TECHNICAL WHITE PAPER



ARUBAOS-CX OVA ON GNS3 VM

USING GNS3 REMOTE VM FOR COMPLEX TOPOLOGY





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Revision History

Document Version	Reason for Change	Revision Date
1.0	Initial Release	April 2019

Introduction

The ArubaOS-CX Simulation Software OVA is a virtual platform to enable simulation of the ArubaOS-CX Network Operating System. Simulated networks can be created using many of the protocols in the ArubaOS-CX operating system like OSPF and BGP. Key features like VSX, Aruba Network Analytics Engine and the REST API can be simulated, providing a lightweight development platform to building the modern network. This software can be easily implemented in the GNS3 simulation software to enable drag and drop network design for building complex simulated topologies.

Using ArubaOS-CX OVA for complex topologies might require some powerful machine and is sometime not suitable on laptop which may not have enough resources to get clean CX VM behavior.

This guide explains how to use the ArubaOS-CX OVA with GNS3 remote VM running on powerful VMware ESXi server. This combination brings very responsive CX Virtual Machine which allows great efficiency in simulating networks including features like VSX, OSPF, BGP, 3-Tier network layers...

Pre-requisites

1. Please download the ArubaOS-CX OVA from here:

https://asp.arubanetworks.com/downloads/software/RmlsZTpjY2M3NjgzOC0yZTUyLTExZTktYjRkOC1iNzk5YmM1YTZmMmM% 3D

2. And please refer to the release notes to understand the unsupported features:

https://support.hpe.com/hpsc/doc/public/display?docId=a00065948en_us

Download the ArubaOS-CX GNS3 appliance:

You may see AubaOS-CX ni the GNS3 marketplace. At the time of writing this guide, this appliance is not maintained



by Aruba yet. Please download and unzip the GNS3 appliance from arubapedia instead: https://arubapedia.arubanetworks.com/arubapedia/index.php/File:arubaoscx_gns3a.zip 4. Download GNS3 client from https://www.gns3.com/

(Version 2.1.16 at the time of that guide)

	DOWNI OAD GNS3	
S	elect the installer for your favourite C	os
	Ć	۵
Windows Version 2.1.16	Mac Version 2.1.16	Linux Version 2.1.16
O DOWNLOAD	O DOWNLOAD	
Install Guide for Windows	Install Guide for Mac	Install Guide for Linux
For optimal per	formance, make sure to also <u>downlo</u>	ad the GNS3 VM
GNS3 is a F		v3 licensing
deployments	earing without the tices.	nue-tree or tum environment

5. Download the associated GNS3 VM for VMware ESXi (recommendation: same version, here 2.1.16) https://www.gns3.com/software/download-vm

	DOWNLOAD GNS3 VM	
The GNS3 VM is recommended development team have worked avoids multiple con	I for most situations when you are using W hard to create a lightweight, robust way o nmon issues experienced when using a loc	Vindows or Mac OS. The GNS3 f creating GNS3 topologies that cal install of GNS3.
Ŷ		
VIRTUALBOX Version 2.1.16	VMWARE WORKSTATION AND FUSION Version 2.1.16	VMWARE ESXI Version 2.1.16
download	C DOWNLOAD	DOWNLOAD
	Learn more about the GNS3 VM	

- 6. A laptop (Windows, MAC, Linux) having, if possible, full IP access to the subnet on which the GNS3 VM will run.
- 7. An ESXi 6.x server with at least 8 CPUs (ex: 4 cores with multithreading) and at least 32GB of RAM.

GNS3 Set-up

Install GNS3 VM

Install from vsphere or ESXi Web-UI the GNS3 VM.

Here is an example of allocated number of vCPUs and RAM.

