



Deployment guide:

*Configuring a highly
available Microsoft®
SQL Server® 2012
environment on a
Dell™ PowerEdge™ VRTX*



A Principled Technologies deployment guide commissioned by Dell Inc.

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INTRODUCTION

When considering a highly available solution for your business' database needs, choosing the Dell PowerEdge VRTX over a traditional hardware combination of servers, networking, and storage can save your IT administrator lots of configuration and management time. The new Dell PowerEdge VRTX shared infrastructure offers a compact solution for small businesses or remote offices that is easy to configure, delivers the performance they require, streamlines management and maintenance, provides all necessary hardware resources in one spot, and keeps important database workloads running.

In this guide, we take you through the simple, straightforward process of setting up a highly available Microsoft SQL Server 2012 environment through the AlwaysOn Availability Groups feature on the Dell PowerEdge VRTX. We set up this environment on the VRTX in our labs, so we provide each step we took along with any best practices we recommend. First, read more about the components of the Dell PowerEdge VRTX. Then, continue on for overview of how to configure a Microsoft SQL Server 2012 environment (for detailed steps, see the corresponding appendices).

ABOUT THE COMPONENTS

About the Dell PowerEdge VRTX

The Dell PowerEdge VRTX is a shared infrastructure solution in a 5U rack-able tower chassis. Designed to be quiet under normal operating conditions, the Dell PowerEdge VRTX can be stowed under a desk in a small office without disrupting conversations. Its four bays house M520 or M620 compute server, providing a space-saving alternative to having four separate tower or rack servers. In addition to space savings, the Dell PowerEdge VRTX provides administrators with a unified interface, the Chassis Management Controller (CMC), for performing routine systems management tasks. The Dell PowerEdge VRTX chassis supports up to 48 TB of shared internal storage that is presentable as virtual drives to single or multiple compute nodes, and provides optional pass-through and eight PCIe slots for additional device connectivity. The chassis integrated storage can be configured with 25 bays for 2.5-inch drives or with 12 bays for 3.5-inch drives. The Dell PowerEdge VRTX integrated switch contains multiple external network ports for easy expansion or integration into any computing environment.

For more information about the Dell PowerEdge VRTX, visit www.dell.com/powerededge.

About the Dell PowerEdge M620 server nodes

The Dell PowerEdge M620 has features optimized for performance, density, and energy efficiency.

- **Processors.** The Dell PowerEdge M620 is powered by two Intel® Xeon® E5-2600-series processors, which incorporate the very latest in processor technology from Intel. The powerful processors provide the performance you need for your essential mainstream tasks. The Intel Xeon E5-2600-series processor gives you up to eight cores per processor or up to 16 cores per server.
- **Memory.** The Dell PowerEdge M620 holds up to 768GB DDR3 RAM (up to 1600 MHz) across 24 DIMM slots per server node.
- **Management.** The Dell PowerEdge M620, like all late-model Dell servers, comes with the Dell Lifecycle Controller. This tool simplifies server management by providing a single interface for management functions and by storing critical system information in the system itself. There are no CDs or USB keys to monitor for drivers or firmware.

About the Intel Xeon processor E5 family

The new Intel Xeon processor E5 family, which comes standard in new Dell PowerEdge servers, incorporates new technology and features to meet the computing demands of the present and future. The Intel Xeon processor E5 family delivers intelligent and adaptive performance using such features as Intel Turbo Boost Technology 2.0, Intel Advanced Vector Extension, Intel Integrated I/O, and Intel Data Direct I/O Technology. These new processors also feature Intel Trusted Execution Technology (Intel TXT) and utilize Intel Advance Encryption Standard New Instructions (Intel AES-NI) to help keep your data safe.

For more information about the Intel Xeon processor E5 family, visit

www.intel.com.

About Microsoft Windows Server 2012

Windows Server® 2012, the latest release of this server OS from Microsoft®, includes many new features and enhancements. According to Microsoft, Windows Server 2012 focuses on four core areas:

- **Beyond virtualization.** Windows Server 2012 provides a robust and dynamic virtualization platform through Hyper-V®, and includes new features that provide flexible options for delivering cloud services.

