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Introduction to Windows Server 2016 Nano Server

Introduces this new feature of Microsoft Windows Server 2016

Describes how to create and manage these low-footprint servers

Explains how to implement as a virtual machine or bare metal

Helps IT Specialists understand the new features of Windows Server 2016

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Abstract

With Windows Server 2016, Microsoft has introduced a new installation option for Windows Server, called Nano Server, the concept of which is a *zero footprint* model that delivers faster speed and lower resource consumption.

This paper provides details on how to create a Nano Server image, then use the image to deploy either as a Hyper-V virtual machine or bare metal to physical host. The intended audience of this paper is IT professionals, technical partners, and Microsoft Azure users.

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Introduction

In Windows Server 2012, Microsoft offered Server Core to give customers a way to deploy a minimal installation of Windows Server. With a Server Core installation, only essential features and services, such as Active Directory Domain Services (AD DS), DNS, Dynamic Host Configuration Protocol (DHCP), File and Print, and a few other server roles are installed. Everything else that was not absolutely essential for running core network services were stripped out. Even the traditional Windows Desktop GUI was eliminated in Server Core.

New to Windows Server 2016 is an even more lightweight installation offering, named Nano Server. The concept of Nano Server is *zero footprint*. Nano Server is only approximately 350 MB in size once installed, has no GUI or local console at all, and is managed remotely through PowerShell, WMI, Windows Remote Management, or Emergency Management Services (EMS). The zero footprint model is designed to deliver significantly faster speed and lower resource consumption.

The purpose of this paper is to show you how to create a Nano Server image, then use the image to deploy either as a Hyper-V virtual machine or bare metal to physical host. The intended audience of this paper is IT professionals, technical partners, and Microsoft Azure users.

The paper was written based on Windows Server 2016 Technical Preview 4 and testing was performed on the following servers:

- ▶ Lenovo System x3650 M5
- ▶ Lenovo System x3550 M5
- ▶ Lenovo System x3250 M5

Creating a Nano Server image

This section explains how to create a Nano Server virtual image, in either VHD or VHDX format. You will require the following:

- ▶ Windows Server 2016 ISO image (in our testing we used Technical Preview 4)
- ▶ PowerShell Scripts:
 - Convert-WindowImage.ps1
 - NanoServerImageGenerator.psm1

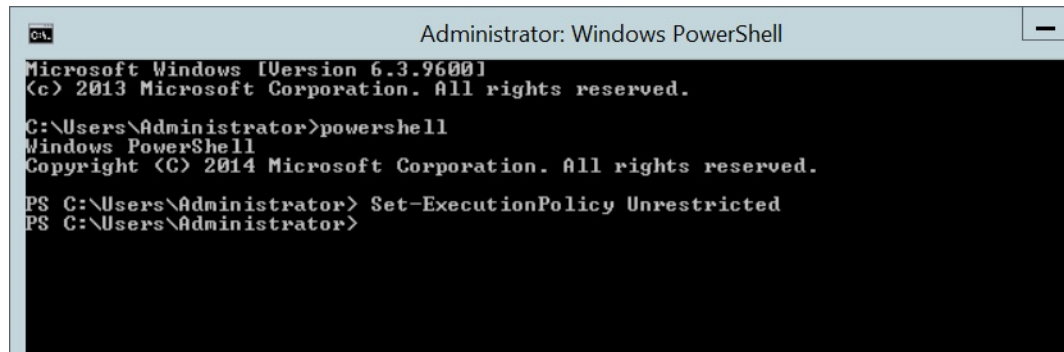
These two scripts are located in the \NanoServer folder in the Windows Server Technical Preview ISO image.

The following are the steps to create a Nano Server VHD image:

1. Create a directory on your local disk. We used c:\Nano for our example.
2. Open a PowerShell session and set the execution policy to unrestricted by issuing the following command:

```
Set-ExecutionPolicy Unrestricted
```

You will see a result similar to Figure 1 on page 4



```
Administrator: Windows PowerShell
Microsoft Windows [Version 6.3.9600]
(c) 2013 Microsoft Corporation. All rights reserved.

C:\Users\Administrator>powershell
Windows PowerShell
Copyright (C) 2014 Microsoft Corporation. All rights reserved.

PS C:\Users\Administrator> Set-ExecutionPolicy Unrestricted
PS C:\Users\Administrator>
```

Figure 1 Set-ExecutionPolicy command

3. From PowerShell change to the c:\Nano directory.
4. Copy the \NanoServer and \Sources directories from the Windows Server 2016 iso image to the c:\Nano directory.
5. Copy the Convert-WindowsImage.ps1 and NanoServerImageGenerator.psm1 scripts to the c:\Nano directory.
6. Create the VHDX image by running the following scripts from the c:\Nano directory.

