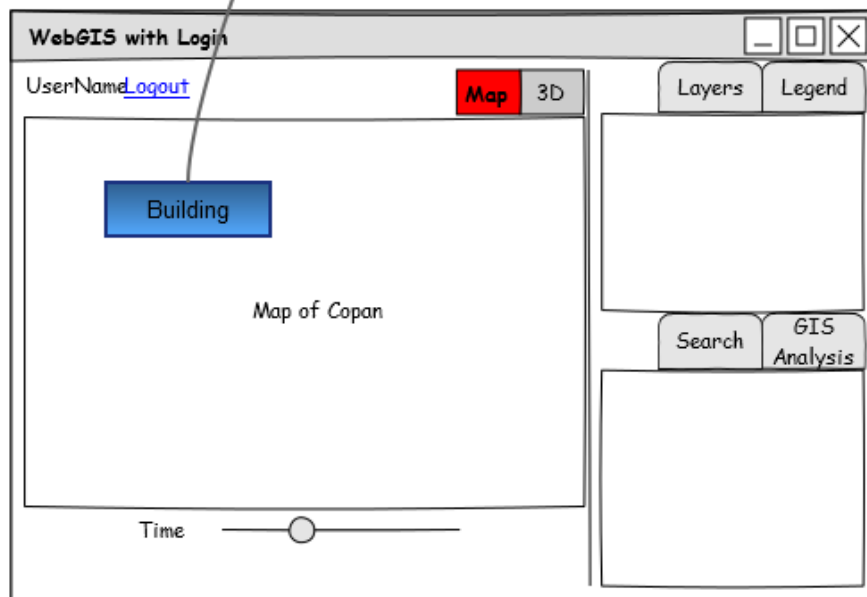
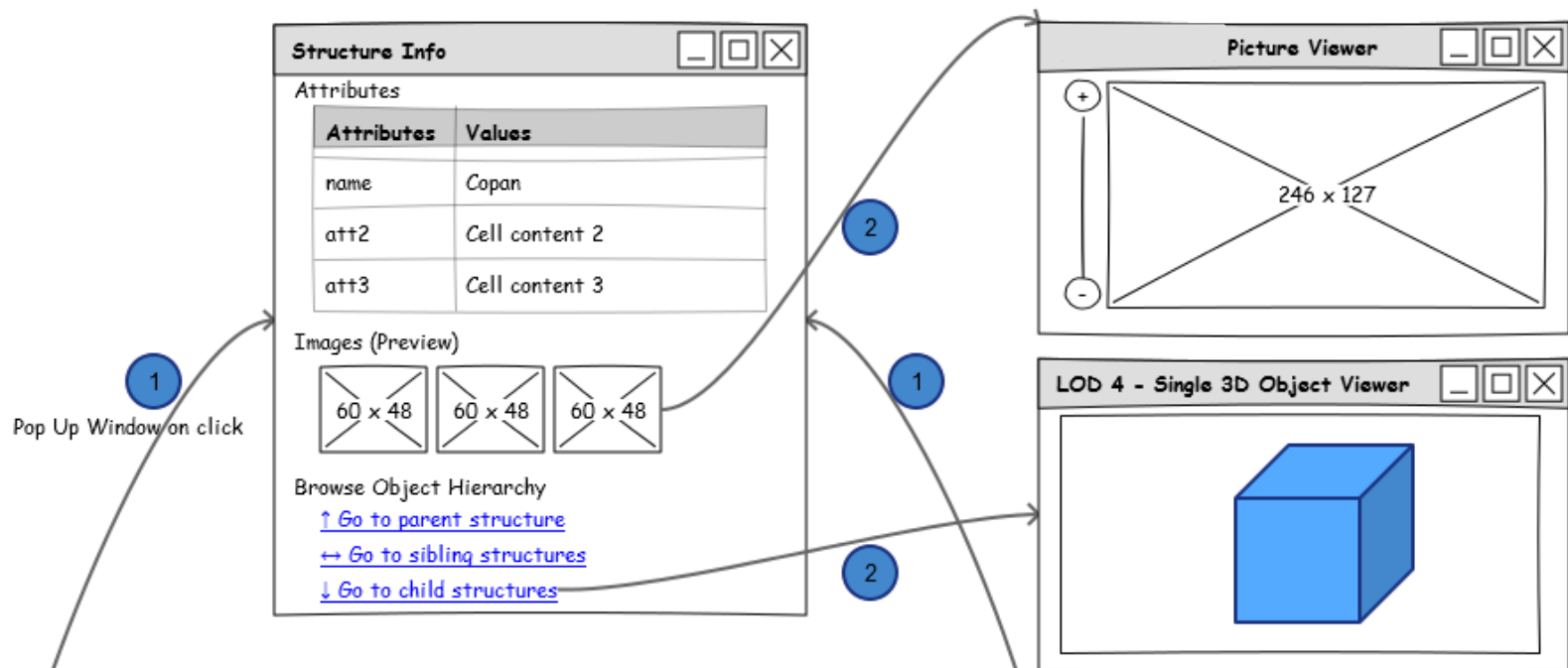
Children by Structure

