SERVERMARK® VDI

Technical Guide

Updated August 27, 2018

SERVERMARK

Servermark is a suite of server benchmarks developed by the same team at UL that makes *3DMark*, *PCMark*, and *VRMark* benchmarks and *Testdriver*, a benchmark automation solution.

Designed for industry, enterprise and press use, Servermark brings UL's trusted expertise to IT professionals searching for accurate and impartial server benchmark tests.

Servermark tests are easy to install, run, and understand, which means you can choose and compare server hardware configurations with confidence.

SERVERMARK BENCHMARKS AT A GLANCE

The Servermark product line includes Servermark Media Transcode and Servermark VDI, each designed for a specific type of server use and each available separately.

Use **Servermark Media Transcode** to test the performance of media transcoding servers individually or as a cluster. The benchmark determines how many video streams a server can transcode simultaneously using high-performance media-transcoding libraries from Intel and NVIDIA. The benchmark covers real-world challenges and provides a range of options to configure the target video format, resolution, and quality level. The benchmark result produces useful performance and quality metrics to compare server configurations.

Use **Servermark VDI** to benchmark the performance and capacity of Virtual Desktop Infrastructure servers. It offers a range of workloads from basic office tasks to demanding content creation work. This flexibility helps IT pros match and allocate VDI resources to the distinct roles and needs of their end users. Servermark VDI produces practical performance metrics that help you identify poor performance, detect bottlenecks, and optimize your server configuration to get more value from your hardware resources.

⚠ This guide is for Servermark VDI. There is a separate guide for Servermark Media Transcode.

LATEST VERSION NUMBERS

	VERSION
Servermark VDI Controller	1.0.19
Servermark VDI benchmark	1.0

Controller version number

The Controller version number applies to the software as a whole. It will change when we update the application to add new features and ensure compatibility with the latest hardware. We recommend using the latest Controller version.

Benchmark version numbers

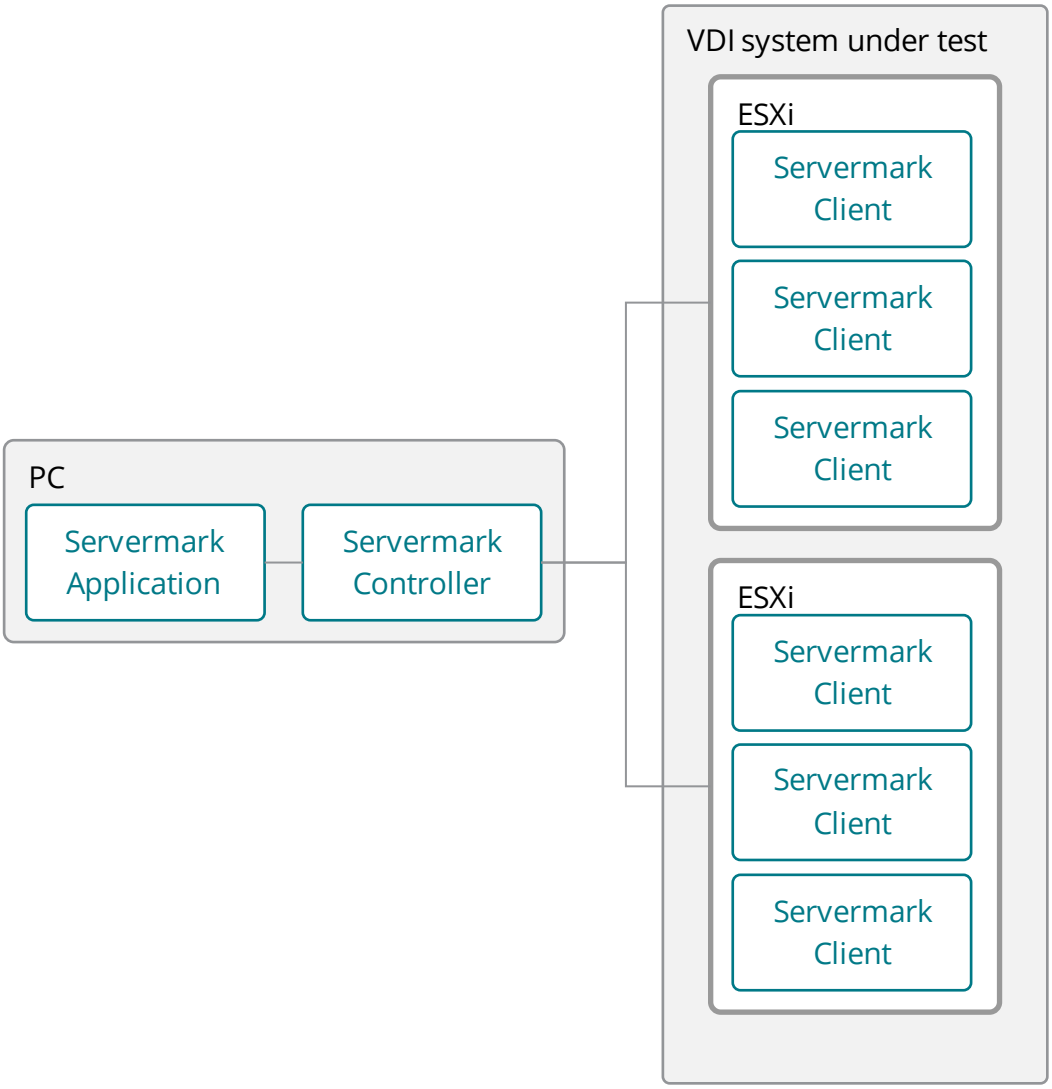
A benchmark version number is specific to a test. For example, the VDI benchmark has its own specific version number. Benchmark version numbers change rarely and only when absolutely necessary to accommodate changes in third-party applications or bug fixes.

