LEARNING MADE EASY

4th Stratus Special Edition

Virtualization

for dummies®
A Wiley Brand

What virtualization is

The different ways you can use virtualization

How availability solutions optimize virtualization

Brought to you by

Stratus®

AutomaTech®
Optimizing Industrial Operations

About Stratus

For nearly 40 years, Stratus Technologies has been supplying smart, result-driven technology and has become a key competitor within the Industrial Automation field and many more. Stratus solutions support companies in a wide range of industries including oil and gas, waste water management, and manufacturing. Though continuous availability is at the core of what Stratus offers, it is the simplicity of their solutions that make them even more valuable to customers. Stratus solutions:

- Take the complexity out of keeping business-critical applications running 24/7.
- Proactively prevent instances of unplanned downtime both in the data center and at the edge.
- Are simple to set up, use, and maintain without the complexity of IT resources.
- Are cost-effective – securing customer reputation and guaranteeing data integrity and compliance that otherwise could be ruined by downtime
- Integrate virtualization, continuous availability, and fault tolerance

The award-winning solutions from Stratus Technologies are a remarkably valued asset for Global Fortune 500 companies and small-medium sized businesses across the world.

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by Linda Hammer and Ken Donoghue

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Business Development Representative: Sue Blessing
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Table of Contents

Introduction

These days, most businesses use virtualization technology in some fashion. This book provides you with a brief introduction to the subject and helps you understand the various options regarding availability for virtualized environments. Knowing all this can help you create an action plan as you move forward with the next phase of your virtualization strategy.

About This Book

This book focuses on the importance of having the right hardware infrastructure underneath your virtualized environment. Here's why: With multiple virtual machines running on a single physical host, a hardware failure has much broader impact than the traditional one application/one server model. In today's always-on world where nearly everything is connected, ensuring availability of your physical infrastructure is especially important.

Icons Used in This Book

Throughout this book, you find a series of icons in the margins that help to flag special information.

REMEMBER

This icon alerts you to information that is especially important to remember.

TIP

This icon flags a shortcut or some information that's really useful.

TECHNICAL STUFF

This icon flags technical information that is helpful to know, but not really essential.

IN THIS CHAPTER

- Why virtualization has hit the mainstream
- Looking at virtualization's roots
- Using virtualization for important business tasks

Chapter 1
Virtualization: The Gift That Keeps Giving!

In the last few years, using virtualization has become standard practice in organizations of all types and sizes around the world. Its rise to mainstream has generated more conversations on the inevitable growth of edge computing solutions. And interestingly, although virtualization has been at the forefront of countless organizations, many forget that it was used in mainframe computers back in the 1960s.

But what has made virtualization so well received? Simple: cost and performance. Virtualization allows multiple instances of an operating environment to run on a single piece of hardware. These *virtual machines* — or VMs — run applications and services just like a physical server but without the cost of a physical server. So, by having multiple VMs on one physical host, you can support a lot more applications for a lot less money.

What Got Us Here?

Virtualization is the result of a natural evolution in the computing world and a response to growing economic pressures.

As you probably know, at one time, mainframes ruled the computer world. But a lot of organizations wanted more flexibility to carve up workloads for different departments or projects and give them dedicated resources for better performance and more capacity. This was the birth of *client-server* computing. Usually one application ran on one server accessed by many different clients (PCs). The emergence of x86 technology also made client-server computing cost effective.

But was it too much of a good thing? Before long, everybody in an organization wanted servers for his or her particular applications. That resulted in something called *server sprawl* — servers filling up every inch of the data center.

So, this is where the economic angle comes in. All those servers need power, and electricity isn't getting cheaper. A room full of servers generates a lot of heat, requiring more air conditioning. All of this drives up costs dramatically, which is bad enough in the best of times. During economic slowdowns, it wreaks havoc on the bottom line.

VIRTUALIZATION: A BRIEF HISTORY LESSON

TECHNICAL STUFF

Although it might seem like the latest and greatest thing in technology, virtualization is actually a venerable and well-established computing concept.

As long ago as the 1960s, IBM provided the capability to "timeshare" its mainframes. This concept, radical in its day, subdivided a machine, allowing multiple programs to execute within an operating system and share the operating system's resources (not too different from what Windows and Linux do today).

IBM then created the capability to run multiple virtual machines on its mainframes. Each VM looked exactly like the underlying physical machine, and each VM could have its own operating system.