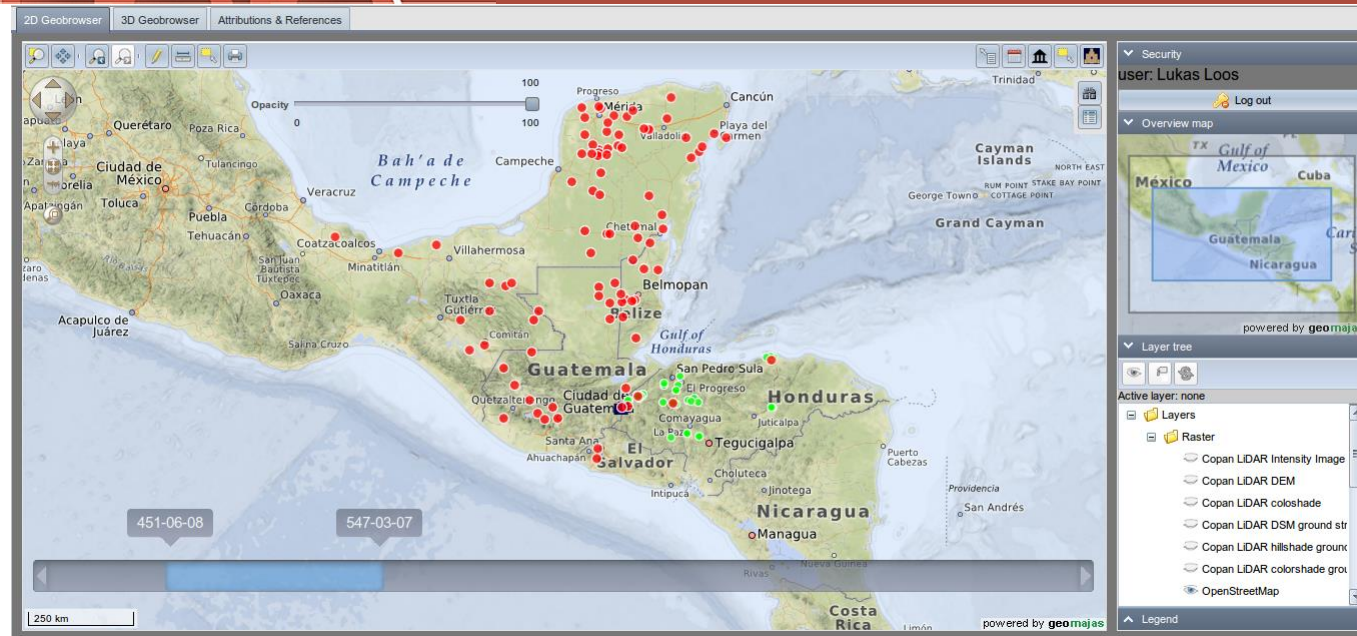
Shown first 5 of 5 records (full view)

Has Children	Id	Parent Id	Class Id	Str Name	Idafield Id	Description	Notes
	4267	10L-18 - Sup. Storey 1	Temple super. Storey Outer Wall	10L-18 - Sup. Outer Wall East	15244	NULL	NULL
	4268	10L-18 - Sup. Storey 1	Temple super. Storey Outer Wall	10L-18 - Sup. Outer Wall West	14153	NULL	NULL
	4266	10L-18 - Sup. Storey 1	Temple super. Storey Outer Wall	10L-18 - Sup. Outer Wall North	15245	NULL	NULL
✓	4270	10L-18 - Sup. Storey 1	Temple super. Storey Room	10L-18 - Sup. Room 2	7585	NULL	NULL
✓	4269	10L-18 - Sup. Storey 1	Temple super. Storey Room	10L-18 - Sup. Room 1	7573	NULL	NULL