- **The power of many servers, the simplicity of one.** Windows Server 2012 offers features that allow for high availability and ease of management for multiple-server infrastructures.
- **Every app, any cloud.** Windows Server 2012 delivers a scalable and flexible Web and application platform by providing a consistent and open set of tools and frameworks that apply to applications on premises, in the cloud, or in a hybrid environment.
- **Modern work style, enabled.** Microsoft Windows Server 2012 empowers users and IT staff with remote access to data, applications, and simpler management tools while strengthening security and compliance.

About Microsoft SQL Server 2012

SQL Server 2012 is the latest release of Microsoft's database management platform. Microsoft has added new features to enhance performance, security, and management. SQL Server 2012 introduces Data Quality Services (DQS) to improve the usability of collected data, both locally and from cloud-based data service providers. In addition, SQL Server 2012 is more tightly-integrated with both Microsoft Office client applications and with Microsoft SharePoint® Server, providing greater usability.

For more information about Microsoft SQL Server 2012, visit

www.microsoft.com/en-us/sqlserver/default.aspx.

WE SHOW YOU HOW – INSTALLING SQL SERVER 2012 ON THE DELL POWEREDGE VRTX

Prerequisites for this guide

This guide assumes that you will be deploying virtualized instances of Microsoft SQL Server 2012 onto a Windows Server 2012 with Hyper-V Failover Cluster. We recommend this configuration as it takes advantage of both guest-level and application-level high availability features. For instructions on how to create a failover cluster using Microsoft Windows Server 2012 with Hyper-V, see the companion failover cluster deployment guide at

www.principledtechnologies.com/Dell/VRTX_failover_cluster_0613.pdf.

Creating and clustering the virtual machines

In this section, we detail how to create two virtual machines through Failover Cluster Manager, which we named SQL1 and SQL2, respectively, and create a cluster out of them. For complete details, see [Appendix A](#).

Before beginning these steps, make sure the virtual switch in each physical server node has the same name.

1. In Failover Cluster Manager, add two virtual machines to the cluster, and store their virtual hard disks in the clustered storage, as Figure 1 shows.

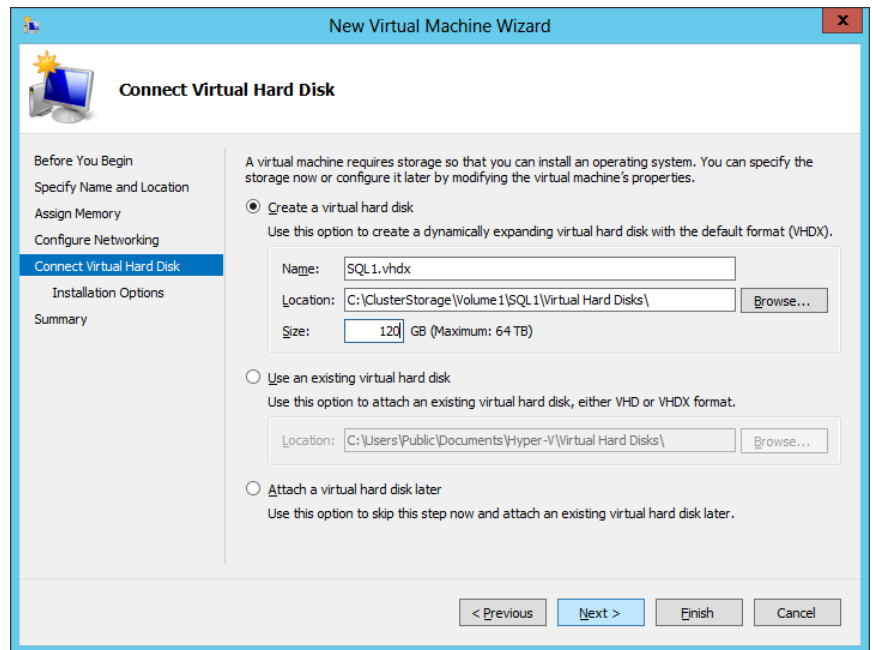


Figure 1: Storing virtual hard disks to a clustered disk.

2. Once you have created the two VMs, complete the following steps on each:
 - a. Install Windows Server 2012 Datacenter with GUI.
 - b. Assign login credentials, and provide an appropriate static IP address. This IP address should be in the same IP scheme as your existing network.
 - c. Give an appropriate name, and join it to the existing domain.
 - d. Restart the VM, and log into an appropriate domain user with administrator privileges.
 - e. Install the Failover Clustering role and .NET Framework 3.5 features.
3. On each VM and on each physical server node, open Windows PowerShell, type `Get-NetAdapter -name * | disable-NetAdapterChecksumOffload` and press Enter.

