



NetBrain[®] Integrated Edition 8.0
System Setup Guide
Two-Server Deployment

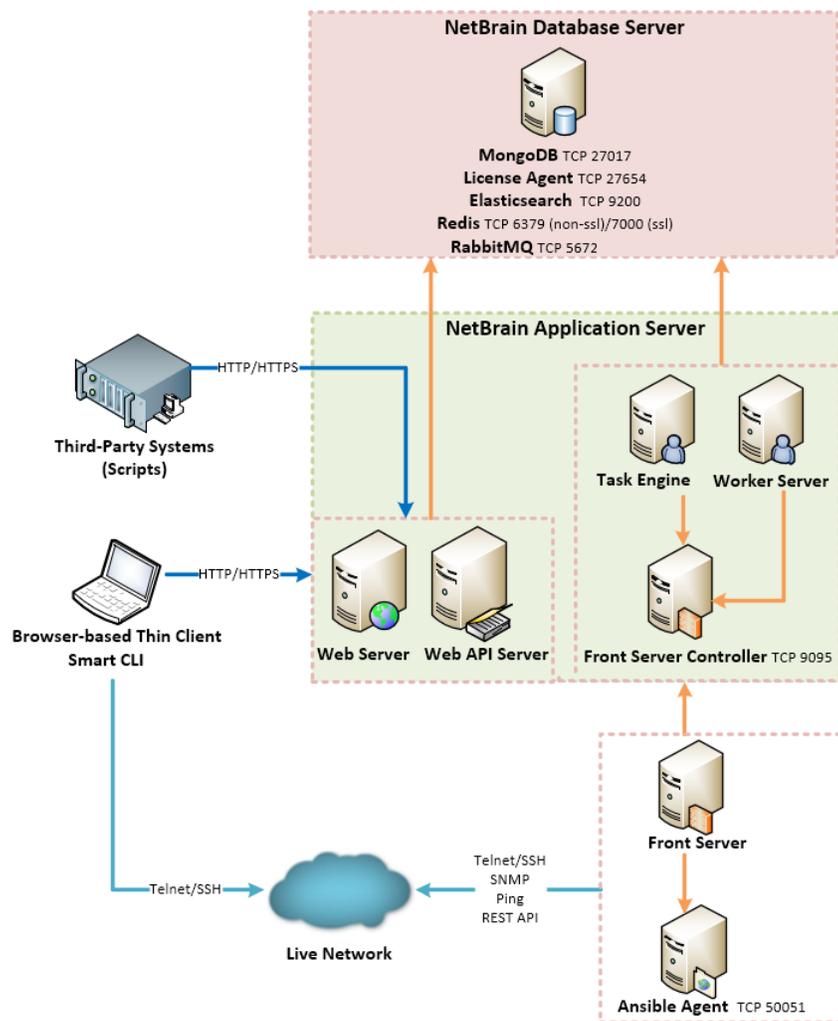
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1. System Overview

NetBrain Integrated Edition is an adaptive automation platform, where you can integrate with your existing Network Management System (NMS) tools and IT workflows to automate documentation, troubleshooting, network change, and defense. It serves as an operating system of your whole network to relieve network professionals from manual CLI-digging and also empowers team collaboration to elevate productivity.

The browser-based interface of NetBrain Integrated Edition is backed by a full-stack architecture, adopting advanced distributed technologies to support large-scale networks with more expansion possibilities.

The distributed system architecture is as follows:



The system components include:

Component	Description
Browser-based Thin Client	provides a user interface for end users to access the system.

Component	Description
MongoDB	serves as a system data repository.
License Agent	provides services that validate and activate licenses.
Elasticsearch	serves as a full-text search and analytics engine in a distributed multi-user environment.
Redis	provides memory cache for the system.
RabbitMQ	prioritizes and forwards requested tasks.
Web Server	serves static content such as HTML, JavaScript, and CSS resources, which serves as the user interface of the Thin Client.
Web API Server	provides the front-end web applications to support the browser-based Thin Clients and serves RESTful API calls from third-party applications for integration.
Worker Server	serves as a resource manager to support computing tasks. It relies on both Redis and RabbitMQ to work.
Task Engine	coordinates computing tasks.
Front Server Controller	serves to coordinate and communicate with Front Servers and other components.
Front Server	serves as a polling server to collect and parse live network data. It is the only component required to access the live network.
Service Monitor Agent	monitors the health of your NetBrain Servers with operations management of related services.
Ansible Agent (add-on)	integrates with Ansible to define, execute playbooks and visualize results in Change Management Runbooks. See Ansible Integration for more details.
Smart CLI (add-on)	provides a Telnet/SSH client to connect to devices from Windows and can be integrated with NetBrain workflows. See Smart CLI for more details.

2. System Requirements

This section introduces the hardware requirements, network connectivity requirements, and more prerequisites for deploying a two-server system.

- [Reference Specification](#)
- [Network Connectivity Requirements](#)
- [Deployment Prerequisites](#)

Reference Specification

The two-server deployment requires one Windows server for applications and one Linux server for the database. Both physical machines and virtual machines are supported.

Environment	NetBrain Component	Machine Count	CPU ¹⁾	Memory	Hard Disk	Operating System
≤1000 nodes ≤10 users	Application Server	1	4 CPU Cores	16GB	200GB ³⁾	<ul style="list-style-type: none">▪ Windows Server 2012/2012 R2 (Standard/Datacenter Edition), 64-bit▪ Windows Server 2016/2019 (Standard/Datacenter Edition), 64-bit
	Database Server	1	4 CPU Cores	16GB ²⁾	300GB ⁴⁾	<ul style="list-style-type: none">▪ Red Hat Enterprise Linux Server 7.5/7.6/7.7/7.8, 64-bit▪ CentOS 7.5/7.6/7.7/7.8, 64-bit▪ Oracle Linux 7.7/7.8, 64-bit
1001~2000 nodes ≤10 users	Application Server	1	4 CPU Cores	32GB	200GB ³⁾	<ul style="list-style-type: none">▪ Windows Server 2012/2012 R2 (Standard/Datacenter Edition), 64-bit▪ Windows Server 2016/2019 (Standard/Datacenter Edition), 64-bit
	Database Server	1	4 CPU Cores	32GB ²⁾	300GB ⁴⁾	<ul style="list-style-type: none">▪ Red Hat Enterprise Linux Server 7.5/7.6/7.7/7.8, 64-bit▪ CentOS 7.5/7.6/7.7/7.8, 64-bit▪ Oracle Linux 7.7/7.8, 64-bit

Notes:

- 1) In a virtual hosting environment, vCPU (virtual central processing unit) consists of time slots across all the available physical cores. The number of vCPUs assigned to your server depends on the amount of load the Virtual Machine (VM) will be under.
- 2) Allocating at least half of the RAM amount for swap space on your Linux server is required to provide the necessary additional memory when the RAM space has been exhausted.
- 3) For good performance of data processing and caching, it is recommended to install the Application Server on a machine equipped with Solid State Drive (SSD) when managing up to 5000 nodes.
- 4) The required hard disk space must be exclusively reserved for NetBrain. For better performance, it is recommended to install the MongoDB on a machine equipped with Solid State Drive (SSD), or Hard Disk Drive (HDD) RAID-10.

Network Connectivity Requirements

Source	Destination	Protocol and Port Number *)
Thin Client Service Monitor Agent	Application Server	HTTP/HTTPS (80/443)
Application Server	Knowledge Cloud Domain (https://knowledgecloud.netbraintech.com/)	HTTPS (443)
Application Server	Database Server	TCP 5672/9200/27017/27654 TCP 6379 (non-SSL)/7000 (SSL)
Application Server	Ansible Agent (add-on)	TCP 50051
Application Server	Live Network	ICMP/SNMP/Telnet/SSH/REST API

Note: *) The port numbers listed in this column are defaults only. The actual port numbers used during installation might be different.

Deployment Prerequisites

The following requirements must be satisfied before setting up your NetBrain system:

- The operating system must be installed with an English-language version (not language packs).
- When installing NetBrain servers, comply with your company security policy to set the passwords and archive them for further reference.
- NetBrain servers use hostnames to identify and communicate with each other. Make sure each server has a unique hostname.
- Add all the NetBrain installation folders and files (on both Windows and Linux) to the allow list of antivirus software for routine scans, and keep the TCP connections unblocked between NetBrain components.

- If the machine's firewall is turned on, make sure the firewall rules allow traffics to all the ports and protocols that will be used by the NetBrain system.
- **Special Requirements for Windows Server**
 - Users with administrative privileges of the machine are required to implement the installation.
 - NetBrain Integrated Edition should not be installed on the same server as an existing NetBrain Enterprise Edition (6.2 or earlier version), except that Front Server and Network Server (EEv6.2) can be installed on the same machine.
 - There must be more than 3GB free space in the system drive (for example, C drive) to complete the installation no matter which drives the NetBrain system will be installed on.
 - Temporarily disable antivirus software during the installation process.
- **Special Requirements for Linux Server**
 - Users with root privileges of the machine are required to implement the installation.
 - It is highly recommended to store the data files and log files of NetBrain servers into separated disk partitions. Make sure each partition has enough disk space.
 - More than **100GB** free space in the directory where the data files of MongoDB/Elasticsearch will be saved.
 - More than **50GB** free space in the directory where the log files of MongoDB/Elasticsearch will be saved.