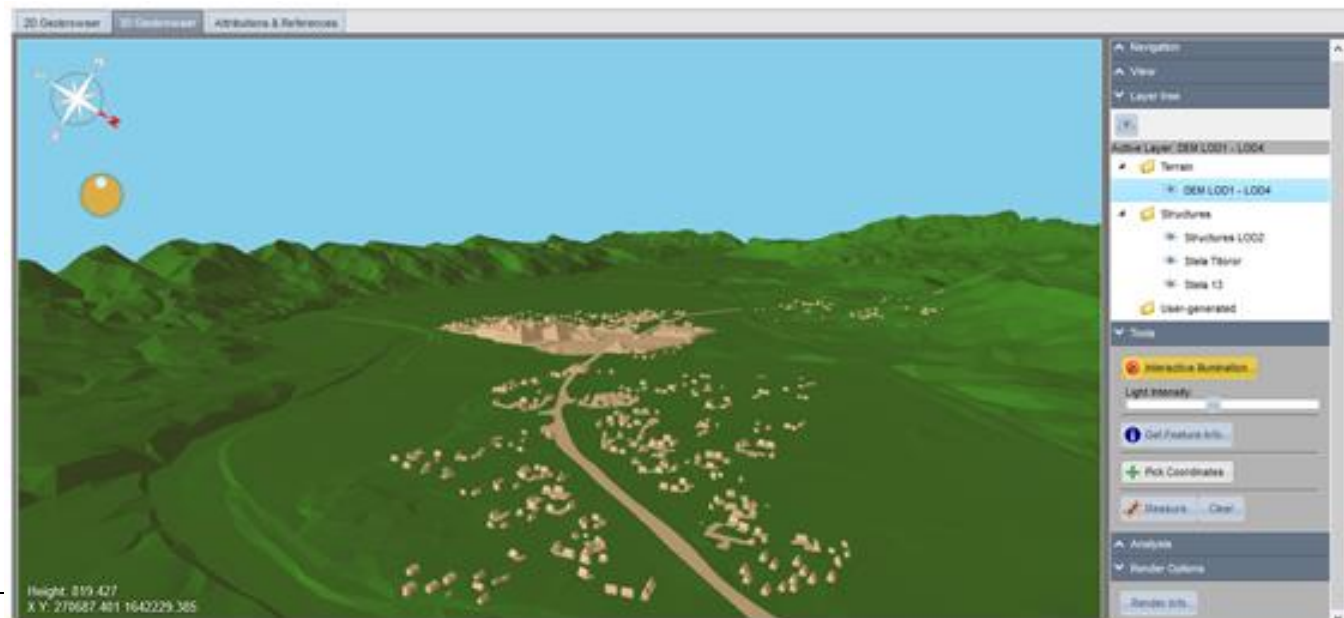
- **Conclusions**
- 3D database allows for storage of 3D models, and linkage to attributes database
- Possibility to store multi-resolution models and multiple representations of the same object in the same database, and to organise them into different LoDs
- Possibility to extend the 3D database once (if) FileMaker Pro is dropped
- Semantics tailored to Maya, but conceptual model is „recyclable“ in other contexts