4. Create a cluster out of the newly created VMs, and provide it with an appropriate IP address.
5. (Optional) If you wish to house the SQL databases on a separate virtual drive, create and attach an additional virtual hard disk to each of the VMs. To do this, log into one of the Hyper-V host server nodes, right-click on each VM in Failover Cluster Manager, and edit the settings. Be sure that the virtual hard disk is stored in a cluster shared volume.

Installing SQL Server 2012 instances

In this section, we describe how to install SQL Server 2012 instances on the two VMs. We used SQL Server's AlwaysOn Availability Groups feature to provide high availability to the SQL instances. For this method, you will install standalone SQL Server instances on each VM and then create a Database availability group out of them. When deploying SQL Server in a domain, do not make the SQL Server service domain accounts members of the Domain Administrators group; grant only the necessary rights on the local server to the SQL Server service account as part of your pre-installation planning. The SQL Server installation software creates the local groups it needs for security purposes. Perform the following steps on each VM. For complete details, see [Appendix B](#).

1. Attach the SQL Server 2012 installation DVD to the VM.
2. Begin setup, and start a new SQL Server stand-alone installation.
3. Go through the installation wizard and at the Feature Selection screen, include the appropriate features for your deployment. For a basic deployment, we selected:
 - Database Engine Services
 - SQL Server Replication
 - Full-Text and Semantic Extractions for Search
 - Client Tools Connectivity
 - Client Tools Backward Compatibility
 - Management Tools – Basic
 - Management Tools – Complete
4. Assign an appropriate name to the SQL instance. On the first installation, you may choose to install the default instance, but will need to choose Named Instance and provide a name for any subsequent instances.
5. Configure the credentials of the SQL Server service account and SQL Server Agent accounts.

6. Specify SQL Server administrators and a password for the system administrator account, and specify the authentication mode for your configuration. For our configuration, we selected Mixed Mode authentication.
7. Complete the installation, and restart the server if the installation prompts you.

Configuring the AlwaysOn Availability Group

In this section, we show you how to create a new AlwaysOn Availability Group on the two VMs. You must migrate your databases to each of the SQL VM instances in step 2 of this section before you can enable AlwaysOn. See below for additional information and resources. Complete the following steps. See [Appendix C](#) for further details.

1. In each SQL Server VM, open SQL Server Configuration Manager, and Enable AlwaysOn Availability Groups for the SQL Server service. Decide which SQL Server VM instance will serve as your primary instance, and which instance will serve as your secondary instance.
2. Migrate any databases to each SQL instance on each VM. Please note:
 - We recommend migrating your databases offline through the backup and restore method, as outlined at <http://technet.microsoft.com/en-us/library/ms187048.aspx>.
 - When you restore the database to the secondary instance, use RESTORE WITH NORECOVERY. For example:

```
RESTORE DATABASE <database name>
FROM DISK = N'\\<backup location>\<database>.bak'
WITH NORECOVERY
```
 - If you are running SQL in mixed mode, you must migrate your SQL Logins. For more information on how to do this, see <http://support.microsoft.com/kb/918992>.
3. From the primary instance, launch the New Availability Group Wizard.
4. Specify the secondary instance as a replica (see Figure 3), and create an availability group listener. This will assign a virtual network name that allows client connections to the database on the appropriate instance within the availability group.
5. Select the appropriate type of data synchronization for your configuration and finish the wizard. Here, we used the Join only data synchronization type. See <http://msdn.microsoft.com/en-us/library/hh231021.aspx> for more information on the multiple data synchronization types.

