

Bachelor's Thesis

« Dynamic Management of Shared Virtual Memory for Multi-Processing on Linux »

Background

Modern operating systems provide a mechanism to share physical memory between multiple processes the same way as multiple threads share the virtual memory of a single process. This concept is called Shared Virtual Memory or Shared Memory for short. The operating system usually provides an API which allows to create shared memory segments and map them into the virtual address space of certain process. When attached, the processes have random access to that memory region the same way as threads to memory in a process. The main difference to memory in a process is, that there is no dynamic memory management (such as provided by malloc). It would be possible to create a new segment for each new memory region required but then the application will face several pitfalls: A process cannot access the new segments unless they have been mapped into its virtual address space. The system-wide number of segments, as well as their size is limited and it is not guaranteed that the segments can be mapped at arbitrary virtual addresses in each process to allow growing and shrinking of a shared memory region. There are a few libraries which provide a dynamic memory management which have different disadvantages. Some are file based, which reduces throughput in memory access, some provide dynamic memory management inside a given shared memory segment only and do not create new ones and they use their own memory management method which is not competitive with the newest algorithms and do not consider multi-processing.

Work Description

Mission of this master thesis is to design and implement a new system wide shared virtual memory management for Linux which allows adaption of any dynamic memory management algorithm such as Douglas Lea's allocator (known as malloc).

The work will consist of the following tasks:

- Studying Linux system capabilities and available libraries for memory management on shared memory.
- Design of a system-wide shared memory management which mets the given requirements.
- Implementation of the design for a Linux 64 bit operating system.
- Prototypical adaption of Doug Lea's allocator in a separate malloc function.
- A performance evaluation by comparison to process local heap memory allocation.
- Write the thesis text according to common standards.

Requirements

- Knowledge in C/C++ and Linux

Contact: Holger Machens

machens@tu-harburg.de

Phone: +49 40 / 428 78 – 3703

Room: E 4.090