



Network Display System for Large Cultural Heritage Objects via Cloud Computing Environments

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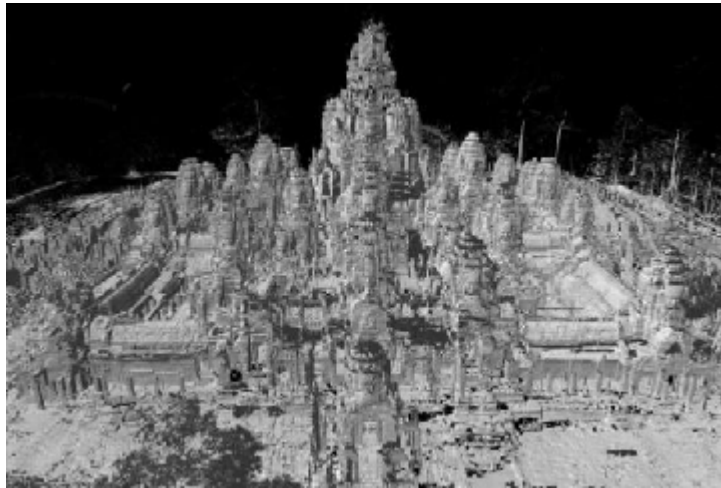
**University of Tokyo, and
University of California, Berkeley**

e-Heritage - Archiving cultural objects -

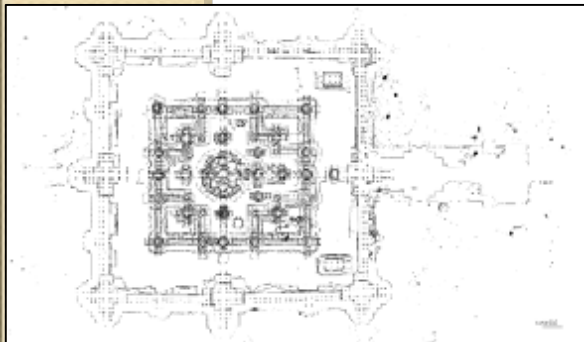
– Bayon Digital Archival Project



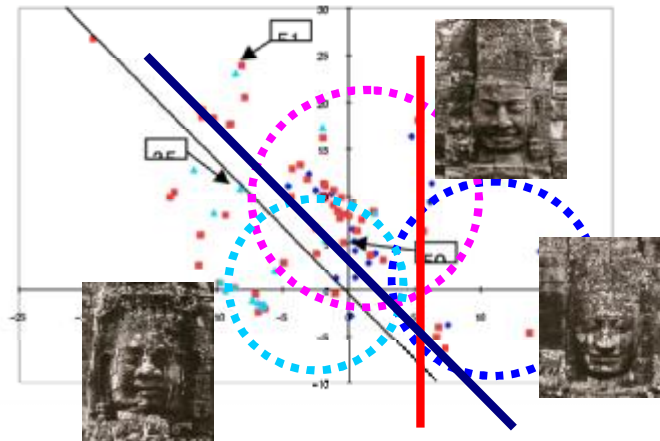
e-Heritage - Utilization of archived data -



Restoration activity



Archaeological Analysis



Exhibition



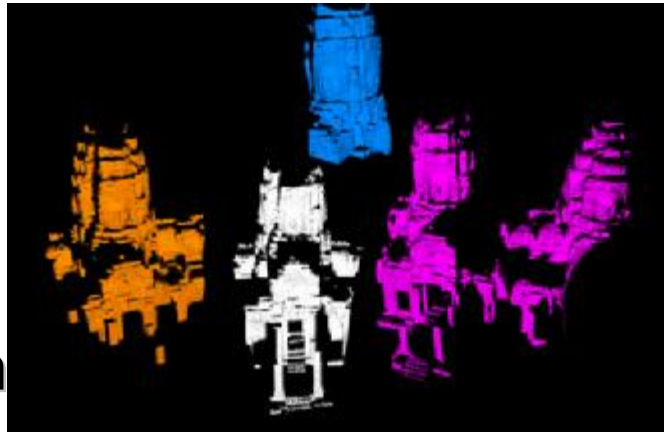


Contents

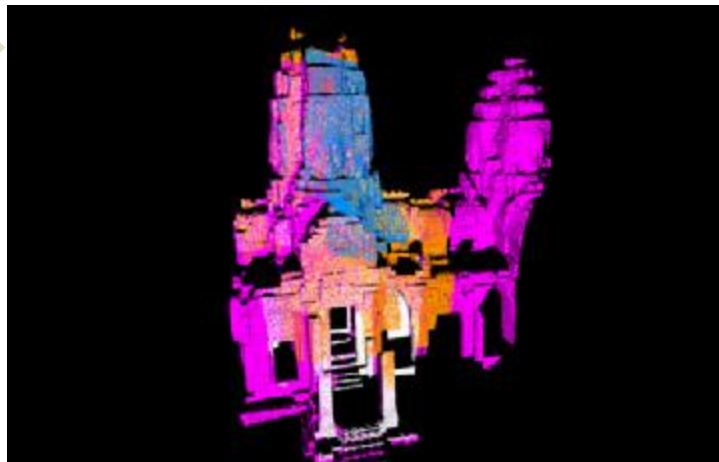
- e-Heritage project
 - 3D digitization methods for real objects
 - Usage of obtained 3D models
- Interactive display system through network
 - Hybrid real-time rendering method