Comparing scores across versions

UL guarantees that benchmark results are comparable across Servermark VDI Controller versions provided that the major digit of the benchmark version number is the same.

SERVERMARK OVERVIEW

Servermark has two components—the Controller and the Client—that work together to benchmark the system under test.



Servermark VDI Controller

The Servermark VDI Controller is a Windows application that can be invoked from the Servermark application. During a benchmark run, the Servermark VDI Controller communicates with Servermark Clients to perform the desired tests on the system under test.

Servermark Client

The Servermark Client application is the interface between the Servermark Controller and the benchmark workload. It is installed on the virtual desktop and is used for starting the workload and stressing the server.

SYSTEM REQUIREMENTS

Servermark application minimum requirements

OS	Windows 7 Service Pack 1, 64-bit[1]
CPU	Dual core
SYSTEM MEMORY	4 GB
STORAGE	1 GB free space
NETWORK	A network connection to Servermark Clients

Server minimum requirements

CPU	Dual core
SYSTEM MEMORY	8 GB
STORAGE	100 GB free space
NETWORK	A network connection to Servermark controller

VMware requirements

VMware vCenter Server 6.7[2] for Windows
vCenter Server for Windows Requirements

VMware vCenter Server 6.7[2] Appliance for Linux
System Requirements for the vCenter Server Appliance Installer

VMware vSphere Hypervisor[2] (ESXi) 6.5
ESXi Hardware Requirements

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1 Including all available Windows updates. Microsoft .NET Framework 4.5.2 required.

2 Servermark is not guaranteed to be compatible with previous versions.

Virtual machine minimum requirements

	PCMARK 10	PCMARK 8
OS	Windows 7 Service Pack 1, 64-bit	Windows 7 Service Pack 1, 32 and 64-bit[3]
CPU	Dual core	Dual core
SYSTEM MEMORY	4 GB	2 GB
STORAGE	35 GB free space	35 GB free space
GPU	Required for the *Digital Content Creation* and *Gaming* benchmarks	Not required
GRAPHICS API	DirectX 11	DirectX 9[4]
NETWORK	Required	Required

[3] Windows 8 N Edition and Windows 8 KN Edition users will need to install Windows Media Player 12.

[4] DirectX 9 minimum. DirectX 11 recommended.

SETUP

SERVER SETUP

With the Servermark Universal VDI benchmark, you can use any virtualization platform that meets the minimum requirements. Install updates and drivers as needed.

The Servermark VMware VDI benchmark requires VMware vCenter and the vSphere Hypervisor virtualization platform. Please check the requirements in the previous section.

VIRTUAL MACHINE SETUP

Complete the following steps to set up the virtual machine.

Create virtual machine

Please enable automatic sign-in to the user account at startup in the OS.

Install PCMark on the virtual machine

> ⚠ PCMark must be installed with the default options otherwise the Servermark Client will not recognize the path.

The PCMark 10 installer is found inside the `Servermark-{version}.zip` in the `VirtualDesktopInfrastructureBenchmark` folder in the `PCMark10-{version}-all-dlcs.zip` package.

1. Run `pcmark10-setup.exe` to install PCMark 10.
2. Open the application and go to the Options screen.
3. Enter the license key that was provided to you.
4. Close the application.

The PCMark 8 installer is found inside the `Servermark-{version}.zip` in the `VirtualDesktopInfrastructureBenchmark` folder in the `PCMark8-v{version}.zip` package.

1. Run `pcmark8-setup.exe` to install PCMark 8.
2. Open the application and go to the Welcome screen.
3. Enter the license key that was provided to you.
4. Close the application.

