



OO/UC3M/58- LIGHTWEIGHT ADAPTIVE FAULT-TOLERANT DATA STORAGE SYSTEM (AFTSYS)

Research group ARCOS of Universidad Carlos III de Madrid (Spain) have been working on flexible and adaptive data storage systems for several years. The storage systems developed are featured by software governance, making them portable across different hardware storage resources, and their dynamic adaptivity to the different circumstances of computer systems following the autonomic system paradigm. They also allow getting high performance storage by using data distribution or striping across multiple devices.

One of the group's technologies is the AFTSYS system. A fault-tolerant storage system for persistent distributed objects, user configurable and adaptive to system behaviour.

Description and special features

This technology provides a fault-tolerance model for the files of a parallel and distributed storage system. The main features of this technology are the following:

- A fault-tolerance model for parallel and distributed storage systems that allows employ different fault-tolerance mechanisms at file level.
- A model based on distribution patterns that offers a flexible and simple fault tolerance model description.
- Properties of the distribution schemes resulted from the associated distribution patterns as defined in the proposed fault-tolerance model.
- The algorithms needed to add, remove or modify the file-based fault-tolerance model in a dynamic way.
- The introduction of distribution schemes based on external redundancy. Those schemes allow the dynamic addition and removal of fault-tolerance support to a file.
- A POSIX extension to add, remove, modify and define the distribution schemes for files. The same functionality can be extended for minial systems or systems without file systems.

An evaluation of the proposed model shows that, even with the natural overhead introduced by the fault-tolerant objects, this overhead is low and offer storage system users a simple and practical solution.

Innovative aspects

This system provides the following new features:

- 1.- Adaptive storage and computing system following circumstances.
 - 2.- Totally governed by software, making it fully portable.
 - 3.- Fault tolerance schemas can be defined in a per object basis.
 - 4.- More than one fault tolerated, and the user may request this feature dynamically.
 - 5.- Not linked to a specific hardware and low resources consumption, which makes it useful even for embedded systems.
 - 6.- Specially well suited to be used in high-performance systems, like high-availability data servers, imaging servers or Web servers.
 - 7.- Allows the an object to be used with or without the fault tolerant schema, following performance needs and converting fault tolerant in conventional objects and viceversa.
 - 8.- Easily stackable with extra security layers, cipher, compression, etc.
- Nowadays, fault-tolerant storage systems are strongly linked to a specific technology (as RAID devices) or to a specific operating systems (as Linux o Windows).

Competitive advantages

This technology might provide competitive advantages or in those systems where large conventional fault-tolerant storage systems are not available, either in those systems with a set of independent distributed storage devices to provide different fault-tolerant object-oriented schemas with great flexibility. In particular, it may be useful to dynamically manage fault-tolerant storage in those systems without a



Competitive advantages

basic, or even none, local file system.

It may also allow reducing exploitation costs because it does not need extraordinary investment. Moreover, management is easy and intuitive.

Technology Keywords

Fault tolerance; Safety systems; High-performance storage; Adaptive systems; Autonomic systems; Portability; Advanced Systems Architecture; Archivistics / Documentation / Technical Documentation; Data protection, storage technology, cryptography, data security.

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