Virtual Hardware	VM Options	SDRS Rules	vApp Opt	tions			
CPU		8	-	0			
Cores per So	ocket	2	Sockets	: 4			
CPU Hot Plu	g	Enable CPU Hot Add					
Reservation		0			-		
Limit		Unlimited	-	MHz	-		
Shares		Normal	-	8000	-		
CPUID Mask	E	Expose the NX/	XD flag to	guest	-	Advanced	
Hardware vir	tualization	Expose hardw	vare assist	ed virtuali	zation	to the guest O 🚯	
Performance	Counters	🗹 Enable virtual	ized CPU	performar	ice co	unters	
Scheduling A	Affinity			0			
CPU/MMU Virtualization		Automatic			•	0	
Memory		32768	*	MB	*		
🛄 Hard disk 1		19.53125	*	GB	-	6 6	
Ard disk 2		97.65625	*	GB	-		
G SCSI control	ler 0	LSI Logic Paralle	el				
Metwork ada	pter 1	VM Network net	t15		-	Connected	
le CD/DVD driv	e 1	Host Device			-	Connected	
Video card		Specify custom	settings		-		
🔅 VMCI device							
Other Devices							
Linese de		Schedule VM	Compatib	ility Upgra	de		

The main important point is the Hardware Virtualization which needs to be checked to expose hardware assisted virtualization to the GNS3 VM.

This setting is mandatory to get KVM support from GNS3 VM. Once GNS3 VM is started, you'll get this information screen:



Select "OK" and select Networking from the Menu below

GNS3 2.1.15 GNS3 2.1.15 Information Upgrade Shell	Display VM information Upgrade GNS3 Open a console	
Security Keyboard Configure Proxy Networking Log Test Version Restore Reboot Shutdown	Configure authentication Change keyboard layout Edit server configuration (advanced users ONLY) Configure proxy settings Configure networking settings Show server log Check internet connection Select the GNS3 version Restore the VM (if you have trouble for upgrade) Reboot the VM Shutdown the VM	
	< OK > <cancel></cancel>	

Edit the /etc/network/interfaces file to set your corresponding fixed IP address.

GNU nano 2.2.6 File: /etc/network/interfaces
This file describes the network interfaces available on your system # and how to activate them. For more information, see interfaces(5).
Warning this file will be erased by each # GNS3 VM update; if you want to customize it # change the following var to 1 but DO NOT # remove the leading #. # # MANUAL=0
Host only interface auto eth0
Comment this line to disable DHCP
iface eth0 inet dhcp
Uncomment this lines if you want to manually configure network
It's not recommended if you can avoid it.
#
#iface eth0 inet static
address 10.10.10
netmask 255.255.0.0
gateway 10.10.0.1
dns-nameservers 8.8.8.8
The loopback network interface [Read 43 lines]
TG Get Help TU WriteOut TR Read File TY Prev Page TR Cut Text TC Cur Pos <mark>*X Exit ^J Justify [*]W Where Is [*]U Next Page [*]U</mark> UnCut Text <mark>*T</mark> To Spell

CTRL+O to save, CTRL+X to exit.

On Exit the GNS3 VM will restart and is ready to use.

The default username and password of the GNS3 VM are: gns3 / gns3. SSH can be used to access the VM if needed and to change the password of gns3 username (using sudo passwd).

Install GNS3 Client

Perform regular installation of GNS3 on your prefer client platform.

Start GNS3 Client. As an example here is GNS3 running on Windows10:

		Topology Summery Node Console
3	Setup Wilard 7 × Server Rese choice a server type to run your (7/53 network simulations. The (7/83 VM is abondy recommended on Windows and Mac OS X.	
	Kan modern IOS (IDSY or IOU), ASA and appliances from non rise manufacturers. This if requires an additional (W or IOS 3VH as available for free). Rau, only legacy 106 on my computer Requires IOH magnes <= C7200 Requires (IOH magnes >= C7200 The server will be on a remote computer and can be shared with multiple users.	
		Servers Summary
	ConT show the agen	
	Bext > Carcel	
Console		
GHS3 management console. Running GHS3 version 2.1.15 on Windows Copyright (c) 2006-2019 GHS3 Technologi Use Help -> GHS3 Doctor to detect commo	Steholy with Python 3.6.8 Qt 5.12.1 and PyQt 5.12.	

