



Oracle RAC on Microsoft Azure

Deployment Process Demonstration

rev. 2021-02-15



About FlashGrid for Oracle RAC on Azure

Ensuring high availability of backend relational databases is a critical part of the cloud strategy - whether it is a lift-and-shift migration or a green-field deployment of mission critical applications. FlashGrid is an engineered cloud system designed for database high availability. FlashGrid is delivered as a fully integrated Infrastructure-as-Code template that can be customized and deployed to Azure account with a few mouse clicks. Key components of FlashGrid for Oracle RAC on Azure include:

- Azure Virtual Machines
- Azure Managed Premium SSD block storage
- FlashGrid Storage Fabric software
- FlashGrid Cloud Area Network software
- Oracle Grid Infrastructure software
- Oracle RAC database engine

By leveraging the proven Oracle RAC database engine FlashGrid enables the following use-cases:

- Lift-and-shift migration of existing Oracle RAC databases to Azure.
- Migration of existing Oracle databases from high-end on-premises servers to Azure without reducing availability SLAs.
- Design of new mission critical applications for the cloud based on the industry proven and widely supported database engine.

About This Demo

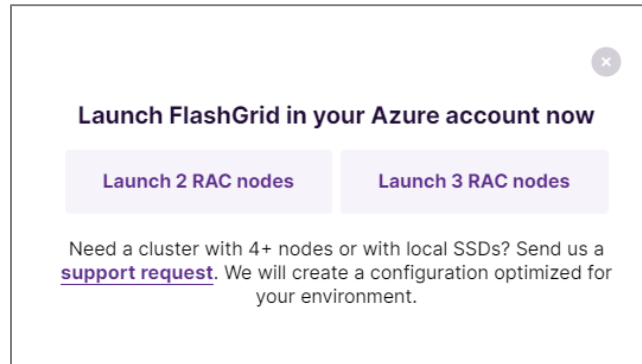
This brief demo the main steps of deploying FlashGrid for Oracle RAC on Azure. The target audience is Azure cloud architects and engineers and database architects and administrators.

More detailed information is available in the following documents:

- White paper: [Oracle RAC on Microsoft Azure enabled by FlashGrid engineered cloud system.](#)
- [Deployment Guide](#)

Step 0: Select one of standard configuration templates

Since majority of deployments have 2 or 3 RAC nodes, these two standard configuration are readily available when you click *Launch* at <https://www.flashgrid.io/products/flashgrid-for-oracle-rac-on-azure/>



Click on a button that corresponds to either 2, or 3 RAC nodes. It will open FlashGrid Launcher tool. (For configurations other than 2 or 3 RAC nodes contact FlashGrid support.)

FlashGrid Cloud Cluster Launcher

Oracle RAC on Azure: 2 database nodes

This wizard will help you specify parameters for your FlashGrid Cloud Cluster with Oracle RAC and will generate Azure Resource Manager (ARM) template for deployment in your Azure account.

1. Cluster Info

Cluster Info

For access to the 1 month free trial submit request at <https://www.flashgrid.io/skycluster-in-azure-free-trial> and include your Azure subscription Id.

Cluster Name

myrac

The cluster name may have up to 15 alphanumeric characters.

Cloud Type

Commercial

Select which Azure cloud type you are planning to use.

Operating System

Oracle Linux 7

The OS selection determines the Marketplace SKU used for the deployment.

Production or Trial

Production

Free trial is strictly limited to 1 month and cannot be extended. Do not select the free trial for production deployments.

SSH key

Enter your public SSH key that will be used for accessing the VMs. For information about the format of the key see <https://kb.flashgrid.io/public-ssh-key-format-for-azure>

Next

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Step 1: Enter basic information about the cluster

At this step you need to enter information such as Azure Cloud type, operating system, and the SSH key that you will use for accessing the VMs.

- 1. Cluster Info
- 2. DB Version
- 3. Oracle Files
- 4. Nodes
- 5. Storage
- 6. Memory
- 7. Listener Ports
- 8. Network
- 9. DNS
- 10. Time Zone, NTP
- 11. Alerts
- 12. Tags
- 13. Registration
- 14. Validate
- 15. Launch

Cluster Info

For access to the 1 month free trial submit request at <https://www.flashgrid.io/skycluster-in-azure-free-trial> and include your Azure subscription Id.

