# Oracle High Availability, Disaster Recovery, and Cloud Services

Explore RAC, Data Guard, and Cloud Technology

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Apress®

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# About the Authors

**Yenugula Venkata Ravi Kumar (YVR)** is an Oracle ACE Director and Oracle Certified Master (OCM) with 21+ years of experience in the banking, financial services, and insurance (BFSI) verticals. He has played various roles such as vice president (DBA), senior database architect, and senior specialist production DBA. He is also an OCP in Oracle 8i to 12c and Oracle certified in GoldenGate, RAC, performance tuning, and Oracle engineered systems (Exadata and ODA).

He has written 100+ articles for the Oracle Technology Network (in Spanish, Portuguese, and English), OraWorld, UKOUG, OTech Magazine, and Redgate. He is an Oracle speaker at @OOW, @IOUG, @NYOUG, @OTN, @AIOUG, @Sangam, and @SOUG. He designed, architected, and implemented the core banking system (CBS) database for the central banks of two countries, India and Mahe, Seychelles. He also coauthored *Oracle Database Upgrade and Migration Methods*, published by Apress.

**Nassyam Basha** is a technology expert with 11 years of Oracle Database experience. He holds a master's degree in computer science. In 2014 he became an Oracle Database 11g Certified Master. Nassyam was honored with the title of Oracle ACE Director in 2015 based on his extraordinary contributions to the Oracle community. He was the second Oracle ACE Director in India in the area of database management. He is board member of the Oracle RACSIG team. He actively participates in Oracle-related forums, such as OTN, Oracle Lists (with the status of Super Hero), and Oracle Support (with the title of Guru), and acts as an OTN moderator. He has deep knowledge in the business fields of finance, retail, health, manufacturing, and consulting.

He started his career with dBase and FoxPro, and participated in several projects with FoxPro and Oracle Database from Oracle 7. He currently works as a database expert with eProseed. Nassyam co-wrote his first book on Oracle Data Guard 11gR2 in 2013 and co-wrote *Oracle Database Upgrade and Migration Methods* in 2017. He has written more than 50 articles and published in OTN, IOUG, Oracle Scene, and various other portals on technologies such as Data Guard, EM 13c, RAC, Oracle Cloud, 12c DB, GDS/GSM and sharding technologies.

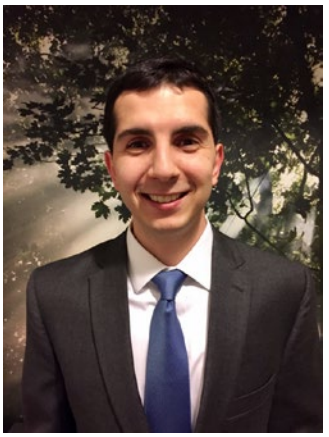
In 2012 Nassyam started presenting at various user group conferences, such as OTN Yathra, AIOUG Tech Days, and SANGAM, and appeared at international conferences such as OOW, TROUG, and OUGF. Nassyam maintains an Oracle technology blog (www.oracle-ckpt.com). Feel free to contact him at nassyambasha@gmail.com.

**K M Krishna Kumar** is a database administrator with 14 years of experience with Oracle Database (8i to 18c). He has a master's degree in business administration from Anna University. He started his career in 2004 as an Oracle database administrator and has been working with Oracle Corporation for the last eight years. He has expertise in Oracle Database installation, patching, upgrades, migration, Data Guard, RMAN, RAC, backup, and recovery. He is also proficient in Oracle public, private, and hybrid cloud environments. He is an Oracle 11g and 12c certified professional on an Oracle Cloud infrastructure. He has delivered presentations to customers through various channels. He actively participates in Oracle-related forums such as OTN communities. He is a Oracle speaker at @Oracle Open World, @OTN, @AIOUG, and @Sangam. He coauthored the book *Oracle Database Upgrade and Migration Methods*, published by Apress. He is reachable at kmkittu2005@gmail.com.

**Bal Sharma** works for Oracle America as a product manager of Oracle Cloud infrastructure. He is an Oracle Certified Professional (OCP) with 14 years of experience across various industries such as telecom, healthcare, financial services, and insurance; he has played various roles such as database manager, technical lead DBA, and content architect. He holds several certifications across the Oracle Cloud infrastructure and Oracle 10g/11g/12c, is certified in RAC and Oracle Exadata, and has a deep understanding of information technology and public cloud services. In his recent role, he advises customers on the adoption of cloud platforms, digital transformation, and database technologies such as high availability and engineered systems on the Oracle Cloud infrastructure. He is also setting up a database and infrastructure strategy for the largest banks and telcos in India and the United States and has led various complex implementations at top banks and telcos in India.

Bal is an avid technologist and believes customer satisfaction is of prime importance. His work with customers such as the State Bank of India, HDFC, Idea Cellular, and the Reliance Group is a testimonial for this.

Besides this, Bal enjoys cooking for friends and family.