3. Deploying and Installing System

Install the system components in the following order:

1. [Install NetBrain Database Server on Linux.](#)
2. [Install NetBrain Application Server on Windows.](#)

3.1. Installing NetBrain Database Server on Linux

All NetBrain Linux components, including MongoDB, License Agent, Elasticsearch, Redis, RabbitMQ, and Service Monitor Agent, will be installed sequentially on this Linux server. However, if an error occurs during the installation of any components, the installation will abort. After resolving the error, you can re-run the installation package to install the remaining components.

Pre-installation Tasks

- Ensure you have upgraded the Linux OS to **Red Hat Enterprise Linux Server 7.5/7.6/7.7/7.8, 64-bit** or **CentOS 7.5/7.6/7.7/7.8, 64-bit** to avoid installation or upgrade failure. Refer to [Linux System Upgrade Instructions Online](#) for more details. If your Linux server has no access to the Internet, refer to [Linux System Upgrade Instructions Offline](#).
- Ensure the hostname of the Linux server must be resolvable by DNS or configured in **/etc/hosts** because RabbitMQ needs a resolvable hostname no matter whether it is a standalone server or a cluster.
- RabbitMQ has dependencies on the third-party packages **socat** and **logrotate**. Run the `rpm -qa|grep socat` and `rpm -qa|grep logrotate` commands to check whether **socat** and **logrotate** have been installed on this Linux server. If they have not been installed yet, you can choose either option below to install the dependencies.
 - **Online Install:** run the `yum -y install socat` and `yum -y install logrotate` commands to install them online.
 - **Offline Install:** refer to [Offline Installing Third-party Dependencies](#) for more details.
- Service Monitor Agent has dependencies on the third-party package **zlib-devel readline-devel bzip2-devel ncurses-devel gdbm-devel xz-devel tk-devel libffi-devel**. Run the `rpm -qa|grep -E "zlib-devel|readline-devel|bzip2-devel|ncurses-devel|gdbm-devel|xz-devel|tk-devel|libffi-devel"` command to check whether it has been installed on this Linux server. If it has not been installed yet, you can choose either option below to install the dependencies:
 - **Online Install:** run the `yum -y install zlib-devel readline-devel bzip2-devel ncurses-devel gdbm-devel xz-devel tk-devel libffi-devel` command to install it online.
 - **Offline Install:** refer to [Offline Installing Third-party Dependencies](#) for more details.

- It is highly recommended to install **numactl** on this Linux server to optimize MongoDB performance. Run the `rpm -qa | grep numactl` command to check whether it has been installed. If it has not been installed yet and the Linux server has access to the Internet, run the `yum install numactl` command to install it online.
- If you want to enable SSL to encrypt the communications between servers, prepare a set of certificate files and upload them to the `/etc/ssl` directory by using a file transfer tool. For more details regarding the requirements for these certificate files, refer to [SSL Certificate Requirements](#).

Note: Make sure each path of `/usr/lib`, `/usr/share`, and `/etc` has more than **1GB** free space to install the component files.

Installing Database Server

1. Log in to the Linux server as the **root** user.
2. Create a directory under the `/opt` directory to place the installation package. For example, **netbraintemp8.0.3**.

```
[root@localhost ~]# mkdir /opt/netbraintemp8.0.3
```

3. Run the `cd /opt/netbraintemp8.0.3` command to navigate to the `/opt/netbraintemp8.0.3` directory.

Note: Don't place the installation package under any personal directories, such as `/root`.

4. Download the installation package.
 - **Option 1:** If the Linux server has no access to the Internet, obtain the **netbrain-all-in-two-linux-x86_64-rhel7-8.0.3.tar.gz** file from NetBrain and then upload it to the `/opt/netbraintemp8.0.3` directory by using a file transfer tool.
 - **Option 2:** If the Linux server has access to the Internet, run the `wget http://download.netbraintech.com/netbrain-all-in-two-linux-x86_64-rhel7-8.0.3.tar.gz` command under the `/opt/netbraintemp8.0.3` directory to directly download the **netbrain-all-in-two-linux-x86_64-rhel7-8.0.3.tar.gz** file.

Note: The download link is case-sensitive.

Tip: Run the `yum -y install wget` command to install the **wget** command if it has not been installed.

5. Run the `tar -zxvf netbrain-all-in-two-linux-x86_64-rhel7-8.0.3.tar.gz` command under the `/opt/netbraintemp8.0.3` directory to extract installation files.

```
[root@localhost netbraintemp8.0.3]# tar -zxvf netbrain-all-in-two-linux-x86_64-rhel7-8.0.3.tar.gz
netbrain-all-in-two-linux-8.0.3/
netbrain-all-in-two-linux-8.0.3/config/
netbrain-all-in-two-linux-8.0.3/config/setup.conf
...
```

```
netbrain-all-in-two-linux-8.0.3/install.sh
...
```

6. Run the `cd netbrain-all-in-two-linux-8.0.3` command to navigate to the **netbrain-all-in-two-linux-8.0.3** directory.
7. Run the `./install.sh` command under the **netbrain-all-in-two-linux-8.0.3** directory to install NetBrain Linux components.
 - 1) Read the license agreement, and then type **YES** and press the **Enter** key.
 - 2) Type **I ACCEPT** and press the **Enter** key to accept the license agreement. The script starts to check whether the system configuration of the Linux server meets the requirement, and all required dependent packages are installed for each Linux component.

```
[root@localhost netbrain-all-in-two-linux-8.0.3]# ./install.sh

Please read the End User License Agreement ("EULA") for the license type (perpetual or
subscription)
purchased in the order form at https://www.netbraintech.com/legal-tc/ carefully. I have read
the
subscription EULA, if I have purchased a subscription license, or the perpetual EULA, if I
have
purchased a perpetual license, at the link provided above. Please type "YES" if you have read
the
applicable EULA and understand its and understand its contents, or "NO" if you have not read
the
applicable EULA. [YES/NO]: YES

Do you accept the terms in the subscription EULA, if you have purchased a subscription
license, or
the perpetual EULA, if you have purchased a perpetual license? If you accept, and to continue
with
the installation, please type "I Accept" to continue. If you do not accept, and to quit the
installation script, please type "CANCEL" to stop. [I ACCEPT/CANCEL]: I ACCEPT
INFO: Creating installation log file...
INFO: Starting to checking system
INFO: Collecting system information...
INFO: Starting to check Linux OS info
INFO: Starting to check crontab
INFO: MongoDB was not installed. Fresh installation is required.

Components to be installed:
  mongodb
  licenseagent
  elasticsearch
  rabbitmq
  redis
  servicemonitoragent
...
Checking information for mongodb...
INFO: Dependent packages checking SUCCEEDED
Checking information for licenseagent...
INFO: Dependent packages checking SUCCEEDED
Checking information for elasticsearch...
```

```
Checking information for rabbitmq...
INFO: Dependent packages checking SUCCEEDED
Checking information for redis...
INFO: Dependent packages checking SUCCEEDED
Checking information for servicemonitoragent...
Start dependencies checking...
Dependencies checking SUCCEEDED.
```

3) Configure the following [parameters](#) one by one with an interactive command line.

```
Install NetBrain Linux components.
The values in brackets are the default values of the parameters. To keep the default value
for the
current parameter, press the Enter key.
Please enter the data path for NetBrain [/var/lib/netbrain]:
Please enter the log path for NetBrain [/var/log/netbrain]:
Please enter the IP address of this machine [10.10.3.142]:
Please create NetBrain service username [admin]:
Please create NetBrain service password:
Please re-enter NetBrain service password to confirm:
Use SSL on NetBrain Services [no]:
Use customized server ports? [no]
Please enter the URL (must end with /) to call NetBrain Web API service for the Service
Monitor
[http(s)://<IP address or hostname of NetBrain Application Server>/]: http://10.10.3.141/
```

Note: Make sure the designated data path has more than **100GB** free space and the designated log path has more than **50GB** free space. You can run the `df -h` command to check which directory has been mounted to a large disk.

Note: The certificate name specified in the path must strictly match the one you uploaded.

Note: Keep notes of the NetBrain service username and password because they will be used later.

4) After these parameters are configured, the key configurations for each component are listed for your further confirmation. To continue the installation with the current configurations, press the **Enter** key. To change any configurations, type **no**.

```
Data path: /var/lib/netbrain
Log path: /var/log/netbrain

MongoDB IP address: 10.10.3.142
MongoDB port: 27017
MongoDB username: admin
MongoDB password: *****
MongoDB uses SSL: no

License Agent port: 27654
License Agent uses SSL: no

Elasticsearch address: 10.10.3.142
Elasticsearch port: 9200
Elasticsearch username: admin
Elasticsearch password: *****
```

```
Elasticsearch uses SSL:      no

RabbitMQ address:           10.10.3.142
RabbitMQ port:              5672
RabbitMQ username:          admin
RabbitMQ password:          *****
RabbitMQ uses SSL:          no

Redis address:              10.10.3.142
Redis port:                 6379
Redis password:             *****
Redis uses SSL:             no

NetBrain Web API service URL: http://10.10.3.141/ServicesAPI

Do you want to continue using these parameters? [yes]
```

8. After all the components are successfully installed, run the `reboot` command to restart the machine.
9. Run the following commands to check their service status separately.