Cluster Name

The cluster name may have up to 15 alphanumeric characters.

Cloud Type

Select which Azure cloud type you are planning to use.

Operating System

The OS selection determines the Marketplace SKU used for the deployment.

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Free trial is strictly limited to 1 month and cannot be extended. Do not select the free trial for production deployments.

SSH key

Enter your public SSH key that will be used for accessing the VMs. For information about the format of the key see <https://kb.flashgrid.io/public-ssh-key-format-for-azure>

Next

Step 2: Select database version

Select which version of the database you are planning to use, along with Patch Set Update / Release Update version for it.

- 1. Cluster Info
- 2. DB Version**
- 3. Oracle Files
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- 14. Validate
- 15. Launch

Database Version

Select options for database software installation.

Database install mode

RAC (not supported with 19c SE2)

Select database home installation mode.

Database Version

19c EE

Select which Database software version will be installed.

Database PSU/RU

2021-01-19

Database PSU/RU version to apply.

GI Release Update

2021-01-19

Grid Infrastructure Release Update version to apply.

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Step 3: Provide location of Oracle installation files

You need to upload the listed Oracle installation files to a Blob Storage Container and provide URL of the container. Cluster initialization script will download and install the files.

- 1. Cluster Info
- 2. DB Version
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- 15. Launch

Oracle Files

We ask you to use your own copy of Oracle installation files. Place the files listed below in a blob container with *Blob* access enabled and provide name of the storage account and the container.

We recommend downloading the files using the hyper-links. If you prefer to download from eDelivery then need to rename the files to the names listed below.

- [LINUX.X64_193000_db_home.zip](#) - Oracle Database 19c (19.3) for Linux x86-64
- [LINUX.X64_193000_grid_home.zip](#) - Oracle Database 19c Grid Infrastructure (19.3) for Linux x86-64
- [oracle-instantclient19.3-basic-19.3.0.0.0-1.x86_64.rpm](#) - Oracle Instant Client Basic 19.3.0.0.0 for Linux x86-64
- [p32067171_190000_Linux-x86-64.zip](#) - Patch 32067171: OJVM RELEASE UPDATE 19.10.0.0.0. Requires Oracle support subscription.
- [p32226239_190000_Linux-x86-64.zip](#) - Patch 32226239: GI RELEASE UPDATE 19.10.0.0.0. Requires Oracle support subscription.
- [p6880880_190000_Linux-x86-64.zip](#) - OPatch 12.2.0.1.24 for DB 19.x releases (Feb 2021) (Patch), Platform: Linux x86-64. Requires Oracle support subscription.

If you do not have the required files then keeping <https://demo.url> will allow you to proceed.

URL of Blob Storage Container with Oracle installation files

Copy the URL from the container properties page. Example: <https://mystorageaccount.blob.core.windows.net/mycontainer>

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Step 4: Configure cluster nodes

Provide hostnames, Availability Zone placement (for regions where AZs are supported), and sizes of the cluster nodes.

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- 14. Validate
- 15. Launch

Nodes

Configure names and sizes for the cluster nodes.

- If the target region supports [Availability Zones](#) then spread the nodes across three AZs.
- If AZs are not supported then confirm [how many Fault Domains](#) the target region has.

Availability Zones or Fault Domains

Region supports availability zones

Select whether the target region supports AZs. If not, then specify number of fault domains available in the target region: 2 or 3.

Cluster Nodes

Hostname*	Role*	AZ*	VM type*
<input type="text" value="rac1"/>	<input type="text" value="database"/>	<input type="text" value="1"/>	<input type="text" value="E32s_v3: 16 cores, 256 GiB, storage: 32 disks max, 768 MB/s, 51200 IOPS"/>
<input type="text" value="rac2"/>	<input type="text" value="database"/>	<input type="text" value="2"/>	<input type="text" value="E32s_v3: 16 cores, 256 GiB, storage: 32 disks max, 768 MB/s, 51200 IOPS"/>
<input type="text" value="racq"/>	<input type="text" value="quorum"/>	<input type="text" value="3"/>	<input type="text" value="DS2_v2: 2 cores, as quorum node only"/>

Do not change node Roles unless instructed by FlashGrid support. If the target region supports Availability Zones then configure the AZ parameter for each node.

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Step 5: Configure storage

Specify ASM disk groups that will be created. The corresponding disks will be automatically attached to the nodes.

