Sneak preview of the Scenario ADE v. 0.2

Giorgio Agugiaro

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Smart and Resilient Cities Unit
Center for Energy
AIT - Austrian Institute of Technology
Vienna, Austria
Outlook

- Bridging 3D city modelling & simulation domains (reprise)
  - Refer to previous presentation of Edmund Widl on the "Simulation Package"

- The Scenario ADE
  - Definition and properties
  - UML Diagram
  - 3DCityDB

- Conclusions
Real city

"Digital twin"

City model

Image source: https://cdn.austria.info/media/17083/thumbnails/stadtansicht-wien--oesterreich-werbung-julius-silver--d.jpg.3146497.jpg
Simulation tool A

Physical process A

simulated by

Simulation tool B

Physical process B

simulated by

Results set A

Conditions set A (assumptions, constraints, etc.)

City model A

Results set B

Conditions set B (assumptions, constraints, etc.)

City model B

Extraction of city model entities (and their characteristics)
Simulation tool A | Physical process A | Results set A | Conditions set A (assumptions, constraints, etc.) | City model A
---|---|---|---|---
Simulation tool B | Physical process B | Results set B | Conditions set B (assumptions, constraints, etc.) | City model B
Simulation tool C1 | Physical process C | Results set C1 | Conditions set C1 (assumptions, constraints, etc.) | City model C
Simulation tool C2 | City model C

Extraction of city model entities (and their characteristics)
Simulation tool A

Physical process A

Results set A

Conditions set A (assumptions, constraints, etc.)

City model A

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Simulation tool B

Physical process B

Results set B

Conditions set B (assumptions, constraints, etc.)

City model B

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Simulation tool C1

Physical process C

Results set C1

Conditions set C1 (assumptions, constraints, etc.)

City model C

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Simulation tool C2

Physical process C

Results set C2

Conditions set C2 (assumptions, constraints, etc.)

City model C

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Extraction of city model entities (and their characteristics)

Import of simulation results
**PROBLEM:**

Which set of results is "better"?

Storing "just" the results may not be enough!
Deriving new city models

- A city is a "living" system which continuously changes over time
- A virtual city model is a snapshot at a certain moment

These progressive time-dependent changes can be taken care of by means of versioning
Deriving new city models

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- A virtual city model is a snapshot at a certain moment.
- But, as a digital twin, it can be also manipulated at will! 😊
Scenario ADE: Rationale

- A city is a "living" system which continuously changes over time.
- A city model is a snapshot at a certain instant.
- But, as "digital twin", it can be also changed at will!

These progressive time-dependent changes can be taken care of by means of versioning.
Deriving "new" city models: basic operations

- Source city model
- City model A

Changes: Add Feature
Deriving "new" city models: basic operations

Source city model

City model B

Changes

Remove Feature
Deriving "new" city models: basic operations
Scenario ADE: Rationale

- A city is a "living" system which continuously changes over time.
- A city model is a snapshot at a certain instant.
- But, as "digital twin", it can be also changed at will! 😊
PROBLEM:

Storing "just" the results is definitely not enough!
(Some) related work

- Chaturvedi K. et al. (2015), “Managing versions and history within semantic 3D city mode for the next generation of CityGML”
  - Oriented at CityGML 3.0
  - A rather profound change/addition to the current CityGML model

- Sindram M. (PhD in preparation) "Modeling of Urban Planning Actions by Complex Transactions on Semantic 3D City Models"
  - Work in progress paper (2014):


- Several bilateral discussions with colleagues
  - IF any, then home-made, specific solutions
  - No detailed information, documentation, code, etc.
Scenario ADE: Rationale

- In the Scenario ADE, a **scenario** is defined as a **unique** combination of:
  
  - A **city model** (a building, a district, …, the whole city)
    - Information about how the city model (virtual or real) was obtained
      - Description of changes from city model A to city model B
  
  - A **simulation tool/model** characterised by a set of conditions:
    - Specific assumptions
    - Specific constraints
  
  - The set of **results**, (KPIs, time series, …)
    - possibly having different spatial and temporal resolutions
    - possibly linked to specific entities (CityObjects)
  
  - A scenario is the **connection** point between the Simulation Package and the/a city model.
Scenario ADE: UML Diagram
Scenario ADE: UML Diagram

Image source: http://www.lego.com
Scenario ADE & 3DCityDB

- Already implemented as database schema and included in the extended 3DCityDB "plus"

- Implementation rules are exactly the same as for Energy ADE and Utility Network ADE

→ See next presentation
Scenario ADE & 3DCityDB

- Basic idea: **avoid "cloning"** objects used in multiple city models
  - Store (City)Objects only once, and use different grouping rules
Scenario ADE & 3DCityDB

- Basic idea: **avoid "cloning"** objects used in multiple city models
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- The **GOOD NEWS:**
  - The 3DCityDB **already** has tables allowing it
    - CITYMODEL table
    - CITYOBJECT_MEMBER table
  - Currently unused (for a number of reasons) by the Importer/Exporter, but they can be used by interacting directly with the 3DCityDB

- **BUT:**
  - The Importer/Exporter tools does not support handling of multiple city models in the same database instance
  - Some workarounds are necessary to import and export (e.g. "ab"using a bit the concept of CityObjectGroup)
Conclusions

- The current Scenario ADE (v. 0.2!!)
  - gives a (relatively simple and lightweight) answer to the general need of scenario management within virtual city models
  - Contributes to bridging the "city modelling" and "simulation" worlds
    - The link is the Scenario, not the CityModel itself
    - It allows for documentation of "how a city model was obtained"
  - It is compatible with the current CityGML 2.0
  - It exploits already existing objects of the 3DCityDB
    - Already implemented for the 3DCityDB
    - BUT some limitations in terms of Importer/Exporter
  - Already being used and tested within project IntegrCiTy
  - Is still work in progress: Nothing is set in stone!
    - Are you interested at deeper look?
    - Willing to use it? Willing to contribute?
    - Interested in finding resources to "push" the changes also to the Importer/Exporter?

CONTACT US!!
Dr. Giorgio Agugiaro  
Energy Department  
Smart and Resilient Cities Unit  
AIT - Austrian Institute of Technology GmbH  
giorgio.agugiaro@ait.ac.at

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