- `systemctl status mongod`

```
[root@localhost ~]# systemctl status mongod
mongod.service - MongoDB service
   Loaded: loaded (/usr/lib/systemd/system/mongod.service; enabled; vendor preset: disabled)
   Active: active (running) since Tue 2020-01-14 00:43:32 EST; 4min 32s ago
   Process: 6136 ExecStart=/bin/mongod -f /etc/mongodb/mongod.conf (code=exited, status=0/SUCCESS)
   Main PID: 6375 (mongod)
   Memory: 902.3M (limit: 8.0G)
   ...
```

- `systemctl status netbrainlicense`

```
[root@localhost ~]# systemctl status netbrainlicense
netbrainlicense.service - NetBrain license agent service
   Loaded: loaded (/usr/lib/systemd/system/netbrainlicense.service; enabled; vendor preset: disabled)
   Active: active (running) since Tue 2020-01-14 00:43:41 EST; 27min ago
   Process: 16490 ExecStart=/usr/bin/netbrainlicense/licensed -f /etc/netbrainlicense/licensed.conf (code=exited, status=0/SUCCESS)
   Process: 16488 ExecStartPre=/bin/chmod o+r /sys/class/dmi/id/product_uuid (code=exited, status=0/SUCCESS)
   Main PID: 16492 (licensed)
   Memory: 15.0M
   ...
```

- `systemctl status elasticsearch`

```
[root@localhost ~]# systemctl status elasticsearch
elasticsearch.service - Elasticsearch
   Loaded: loaded (/usr/lib/systemd/system/elasticsearch.service; enabled; vendor preset: disabled)
   Active: active (running) since Tue 2020-01-14 00:43:41 EST; 27min ago
   Docs: http://www.elastic.co
```

```
Main PID: 5922 (java)
Memory: 4.6G
...
```

- **systemctl status rabbitmq-server**

```
[root@localhost ~]# systemctl status rabbitmq-server
rabbitmq-server.service - RabbitMQ broker
  Loaded: loaded (/usr/lib/systemd/system/rabbitmq-server.service; enabled; vendor preset: disabled)
  Active: active (running) since Tue 2020-01-14 00:38:43 EST; 36min ago
  Main PID: 4509 (beam.smp)
  Status: "Initialized"
  Memory: 96.5M
  ...
```

- **systemctl status redis**

```
[root@localhost ~]# systemctl status redis
redis.service - Redis
  Loaded: loaded (/usr/lib/systemd/system/redis.service; enabled; vendor preset: disabled)
  Active: active (running) since Tue 2020-01-14 00:38:49 EST; 37min ago
  Main PID: 52318 (redis-server)
  Memory: 7.7M
  ...
```

- **systemctl status netbrainagent**

```
[root@localhost ~]# systemctl status netbrainagent
netbrainagent.service - NetBrain Service Monitor Agent Daemon
  Loaded: loaded (/usr/lib/systemd/system/netbrainagent.service; enabled; vendor preset: disabled)
  Active: active (running) since Mon 2020-01-13 22:01:54 EST; 3h 15min ago
  Main PID: 4520 (python3)
  Memory: 73.5M
  ...
```

Post-installation Tasks

- If you have customized a port for any of MongoDB/License Agent/Elasticsearch/RabbitMQ/Redis or you have configured DNS connection during Database Server installation, to make the Server Monitor can still detect and monitor its service, you must add the customized port number to the corresponding configuration file.

Server Name	File Name
MongoDB	mongodb.yaml
License Agent	license.yaml
Elasticsearch	elasticsearch.yaml
RabbitMQ	rabbitmq.yaml

Server Name	File Name
Redis	redis.yaml

Example: If you configured the port number **27000** during MongoDB installation, do the following:

- 1) Run the `cd /etc/netbrain/nbagent/checks` command to navigate to the **checks** directory.
- 2) Add the customized port number to the **mongodb.yaml** file, and save the changes. For how to modify the file, refer to [Editing a File with VI Editor](#).

Note: Follow the text format in the example strictly, including alignment, punctuations, and spaces.

```
init_config:

instances:
  - name: default
    port: 27000
```

Parameters

Refer to the following table for the parameters of NetBrain Database Server.

Parameter	Default Value	Description
Data path	<code>/var/lib/netbrain</code>	The directory to save data of all NetBrain Linux components. You can press the Enter key to keep the default path or type a new one.
Log path	<code>/var/log/netbrain</code>	The directory to save logs of all NetBrain Linux components. You can press the Enter key to keep the default path or type a new one.
IP address of this machine	<current IP address automatically obtained from the machine>	The IP address of this server. It will be used for establishing connections with NetBrain Application Server. You can press the Enter key to keep the default value or type a new one. Note: 127.0.0.1 is not supported. Note: If you configured multiple network cards on this machine, type the designated IP address to be bound.
NetBrain service username	<code>admin</code>	The admin username and password created for MongoDB, Elasticsearch, RabbitMQ, Redis, Front Server Controller, and Service Monitor.
NetBrain service password		Note: The username and password cannot contain any of the following special characters, and their lengths cannot exceed 64 characters. { } [] : " , ' < > @ & ^ % \ and spaces Note: The username and password cannot be empty and it cannot start with ! or # .

Parameter	Default Value	Description
		<p>Note: Keep notes of the NetBrain service username and password because they will be used for validating the connections with:</p> <ul style="list-style-type: none"> - MongoDB, Elasticsearch, RabbitMQ, and Redis when installing NetBrain Application Server - Front Server Controller when setting up the system - Service Monitor Agent when communicating with Web API Server
Use SSL on NetBrain Services	no	<p>Whether to enable SSL on NetBrain Database Server. To enable SSL, type yes.</p> <p>Note: SSL cannot be enabled or disabled separately for the two-server deployment mode.</p>
Certificate file path		<p>The file name of the certificate file that contains the public key.</p> <p>Note: It is required only if Use SSL on NetBrain Services is enabled.</p>
Private Key file path		<p>The file name of the private key file.</p> <p>Note: It is required only if Use SSL on NetBrain Services is enabled.</p>
Certificate Authority file path		<p>The name and directory of the chain certificate authority (CA) file, which is used to authenticate the CA issuing the SSL certificates.</p> <p>Note: It is required only if Use SSL on NetBrain Services is enabled.</p>
Use customized server ports?	no	<p>Whether to customize a port for each Linux component. To customize ports, type yes.</p>
MongoDB port	27017	<p>The port number that the MongoDB service listens to. You can press the Enter key to keep the default port or type a new one.</p> <p>Note: Make sure the port is not used by other applications. The value cannot be modified anymore after it is specified.</p> <p>Note: Keep notes of the customized port because it will be used for validating the connections with MongoDB when installing NetBrain Application Server.</p>
License Agent port	27654	<p>The port number that the License Agent service listens to. You can press the Enter key to keep the default port or type a new one.</p> <p>Note: Make sure the port is not used by other applications. The value cannot be modified anymore after it is specified.</p> <p>Note: Keep notes of the customized port because it will be used for validating the connections with License Agent when installing NetBrain Application Server.</p>
Elasticsearch port	9200	<p>The port number that the Elasticsearch service listens to. You can press the Enter key to keep the default port or type a new one.</p>

Parameter	Default Value	Description
		<p>Note: Make sure the port is not used by other applications. The value cannot be modified anymore after it is specified.</p> <p>Note: Keep notes of the customized port because it will be used for validating the connections with Elasticsearch when installing NetBrain Application Server.</p>
Rabbitmq port	5672	<p>The port number that the RabbitMQ service listens to. You can press the Enter key to keep the default port or type a new one.</p> <p>Note: Make sure the port is not used by other applications. The value cannot be modified anymore after it is specified.</p> <p>Note: Keep notes of the customized port because it will be used for validating the connections with RabbitMQ when installing NetBrain Application Server.</p>
Redis port	6379 (non-SSL) 7000 (SSL)	<p>The port number that the Redis service listens to. You can press the Enter key to keep the default port or type a new one.</p> <p>Note: Make sure the port is not used by other applications. The value cannot be modified anymore after it is specified.</p> <p>Note: Keep notes of the customized port because it will be used for validating the connections with Redis when installing NetBrain Application Server.</p>
URL to call NetBrain Web API service for the Service Monitor	http(s)://<IP address or hostname of NetBrain Application Server>/	<p>The URL to call NetBrain Web API service. For example, <code>http://10.10.3.141/</code> or <code>https://www.YOURCOMPANY.com/</code>.</p> <p>Note: If SSL will be enabled with https binding created for the system website in IIS Manager, type https in the URL.</p> <p>Note: When you type https in the URL, the CA verification will not be performed during the installation by default. To verify the CA certificate, complete the following steps after the installation:</p> <ol style="list-style-type: none"> 1) Run the <code>cd /etc/netbrain/nbagent</code> command to navigate to the /etc/netbrain/nbagent directory. 2) Run the <code>vi agent.conf</code> command to edit the agent.conf file as follows and save the changes. For more details on how to edit the file with the vi editor, refer to Editing a File with VI Editor. <ul style="list-style-type: none"> ▪ Modify the value of the enable_ssl_validation parameter to True. ▪ Remove the pound sign (#) in front of the cert_path parameter, and then enter the path of the CA certificate file. <p>Example:</p> <pre># enable ssl validation (default:False) enable_ssl_validation: True cert_path: /etc/ssl/smca.pem</pre>

