

The Fortinet logo, featuring the word "FORTINET" in a bold, black, sans-serif font. The letter "O" is replaced by a red square with a white grid pattern. A registered trademark symbol (®) is located to the right of the text.

**FORTINET®**

# Measuring FortiGate Dynamic Route Capacity

Version 1.3



# FortiGate Dynamic Route Capacity

## FortiOS

- There is no fixed, hard limit for the number of Dynamic routes that FortiGate can accommodate
- The FortiGate Dynamic Route capacity depends on the amount of RAM available for the unit, irrespective whether it is a Hardware Appliance or a VM based appliance.
- This document provides testing output on FortiGate with various RAMs such as 2GB, 4GB and 8GB for 100K, 500K and 900K routes, respectively.
- This test is carried out on FortiGate-VM with FortiOS v7.2.5 using GoBGP tool injecting Internet routes collected by RIPE, however the test outcome is the same, be it a VM or a Hardware Appliance. What matters is the RAM size.
- As the current RIPE Internet route database consist of only 928K routes as of Jul-2023, this is the maximum that is tested, even though the FortiGate with sufficient memory can accommodate beyond 1 million routes.



# Default State - GUI

FortiGate with 2 GB RAM

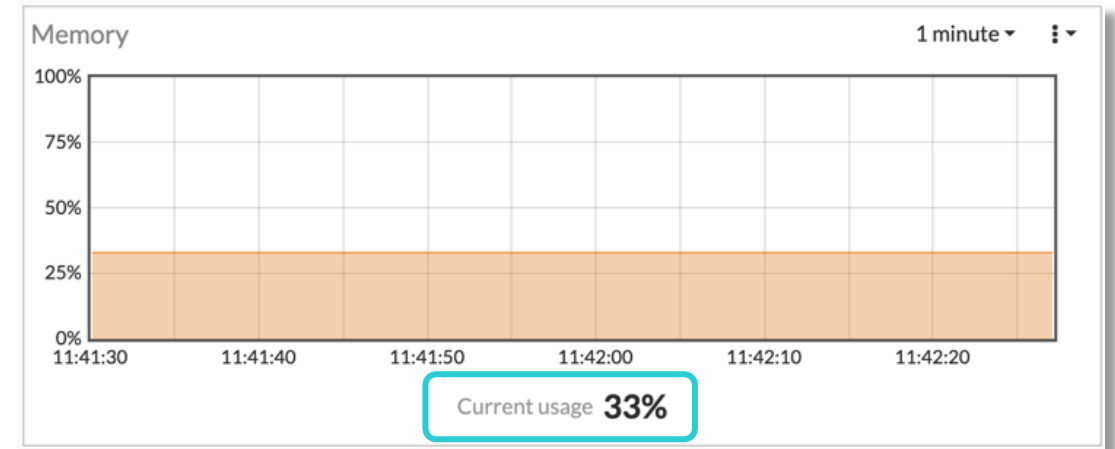
Virtual Machine

✓ FGVM08 License

Allocated vCPUs 1 / 8

13%

Allocated RAM 2 GB



Routing Static & Dynamic

3 Routes

Type

- Connected
- Static

3 Routes

Interfaces

- MPLS-HUB (port3)
- MGMT (port1)
- Internet (port2)

Route Lookup View Create Address Search

Network	Gateway IP	Interfaces	Distance	Type
10.250.250.105/32	10.100.205.10	MPLS-HUB (port3)	10	Static
172.20.0.0/24	0.0.0.0	MGMT (port1)	0	Connected
172.20.250.0/24	0.0.0.0	Internet (port2)	0	Connected