Geometric modeling

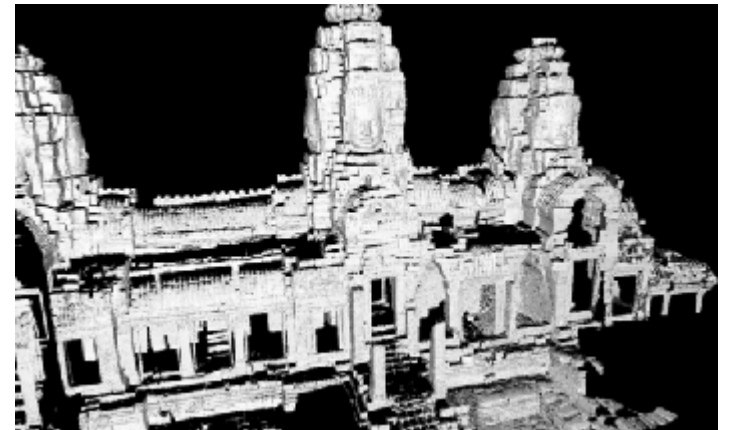
**Data
acquisition**



Alignment



Merging



Many kinds of Sensors



Balloon sensor

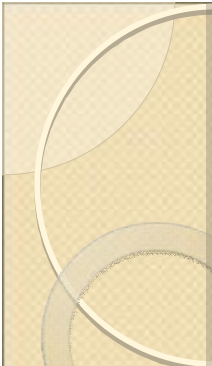


Mirror sensor

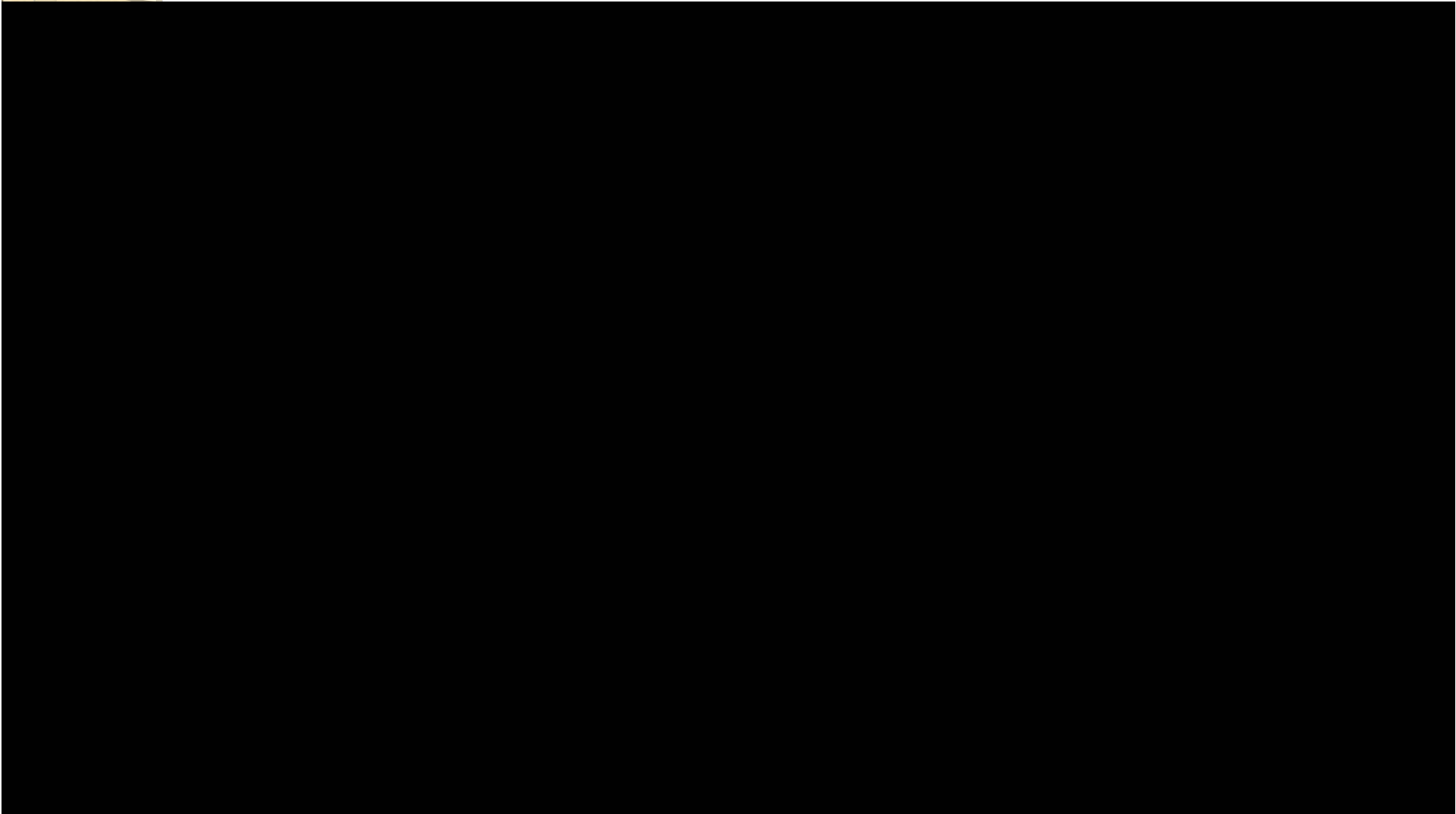


Climbing sensor