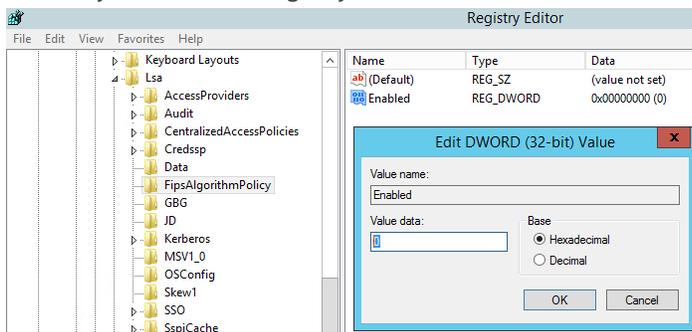
Parameter	Default Value	Description
		3) Upload the CA certificate file under the specified path.

3.2. Installing NetBrain Application Server on Windows

All NetBrain Windows components, including Web Server, Web API Server, Worker Server, Task Engine, Front Server Controller, Front Server, and Service Monitor Agent will be installed sequentially on this Windows server.

Pre-installation Tasks

- Make sure the extended memory of your machine is larger than **16GB** and the Windows update is of the latest.
- Remove the Existing Internet Information Services (IIS) and disable the FIPS setting by modifying the **Enabled** value to **0** under the **HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Control\Lsa\FipsAlgorithmPolicy** directory of Windows registry.



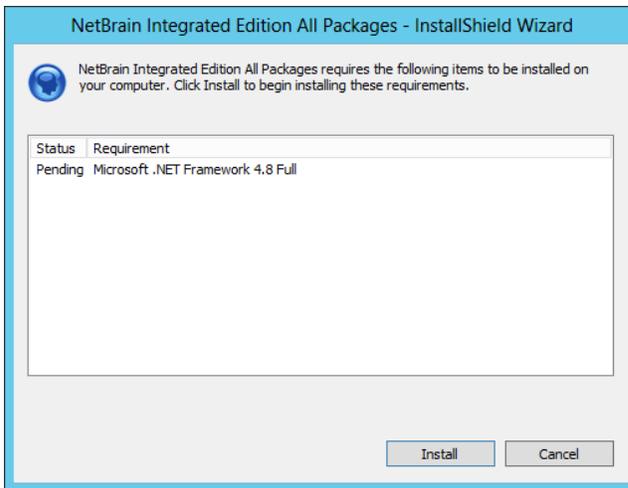
- If you use a proxy server to access the Internet on this server, you must add the IP address of Elasticsearch into the proxy exception list so that the Application Server can communicate with the Elasticsearch.
 - Click the icon at the upper-right corner of Chrome and select **Settings > Advanced**.
 - In the **System** area, click **Open proxy settings**.
 - On the **Connections** tab, click **LAN settings**.
 - In the **Proxy Server** area, click **Advanced** to add the IP address and port number of Elasticsearch into the **Exceptions** area.

Installing Application Server

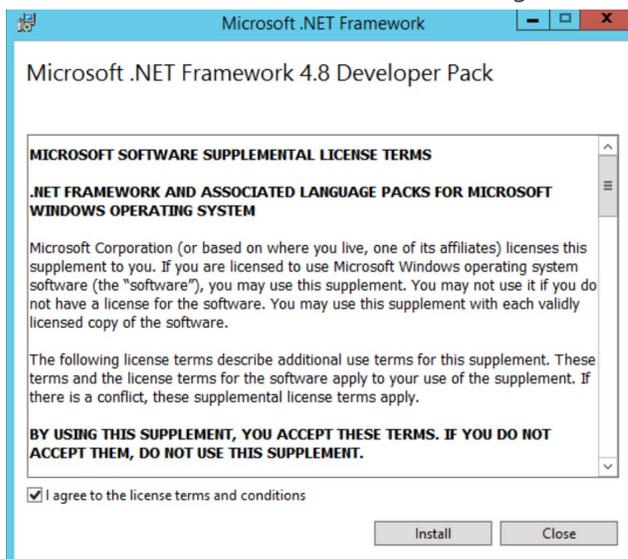
Complete the following steps with administrative privileges.

- Download the **netbrain-all-in-two-windows-x86_64-8.0.3.zip** file from http://download.netbraintech.com/netbrain-all-in-two-windows-x86_64-8.0.3.zip and save it in your local folder.

2. Extract files from the **netbrain-all-in-two-windows-x86_64-8.0.3.zip** file.
3. Navigate to the **netbrain-all-in-two-windows-x86_64-8.0.3** folder, right-click the **netbrain-application-8.0.3.exe** file and then select **Run as administrator** to launch the Installation Wizard.
4. Follow the Installation Wizard to complete the installation step by step:
 - 1) .NET Framework 4.8 must be pre-installed on this machine before you install the Application Server. The Installation Wizard will automatically check this dependency. If it has not been installed, the wizard will guide you through the installation as follows; if it has been installed, the wizard will directly go to step 2).
 - a) Click **Install**.

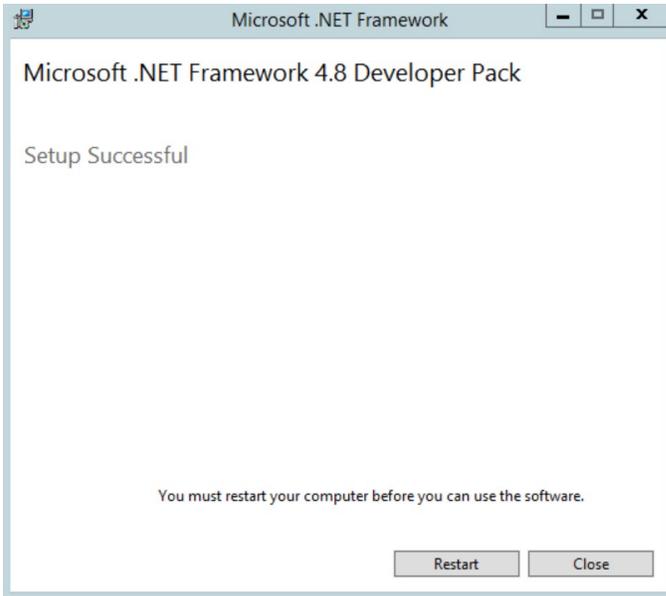


- b) Read the license agreement of Microsoft .NET Framework 4.8, select the **I agree to the license terms and conditions** check box and click **Install**. It might take a few minutes for the installation to be completed.



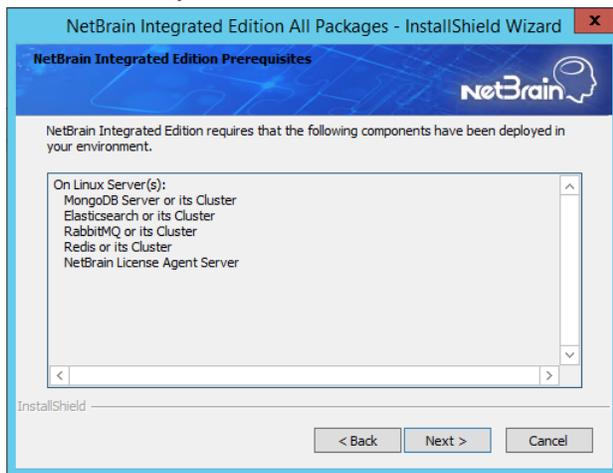
Note: Some running applications must be closed during the installation of .NET Framework 4.8, such as Server Manager.

- c) You must click **Restart** to restart the machine immediately. Otherwise, the upgrade will fail due to the failure of upgrading the new .Net Framework. After the machine reboots, continue with step 2).