Updated: 11:45:03



# Default State – CLI

FortiGate with 2 GB RAM

```
CLI Console (1)
FGT-VM # get hardware status | grep RAM
RAM: 1994 MB

FGT-VM # get system performance status | grep Memory
Memory: 2042016k total, 681824k used (33.4%), 1197936k free (58.7%), 162256k freeable (7.9%)

FGT-VM # get router info bgp summary

VRF 0 BGP router identifier 172.20.0.110, local AS number 65002
BGP table version is 1
0 BGP AS-PATH entries
0 BGP community entries

Neighbor      V      AS MsgRcvd MsgSent   TblVer  InQ  OutQ Up/Down  State/PfxRcd
172.20.0.140  4      65001     0       0         0    0    0 never    Active

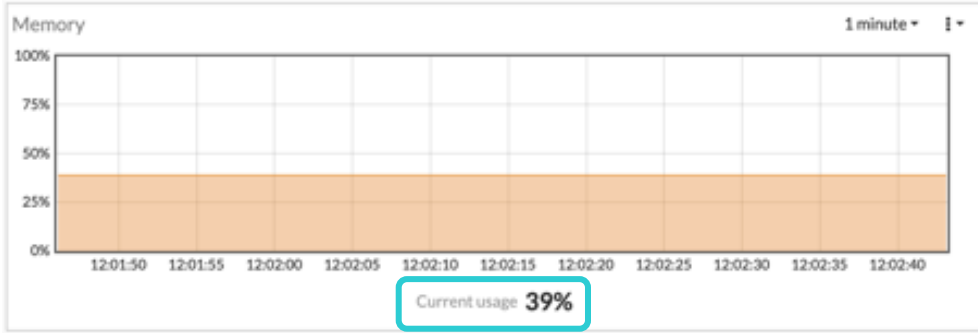
Total number of neighbors 1

FGT-VM #
```



# 100K Routes Injected - GUI

FortiGate with 2 GB RAM



Routing Static & Dynamic

Route Lookup View Create Address

Network	Gateway IP	Interfaces	Distance	Type
1.0.64.0/18	172.20.0.140	MGMT (port1)	20	BGP
1.0.128.0/17	172.20.0.140	MGMT (port1)	20	BGP
1.0.128.0/18	172.20.0.140	MGMT (port1)	20	BGP
1.0.128.0/19	172.20.0.140	MGMT (port1)	20	BGP
1.0.144.0/20	172.20.0.140	MGMT (port1)	20	BGP
1.0.160.0/19	172.20.0.140	MGMT (port1)	20	BGP
1.0.192.0/18	172.20.0.140	MGMT (port1)	20	BGP
1.0.192.0/19	172.20.0.140	MGMT (port1)	20	BGP
1.0.224.0/19	172.20.0.140	MGMT (port1)	20	BGP
1.0.224.0/20	172.20.0.140	MGMT (port1)	20	BGP
1.1.64.0/19	172.20.0.140	MGMT (port1)	20	BGP
1.1.128.0/17	172.20.0.140	MGMT (port1)	20	BGP
1.1.128.0/18	172.20.0.140	MGMT (port1)	20	BGP
1.1.128.0/19	172.20.0.140	MGMT (port1)	20	BGP
1.1.160.0/19	172.20.0.140	MGMT (port1)	20	BGP

0% 100,320 Updated: 12:01:46



# 100K Routes Injected - CLI

FortiGate with 2 GB RAM

```
CLI Console (1)
FGT-VM # get hardware status | grep RAM
RAM: 1994 MB

FGT-VM # get system performance status | grep Memory
Memory: 2042016k total, 808964k used (39.6%), 1070860k free (52.4%), 162192k freeable (8.0%)

FGT-VM # get router info bgp summary

VRF 0 BGP router identifier 172.20.0.110, local AS number 65002
BGP table version is 1
12770 BGP AS-PATH entries
5628 BGP community entries

Neighbor      V      AS MsgRcvd MsgSent   TblVer  InQ  OutQ  Up/Down  State/PfxRcd
172.20.0.140  4      65001  381491     9         0    0    0 00:03:11 100317

Total number of neighbors 1

FGT-VM #
```