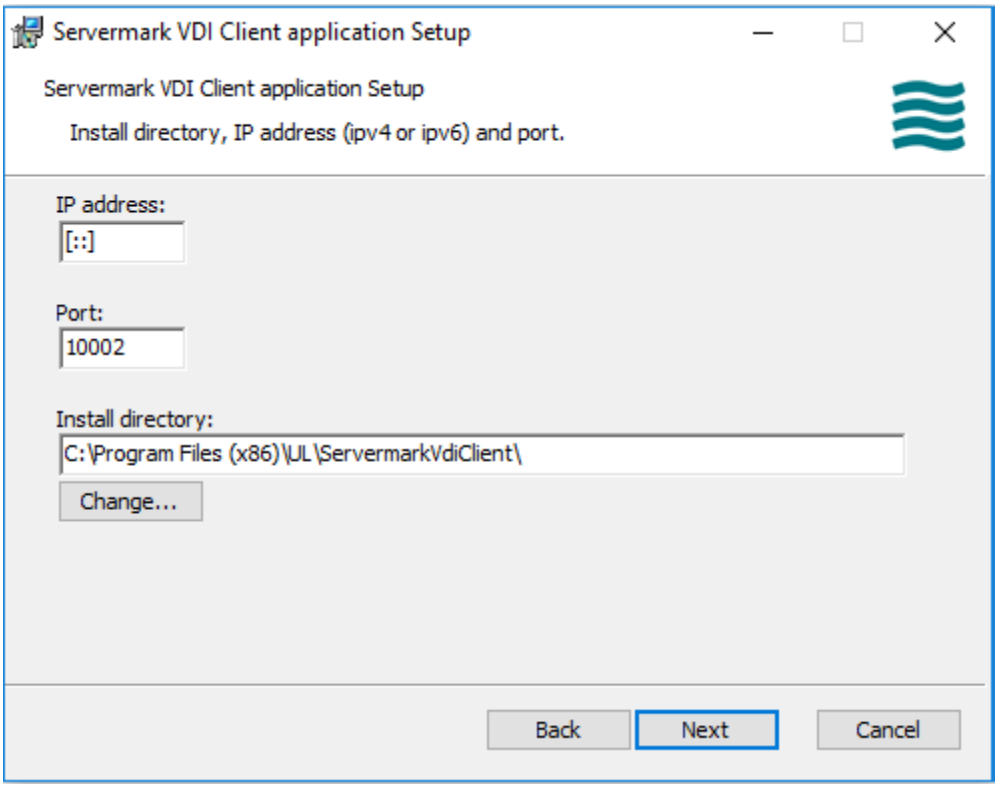
Install the Servermark Client

The Servermark Client installer is found inside the `Servermark-{version}.zip` in the `VirtualDesktopInfrastructureBenchmark` folder.

Launch `ServermarkVirtualDeskttopInfrastructureClient-{version}-setup.exe`.

Please read and accept EULA, then click **Install**.

If necessary, change the IP address of the client and port number used for communication between the Servermark Client and Servermark Controller. The [::] symbol represents automatic IP detection. By default, Servermark Client listens to any ipv4 or ipv6 address.



> ⚠ Ipv6 addresses must be in the `[ipv6_address]` format, for example `[2001:4860:4860::8888]`.

When installation is complete, a new command line window opens. The Servermark Client shows its status text in the console when ready:

```
YYY-MM-DD T HH:MM:SS.ms Workload “SERVERMARK-VDI” version x.y.z.k started
```

```
YYY-MM-DD T HH:MM:SS.ms Listening IP “::” port: “10002”
```

Cloning

> ⚠ Only required for the Servermark Universal VDI benchmark.

Clone the images manually or use your virtualization platform to automate the cloning process.

Convert to template

> ⚠ Only required for the Servermark VMware VDI benchmark.

Using the VMware control panel, convert the virtual machine to template.

The name of the template will be required during the connection configuration with the server in Servermark Application.

SERVERMARK APPLICATION SETUP

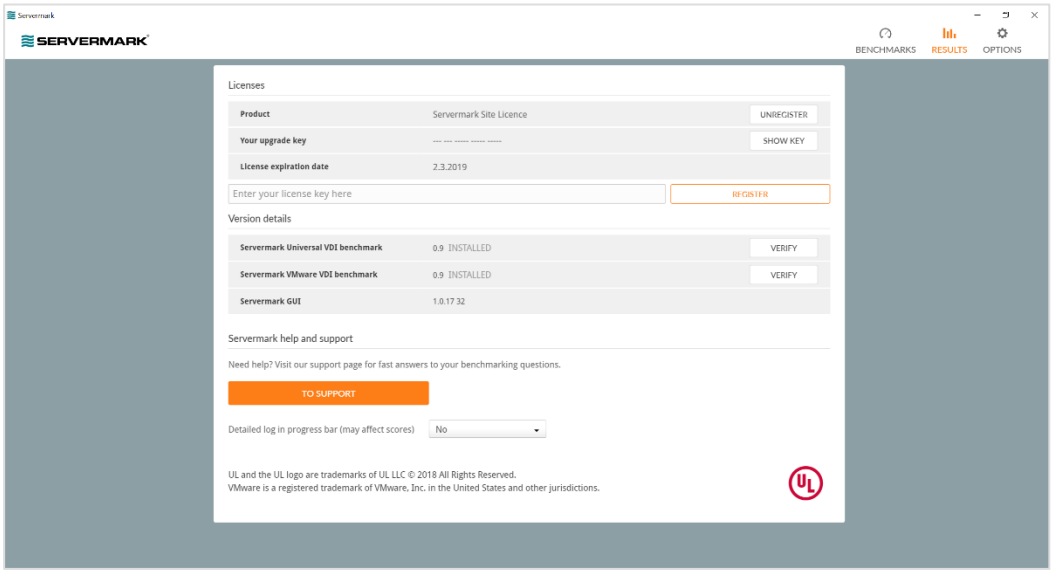
The Servermark Application can be installed on any desktop or laptop PC connected to the server under test.