**Konstantin Kerekovski** is an Oracle professional with more than six years of experience in the financial services industry. He is a member of the Independent Oracle User Group, Suncoast Oracle User Group, and New York Oracle User Group. He has worked as a senior and lead database administrator with production support duties in the financial services industry. He was a speaker at the OOW 17/18 IOUG 17/18, SOUG, and NYOUG meetings. He is an expert at Oracle Real Application Cluster technologies, ASM, GoldenGate, and Oracle 11g and 12c.

# About the Technical Reviewer

**Arup Nanda** has been working in database management for 25 years and counting. With 6 books, more than 700 published articles, and 500 presentations in 22 countries, he is well known in the database area in general and Oracle technologies in particular. Today he is the chief data officer of Priceline.com in the New York area. He blogs at `arup.blogspot.com`.

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**—Y V Ravi Kumar**

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**—Konstantin Kerekovski**

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**—Krishna Kumar**

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**—Bal Sharma**

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**—Nassyam Basha**

CHAPTER 1

# Introduction to High Availability and Disaster Recovery with Cloud Technology

Welcome to the world of high availability and disaster recovery. It is high time for us to learn about database software high availability concepts. Software has become an essential element in today's world. Almost all businesses in every industry have started using software to complete their business tasks more efficiently. In fact, some professions are completely dependent on software; they get all of their tasks done using software. On the other hand, there are some industries such as the manufacturing sector that use software for only a portion of their life cycle. But anyhow all businesses should be trying to utilize software to automate their work as much as possible.

Consider how the banking system has improved using software. In the past we had to visit a bank in person and conduct a transaction with the help of bank staff members. It took a lot of manual effort and time to conduct a transaction. Now, the banking system has been completely reformed and automated with most of its functions being done using software. Their tasks are automated with automatic teller machines (ATMs), which in turn has helped to build high-quality banking products. All banks now have websites that work 24/7, and customers are able to complete banking transactions without the involvement of bank staff members. All this has become possible because of the evolution of software.




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Another example is the manufacturing industry where human attention is mandatory at each phase of production work, but the industry uses software for data analysis, management, auditing, and wherever else it is possible.

Now we know about the influence of software in almost all businesses, but software runs on hardware. So, how much can an industry trust the availability of the software it is using? If something goes wrong with the hardware and that affects the software, then how will the business survive? If something happens to the environment where the software and hardware are hosted, then what will happen to the application? These questions insist on the necessity of Hardware & software's *high availability* and *disaster recovery*. With the booming software influence, Achieving high availability and disaster recovery is mandatory for any industry. Having high availability and disaster recovery denotes the capability of running a business continuously without any disruption or irrespective of any damages or planned maintenance in the environment.

Let's discuss an example explaining the necessity of high availability and disaster recovery. Suppose a bank needs to migrate its data to a new data center. We know that migration may require downtime, but the bank cannot afford downtime; that will affect its business a lot. This is not only for banks. In this competitive world, none of the industry can afford downtime to its business. Customers look for vendors that are capable of providing continuous service around the clock. So, the bank has to look for options to do migrations without any downtime.

Along with maintenance tasks, there could be a chance of other, unpredicted disruptions that may affect the software's availability. Natural disasters like earthquakes may affect the site where the hardware is located, and the building that has the physical server in it may collapse. This might be rare, but we cannot completely ignore this factor. When a disaster happens, we will not be able to access the physical servers; hence, the Application is not accessible, and the business cannot continue. That is unacceptable! Our environment design should be robust to handle these kind of situations. To be proactive, we need to set up alternate plans to be able to overcome the impact of an earthquake or any fire or server crash that affects your physical servers located in the data center. Remember when the World Trade Center in the United States was bombed in 2001. The companies located on that campus lost their physical servers, but that did not stop them from running their businesses. They came online and started serving customers within a couple of hours. How was that possible? What did they do to overcome such a situation? We can get answers to all these questions in this book. We will be discussing Oracle Database and its high availability concepts.

In addition, we will find many best practices that can be followed in our industry to make our data safe. This book also covers the Oracle public cloud. Enjoy reading!!!

## Why High Availability?

Before proceeding into high availability, let's discuss what we are trying to achieve with high availability. Businesses in all industries rely on data, be it the software, medical, or insurance industry. Take, for example, a hospital. A patient's record is precious data. In the past, the data was seen just as a record, and it was used for querying purposes and to derive an annual progress report. Now data is not seen like that; it undergoes a data mining process, and many manipulations are done using the mining results. *Data mining* refers to extracting and discovering knowledge from large amounts of data stored in a database. For a hospital, data is required not only to calculate an annual financial sheet but to analyze how it has performed in the past and to predict how it will be doing in the future. This analysis can proactively find out whether any existing policy requires changes to make a better future. In fact, many industries mine their historical data and generate statistics using various algorithms to predict future business opportunities.

Another good example is the telecommunications industry, which mines its historical data and finds out customers' favorite phone plan, customers' calling behavior, ways to improve the quality of the service, and ways to achieve better customer retention and satisfaction. You probably have noticed many phone providers have introduced wallets recently to avail of their service. This is one of the promotions they invented after mining their historical data.