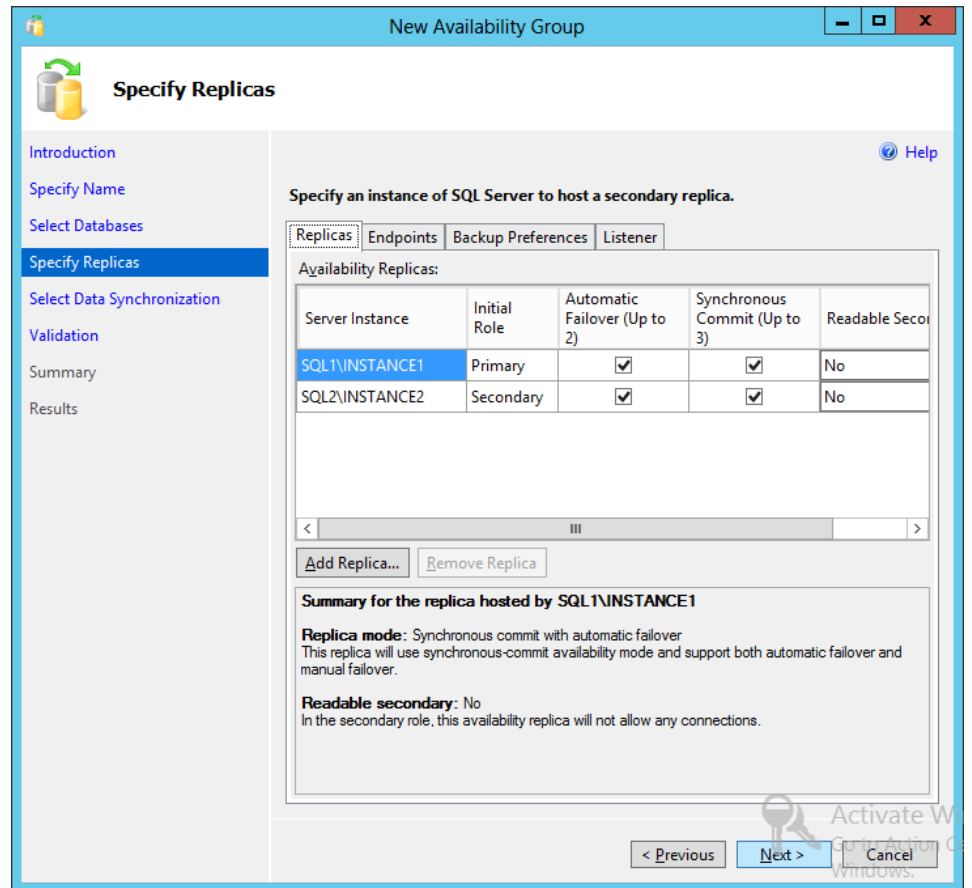


Figure 3: Configuring availability replicas.

SUMMING IT ALL UP

As this guide has shown, setting up a highly available Microsoft SQL Server 2012 environment on the Dell PowerEdge VRTX is a straightforward process. In little time, you can deploy Dell PowerEdge VRTX with up to four M-series servers, switches, and storage in a redundant configuration using Microsoft Windows Server 2012, and set up your SQL Server infrastructure. By setting up a highly available SQL Server 2012 environment on your compact PowerEdge VRTX, you can ensure your database workloads stay running to keep your business moving.

APPENDIX A – CREATING AND CLUSTERING THE VIRTUAL MACHINES

In this section, we show you how to create two virtual machines through Failover Cluster Manager, configured their names and IP addresses, and created a cluster out of them for the SQL Server availability group.

If you haven't created a virtual switch in each host with identical names yet, follow the steps below in each physical server node.

1. Open Hyper-V Manager, and click Virtual Switch Manager.
2. In the left pane, select New virtual network switch. Leave External selected, and click Create Virtual Switch.
3. Enter a name for the virtual switch. This name must be identical between both nodes. We used the name `VirtualSwitch`. Use the drop-down menu to select an adapter that can communicate with the Active Directory domain controller. Click OK.
4. Close Virtual Switch Manager and Hyper-V Manager.

Perform the following steps twice on one of the physical nodes to create each virtual machine.

1. In Failover Cluster Manager, click Roles.
2. In the right pane, click Virtual Machines → New Virtual Machine.
3. Select a node to install the VM on, and click OK.
4. At the Before You Begin screen, click Next.
5. At the Specify Name and Location screen, verify that the location is on clustered shared storage. Provide an appropriate name for the VM, and click Next. We used the names `SQL1` and `SQL2` for our VMs.
6. At the Assign Memory screen, enter an appropriate amount of Startup memory, and click Next. We provided ours with 4096 MB.
7. At the Configure Networking screen, provide the virtual switch from earlier in the Connection field, and click Next.
8. At the Connect Virtual Hard Disk screen, create a new disk, enter a size, and click Finish. For our testing, we created a 70GB disk. Note that you may need to allow for more space if you choose to host the databases on the same virtual drive. Alternatively, you can add additional virtual hard disks later on to host the SQL databases.
9. At the Summary screen, click Finish.