Today, virtualization is no longer limited to mainframes; it's been turned loose into today's x86-populated data centers.

REMEMBER

Then virtualization for x86 technology came along — just in the nick of time. All of a sudden, one physical server could become multiple virtual servers, providing all the isolation and resources needed by each application.

Problem solved — partly.

Hey, This Stuff Works

Early on in the rise of x86 virtualization, there was significant doubt among IT and business people alike. Despite a compelling financial benefit, there remained big concerns. What if the virtualization layer (called a *hypervisor*) didn't work? Already, it was clear that many systems could fail with one fault in the virtualized environment.

REMEMBER

Therefore, organizations started out virtualizing only their nonproduction systems, like development and testing. But pretty soon, these organizations saw that the hypervisors delivered the stability and performance they needed. And they began virtualizing production workloads, too.

Where We Are Today: Business-Critical Applications

The benefits of virtualization — like lower costs, more agility, better hardware utilization — proved significant, so it wasn't long before IT organizations wanted to virtualize all their applications, including their most important ones. This task wasn't difficult, but the risks were now substantial. It meant putting a lot more faith in the hardware.

Would you trust running dozens of virtualized business-critical applications on the hardware you have today? Suppose you had 20 critical VMs on one server and it failed? How long would it take to fix the problem? And what would that downtime cost your business?

TIP

Now you understand: Hardware in virtualized environments is more important than ever. It simply must be available if you're going to trust it to host your most critical business applications.

IN THIS CHAPTER

- Getting to know the cloud
- Understanding where the cloud came from
- Looking at virtualization and the cloud
- Examining cloud limitations

Chapter 2
The Forecast Is Cloudy with a Chance of Confusion

Many of the technologies related to virtualization seem confusing, especially when companies recycle the same ideas with new names — like *cloud.* That's why it's important to cut through the fog and see how cloud computing really matters to you.

You Say Cloud, I Say Timesharing

It seems like a law was recently passed prohibiting any discussion, presentation, or book on IT that doesn't mention cloud computing. But what is it — really?

In a cloud, computing is a service that you can acquire as if from a utility. Instead of computing resources being local, workloads are processed on systems that could be anywhere. You get to them through a network connection, but their physical location doesn't

matter. The cloud service provider usually provides you with a service-level agreement for added assurance.


REMEMBER

Remember the timesharing concept in the early days of virtualization? Cloud computing takes timesharing to a whole new level because the pools of virtualized resources that are timeshared are much bigger today than was possible in the past. This allows organizations to use cloud computing to perform highly complex calculations using shared resources, which is much more cost effective than building and maintaining a local infrastructure.

Old Concept, New Technologies

Just like virtualization, cloud computing has its roots in the 1960s. Some computer scientists in the 1960s predicted that computation would be similar to an electric or telephone grid. In fact, many older IT diagrams included an image of a cloud, which represented the network. This is where *cloud computing* gets its name.


TIP

However, it took the Internet's ubiquity to make cloud computing practical. Using high-speed connections over long distances, nearly anyone could use public cloud services. And now, many organizations are bringing the cloud right into their own data centers. This *private cloud* concept is a great way to transform your IT organization into a service provider and offer cloud-based services to your internal customers.

The Role Virtualization Plays in the Cloud

Almost all cloud computing uses virtualization to make efficient use of resources. Whether the solution is a public cloud, private cloud, or a *hybrid* (combining public cloud, private cloud, and/or a noncloud environment), virtualization is the abstraction engine that moves things around in the cloud without impacting the applications or physical servers.

Limitations of Most Clouds

A lot of organizations are excited about cloud computing because it's so flexible and scalable — thanks to being virtualized. They can also save money with clouds compared to building out traditional infrastructures. But clouds have their limitations.

REMEMBER

First of all, moving applications into the cloud is tricky. In fact, it can be downright risky. Most applications require some level of work to operate properly in a cloud environment, and according to CloudTP, 50 percent of them need replatforming, or refactoring.

Then there's the matter of availability in the cloud. Traditionally, applications relied on the hardware to ensure availability. However, clouds are typically built on large numbers of commodity servers to keep costs down. Multiple points of failure in these systems are a given. That means the applications have to take care of ensuring availability — more work, more time, more expense, and more risk.