You may skip the set-up wizard and go to Edit/Preferences, Main Server and Enable local server (for any reason having a local server is a must)

9 FICICICIUS	I	
General	Server preferences	
Server		
GNS3 VM		
Packet capture	main server Rémote servers	-
- Built-in	✓ Enable local server	
Ethernet hubs	General settings	
Ethernet switches		
Cloud nodes	server path:	
* VPCS	C: \Program Files \GNS3 \gns3server.EXE Browse	
VPCS nodes	Ubridge path:	
 Dynamips 	C:\Program Files\GNS3\ubridge.EXE Browse	
IOS routers	Host binding:	
- IOS on UNIX	15.136.40.112	
OU Devices	Port:	
	2000 TCD	
Virtual Rox		
	✓ Protect server with password (recommended)	
	Allow console connections to any local IP address	
VMware VMs		
* Docker	Console port range (5900 => 6000 is shared with VNC)	
Docker Containers	5000 TCP 🗘 to 10000 TCP 🗘	
	UDP turneling port range	
	10000 UDP 💠 to 20000 UDP 🜩	
	Restore defa	ılts
	OK Cancel Apr	lv

Host binding can be the loopback address 127.0.0.1.

Then go to the Remote Servers tab and enter the information of your remote GNS3 VM:

🚱 Preferences										? >	<	
General	Server pre	eferences										
GNS3 VM Packet capture	Main server	Remote servers										
 Built-in Ethernet hubs Ethernet switches Cloud nodes VPCS VPCS nodes Dynamips IOS routers IOS on UNIX IOU Devices QEMU Qemu VMs VirtualBox VIMs VMware VMware VMware VMs Docker Docker Containers 	Name GN53-V Add Note: Change	Protocol M http Edit s are not visible in r	Host 15,136.40.40 Delete other part of the set	Port 3080 Server s Name Host: Port: Enab	erver settii ttings GNS3-VM 15.136.40 3080 TCP	User				ĸ	? Can	×
									Restore	defaults		
							 ОК	Ca	ncel	Apply		

Authentication (that can be enabled) was not successfully tested.

Once apply, 2 green GNS3 servers should appear in the Serves Summary Tile of the GNS3 Client: the local and the remote.



ArubaOS-CX OVA set-up in GNS3

ArubaOS-CX GNS3 Appliance

The ArubaOS-CX GNS3 appliance is combination of a descriptor file .gns3a and a disk .vmdk file.

Here is the arubaoscx.gns3a:

```
{
    "name": "ArubaOS-CX Simulation Software",
    "category": "multilayer_switch",
    "status": "stable",
    "product_name": "ArubaOS-CX Simulation Software",
    "description": "The ArubaOS-CX Simulation Software OVA is a virtual platform to enable simulation of
the ArubaOS-CX Network Operating System. Simulated networks can be created using many of the protocols in
the ArubaOS-CX Operating system like OSPF and BGP. Key features like the Aruba Network Analytics Engine
and the REST API can be simulated, providing a lightweight development platform to building the modern
network. This software can be easily implemented in the GNS3 simulation software to enable drag and drop
network design for building complex simulated topologies.",
    "maintainer_email": "TBD",
    "vendor_url": "arubanetworks.com",
    "vendor_name": "HPE Aruba",
    "availability": "service-contract",
    "maintainer": "TBD",
    "registry_version": 4,
    "usage": "Default username admin with blank password.",
    "symbol": ":/symbols/route_switch_processor.svg",
    "first_port_name": "",
    "port_name_format": "1/1/{0}",
    "gemu": {
        "arch": "x86_64",
        "ram": 4096,
        "adapters": 8,
        "hdb_disk_interface": "ide",
        "hdc_disk_interface": "ide",
        "hda_disk_interface": "ide",
        "cpus": 2,
        "kvm": "require",
        "adapter_type": "virtio-net-pci",
        "console_type": "vnc",
        "options": "-nographic",
        "process_priority": "normal"
    },
    "images": [
        {
            "filename": "arubaoscx-disk-image-genericx86-p4-20190129201401.vmdk",
            "version": "10.02.0010",
            "md5sum": "ac3c74eedb90d6451083ada5467271c6",
            "filesize": 287734784,
            "download_url": "http://support.arubanetworks.com/"
        }
    ],
    "versions": [
        {
            "name": "10.02.0010",
            "images": {
                "hda_disk_image": "arubaoscx-disk-image-genericx86-p4-20190129201401.vmdk"
            }
        }
    1
```