# Default State - GUI

FortiGate with 4 GB RAM

Virtual Machine

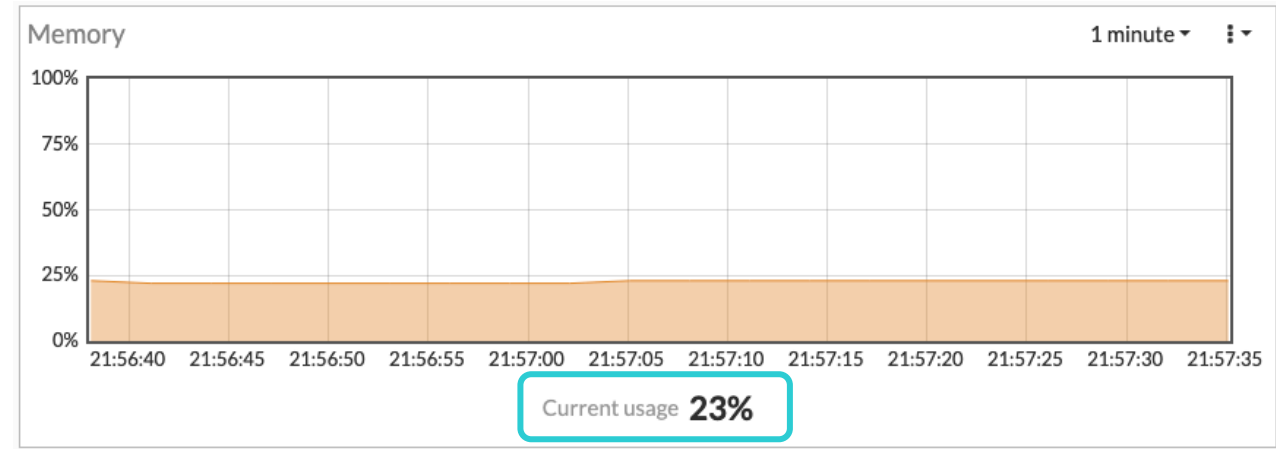
✓ FGVM08 License

Allocated vCPUs 2 / 8

25%

Allocated RAM 4 GB

Auto Scaling ✖



Routing

Static & Dynamic

4 Routes

Type

- Static
- Connected

Interfaces

- port1
- Internal (port2)

Route Lookup View Create Address Search

Network	Gateway IP	Interfaces	Distance	Type
0.0.0.0/0	10.24.40.1	port1	10	Static
10.24.40.0/22	10.24.41.1	Internal (port2)	10	Static
10.24.40.0/26	0.0.0.0	port1	0	Connected
10.24.41.0/26	0.0.0.0	Internal (port2)	0	Connected

Updated: 21:58:13



# Default State – CLI

FortiGate with 4 GB RAM

```
CLI Console (1)
FGT-VM01 # get hardware status | grep RAM
RAM: 3946 MB

FGT-VM01 # get system performance status | grep Memory
Memory: 4041660k total, 966368k used (23.9%), 2829324k free (70.0%), 245968k freeable (6.1%)

FGT-VM01 # get router info bgp summary

VRF 0 BGP router identifier 10.24.41.4, local AS number 65002
BGP table version is 1
0 BGP AS-PATH entries
0 BGP community entries

Neighbor V AS MsgRcvd MsgSent TblVer InQ OutQ Up/Down State/PfxRcd
10.24.41.6 4 65001 2 2 0 0 0 00:00:15 0

Total number of neighbors 1

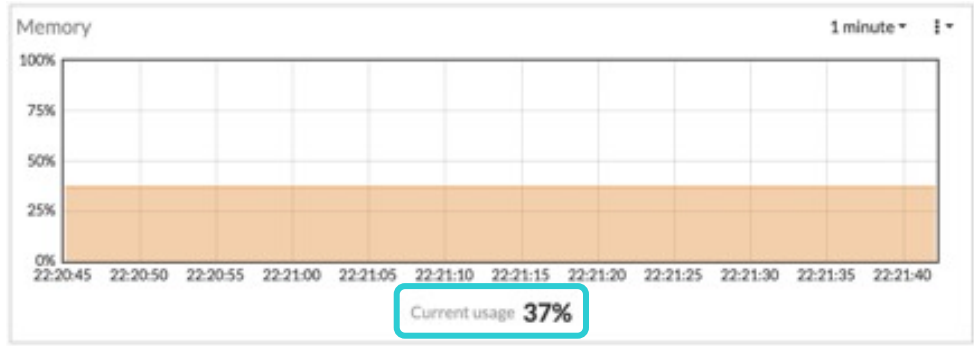
FGT-VM01 #
```





