



UNIVERSITÉ **LUMIÈRE** LYON 2
UNIVERSITÉ DE LYON

Managing temporal change of cities

Laboratoire d'InfoRmatique en Image et Systèmes d'information

LIRIS UMR 5205 CNRS/INSA de Lyon/Université Claude Bernard Lyon 1/Université Lumière Lyon 2/Ecole Centrale de Lyon

<http://liris.cnrs.fr>

Maxime Morel, Gilles Gesquière

Gilles.Gesquiere@liris.cnrs.fr

Introduction- need of temporal information

- Archeological data

- Each object may have two temporal informations:
 - When the object has been founded
 - When the object has been created
- Important to record these changes during time



Archeorient- LIRIS

- Video- games

- Instances may have to change during the game
 - E.g: Building (destroyed, burned, ...)



SimFor Project

- Urban management

- Creation, modification, destruction of instances

- Physical simulation models

- Taking into account the temporal aspect

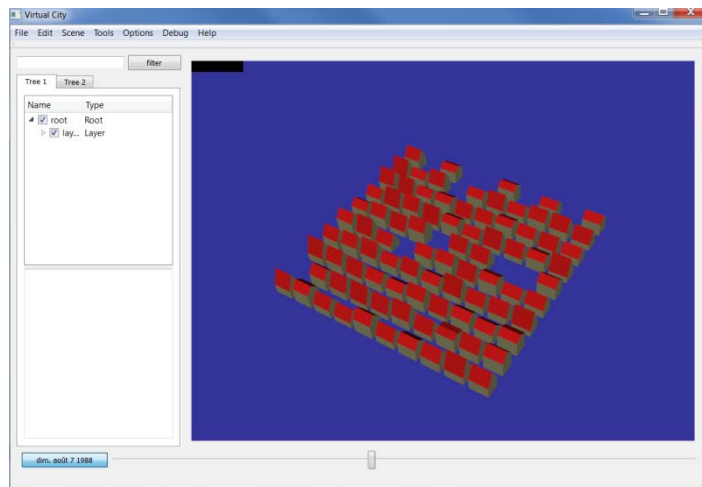
- Geometry and semantic must evolve during time



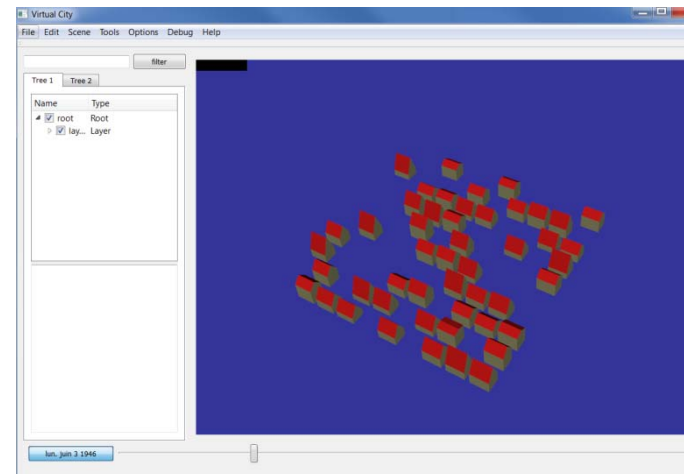
SDIS 13

Introduction- Temporality and CityGML

- Informations are available in cityGML
 - year of construction : The construction is started
 - year of destruction : The building has disappeared
 - Using creationdate/ terminationdate in core::AbstractcityObject