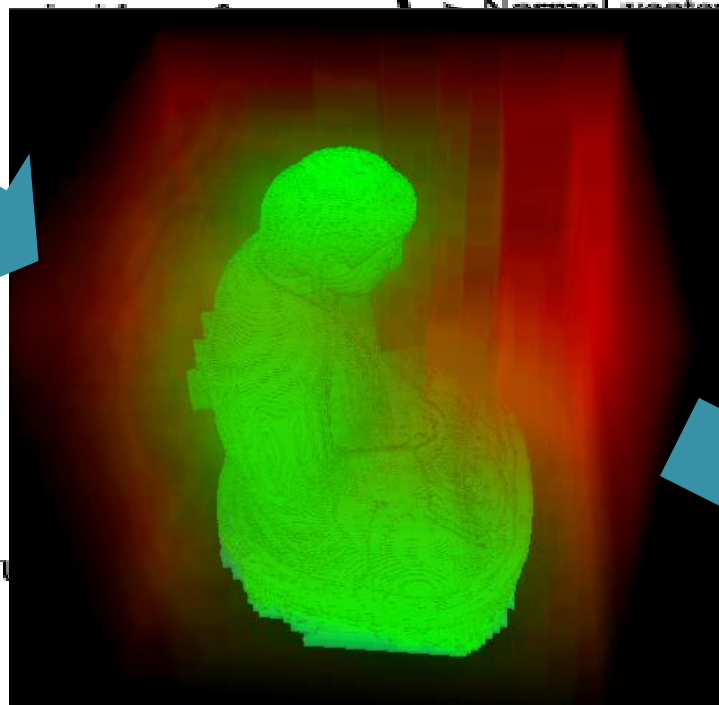
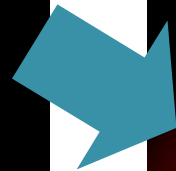
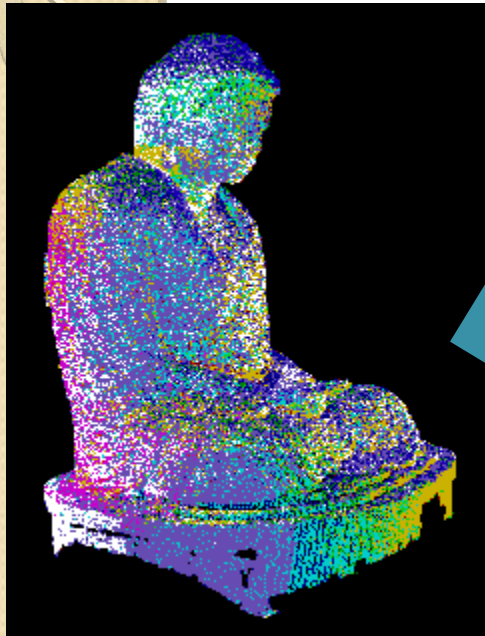
Developed sensors



Alignment



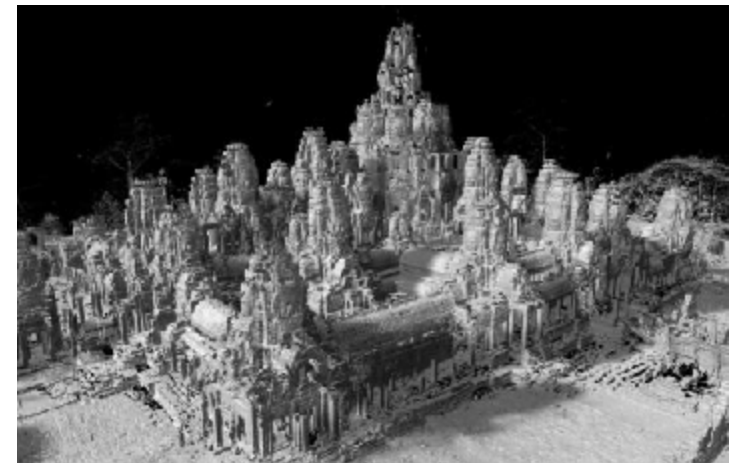
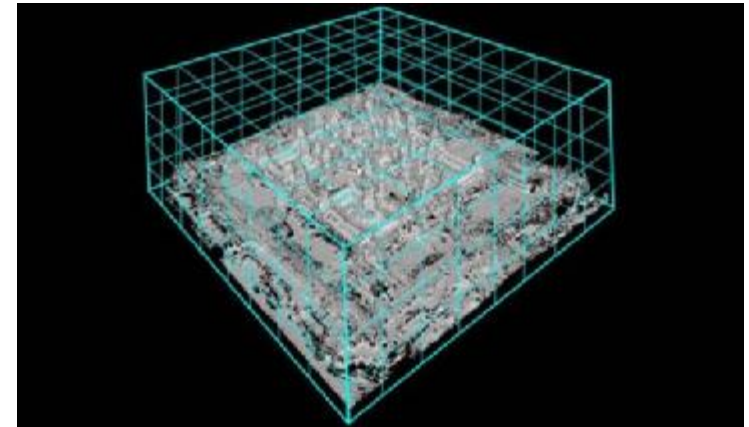
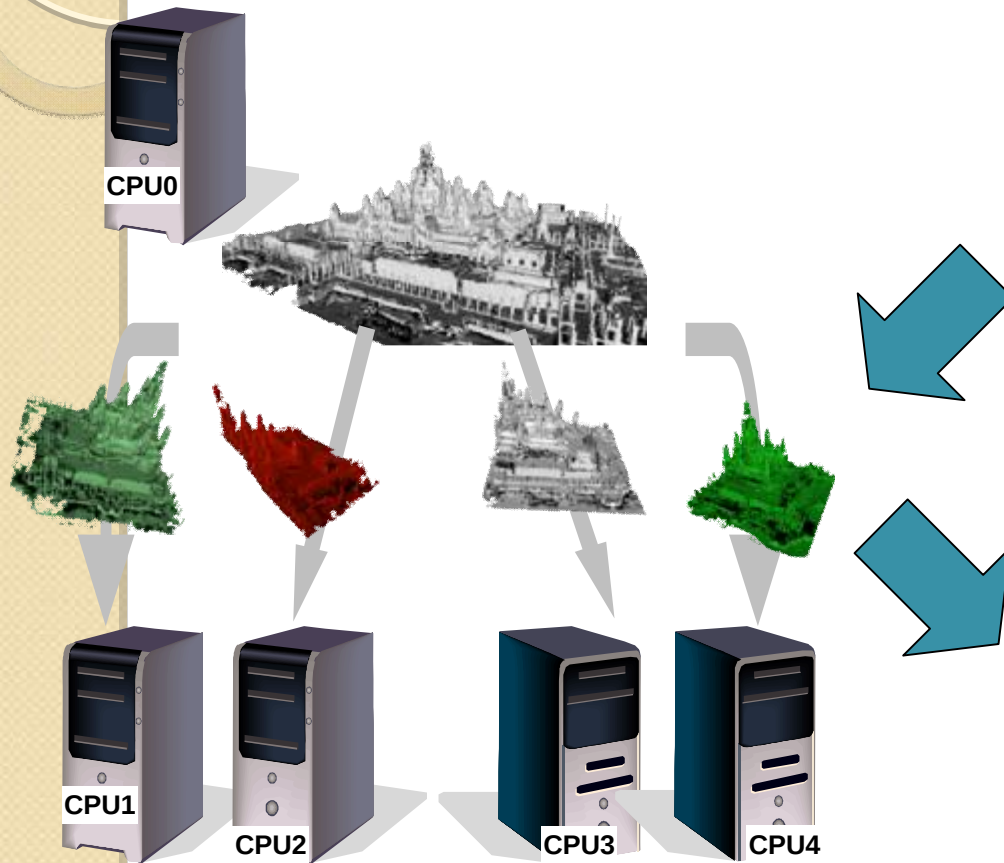
Merging