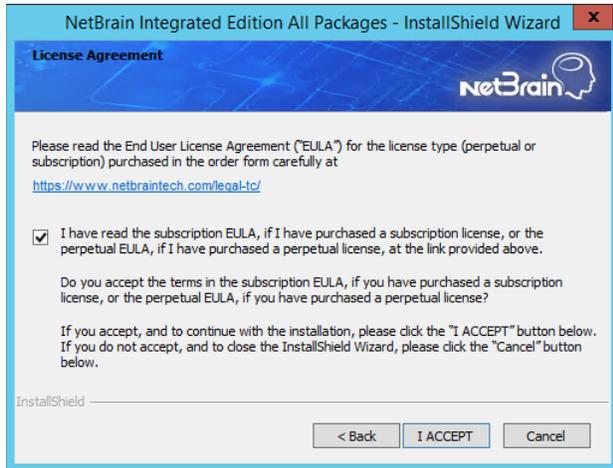
Note: Ensure the FIPS is disabled after restarting the machine. To disable the FIPS setting, modify the **Enabled** value to **0** under the **HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Control\Lsa\FipsAlgorithmPolicy** directory of Windows registry

- 2) On the Welcome page, click **Next**.
- 3) On the NetBrain Integrated Edition Prerequisites page, read the list of Linux components that must be deployed beforehand in your environment and click **Next**.



- 4) On the System Configuration page, review the system configuration summary and click **Next**.

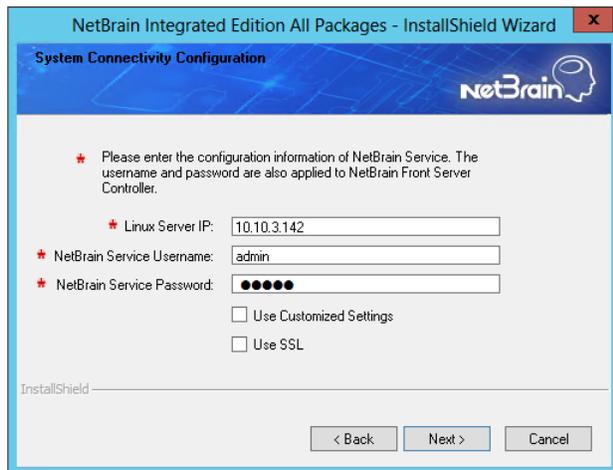
- 5) On the License Agreement page, read the license agreement, and then select the **I have read the subscription EULA** check box and click **I ACCEPT**.



- 6) On the Customer Information page, enter your company name and click **Next**.
- 7) Click **Next** to install the Application Server under the default path: **C:\Program Files\NetBrain**. If you want to install it under another location, click **Change**.

Note: If you select to install it under another drive, make sure there are no spaces in the installation path. For example, use **D:\Program_Files** instead of **D:\Program Files**.

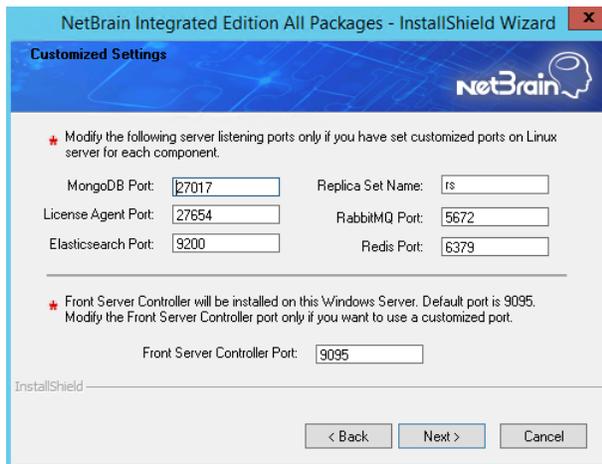
- 8) On the System Connectivity Configuration page, enter the information to connect to NetBrain Database Server, including the IP of NetBrain Database Server and the service username and password created on NetBrain Database Server. Click **Next**.



Note: If you enabled SSL on NetBrain Database Server, you must select the **Use SSL** check box here. Both NetBrain Database Server and NetBrain Application Server must use the same set of SSL certificate files.

Note: Select the **Use Customized Settings** check box only if you customized a port number for any of Linux components during the installation of NetBrain Database Server.

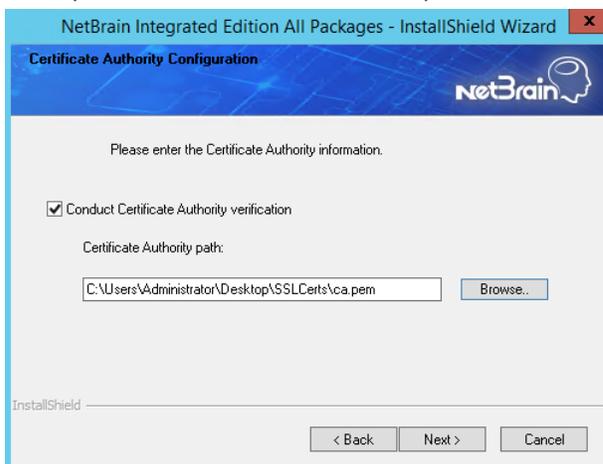
- 9) (Required only if the **Customized Settings** check box is selected) On the Customized Settings page, you can customize the ports of Linux Components and customize the port for Front Server Controller if you don't want to use the default port 9095. Click **Next**.



The screenshot shows the 'Customized Settings' window of the NetBrain InstallShield Wizard. The window title is 'NetBrain Integrated Edition All Packages - InstallShield Wizard'. The main heading is 'Customized Settings' with the NetBrain logo. A red asterisk icon indicates a warning: 'Modify the following server listening ports only if you have set customized ports on Linux server for each component.' Below this, there are input fields for: MongoDB Port (27017), Replica Set Name (rs), License Agent Port (27654), RabbitMQ Port (5672), Elasticsearch Port (9200), and Redis Port (6379). A second warning icon states: 'Front Server Controller will be installed on this Windows Server. Default port is 9095. Modify the Front Server Controller port only if you want to use a customized port.' Below this is an input field for 'Front Server Controller Port' with the value 9095. At the bottom, there are buttons for '< Back', 'Next >', and 'Cancel'.

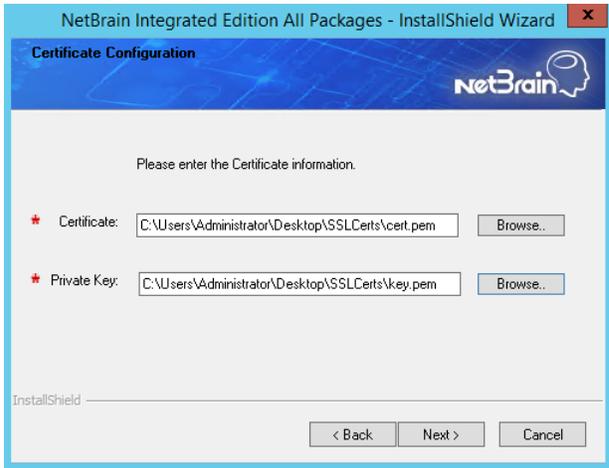
NetBrain Application Server will use the specified information of NetBrain Database Server, including IP address, username, password, SSL Settings, and port settings to validate the connectivity to MongoDB, License Agent, Elasticsearch, RabbitMQ, and Redis one by one.

- 10) (Required only if the **Use SSL** check box is selected) Configure the following SSL settings.
- a) On the Certificate Authority Configuration page, to validate the Certificate Authority (CA) of the SSL certificates used on NetBrain Database Server, select the **Conduct Certificate Authority verification** check box (optional) and click **Browse** to upload the chain certificate file. Click **Next**.

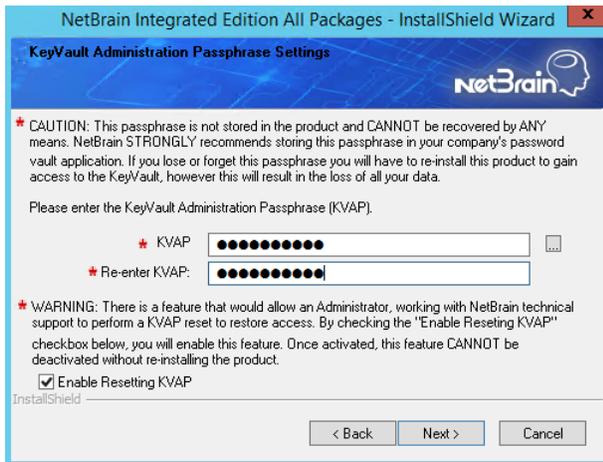


The screenshot shows the 'Certificate Authority Configuration' window of the NetBrain InstallShield Wizard. The window title is 'NetBrain Integrated Edition All Packages - InstallShield Wizard'. The main heading is 'Certificate Authority Configuration' with the NetBrain logo. The text says 'Please enter the Certificate Authority information.' There is a checked checkbox for 'Conduct Certificate Authority verification'. Below it, the 'Certificate Authority path:' is shown with an input field containing 'C:\Users\Administrator\Desktop\SSLCerts\ca.pem' and a 'Browse..' button. At the bottom, there are buttons for '< Back', 'Next >', and 'Cancel'.

- b) On the Certificate Configuration page, click **Browse** to upload the certificate file and private key file to enable SSL communications on Front Server Controller. Click **Next**.