Example 1 Commands to create the VHDX image

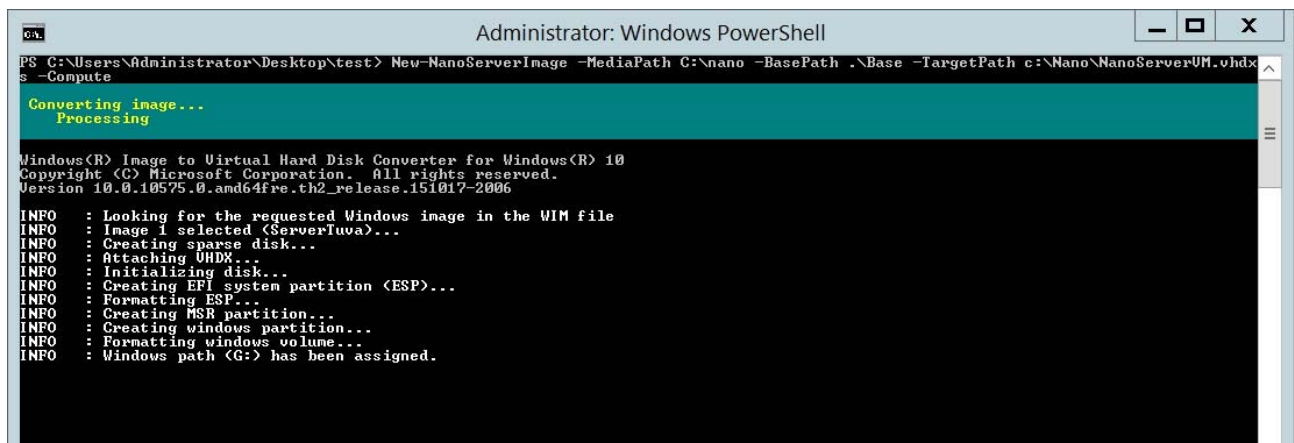
```
Import-Module .\NanoServerImageGenerator.psm1 -Verbose
```

```
New-NanoServerImage -MediaPath f:\ -BasePath .\Base -TargetPath
c:\Nano\NanoServerVM.vhdx -ComputerName nano -GuestDrivers -Compute
```

The New-NanoServerImage cmdlet will do the following:

- Create the Nano Server image on the c:\Nano directory
- Create the image with the name NanoServerVM.vhdx
- Set the computer name to be nano
- Add the Compute and GuestDrivers packages

The command and result are shown in Figure 2 on page 4.



```
Administrator: Windows PowerShell
PS C:\Users\Administrator\Desktop\test> New-NanoServerImage -MediaPath C:\nano -BasePath .\Base -TargetPath c:\Nano\NanoServerVM.vhdx
s -Compute

Converting image...
Processing

Windows(R) Image to Virtual Hard Disk Converter for Windows(R) 10
Copyright (C) Microsoft Corporation. All rights reserved.
Version 10.0.10575.0.amd64fre.th2_release.151017-2006

INFO : Looking for the requested Windows image in the WIM file
INFO : Image 1 selected (ServerIuva)...
INFO : Creating sparse disk...
INFO : Attaching VHDX...
INFO : Initializing disk...
INFO : Creating EFI system partition (ESP)...
INFO : Formatting ESP...
INFO : Creating MSR partition...
INFO : Creating windows partition...
INFO : Formatting windows volume...
INFO : Windows path (G:) has been assigned.
```

Figure 2 Output of the New-NanoServerImage command

Injecting new drivers

Nano Server has a minimal set of drivers by default. These are the most basic drivers that can allow it to run as a VM guest. If you plan to set up the Nano Server as a bare metal install you will probably need to install additional drivers for your server.