Signed distance field



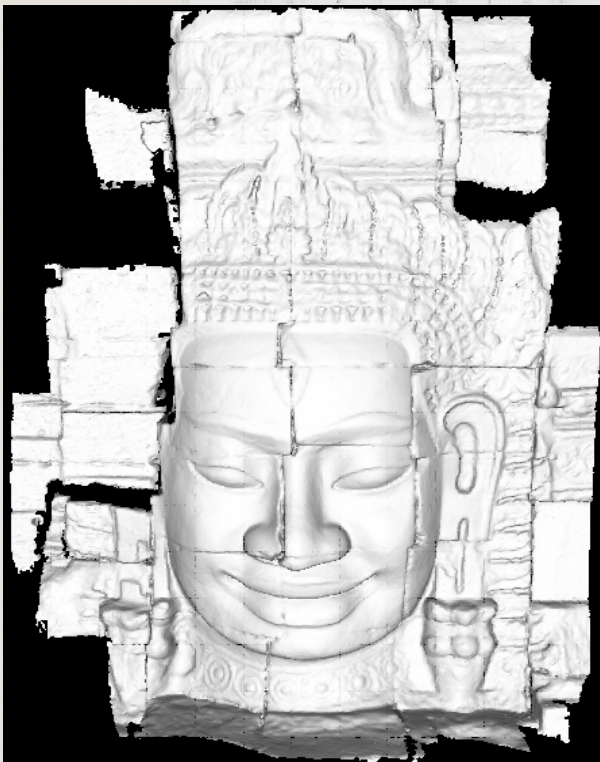
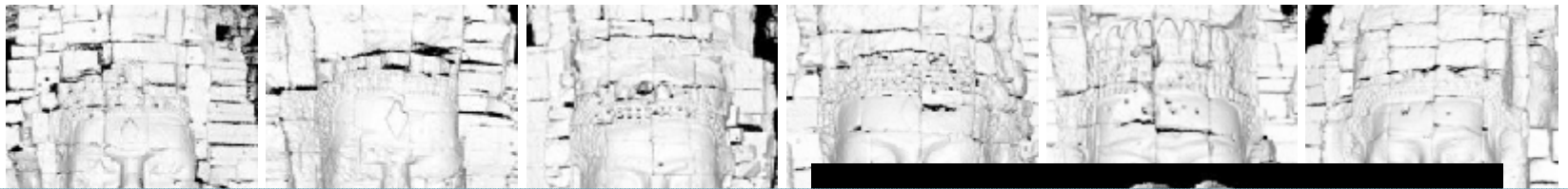
Parallel volumetric merging





Archiving Results

God's face library



Deva



Devata



Asura

Face15N

Face15S

Face15W

Face15E

Face15N

Face15S

Archiving Results

Relief carved on walls



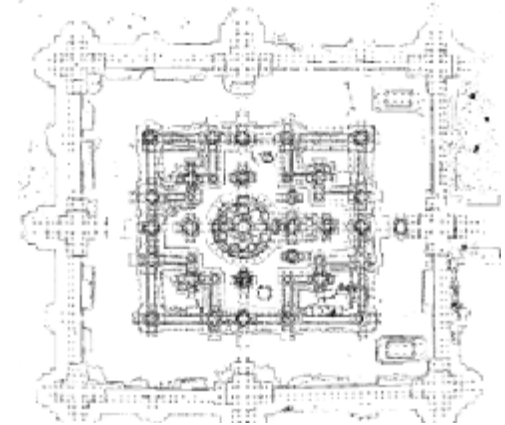
Hidden Pediments



Archaeological Findings

– Structure

- 0.94 degree Counterclockwise



– Deity faces:

- Can classify 173 faces into three groups: Dava, Davata, Asherah



– Pediments:

- World Premiere of Hidden pediments that suggest religious change from Buddhism to Hinduism