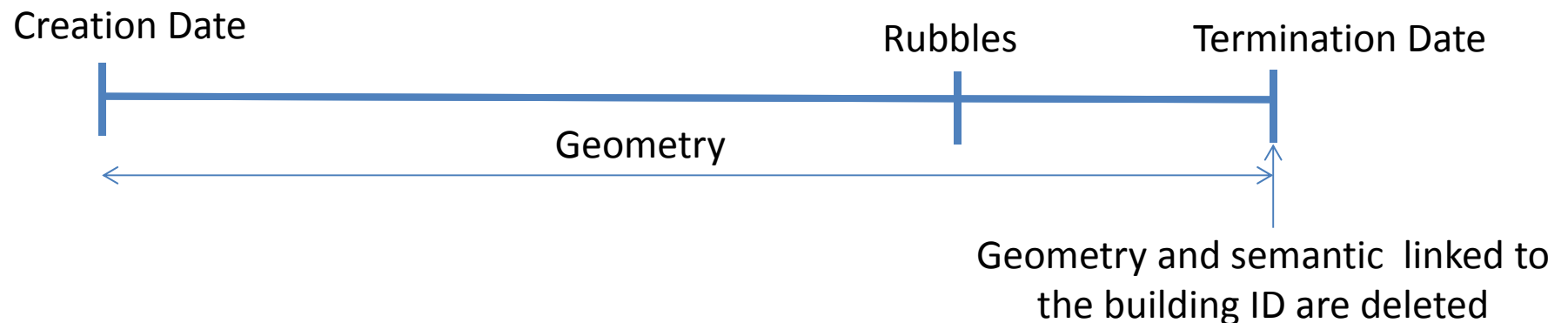
7/08/1988



03/06/1946

Time management (1)

- We propose to add new information in cityGML to take into account temporal part
- We propose to add Tags
 - Temporal step (at a given date)
 - An interval is given by two consecutive Tags
 - A Tag has always a reference to a geometry
 - If there is no reference, the building is considered as deleted



Time management (2)

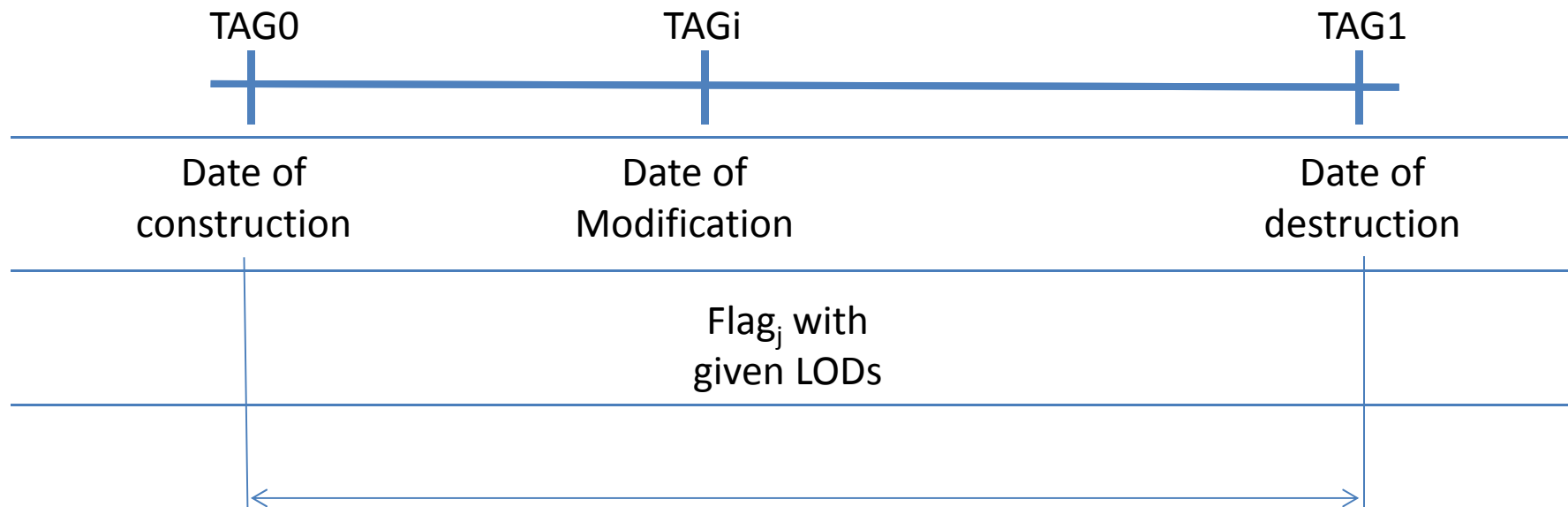
- If there is no Tag
 - Year of construction / destruction or creationDate / terminationDate
 - If there is no date, the building is visible at any time

Time management (3)

- Flags (state)
 - Flag = Description of a behavior
 - Defined for a given tag
 - A Flag is composed of semantic and/or geometry information
 - Examples
 - The building has been
 - Partially constructed
 - Modified
 - Partially destroyed
 - Totally destroyed
 - ...