- 1. Cluster Info
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- 13. Registration
- 14. Validate
- 15. Launch

Storage

Configure ASM disk groups that will be automatically created.

- The number of disks is specified per node.
- Usable_Capacity = Number_of_Disks_per_Node x Disk_Size (because of mirroring between the nodes)
- Performance information for Premium SSD is available [here](#).
- For production deployments or performance tests, do not use disks smaller than 512 GiB.
- GRID disk group is configured automatically for Vote+OCR.

ASM Disk Groups

Storage profile

Disk Group Name*	# Disks per Node*	Disk Size, GiB*	
<input type="text" value="DATA"/>	<input type="text" value="3"/>	<input type="text" value="1024"/>	<input type="button" value="✕"/>
<input type="text" value="FRA"/>	<input type="text" value="3"/>	<input type="text" value="512"/>	<input type="button" value="✕"/>
			<input type="button" value="⊕"/>

Prev

Step 6: Specify memory allocation

If needed, customize database memory allocation percentages. These percentages are used for automatic configuration of HugePages when database node boots up based on the total memory.

- 1. Cluster Info
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- 3. Oracle Files
- 4. Nodes
- 5. Storage
- 6. Memory**
- 7. Listener Ports
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- 12. Tags
- 13. Registration
- 14. Validate
- 15. Launch

Memory

Select whether HugePages will be automatically configured for SGA.

- Enabling HugePages is recommended for reducing CPU utilization.
- The number of HugePages will be updated automatically when VM size changes.

Automatically configure HugePages

Recommended except when Oracle AMM must be used.

% of System Memory allocated for Databases (SGA+PGA)

Percentage of system memory that will be allocated for use by all databases. 80% recommended. Ignored if automatic configuration of HugePages is disabled.

% of the Database Memory allocated for SGA

This parameter is used for automatically calculating the number of required HugePages. Ignored if automatic configuration of HugePages is disabled.

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Step 7: Specify listener ports

If needed, customize SCAN and Local listener port numbers.

- 1. Cluster Info
- 2. DB Version
- 3. Oracle Files
- 4. Nodes
- 5. Storage
- 6. Memory
- 7. Listener Ports**
- 8. Network
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- 11. Alerts
- 12. Tags
- 13. Registration
- 14. Validate
- 15. Launch

Listener Ports

Select listener port numbers. The SCAN listener and Local listener port numbers must be different.

SCAN Listener Port

Default: 1521. Must be different from Local Listener port.

Local Listener Port

Default: 1522. Must be different from SCAN Listener port.

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Step 8: Provide information about target VNet

In most cases the cluster must be deployed in an existing VNet. Provide information about the VNet and other network resources. Alternatively, you can choose to create a new VNet.

- 1. Cluster Info
- 2. DB Version
- 3. Oracle Files
- 4. Nodes
- 5. Storage
- 6. Memory
- 7. Listener Ports
- 8. Network**
- 9. DNS
- 10. Time Zone, NTP
- 11. Alerts
- 12. Tags
- 13. Registration
- 14. Validate
- 15. Launch

Network

Select to create a new virtual network (VNet) or specify parameters of an existing VNet. For an existing VNet, FlashGrid recommends configuring NSG rules by using an Application Security Group (ASG) for the cluster node VMs. You can configure one ASG per cluster or a separate ASG for each cluster. Regardless of how security groups are configured, the following ports must be open:

- UDP 4801, 4802, 4803 and TCP 3260 between the cluster node VMs
- TCP ports 1521 (or customized SCAN Listener port) and 1522 (or customized Local Listener port) for client and app server access
- TCP port 22 for SSH access

Create new VNet
Uncheck if using an existing VNet

VNet Resource Group (if using existing VNet)

Resource Group of the existing VNet where VMs will be created. Keep blank if creating a new VNet.

VNet Name (if using existing VNet)

Name of the existing VNet where VMs will be created. Keep blank if creating a new VNet.

Subnet Name (if using existing VNet)

Name of a subnet in the existing VNet. Keep blank if creating a new VNet.

Network Security Group (only for existing VNet, optional)

Keep blank to use the NSG attached to the subnet. If using an existing VNet you can specify an NSG that will be assigned to VM NICs. The NSG must be in the same Resource Group as the VNet.

