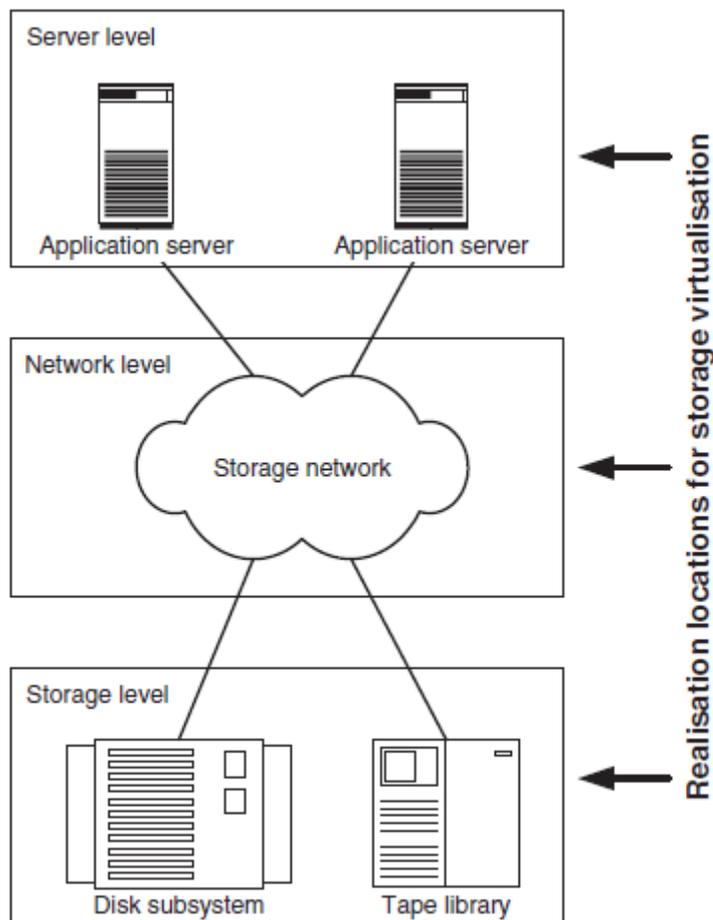


## STORAGE VIRTUALISATION ON VARIOUS LEVELS OF THE STORAGE NETWORK

In the following we will concern ourselves with the locations at which a virtualization entity can be positioned in the storage network. The following three levels can be defined here (Figure 5.14): the server (Section 5.6.1), the storage devices (Section 5.6.2) and the network (Section 5.6.3). This will be explained in what follows.



**Figure 6.14** A virtualisation entity can be positioned on various levels of the storage network.

### 6.6.1 Storage virtualisation in the server

A classic representative of virtualisation in the server is the combination of file system and volume manager (Section 4.1.4). A volume manager undertakes the separation of

the storage into logical view and physical implementation by encapsulating the physical hard disk into logical disk groups and logical volumes. These are then made available to the applications via file systems. File systems and databases positioned on the server now work with these logical volumes and cease to work directly with the physical hard disks. Some volume managers additionally have further storage functions such as RAID, snapshots or dynamic reconfiguration options, which permit the addition and removal of storage during operation. With shared disk file systems (Section 4.3) storage virtualization can be expanded to several servers, in order to allow fast file sharing among several servers. These cannot, however, be used in a straightforward manner in heterogeneous environments due to the incompatibilities that prevail. Virtualisation on block level can be performed on a server by the host bus adapter itself. Virtualisation on block level is found, for example, in the use of a RAID controller.

This performs the mapping of the logical blocks that are used by the file system or the volume manager of the operating system to the physical blocks of the various drives.

The benefits of virtualisation on server level are:

- Tried and tested virtualisation techniques are generally used.
- The virtualisation functions can integrate multiple storage systems.
- No additional hardware is required in the storage network to perform the virtualisation.

Thus additional error sources can be ruled out. The approach remains cost-effective.

The disadvantages of a virtualisation on server level are:

- The administration of the storage virtualisation must take place on every single server.

To achieve this, the appropriate software must be installed and maintained upon the computers.

- The storage virtualisation software running on the server can cost system resources and thus have a negative impact upon the server performance.
- Incompatibilities may occur between the virtualisation software and certain applications.

- The virtualisation extends only to those areas of a storage network that are accessible or assigned to those servers running a virtualisation entity.
- The virtualisation only ever takes place on individual servers. This disadvantage can be remedied by complex cluster approaches, which, however, come at an additional administration cost.

### **6.6.2 Storage virtualisation in storage devices**

Virtualisation on block level in storage devices is, for example, found within intelligent disk subsystems (Section 2.7). These storage systems make their storage available to several servers via various I/O channels by means of LUN masking and RAID. The physical hard disks are brought together by the storage devices to form virtual disks, which the servers access using protocols such as SCSI, Fibre Channel FCP, FCoE and iSCSI. In this manner, the mapping of virtual to physical blocks is achieved. Virtualisation on file level in storage devices is, for example, achieved by NAS servers (Section 4.2.2). The file system management is the responsibility of the NAS server. Access by the server to the storage resources takes place on file level by means of protocols such as NFS and CIFS.

The advantages of virtualisation on storage device level are:

- The majority of the administration takes place directly upon the storage device, which is currently perceived as easier and more reliable since it takes place very close to the physical devices.
- Advanced storage functions such as RAID and instant copies are realised directly at the physical storage resources, meaning that servers and I/O buses are not loaded.
- The uncoupling of the servers additionally eases the work in heterogeneous environments since a storage device is able to make storage available to various platforms.
- The servers are not placed under additional load by virtualisation operations.

The disadvantages of virtualisation on storage device level are:

- Configuration and implementation of virtualisation are manufacturer-specific and may thus become a proprietary solution in the event of certain incompatibilities with other storage devices.

- It is very difficult – and sometimes even impossible – to get storage devices from different manufacturers to work together.
- Here too, virtualisation takes place only within a storage system and cannot effectively be expanded to include several such storage devices without additional server software.

### **6.6.3 Storage virtualisation in the network**

Storage virtualisation by a virtualisation entity in the storage network is realised by symmetric or asymmetric storage virtualisation (Section 5.7). First, however, we want to discuss the general advantages and disadvantages of storage virtualisation in the network.

The advantages of virtualisation in the storage network are:

- The virtualisation can extend over the storage devices of various manufacturers.
- The virtualisation is available to servers with different operating systems that are connected to the storage network.
- Advanced storage functions, such as mirroring or snapshots can be used on storage devices that do not themselves support these techniques (for example, JBODs and low cost RAID arrays).
- The administration of storage virtualisation can be performed from a central point.
- The virtualisation operations load neither the server nor the storage device.

The disadvantages are:

- Additional hardware and software are required in the storage network.
- A virtualisation entity in the storage network can become a performance bottleneck.
- Storage virtualisation in the storage network is in contrast to other storage technologies currently (2009) still a new product category. Whilst storage virtualisation on the block level has been successfully established in production environments, there is still very limited experience with file level storage virtualisation which is located in the storage network

Source : <http://elearningatria.files.wordpress.com/2013/10/cse-viii-storage-area-networks-06cs833-notes.pdf>