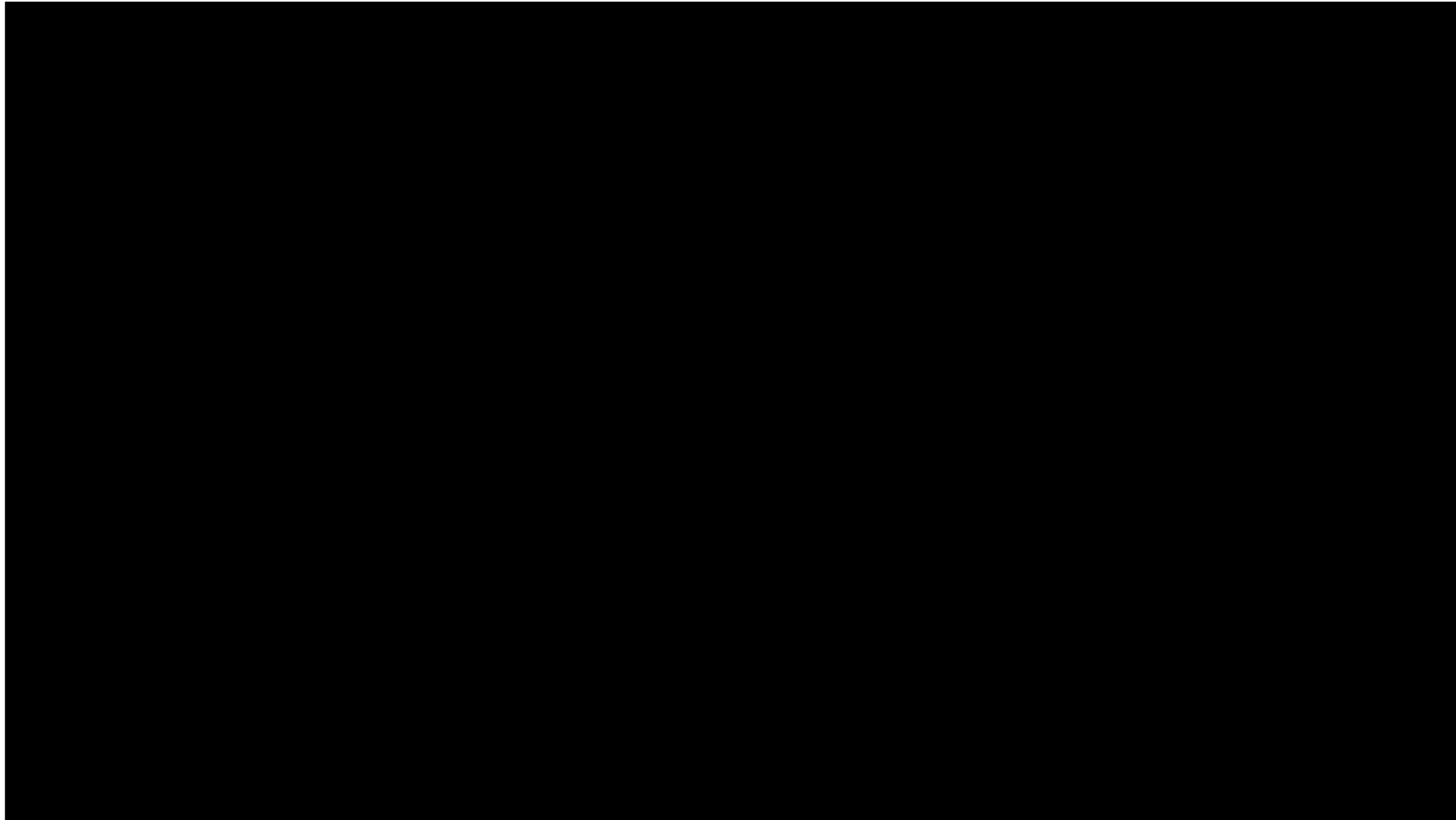
Time management (4)

