

# Cache-Line Transactions: Building Blocks for Persistent Kernel Data Structures Enabled by AspectC++

Jana Traue, Marcel Köppen, Christoph Borchert, Jörg Nolte  
and Olaf Spinczyk, TU Cottbus & Universität Osnabrück

With the recent availability of systems that contain large amounts of byte-addressable non-volatile memory, there is a growing need for data structures, that can be mapped into a process's address space and be used without data (de-)serialisation. While NVRAM is able to keep memory contents during system failure and power loss, data consistency has to be preserved by using transactional operations for data manipulation. We describe a lightweight and efficient transaction mechanism for small data structures in memory-mapped NVRAM. As the size per data structure is limited, the approach cannot serve as a general purpose mechanism for arbitrary applications, but could be used within an operating system as a low-level building block for more complex data structures. By using aspect-oriented programming with AspectC++ the mechanism can be used in an almost transparent manner, which helps to avoid many possible sources for bugs.