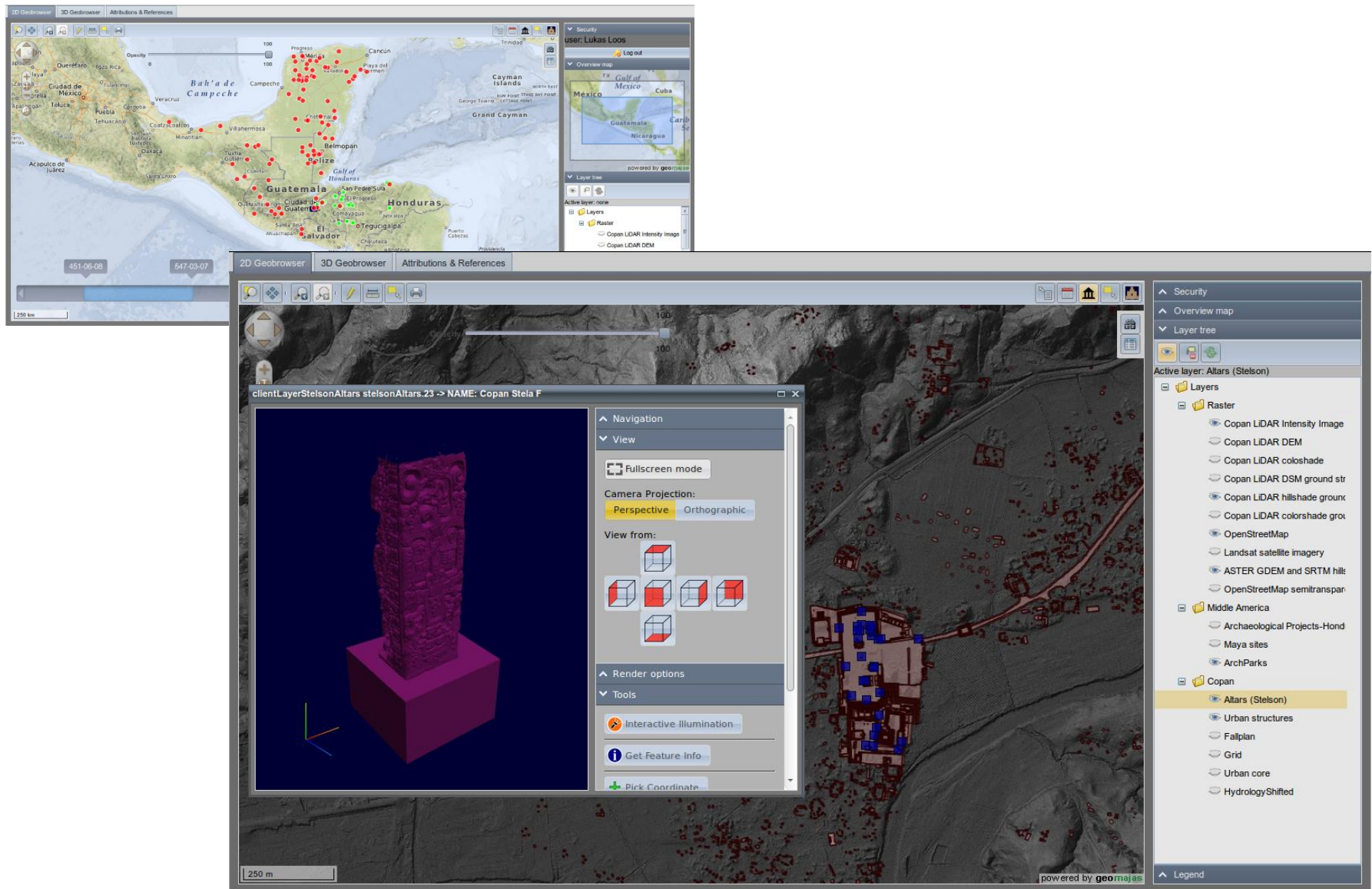
2D - component

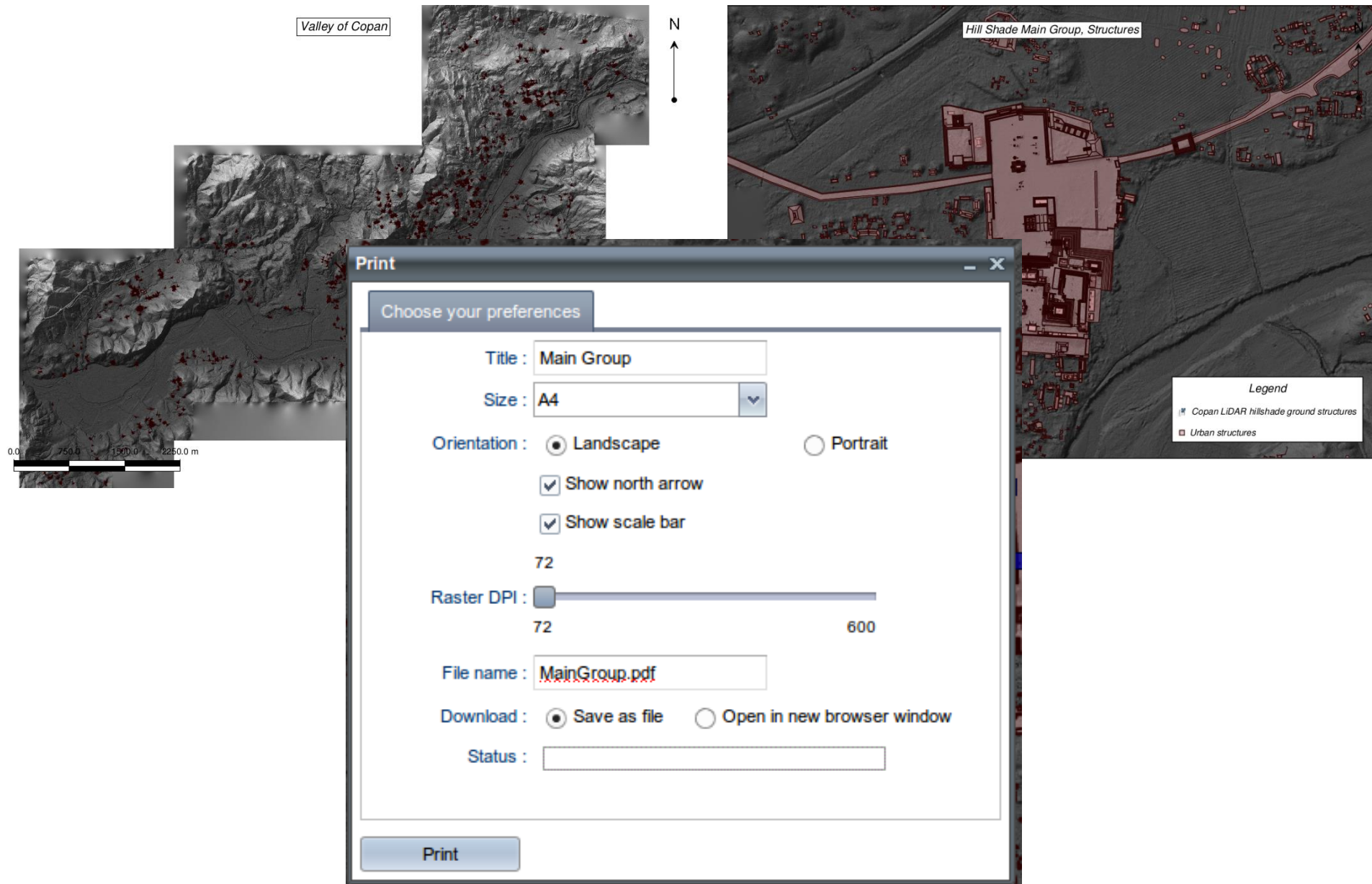


3D - component



<http://www.geomajas.org/>





The screenshot displays the MayaArch3D geo-browser interface. The main map shows Central America and the Caribbean, with labels for Mexico, Cuba, Cayman Islands, and Grand Cayman. A pop-up window titled 'fm_id: 2338' is open, showing a table of attributes for a specific feature. The table has two columns: 'Attribute Name' and 'Attribute Value'. The attributes listed are: EndEpoche (value: --), Ort_LandProvinz (value: Hond - Copán), Kulturkreis (value: Maya), AnfEpoche (value: --), KurzbeschreibungTopos (value: Río Amarillo), and PS_ToposID (value: 2338). The interface also includes a toolbar at the top, a layer tree on the right, and a legend at the bottom right.

2D Geobrowser 3D Geobrowser Attributions & References

Victoria 100 0 100 Opacity

Mexico

San Luis Potosí Ciudad Valles Tampico Querétaro Poza Rica Tulancingo Puebla Córdoba Veracruz Tehuacán Coatzacoalcos Minatitlán Oaxaca Salina Cruz Salina Cruz

