Install TmaxSoft OpenFrame on Azure

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Introduction

TmaxSoft OpenFrame is a popular mainframe rehosting solution that makes it easy to lift your existing mainframe assets and shift them to Microsoft Azure. Lift-and-shift is the no-code approach to quickly migrating existing applications as-is to a mainframe emulation environment on Azure. By moving some or all of your mainframe workloads to the cloud, you can modernize your infrastructure, benefit from the scale of Azure, and leave behind many of the drawbacks associated with mainframes.

This document explains how to set up an OpenFrame environment on Azure suitable for development, demos, testing, or production workloads. As Figure 1 shows, OpenFrame includes multiple components that create the mainframe emulation environment on Azure. For example, OpenFrame online services replace the mainframe middleware such as IBM Customer Information Control System (CICS), and OpenFrame Batch, with its TJES component, replaces the IBM mainframe's Job Entry Subsystem (JES).

OpenFrame works with any relational database, including Oracle Database, Microsoft SQL Server, IBM Db2, and MySQL. This installation of OpenFrame uses the TmaxSoft Tibero relational database. Both OpenFrame and Tibero run on a Linux operating system. This deployment installs CentOS 7.3, although you can use other supported Linux distributions, and it installs the OpenFrame application server and the Tibero database on one virtual machine (VM).

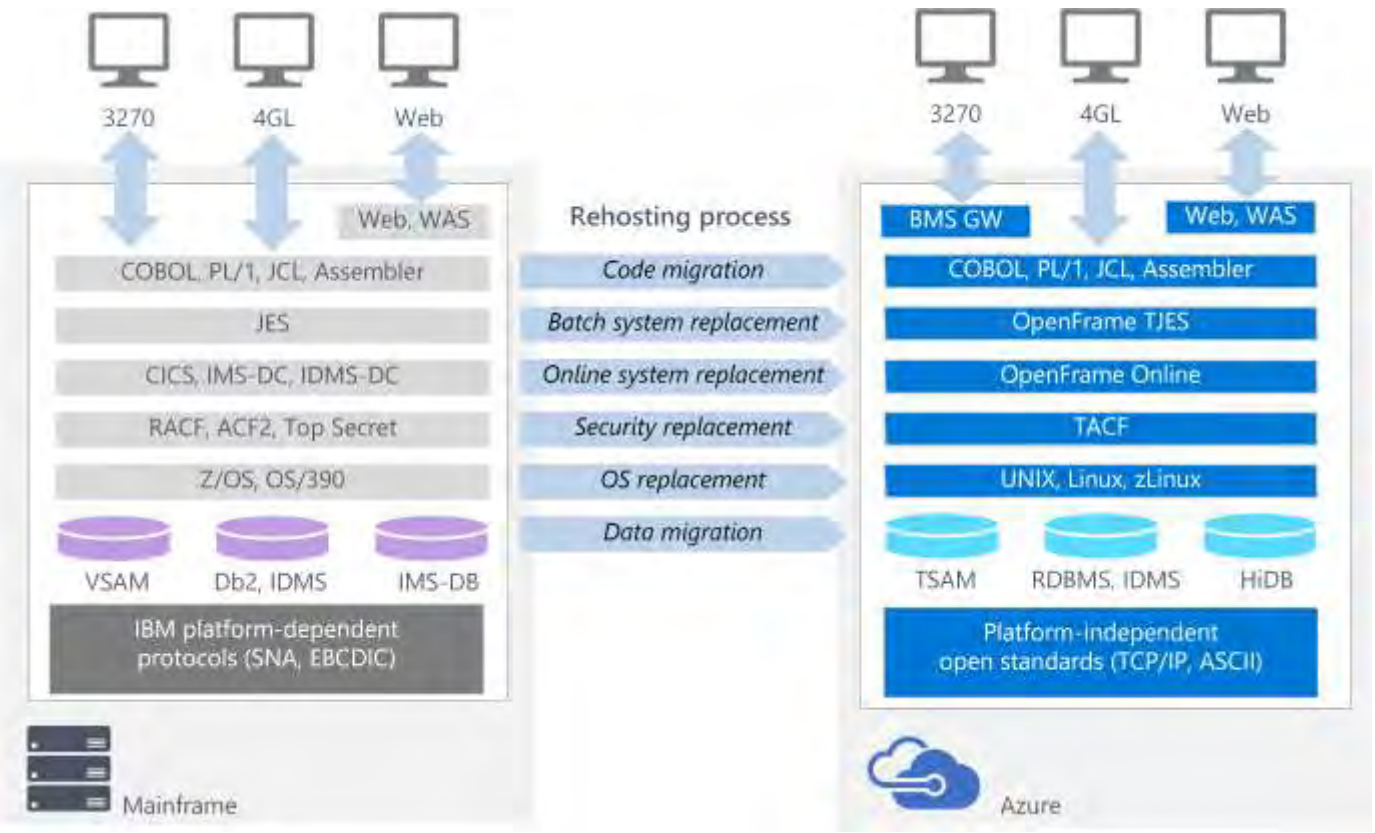


Figure 1. OpenFrame creates a rehosting environment on Azure for mainframe workloads

ⓘ **NOTE:** To run the OpenFrame environment on Azure, you must have a valid product license or trial license from TmaxSoft.

Certain components must be installed separately. The guide steps you through the installation of the following main components of the OpenFrame suite:

- Required installation packages.
- Tibero database.
- Open Database Connectivity (ODBC) is used by applications in OpenFrame to communicate with the Tibero database.
- OpenFrame Base, the middleware that manages the entire system.
- OpenFrame Batch, the solution that replaces the mainframe's batch systems.
- TACF, a service module that controls user access to systems and resources.
- ProSort, a sort tool for batch transactions.
- OFCOBOL, a compiler that interprets the mainframe's COBOL programs.
- OFASM, a compiler that interprets the mainframe's assembler programs.
- OpenFrame Server Type C (OSC), the solution that replaces the mainframe's middleware and IBM CICS.
- Java Enterprise User Solution (JEUS), a web application server that is certified for Java Enterprise Edition 6.
- OFGW, the OpenFrame gateway component that provides a 3270 listener.
- OFManager, a solution that provides OpenFrame's operation and management functions in the web environment.

In addition, when you install OpenFrame, you also install the following components:

- OSI, the solution that replaces the mainframe middleware and IMS DC.
- TJES, the solution that provides the mainframe's JES environment.
- OFTSAM, the solution that enables (V)SAM files to be used in the open system.
- OFHiDB, the solution that replaces the mainframe's IMS DB.
- OFPLI, a compiler that interprets the mainframe's PL/I programs.
- PROTRIEVE, a solution that executes the mainframe language CA-Easytrieve.
- OFMiner, a solution that analyzes the mainframes assets and then migrates them to Azure.

The following figure provides an overview of the OpenFrame 7.0 architecture:

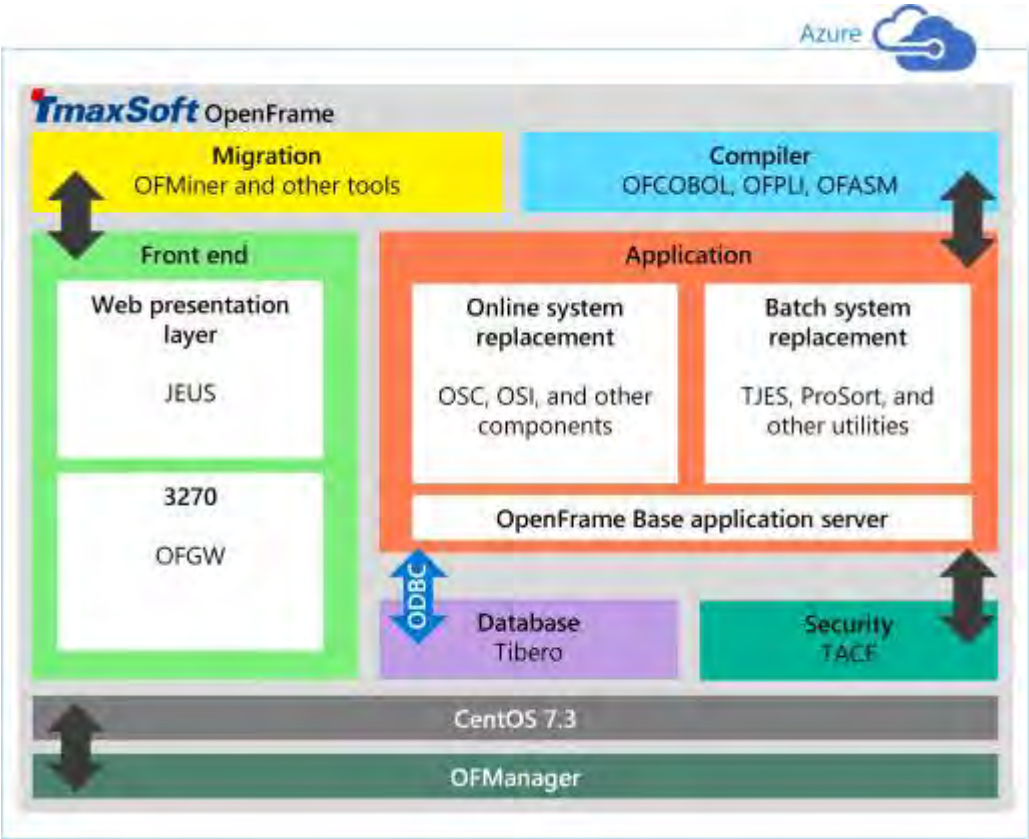


Figure 2. The OpenFrame 7.0 architectural components installed in this guide

Azure system requirements

The following table lists the requirements for the installation on Azure.

Requirement	Description
Supported Linux distributions on Azure	Linux x86 2.6 (32-bit, 64-bit) • Red Hat 7.x • CentOS 7.x
Hardware	Cores: 2 (minimum) Memory: 4 GB (minimum) Swap space: 1 GB (minimum) Hard disk: 100 GB (minimum)
Optional software for Windows users	• PuTTY: Used in this guide to configure VM features • WinSCP: A popular SFTP client and FTP client you can use • Eclipse for Windows: A development platform supported by TmaxSoft (Microsoft Visual Studio is not supported at this time)

Prerequisites

Plan on spending a few days to assemble all the required software and complete all the manual processes.

Before getting started, do the following:

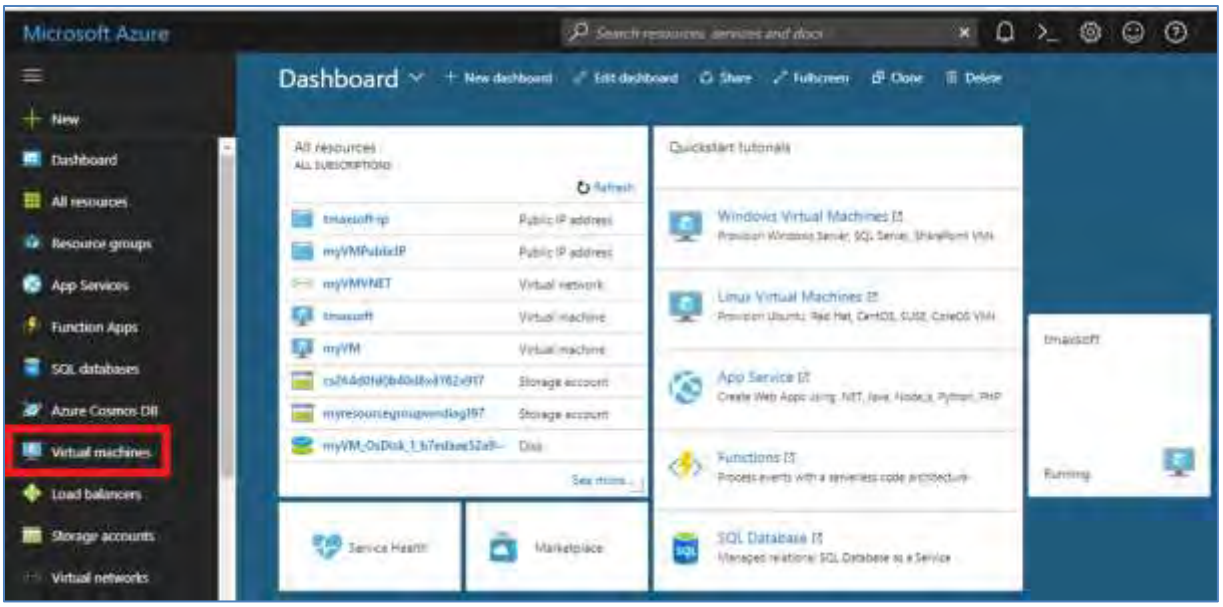
- Get the OpenFrame installation media from TmaxSoft. If you are an existing TmaxSoft customer, contact your TmaxSoft representative for a licensed copy. Otherwise, request a trial version from TmaxSoft at http://www.tmaxsoft.com/contact/.
- Request the OpenFrame documentation by sending email to support@tmaxsoft.com.
- Get an Azure subscription if you don't already have one. You can also create a free account before you begin.
- Set up a site-to-site VPN tunnel or a jumpbox that restricts access to the Azure VM to the permitted users in your organization. This step is not required, but it is a best practice.