Example for a given building

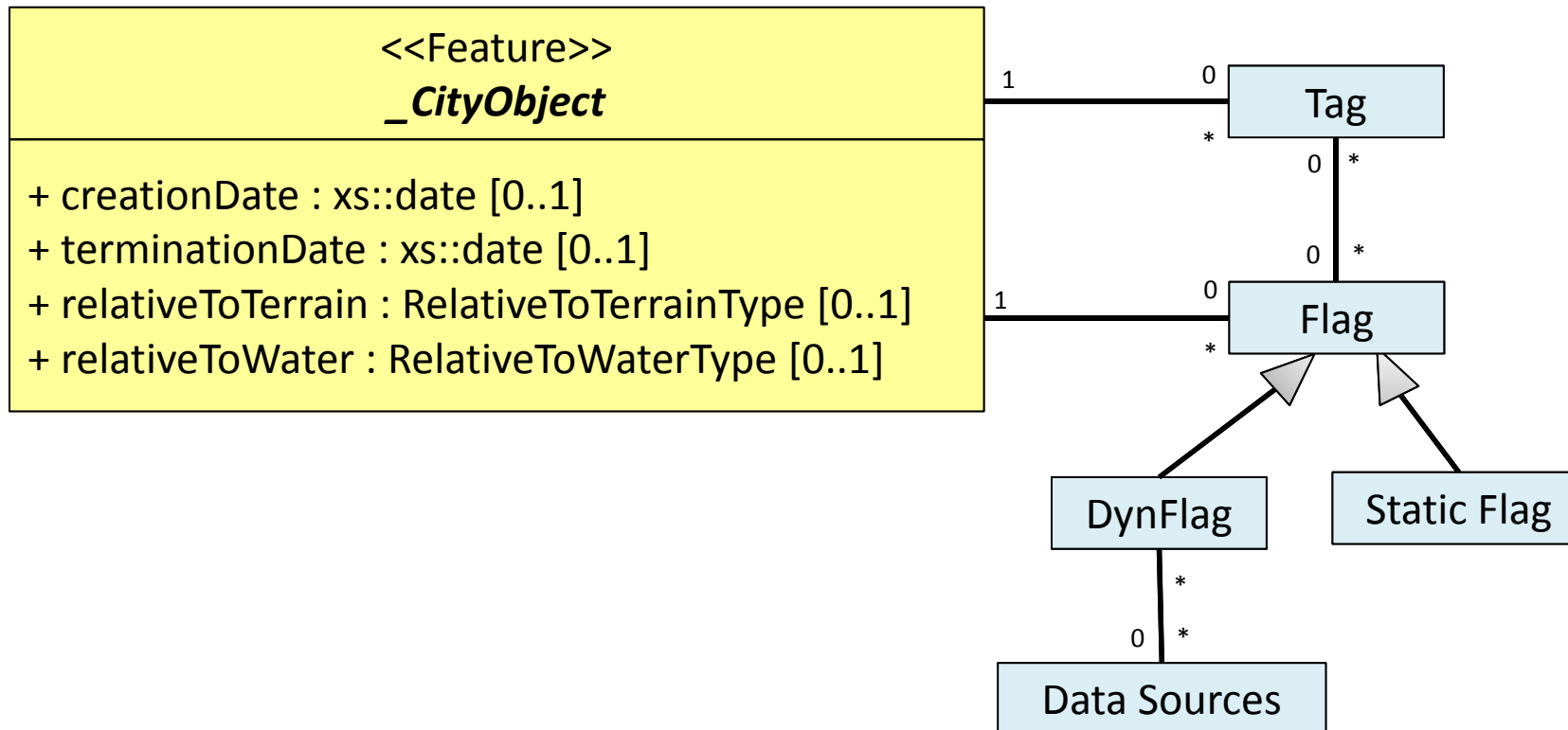


- It is only possible to create Flags on this building between these two dates
- Flags are timeless (we can use them several time between these two dates)