Bahía de Campeche

La Habana Matanzas Sagua la Grande Cienfuegos Santa Clara Ciego de Avila Camagüey Trinidad Nueva Gerona Pinar del Río

Cuba

Cayman Islands

George Town NORTH EAST POINT STAKE BAY POINT COTTAGE POINT

Grand Cayman

Mont Bay Spani Tov Jamai

Colón

powered by geomajas

Security

Overview map

Layer tree

Active layer: ArchParks

Layers

Raster

- Copan LIDAR Intensity Image
- Copan LIDAR DEM
- Copan LIDAR coloshade
- Copan LIDAR DSM ground str
- Copan LIDAR hillshade grounc
- Copan LIDAR colorshade groi
- OpenStreetMap
- Landsat satellite imagery
- ASTER GDEM and SRTM hills
- OpenStreetMap semitranspar

Middle America

- Archaeological Projects-Hond
- Maya sites
- ArchParks

Copan

- Altars (Stelson)
- Urban structures
- Fallplan
- Grid
- Urban core
- Hydrology Shifted

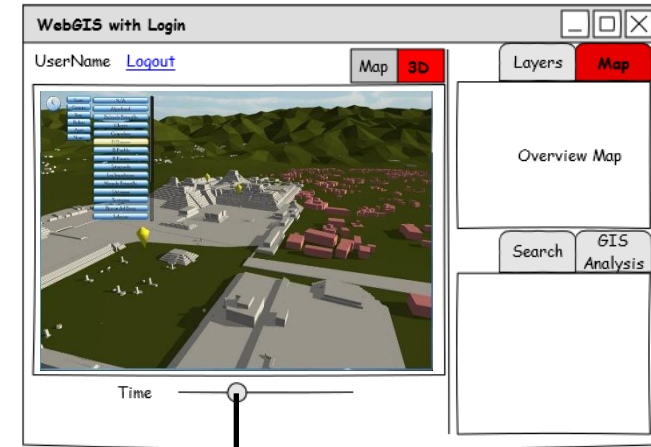
Legend

Show all attributes	
Attribute Name	Attribute Value
EndEpoche	--
Ort_LandProvinz	Hond - Copán
Kulturkreis	Maya
AnfEpoche	--
KurzbeschreibungTopos	Río Amarillo
PS_ToposID	2338