There aren't a lot of availability solutions for the cloud, and most that do exist are still immature. Virtual machines can be monitored and restarted on other hosts, but that takes time and risks data loss if you happen to have transactions going on during the restart. There are some open-source tools if you don't mind more custom development, lots of configuration work, and pulling your hair out to support them. Of course, you can rewrite your applications to build in availability capabilities.

And the truth is, not every application needs the same level of availability. So on top of everything else, you could face tedious scripting to create appropriate availability policies for each application.

IN THIS CHAPTER

- Using virtualization for everything
- Making sure your hardware is perfect for virtualization

Chapter 3
Virtually Everything

The exponential growth of computing power, the adoption of automated processes to replace manual tasks, the increasing cost to power a multitude of computers, and the need for greater agility to avoid business disruption — they all cry out for a more efficient way to run data centers.

Virtualization is a solution for many of these problems.

Not Just for Servers Anymore

Physical desktop computers and laptops are expensive to update and support.

Plus, a lot of people these days want to use their own device (like a tablet or smartphone) at work. Or they want to access their business applications from home.

REMEMBER

So why not create a bunch of desktops on the virtualization platform? Many organizations have done just that, with something called a *virtual desktop infrastructure (VDI)*. In fact, businesses are increasingly turning to VDI to improve security, meet compliance requirements, and regain enterprise-wide IT control while offering flexibility to users.

VDI usually involves creating individual desktop environments on virtualized servers running in the data center or cloud. A *connection broker* acts as the traffic cop, directing requests from users from across the enterprise to the right place in the VDI to get their personal desktops.


TIP

Core VDI components, such as the connection broker, are business critical. If the host servers supporting the virtual desktops fail, many users are affected and work comes to a standstill. Therefore, a resilient availability solution built to prevent server downtime should be part of your VDI deployment plan.

The virtualization craze also extends to storage, with many storage arrays and storage area networks now being virtualized. Whether you're talking about the desktop, storage, or anything else, all those things share the server as a common hub.


REMEMBER

With a virtual desktop, the applications and the majority of your data reside on a server. Storage is useless unless it can be accessed and processed through a server. This is why the availability solution you choose to protect the server is critical.

Hardware Expectations in a Virtualized Environment

Virtualization changes the traditional hardware expectations of IT shops. It used to be that most companies owned a few business-critical applications that necessitated highly available hardware, along with a bunch of less critical applications that ran on commodity servers.


REMEMBER

In a virtualized infrastructure, all those less critical applications become business critical because they're aggregated on a few physical servers running many virtual machines. So their loss has much greater business impact.

And it's not just your applications. The management components of your virtualized environment are equally important. If management services went down, you'd no longer be able to create and manage VMs or virtualized workloads, resulting in another source of costly downtime.

Because different applications have different availability requirements, it's important to have an availability strategy that properly aligns infrastructure with the application mix. This is the key to delivering service levels that match the criticality of each application.

IN THIS CHAPTER

- Examining the nines
- Introducing the fifth nine
- Knowing if you're fault tolerant
- Looking at how Stratus can help

Chapter 4
Application Availability in an Always-On World

The paradox of virtualization is that it removes hardware dependencies while making hardware more important. When an individual physical server must support many workloads, even noncritical applications become critical when viewed as part of the collective business process.

Although a number of solutions can improve the availability of applications, fault tolerance is the only way to ensure applications are always on.

The Nines

If 100 percent is perfection, then 99.999+ percent availability is the Holy Grail. What do most availability solutions attain? Try plain old 99 percent. That's right, an average x86 server will often deliver 99 percent availability for the service running on it. This may seem pretty good, until you consider what this means to your organization.

Two nines of availability (99 percent) means a system has unplanned outages totaling 87.6 hours a year — and you don't get to choose those hours. Now consider that, according to Aberdeen Group, an hour of downtime costs the average company $163,674.14. You do the math.

REMEMBER

It's relatively easy to go to three nines — 99.9 percent. All it takes is a good server with redundant power supplies, fans, a RAID array, and a habit of following good business practices. This will get you down to about 8.76 hours of unplanned downtime a year. That might seem like a big jump, but a day's downtime during peak processing periods can still wreak havoc on your bottom line.

Climbing up the scale to 99.95 percent uptime often involves cluster technology. Typically referred to as a *high availability (HA)* solution, clusters involve connecting two or more physical servers in a single network. If one server goes down, applications start up again on the other one. Some cluster solutions claim 99.99 percent (52 minutes of downtime a year), but this requires a really well-built cluster with an application that can failover very quickly. Many commonly clustered applications such as databases can't failover that quickly because they must check file integrity and replay transaction logs after the failure.