The installer is found inside the `Servermark-{version}.zip`.

Launch `servermark-vdi-setup.exe`.

SERVERMARK APPLICATION OPTIONS

You can see and manage your license information on the **OPTIONS** screen.



Licenses

This section shows which benchmark licenses are activated and when they will expire. If you wish to unregister your key, so you can move your license to a different computer for example, press the **UNREGISTER** button.

Version details

Here you see the current version number of the Servermark VDI Controller application and your benchmarks. If a newer version is available, you will be able to update from this screen.

Servermark help and support

If you need it, click on the **TO SUPPORT** button to contact our support team.

Choose **Write detailed log** to show detailed status information during the benchmark in the progress bar. The default value is “No.”

SERVERMARK®
VDI

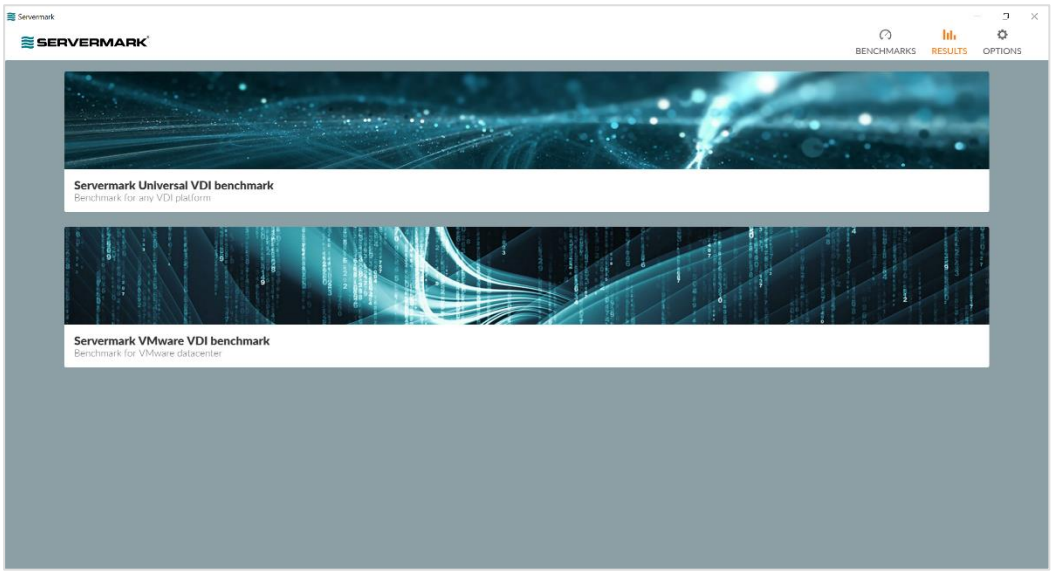
SERVERMARK VDI BENCHMARK

Servermark VDI is a benchmark for measuring the performance and capacity of Virtual Desktop Infrastructures.

Servermark VDI uses workloads from PCMark 10 and PCMark 8, our industry-standard PC benchmarks, to measure virtual machine performance. You can choose from a range of workloads covering basic office work, such as web browsing, documents and spreadsheets, to more intensive tasks, such as photo and video editing, that require more processing, memory, and storage resources. This flexibility helps IT professionals estimate and allocate VDI resources for different user roles, from basic office workers to power users and media creators.

With Servermark VDI, you can also establish baseline performance expectations, track performance over time, and plan for future capacity needs. With regular benchmark runs, you can identify poor performance, detect system bottlenecks, and optimize server configurations to get more performance from their hardware resources.

Servermark VDI includes two benchmark tests. Both let you choose the benchmark workload and the ratio of active to idle machines to match the work roles and usage patterns of your end users.



Servermark Universal VDI benchmark

With the Servermark Universal VDI benchmark, you can test any virtualization platform—VMware, Microsoft Hyper-V, or Citrix XenServer, for example—that meets the benchmark's system requirements.

This benchmark measures the end-user performance of each virtual machine in a given VDI configuration. Use this test to determine if your server can deliver an acceptable level of performance for a set number of virtual machines. Make changes and repeat the test to find the configuration that offers the best balance of performance and utilization.