# 500K Routes Injected - GUI

FortiGate with 4 GB RAM



Routing

Static & Dynamic

Route Lookup View Create Address

Network	Gateway IP	Interfaces	Distance	Type
0.0.0.0/0	10.24.40.1	port1	10	Static
1.0.0.0/24	10.24.41.6	Internal (port2)	20	BGP
1.0.4.0/22	10.24.41.6	Internal (port2)	20	BGP
1.0.5.0/24	10.24.41.6	Internal (port2)	20	BGP
1.0.16.0/24	10.24.41.6	Internal (port2)	20	BGP
1.0.32.0/24	10.24.41.6	Internal (port2)	20	BGP
1.0.64.0/18	10.24.41.6	Internal (port2)	20	BGP
1.0.128.0/17	10.24.41.6	Internal (port2)	20	BGP
1.0.128.0/18	10.24.41.6	Internal (port2)	20	BGP
1.0.128.0/19	10.24.41.6	Internal (port2)	20	BGP
1.0.128.0/24	10.24.41.6	Internal (port2)	20	BGP
1.0.129.0/24	10.24.41.6	Internal (port2)	20	BGP
1.0.130.0/23	10.24.41.6	Internal (port2)	20	BGP
1.0.132.0/24	10.24.41.6	Internal (port2)	20	BGP
1.0.133.0/24	10.24.41.6	Internal (port2)	20	BGP

0% 5,00,048 Updated: 22:20:14



# 500K Routes Injected - CLI

FortiGate with 4 GB RAM

```
CLI Console (1)
FGT-VM01 # get hardware status | grep RAM
RAM: 3946 MB

FGT-VM01 # get system performance status | grep Memory
Memory: 4041660k total, 1508664k used (37.3%), 2286628k free (56.6%), 246368k freeable (6.1%)

FGT-VM01 # get router info bgp summary

VRF 0 BGP router identifier 10.24.41.4, local AS number 65002
BGP table version is 1
69682 BGP AS-PATH entries
110 BGP community entries

Neighbor    V      AS MsgRcvd MsgSent  TblVer  InQ  OutQ  Up/Down  State/PfxRcd
10.24.41.6  4      65001 1566485    18        0     0    0 00:06:57 500044

Total number of neighbors 1

FGT-VM01 #
```