So, the Holy Grail for any system is five nines — 99.999 percent availability — which translates to a bit more than five minutes of downtime a year. In order to hit this number, you need to avoid system failure in the first place, rather than try to recover from it.

Understanding Fault Tolerance

Fault-tolerant systems do more than simply recover quickly following an outage — they work through faults and continue to run without disrupting applications at all. In that way, they prevent downtime from happening in the first place.

There are hardware and software solutions to achieve fault tolerance. Fault-tolerant hardware solutions consistently deliver 99.999 percent or better availability, which is less than 5 minutes of unplanned downtime a year.

REMEMBER

Software fault tolerance is similar, but different. This approach uses two industry-standard x86 servers running in parallel. The fault-tolerant software enables a single application to live on two virtual machines simultaneously — one on each physical server. If one VM fails, the application continues to run on the other VM with no interruptions or data loss. Simple as that.

So You Think You're Fault Tolerant

Even though most virtualization solutions have ways to handle server failures, they usually involve failing over and recovering or restarting on another host. Failover routines and restarting VMs require downtime — precious time business-critical applications can't afford to lose. It's better to prevent downtime from happening in the first place.

Failover techniques — typically using clustering — get you to a level of three to four nines. But they're not fault tolerant. A failure still occurs. To recover from a failure, applications must be restarted on a healthy system. In most cases, this requires applications that are *cluster aware* and may involve extra scripting by your IT staff. Yet, despite all this extra work and complexity, any data being written to disk when the failure occurs (otherwise known as *in-flight* data) is lost.

None of this is an issue in true fault-tolerant solutions. No additional configuration work or system modifications are necessary. You simply get downtime prevention and data protection right out of the box.

Stratus Helps Prevent Downtime

All fault-tolerant solutions aren't created equal. Some virtualization solutions emulate software fault tolerance but end up creating lots of overhead, which drags down performance. They're also typically limited in how many processor cores they support, which can be a problem for performance-intensive applications that require *multicore symmetric multiprocessing (SMP).* You need true fault tolerance to avoid performance problems and meet all your application requirements. That's where Stratus comes in.

Whether protecting select virtualized applications, an entire private cloud, or a hybrid environment, Stratus solutions can prevent downtime before it occurs and ensure uninterrupted performance of essential business operations.


REMEMBER

Stratus also provides excellent customer service. Stratus's team of availability experts are always available, providing proactive availability monitoring, management, and support around the clock, around the world.

IN THIS CHAPTER

- Looking for always-on software
- Finding fault-tolerant platforms

Chapter 5
Getting the Right Availability Where and When You Need It

System and application failures happen. That's a fact of life in IT. The question is how well your infrastructure handles the failures. This chapter discusses the important ways Stratus helps you get the availability you need, wherever you need it.

Always-On Software

Stratus's software-defined availability helps prevent downtime.

REMEMBER

Most other solutions rely on recovering from a fault, usually by failing over VMs to another host and restarting the application. That means there will be at least some downtime. But Stratus's software works right through failures, so you have continuous availability. No failover or restarts necessary.

Stratus's software uses something called an Availability Engine, which mirrors an application so it runs on two different servers at the same time. You can use almost any industry-standard x86 server and easily create VMs to run your apps.

If one of the servers has a problem, your applications continue to run on the other server while you fix the problem. There's no disruption to users and no lost data.

Fault-Tolerant Platforms

If you need a completely integrated, always-on solution, Stratus availability platforms could be the answer to your dreams. These fault-tolerant systems are known for maintaining continuous availability in some of the most demanding environments in the world.

Stratus platforms combine hardware, software, and service out of the box. There are two of everything on these platforms — CPUs, memory, I/O, disks, and power supplies — all working in synch as a single system. If a component fails, its twin component continues to operate without causing performance degradation, lost data, or downtime. There is absolutely no need to reboot or failover.

Stratus platforms are easy to set up and there's no need to modify your applications to run on them. Maintaining them is easy, too. Each platform has built-in software that automatically detects and prevents many causes of downtime.

The onboard software also enables remote service and support by Stratus availability experts. But if you ever do need to replace a component, Stratus will ship a new one to you overnight.