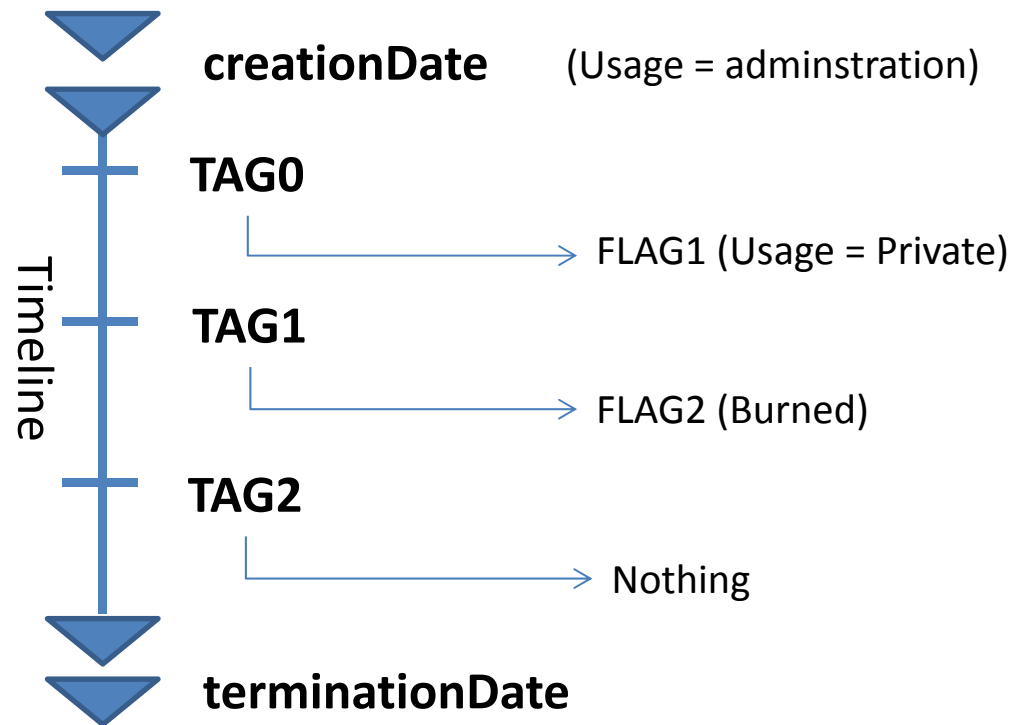
Demonstration TAG-FLAGS



TAG/ FLAG: CityGML modification



Example : Time Management



// Original object : building

```
<bldg:Building gml:id="building1">  
  ... // geometry, texture, attributes  
</bldg:Building>
```

// Adding a flag Flag0

```
<bldg:Building gml:id="building1_FLAG0">  
  ...  
  <gen:stringAttribute name="usage">  
    <gen:value>house</gen:value>  
  </gen:stringAttribute>  
  ...  
</bldg:Building>
```

// Adding Tag0

```
<bldg:Building gml:id="building1_TAG0">  
  ...  
  <gen:stringAttribute name="date">  
    <gen:value>2012-01-25</gen:value>  
  </gen:stringAttribute>  
  ...  
</bldg:Building>
```