Set up a VM on Azure for OpenFrame and Tibero

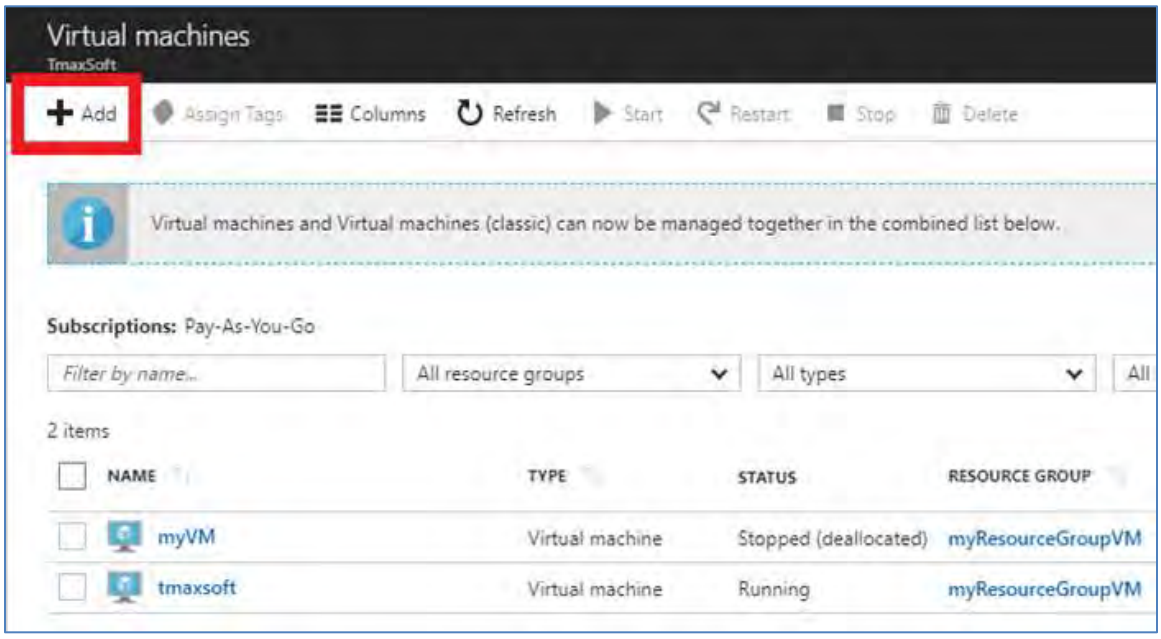
You can set up the OpenFrame environment using various deployment patterns, but the following procedure shows how to deploy the OpenFrame application server and the Tibero database on one VM. In larger environments and for sizeable workloads, a best practice is to deploy the database separately on its own VM for better performance.

To create a VM:

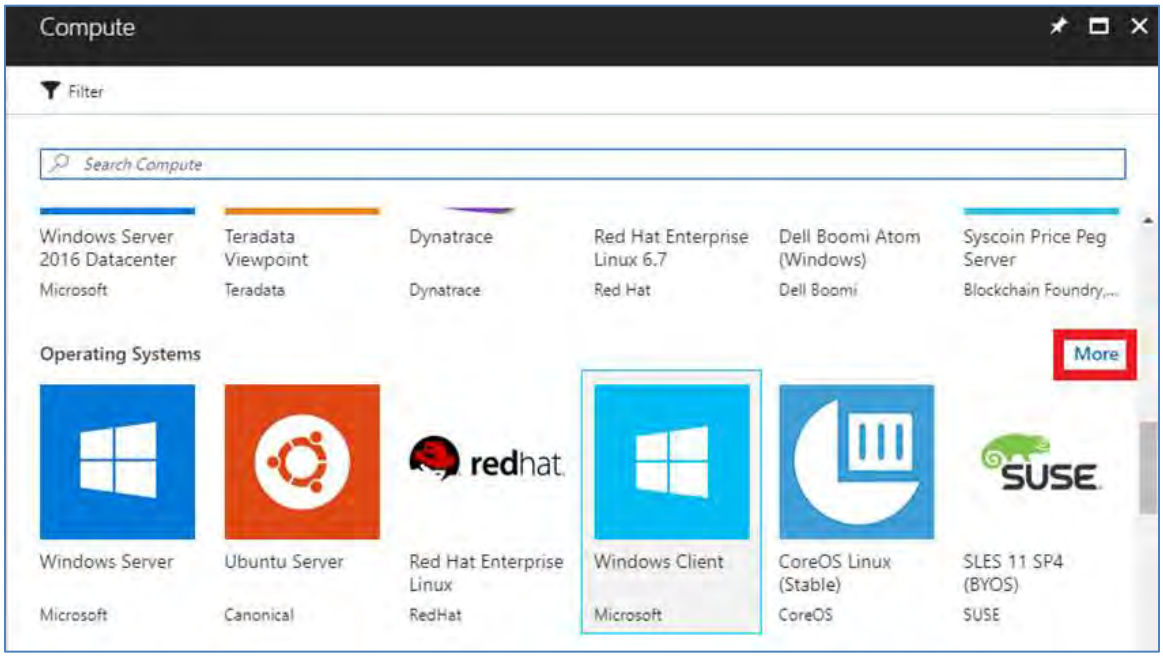
1. Go to the Azure portal at http://portal.azure.com and sign in to your account.
2. Click **Virtual machines**.



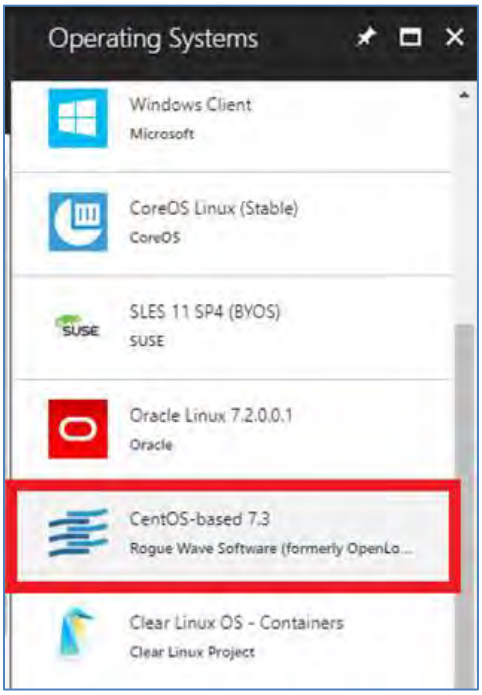
3. Click **Add**.



4. To the right of **Operating Systems**, click **More**.



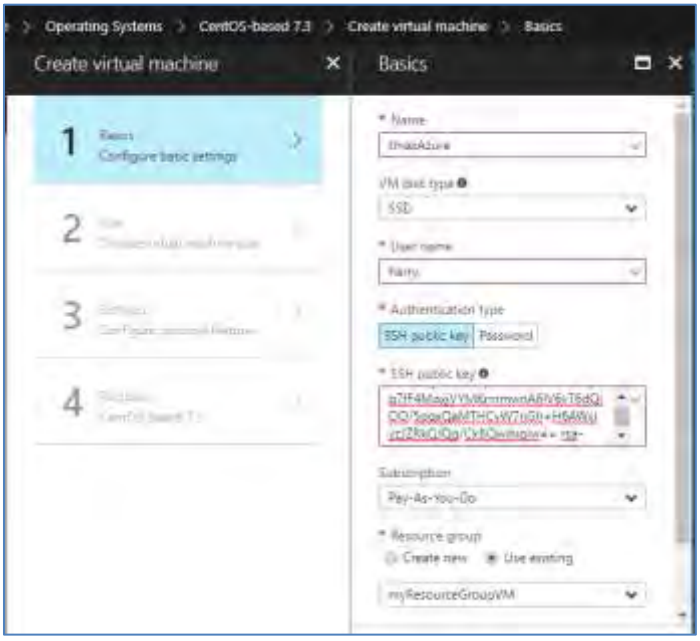
5. Click **CentOS-based 7.3** to follow this walk-through exactly, or you can choose another supported Linux distribution.



6. In the **Basics** settings, enter **Name**, **User name**, **Authentication type**, **Subscription** (Pay-As-You-Go is the AWS style of payment), and **Resource group** (use an existing one or create a TmaxSoft group).

7. When complete (including the public/private key pair for **Authentication type**), click **Submit**.

> ⓘ **NOTE:** If using an SSH public key for **Authentication type**, see the steps in the next section to generate the public/private key pair, then resume the steps here.



Generate a public/private key pair

If you are using a Windows operating system, you need PuTTYgen to generate a public/private key pair.

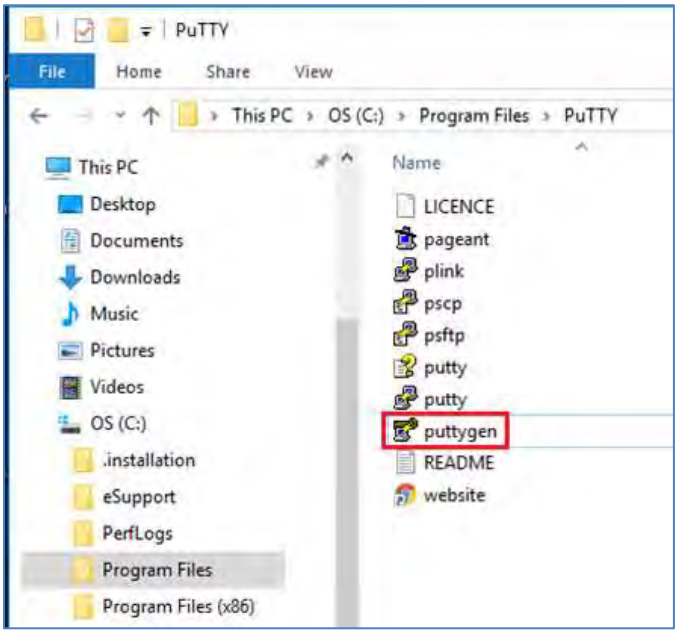
The public key can be freely shared, but the private key should be kept entirely secret and should never be shared with another party. After generating the keys, you must paste the **SSH public key** into the configuration—in effect, uploading it to the Linux VM. It is stored inside authorized_keys within the ~/.ssh directory of the user account's home directory. The Linux VM is then able to recognize and validate the connection once you provide the associated **SSH private key** in the SSH client (in our case, PuTTY).

When giving new individuals access the VM, the recommended steps are:

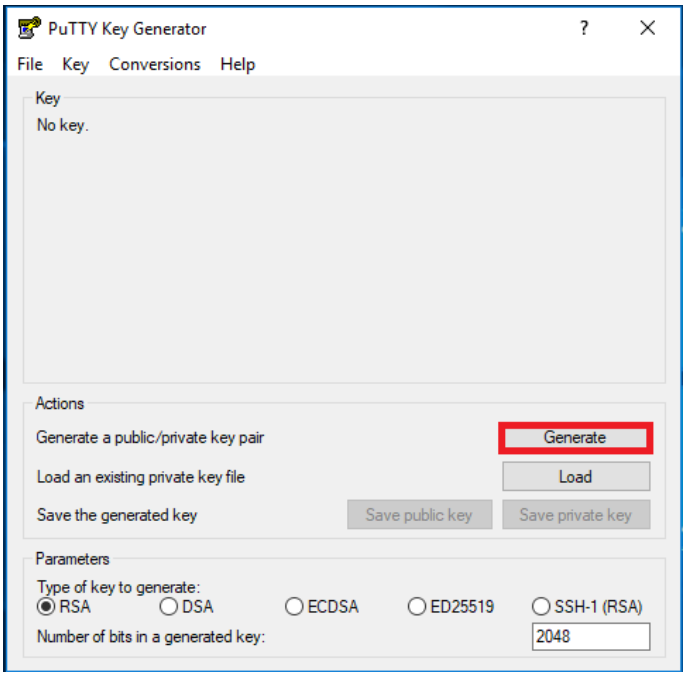
1. Each new individual generates their own public/private keys using PuTTYgen.
2. Individuals store their own private keys separately and send the public key information to the administrator of the VM.
3. The administrator pastes the contents of the public key to the ~/.ssh/authorized_keys file.
4. The new individual connects via PuTTY.