2D Geobrowser 3D Geobrowser Attributions & References

The screenshot displays the MayaArch3D geo-browser interface. The main map shows Central America, with a focus on the Yucatan Peninsula and the Gulf of Mexico. A data window titled 'fm_id: 2338' is open, displaying a table of attributes for a specific feature. The table has two columns: 'Attribute Name' and 'Attribute Value'. The 'Attribute Name' column lists various metadata fields, and the 'Attribute Value' column shows the corresponding values. The 'KlassifizierungGeneral_Topos' attribute is set to 'Settlement'. The 'DS_Bearbeitungsdatum' attribute is set to '2013-08-28'. The 'Lage' attribute is set to 'Está situado a 16 km de Copán.' The 'AnfEpoche' attribute is set to '--'. The 'AnfDatvn' attribute is set to '--'. The 'Antike_Quellen' attribute is set to '--'. The 'FS_LampenID' attribute is set to '--'. The 'Ueberschrift' attribute is set to '--'. The 'Geschichte_Forschung_neu' attribute is set to '--'. The 'FS_PutzID' attribute is set to '--'. The 'DS_Eigentuermer' attribute is set to '--'. The 'Arbeitsnotiz' attribute is set to '--'. The 'Grundlage' attribute is set to '--'. The 'Antike_Landschaft' attribute is set to '--'. The 'FS_ToposID' attribute is set to '--'. The 'Kulturkreis_Zuweisung' attribute is set to '--'. The '[Datierung]' attribute is set to '--'. The 'Kampagne' attribute is set to '--'. The 'FS_GlasID' attribute is set to '--'. The '[Datierung_fuer]' attribute is set to '--'. The 'KommentarDat' attribute is set to '--'. The 'Layers' panel on the right shows the active layer 'ArchParks' and other layers like 'Copan LiDAR Intensity Image', 'Copan LiDAR DEM', 'Copan LiDAR coloshade', 'Copan LiDAR DSM ground str', 'Copan LiDAR hillshade grounc', 'Copan LiDAR colorshade gro', 'OpenStreetMap', 'Landsat satellite imagery', 'ASTER GDEM and SRTM hills', 'OpenStreetMap semitranspan', 'Archaeological Projects-Hond', 'Maya sites', 'Copan', 'Altars (Stelson)', 'Urban structures', 'Fallplan', 'Grid', 'Urban core', and 'HydrologyShifted'. The 'Legend' panel is also visible at the bottom right.

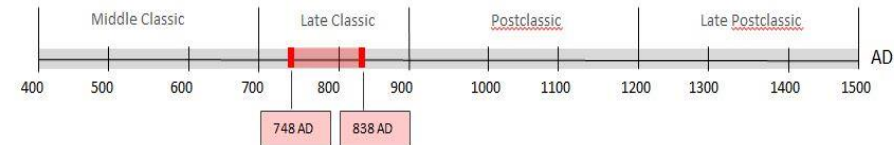
Attribute Name	Attribute Value
AnfDatvn	--
Antike_Quellen	--
FS_LampenID	--
Ueberschrift	--
Lage	Está situado a 16 km de Copán.
[Ueberschrift]	--
FS_PutzID	--
Geschichte_Forschung_neu	--
FS_ReliefszenelD	--
DS_Bearbeitungsdatum	2013-08-28
AnfEpoche	--
Grundlage	--
DS_Eigentuermer	--
Arbeitsnotiz	--
KlassifizierungGeneral_Topos	Settlement
EndApogee	--
Antike_Landschaft	--
FS_ToposID	--
Kulturkreis_Zuweisung	--
[Datierung]	--
Kampagne	--
FS_GlasID	--
[Datierung_fuer]	--
KommentarDat	--



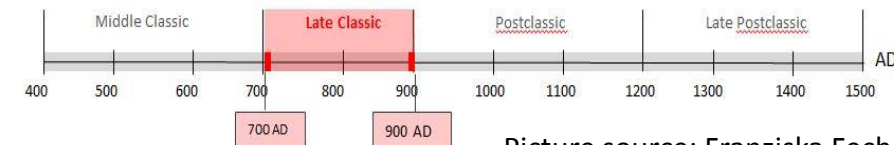
A



B



C



Picture source: Franziska Fecher

Time Service

Gregorian Date (astronomical year numbering):

[-31-09-01T13:50:59-00:00,
Source-Calendar-Code,
Target-Calendar-Code]