}

The .vmdk file is contains in the ArubaOS-CX OVA that is downloaded from Arubra Support Portal.

Please note that the provided gns3a file is linked to CX version. Here it is 10.02.0010. The vmdk filename, filesize and md5 signature should match the corresponding vmdk file.

Import CX Appliance in GNS3.

In GNS3 Client



Select the GNS3 appliance file that was downloaded before (pre-requisite: arubaoxcx.gns3a).

ArubaOS-C ne ArubaOS-CX S mulated network	X Simulation Software imulation Software OVA is a virtual platform to enable simulation of the ArubaOS-CX Network Operating System s can be created using many of the protocols in the ArubaOS-CX Operating system like OSPF and BGP. Key feat	i. tures
e the Aruba Netv e modern netwo esign for building	vork analytics Engine and the RES1 AP1 can be simulated, providing a lightweight development platform to Duild K. This software can be easily implemented in the GNS3 simulation software to enable drag and drop network complex simulated topologies.	ng
ategory:	multilayer_switch	
roduct: /endor:	ArubaOS-CA Simulation Sottware HDF Δruba	
itatus:	stable	
Aaintainer:	Aruba TME	
Architecture:	x86_64	
VM:	require	
	Next > Canc	el

Click on Next.

Please choose a server type to run your new Appliance.	*
Server type	
The grayed server types are not supported or configured.	
O Run the appliance on a remote server	
Run the appliance on the GNS3 VM (recommended)	
O Run the appliance on your local computer	

Next.

3 Add appliance				?	×
GNS3 server requirements is OK you can continue the installa	tion				
		< <u>B</u> ack	Next >	Cano	el

Next.

Add appliance					? >
uired files he following versions are availa	ble for ArubaOS-CX Simulation Software. Check the	status of files required to install.			*
lick on a version to see the requ NS3 is looking for files in your d	uired files and import the file from your computer. Iownloads directory and in the GNS3 images directory				
/ersion	Filename	Size	Status	File version	MD5
 ArubaOS-CX Simulation 	Software 10.02.0010	304.9 MB	Ready to instal		
	arubaoscx-disk-image-g	enericx86-p4 304.9 MB	Found	10.02.0010	ac3c74eedb90d6451083ada
				C	Create a new version Refresh
				10-	de la Neuda de Consul
				< <u>B</u> a	ck <u>N</u> ext > Cancel

The filename might not be found as disk path is missing. If "Not Found" appears, simply import the expected file with the import button once the missing item is selected:

					?
for ArubaOS-CX Simulation Software. Check the st	atus of files required to install.				✻
ed files and import the file from your computer. Inloads directory and in the GNS3 images directory.					
Filename	Size	Status	File version	MD5	
oftware 10.02.0010	304.9 MB	Ready to install			
arubaoscx-disk-image-ger	nericx86-p4 304.9 MB	Found	10.02.0010	ac3c74eedb90d	6451083ada
				Create a new version	Refresh
	for ArubaOS-CX Simulation Software. Check the st ed files and import the file from your computer. Inloads directory and in the GNS3 images directory. Filename oftware 10.02.0010 arubaoscx-disk-image-ger	for ArubaOS-CX Simulation Software, Check the status of files required to install. ed files and import the file from your computer. Inloads directory and in the GNS3 images directory. Filename Size oftware 10.02.0010 304.9 MB arubaoscx-disk-image-genericx86-p4 304.9 MB	for ArubaOS-CX Simulation Software. Check the status of files required to install. ed files and import the file from your computer. Inloads directory and in the GNS3 images directory. Filename Size Status oftware 10.02.0010 304.9 MB Ready to install arubaoScx-disk-image-genericx96-p4 304.9 MB Found	for ArubaOS-CX Simulation Software. Check the status of files required to install. ed files and import the file from your computer. Inloads directory and in the GNS3 images directory. Filename Size Status File version 304.9 MB Ready to install arubaoscx-disk-image-genericx86-p4 304.9 MB Found 10.02.0010	for ArubaOS-CX Simulation Software. Check the status of files required to install. ed files and import the file from your computer. Inloads directory and in the GNS3 images directory. Filename Size Status File version MD5 oftware 10.02.0010 304.9 MB Ready to install arubaoscx-disk-image-genericx86-p4 304.9 MB Found 10.02.0010 ac3c74eedb90d Create a new version