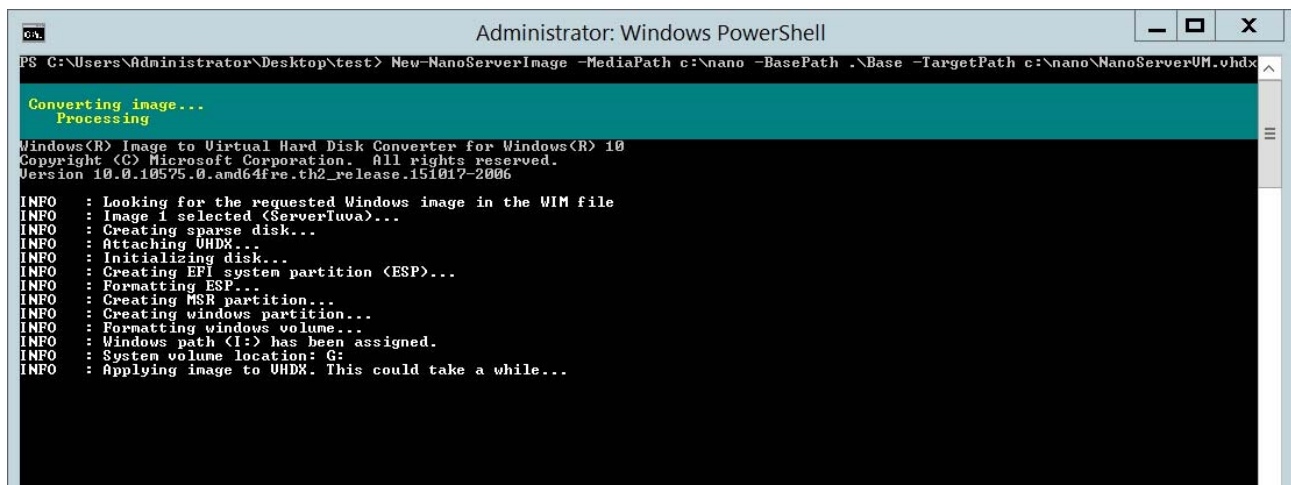
1. Create the directory `c:\Nano\drivers`.
2. Put the drivers you want to have inserted into the VHDX file in this directory. The script will be looking for `.INF` files.
3. To install additional drivers, execute the following command:

```
New-NanoServerImage -MediaPath c:\nano -BasePath .\Base -TargetPath  
c:\nano\NanoServerVM.vhdx -DriversPath c:\nano\driver
```

Where:

- *MediaPath* is that path to the Windows Server 2016 ISO image that contains the Nano Server files.
- *NanoServerVM.vhdx* is the name of your Nano Server VHDX image.
- *DriversPath* is the path where your new drivers to inject into the Nano Server. In this example you copied them to `c:\Nano\Driver`

The output of the command is shown in Figure 3. If any errors occur you will see them printed in red.



```
Administrator: Windows PowerShell  
PS C:\Users\Administrator\Desktop\test> New-NanoServerImage -MediaPath c:\nano -BasePath .\Base -TargetPath c:\nano\NanoServerVM.vhdx  
  
Converting image...  
Processing  
  
Windows(R) Image to Virtual Hard Disk Converter for Windows(R) 10  
Copyright (C) Microsoft Corporation. All rights reserved.  
Version 10.0.10575.0.amd64fre.th2_release.151017-2006  
  
INFO : Looking for the requested Windows image in the WIM file  
INFO : Image 1 selected (ServerIuva)...  
INFO : Creating sparse disk...  
INFO : Attaching VHDX...  
INFO : Initializing disk...  
INFO : Creating EFI system partition (ESP)...  
INFO : Formatting ESP...  
INFO : Creating MSR partition...  
INFO : Creating windows partition...  
INFO : Formatting windows volume...  
INFO : Windows path (I:) has been assigned.  
INFO : System volume location: G:  
INFO : Applying image to VHDX. This could take a while...
```

Figure 3 Injecting new drivers

Launching Nano Server a VM guest

Here we describe how to create a new Virtual Machine from Hyper-V Manager and select the Nano Server VHD or VHDX.

