

# Paper Out of Core Processes

Proseminar Paper by

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# 1. Abstract

With the ever increasing amount of data to be rendered for a single given scene, experimenting with new approaches for handling and structuring that data becomes more and more important. This paper covers the approach to enhance response times and quality using out-of-core techniques.

With the help of out-of-core techniques, it is possible to achieve real-time rendering performance on current-generation graphics cards by overcoming limits posed by the graphics cards' internal memory [CNLE09]. Thus, this topic is essential for everyone hoping to achieve such performance for scenes that cannot be efficiently rendered using conventional methods.

I will discuss different strategies used to load necessary data chunks into working memory taking into account its finiteness using intelligent data streaming. These include visibility culling and virtual texturing. Also, this paper will give an overview of the possibility to use volumetric texture units called “Voxels” instead of regular texels and the advantages and challenges that come with it. Lastly, the topic will be further explored using the examples [CNLE09] and [VW09].

## 2. Motivation

Here I will give examples for problems solved by out of core rendering algorithms. I will extract the specific technical limitations of not using the technique from the examples.

## 3. Basics

Here I will introduce key terminology used. I will explain the terms “Texture Mapping”, “Memory Virtualization” and “Virtual Texture”.

## 4. Main Content

### 4.1 Memory Management

Here I will talk about ways to utilize slow external memory to be able to store large datasets without losing wanted performance. I will refer to voxels, virtual paging and other techniques.

### 4.2 Voxels

Here I will give a detailed overview of the concept of voxels. I will talk about their differences to texels, advantages, challenges and their suitability for out of core processes.

### 4.3 Example 1: GigaVoxels

Here I will use the discussed concepts to explain how GigaVoxels can be used to render large volumetric datasets with high performance. I will explain how this is related to both voxels and out of core processes.

### 4.4 Example 2: ID Tech 5 Challenges

Here I will discuss in detail how out of core rendering is compatible with parallelization using the ID Tech 5 Challenges example. I will talk about the faced challenges and how they were solved.

### 4.5 Example 3: Visualization of very large Landscapes

Here I will summarize the findings from [CGG<sup>+</sup>03]. I will refer to multi-resolution algorithms and how they are related to the topic.

## 5. Epilogue

Here I will outline how out of core techniques can be used to develop new ways of data provision and rendering scenes in the future.

# Literaturverzeichnis

- [CGG<sup>+</sup>03] Paolo Cignoni, Fabio Ganovelli, Enrico Gobbetti, Fabio Marton, Federico Ponchio und Roberto Scopigno: *Interactive Out-of-Core Visualisation of Very Large Landscapes on Commodity Graphics Platform*. In: Olivier Balet, Gérard Subsol und Patrice Torguet (Herausgeber): *Virtual Storytelling. Using Virtual Reality Technologies for Storytelling*, Seiten 21–29, Berlin, Heidelberg, 2003. Springer Berlin Heidelberg, ISBN 978-3-540-40014-1.
- [CNLE09] Cyril Crassin, Fabrice Neyret, Sylvain Lefebvre und Elmar Eisemann: *Giga Voxels: Ray-guided Streaming for Efficient and Detailed Voxel Rendering*. In: *Proceedings of the 2009 Symposium on Interactive 3D Graphics and Games*, I3D '09, Seiten 15–22, New York, NY, USA, 2009. ACM, ISBN 978-1-60558-429-4. <http://doi.acm.org/10.1145/1507149.1507152>.
- [VW09] JMP Van Waveren: *id tech 5 challenges-from texture virtualization to massive parallelization*. Talk in Beyond Programmable Shading course, SIGGRAPH, 9:5, 2009.



# Erklärung

Ich versichere, dass ich die Arbeit selbstständig verfasst habe und keine anderen als die angegebenen Quellen und Hilfsmittel benutzt habe, die wörtlich oder inhaltlich übernommenen Stellen als solche kenntlich gemacht und die Satzung des KIT zur Sicherung guter wissenschaftlicher Praxis in der jeweils gültigen Fassung beachtet habe. Die Arbeit wurde in gleicher oder ähnlicher Form noch keiner anderen Prüfungsbehörde vorgelegt und von dieser als Teil einer Prüfungsleistung angenommen.

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