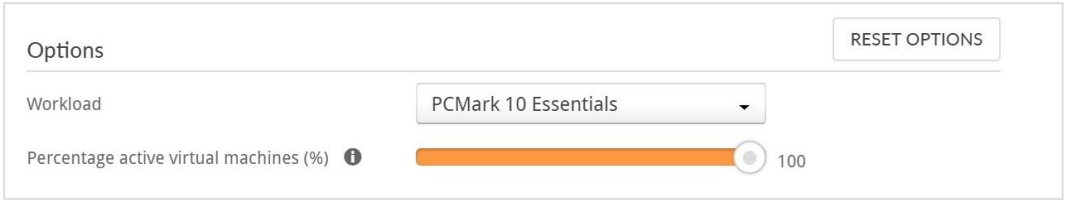
Servermark VMware VDI benchmark

The Servermark VMware VDI benchmark is designed for the VMware vCenter and vSphere Hypervisor virtualization platform. This benchmark runs a series of loops and automates some of the manual work involved in running the Universal test. For a given configuration, the benchmark determines the maximum number of virtual machines that the VMware data center can support at an acceptable level of performance for the end user.

SERVERMARK UNIVERSAL VDI BENCHMARK

Setup the virtual machines before starting the test. PCMark 10 and/or PCMark 8 must be installed and activated on each virtual machine. After the desired number of virtual machines have been cloned and powered up, follow the steps below to setup and run the benchmark test.

Choose benchmark options



Workload

There are five workloads available for testing:

- PCMark 10 Essentials
- PCMark 10 Productivity
- PCMark 10 Digital Content Creation
- PCMark 10 Gaming
- PCMark 8 Work 2.0 (Conventional)

Percentage active virtual machines (%)

During the test, virtual machines can be *active*, (running the workloads), or *idle* (representing a user that is not currently using the computer).

The **Percentage active virtual machines (%)** setting specifies the proportion of Servermark Clients that will run the benchmark simultaneously, i.e. the percentage of virtual machines that are *active*. The default value is 100%. Virtual machines not running the benchmark will idle.

For example, for a test running on 80 virtual machines, a percentage active setting of 30 will result in 24 active machines and 56 idle machines.

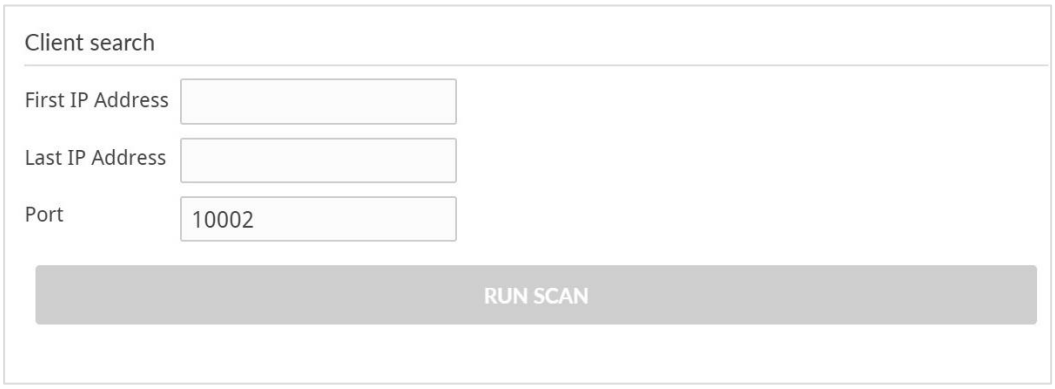
Add Servermark Clients

Before stating the benchmark, you need to create a connection between the Servermark Controller and all the Servermark Clients under test. Clients can be added by specifying an IP range using Client Search or Manually, one at a time by IP address.

Client search

Enter the **First IP Address** and **Last IP Address** to specify the range of IP addresses to scan. **Port** is the TCP port used for communication between Servermark Controller and Servermark Client. The default port is 10002.

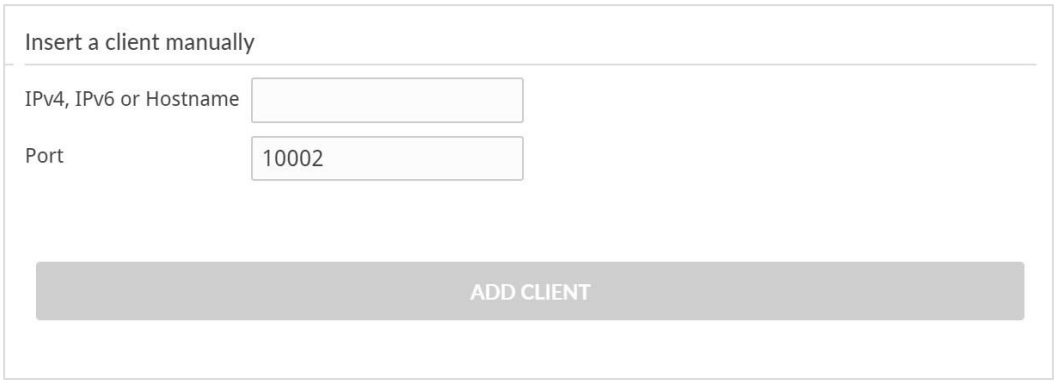
When all the fields have been entered, press **Run Scan**.