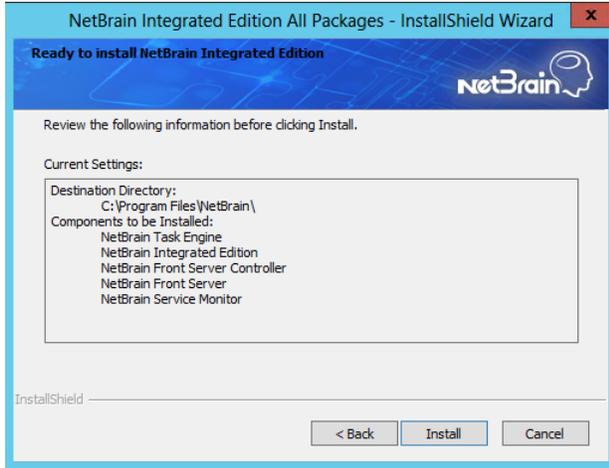
- 11) On the KeyVault Administration Passphrase Settings page, create a passphrase to initialize and manage the system KeyVault which contains all encryption keys to protect data security. Type it twice and click **Next**.



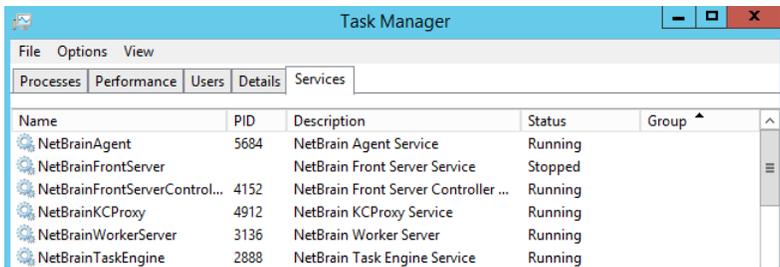
Tip: The passphrase must contain at least one uppercase letter, one lowercase letter, one number, and one special character, and the minimum permissible length is 8 characters. All special characters except for the quotation mark (") are allowed.

Note: Keep notes of the passphrase because it is required when you scale up or upgrade the Application Server. In case of losing the passphrase, select the **Enable Reseting KVAP** check box so that NetBrain system admin can reset the passphrase at any time.

- 12) Review the server components to be installed and click **Install**. All the Windows components will be installed one by one. It will take a long while for all the components to be installed.



5. After all the components are successfully installed, click **Finish** to complete the installation process and exit the Installation Wizard.
6. Open the Task Manager and navigate to the **Services** panel, you can find the following running NetBrain services.



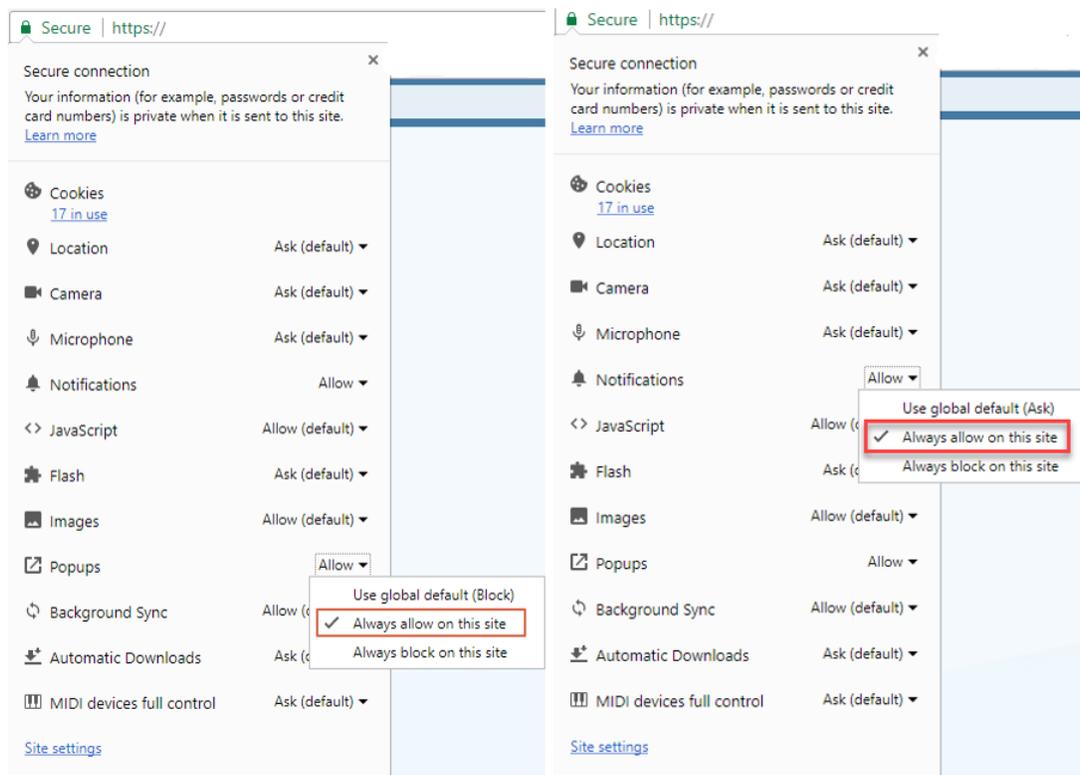
Tip: The **NetBrainFrontServer** service is not running because Front Server has not been registered.

4. Setting Up Your System

Complete the following steps to set up your system:

1. [Log in to System Management Page.](#)
2. [Activate Your License.](#)
3. [Create System Users Accounts.](#)
4. [Allocate the Tenant to a Front Server Controller.](#)
5. [Add a Front Server to the Tenant.](#)
6. [Register the Front Server.](#)
7. [Customize Resource Auto Update Settings.](#)
8. [Monitor Server and Service Metrics.](#)

Note: The system is designed to work with a minimum screen resolution of 1440x900 pixels. Make sure the Notifications and Popups are allowed for the Web Server URL in your web browser and zoom it at 100% to get the best view.



4.1. Logging in to System Management Page

1. In your web browser, navigate to **http(s)://<Hostname or IP address of NetBrain Application Server>/admin.html**. For example, `https://10.10.3.141/admin.html` or `http://10.10.3.141/admin.html`.
2. In the login page, enter your username or email address, and password. The initial username/password is **admin/admin**.
3. Click **Log In**.
4. Modify your password first and then complete your user profile in the pop-up dialog, by entering the email address, first name, and last name, and then click **Save**.

4.2. Activating a Subscription License

1. In the System Management page, click **Activate** under the **License** tab. The activation wizard prompts.
2. Activate your subscription license:
 - 1) Select **Activate Subscription License** and click **Next**.
 - 2) Enter the license ID and activation key that you received from NetBrain, with your first name, last name, and email address.
 - 3) Select the activation method based on your situation.
 - **Online** (recommended) — click **Activate** to connect to NetBrain License Server and validate your license information immediately.
 - **Via Email** — validate your license information by sending an email to NetBrain.

Note: Only use this activation method when your NetBrain Application Server is not allowed to access the Internet.

 - a) Follow the instructions to generate your license file. Attach the file to your email and send it to [NetBrain Support Team](#). After receiving your email, the NetBrain team will fill in the license information on NetBrain License Server and generate the corresponding activation file, and then send it back to you.
 - b) Click **Browse** to select the activation file that you received from NetBrain team, and then click **Activate**.
- 4) A message box will prompt you the subscription license has been activated successfully. Click **OK**.
3. A confirmation dialog box prompts to ask you whether to generate an initial tenant. Click **Yes** and the initial tenant will be created automatically with all purchased nodes assigned.

4.3. Creating User Accounts

Tip: To synchronize authenticated user accounts that are managed in third-party user management servers, refer to [Third-Party User Authentication](#).

To manually create a user account, do the following:

1. In the System Management page, select the **User Accounts** tab.
2. Click **Add** at the upper-left corner, and complete the settings. This is an example:

Add User

Basic Information

Authentication Source: NetBrain Only Portal User

* Email: John.Cook@netbrain.com

* First Name: John

* Last Name: Cook

* Username: J.Cook

* Password:

* Confirm Password:

Authentication Server: NetBrain

Phone Number: _____

Department: _____

Description: Enter text...

Advanced Settings

Expired after _____ 12:00 AM

Allowed to change individual password

User Rights

System Admin
 System Management
 User Management

1 Tenants, 5 Domains selected

Tenant Access	Tenant Admin...	Allowed to Create Domain ...	Domain Access	Domain Privileges ...
<input checked="" type="checkbox"/>	Initial Tenant	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Domain Admin
			<input checked="" type="checkbox"/>	Domain1
			<input checked="" type="checkbox"/>	Boston
			<input checked="" type="checkbox"/>	Domain2
			<input checked="" type="checkbox"/>	BJ1
			<input checked="" type="checkbox"/>	BJ2

Cancel Submit

- 1) Enter basic information. The fields marked with asterisks are mandatory.
 - 2) Assign user rights, including access permissions and user privileges. See [online help](#) for more details.
 - 3) **Configure** the advanced settings if required, including account expiration and privilege to modify/reset password.
3. Click **Submit**. The user account will be added to the Existing User List.

4.4. Allocating Tenants to Front Server Controller

1. In the System Management page, select the **Front Server Controllers** tab, and then click **Add Front Server Controller**.
2. In the **Add Front Server Controller** dialog, configure the settings for the Front Server Controller, and then allocate tenants to it.
 - 1) Select the deployment mode, and then specify the basic information about the Front Server Controller. See [FSC Settings](#) for more details.