Exhibition: Virtual Bayon



~Virtual Bayon~

**Ars Electronica Campus 2008
Hybrid Ego - The University of Tokyo**

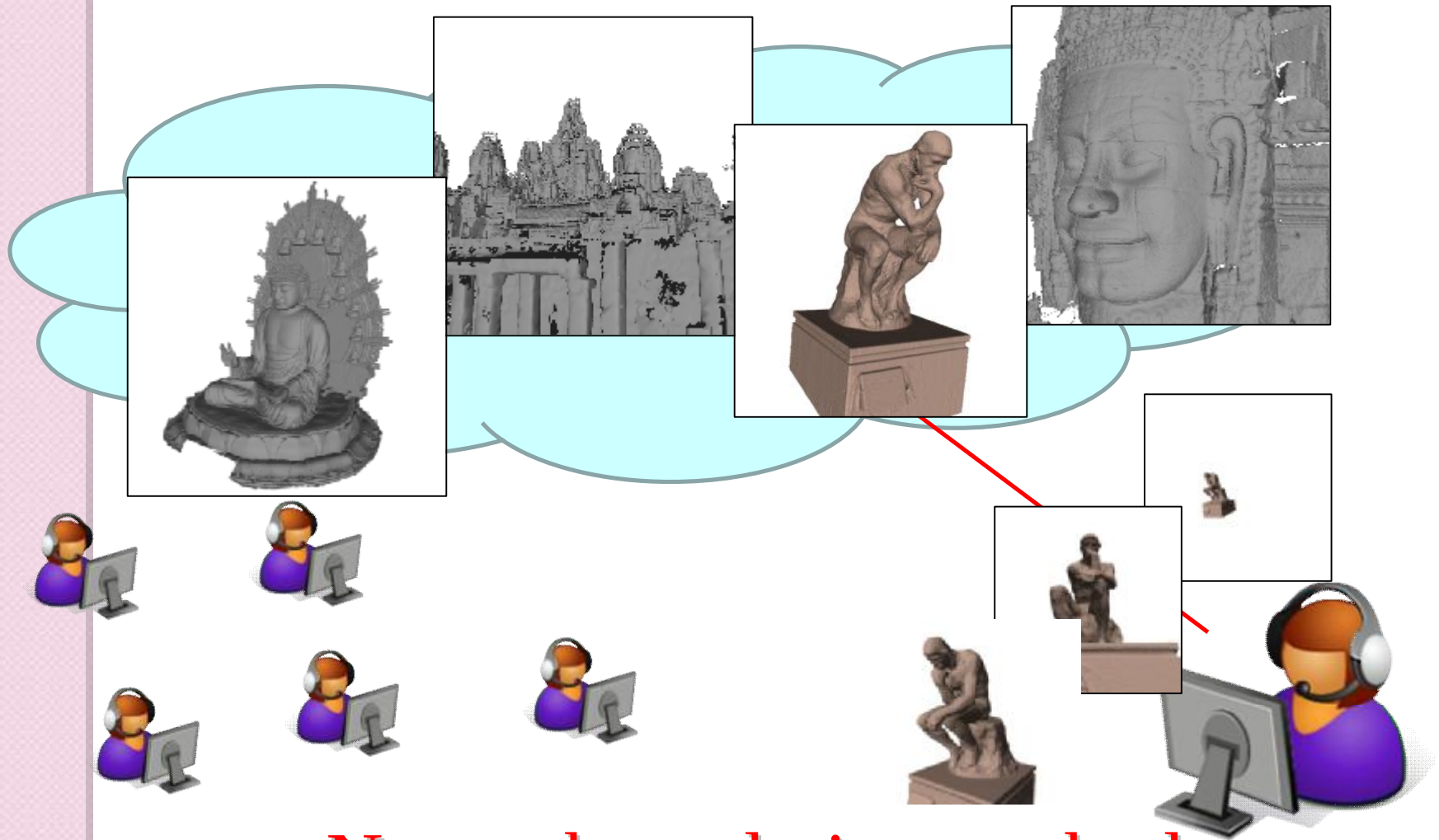
9/4-10/2008

Application: 3D Information Sharing System

Interactive access to archaeological information through 3D data



Access to Huge 3D Models through Network

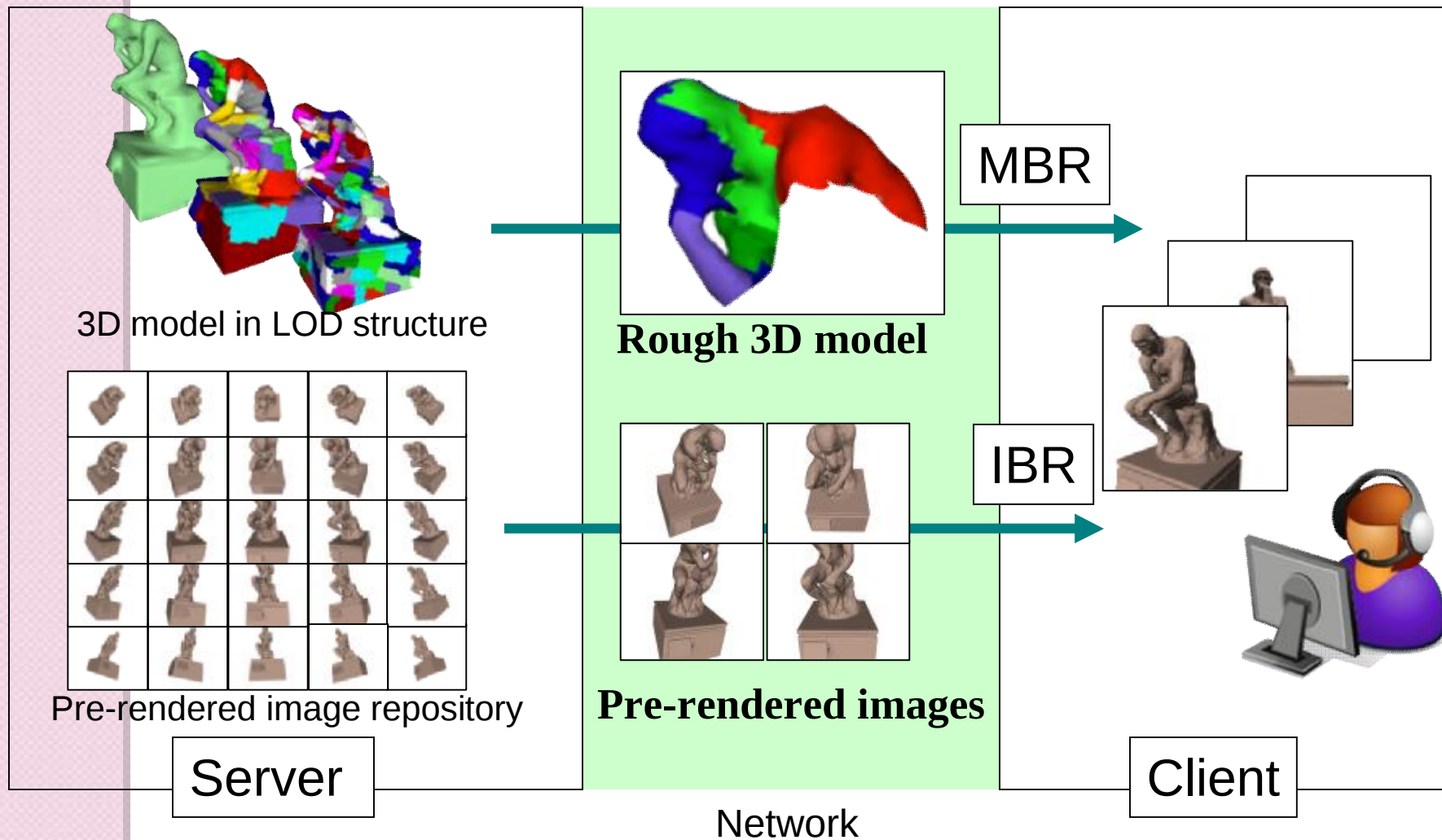