Insert a client manually

Enter the **IPv4, IPv6 or Hostname** for the client. **Port** is the TCP port used for communication between Servermark Controller and Servermark Client. The default port is 10002.

When all the fields have been entered, press **Add Client**.



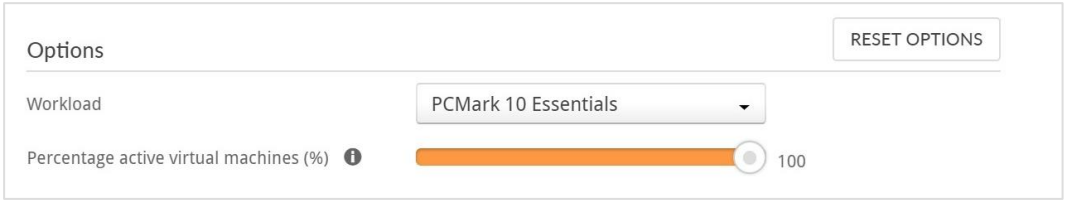
Run the benchmark

Click the **RUN** button. The duration of the benchmark run will depend on the chosen workload. The minimum time is around 15 minutes, and the maximum time is around 45 minutes.

SERVERMARK VMWARE VDI BENCHMARK

Setup the virtual machines before starting the test. PCMark 10 and/or PCMark 8 must be installed and activated on each virtual machine. After the desired number of virtual machines have been powered up, follow the steps below to setup and run the benchmark test.

Choose benchmark options



Workload

There are five workloads available for testing:

- PCMark 10 Essentials
- PCMark 10 Productivity
- PCMark 10 Digital Content Creation
- PCMark 10 Gaming
- PCMark 8 Work 2.0 (Conventional)

Percentage active virtual machines (%)

During the test, virtual machines can be *active*, (running the workloads), or *idle* (representing a user that is not currently using the computer).

The **Percentage active virtual machines (%)** setting specifies the proportion of Servermark Clients that will run the benchmark simultaneously, i.e. the percentage of virtual machines that are *active*. The default value is 100%. Virtual machines not running the benchmark will idle.

For example, for a test running on 80 virtual machines, a percentage active setting of 30 will result in 24 active machines and 56 idle machines.

Connect with VMware

Address

Enter the IP address of the vCenter server. You can use IPv4, IPv6, or hostname. Add `/sdk` to the end of the address.

Datacenter

Enter the name of the VMware datacenter.

Port

Enter the port used for communication with the Servermark Client.

Template name

Enter the name of the template used for cloning the virtual machines.

Username

Enter your login username.

Password

Enter your login password.

Run the benchmark

Click the **RUN** button to start the benchmark.

The duration of the benchmark run will depend on the time for the cloning process and the number of rounds needed to determine the number of virtual machines that the server is able to support. The minimum time for running the VMware benchmark is around one hour. The average time is usually between 2-4 hours.

GOOD TESTING GUIDE

To ensure accurate and consistent benchmark results you should test clean server systems without third party software installed. If this is not possible, try to close as many background tasks as possible, especially those that might interrupt the benchmark run with updates or notifications.

> ⚠ Running other programs on the server while the benchmark is running will affect the results.

You can cancel a benchmark run by pressing **CTRL+C** on the Servermark Client system. With the Servermark Universal VDI benchmark, you can also cancel the run by pressing the **Cancel** button in the Servermark Controller.

Recommended process for Servermark VDI benchmark

1. Reboot both the Servermark Controller and Servermark Clients.
2. Verify that the virtual machines are powered on.
3. Before starting the benchmark, ensure the network connection with at least one virtual machine using the ping command from the Windows Command Prompt.
4. Verify that the Servermark Client is running.
5. Start the Servermark Controller and add the Servermark Client(s).
6. Configure the benchmark options and run the benchmark.
7. Repeat at least three times to verify your results.

RESULTS

Client count

The client count, shown in the top left corner of the Result screen, is the main score result produced by the benchmark.

With the **Servermark Universal VDI benchmark**, the client count is the number of virtual machines (active and idle) that were used in the test.

With the **Servermark VMware VDI benchmark**, the client count is the number of virtual machines that the VDI can support. The value is the maximum number of virtual machines (active and idle) in a single iteration, taken from iterations where the average score was above the minimum score performance level.

Scores

Servermark VDI produces six different scores:

- Minimum
- Average
- Median
- 90% of scores above
- Maximum
- Standard deviation of scores

In most cases, you will want to look at the client count, average, and standard deviation in relation to the workload's minimum score performance level to see how well the server performed.

You can find detailed information about each score in Scoring section.

Heat map

The heat map part of the Result screen shows the distribution of workload scores from the active virtual machines for each round of the test.

The Servermark Universal VDI benchmark has only one round.

The VMware VDI benchmark runs for multiple rounds as it iterates the number of clients to find the maximum number that can be supported at an acceptable level of performance.

The example below shows a heat map with four rounds of testing. The first round used four active machines. The following rounds used seven, six and five active virtual machines, respectively.