Deployment Mode: Standalone

Front Server Controller Settings:

Front Server Controller

*Name:

*Hostname or IP Address:

*Port:

*Username:

*Password:

Timeout: Seconds

Description:

SSL Settings

Allocated Tenants:

<input checked="" type="checkbox"/>	Tenant Name	Dedicated Front Server Controller
<input checked="" type="checkbox"/>	Initial Tenant	

Cancel Test OK

- **Standalone** — applicable to a single Front Server Controller deployment.
 - **Group** — applicable to a failover deployment of Front Server Controller.
- 2) Configure the SSL settings.
 - a) If SSL is enabled on Front Server Controller, select the **Use SSL** check box to encrypt the connections established from the Worker Server and Front Server with SSL. Otherwise, leave it unchecked.
 - b) To authenticate the Certificate Authority (CA) certificate on the Front Server Controller, select the **Conduct Certificate Authority verification** check box.
 - c) If CA has not been installed on the Worker Server and Task Engine, click **Browse** to upload the CA file, for example, **ca.pem**. Otherwise, click **I have already installed the Certificate Authority on Worker Server and Task Engine**.

Note: Only certificates in the **Base-64 encoded X.509 PEM** format are supported.

- 3) Click **Test** to verify whether the Worker Server can establish a connection to Front Server Controller with the configurations.
- 4) In the **Allocated Tenants** area, select the target tenants to allocate them to the controller.
- 5) Click **OK** to save the settings.

The Front Server Controller is added.

+ Add Front Server Controller Refresh

Search...	Front Server Control...	Hostname or IP ...	Port	Username	Description	Tenants	Status
▲ FSC Connected	FSC	10.10.3.141	9095	netbrain		Initial Tenant	Connected
● Initial Tenant							

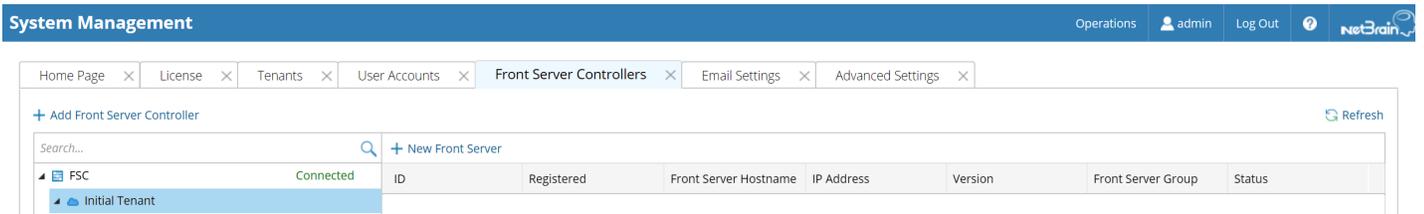
Front Server Controller Settings

The following items (except **Timeout** and **Description**) are required to be consistent with those configured during the installation of NetBrain Application Server.

Field	Description
Name	Keep the default value FSC as it is.
Hostname or IP Address	Enter the IP address of NetBrain Application Server.
Port	The port number created when you install the Front Server Controller for listening to the connections from Worker Server. By default, it is 9095 .
Username	The user name created for NetBrain service when installing NetBrain Database Server.
Password	The password created for NetBrain service when installing NetBrain Database Server
Timeout	The maximum waiting time for establishing a connection from Worker Server to this Front Server Controller. By default, it is 5 seconds.
Description	The brief description to help you add more information about the Front Server Controller.

4.5. Adding a Front Server to a Tenant

1. In the Front Server Controller Manager, select the target tenant and click **New Front Server**.



2. Enter the following properties of the Front Server.

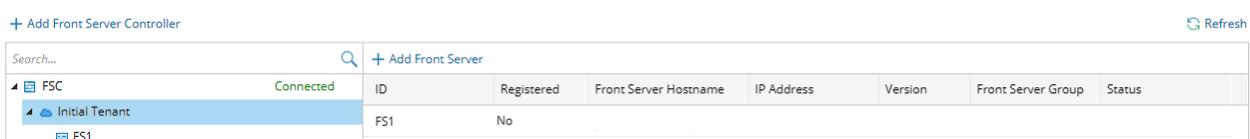
The 'Add Front Server' dialog box is shown. It contains the following text: 'The Front Server ID and Authentication Key will be used when you register this Front Server.' Below this text are three input fields: '*Front Server ID:' with the value 'FS1', '*Authentication Key:' (empty), and 'Front Server Group:' with a dropdown menu set to '(None)'. At the bottom right, there are 'Cancel' and 'OK' buttons.

- **Front Server ID** — keep the default value **FS1** as it is.
- **Authentication Key** — create an authentication key for the Front Server.

Tip: Keep notes of the Authentication Key because it is required when you [register this Front Server](#).

- **Front Server Group** — assign the Front Server to a group for load balancing. It is only applicable when multiple Front Servers are added to one tenant, otherwise, leave it as default.

3. Click **OK**. The Front Server is added to the Front Server list.

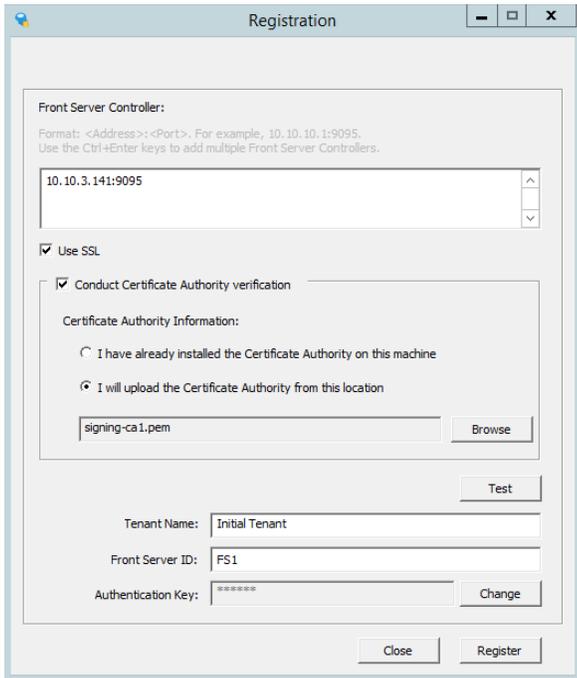


4.6. Registering a Front Server

Example: Register a Front Server on Windows Server 2012 R2.

Complete the following steps with administrative privileges.

1. On the machine where the Front Server is installed, click the Windows start menu and then click the  icon to open the **Apps** pane.
2. Under the **NetBrain** category, right-click **Registration** and then select **Run as administrator** from the drop-down list.
3. In the **Registration** dialog, complete the registration form.



- 1) Enter the following information about the Front Server Controller.
 - **Hostname or IP address** — the IP address of NetBrain Application Server and the port number (defaults to 9095).
- 2) Configure the SSL settings.
 - a) Select the **Use SSL** check box to encrypt the connections to Front Server Controller with SSL. If SSL is disabled on Front Server Controller, leave it unchecked and skip step b) to c).

Note: Select the **Use SSL** check box only if you enabled SSL on Front Server Controller.

- b) To authenticate the Certificate Authority (CA) of SSL certificates on Front Server, select the **Conduct Certificate Authority verification** check box.
- c) If the CA has not been installed on this machine, click **Browse** to upload the CA file, for example, **ca.pem**; otherwise, select **I have installed the Certificate Authority on this machine**.

Note: Only the certificate in **Base-64 encoded X.509 PEM** format is supported.

- 3) Click **Test** to verify whether this Front Server can establish a connection with Front Server Controller.
 - 4) Keep all default values, and then enter the authentication key created when you add this Front Server to a tenant.
4. Click **Register**.

Tip: After registering the Front Server successfully, you can open the Task Manager and navigate to the **Services** panel to check whether the **NetBrainFrontServer** service is running.

5. Click **Close** after the registration is finished. The Front Server information in the Front Server Controller Manager will be synchronized by clicking **Refresh**.

+ Add Front Server Controller Refresh

Search...		+ New Front Server						
ID	Registered	Front Server Hostname	IP Address	Version	Front Server Group	Status		
<ul style="list-style-type: none"> [-] FSC Connected [-] Initial Tenant <ul style="list-style-type: none"> [+] FS1 Connected 		FS1	YES	WIN-M2CQ6EJO685	10.10.3.141	8.0		Connected

Legend: ■ Front Server Controller ■ Front Server Controller Group ■ Tenant ■ Front Server (Registered) ■ Front Server (Unregistered)

4.7. Customizing Resource Auto-Update Settings

Knowledge Cloud is a centralized resource base housing various types of regular/customized NetBrain resources. NetBrain IE system can download any NetBrain resources (that apply to your specific IE version) from Knowledge Cloud constantly. These [resources](#), once downloaded, will be deployed automatically in your IE system.