Network rendering method

Network Rendering Methods

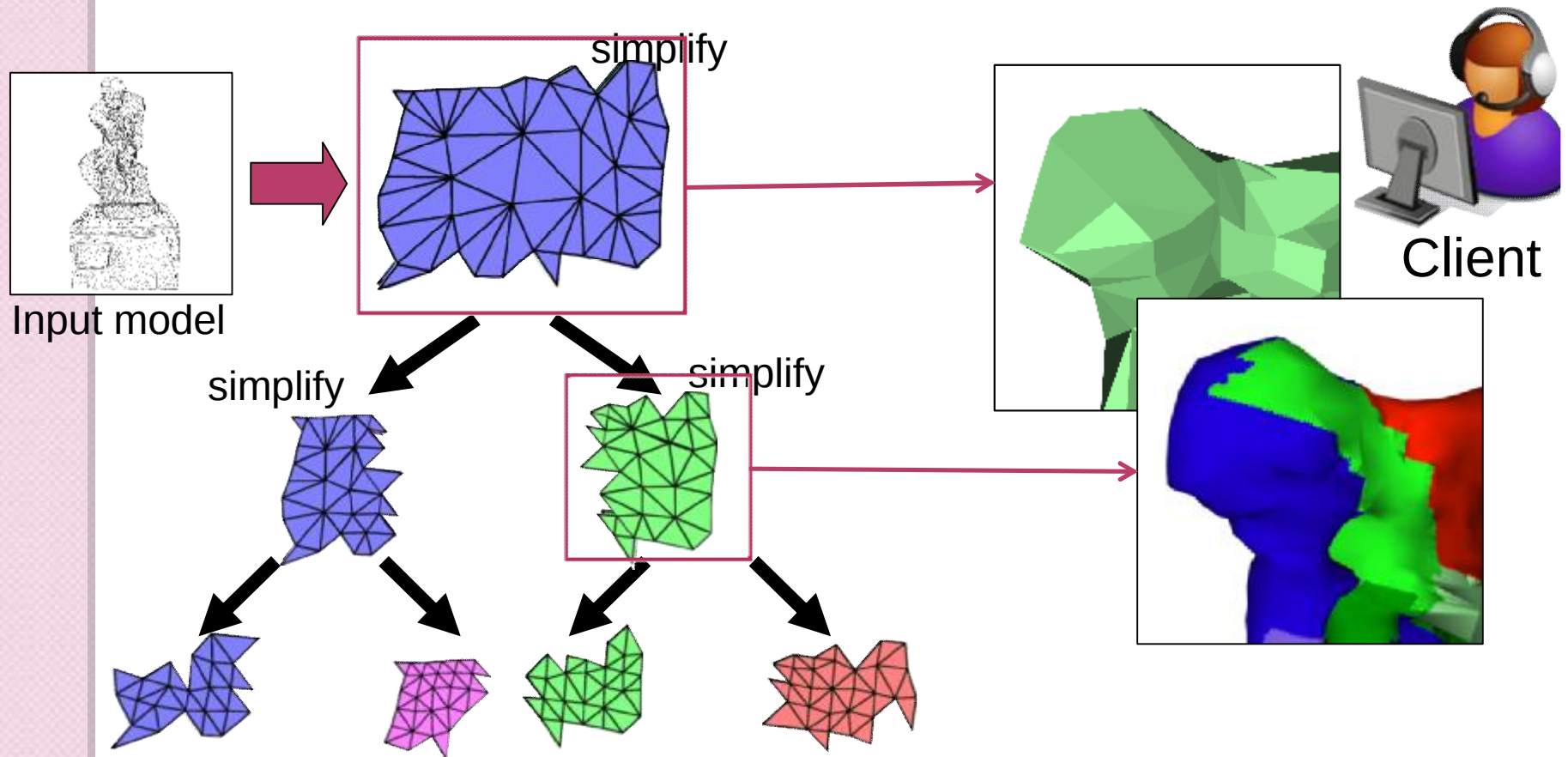
- Model-based method
 - High quality image
 - Requires huge data in case that the target structure is complex
- Image-based method
 - Amount of data depends on the image size
 - Easy to handle (2D images)
 - Difficult to reconstruct accurate image