Application Security Groups (if using existing VNet)

Provide list of ASGs that will be assigned to VM NICs. Keep empty if creating a new VNet.

Assign Public IP to VM(s)
ATTENTION! Enabling Public IP is NOT recommended on production systems for security reasons. Enable if SSH access via Internet without VPN is required.

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Step 9: Configure DNS

Specify domain name that will be assigned to cluster nodes. You can also replace the default Azure DNS server with your own list of DNS servers.

- 1. Cluster Info
- 2. DB Version
- 3. Oracle Files
- 4. Nodes
- 5. Storage
- 6. Memory
- 7. Listener Ports
- 8. Network
- 9. DNS**
- 10. Time Zone, NTP
- 11. Alerts
- 12. Tags
- 13. Registration
- 14. Validate
- 15. Launch

DNS

Within the cluster host name resolution is performed by DNSMASQ service configured locally.
For resolving cluster node names on clients or app servers need to add corresponding records to your DNS servers.
For resolving host names that are outside of the cluster (e.g. storage service endpoint) on the cluster nodes, you can use Azure-provided DNS server (default) or custom DNS servers.

Domain Name

The domain name will be configured in the OS. The domain must be in a zone hosted on your DNS servers.

DNS Servers

✕

+

Keep the 168.63.129.16 address to use Azure-provided name resolution for external host names. To use your own DNS servers, provide their IP addresses.

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Step 10: Select time zone and time servers

You can provide your own list of time servers or keep the default list of Google time servers.

- 1. Cluster Info
- 2. DB Version
- 3. Oracle Files
- 4. Nodes
- 5. Storage
- 6. Memory
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- 8. Network
- 9. DNS
- 10. Time Zone, NTP**
- 11. Alerts
- 12. Tags
- 13. Registration
- 14. Validate
- 15. Launch

Time Zone, NTP

Time Zone

UTC

UTC is recommended.

NTP Servers

time1.google.com	↑	↓	×
time2.google.com	↑	↓	×
time3.google.com	↑	↓	×
time4.google.com	↑	↓	×

[+](#)

The servers must be accessible from the VPC/VNet.

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Step 11: Configure email alerts

Specify list of emails where alerts will be sent for errors that may happen during operation of the cluster.

- 1. Cluster Info
- 2. DB Version
- 3. Oracle Files
- 4. Nodes
- 5. Storage
- 6. Memory
- 7. Listener Ports
- 8. Network
- 9. DNS
- 10. Time Zone, NTP
- 11. Alerts**
- 12. Tags
- 13. Registration
- 14. Validate
- 15. Launch

Alerts

Specify email addresses where alerts will be sent in case of a failure during cluster operation. Optionally, enable sending alerts directly to FlashGrid support.

Email Addresses

✕

+

Send operation error alerts to FlashGrid Cloud Cluster technical support

Must have outbound HTTPS traffic to <https://alerts.support.flashgrid.io> allowed. The alert information consists of system name, host name, source IP, license status, error details.

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Step 12: Specify tags

Optionally, specify the list of tags that will be assigned to VMs and disks.

- 1. Cluster Info
- 2. DB Version
- 3. Oracle Files
- 4. Nodes
- 5. Storage
- 6. Memory
- 7. Listener Ports
- 8. Network
- 9. DNS
- 10. Time Zone, NTP
- 11. Alerts
- 12. Tags**
- 13. Registration
- 14. Validate
- 15. Launch

VM and Disk Tags

Optionally, specify tags that will be attached to the VMs and disks. Do not add *name* or *cluster* tags, these tags are configured automatically.

Tags / Labels (optional)

Key / Name	Value	
<input type="text" value="Org"/>	<input type="text" value="MyOrg"/>	<input type="button" value="✕"/>
		<input type="button" value="⊕"/>

Do not add Name or Cluster tags.

[Prev](#)

Step 13: Provide registration information

- 1. Cluster Info
- 2. DB Version
- 3. Oracle Files
- 4. Nodes
- 5. Storage
- 6. Memory
- 7. Listener Ports
- 8. Network
- 9. DNS
- 10. Time Zone, NTP
- 11. Alerts
- 12. Tags
- 13. Registration**
- 14. Validate
- 15. Launch

Registration

Please enter your contact information. This will allow us to provide you with better support for this system.