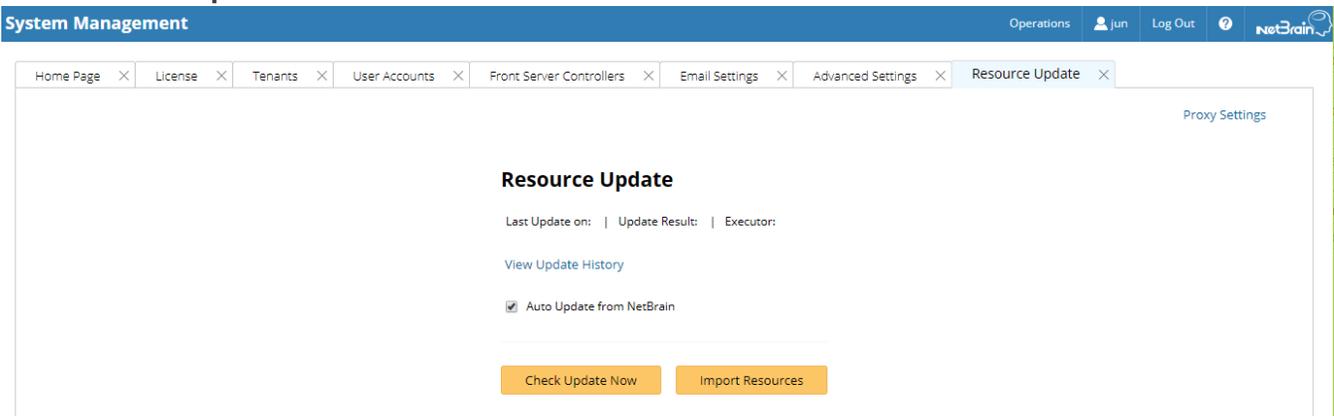
There are three ways to perform a resource update in your IE system.

- **Auto-update Resources (Recommended)** — the system will fetch the latest resources from Knowledge Cloud constantly (twice per day between 12AM and 3AM, 12 PM and 3 PM at local time zone) in a fully automatic manner. See [Auto-updating Resources](#) for more details.
- **Manually Trigger Resource Update** — manually initiate the auto-updating process and apply the latest resources (if any) immediately to the system. See [Manually Triggering Resource Update](#) for more details.
- **Manually Import Resources** — manually upload the latest resource package into the system when your servers are not allowed to access the Internet. See [Manually Importing Resources](#) for more details.

Auto-Updating Resources

1. In the System Management page, select **Operations > Resource Update**.

2. Select the **Auto Update from NetBrain** check box.



Tip: If your Web Server has no Internet access, you can click **Proxy Settings** to set up a proxy server to access the internet.

Manually Triggering Resource Update

1. In the System Management page, select **Operations > Resource Update**.
2. Click **Check Update Now** to see if there is any available new resource package and apply the updates to the system if any.

Note: Once the button is clicked, any available updates will be downloaded and installed automatically.

Tip: If your Web Server has no Internet access, you can click **Proxy Settings** to set up a proxy server to access the internet.

Manually Importing Resources

1. In the System Management page, select **Operations > Resource Update**.
2. Check the last update time and result to see if your resources need an upgrade.

Tip: To check historical update records and results, click **View Update History**.

3. Click **Import Resources**, select the new resource package you obtained from [NetBrain Support Team](#).

Resource List

The following resources can be auto-updated by Knowledge Cloud:

- Cloud Type
- Driver/Device Type/Vendor Model Table
- Qapp/Gapp/Parser Library

- Runbook Template/(Default) Data View Template
- Device Group/Device Icon/Image/Media Type/Topology Link Type (IPv4, IPv6, etc.)
- GDR Properties/Interface Type Translation
- Tech Spec/Schema/Visual Space/Network Tree Category and View
- Platform Plugin/Global Python Scripts (including Path Scripts)
- SPOG URL/API Adapter
- Variable Mapping/Global Variable
- Golden Baseline Dynamic Analysis Logic

4.8. Monitoring Server and Service Metrics

1. In the System Management page, click **Operations > Service Monitor** from the quick access toolbar.
2. In the Service Monitor home Page, you can monitor key server metrics, server connectivity, resource utilization, service status and so on.
3. Customize the conditions for when to send out alert emails and take more actions for low disk space on MongoDB by clicking **Alert Rules**. See [Managing Alert Rules](#) for more details.

5. Appendix

- [Offline Installing Third-party Dependencies](#)
- [Editing a File with VI Editor](#)
- [SSL Certificate Requirements](#)
- [Third-Party User Authentication](#)

5.1. Offline Installing Third-party Dependencies

1. Download the dependency package from a server with the Internet access using one of the following download links according to the version of your Operating System:
 - **CentOS7.5:** <http://download.netbraintech.com/dependencies-centos7.5-8.0.tar.gz>
 - **CentOS7.6:** <http://download.netbraintech.com/dependencies-centos7.6-8.0.tar.gz>
 - **CentOS7.7:** <http://download.netbraintech.com/dependencies-centos7.7-8.0.tar.gz>
 - **CentOS7.8:** <http://download.netbraintech.com/dependencies-centos7.8-8.0.tar.gz>
 - **CentOS7.9:** <http://download.netbraintech.com/dependencies-centos7.9-8.0.tar.gz>
 - **RHEL7.5:** <http://download.netbraintech.com/dependencies-rhel7.5-8.0.tar.gz>
 - **RHEL7.6:** <http://download.netbraintech.com/dependencies-rhel7.6-8.0.tar.gz>
 - **RHEL7.7:** <http://download.netbraintech.com/dependencies-rhel7.7-8.0.tar.gz>
 - **RHEL7.8:** <http://download.netbraintech.com/dependencies-rhel7.8-8.0.tar.gz>
 - **RHEL7.9:** <http://download.netbraintech.com/dependencies-rhel7.9-8.0.tar.gz>
2. Copy the downloaded dependency package to your Linux server.
3. Run the `tar -zxvf dependencies-<OS version>-8.0.tar.gz` command to decompress the package.

Tip: Possible values of **OS version** include: `centos7.5`; `centos7.6`; `centos7.7`; `centos7.8`; `rhel7.5`; `rhel7.6`; `rhel7.7`; `rhel7.8`.
4. Run the `cd dependencies` command to navigate to the decompressed directory.
5. Run the `offline-install.sh` command to install the dependencies.

5.2. Editing a File with VI Editor

The following steps illustrate how to edit a configuration file with the vi editor, which is the default text file editing tool of a Linux operating system.

1. Create a terminal and run the `cd` command at the command line to navigate to the directory where the configuration file is located.
2. Run the `vi <configuration file name>` command under the directory to show the configuration file.
3. Press the **Insert** or **I** key on your keyboard, and then move the cursor to the location where you want to edit.
4. Modify the file based on your needs, and then press the **Esc** key to exit the input mode.
5. Enter the `:wq!` command and press the **Enter** key to save the changes and exit the vi editor.

5.3. SSL Certificate Requirements

The requirements of SSL certificates may vary for different NetBrain servers, depending on their different roles in SSL encrypted connections, SSL-server or SSL-client.

- [SSL Certificate Requirements for SSL-Server](#)
- [SSL Certificate Requirements for SSL-Client](#)

Certificate Requirements for SSL-Server

The following table lists the requirements of SSL certificates for NetBrain servers that work as SSL-server in encrypted connections.

NetBrain Server	Required SSL Certificate and Key	Format
MongoDB License Agent Elasticsearch	<ul style="list-style-type: none">▪ Certificate that contains a public key. For example, cert.pem.▪ CA certificate (only required for Elasticsearch). For example, ca.pem.	Base-64 encoded X.509 PEM
Redis RabbitMQ Front Server Controller Ansible Agent	<ul style="list-style-type: none">▪ Private key. For example, key.pem. <p>Note: Private keys protected by a password are not supported.</p>	PKCS#8 key

Tip: The certificates in PEM format usually have extensions such as **.pem**, **.crt**, **.cer**, and **.key**.

Certificate Requirements for SSL-Client

Note: By default, NetBrain servers that work as SSL-client don't require any SSL certificates. If you want to authenticate the Certificate Authority of the certificates for SSL-server, then the SSL certificates are required on SSL-client.

The following table lists the certificate requirements for SSL-client, including Web Server, Web API Server, Worker Server, Front Server, Task Engine, and Service Monitor Agent.

Authentication Method	Requirements	Format
Use the certificates installed on Windows	<ul style="list-style-type: none">All the certificates are valid and installed in the certificate store.The certificate store must be under the Trusted Root Certification Authorities directory instead of the Personal directory.	N/A
Upload certificates when installing NetBrain servers	<ul style="list-style-type: none">For Front Server and Worker Server: CA certificate containing root CA certificate and class 2 CA certificate is required.For other SSL-client: class 2 or class 3 CA certificate is required.	Base-64 encoded X.509 PEM

5.4. Third-Party User Authentication

In addition to [creating user accounts manually](#), the system supports integrating with the following third-party user management systems for authentication.

- [LDAP Authentication](#)
- [AD Authentication](#)
- [TACACS+ Authentication](#)
- [SSO Authentication](#)