To generate a public/private key pair, do the following:

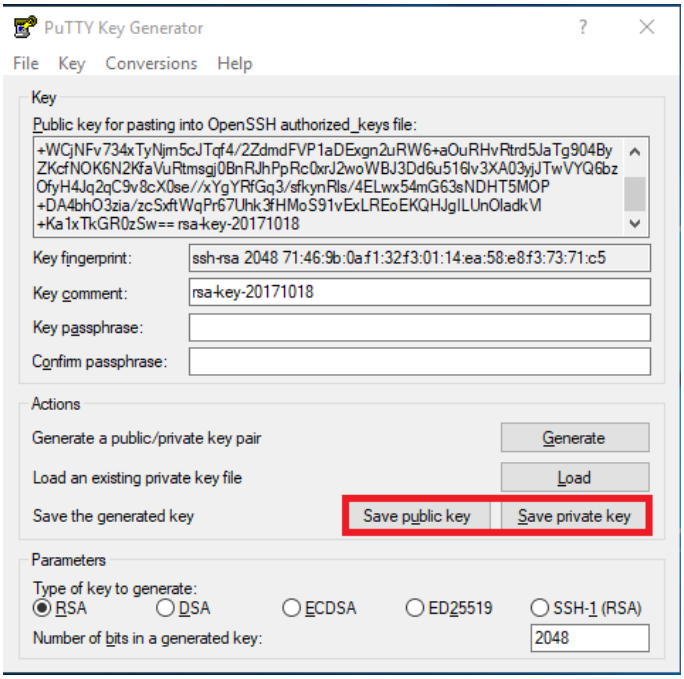
1. Download PuTTYgen from https://www.putty.org/ and install it using all the default settings.
2. To open PuTTYgen, locate the PuTTY installation directory in C:\Program Files\PuTTY.



3. Click **Generate**.



4. After generation, save both the public key and private key. Paste the contents of the public key in the **SSH public key** section of the **Create virtual machine** > **Basics** pane (shown in steps 6 and 7 in the previous section).

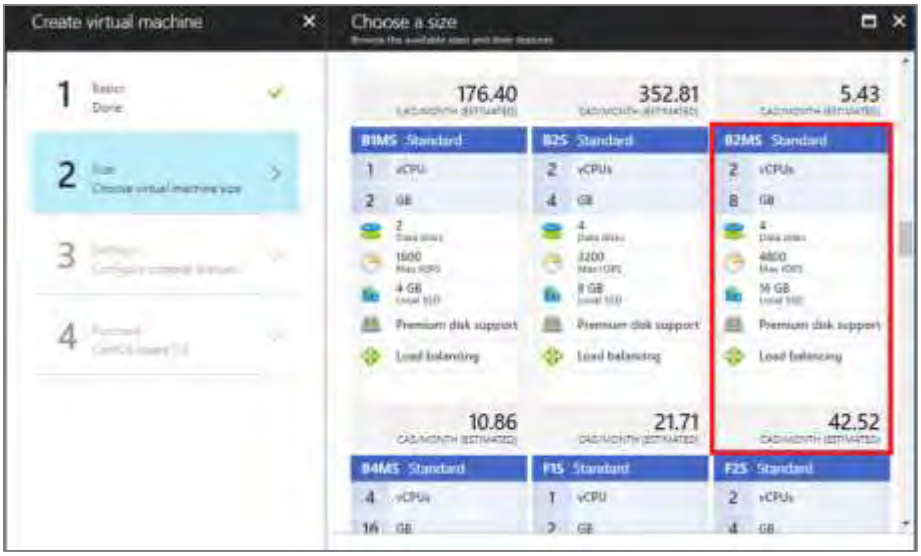


Configure VM features

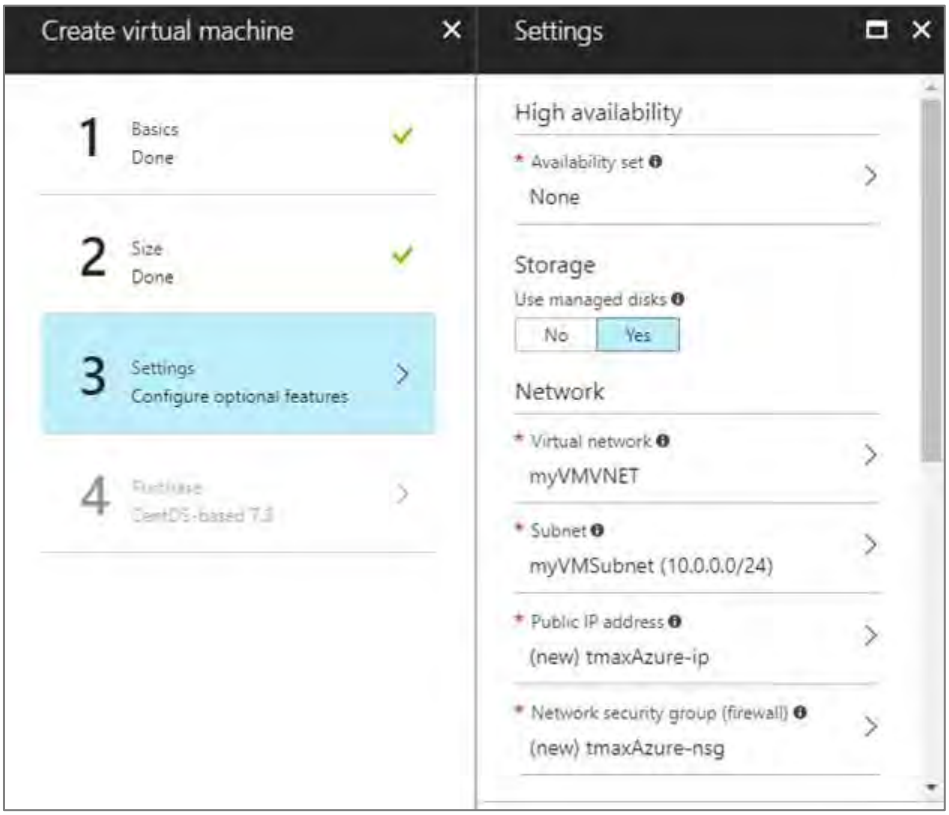
1. In Azure portal, in the **Choose a size** blade, choose the Linux machine hardware settings you want. The *minimum* requirements for installing both Tibero and OpenFrame are:

- 2 CPUs
- 4 GB RAM

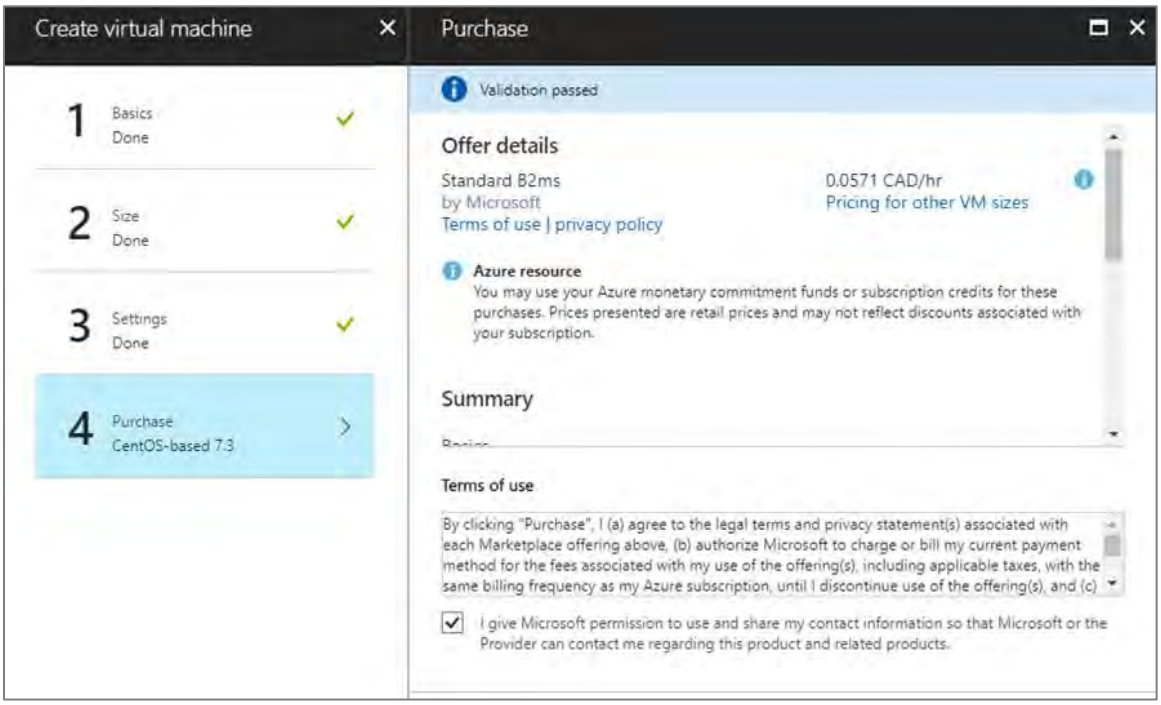
For this example installation, 2 CPUs and 8 GB RAM are used:



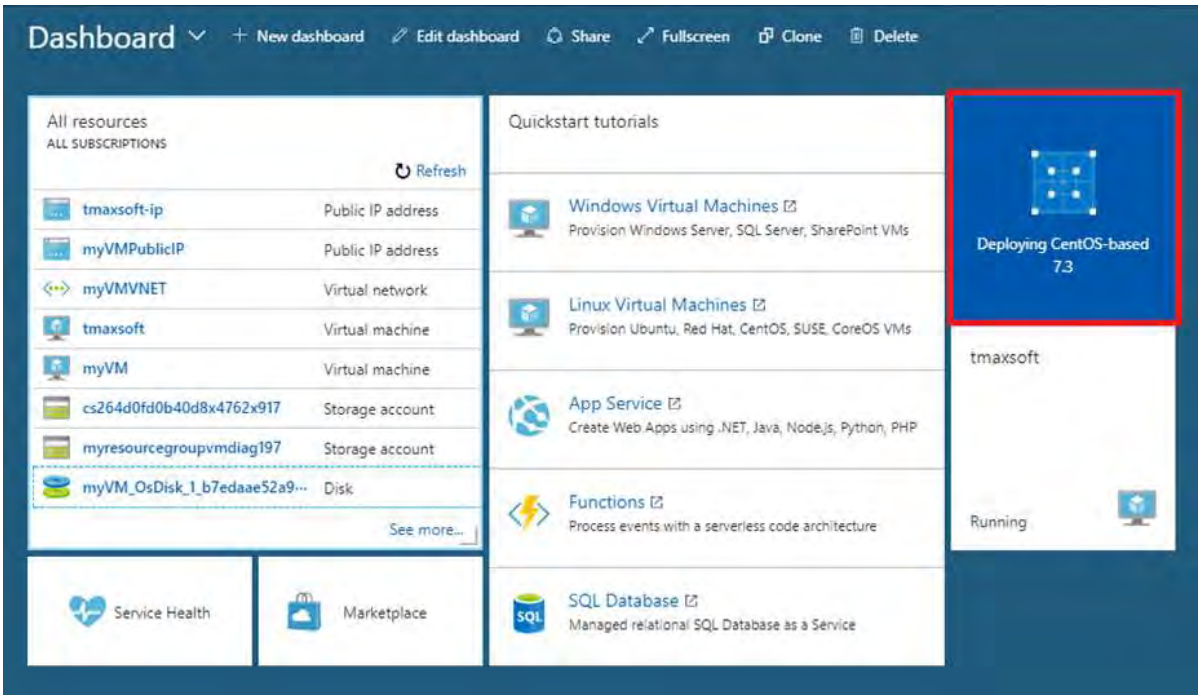
2. To configure the optional features, on the **Settings** pane, use the default settings.



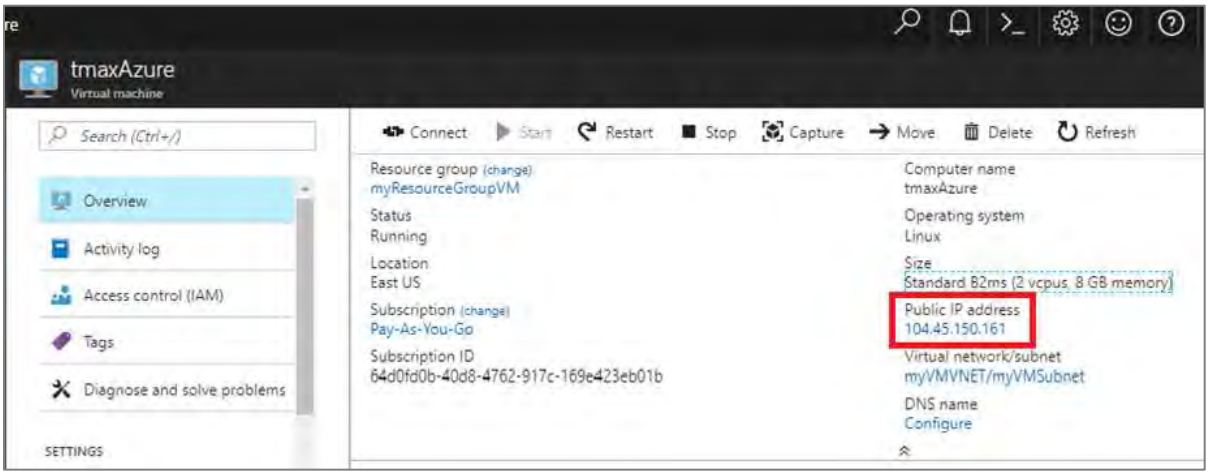
3. Review your payment details.