The shaded bars show the workload scores for individual virtual machines in each round. A light, dotted line shows the average score for all active clients in the round.

The heavier dotted line in the heat map marks the minimum score performance level for the chosen workload. This line represents the lowest acceptable level of virtual machine performance required to perform the work represented by the workload.

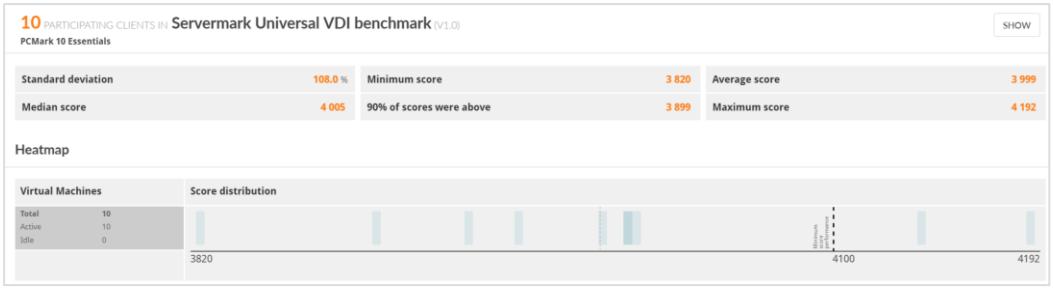
In the example above, the minimum score of 4500 is for the PCMark 10 Productivity workload, which tests performance when working with documents and spreadsheets.

Virtual machines with workload scores greater than the minimum (shown to the right of the dotted line in the heat map) have sufficient performance to support the type of work represented by the workload.

Clients with scores less than the minimum (shown to the left of the dotted line) did not meet the performance requirements. The user experience on those machines would be poor and users would be less productive.

In our example, only the first round has an average score (4994) that is higher than the minimum score performance level (4500). In the other rounds, the average score is below the minimum score performance level.

The screenshot below shows a second example from the Servermark Universal VDI benchmark test.



In this example, the average workload score of 3999—shown in the result table and marked on the heat map with a light, dotted line—is lower than the PCMark 10 Essentials minimum performance score of 4100 marked on the heatmap.

This tells you that this VDI configuration is unable to provide sufficient performance to support 10 clients for the types of basic office tasks that the PCMark 10 Essentials workload represents.

The next step in this example would be to repeat the test with a lower number of clients until the average workload score is above the minimum performance score for the workload.

Minimum score performance levels

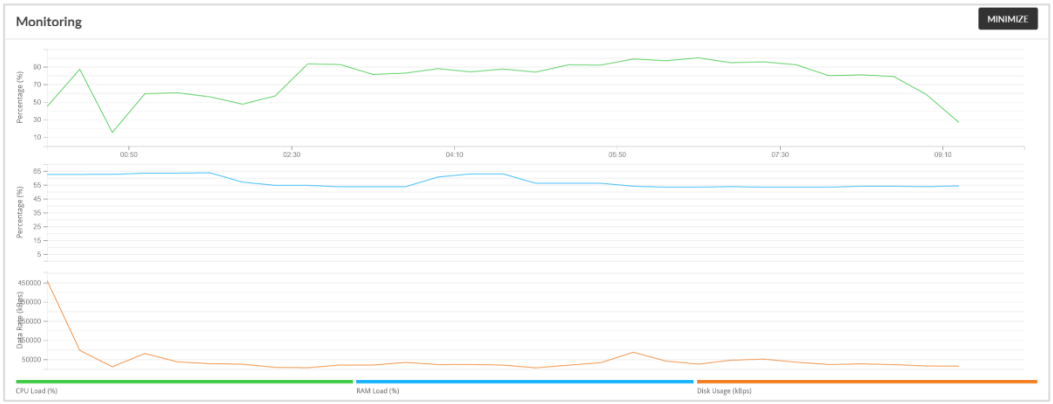
The minimum score performance marked on the heat map represents the lowest acceptable level of virtual machine performance required to perform the work represented by the workload.

The minimum score for each workload is based on extensive testing by UL.

WORKLOAD	MINIMUM SCORE PERFORMANCE
PCMark 10 Essentials	4100
PCMark 10 Productivity	4500
PCMark 10 Digital Content Creation	3000
PCMark 10 Gaming	1500
PCMark 8 Work 2.0 (Conventional)	2200

Monitoring data

After running the VMware VDI benchmark, you can see monitoring data presented in a set of charts. The charts show the performance of a single Server during the ramp-up phase. CPU load(%), RAM load(%) and Disk usage (kBps) are collected every 20 seconds.



ESXi information

After running the VMware VDI benchmark, you can see ESXi information in a table on the result screen.

For each server, you can see RAM, CPU model and hypervisor information.

Result export

The results can be exported as PDF and XML.

The PDF result report includes the benchmark scores, result details, test settings and hardware monitoring charts to provide a full view of the benchmark run. This makes it easier to store and share the test results.

SCORING

Each of the active virtual machines that has run the workload produces a score. The scores are sent by the Servermark Client to the Servermark Controller.