Prerequisites:

- ▶ You must select Generation 2 for VHDX images.
- ▶ create a virtual switch for you networking
- ▶ Ensure DHCP is running, so your Nano Server can be assigned a dynamic IP

After you have created and launched the virtual machine with the Nano Server VHDX, do the following:

1. The login panel appears automatically, Figure 4 on page 6 (we used Technical Preview 4 in our lab). Login to manage your Nano Server.

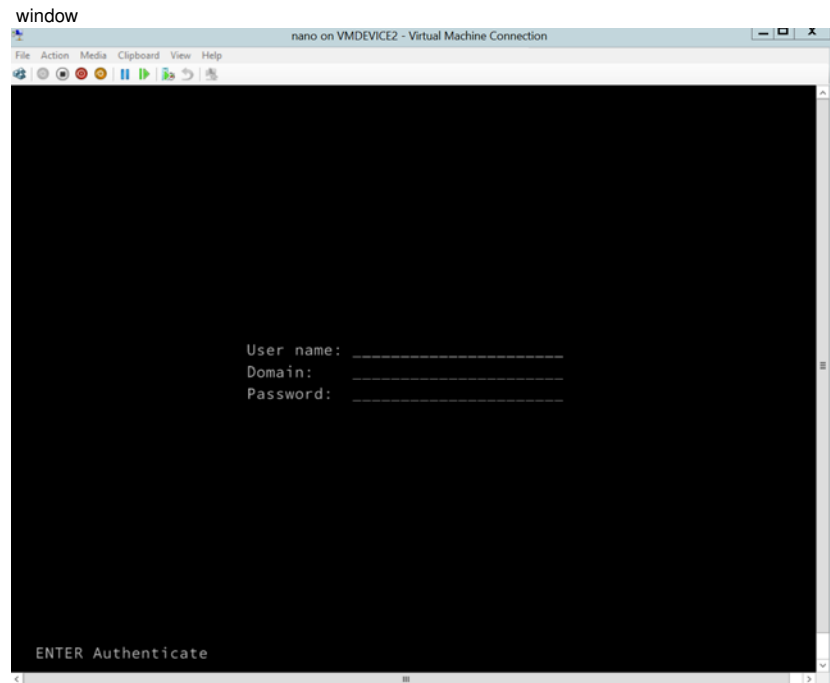


Figure 4 Nano Server login

2. Enter the administrator user ID and password: **Administrator / Passw0rd** (where 0 is zero).
3. You will be presented with a welcome window that will show you the IP been assigned to your Nano Server, similar to Figure 5 on page 7. This IP address is important, because you will need it to manage the Nano Server.