4. Once you submit your selections, Azure begins to deploy the VM. This process typically takes a few minutes.

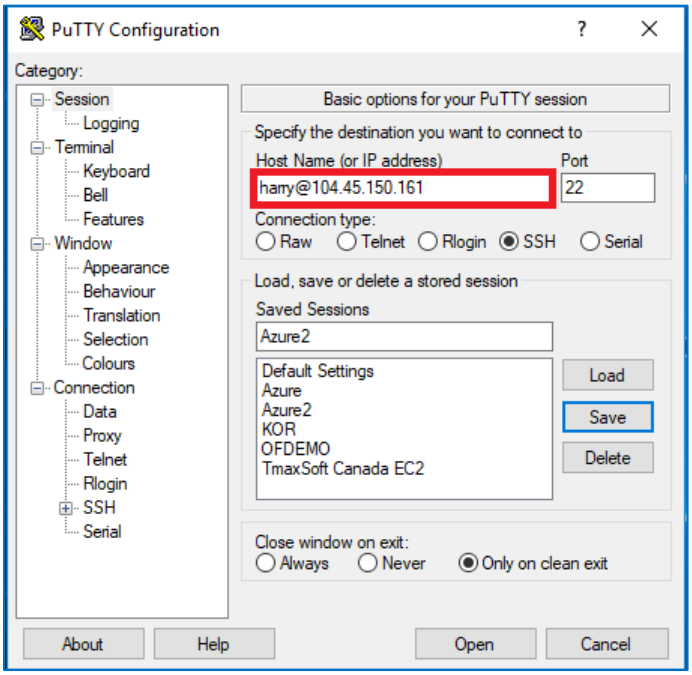


5. When the VM is deployed, its dashboard is displayed, showing all the settings that were selected during the configuration. Make a note of the **Public IP address**.

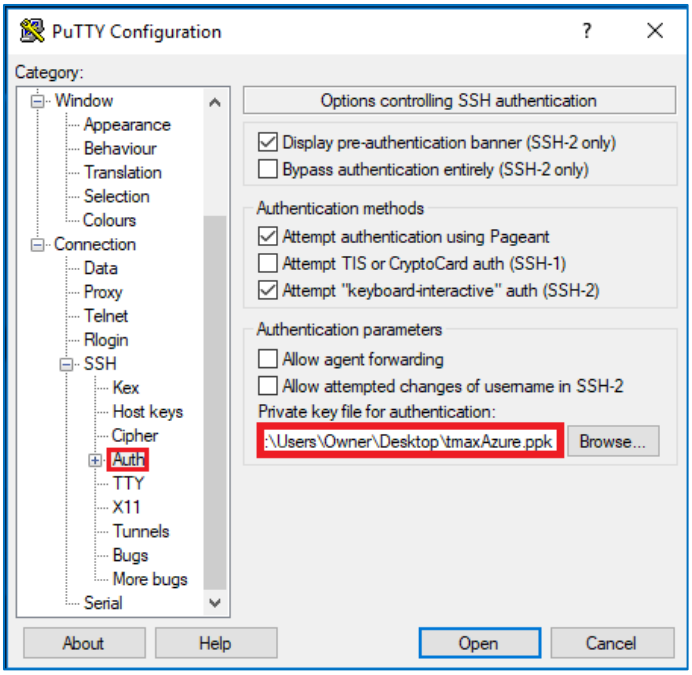


6. Open PuTTY.

7. For **Host Name**, type your username and the public IP address you copied. For example, **username@publicip**.

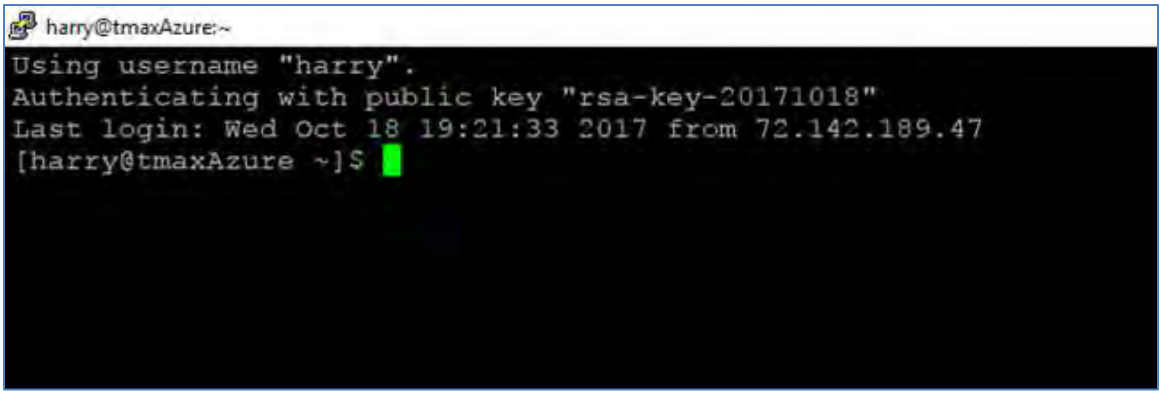


8. In the **Category** box, click **Connection** > **SSH** > **Auth**. Provide the path to your **private key** file.



9. Click **Open** to launch the PuTTY window. If successful, you are connected to your new CentOS VM running on Azure.

10. To log on as root user, type **sudo bash**.



Set up the environment and packages

Now that the VM is created and you are logged on, you must perform a few setup steps and install the required preinstallation packages.

1. Map the name **ofdemo** to the local IP address by using vi to edit the hosts file:

```
vi /etc/hosts
Assuming our IP is: 192.168.96.148 ofdemo
```

Before change:

```
127.0.0.1   localhost localhost.localdomain localhost4 localhost4.localdomain4
::1             localhost localhost.localdomain localhost6
localhost6.localdomain
<IP Address>    <your hostname>
```

After change:

```
127.0.0.1   localhost localhost.localdomain localhost4 localhost4.localdomain4
::1             localhost localhost.localdomain localhost6
localhost6.localdomain
192.168.96.148   ofdemo
```

2. Create groups and users:

```
[root@ofdemo ~]# adduser -d /home/oframe7 oframe7
[root@ofdemo ~]# passwd oframe7
```

3. Change the password for user oframe7:

```
New password:
Retype new password:
passwd: all authentication tokens updated successfully.
```

4. Update the kernel parameters in /etc/sysctl.conf:

```
[root@ofdemo ~]# vi /etc/sysctl.conf
kernel.shmall = 7294967296
kernel.sem = 10000 32000 10000 10000
```

5. Refresh the kernel parameters dynamically without reboot:

```
[root@ofdemo ~]# /sbin/sysctl -p
```

6. Install the required packages. Make sure the server is connected to the Internet, download the following packages, and then install them:

   - dos2unix
   - glibc
   - glibc.i686 glibc.x86_64
   - libaio
   - ncurses

   ⓘ **NOTE:** After installing the ncurses package, create the following symbolic link:

   ```
   ln -s /usr/lib64/libncurses.so.5.9 /usr/lib/libtermcap.so
   ln -s /usr/lib64/libncurses.so.5.9 /usr/lib/libtermcap.so.2
   ```

   - gcc
   - gcc-c++
   - libaio-devel.x86_64
   - strace
   - ltrace
   - gdb

ⓘ **NOTE:** In case of Java RPM installation, do the following:

```
root@ofdemo ~]# rpm -ivh jdk-7u79-linux-x64.rpm
[root@ofdemo ~]# vi .bash_profile

# JAVA ENV
export JAVA_HOME=/usr/java/jdk1.7.0_79/
export PATH=$JAVA_HOME/bin:$PATH
export CLASSPATH=$CLASSPATH:$JAVA_HOME/jre/lib/ext:$JAVA_HOME/lib/tools.jar

[root@ofdemo ~]# source /etc/profile
[root@ofdemo ~]# java –version

java version "1.7.0_79"
Java(TM) SE Runtime Environment (build 1.7.0_79-b15)
Java HotSpot(TM) 64-Bit Server VM (build 24.79-b02, mixed mode)

[root@ofdemo ~]# echo $JAVA_HOME /usr/java/jdk1.7.0_79/
```

Install the Tibero database

Tibero provides the several key functions in the OpenFrame environment on Azure:

- Tibero is used as the OpenFrame internal data store for various system functions.
- VSAM files, including KSDS, RRDS, and ESDS, use the Tibero database internally for data storage.
- The TACF data repository is stored in Tibero.
- The OpenFrame catalog information is stored in Tibero.
- The Tibero database can be used as a replacement for IBM Db2 to store application data.

To install Tibero:

1. Verify that the Tibero binary installer file is present and review the version number.
2. Copy the Tibero software to the Tibero user account (oframe):

```
[oframe7@ofdemo ~]$ tar -xzvf tibero6-bin-6_rel_FS04-linux64-121793-opt-
tested.tar.gz
[oframe7@ofdemo ~]$ mv license.xml /opt/tmaxdb/tibero6/license/
[oframe7@ofdemo ~]$ vi .bash_profile
```

3. Paste the following into .bash_profile:

```
# Tibero6 ENV
export TB_HOME=/opt/tmaxdb/tibero6
export TB_SID=TVSAM export TB_PROF_DIR=$TB_HOME/bin/prof
export LD_LIBRARY_PATH=$TB_HOME/lib:$TB_HOME/client/lib:$LD_LIBRARY_PATH
export PATH=$TB_HOME/bin:$TB_HOME/client/bin:$PATH
```

4. Execute:

```
[oframe7@ofdemo ~]$ source .bash_profile
```

5. Generate and modify the tip file (a configuration file for Tibero):

```
[oframe7@ofdemo ~]$ sh $TB_HOME/config/gen_tip.sh
[oframe7@ofdemo ~]$ vi $TB_HOME/config/$TB_SID.tip
```

6. Modify $TB_HOME/client/config/tbdsn.tbr and put 127.0.0.1 instead of localhost as shown:

```
TVSAM=(
(INSTANCE=(HOST=127.0.0.1)
(PT=8629)
(DB_NAME=TVSAM)
          )
   )
```

7. Create the database. The following output appears:

```
Change core dump dir to /opt/tmaxdb/tibero6/bin/prof.
Listener port = 8629
Tibero 6
TmaxData Corporation Copyright (c) 2008-. All rights reserved.
Tibero instance started up (NOMOUNT mode).
 /--------------------- newmount sql ------------------------/
create database character set MSWIN949 national character set UTF16;
/-----------------------------------------------------------/
Database created.
Change core dump dir to /opt/tmaxdb/tibero6/bin/prof.
Listener port = 8629
Tibero 6
TmaxData Corporation Copyright (c) 2008-. All rights reserved.
Tibero instance started up (NORMAL mode).
/opt/tmaxdb/tibero6/bin/tbsvr
……..
Creating agent table...
Done.
For details, check /opt/tmaxdb/tibero6/instance/TVSAM/log/system_init.log.
************************************************
* Tibero Database TVSAM is created successfully on Fri Aug 12 19:10:43 UTC
2016.
*     Tibero home directory ($TB_HOME) =
*         /opt/tmaxdb/tibero6
*     Tibero service ID ($TB_SID) = TVSAM
*     Tibero binary path =
*         /opt/tmaxdb/tibero6/bin:/opt/tmaxdb/tibero6/client/bin
*     Initialization parameter file =
*         /opt/tmaxdb/tibero6/config/TVSAM.tip
*
* Make sure that you always set up environment variables $TB_HOME and
* $TB_SID properly before you run Tibero.
************************************************************************
```

8. To recycle Tibero, first shut it down:

```
[oframe7@ofdemo ~]$$ tbdown
Tibero instance terminated (NORMAL mode).
```

9. Now boot Tibero:

```
[oframe7@ofdemo ~]$ tbboot
Change core dump dir to /opt/tmaxdb/tibero6/bin/prof. Listener port = 8629

Tibero 6
TmaxData Corporation Copyright (c) 2008-. All rights reserved.
Tibero instance started up (NORMAL mode).
```

10. To create a tablespace, access the database using SYS user (sys/tmax), then create the necessary tablespace for the default volume and TACF:

```
[oframe7@ofdemo ~]$ tbsql tibero/tmax
tbSQL 6
TmaxData Corporation Copyright (c) 2008-. All rights reserved.
Connected to Tibero.
```