Start Date
YYYY.MM.DD XXXXXX
Gregorian Date Long Count

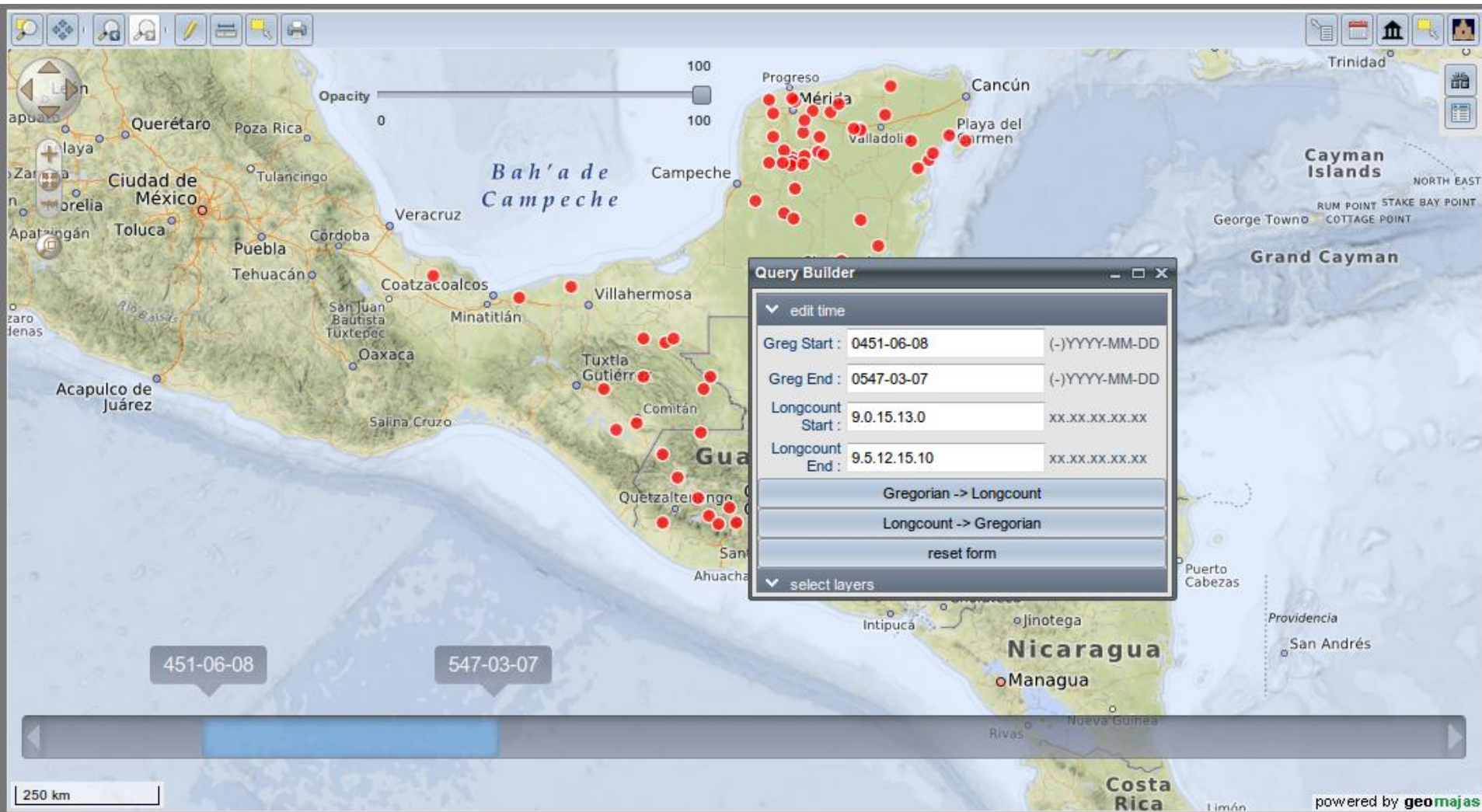
End Date
YYYY.MM.DD XXXXXX
Gregorian Date Long Count

Gregorian Date:
31-09-01 BC

Maya Date (Long Count):
7.16.6.16.18

Maya Date (Long Count):
[7.16.6.16.18]
Source-Calendar-Code,
Target-Calendar-Code]

Time service implementation: **Nicolas Billen**



Time slider: JQRangeSlider (<https://ghusse.github.io/jQRangeSlider>)

The screenshot displays the MayaArch3D geo-browser interface. The main map shows Central America, with Guatemala, Honduras, El Salvador, and Nicaragua visible. A table of attributes is overlaid on the map, showing data for three locations. The table has columns for various attributes, including dates and descriptions. A time slider at the bottom of the map allows for navigating through time, with markers for 450-06-01 and 561-06-09. The interface also includes a sidebar with a layer tree and a legend.