# Default State - GUI

FortiGate with 8 GB RAM

Virtual Machine

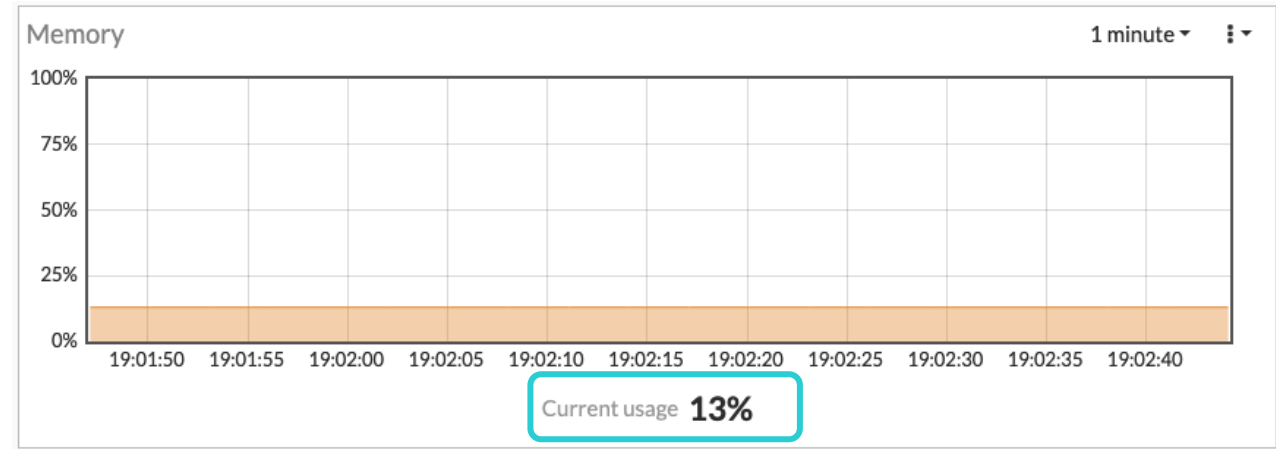
✓ FGVM08 License

Allocated vCPUs 2 / 8

25%

Allocated RAM 8 GB

Auto Scaling ✕



Routing Static & Dynamic

4 Routes (Static & Connected)

4 Routes (port1 & Internal (port2))

Network	Gateway IP	Interfaces	Distance	Type
0.0.0.0/0	10.24.40.1	port1	10	Static
10.24.40.0/22	10.24.41.1	Internal (port2)	10	Static
10.24.40.0/26	0.0.0.0	port1	0	Connected
10.24.41.0/26	0.0.0.0	Internal (port2)	0	Connected

Updated: 19:00:03



# Default State – CLI

FortiGate with 8 GB RAM

```
CLI Console (1)
FGT-VM02 # get hardware status | grep RAM
RAM: 7978 MB

FGT-VM02 # get system performance status | grep Memory
Memory: 8170028k total, 1122756k used (13.7%), 6705128k free (82.1%), 342144k freeable (4.2%)

FGT-VM02 # get router info bgp summary

VRF 0 BGP router identifier 10.24.41.5, local AS number 65002
BGP table version is 1
0 BGP AS-PATH entries
0 BGP community entries

Neighbor V AS MsgRcvd MsgSent TblVer InQ OutQ Up/Down State/PfxRcd
10.24.41.6 4 65001 2 2 0 0 0 00:00:17 0

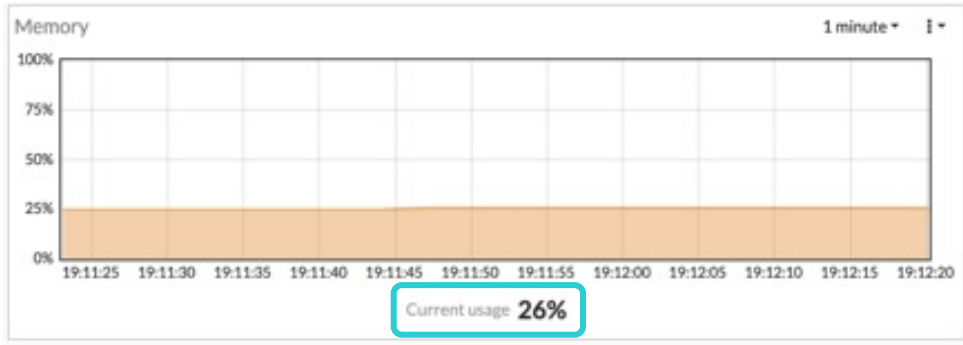
Total number of neighbors 1

FGT-VM02 #
```