Hybrid Rendering System



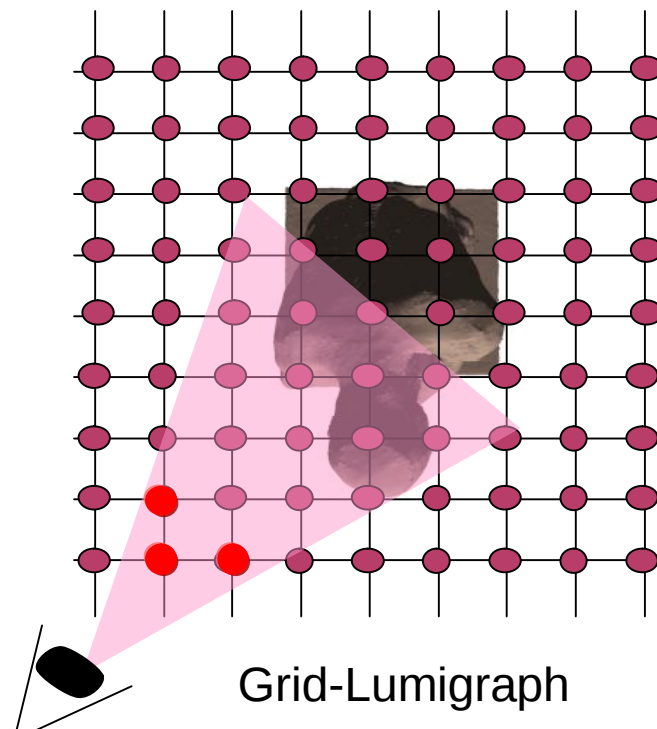
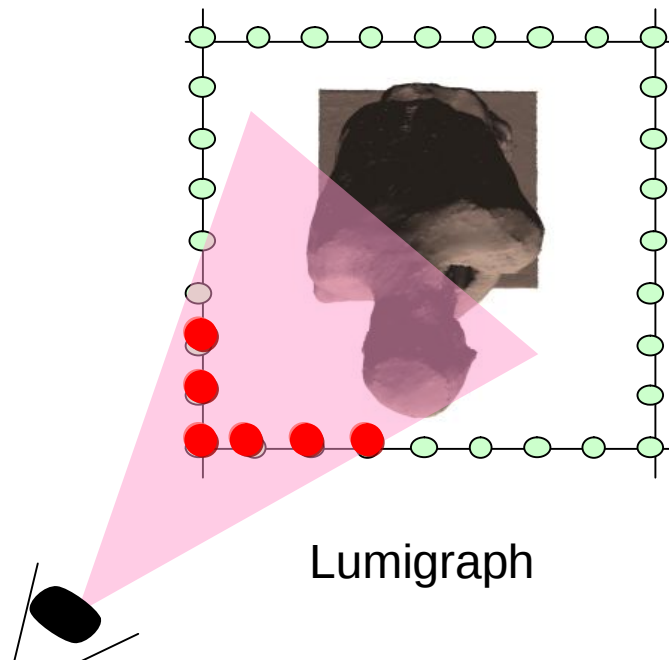
LOD Geometric Model

- Recursive splitting and simplification of the mesh
- Provide minimum required 3D data to clients



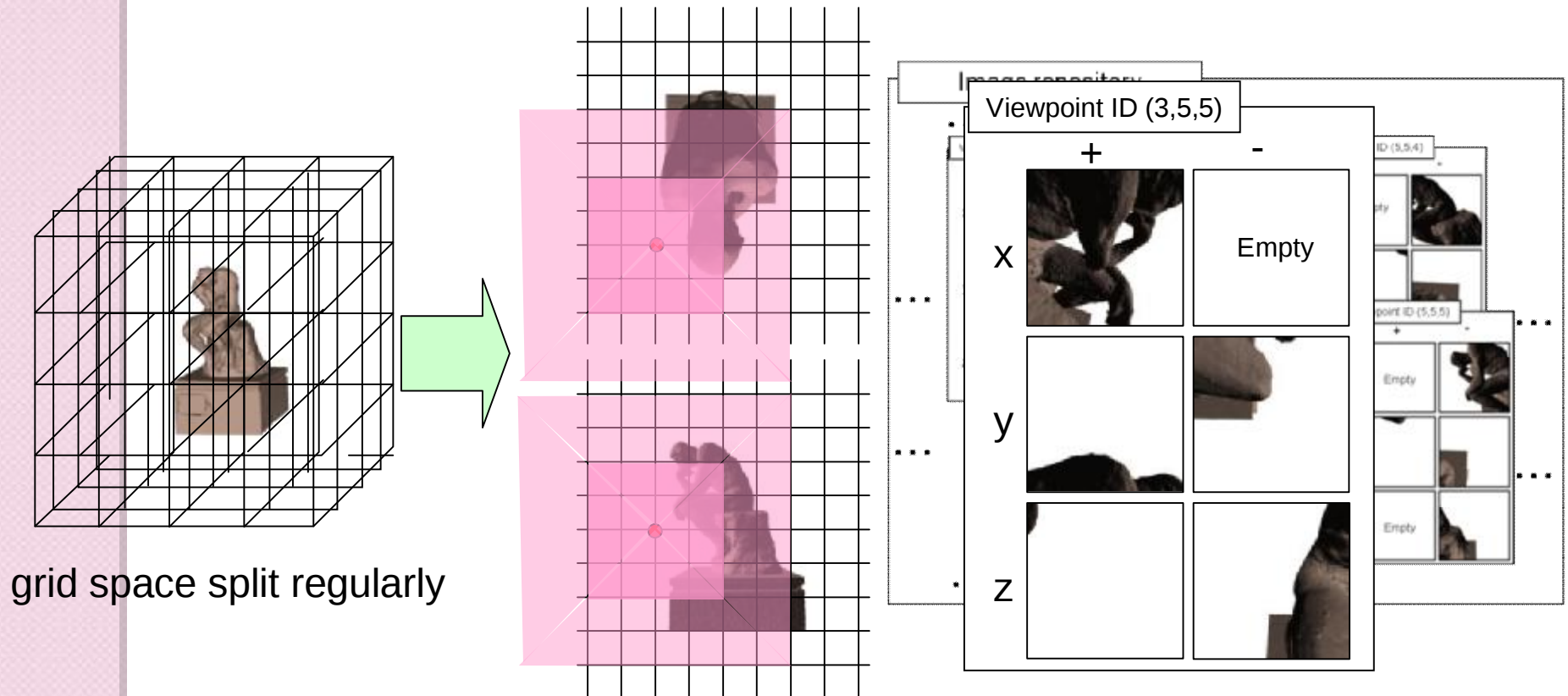
Grid-Lumigraph

- Image based rendering method using geometric data
- More complex models can be represented
- Number of images for view reconstruction is reduced
- Number of sampling images becomes large