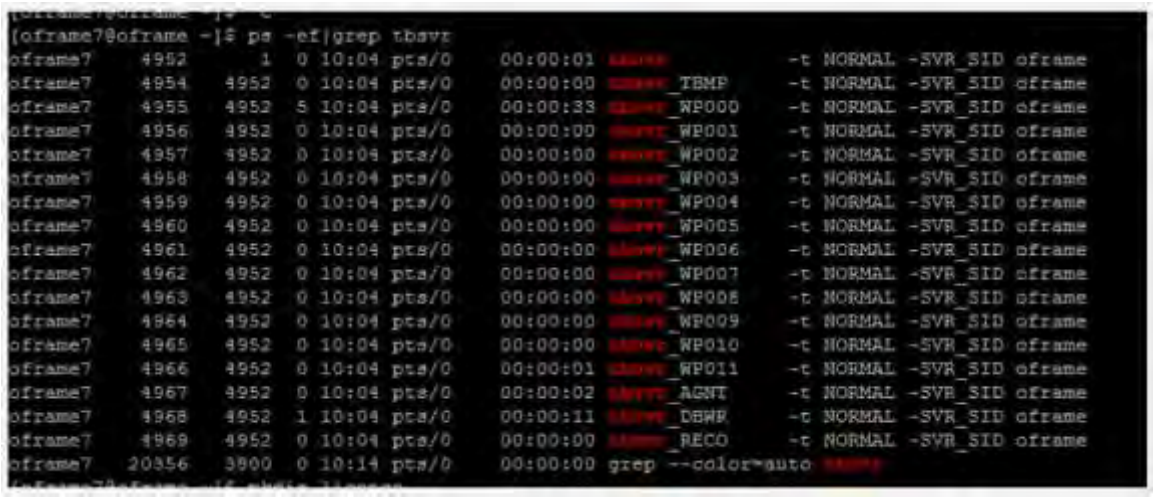
11. Now type the following SQL commands:

```
SQL> create tablespace "DEFVOL" datafile 'DEFVOL.dbf' size 500M autoextend on;
create tablespace "TACF00" datafile 'TACF00.dbf' size 500M autoextend on;
create tablespace "OFM_REPOSITORY" datafile 'ofm_repository.dbf' size 300M
autoextend on;
SQL> Tablespace 'DEFVOL' created.
SQL> Tablespace 'TACF00' created.
SQL> Tablespace ' OFM_REPOSITORY ' created.
SQL> SQL> Disconnected.
```

12. Boot Tibero and verify that the Tibero processes are running:

```
[oframe7@ofdemo ~]$ tbboot
ps -ef | egrep tbsvr
```

Output:



Install ODBC

Applications in OpenFrame communicate with the Tibero database using the ODBC API provided by the open-source unixODBC project.

To install ODBC:

1. Verify that the unixODBC-2.3.4.tar.gz installer file is present, or use the `wget unixODBC-2.3.4.tar.gz` command:

```
[oframe7@ofdemo ~]$ wget ftp://ftp.unixodbc.org/pub/unixODBC/unixODBC-
2.3.4.tar.gz
```

2. Unzip the binary:

```
[oframe7@ofdemo ~]$ tar -zxvf unixODBC-2.3.4.tar.gz
```

3. Navigate to unixODBC-2.3.4 directory and generate the Makefile by using the checking machine information:

```
[oframe7@ofdemo unixODBC-2.3.4]$ ./configure --prefix=/opt/tmaxapp/unixODBC/ --
sysconfdir=/opt/tmaxapp/unixODBC/etc
```

> ⓘ **NOTE:** By default, unixODBC is installed in /usr /local. To change the location, add:
>
> `--prefix=/opt/tmaxapp/unixODBC/`
>
> In addition, configuration files are installed in /etc by default. To change the location, add:
>
> `-- sysconfdir=/opt/tmaxapp/unixODBC/etc`

4. Execute Makefile:

```
[oframe7@ofdemo unixODBC-2.3.4]$ make
```

5. Copy the executable file in the program directory after compiling:

```
[oframe7@ofdemo unixODBC-2.3.4]$ make install
```

6. Use vi to edit the bash profile and add the following:

```
[oframe7@ofdemo unixODBC-2.3.4]$ vi ~/.bash_profile

# UNIX ODBC ENV
export ODBC_HOME=$HOME/unixODBC
export PATH=$ODBC_HOME/bin:$PATH
export LD_LIBRARY_PATH=$ODBC_HOME/lib:$LD_LIBRARY_PATH
export ODBCINI=$HOME/unixODBC/etc/odbc.ini
export ODBCSYSINI=$HOME
```

7. Apply the ODBC. Edit the following files accordingly:

```
[oframe7@ofdemo unixODBC-2.3.4]$ source ~/.bash_profile

[oframe7@ofdemo ~]$ cd

[oframe7@ofdemo ~]$ odbcinst -j unixODBC 2.3.4
DRIVERS.............: /home/oframe7/odbcinst.ini
SYSTEM DATA SOURCES: /home/oframe7/odbc.ini
```

```
FILE DATA SOURCES..: /home/oframe7/ODBCDataSources
USER DATA SOURCES..: /home/oframe7/unixODBC/etc/odbc.ini
SQLULEN Size.......: 8
SQLLEN Size........: 8
SQLSETPOSIROW Size.: 8
```

```
[oframe7@ofdemo ~]$ vi odbcinst.ini

[Tibero]
Description = Tibero ODBC driver for Tibero6
Driver = /opt/tmaxdb/tibero6/client/lib/libtbodbc.so
Setup =
FileUsage =
CPTimeout =
CPReuse =
Driver Logging = 7

[ODBC]
Trace = NO
TraceFile = /home/oframe7/odbc.log
ForceTrace = Yes
Pooling = No
DEBUG = 1
```

```
[oframe7@ofdemo ~]$ vi odbc.ini

[TVSAM]
Description = Tibero ODBC driver for Tibero6
Driver = Tibero
DSN = TVSAM
SID = TVSAM
User = tibero
password = tmax
```

8. Create a symbolic link and validate the Tibero database connection:

```
[oframe7@ofdemo ~]$ ln $ODBC_HOME/lib/libodbc.so $ODBC_HOME/lib/libodbc.so.1
[oframe7@ofdemo ~]$ ln $ODBC_HOME/lib/libodbcinst.so
$ODBC_HOME/lib/libodbcinst.so.1

[oframe7@ofdemo lib]$ isql TVSAM tibero tmax
```

Output:

Install OpenFrame Base

The Base application server is installed before the individual services that OpenFrame uses to manage the system on Azure, including the transaction handling server processes.

To install OpenFrame Base:

1. Make sure the Tibero installation succeeded, then verify that the following installer file and configuration file are present:
   - OpenFrame_Base7_0_Linux_x86_64.bin
   - base.properties
2. Update the bash profile with the following Tibero-specific information:

```
alias ofhome='cd $OPENFRAME_HOME'
alias ulog='cd $OPENFRAME_HOME/log/tmax/ulog'
alias sysjcl='cd $OPENFRAME_HOME/volume_default/SYS1.JCLLIB'
alias sysload='cd $OPENFRAME_HOME/volume_default/SYS1.LOADLIB'
alias sysproc='cd $OPENFRAME_HOME/volume_default/SYS1.PROCLIB'
alias oscsrc='cd $OPENFRAME_HOME/osc/oivp'
alias osisrc='cd $OPENFRAME_HOME/osi/oivp'
alias defvol='cd $OPENFRAME_HOME/volume_default'
```

3. Execute the bash profile:

```
[oframe7@ofdemo ~]$ . .bash_profile
```

4. Ensure that the Tibero processes are running:

```
[oframe7@ofdemo ~]$ ps -ef|grep tbsvr
```

   Output:

> ⓘ **IMPORTANT:** Make sure you start Tibero before installation.

5. Generate license at technet.tmaxsoft.com and PUT the OpenFrame Base, Batch, TACF, OSC licenses in the appropriate folder:

```
[oframe7@ofdemo ~]$ cp license.dat /opt/tmaxapp/OpenFrame/core/license/
[oframe7@ofdemo ~]$ cp lictjes.dat lictacf.dat licosc.dat
$OPENFRAME_HOME/license/
```

6. Download the OpenFrame Base binary and base.properties files:

```
[oframe7@ofdemo ~]$ vi base.properties
OPENFRAME_HOME= <appropriate location for installation> ex.
/opt/tmaxapp/OpenFrame TP_HOST_NAME=<your IP Hostname> ex. ofdemo
TP_HOST_IP=<your IP Address> ex. 192.168.96.148
TP_SHMKEY=63481
TP_TPORTNO=6623
TP_UNBLOCK_PORT=6291
TP_NODE_NAME=NODE1
TP_NODE_LIST=NODE1
MASCAT_NAME=SYS1.MASTER.ICFCAT
MASCAT_CREATE=YES
DEFAULT_VOLSER=DEFVOL
VOLADD_DEFINE=YES TSAM_USERNAME=tibero
TSAM_PASSWORD=tmax
TSAM_DATABASE=oframe
DATASET_SHMKEY=63211
DSLOCK_DATA=SYS1.DSLOCK.DATA
DSLOCK_LOG=SYS1.DSLOCK.LOG
DSLOCK_SEQ=dslock_seq.dat
DSLOCK_CREATE=YES
OPENFRAME_LICENSE_PATH=/opt/tmaxapp/license/OPENFRAME
TMAX_LICENSE_PATH=/opt/tmaxapp/license/TMAX
```

7. Execute the installer using the base.properties file:

```
[oframe7@ofdemo ~]$ chmod a+x OpenFrame_Base7_0_Linux_x86_64.bin
[oframe7@ofdemo ~]$ ./OpenFrame_Base7_0_Linux_x86_64.bin -f base.properties
Preparing to install...
Extracting the JRE from the installer archive...
Unpacking the JRE...
Extracting the installation resources from the installer archive...
Configuring the installer for this system's environment...
Launching installer...
Preparing SILENT Mode Installation...
===============================================================================
OpenFrame_Base7_0                (created with InstallAnywhere by Macrovision)
-------------------------------------------------------------------------------


===============================================================================
Installing... ------------
[==================|==================|==================|==================]
[------------------|------------------|------------------|------------------]
Installation Complete.
```

8. After the installation is complete, verify the OpenFrame Base directory structure:

```
[oframe7@ofdemo OpenFrame]$ ls -ltr
total 44

drwxrwxr-x. 4 oframe7 oframe7 61 Nov 30 16:57 UninstallerData
drwxrwxr-x. 2 oframe7 oframe7 4096 Nov 30 16:57 bin
drwxrwxr-x. 2 oframe7 oframe7 4096 Nov 30 16:57 cpm drwxrwxr-x. 2 oframe7
oframe7 4096 Nov 30 16:57 data
drwxrwxr-x. 2 oframe7 oframe7 4096 Nov 30 16:57 include
drwxrwxr-x. 2 oframe7 oframe7 8192 Nov 30 16:57 lib
drwxrwxr-x. 6 oframe7 oframe7 48 Nov 30 16:57 log
drwxrwxr-x. 2 oframe7 oframe7 6 Nov 30 16:57 profile
drwxrwxr-x. 7 oframe7 oframe7 62 Nov 30 16:57 sample
drwxrwxr-x. 2 oframe7 oframe7 6 Nov 30 16:57 schema
drwxrwxr-x. 2 oframe7 oframe7 6 Nov 30 16:57 temp
drwxrwxr-x. 3 oframe7 oframe7 16 Nov 30 16:57 shared
drwxrwxr-x. 2 oframe7 oframe7 4096 Nov 30 16:58 license
drwxrwxr-x. 23 oframe7 oframe7 4096 Nov 30 16:58 core
drwxrwxr-x. 2 oframe7 oframe7 4096 Nov 30 16:58 config
drwxrwxr-x. 2 oframe7 oframe7 4096 Nov 30 16:58 scripts
drwxrwxr-x. 2 oframe7 oframe7 25 Nov 30 16:58 volume_default
```

9. Start OpenFrame Base:

```
[oframe7@ofdemo ~]$ cp /usr/lib/libtermcap.so.2 $TMAXDIR/lib
Startup Tmax Server
[oframe7@ofdemo ~]$ tmboot
```

```
[oframe7@oframe ~]$ tmboot

TMBOOT for node(NODE1) is starting:
Welcome to Tmax demo system: it will expire 2017/1/29
Today: 2016/11/29
        TMBOOT: TMM is starting: Tue Nov 29 11:26:44 2016
        TMBOOT: CLL is starting: Tue Nov 29 11:26:44 2016
        TMBOOT: CLH is starting: Tue Nov 29 11:26:44 2016
        TMBOOT: TLM(tlm) is starting: Tue Nov 29 11:26:44 2016
        TMBOOT: SVR(ofrsasvr) is starting: Tue Nov 29 11:26:44 2016
        TMBOOT: SVR(ofrlhsvr) is starting: Tue Nov 29 11:26:44 2016
        TMBOOT: SVR(ofrdmsvr) is starting: Tue Nov 29 11:26:44 2016
        TMBOOT: SVR(ofrdsedt) is starting: Tue Nov 29 11:26:44 2016
        TMBOOT: SVR(ofrcmsvr) is starting: Tue Nov 29 11:26:44 2016
        TMBOOT: SVR(ofruisvr) is starting: Tue Nov 29 11:26:44 2016
        TMBOOT: SVR(ofrsmlog) is starting: Tue Nov 29 11:26:44 2016
        TMBOOT: SVR(vtammgr) is starting: Tue Nov 29 11:26:44 2016
[oframe7@oframe ~]$
```