Perform the following steps on each virtual machine.

1. In Failover Cluster Manager, right-click the VM and click Settings.
2. In the left pane, click DVD Drive.
3. Select the image file or the DVD drive containing the Windows Server 2012 installation media. The VRTX DVD drive can be mapped to different server nodes using the chassis display.
4. Click OK.
5. Right-click the VM, and click Start.
6. Follow the on-screen instructions to install Windows Server 2012 Datacenter with GUI.
7. After the VM restarts, log into Windows.
8. In the Local Server page of Server Manager, click the hyperlink next to Computer Name.
9. In the Computer Name tab, click the Change... button.
10. At the Computer Name/Domain Changes screen, provide a reasonable name for the VM and join the pre-existing domain. We used the names `SQL1` and `SQL2`. Close this window.
11. In the Local Server page of Server Manager, click the hyperlink next to the network adapter name.
12. At the Network Connections screen, right-click the network adapter, and click Properties.
13. Select Internet Protocol Version 4 (TCP/IPv4), and click Properties.
14. Provide appropriate IPv4 configurations to each VM. We gave `SQL1` an IP address of `192.168.1.21`, and `SQL2` an IP of `192.168.1.22`.
15. Restart the VM, and log in with domain administrator credentials.
16. In Server Manager, click Manage→Add Roles and Features.
17. At the Before You Begin screen, click Next.
18. At the Installation Type screen, click Next.
19. At the Server Selection screen, select the current server, and click Next.
20. At the Server Roles screen, click Next.
21. At the Features screen, click the boxes for .NET Framework 3.5 Features and Failover Clustering, and click OK in any popup windows that appear. Click Next. (You may be required to point the installation wizard to the Windows Server 2012 installation media to install .NET Framework 3.5 Features.)
22. At the Confirmation screen, click Install.

23. Close the wizard when installation completes.
24. On any of the two new virtual machines, click Tools→Failover Cluster Manager.
25. Click Validate Configuration.
26. At the Before You Begin screen, click Next.
27. In the Select Servers or a Cluster screen, enter the names of each of the two virtual machines to be included in the guest cluster in the Enter name field, clicking the Add button after each. Click Next when finished.
28. At the Testing Options screen, click Next.
29. At the Confirmation page, click Next.
30. After the testing completes successfully, make sure the Create a cluster now using the validated nodes box is checked.
31. Click Finish.
32. At the Before You Begin screen, click Next.
33. At the Access Point for Administering the Cluster screen, give the cluster an appropriate name, an appropriate IP address, and click Next. We used the name `SQLCluster` and an IP address of `192.168.1.150`.
34. Click Next.
35. At the Confirmation screen, click Next.
36. At the Summary screen, click Finish.
37. On each VM and on each Dell PowerEdge VRTX server node, open PowerShell, type `Get-NetAdapter -name * | disable-NetAdapterChecksumOffload` and press Enter.

APPENDIX B – INSTALLING SQL SERVER 2012 INSTANCES

We performed the following SQL Server stand-alone installation steps on both of the guest cluster nodes.

1. Log into the virtual machine, insert the installation media for SQL Server 2012 into the appropriate Hyper-V host server's DVD drive, and attach it to the virtual machine.
2. Navigate to the SQL Server 2012 DVD, and run `SETUP.EXE`.
3. If the installer prompts you with a .NET installation prompt, click Yes to enable the .NET Framework Core role.
4. In the left pane of the SQL Server Installation Center window, click Installation.
5. Click New SQL Server stand-alone installation or add features to an existing installation.
6. At the Product Support screen, enter your product key, and click Next.
7. At the License Terms screen, click the box to accept the license terms, and click Next.
8. At the Product Updates screen, allow the update check to complete, and click Next.
9. At the Install Setup Files screen, allow the file to download, and click Install.
10. At the Setup Support Rules screen, allow the rule check to complete. If there are no failures, click Next.
11. At the Setup Role screen, select SQL Server Feature Installation, and click Next.
12. At the Feature Selection screen, select the features that your organization requires. We chose the following features for this guide: Database Engine Services, SQL Server Replication, Full-Text and Semantic Extractions for Search, Client Tools Connectivity, Client Tools Backwards Compatibility, Management Tools – Basic and Management Tools – Complete. Click Next.
13. At the Installation Rules screen, click Next.
14. At the Instance Configuration screen, you may leave the default for the first instance and then name the second instance, or select Named Instance in both cases, and provide an appropriate name for each instance, which should force the Instance ID field to match the provided name. We used the names `Instance1` and `Instance2`.
15. At the Disk Space Requirements screen, click Next.