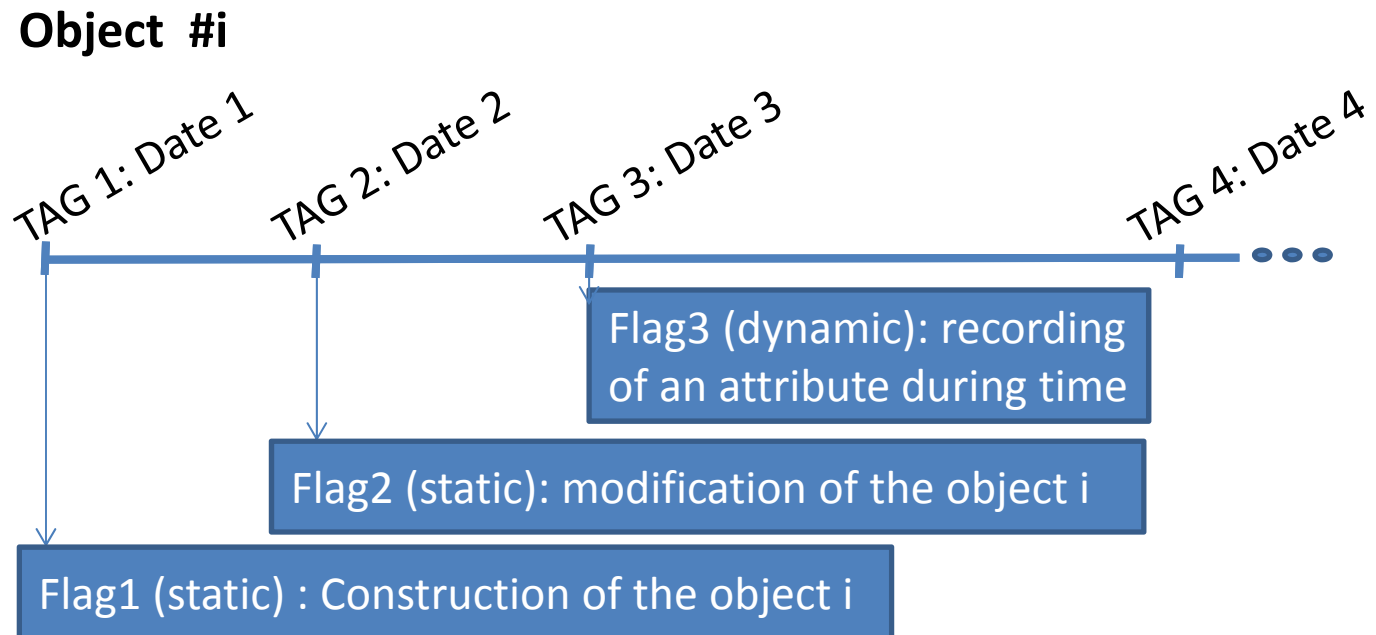
// Linking the flag FLAG0 with the tag TAG0

```
<bldg:Building  
  gml:id="building1_TAG0">  
  ...  
  <gen:stringAttribute name="date">  
    <gen:value>2012-01-25</gen:value>  
  </gen:stringAttribute>  
  <gen:stringAttribute name="flag">  
    <gen:value>building1_FLAG0</gen:value>  
  >  
</gen:stringAttribute>  
  ...  
</bldg:Building>
```

// Tag1, ending tag (no flag associated)

```
<bldg:Building  
  gml:id="building1_TAG1">  
  ...  
  <gen:stringAttribute name="date">  
    <gen:value>2014-01-25</gen:value>  
  </gen:stringAttribute>
```

Flag extension



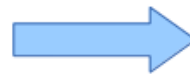
Flag extension

- A Flag can be seen as a container
 - Geometry change
 - Attribute modification
- In the dynamic case, a flag is containing a file or a link to a stream of data

Example with DynFlag

- Show the evolution of temperature
- Texture temporalisation
- All states are stored in one flag : a dynamic flag
- Example of date file for « texture » attribute

```
2001/02/10-01:01:01  
/home/maxime/0-21-1.TIF  
2002/02/10-01:01:01  
/home/maxime/0-21-2.TIF  
2003/02/10-01:01:01  
/home/maxime/0-21-3.TIF  
2004/02/10-01:01:01  
/home/maxime/0-21-4.TIF
```