10. Verify the process status is ready using the `tmadmin` command in si. RDY is displayed in the **status** column for each of the processes:

```
[oframe7@ofdemo ~]$ tmadmin
[oframe7@oframe ~]$ tmadmin
--- Welcome to Tmax Admin (Type "quit" to leave) ---

$$1 NODE1 (tmadm): si
-------------------------------------------------------------------------------
  clh    svrname     (svri)    status      count    qcount    qpcount  emcount
-------------------------------------------------------------------------------
    0    ofrsasvr    (   4)       RDY          0         0          0        0
    0    ofrlhsvr    (   5)       RDY          0         0          0        0
    0    ofrdmsvr    (   6)       RDY          0         0          0        0
    0    ofrdsedt    (   7)       RDY          0         0          0        0
    0    ofrcmsvr    (   8)       RDY          0         0          0        0
    0    ofruisvr    (   9)       RDY          0         0          0        0
    0    ofrsmlog    (  10)       RDY          0         0          0        0
    0    vtammgr     (  11)       RDY          0         0          0        0
```

11. Shut down OpenFrame Base:

```
[oframe7@ofdemo ~]$ tmdown
Do you really want to down whole Tmax? (y : n): y

TMDOWN for node(NODE1) is starting:
TMDOWN: SERVER(ofrsasvr:36) downed: Wed Sep  7 15:37:21 2016
TMDOWN: SERVER(ofrdsedt:39) downed: Wed Sep  7 15:37:21 2016
TMDOWN: SERVER(vtammgr:43) downed: Wed Sep  7 15:37:21 2016
TMDOWN: SERVER(ofrcmsvr:40) downed: Wed Sep  7 15:37:21 2016
TMDOWN: SERVER(ofrdmsvr:38) downed: Wed Sep  7 15:37:21 2016
TMDOWN: SERVER(ofrlhsvr:37) downed: Wed Sep  7 15:37:21 2016
TMDOWN: SERVER(ofruisvr:41) downed: Wed Sep  7 15:37:21 2016
TMDOWN: SERVER(ofrsmlog:42) downed: Wed Sep  7 15:37:21 2016
TMDOWN: CLH downed: Wed Sep  7 15:37:21 2016
TMDOWN: CLL downed: Wed Sep  7 15:37:21 2016
TMDOWN: TLM downed: Wed Sep  7 15:37:21 2016
TMDOWN: TMM downed: Wed Sep  7 15:37:21 2016
TMDOWN: TMAX is down
```

Install OpenFrame Batch

OpenFrame Batch consists of several components that simulate mainframe batch environments and is used to run batch jobs on Azure.

To install Batch:

1. Make sure the base installation succeeded, then verify that the following installer file and configuration file are present:
   - OpenFrame_Batch7_0_Fix2_MVS_Linux_x86_64.bin
   - batch.properties
2. Edit the batch.properties file using vi:

```
[oframe7@ofdemo ~]$ vi batch.properties
```

3. Modify the parameters as follows:

```
OPENFRAME_HOME = /opt/tmaxapp/OpenFrame
DEFAULT_VOLSER=DEFVOL
TP_NODE_NAME=NODE1
TP_NODE_LIST=NODE1
RESOURCE_SHMKEY=66991
#JOBQ_DATASET_CREATE=YES
#OUTPUTQ_DATASET_CREATE=YES
DEFAULT_JCLLIB_CREATE=YES
DEFAULT_PROCLIB_CREATE=YES
DEFAULT_USERLIB_CREATE=YES
TJES_USERNAME=tibero
TJES_PASSWORD=tmax
TJES_DATABASE=oframe
BATCH_TABLE_CREATE=YES
```

4. Execute the batch installer:

```
[oframe7@ofdemo ~]$ ./OpenFrame_Batch7_0_Fix2_MVS_Linux_x86_64.bin -f
batch.properties

Preparing to install...
Extracting the JRE from the installer archive...
Unpacking the JRE...
Extracting the installation resources from the installer archive...
Configuring the installer for this system's environment...

Launching installer...

Preparing SILENT Mode Installation...
===============================================================================
OpenFrame_Batch7_0_Fix2_MVS       (created with InstallAnywhere by Macrovision)
-------------------------------------------------------------------------------

===============================================================================
Installing...
[==================|==================|==================|==================]
Installation Complete
```

5. Start the installed OpenFrame suites:

```
[oframe7@ofdemo ~]$ tmboot
```

```
TMBOOT for node(NODE1) is starting:
Welcome to Tmax demo system: it will expire 2017/1/29
Today: 2016/11/29
        TMBOOT: TMM is starting: Tue Nov 29 11:39:39 2016
        TMBOOT: CLL is starting: Tue Nov 29 11:39:39 2016
        TMBOOT: CLH is starting: Tue Nov 29 11:39:39 2016
        TMBOOT: TLM(tlm) is starting: Tue Nov 29 11:39:39 2016
        TMBOOT: SVR(ofrsasvr) is starting: Tue Nov 29 11:39:39 2016
        TMBOOT: SVR(ofrlhsvr) is starting: Tue Nov 29 11:39:39 2016
        TMBOOT: SVR(ofrdmsvr) is starting: Tue Nov 29 11:39:39 2016
        TMBOOT: SVR(ofrdsedt) is starting: Tue Nov 29 11:39:39 2016
        TMBOOT: SVR(ofrcmsvr) is starting: Tue Nov 29 11:39:39 2016
        TMBOOT: SVR(ofruisvr) is starting: Tue Nov 29 11:39:39 2016
        TMBOOT: SVR(ofrsmlog) is starting: Tue Nov 29 11:39:39 2016
        TMBOOT: SVR(vtammgr) is starting: Tue Nov 29 11:39:39 2016
        TMBOOT: SVR(obmjmsvr) is starting: Tue Nov 29 11:39:39 2016
        TMBOOT: SVR(obmjmsvr) is starting: Tue Nov 29 11:39:39 2016
        TMBOOT: SVR(obmjmsvr) is starting: Tue Nov 29 11:39:39 2016
        TMBOOT: SVR(obmjmsvr) is starting: Tue Nov 29 11:39:39 2016
        TMBOOT: SVR(obmjmsvr) is starting: Tue Nov 29 11:39:39 2016
        TMBOOT: SVR(obmjmsvr) is starting: Tue Nov 29 11:39:39 2016
        TMBOOT: SVR(obmjmsvr) is starting: Tue Nov 29 11:39:39 2016
        TMBOOT: SVR(obmjmsvr) is starting: Tue Nov 29 11:39:39 2016
        TMBOOT: SVR(obmjmsvr) is starting: Tue Nov 29 11:39:39 2016
        TMBOOT: SVR(obmjmsvr) is starting: Tue Nov 29 11:39:39 2016
        TMBOOT: SVR(obmjschd) is starting: Tue Nov 29 11:39:39 2016
        TMBOOT: SVR(obmjinit) is starting: Tue Nov 29 11:39:39 2016
        TMBOOT: SVR(obmjhist) is starting: Tue Nov 29 11:39:39 2016
        TMBOOT: SVR(obmjspbk) is starting: Tue Nov 29 11:39:39 2016
        TMBOOT: SVR(ofrpmsvr) is starting: Tue Nov 29 11:39:39 2016
        TMBOOT: SVR(obmtsmgr) is starting: Tue Nov 29 11:39:39 2016
```

6. Check the OpenFrame process:

```
[oframe7@ofdemo ~]$ tmadmin
```

```
[oframe7@oframe ~]$ tmadmin
--- Welcome to Tmax Admin (Type "quit" to leave) ---

$$1 NODE1 (tmadm): si
------------------------------------------------------------------------
  clh   svrname    (svri)   status     count   qcount   qpcount  emcount
------------------------------------------------------------------------
    0   ofrsasvr   (    4)     RDY         0        0         0        0
    0   ofrlhsvr   (    5)     RDY         0        0         0        0
    0   ofrdmsvr   (    6)     RDY         0        0         0        0
    0   ofrdsedt   (    7)     RDY         0        0         0        0
    0   ofrcmsvr   (    8)     RDY         0        0         0        0
    0   ofruisvr   (    9)     RDY         0        0         0        0
    0   ofrsmlog   (   10)     RDY         0        0         0        0
    0   vtammgr    (   11)     RDY         0        0         0        0
    0   obmjmsvr   (   12)     RDY         0        0         0        0
    0   obmjschd   (   13)     RDY         1        0         0        0
    0   obmjinit   (   14)     RDY         2        0         0        0
    0   obmjhist   (   15)     RDY         0        0         0        0
    0   obmjspbk   (   16)     RDY         0        0         0        0
    0   ofrpmsvr   (   17)     RDY         0        0         0        0
    0   obmtsmgr   (   18)     RDY         0        0         0        0

$$2 NODE1 (tmadm):
```

7. Execute the following commands:

```
$$2 NODE1 (tmadm): quit
ADM quit for node (NODE1)
```

8. Start up and shut down Batch:

```
[oframe7@ofdemo ~]$tmdown
Do you really want to down whole Tmax? (y : n): y

TMDOWN for node(NODE1) is starting:
TMDOWN: SERVER(ofrsasvr:36) downed: Wed Sep  7 16:01:46 2016
TMDOWN: SERVER(obmjmsvr:44) downed: Wed Sep  7 16:01:46 2016 TMDOWN:
SERVER(vtammgr:43) downed: Wed Sep  7 16:01:46 2016
TMDOWN: SERVER(ofrcmsvr:40) downed: Wed Sep  7 16:01:46 2016
TMDOWN: SERVER(obmjmsvr:45) downed: Wed Sep  7 16:01:46 2016
TMDOWN: SERVER(obmjmsvr:46) downed: Wed Sep  7 16:01:46 2016
TMDOWN: SERVER(ofrdmsvr:38) downed: Wed Sep  7 16:01:46 2016
TMDOWN: SERVER(obmjmsvr:47) downed: Wed Sep  7 16:01:46 2016
TMDOWN: SERVER(ofrdsedt:39) downed: Wed Sep  7 16:01:46 2016
TMDOWN: SERVER(obmjschd:54) downed: Wed Sep  7 16:01:46 2016
TMDOWN: SERVER(obmjinit:55) downed: Wed Sep  7 16:01:46 2016
TMDOWN: SERVER(obmjmsvr:48) downed: Wed Sep  7 16:01:46 2016
TMDOWN: SERVER(obmjspbk:57) downed: Wed Sep  7 16:01:46 2016
TMDOWN: SERVER(obmjmsvr:49) downed: Wed Sep  7 16:01:46 2016
TMDOWN: SERVER(obmjmsvr:50) downed: Wed Sep  7 16:01:46 2016
TMDOWN: SERVER(obmjmsvr:51) downed: Wed Sep  7 16:01:46 2016
TMDOWN: SERVER(ofrlhsvr:37) downed: Wed Sep  7 16:01:46 2016
TMDOWN: SERVER(obmjmsvr:52) downed: Wed Sep  7 16:01:46 2016
TMDOWN: SERVER(obmjmsvr:53) downed: Wed Sep  7 16:01:46 2016
TMDOWN: SERVER(obmjhist:56) downed: Wed Sep  7 16:01:46 2016
TMDOWN: SERVER(ofruisvr:41) downed: Wed Sep  7 16:01:46 2016
TMDOWN: SERVER(obmtsmgr:59) downed: Wed Sep  7 16:01:46 2016
TMDOWN: SERVER(ofrpmsvr:58) downed: Wed Sep  7 16:01:46 2016
TMDOWN: SERVER(ofrsmlog:42) downed: Wed Sep  7 16:01:46 2016
TMDOWN: CLL downed: Wed Sep  7 16:01:46 2016
TMDOWN: TLM downed: Wed Sep  7 16:01:46 2016
TMDOWN: CLH downed: Wed Sep  7 16:01:46 2016
TMDOWN: TMM downed: Wed Sep  7 16:01:46 2016
TMDOWN: TMAX is down
```

Install TACF

TACF Manager is an OpenFrame service module that controls user access to systems and resources through RACF security.