Another best example is e-commerce sites. When we purchase or review any item on a web site, it records the details in the background, and the next time we log into that site, we see items related to our past searches. Customers' favorites are the data.

Having discussed the importance of the data, now we know why the data has to be secured. That means the data has to be highly available in any circumstance.

Let's discuss the high availability options one by one. At first when industry required high availability option, they started looking at backup and restore strategies for their data. If they lose data, they can restore it from a backup. They had invested in creating remote backup storage, creating network connectivity for backup storage, taking backups of data regularly to the storage, and then periodically validating the stored backups. See Figure 1-1.

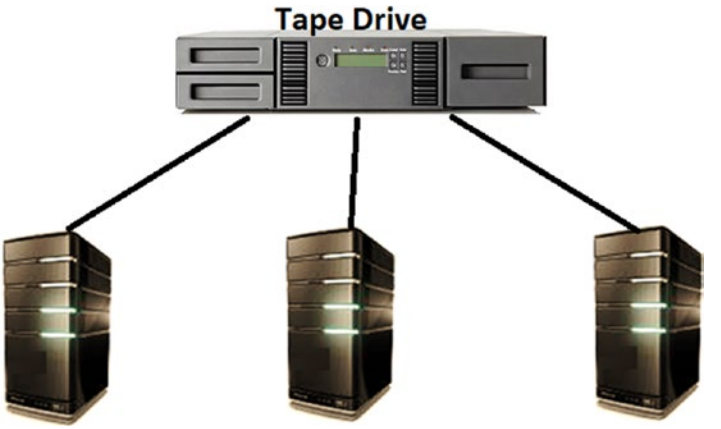


***Figure 1-1.*** *Data backup to tape drive*

Low-cost media tape devices are commonly used as remote storage to store backups for restoring. In addition to being used for restore purposes, the backup is used in the development or preproduction environment for testing purposes.

Even now the backup/restore method is a standard practice that is used across many industries for securing data. But there are some challenges while dealing with backup/restore. Suppose there is a hardware failure or disaster and the current system crashes, then the data is not available, so a backup needs to be restored on the same or different system or in a different data center, based on the conditions. If you choose a different system, then an additional set of storage, memory, and other resources needs to be purchased, and then backup can be restored there. But it will take time to configure the environment. We need to install all the dependent operating system packages for our databases and then restore the backup. Also, the new environment should have access to the backup storage. Here the main concern is the time required for restoring the backup. Restoration will take time based on the volume of the data. But practically any organization cannot afford downtime to restore a backup while it is undergoing a disaster. Consider any international bank—their business cannot afford a single minute

of downtime to customers. So, they need an alternate solution. In addition to downtime, there are many challenges while dealing with backups.

- Suppose your database size is huge. Then the backup size will also be huge. It will take more time to restore that big database.
- If there is a failure with the restoration process, then you need to start it again from the beginning, which will increase the restoration time.
- The restoration process performance should be appropriate.
- There is a chance that a backup piece might have gotten corrupted physically, which means we don't have valid backup.
- When our backup storage is at a remote location and network bandwidth with the remote location is poor, then the restore will take a long time to transfer.
- To access the backup storage, we may need help from storage administrators and system administrators along with database administrators.

In addition, at regular intervals, we should perform restore and recovery testing to ensure the integrity of the backup else we might end up in trouble. What if you don't validate your backup and it doesn't restore properly when we need it. In other words, the backup is not fulfilling its purpose. Another issue with backups is storage media failure. Suppose the site with the backup has met a disaster. Then we don't have any backup for our database, which is an unsafe position.

The next challenging point with backups is determining a retention period. How much backup can we store for your database? Suppose we have the need to restore data up to one week before, as an undesirable change has been made a week ago, and we need to restore the backup to get your database to that point. In that case, we should have backups from a week ago. Remember, the database size will keep increasing every day, so the backup size increases daily. So, we need to do a thorough study about the environment and make a proper judgment about the backup retention period. Having a high retention period will increase the need for more storage.

In addition, we have to choose the right backup media. Storing the backup on disk is expensive. We need to look for low-cost storage like an SBT tape. Currently many customers have started moving backups to cloud object storage.

This discussion shows that we cannot fully trust a backup. We need something beyond the backup to confirm that our environment is safe. Here comes the high availability (HA) and disaster recovery (DR) concepts as our savior. In this method, a similar environment as production/live will be maintained at a remote location, and it will play a role if a disaster strikes. This means we will have a copy of the data at another location, and any changes made in production will get replicated to that secondary site. When there is a disaster situation, we don't need to perform a restore/recovery from backup; instead, we can connect the replicated environment and starting working on that.

By having a replicated high availability environment, we will get the following benefits:

- The secondary environment can be switched to the live environment at any time. The replicate environment is similar to production from a hardware and software configuration perspective. So, it can serve the same workload as production was serving. See Figure 1-2.

***Figure 1-2.*** *Data replication*

- During a nondisaster period, the replicate environment can contribute as a reporting database as it has live data within it. This reduces the workload for the production database.