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ING Bank Down Ten Hours Due to Fire-Suppression Test September 2016

Fire-suppression testing strikes again. In 2010, WestHost, a major web-hosting company, was taken down for days by a fire suppression test, the noise of which damaged many of its hard disks.¹ On Saturday, September 10, 2016, a similar test disabled an ING data center in Bucharest, Romania, for ten hours.



It is common for data centers to use Inergen fire suppression systems, as the Inergen gas is non-destructive to electronic equipment. However, the noise of the release of the Inergen gas is explosive. Coupled with the noise of the sirens, the vibrations can generate hard-disk drive errors and in some cases even damage the disks. During a recent test of its Inergen fire-suppression system, this is exactly what happened to ING. It took ING ten hours to bring its data center back into operation.

Inergen Fire-Suppression Systems

Inergen fire-suppression systems work by releasing Inergen gas into the computer room. Inergen gas comprises 52% nitrogen, 40% argon, and 8% carbon dioxide. The normal air that we breathe contains 21% oxygen and 79% nitrogen.

In the event of a fire in a data-center room, enough Inergen gas is released to cause a 40% to 50% concentration of Inergen in the computer-room's air supply. This reduces the oxygen content in the data center room to 10% to 15%. This is a safe level for humans and allows time for data-center personnel to safely evacuate the data center. However, this level of oxygen is insufficient to support combustion. Therefore, the injection of Inergen into the computer-room air extinguishes the fire.

Unfortunately, the Inergen gas is released rapidly through nozzles located throughout the computer room. This rapid release of gas generates a great deal of noise. In addition, the fire sirens in the room add additional noise. There have been several incidents in which hard disk drives (HDDs) have been damaged during testing of Inergen fire-suppression systems.

Tests by Tyco, the manufacturer of Inergen, and by Siemens, the manufacturer of the fire-suppression systems, have determined that it is neither the Inergen gas nor the increased pressure from the gas that causes the disk damage. Rather, the HDD damage is caused by the noise generated from the gas discharge along with the accompanying noise of the warning sirens. In particular, the high decibel level of the noise, coupled with the high-frequency content of the gas discharge and the sirens, causes the disks to generate errors and, in some cases, to be damaged.

¹ Fire Suppression Suppresses WestHost for Days, *Availability Digest*, May 2010.
http://www.availabilitydigest.com/public_articles/0505/westhost.pdf

The ING Bank Fire-Suppression Test

On Saturday, September 10, 2016, personnel in ING's Bucharest, Romania, data center performed their yearly fire-extinguisher test. Their system is an Inergen system, and the test involved activating the system and flooding the data center with Inergen gas.

The pressure of the gas was higher than expected, and its discharge created an explosive din much larger than ING had experienced in previous tests. The clamor exceeded the capability of the bank's noise-measuring equipment, which topped out at 130 decibels. 130 decibels is equivalent to being fifty feet away from a jet aircraft taking off from an aircraft carrier with afterburner. The noise destroyed dozens of hard disk drives.

The bank had to rely on its backup data center a few miles away. However, due to the magnitude and the complexity of the damage, it took the bank ten hours to transfer operations to its backup data center. A cold start of the systems in its disaster-recovery system was needed. Furthermore, to be on the safe side, the bank took the time to make a copy of its database before restoring its systems.

The bank's website was knocked offline by the outage. Several financial transactions were affected over the weekend. ING's ability to notify customers about the situation was hampered by its email and text systems being taken down by the incident.

During this time, between 1 PM and 11 PM, local Romanian clients were unable to use debit cards, to withdraw cash from ATMs, or to perform online banking operations.

Why Are Hard Disks So Affected?

Sound is vibrations sent through the air. These vibrations cause the HDD cases to start to vibrate. The vibration is transmitted to the disk's read/write heads, causing them to go off their data tracks. The heads can also vibrate up and down, scratching the disk surface. If this happens, the disk is destroyed.

According to IBM, an HDD can tolerate less than one-millionth of an inch offset from the center of a data track. Earlier disk technology had much greater spacing. That is why these fire-suppression test failures are only now being seen.

This effect is graphically illustrated in an amusing YouTube video, "Shouting in the Data Center,"² in which a technician cups his hands and yells at disks. Monitoring software graphically shows the degradation in disk performance.

Best Practices

There are several steps that a company can take to avoid the consequences of a fire-suppression test gone wrong:

- Select less sensitive drives or solid-state disks.
- Enclose hard disks in noise-protected enclosures.
- Replicate critical data to off-site disks (on-site backup disks can be damaged).
- Select siren and gas nozzle locations that do not radiate directly on the disk drives.
- Muzzle the sirens during fire-extinguisher tests.
- Increase the number and decrease the spacing of suppression nozzles to decrease their sound levels.
- Avoid very short discharge times.
- De-energize equipment and let the disks park themselves before the test.

² http://www.youtube.com/watch?v=tDacjrSCeq4&feature=player_embedded

Summary

The activation of a fire-suppression system can create enough noise to seriously damage the servers' hard disk drives in the computer room. It is one thing to damage disks in a real fire with noise, as they may be damaged by the fire anyway. It is another thing to damage them when all you are trying to do is to test the fire-suppression system.

The first step is to be aware that fire-suppression testing can (and has) damaged hard disk drives. The next steps are to take precautions as listed above to ensure that this will not happen to you.

Acknowledgements

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Information for this article was taken from the following sources:

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ING Bank datacenter fire suppression system test knocks banking services offline, *ComputerWeekly*; September 13, 2016.