This is the twentieth and last in a series of short articles reviewing the theory and practice of making backups.

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Suppose a manager asks the security and operations staff the following questions:

“If backups are so important that you do a daily full backup, why don’t you do a full backup twice a day?”

“If taking a daily full backup is good enough for you, why don’t you save money by doing a full backup only every other day?”

To answer such questions, managers must be able to adjust the frequency of backups to the perceived risk. One of the ways of approaching a rational allocation of resources when faced with random threats is to calculate the _expected value_ of a strategy. The expected value is the average gain (if it's a positive quantity) or loss (if it's negative) that participants will incur in a process that involves random events. When this technique applies to losses over an entire year, it is called the _annualized loss expectancy_. This approach is used by insurance companies to balance the costs of premiums against the disbursements to customers.

For backups, the principle is summarized by the following equation:

$$E(x) = P(u) \times C(u) - P(n) \times C(n)$$

where

* $x$ is some particular strategy such as doing a daily full backup

* $E(x)$ is the expected value or cost of the strategy

* $P(u)$ is the probability of having to use the backup within a single day; e.g., 1 chance in a 1000 or 0.001

* $C(u)$ is the money saved by not having to redo all the work that would otherwise be lost if there were no backup; e.g., the cost of paying for reconstruction of the previous day's data (e.g., $9,000) + avoidance of lost business, wasted salary and other expenses during 3 hours of downtime during reconstruction (e.g., $30,000) for a savings of $39,000 per incident when the backups are available

* $P(n)$ is the probability of not having to use the backups at all in given day = 1 - $P(y) = 0.999$

* $C(n)$ is the cost of doing and storing a daily backup that won’t be used (e.g., $50).

Then the expected value of doing a single daily full backup using the figures used in the examples above is
\[ E(x) = (0.001 \times 39,000) - (0.999 \times 50) = 39 - 49.95 = -10.95. \]

In other words, the daily full backup has an average cost of about $11 per day when the likelihood of its use is factored into the calculations. This is equivalent to a self-insurance strategy to prevent larger disasters by investing money in preventive mechanisms and measures for rapid and less expensive recovery than possible without the backups.

If one adjusts the frequency of backups, the calculated loss expectancy can be forced to zero or even to a positive number; however, no self insurer makes a profit from loss avoidance measures. Nonetheless, adjusting the frequency and costs of backup strategies using the suggested factors and calculation of loss expectancies can help a data center manager to answer questions from management about backup strategies in a rational manner.

Unfortunately, no one can actually estimate precisely how much a disaster costs nor compute precise probabilities of having to use backups for recovery.

In many organizations, the volume of changes follows a seasonal pattern. For example, 80% of all orders taken might come in two two-month periods spaced half a year apart. Registration for colleges occurs mostly in the autumn, with another bulge in January. Boat sales and ski sales follow seasonal variations. Despite this obvious variability, many organizations follow the same backup schedule regardless of date. It makes sense to adjust the frequency of backups to the volatility of data: operations can schedule more frequent backups when there are lots of changes and fewer when the data are relatively stable.

For Further Reading


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