16. At the Server Configuration screen, enter the appropriate credentials for the services accounts, and click Next.
17. At the Database Engine Configuration screen, select the appropriate authentication mode. For our testing, we selected Mixed Mode, clicked Add Current User, entered the appropriate credentials, and clicked Next.
18. At the Error Reporting screen, click Next.
19. At the Installation Configuration Rules screen, click Next.
20. At the Ready to Install screen, click Install.
21. When installation finishes, click Close.

APPENDIX C – SETTING UP THE ALWAYSON AVAILABILITY GROUP

We performed the following setup to enable AlwaysOn Availability Groups in each server and to restore databases for each SQL instance. Perform steps 1 through 7 for both VMs.

1. In a SQL server, open the SQL Server Configuration Manager.
2. Navigate to SQL Server Configuration Manager (Local)→SQL Server Services.
3. In the right pane, right-click SQL Server, and click Properties.
4. In the AlwaysOn High Availability tab, check the box for Enable AlwaysOn Availability Groups, and click Apply.
5. If a warning message pops up, click OK.
6. Right-click SQL Server, and click Restart.
7. Migrate any databases to each SQL instance on each VM. Please note:
 - We recommend migrating your databases offline through the backup and restore method, as outlined at <http://technet.microsoft.com/en-us/library/ms187048.aspx>.
 - When you restore the database to the secondary instance, use RESTORE WITH NORECOVERY. For example:

```
RESTORE DATABASE <database name>
FROM DISK = N'\\<backup location>\<database>.bak'
WITH NORECOVERY
```
 - If you are running SQL in mixed mode, you must migrate your SQL Logins. For more information on how to do this, see <http://support.microsoft.com/kb/918992>.
8. In Object Explorer, navigate to the instance that will be the primary replica, expand AlwaysOn High Availability, right-click Availability Groups, and select New Availability Group Wizard....
9. At the Introduction screen, click Next.
10. At the Specify Name screen, select an appropriate name for the availability group. We used Group1.
11. At the Select Databases screen, select the appropriate database that you migrated previously, and click Next.
12. At the Specify Replicas screen, click Add Replica....
13. Enter the Server name for the other SQL server, and click Connect. In our case, we used SQL2\INSTANCE2.

- 14.** In the Specify Replicas screen, to the right of both of the Server Instances, check the boxes for Automatic Failover.
- 15.** In the Listener tab, select Create an availability group listener.
- 16.** Provide an appropriate name for the listener. We used the name `sql-listener`.
- 17.** Provide an appropriate port for the listener. We used port 1433.
- 18.** Click Add... and enter an IP address for the listener. We used 192.168.1.25.
- 19.** Click OK.
- 20.** Click Next.
- 21.** At the Select Data Synchronization screen, select Join only, and click Next.
- 22.** At the Validation screen, click Next.
- 23.** At the Summary screen, click Finish.
- 24.** At the Results screen, when the wizard completes successfully, click Close.

ABOUT PRINCIPLED TECHNOLOGIES



Principled Technologies, Inc.
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We provide industry-leading technology assessment and fact-based marketing services. We bring to every assignment extensive experience with and expertise in all aspects of technology testing and analysis, from researching new technologies, to developing new methodologies, to testing with existing and new tools.

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We provide customized services that focus on our clients' individual requirements. Whether the technology involves hardware, software, Web sites, or services, we offer the experience, expertise, and tools to help our clients assess how it will fare against its competition, its performance, its market readiness, and its quality and reliability.

Our founders, Mark L. Van Name and Bill Catchings, have worked together in technology assessment for over 20 years. As journalists, they published over a thousand articles on a wide array of technology subjects. They created and led the Ziff-Davis Benchmark Operation, which developed such industry-standard benchmarks as Ziff Davis Media's Winstone and WebBench. They founded and led eTesting Labs, and after the acquisition of that company by Lionbridge Technologies were the head and CTO of VeriTest.

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