In computing, **data recovery** is a process of salvaging (retrieving) inaccessible, lost, corrupted, damaged or formatted data from secondary storage, removable media or files, when the data stored in them cannot be accessed in a normal way. The data is most often salvaged from storage media such as internal or external hard disk drives (HDDs), solid-state drives (SSDs), USB flash drives, magnetic tapes, CDs, DVDs, RAID subsystems, and other electronic devices. Recovery may be required due to physical damage to the storage devices or logical damage to the file system that prevents it from being mounted by the host operating system (OS).

The most common data recovery scenario involves an operating system failure, malfunction of a storage device, logical failure of storage devices, accidental damage or deletion, etc. (typically, on a single-drive, single-partition, single-OS system), in which case the ultimate goal is simply to copy all important files from the damaged media to another new drive.

Another scenario involves a drive-level failure, such as a compromised file system or drive partition, or a hard disk drive failure. In any of these cases, the data is not easily read from the media devices. Depending on the situation, solutions involve repairing the logical file system, partition table or master boot record, or updating the firmware or drive recovery techniques ranging from software-based recovery of corrupted data, hardware- and software-based recovery of damaged service areas (also known as the hard disk drive's "firmware"), to hardware replacement on a physically damaged drive which allows for extraction of data to a new drive. If a drive recovery is necessary,

The term "data recovery" is also used in the context of forensic applications or espionage, where data which have been encrypted or hidden, rather than damaged, are recovered. Sometimes data present in the computer gets encrypted or hidden due to reasons like virus attack which can only be recovered by some computer forensic experts.

Recovery techniques

Recovering data from physically damaged hardware can involve multiple techniques.[3] Some damage can be repaired by replacing parts in the hard disk. This alone may make the disk usable, but there may still be logical damage. A specialized disk-imaging procedure is used to recover every readable bit from the surface. Once this image is acquired and saved on a reliable medium, the

image can be safely analyzed for logical damage and will possibly allow much of the original file system to be reconstructed.

Hardware Repair

Media that has suffered a catastrophic electronic failure requires data recovery in order to salvage its contents.

A common misconception is that a damaged printed circuit board (PCB) may be simply replaced during recovery procedures by an identical PCB from a healthy drive. While this may work in rare circumstances on hard disk drives manufactured before 2003, it will not work on newer drives. Electronics boards of modern drives usually contain drive-specific adaptation data (generally a map of bad sectors and tuning parameters) and other information required to properly access data on the drive. Replacement boards often need this information to effectively recover all of the data. The replacement board may need to be reprogrammed. Some manufacturers (Seagate, for example) store this information on a serial EEPROM chip, which can be removed and transferred to the replacement board.[4][5]

Each hard disk drive has what is called a *system area* or *service area*; this portion of the drive, which is not directly accessible to the end user, usually contains drive's firmware and adaptive data that helps the drive operate within normal parameters.[6] One function of the system area is to log defective sectors within the drive; essentially telling the drive where it can and cannot write data.

The sector lists are also stored on various chips attached to the PCB, and they are unique to each hard disk drive. If the data on the PCB do not match what is stored on the platter, then the drive will not calibrate properly.[7] In most cases the drive heads will click because they are unable to find the data matching what is stored on the PCB.