To install TACF:

1. Verify that the following installer and configuration files are present:
   - OpenFrame_Tacf7_0_Fix2_Linux_x86_64.bin
   - tacf.properties

2. Make sure the Batch installation succeeded, then use vi to open the tacf.properties file:

```
[oframe7@ofdemo ~]$ vi tacf.properties
```

3. Modify the TACF parameters:

```
OPENFRAME_HOME=/opt/tmaxapp/OpenFrame
USE_OS_AUTH=NO
TACF_USERNAME=tibero
TACF_PASSWORD=tmax
TACF_DATABASE=oframe
TACF_TABLESPACE=TACF00
TACF_TABLE_CREATE=YES
```

4. After completing tacf installer, apply the tacf environment variables:

```
[oframe7@ofdemo ~]$ source ~/.bash_profile
```

5. Execute the TACF installer:

```
[oframe7@ofdemo ~]$ ./OpenFrame_Tacf7_0_Fix2_Linux_x86_64.bin -f
tacf.properties
```

Output:

```
Wed Dec 07 17:36:42 EDT 2016
Free Memory: 18703 kB
Total Memory: 28800 kB

4 Command Line Args:
0:  -f 1:  tacf.properties
2:  -m
3:  SILENT
java.class.path:
/tmp/install.dir.41422/InstallerData
/tmp/install.dir.41422/InstallerData/installer.zip
ZGUtil.CLASS_PATH:
/tmp/install.dir.41422/InstallerData
tmp/install.dir.41422/InstallerData/installer.zip
sun.boot.class.path:
/tmp/install.dir.41422/Linux/resource/jre/lib/resources.jar
/tmp/install.dir.41422/Linux/resource/jre/lib/rt.jar
/tmp/install.dir.41422/Linux/resource/jre/lib/sunrsasign.jar
/tmp/install.dir.41422/Linux/resource/jre/lib/jsse.jar
/tmp/install.dir.41422/Linux/resource/jre/lib/jce.jar
/tmp/install.dir.41422/Linux/resource/jre/lib/charsets.jar
/tmp/install.dir.41422/Linux/resource/jre/lib/jfr.jar
/tmp/install.dir.41422/Linux/resource/jre/classes
```

6. Restart OpenFrame:

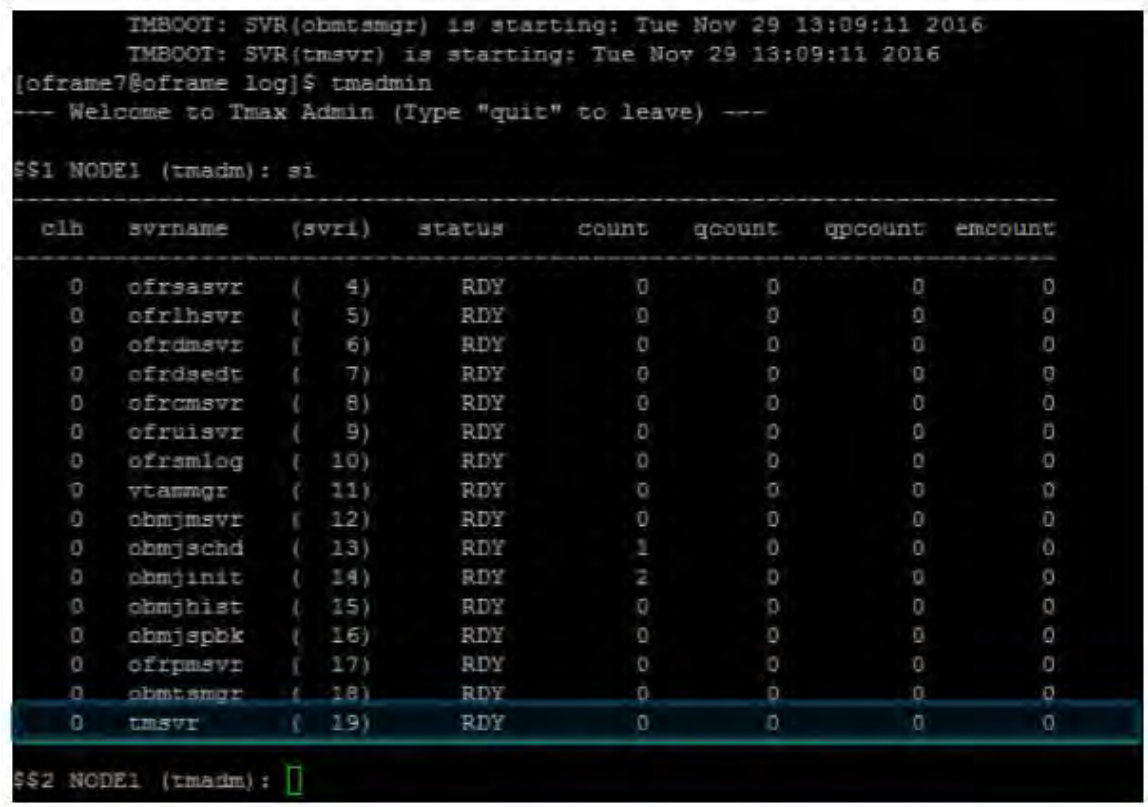
```
[oframe7@ofdemo ~]$ tmboot

TMBOOT for node(NODE1) is starting:
Welcome to Tmax demo system: it will expire 2016/11/4
Today: 2016/9/7
TMBOOT: TMM is starting: Wed Sep  7 17:48:53 2016
```

```
TMBOOT: CLL is starting: Wed Sep  7 17:48:53 2016
TMBOOT: CLH is starting: Wed Sep  7 17:48:53 2016
TMBOOT: TLM(tlm) is starting: Wed Sep  7 17:48:53 2016
TMBOOT: SVR(ofrsasvr) is starting: Wed Sep  7 17:48:53 2016
TMBOOT: SVR(ofrlhsvr) is starting: Wed Sep  7 17:48:53 2016
TMBOOT: SVR(ofrdmsvr) is starting: Wed Sep  7 17:48:53 2016
TMBOOT: SVR(ofrdsedt) is starting: Wed Sep  7 17:48:53 2016
TMBOOT: SVR(ofrcmsvr) is starting: Wed Sep  7 17:48:53 2016
TMBOOT: SVR(ofruisvr) is starting: Wed Sep  7 17:48:53 2016
TMBOOT: SVR(ofrsmlog) is starting: Wed Sep  7 17:48:53 2016
TMBOOT: SVR(vtammgr) is starting: Wed Sep  7 17:48:53 2016
TMBOOT: SVR(obmjmsvr) is starting: Wed Sep  7 17:48:53 2016
TMBOOT: SVR(obmjmsvr) is starting: Wed Sep  7 17:48:53 2016
TMBOOT: SVR(obmjmsvr) is starting: Wed Sep  7 17:48:53 2016
TMBOOT: SVR(obmjmsvr) is starting: Wed Sep  7 17:48:53 2016
TMBOOT: SVR(obmjmsvr) is starting: Wed Sep  7 17:48:53 2016
TMBOOT: SVR(obmjmsvr) is starting: Wed Sep  7 17:48:53 2016
TMBOOT: SVR(obmjmsvr) is starting: Wed Sep  7 17:48:53 2016
TMBOOT: SVR(obmjmsvr) is starting: Wed Sep  7 17:48:53 2016
TMBOOT: SVR(obmjmsvr) is starting: Wed Sep  7 17:48:53 2016
TMBOOT: SVR(obmjmsvr) is starting: Wed Sep  7 17:48:53 2016
TMBOOT: SVR(obmjschd) is starting: Wed Sep  7 17:48:53 2016
TMBOOT: SVR(obmjinit) is starting: Wed Sep  7 17:48:53 2016
TMBOOT: SVR(obmjhist) is starting: Wed Sep  7 17:48:53 2016
TMBOOT: SVR(obmjspbk) is starting: Wed Sep  7 17:48:53 2016
TMBOOT: SVR(ofrpmsvr) is starting: Wed Sep  7 17:48:53 2016
TMBOOT: SVR(obmtsmgr) is starting: Wed Sep  7 17:48:53 2016
TMBOOT: SVR(tmsvr) is starting: Wed Sep  7 17:48:53 2016
```

7. Verify that the process status is ready using `tmadmin` in the `si` command:

```
[oframe7@ofdemo ~]$ tmadmin
```

In the **status** column, RDY appears:



8. Initiate the following commands:

```
$$2 NODE1 (tmadm): quit
DM quit for node (NODE1)

[oframe7@ofdemo ~]$ tacfmgr
Input USERNAME  : ROOT
Input PASSWORD  : SYS1

TACFMGR: TACF MANAGER START!!!

QUIT TACFMGR: TACF MANAGER END!!!

[oframe7@ofdemo ~]$ tmdow
```

9. Shut the server down using the `tmdown` command:

```
[oframe7@ofdemo ~]$ tmdown
Do you really want to down whole Tmax? (y : n): y

TMDOWN for node(NODE1) is starting:
TMDOWN: SERVER(ofrlhsvr:37) downed: Wed Sep  7 17:50:50 2016
TMDOWN: SERVER(ofrdsedt:39) downed: Wed Sep  7 17:50:50 2016
TMDOWN: SERVER(obmjschd:54) downed: Wed Sep  7 17:50:50 2016
TMDOWN: SERVER(obmjmsvr:47) downed: Wed Sep  7 17:50:50 2016
TMDOWN: SERVER(obmjmsvr:48) downed: Wed Sep  7 17:50:50 2016
TMDOWN: SERVER(ofrdmsvr:38) downed: Wed Sep  7 17:50:50 2016
TMDOWN: SERVER(obmjmsvr:50) downed: Wed Sep  7 17:50:50 2016
```

```
TMDOWN: SERVER(obmjhist:56) downed: Wed Sep  7 17:50:50 2016
TMDOWN: SERVER(ofrsasvr:36) downed: Wed Sep  7 17:50:50 2016
TMDOWN: SERVER(ofrcmsvr:40) downed: Wed Sep  7 17:50:50 2016
TMDOWN: SERVER(obmjspbk:57) downed: Wed Sep  7 17:50:50 2016
TMDOWN: SERVER(tmsvr:60) downed: Wed Sep  7 17:50:50 2016
TMDOWN: SERVER(ofrpmsvr:58) downed: Wed Sep  7 17:50:50 2016
TMDOWN: SERVER(obmtsmgr:59) downed: Wed Sep  7 17:50:50 2016
TMDOWN: CLL downed: Wed Sep  7 17:50:50 2016
TMDOWN: CLH downed: Wed Sep  7 17:50:50 2016
TMDOWN: TLM downed: Wed Sep  7 17:50:50 2016
TMDOWN: TMM downed: Wed Sep  7 17:50:50 2016
TMDOWN: TMAX is down
```

Install ProSort

ProSort is a utility used in batch transactions for sorting data.

To install ProSort:

1. Make sure the Batch installation was successful, and then verify that the prosort-bin-prosort_2sp3-linux64-2123-opt.tar.gz installer file is present.
2. Execute the installer using the properties file:

```
oframe@oframe7: tar -zxvf prosort-bin-prosort_2sp3-linux64-2123-opt.tar.gz
```

3. Move the prosort directory to the home location:

```
oframe@oframe7: mv prosort /opt/tmaxapp/prosort
```

4. Copy the license file:

```
oframe@oframe7: cd /opt/tmaxapp/prosort
oframe@oframe7: mkdir license oframe@oframe7: cp
/opt/tmaxsw/oflicense/prosort/license.xml /opt/tmaxapp/prosort/license
```

5. Update the bash profile:

```
oframe@oframe7: vi .bash_profile

#       PROSORT

PROSORT_HOME=/opt/tmaxapp/prosort
PROSORT_SID=gbg
PATH=$PATH:$PROSORT_HOME/bin LD_LIBRARY_PATH=$PROSORT_HOME/lib:$LD_LIBRARY_PATH
LIBPATH$PROSORT_HOME/lib:$LIBPATH
export PROSORT_HOME PROSORT_SID
PATH LD_LIBRARY_PATH LIBPATH
PATH=$PATH:$OPENFRAME_HOME/shbin
export PATH
```

6. Execute the bash profile:

```
oframe@oframe7: . .bash_profile
```

7. Create the configuration file:

```
oframe@oframe7: cd /opt/tmaxapp/prosort/config
oframe@oframe7: ./gen_tip.sh
Using PROSORT_SID "gbg"
 /home/oframe7/prosort/config/gbg.tip generated
```

8. Create the symbolic link:

```
oframe@oframe7: cd /opt/tmaxapp/OpenFrame/util/
oframe@oframe7home/oframe7/OpenFrame/util :  ln -s DFSORT SORT
```

9. Verify the ProSort installation by executing the following command:

```
oframe@oframe7: prosort -h

Usage: prosort [options] [sort script files]
options ------
       -h             Display this information
       -v             Display version information
       -s             Display state information
       -j             Display profile information
       -x             Use SyncSort compatible mode
```

Install OFCOBOL

OFCOBOL is the OpenFrame compiler that interprets the mainframe's COBOL programs. To install OFCOBOL:

1. Make sure that the Batch/Online installation succeeded, then verify that the OpenFrame_COBOL3_0_40_Linux_x86_64.bin installer file is present.
2. Execute the OFCOBOL installer:

```
[oframe7@ofdemo ~]$ ./OpenFrame_COBOL3_0_40_Linux_x86_64.bin
```

3. Read the licensing agreement and press Enter to continue.
4. Accept the licensing agreement. When the installation is complete, the following appears:

```
Choose Install Folder
---------------------
Where would you like to install?
Default Install Folder: /home/oframe7/OFCOBOL

ENTER AN ABSOLUTE PATH, OR PRESS <ENTER> TO ACCEPT THE DEFAULT :
/opt/tmaxapp/OFCOBOL

INSTALL FOLDER IS: /opt/tmaxapp/OFCOBOL
IS THIS CORRECT? (Y/N): Y[oframe7@ofdemo ~]$ vi .bash_profile

===============================================================================
Installing...
-------------
[==================|==================|==================|==================]
[------------------|------------------|------------------|------------------]
```

```
================================================================================
Installation Complete
--------------------
Congratulations. OpenFrame_COBOL has been successfully installed
PRESS <ENTER> TO EXIT THE INSTALLER
```