# 928K Routes Injected - GUI

FortiGate with 8 GB RAM



Routing Static & Dynamic

Route Lookup View Create Address

Network	Gateway IP	Interfaces	Distance	Type
0.0.0.0/0	10.24.40.1	port1	10	Static
1.0.0.0/24	10.24.41.6	Internal (port2)	20	BGP
1.0.4.0/22	10.24.41.6	Internal (port2)	20	BGP
1.0.5.0/24	10.24.41.6	Internal (port2)	20	BGP
1.0.16.0/24	10.24.41.6	Internal (port2)	20	BGP
1.0.32.0/24	10.24.41.6	Internal (port2)	20	BGP
1.0.64.0/18	10.24.41.6	Internal (port2)	20	BGP
1.0.128.0/17	10.24.41.6	Internal (port2)	20	BGP
1.0.128.0/18	10.24.41.6	Internal (port2)	20	BGP
1.0.128.0/19	10.24.41.6	Internal (port2)	20	BGP
1.0.128.0/24	10.24.41.6	Internal (port2)	20	BGP
1.0.129.0/24	10.24.41.6	Internal (port2)	20	BGP
1.0.130.0/23	10.24.41.6	Internal (port2)	20	BGP
1.0.132.0/24	10.24.41.6	Internal (port2)	20	BGP
1.0.133.0/24	10.24.41.6	Internal (port2)	20	BGP

0% 9,28,321 Updated: 19:12:35



Note: As the tool to inject BGP routes uses the current Global Internet Routes as of Jul-2023, the FortiGate displays 928K routes, which is the current limit of Global Internet routes. However, the FortiGate is capable of accepting more than 1 Million routes, as this functionality depends purely on available memory

# 928K Routes Injected - CLI

FortiGate with 8 GB RAM

```
CLI Console (1)
FGT-VM02 # get hardware status | grep RAM
RAM: 7978 MB

FGT-VM02 # get system performance status | grep Memory
Memory: 8170028k total, 2158648k used (26.4%), 5665620k free (69.3%), 345760k freeable (4.3%)


FGT-VM02 # get router info bgp summary

VRF 0 BGP router identifier 10.24.41.5, local AS number 65002
BGP table version is 1
122031 BGP AS-PATH entries
225 BGP community entries

Neighbor V AS MsgRcvd MsgSent TblVer InQ OutQ Up/Down State/PfxRcd
10.24.41.6 4 65001 2923637 28 0 0 0 00:11:28 928317

Total number of neighbors 1

FGT-VM02 #
```

 Note: As the tool to inject BGP routes uses the current Global Internet Routes as of Jul-2023, the FortiGate displays 928K routes, which is the current limit of Global Internet routes. However, the FortiGate is capable of accepting more than 1 Million routes, as this functionality depends purely on available memory

# Test Setup

Steps to reproduce the Test results

Step 1: Setup a lab with a Ubuntu VM and FortiGate directly connected to each other

Step 2: Install GoBGP:

```
sudo apt-get update && sudo apt-get install gobgp
```

Step 3: Create gobgpd.conf file

```
[global.config]
  as = 65001
  router-id = "10.24.41.6"
[[neighbors]]
  [neighbors.config]
  neighbor-address = "10.24.41.4"
  peer-as = 65002
```

Step 4: Download one of the RIPE MRT file which contain the Internet routing updates

```
wget https://data.ris.ripe.net/rrc26/latest-bview.gz
gunzip latest-bview.gz
```



# Test Setup

Steps to reproduce the Test results

## Step 5: Configure the FortiGate BGP

```
config router bgp
  set as 65002
  set router-id 10.24.41.4
  config neighbor
    edit "10.24.41.6"
      set soft-reconfiguration enable
      set remote-as 65001
      set route-map-in "Route_IN"
    next
  end
end

config router route-map
  edit "Route_IN"
    config rule
      edit 1
        set set-ip-nexthop 10.24.41.6
      next
    end
  next
end
```

Step 6: Execute the BGP connectivity between the GoBGP utility and the FortiGate and check if the BGP connection is “Established”

```
sudo -E gobgpd -f gobgpd.conf &
```

Step 7: Inject the desired Routes from the GoBGP utility

```
time gobgp mrt inject global latest-bview [num routes to inject]
```





**F****RTINET**®