Components are easily replaced without specialized tools or computer skills — and, of course, without downtime.


TIP

Instead of relying on hardware availability or custom-written policies for each application, Stratus's software-defined availability approach lets you easily assign just the right availability environment to every type of application requirement on commodity servers.

IN THIS CHAPTER

- Don't build a house of cards
- Service is key

Chapter 6
Nine Things to Keep in Mind When Virtualizing Those Business Apps

Here are nine key things to keep in mind when virtualizing business-critical applications:

- **Remember that virtualization makes hardware more important, not less.** Even though virtualization is a software application, it enables you to run more systems on a single server — so the server becomes more important. If the server crashes, all the operating systems and applications (VMs) on that server come tumbling down as well.
- **Evaluate your current computing environment.** Your computing infrastructure is made up of a wide variety of applications — some mission-critical, some important to daily work tasks, and some that are called on during peak periods. Virtualization is a good opportunity to take inventory and figure out how many of each type you have.

- **Keep your nines in mind.** When it comes to servers, the important number is nine. With standard availability of 99 percent, you can expect to have days of downtime every year — instead of the 5 minutes or less you can get with 99.999 percent availability from Stratus.
- **What level of availability is right for you?** Clusters recover after failure has already occurred; their tragic flaw is that they don't prevent failure from happening in the first place. Stratus always-on solutions help prevent downtime in the first place with multiple hardware and software resources running in parallel. If one resource fails, another is already working on the same instruction and transparently continues operating as normal.
- **No modifications required.** With such powerful always-on platforms and software, it's easy to think that you would have to modify your applications to take advantage of them. Not so with Stratus, where you can immediately take advantage of its platform and software-defined availability solutions without changing a thing.
- **Remember the role service plays!** A resilient availability platform is just one piece of the pie. If a problem does arise, it's nice to know that Stratus availability experts can remotely resolve it for you, so you can sleep soundly.
- **Long live those legacy apps.** Another benefit of virtualization is the capability to continue using legacy applications running in older operating environments that may no longer be supported. You can simply load those legacy apps onto a virtual machine and continue running them without a problem. It's a great way to extend the life of older applications and avoid costly migrations.
- **Don't overlook virtualization management.** The ease of creating new virtual machines has led to a new term: *VM sprawl,* referring to the fact that virtualization can make new systems multiply like rabbits. That's why it's important to use an appropriate virtualization management tool and configure it on a platform that ensures management capability is always available.
- **Plan your end-of-project party!** This phase of your virtualization project is the easiest one of all. Use the time and money you've saved to hire the best caterer, bartender, and entertainment.

Notes

Notes

Simplifying Edge Computing from the Plant Floor to Remote Sites

Stratus ztC Edge

Processor	Intel Core i7, 4 hyperthreaded cores
System Memory	32 GB
Storage	512 GB SSD
System I/O	HDMI Ethernet: 4 x 1 GbE (2 available for user applications) USB: 8 x USB 2.0
OS	Stratus Redundant Linux (with virtualization)
Temperature	–40 to +60 °C (0 to +50 °C if using provided AC adapter)
Humidity	10% to 95%, non-condensing
Vibration	3 Grms (5-500 Hz: X, Y, and Z directions)
Dimensions	280 mm (11.02 in) x 190 mm (7.48 in) x 76 mm (2.99 in)
Weight	4.6 kg (10.2 lbs.)
Certifications	CCC, CE, FCC, ICES, RoHS, UL, VCCI
Installation	DIN rail, wall, or table top
Power Input	9 to 36 VDC
Power Consumption	35W

OT and IT pros prefer ztC Edge because it's:

- **Simple** with built-in redundancy and virtualization software
- **Protected** with seamless failover and single button restore
- **Autonomous** with self-monitoring and remote management

Learn more or request a demonstration today.

www.stratus.com/ztc
800.787.2887

Better availability, lower costs, and a simple way to get there

Virtualization has been around for longer than you think — it's become a matter of course for most businesses to work with some aspect of virtualization. This book provides you with a brief introduction to the subject, discusses cloud technology, and helps you understand the various options regarding availability. Knowing all this can help you create an action plan as you move forward with the next phase of your virtualization infrastructure.

Inside...

- Why virtualization has and will continue to grow
- How the cloud and virtualization relate
- The importance of fault tolerance
- The different levels of service and availability
- Tips to keep in mind when virtualizing business apps

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