First Name

Last Name

Company

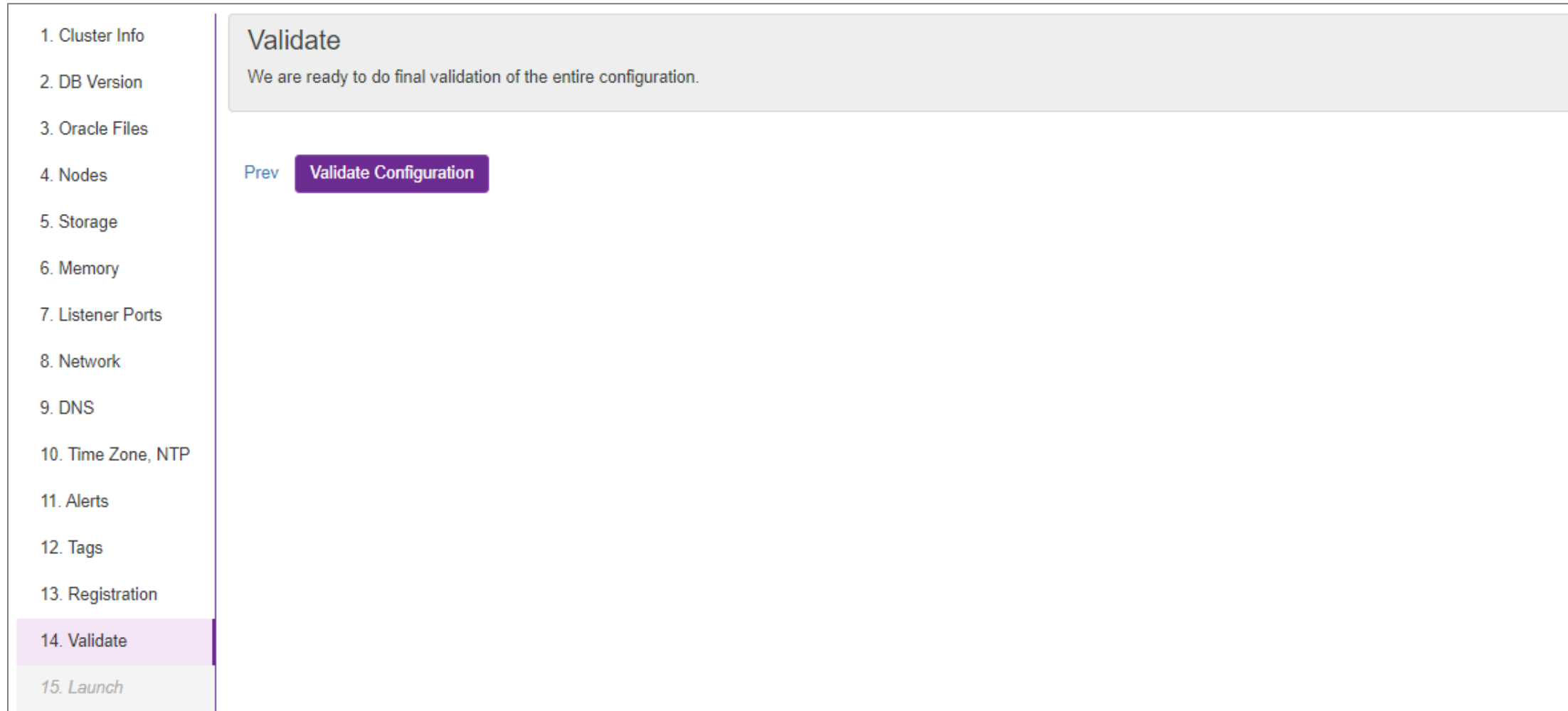
The company name will be used to generate a FlashGrid product license file.

Email

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Step 14: Validate configuration

Click *Validate* to confirm that the provided configuration is consistent.



The screenshot shows a web interface with a sidebar on the left and a main content area on the right. The sidebar contains a list of 15 steps, with '14. Validate' highlighted in purple. The main content area has a grey header with the title 'Validate' and the text 'We are ready to do final validation of the entire configuration.' Below the header, there is a 'Prev' link and a purple button labeled 'Validate Configuration'.

- 1. Cluster Info
- 2. DB Version
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- 9. DNS
- 10. Time Zone, NTP
- 11. Alerts
- 12. Tags
- 13. Registration
- 14. Validate**
- 15. *Launch*

Validate
We are ready to do final validation of the entire configuration.