The score is zero if one or more tests failed to run correctly, or if PCMark is not able to run correctly.

Minimum

Each active Servermark Client produces a score. Servermark reports the minimum score from these scores as Minimum score (S_{min}) as follows:

$$S_{min} = min_{1...N}(x_i)$$

Where:

x	=	Servermark Client benchmark score
N	=	The number of Servermark Clients

Average

Each active Servermark Client produces a score. Servermark calculates all scores together, divides them by Servermark Client count, and rounds it down to get an Average score (S_{avg}) as follows:

$$S_{avg} = floor\left(\frac{\sum_{i=1}^{N} x_i}{N}\right)$$

Where:

x	=	Servermark Client benchmark score
N	=	The number of Servermark Clients

Median

Each active Servermark Client produces a score. Servermark arranges the scores, then reports the middle score as the Median score ($S_{med-odd}$ or $S_{med-even}$) :

$$S_{med-odd} = \left(\frac{N+1}{2}\right)th$$

$$S_{med-even} = floor\left(\frac{\left(\frac{N}{2}\right)th + \left(\frac{N}{2}+1\right)th}{2}\right)$$

Where:

N	=	The number of Servermark Clients
th	=	The th-item term

90% of scores were above

Each active Servermark Client produces a score. Servermark arranges the scores, discards the first 10% while rounding down and then reports the first score left to be the "90% of scores were above" result ($S_{90\%}$):

$$S_{90\%} = \left(floor\left(N \times \frac{10}{100}\right)\right)th$$

Where:

N	=	The number of active Servermark Clients
th	=	The th-item term

Maximum

Each active Servermark Client produces a score. Servermark takes a maximum score of these scores as Maximum score (S_{max}) as follows:

$$S_{max} = max_{1...N}(x_i)$$

Where:

x	=	Servermark Client benchmark score
N	=	The number of Servermark Clients

Standard deviation

Each active Servermark Client produces a score. The standard deviation of these scores is calculated as follows:

$$S_{std} = \sqrt{\frac{1}{N-1}\sum_{i=1}^{N}(x_i - \bar{x})^2}$$

Where:

$\bar{x}$	=	Average score (see Average)
x	=	Servermark Client benchmark score
N	=	The number of Servermark Clients

SERVERMARK VDI VERSION HISTORY

VERSION	NOTES
1.0	Launch version

USING SERVERMARK VDI SCORES

Using Servermark VDI scores in reviews

We provide complimentary Professional Edition benchmarks to members of the press working for established and reputable publications. Contact us at UL.BenchmarkPress@ul.com to request a license for your publication.

Press can use our benchmark scores in their hardware reviews. We kindly ask you to include a link to https://benchmarks.ul.com/ whenever you use our benchmarks in a review, feature or news story.

Using Servermark VDI scores in marketing material

A commercial license to use the software for business purposes is granted with the purchase of Servermark VDI Professional Edition or through our site licensing program.

⚠ You must not disclose or publish Servermark VDI benchmark test results, nor may you use the UL logo or other UL assets in your sales and marketing materials, without prior, written permission from UL. Please contact UL.BenchmarkSales@ul.com for details.

On the first mention of Servermark VDI in marketing text, such as an advertisement or product brochure, please write "Servermark VDI benchmark" in order to protect our trademark. For example:

"We recommend the Servermark® VDI benchmark from UL®."

Please include our legal text in your small print.

Servermark® is a registered trademark of Futuremark Corporation.

RELEASE NOTES

Servermark v1.0.19 – August 27, 2018

Launch version.

ABOUT UL

UL is an independent, global company that offers a wide range of testing, inspection, auditing, and certification services. With 10,000 people in 40 countries, UL helps customers, purchasers, and policymakers navigate market risk and complexity. UL builds trust in the safety, security, and sustainability of products, organizations and supply chains – enabling smarter choices and better lives. Visit https://www.ul.com/ to find out more.

UL benchmarking software is developed by the Product Supply Chain Intelligence division. We enable global product compliance, innovation and promotion throughout the supply chain with our intelligent software and services backed by world-class scientific and technical expertise. Please visit https://psi.ul.com/ to find out more.

UL benchmarks help people measure, understand and manage computer hardware performance. Our talented team creates the industry's most trusted and widely used performance tests for desktop computers, notebooks, tablets, smartphones, and VR systems.

We work in cooperation with leading technology companies to develop industry-standard benchmarks that are relevant, accurate, and impartial. As a result, our benchmarks are widely used by the press. UL maintains the world's largest and most comprehensive hardware performance database, using the results submitted by millions of users to drive innovative online solutions designed to help people make informed purchasing decisions.

Our benchmarks are developed in Finland just outside the capital Helsinki. We also have a performance lab and sales office in Silicon Valley and sales representatives in Taiwan.

Press	UL.BenchmarkPress@ul.com
Sales	UL.BenchmarkSales@ul.com
Support	UL.BenchmarkSupport@ul.com