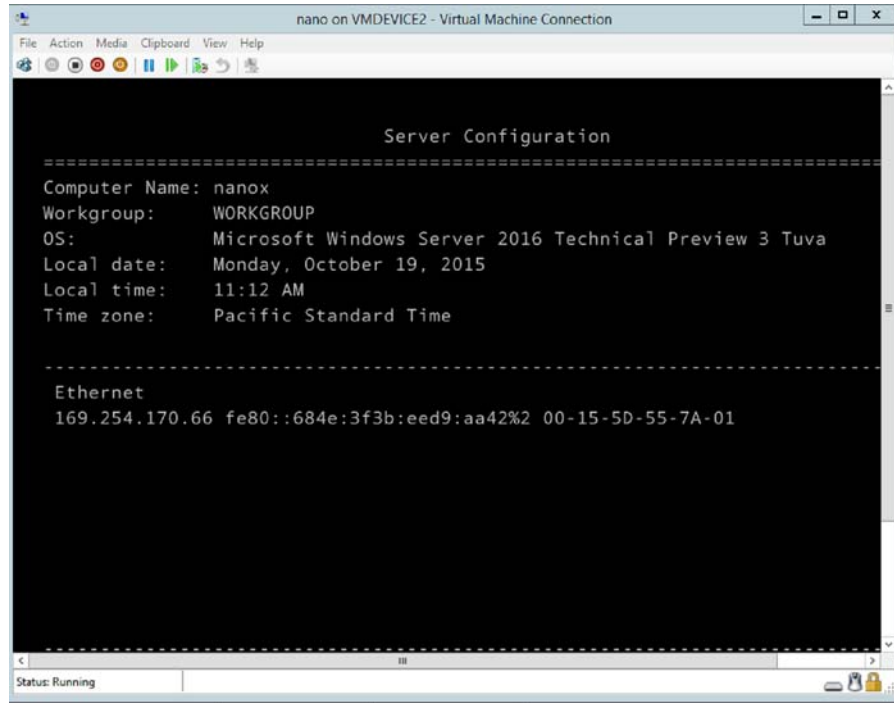


Figure 5 Server Configuration window

Tip: The ability to login directly at the Nano Server console has been added for troubleshooting only. You can see what the Nano Server is able to detect, but you cannot manage the Nano Server from this login window.

Connecting to the Nano Server using PowerShell

You will need Windows Server 2012 R2 or later and it must be on the same network and subnet.

Follow these steps to log into the Nano Server VM using PowerShell to manage and configure the VM:

1. Launch PowerShell.
2. Issue the following PowerShell commands:

```
Set-Item WSMAN:\localhost\Client\TrustedHosts "xx.xx.xx.xx"  
$ip="xx.xx.xx.xx"  
Enter-PSSession -ComputerName $ip -Credential $user
```

Where xx.xx.xx.xx is the IP address of your Nano Server as shown on the welcome window. When prompted, enter your login credentials (ours were Administrator and Passw0rd).

The commands and output are shown in Figure 6.

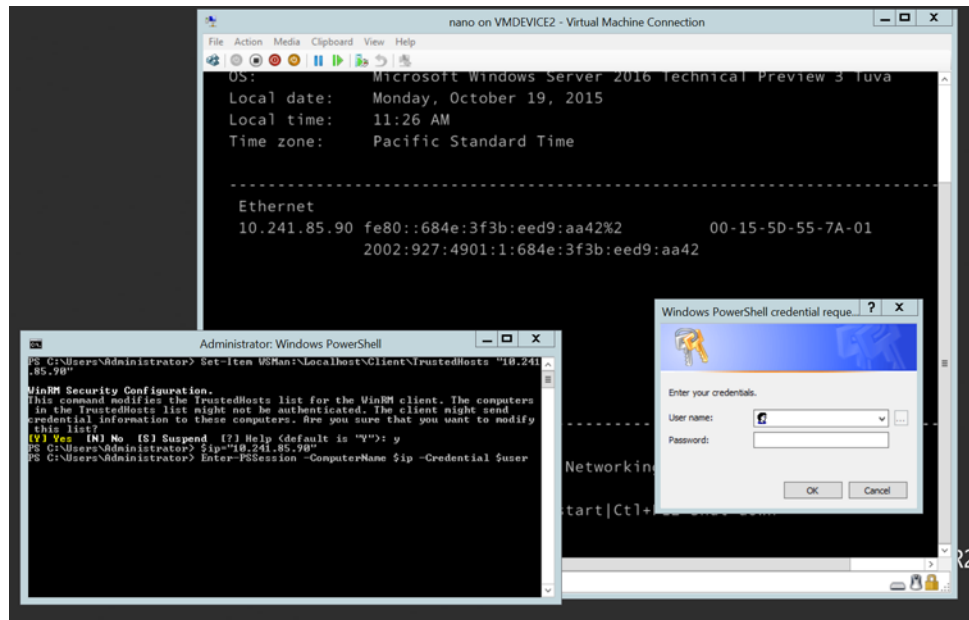


Figure 6 Issuing the Set-Item WsMan command

Tip: Nano Server supports only a small subset of commands. To view the commands supported, issue this PowerShell command

```
Get-Command
```

Joining Nano Server to a Domain

Due to the limited number of PowerShell commands available in a Nano Server, it is impossible to add a Nano Server to a domain directly using the PowerShell command line. The following work-arounds can help you accomplish the task.

Method 1: Build the Nano Server with the information about the network stored in the unattended file that was obtained from an odjblob file, or to create a odjblob file from a system already joined to a domain.

To create the unattended file, review section “Appendix 2: Sample Unattend.xml file that joins Nano Server to a domain” on the following TechNet page:

<https://technet.microsoft.com/en-us/library/mt126167.aspx>

Method 2: From an existing Windows Server 2016 system, create the odjblob file.