[Prev](#) [Validate Configuration](#)

Step 15: Generate Azure Resource Manager (ARM) template

When you click *Launch FlashGrid Cloud Cluster*, ARM template will be generated and Azure Portal will open.

- 1. Cluster Info
- 2. DB Version
- 3. Oracle Files
- 4. Nodes
- 5. Storage
- 6. Memory
- 7. Listener Ports
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- 9. DNS
- 10. Time Zone, NTP
- 11. Alerts
- 12. Tags
- 13. Registration
- 14. Validate
- 15. Launch**

Launch

Click *Launch FlashGrid Cloud Cluster* to generate an Azure Resource Manager (ARM) template and open it in ARM for deploying.

- Creating a new resource group for the cluster is highly recommended. This will make it easier to delete the entire cluster if needed.
- After the ARM template is successfully deployed, cluster initialization process starts and takes about 90 minutes.
- Connect to the first database node via SSH as user `az-admin@`.
- See FlashGrid knowledge base for troubleshooting [ARM errors](#) or [errors during cluster initialization](#).

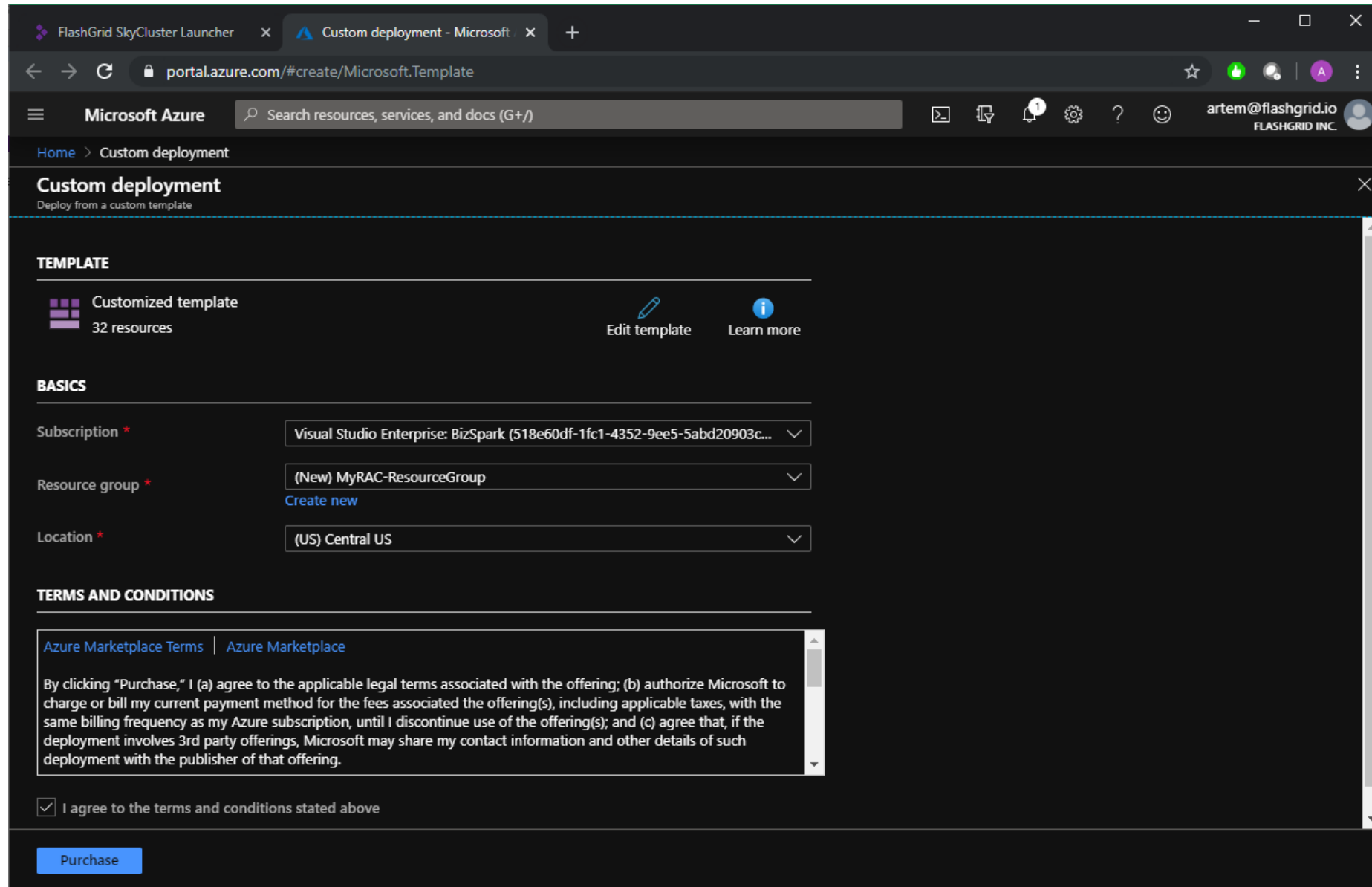
To generate and download the ARM template without opening ARM click [here](#).

