Towards Integrating Feature Surface Properties into 3D GIS

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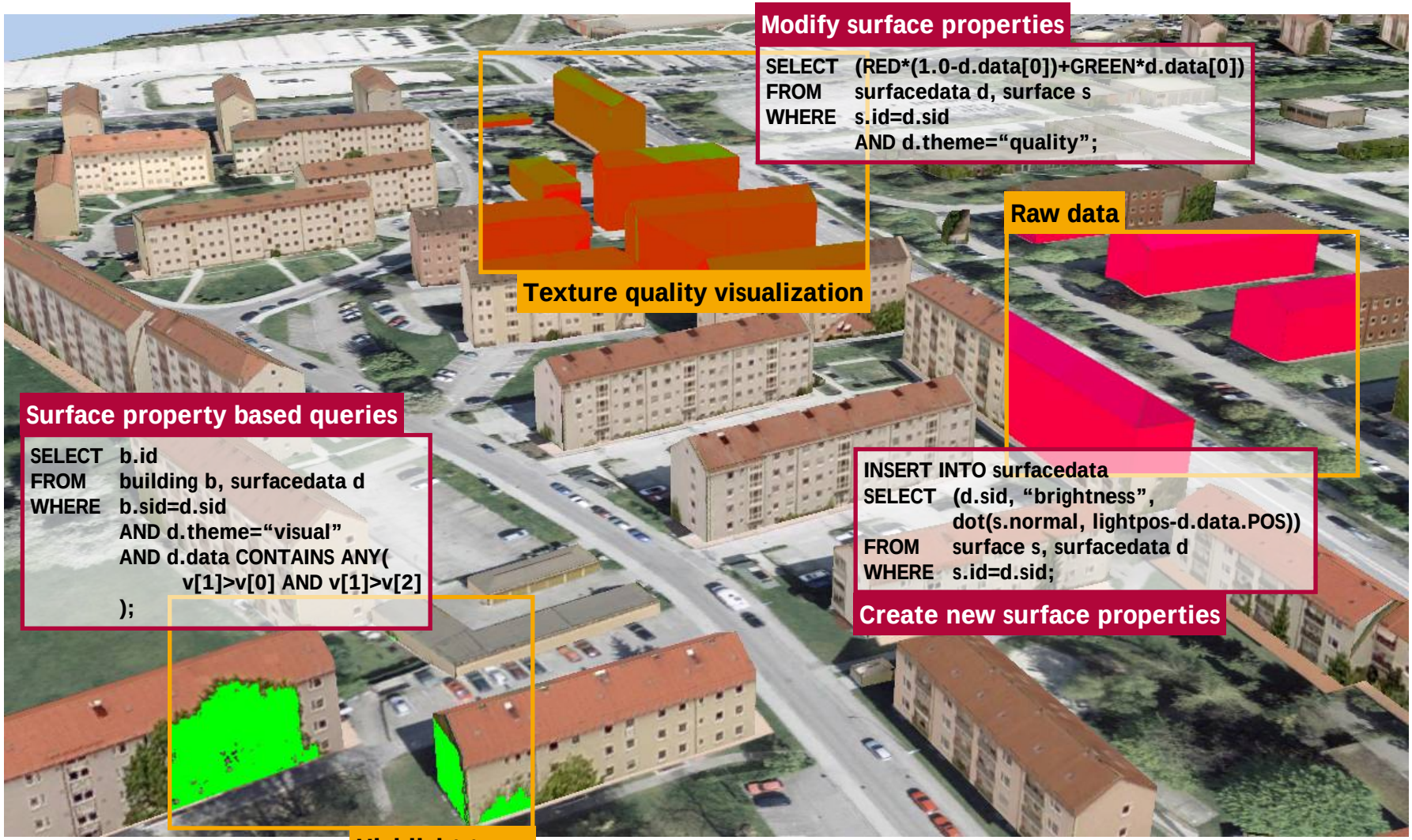


About Surface Properties

Surface property properties:

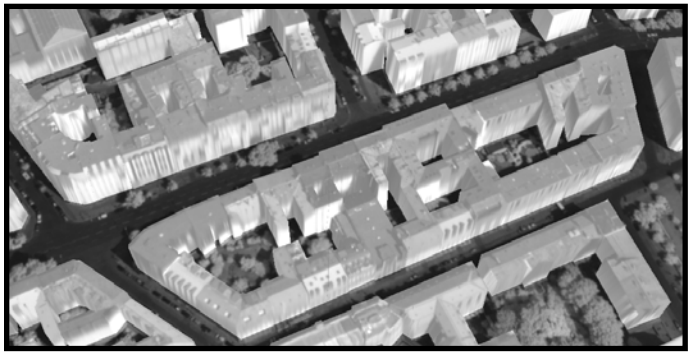
- Surface properties are rasters relating to surfaces
  → Indirectly bound to features via feature surface
  → Mapping from raster location to 3D location
- A feature's surface property is a collection of 2D rasters
  - Demo dataset: 613 buildings, 10182 rasters, 250MB data

Current situation:

- Automatic capturing possible and feasible
- Processing requires proprietary software
- Used mainly for visualization (surface properties = textures)
  - "Queries" by visual inspection

Where to go - Examples

1. Identify poorly insulated buildings



```
SELECT   b.id
FROM     building b, surfacedata d
WHERE    b.sid=d.sid
         AND d.theme="infrared"
         AND d.data CONTAINS ANY(
                  v[0]>20
         );
```

2. Wireless network coverage

[Image courtesy of Wavecall S.A., Switzerland.]

1. **Create empty surface property**
2. **For each "datel"**
   1. Create line of sight to each antenna
   2. Intersect lines with model geometry
   3. **Write** max(signal strength) for all uninterrupted lines

Challenges for Integrating Surface Properties into 3D GIS

GIS component 1: **Capturing**

- Important operation: create empty surface property
- Existing examples: texture atlas creation, surface parameterization
  - E.g.: Praun et al.: “Lapped Textures”, 2000.

GIS component 2: **Storage**

- Deals with massive image patch collections
- Add 3D spatial indices
- Existing examples: texture streaming approaches
  - E.g.: Buchholz and Döllner: “View-Dependent Rendering of Multiresolution Texture-Atlases”, 2005.

Challenges for Integrating Surface Properties into 3D GIS

GIS component 3: **Retrieval**

- Implement operations on/between surface property data
  - Per-”datel” operations
  - Statistics/aggregation operations over surface (patches)
  - Location-based operations
- Requires tight link between features, surfaces, and rasters
- Existing examples: image operations in DBMS, fragment shaders in Computer Graphics

Challenges for Integrating Surface Properties into 3D GIS

GIS component 4: **Analysis**

- Requires writing/updating surface property data
  - Complex per-"datel" functions
  - Includes 3D location of a "datel"
- Similar to fragment shaders in Computer Graphics

GIS component 5: **Portrayal**

- Requires definition of surface property usage/handling
- Can rely on Retrieval/Analysis functionality
- Existing examples: Collada (Computer Graphics data exchange format)
  - Khronos Group Inc.: "COLLADA – Digital Asset Schema Release 1.4.1 – Specification", 2006.

The End

Thank you for your attention!

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