Click Import and select the proper vmdk file.

For 10.02.0010 it is: "arubaoscx-disk-image-genericx86-p4-20190129201401.vmdk".

The .vmdk file is available in the ArubaOS-CX_10_02_0010.ova file.

The .vmdk file can be extracted from .ova file by using any zip-utility (ex: 7-Zip):

Name	Size	Packed Size	Modified	Mode	User	Group
arubaoscx-disk-image-genericx86-p4-20190129201401.ovf	9 077	9 216	2019-01-29 22:26	0rw-rw-r	swbuildn	warp
💝 arubaoscx-disk-image-genericx86-p4-20190129201401.vmdk	319 734 272	319 734 272	2019-01-29 22:26	0rw-rr	swbuildn	warp

Once file selection is made:



Click Yes.

			_
🔮 Add applian	ie	?	×
Qemu settings Please choose	the gemu binary that we will use for running this appliance.	늿	÷
Qemu binary:	/usr/bin/qemu-system-x86_64 (v2.5.0)		•
	< Back Next >	Cance	3
		_	

Keep the default selected Qemu (Qucik Emulator: QEMU is a generic and open source machine emulator and virtualizer). Click Next.

e following cettings a	re going to be used					1
e tollowing securigs a	e going to be used.				2	N
rch:	x86 64					
lam:	4096					
dapters:	8					
ldb disk interface:	ide					
ldc disk interface:	ide					
lda disk interface:	ide					
pus:	2					
vm:	require					
dapter type:	virtio-net-pci					
onsole type:	vnc					
ptions:	-nographic					
rocess priority:	normal					

Next.

Add appliance	? ×
ige lease read the following instructions in order to use your new appliance.	*
The appliance is available in the multilayer switch category.	
Default username admin with blank password.	
	< Back Einish Cancel

Click Finish:



Appliance is installed.

Edit Qemu VM template

Edit/Prefences. Select the Qemu VM template corresponding to the imported appliance.



You'll have to edit the template:

🛞 QEMU VM configura	tion					?	×
ArubaOS-CX							
Consultanting of							
General settings	HDD	CD/DVD	Network	Advanced settings			
Template name:	Arub	aOS-CX					
Default name format:	{nam	e}-{0}					
Symbol:	aruba	aL3-small.png	1			Browse	.
Category:	Swite	thes					
RAM:	4096	MB					•
vCPUs:	2						•
Qemu binary:	/usr/	bin/qemu-sys	stem-x86_64	(v2.5.0)			
Boot priority:	HDD						
Console type:	telne	t					
					ОК	Cano	:el

Change:

- Template Name: use for instance ArubaOS-CX or CX or ...
- Symbol: use Aruba icon (png file) like:



- Category: select Switches
- Console type: select telnet. This will start putty instead of VNC (text color not tunable in VNC).

All the other parameters are kept as proposed.

Click ok twice.

Example

You're ready to use GNS3 with CX VMs running on GNS3 KVM, running on ESXi server.

Here a topology example:



On the right side, you can see CX virtual nodes running on remote GNS3 VM.

You can perform start/stop of all VMs at the same time.