Attributes:

AnfDatvn	Antike_Qu	Ueberschr	FS_Lampe	Lage	FS_PutzID	[Ueberschr	Geschichte	FS_Reliefs	DS_Bearbe	[Ueberschr	AnfEpoche	Grundlage	DS_Ei
BC	3								2013-03-20	Dating	Middle Prec		
BC	3			El lugar est					2013-08-22	Dating	Early Prec	C14 dating	
BC	3			El sitio de Y					2013-12-12	Dating	Middle Prec		

450-06-01 561-06-09

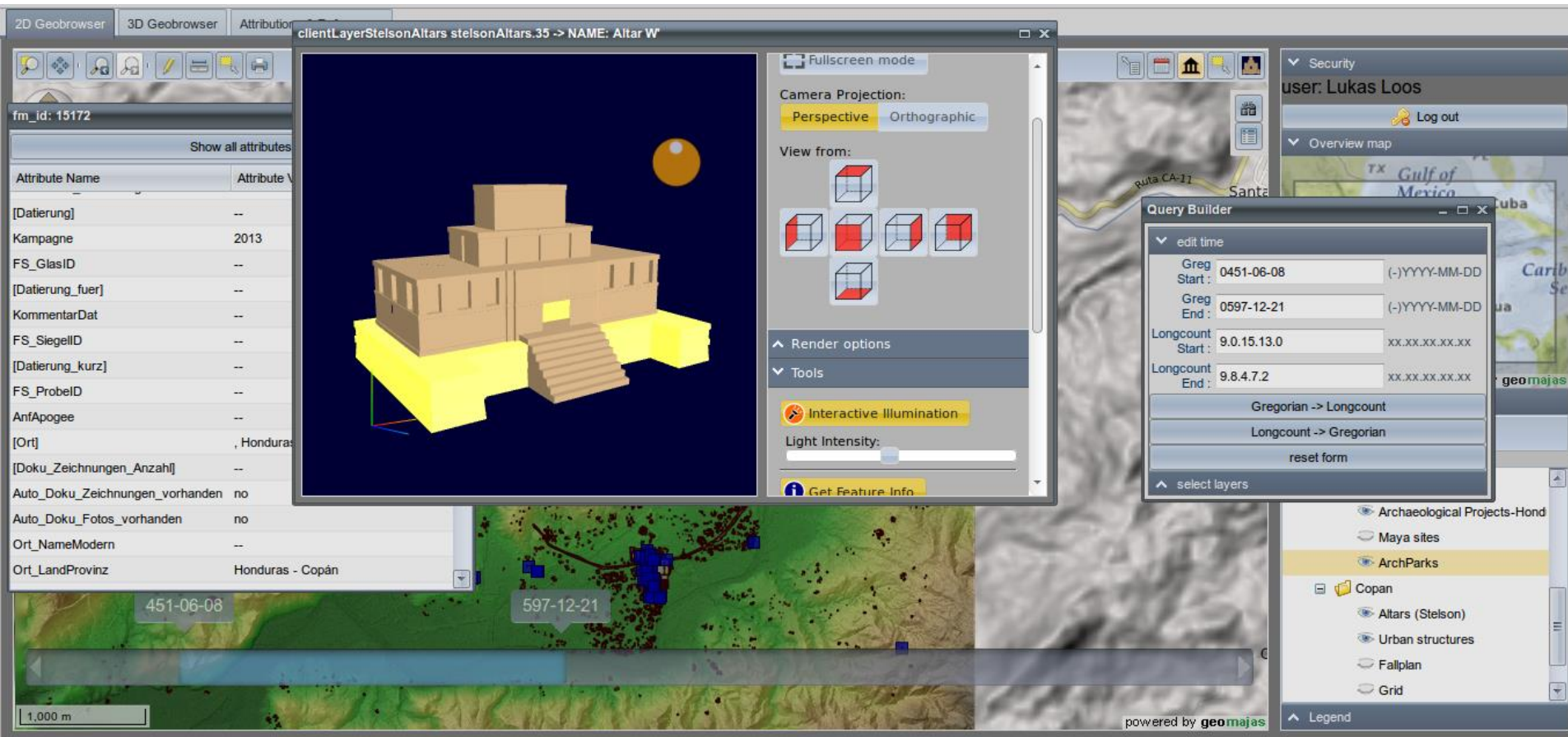
100 km

powered by geomajas

Security
user: Lukas Loos
Log out

Overview map
TX Gulf of Mexico
México Cuba
Guatemala Nicaragua
Carib Sea
powered by geomajas

Layer tree
Active layer: none
Layers
Raster
Legend
OpenStreetMap
ASTER GDEM and SRTM hillshade
Acheological Projects
Altars (Stelson)
Archaeological Parks



Thank you for your attention!

Contacts



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