By clicking *Launch FlashGrid Cloud Cluster* or downloading ARM template you explicitly indicate your acceptance of the [FlashGrid End User License Agreement](#).

[Launch FlashGrid Cloud Cluster](#) [Download Configuration](#) [Edit Configuration](#)

Step 16: Deploy the ARM template

On Azure Portal select target subscription, create new resource group for the cluster, select the target region, and click Purchase.



Step 17: SSH in to the first node

After the deployment of the ARM template is complete, use SSH to connect to the first node of the cluster as user *az-admin*. If the cluster init already finished (takes 60-90 minutes) then you will see the following message.

```
+-----+
|                                     |
|          CLUSTER INITIALIZATION COMPLETED SUCCESSFULLY          |
|                                     |
| Please follow the steps below to finalize cluster configuration: |
| 1. Run 'flashgrid-cluster' to verify status of the cluster.     |
| 2. Protect the cluster from accidental deletion:                 |
|    - in AWS/GCP enable instance termination protection for each node |
|    - in Azure add a lock to the cluster resource group           |
| 3. Add records to the DNS servers used by clients and app servers: |
|    rac1.example.com 10.100.0.5                                   |
|    rac2.example.com 10.100.0.4                                   |
| 4. Test email alerts from each node: $ flashgrid-node test-alerts |
| 5. Disable database features that you do not have a license for. |
| 6. See FlashGrid Knowledge Base for instructions for the following tasks: |
|    - Changing temporary ASM password: kb.flashgrid.io/asm-password |
|    - Creating a database: kb.flashgrid.io/createdb                 |
|    - Connecting clients to a database: kb.flashgrid.io/connect-clients |
|    - Maintenance procedures (reboot, etc.): kb.flashgrid.io/maintenance |
| 7. Before putting cluster in production, upload diags for review by support |
|    $ sudo flashgrid-diags upload-all                             |
| Submit support requests at flashgrid.io/support                  |
| To stop seeing this message after login, run 'sudo rm /etc/motd' |
+-----+
[az-admin@rac1 ~]$ █
```

Step 18: Check status of the cluster

```
# sudo flashgrid-cluster
```

```
[az-admin@rac1 ~]$ sudo flashgrid-cluster
FlashGrid 19.6.13.59452 #9534f704070a91bd32b23bdad1e38df20109dfd6
License: via Marketplace Subscription
Support plan: 24x7
-----
FlashGrid running: OK
Clocks check: OK
Configuration check: OK
Network check: OK

Querying nodes: rac1, rac2, racq ...

Cluster Name: myrac
Cluster status: Good
-----
Node  Status  ASM_Node  Storage_Node  Quorum_Node  Failgroup
-----
rac1  Good    Yes      Yes           No           RAC1
rac2  Good    Yes      Yes           No           RAC2
racq  Good    No       No           Yes          RACQ
-----
-----
GroupName  Status  Mounted  Type    TotalMiB  FreeMiB  OfflineDisks  LostDisks  Resync  ReadLocal  Vote
-----
DATA       Good   AllNodes  NORMAL  3145728   3145336  0              0          No     Enabled   None
FRA        Good   AllNodes  NORMAL  3145728   3145336  0              0          No     Enabled   None
GRID       Good   AllNodes  NORMAL  10240     9456     0              0          No     Enabled   3/3
-----
```

The cluster is ready. You can now create your database using DBCA.

Additional Information

For more information see <https://www.flashgrid.io/products/flashgrid-for-oracle-rac-on-azure/> or email info@flashgrid.io

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