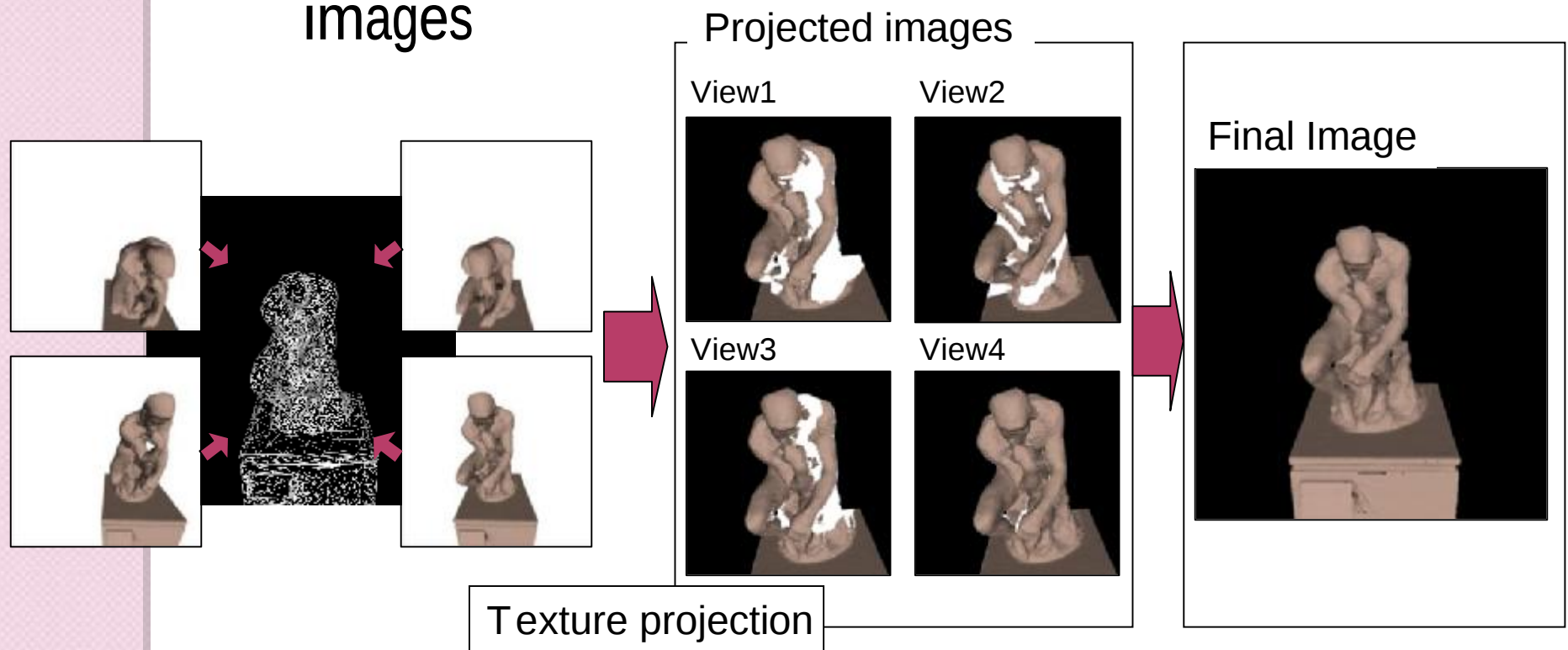
Pre-rendered Images

- Sampling at each grid point on a voxel space in all directions



View Reconstruction

- Texture projection of the nearest images onto the geometric model
- Final reconstruction by combining the projected images



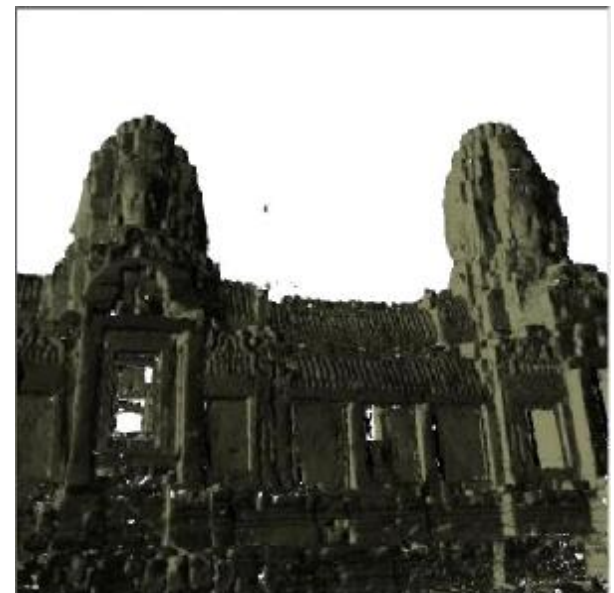
Experimental Results



Model	Thinker
Triangles	1,742,122
Grid	16x16x16
Average fps	59.6



Model	Bayon Face
Triangles	5,922,790
Grid	16x16x16
Average fps	48.1



Model	Bayon Towers
Triangles	18,132,893
Grid	32x32x32
Average fps	38.5

CPU: AMD Athlon 2.4GHz RAM: 4GB
 GPU: GeForce 8800GTS VRAM: 512MB

Demonstration Movie



Summary

Ø E-Heritage

- Ø Bayon Digital Archival Project
- Ø 3D archiving methods for real objects
- Ø Applications for obtained 3D models

Ø Interactive information sharing system through network

- Ø Hybrid network rendering system using Model and Image based approaches (Grid Lumigraph)