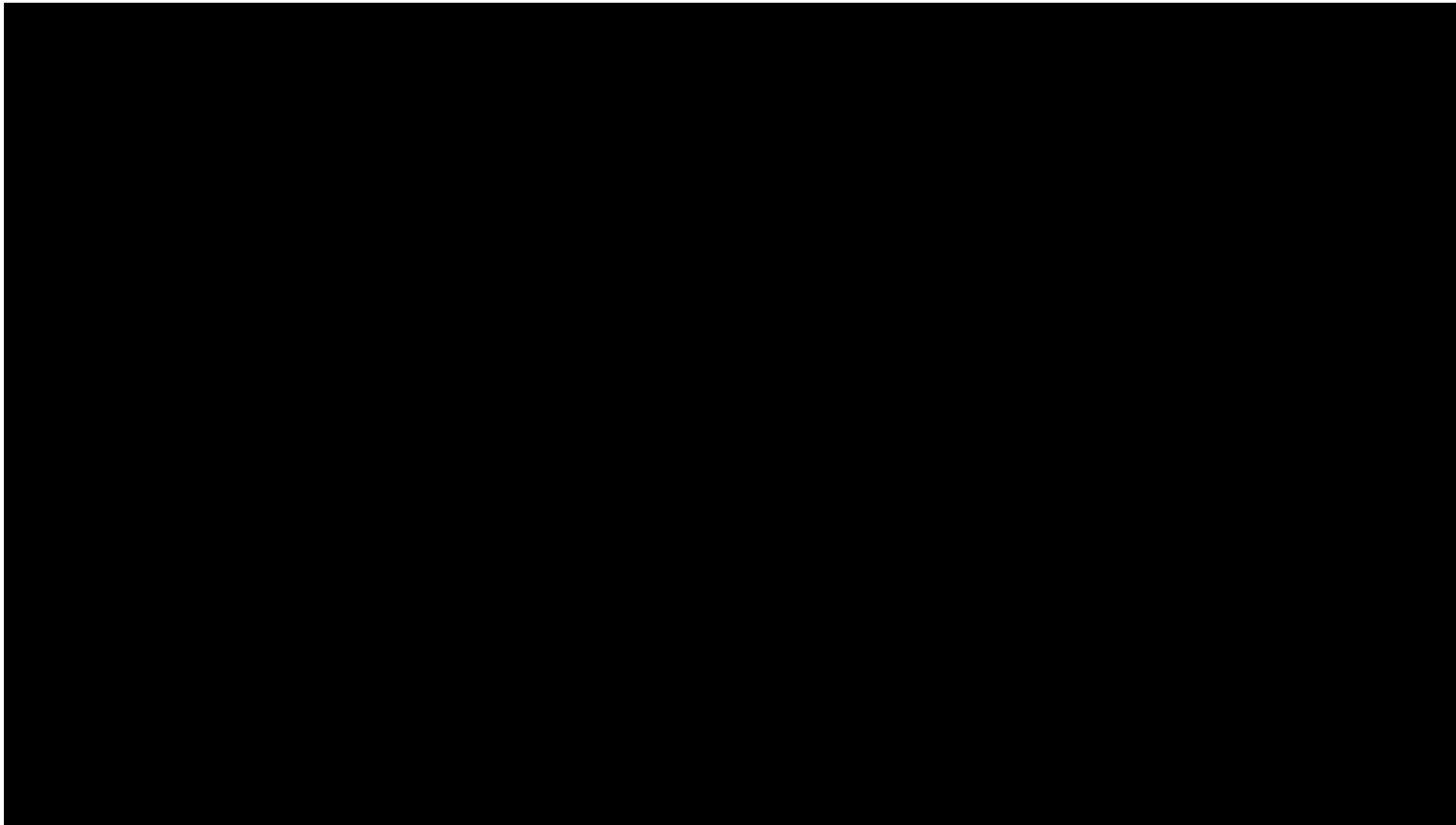


Format :

```
date1  
value1  
date2  
value2  
...
```

Example with DynFlag

Show evolution of temperature



Conclusion

- We have proposed to add temporal information in cityGML
 - Based on Tag (date), and flag (state)
 - Flag can also contain dynamic information
- We have proposed an implementation in the Vcity project

Future works

- Make an automatic process in order to propose values for tags and flags.
 - Need to detect changes between two versions of a same area provided by two different acquisitions
- An other goal is to study the possibility to add uncertainty in the temporal management
 - Important for instance in archeology
 - Visualize of these spatial and temporal data aspect in order to provide real assistance in decision-making processes

Additional information

- More informations in
 - « Managing temporal change of cities with CityGML », Eurographics Workshop on Urban Data Modeling and Visualization (April 2014)
- New positions on this project (don't hesitate to contact me)
 - 1 year postdoctoral position (january 2015)- Alaric project
 - 1 phd position (september 2014, during 3 years)- Vcity Project
- Acknowledgements
 - Paris dataset created with BATI-3D is provided by IGN, France
 - Lyon data are provided by «Grand Lyon »
 - This project is funded by
 - « BQI » Université de Lyon 1
 - *LABEX IMU (ANR-10-LABX-0088) « Investissements d'Avenir » Program*



Intelligences
des Mondes Urbains