1. From an administrator command prompt launch the following command:

```
djoin.exe /provision /domain vvvvvv /machine xxxx /savefile \odjblob /reuse
```

Where vvvvvv is name of the domain and xxxx is the name of the machine when it joins the domain. Our domain for test purposes was *logotest*. We built a Nano Server with the name *nanox*, so the command was:

```
djoin.exe /provision /domain logotest /machine nanox /savefile \odjblob /reuse
```

2. On the Nano Server powershell prompt (log in first, if necessary), make a directory called temp.

3. From the system where you created the odjblob file, copy it to the Nano Server temp directory.

Tip: You will need to log into Nano Server, otherwise you will not be able to transfer files. Use SMB syntax \\nanoserver-IP-address\c\$ to refer to the C:\ drive on the Nano Server.

4. From the PowerShell session connected to the Nano Server, run the following three commands:

```
djoin /REQUESTODJ /LOADFILE c:\temp\odjblob /WINDOWSPATH c:\windows /localos  
shutdown /r /t 15  
Exit-PSSession
```

5. The Nano Server will now reboot. Next time it loads, login using domain credentials.

Installing Nano Server to a bare metal host

Nano Server can be deployed to a virtual machine or it can be installed to a bare metal physical host depend on user's purposes. This section is to show how to install a Nano Server image to a bare metal physical host.

The image are trying to install must have all the necessary drivers needed for the image to run on your the target server.

In this installation example, it is assumed that the server on which you plan to install the Nano Server OS has one hard drive.

The steps to install Nano Server as a bare metal install on a target server are as follows:

1. Create an VHDX image as we described in "Creating a Nano Server image" on page 3, ensuring that it has the correct drivers for the system you are going to install on.
2. Copy the VHDX file to a USB flash drive and insert the drive in the target server.
3. Boot the target server from Windows Server 2016 bootable media (DVD or USB) and press Shift-F10 to get to a command prompt.
4. Run diskpart.exe and issue these commands:

```
select disk 0  
clean  
convert gpt  
create partition EFI size=300  
format quick fs=fat32  
assign letter=s  
create partition primary  
format quick fs=ntfs  
assign letter=c  
exit
```

These commands will prep the C: drive (disk 0) on the target server to get it ready for the Nano Server.

5. Copy the Nano Server image from your USB flash drive to the c:\ drive. For example, our image is called nanox.vhdx. In our case, the USB flash drive appears on the system as drive d:

```
Copy d:\nanox.vhdx c:\
```

6. Run diskpart and issue these commands

```
select vdisk file=c:\nanox.vhdx
attach vdisk
list volume
select volume 4
assign letter=v
exit
```

Note: For the **select volume** command, select the volume that is correct for your test environment. In our environment, it was volume 4.

With the **list volume** command, you will display the list of volumes available and you must identify the volume of you Nano Server that you attached using the **select vdisk** command. You can run a **list volume** prior to running **select vdisk** to view the volumes, run step 3, and then take note of the volume. On our test system, the Nano Server image appears as volume 4.

7. Run this command:

```
bcdboot v:\windows /s s: /f uefi
```

Now you can remove the USB flash drive and reboot the server. The system will boot to the Nano Server OS.

Running Nano Server in Azure

Nano Server can be run in Azure, but you must first add the Hyper-V guest drivers. The **-ForZure** extension will add the required drivers and open the remote management port.

From PowerShell, execute the following command:

```
New-NanoServerImage -MediaPath c:\nano -BasePath .\Base -TargetPath
.\NanoServerVM.vhdx -ForAzure
```

The output of the command is shown in Figure 7 on page 10.



Figure 7 Preparing the image for Azure

Conclusion

Nano Server is one of the key new features of Windows Server 2016. This paper shows how to create a virtual machine image containing Nano Server and also how to deploy that image onto a server as a bare metal OS. We also described how to connect to it using PowerShell and ways you can join the Nano Server to a domain.

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Thanks to the following people for their contributions to this project:

- ▶ David Watts, Lenovo Press
- ▶ Mark T. Chapman, Lenovo

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This document REDP-1234-00 was created or updated on February 23, 2016.

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