5. Verify the bash profile is updated with OFCOBOL variables:

```
[oframe7@ofdemo ~]$ vi .bash_profile
```

6. Execute the bash profile:

```
[oframe7@ofdemo ~]$ source ~/.bash_profile
```

7. Copy the OFCOBOL license to the installed folder:

```
[oframe7@ofdemo ~]$ mv licofcob.dat $OFCOB_HOME/license
```

8. Edit the OpenFrame tjclrun.conf configuration file:

```
[oframe7@ofdemo ~]$ cd $OPENFRAME_HOME/config
[oframe7@ofdemo ~]$ vi tjclrun.conf
```

Before change

```
[SYSLIB]
BIN_PATH=${OPENFRAME_HOME}/bin:${OPENFRAME_HOME}/util:${COBDIR}/bin:/usr/local/
bin:/bin
LIB_PATH=${OPENFRAME_HOME}/lib:${OPENFRAME_HOME}/core/lib:${TB_HOME}/client/lib
:${COBDIR}/lib:/
usr/lib:/lib:/lib/i686:/usr/local/lib:${PROSORT_HOME}/lib:/opt/FSUNbsort/lib
```

After change

```
[SYSLIB]
BIN_PATH=${OPENFRAME_HOME}/bin:${OPENFRAME_HOME}/util:${COBDIR}/bin:/usr/local/
bin:/bin
LIB_PATH=${OPENFRAME_HOME}/lib:${OPENFRAME_HOME}/core/lib:${TB_HOME}/client/lib
:${COBDIR}/lib:/
usr/lib:/lib:/lib/i686:/usr/local/lib:${PROSORT_HOME}/lib:/opt/FSUNbsort/lib
:${ODBC_HOME}/lib
:${OFCOB_HOME}/lib
```

9. Review the OpenFrame_COBOL_InstallLog.log file and verify that there are no errors:

```
[oframe7@ofdemo ~]$ vi
$OFCOB_HOME/UninstallerData/log/OpenFrame_COBOL_InstallLog.log
……..
Summary
------
Installation: Successful.
131 Successes
0 Warnings
0 NonFatalErrors
0 FatalError
```

10. Review the version number to verify the installation:

```
[oframe7@ofdemo ~]$ ofcob --version
OpenFrame COBOL Compiler 3.0.54
CommitTag:: 645f3f6bf7fbe1c366a6557c55b96c48454f4bf
```

11. Reboot OpenFrame by issuing the following command:

```
tmdown/tmboot
```

Install OFASM

OFASM is the OpenFrame compiler that interprets the mainframe's assembler programs.

To install OFASM:

1. Make sure that the Batch/Online installation succeeded, then verify that the OpenFrame_ASM3_0_Linux_x86_64.bin installer file is present.
2. Execute the installer:

```
[oframe7@ofdemo ~]$ ./OpenFrame_ASM3_0_Linux_x86_64.bin
```

3. Read the licensing agreement and press Enter to continue.
4. Accept the licensing agreement.
5. Verify the bash profile is updated with OFASM variables:

```
[oframe7@ofdemo ~]$ source .bash_profile
[oframe7@ofdemo ~]$ ofasm --version
# TmaxSoft OpenFrameAssembler v3 r328
(3ff35168d34f6e2046b96415bbe374160fcb3a34)

[oframe7@ofdemo OFASM]$ vi .bash_profile

# OFASM ENV
export OFASM_HOME=/opt/tmaxapp/OFASM
export OFASM_MACLIB=$OFASM_HOME/maclib/free_macro
export PATH="${PATH}:$OFASM_HOME/bin:"
export LD_LIBRARY_PATH="./:$OFASM_HOME/lib:$LD_LIBRARY_PATH"
```

6. Edit the OpenFrame tjclrun.conf configuration file:

```
[oframe7@ofdemo ~]$ cd $OPENFRAME_HOME/config
[oframe7@ofdemo ~]$ vi tjclrun.conf
```

Before change

```
[SYSLIB]
BIN_PATH=${OPENFRAME_HOME}/bin:${OPENFRAME_HOME}/util:${COBDIR}/bin:/usr/local/
bin:/bi n:${OPENFRAME_HOME}/volume_default/SYS1.LOADLIB
LIB_PATH=${OPENFRAME_HOME}/lib:${OPENFRAME_HOME}/core/lib:${TB_HOME}/client/lib
:${CO
BDIR}/lib:/usr/lib:/lib:/lib/i686:/usr/local/lib:${PROSORT_HOME}/lib:/opt/FSUNb
sort/lib:${OFCOB_HOM E}/lib:${ODBC_HOME}/lib:${OFPLI_HOME}/lib
```

After change

```
[SYSLIB] [SYSLIB]
BIN_PATH=${OPENFRAME_HOME}/bin:${OPENFRAME_HOME}/util:${COBDIR}/bin:/usr/local/
bin:/bi n:${OPENFRAME_HOME}/volume_default/SYS1.LOADLIB
LIB_PATH=${OPENFRAME_HOME}/lib:${OPENFRAME_HOME}/core/lib:${TB_HOME}/client/lib
:${CO
BDIR}/lib:/usr/lib:/lib:/lib/i686:/usr/local/lib:${PROSORT_HOME}/lib:/opt/FSUNb
sort/lib:${OFCOB_HOM
E}/lib:${ODBC_HOME}/lib:${OFPLI_HOME}/lib:${OFASM_HOME}/lib
```

7. Review the OpenFrame_ASM_InstallLog.log file and verify that there are no errors:

```
[oframe7@ofdemo ~]$ vi
$OFASM_HOME/UninstallerData/log/OpenFrame_ASM_InstallLog.log
……..
Summary
------

Installation: Successful.

55 Successes
0 Warnings
0 NonFatalErrors
0 FatalErrors
```

8. Reboot OpenFrame by issuing one of the following commands:

```
tmdown / tmboot
```

—or—

```
oscdown / oscboot
```

Install OSC

OSC is the OpenFrame environment similar to IBM CICS that supports high-speed OLTP transactions and other management functions.

To install OSC:

1. Make sure the base installation succeeded, then verify that the following installer and configuration files are present:
   - OpenFrame_OSC7_0_Fix2_Linux_x86_64.bin
   - osc.properties
2. Edit the following parameters in the osc.properties file:

```
OPENFRAME_HOME=/opt/tmaxapp/OpenFrame
OSC_SYS_OSC_NCS_PATH=/opt/tmaxapp/OpenFrame/temp/OSC_NCS
OSC_APP_OSC_TC_PATH=/opt/tmaxapp/OpenFrame/temp/OSC_TC
```

3. Execute the installer using the properties file:

```
[oframe7@ofdemo ~]$ chmod a+x OpenFrame_OSC7_0_Fix2_Linux_x86_64.bin
[oframe7@ofdemo ~]$ ./OpenFrame_OSC7_0_Fix2_Linux_x86_64.bin -f osc.properties
```

```
Preparing to install...
Extracting the JRE from the installer archive...
Unpacking the JRE...
Extracting the installation resources from the installer archive...
Configuring the installer for this system's environment...

Launching installer... Verification – Review
OpenFrame_OSC7_0_Fix2_InstallLog.log file
Preparing SILENT Mode Installation...
===============================================================================
OpenFrame_OSC7_0_Fix2             (created with InstallAnywhere by Macrovision)
-------------------------------------------------------------------------------
===============================================================================
Installing...
------------
[==================|==================|==================|==================]
[------------------|------------------|------------------|------------------]
Installation Complet
```

4. Verify that the bash profile is updated with OSC variables.
5. Review the OpenFrame_OSC7_0_Fix2_InstallLog.log file:

```
Summary
------
Installation: Successful.

233 Successes
0 Warnings
0 NonFatalErrors
0 FatalError
```

6. Edit the ofsys.seq configuration file:

```
[oframe7@ofdemo ~]$ vi $OPENFRAME_HOME/config/ofsys.seq

Before changes
#BASE
ofrsasvr
ofrlhsvr
ofrdmsvr
ofrdsedt
ofrcmsvr
ofruisvr
ofrsmlog
vtammgr
TPFMAGENT

#BATCH
#BATCH#obmtsmgr
#BATCH#ofrpmsvr
#BATCH#obmjmsvr
#BATCH#obmjschd
#BATCH#obmjinit
```

```
#BATCH#obmjhist
#BATCH#obmjspbk
#TACF #TACF#tmsvr

After changes    #BATCH
#BASE            obmtsmgr
ofrsasvr         ofrpmsvr
ofrlhsvr         obmjmsvr
ofrdmsvr         obmjschd
ofrdsedt         obmjinit
ofrcmsvr         obmjhist
ofruisvr         obmjspbk
ofrsmlog
vtammgr          #TACF
TPFMAGENT        tmsvr
```

7. Copy the license file:

```
[oframe7@ofdemo ~]$ cp /home/oframe7/oflicense/ofonline/licosc.dat

$OPENFRAME_HOME/license

[oframe7@ofdemo ~]$ cd $OPENFRAME_HOME/license
oframe@oframe7/OpenFrame/license / ls -l
-rwxr-xr-x. 1 oframe mqm 80 Sep 12 01:37 licosc.dat
-rwxr-xr-x. 1 oframe mqm 80 Sep  8 09:40 lictacf.dat
-rwxrwxr-x. 1 oframe mqm 80 Sep  3 11:54 lictjes.da
```

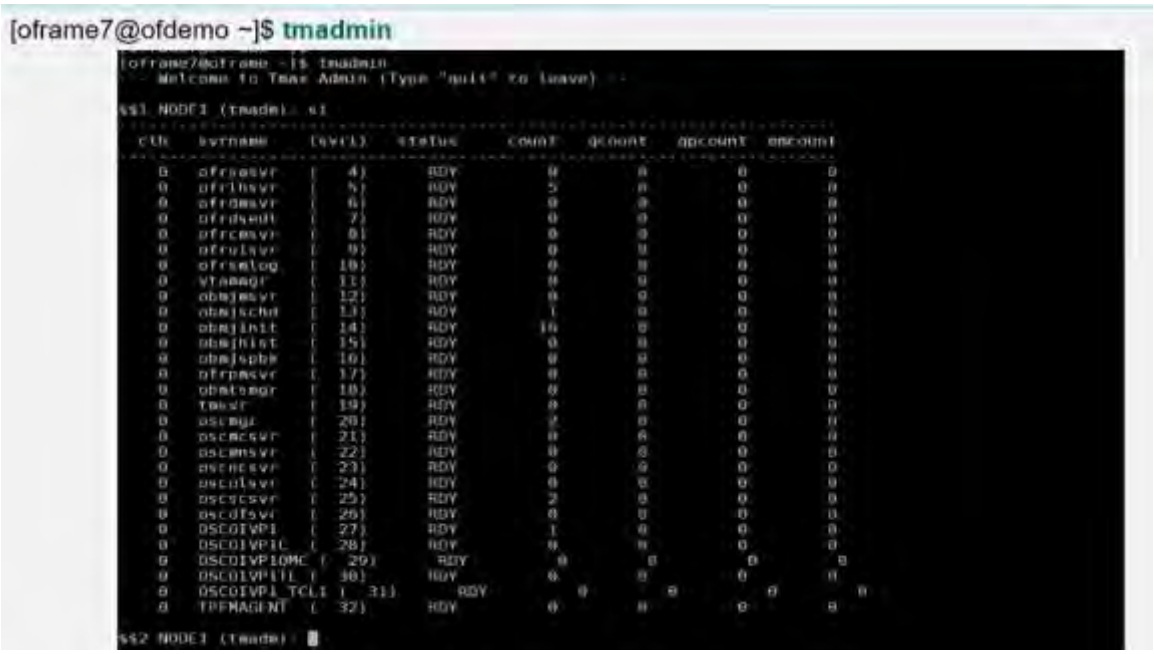
8. To start up and shut down OSC, initialize the CICS region shared memory:

```
 [oframe7@ofdemo ~]$ osctdlinit OSCOIVP1
(I) TDLUTIL0046 TDLDIR initialization complete [TDL0331]
```

9. Run `oscboot` to boot up OSC:

```
[oframe7@ofdemo ~]$ oscboot
OSCBOOT : pre-processing                                          [ OK ]

TMBOOT for node(NODE1) is starting:
Welcome to Tmax demo system: it will expire 2016/11/4
Today: 2016/9/12
       TMBOOT: TMM is starting: Mon Sep 12 01:40:25 2016
       TMBOOT: CLL is starting: Mon Sep 12 01:40:25 2016
       TMBOOT: CLH is starting: Mon Sep 12 01:40:25 2016
       TMBOOT: TLM(tlm) is starting: Mon Sep 12 01:40:25 2016
|
```

10. To verify that the process status is ready, use the `tmadmin` command in si. All the processes should display RDY in the **status** column:



11. Shut OSC down using the `oscdown` command:

```
[oframe7@ofdemo ~]$ oscdown
```

Install JEUS

JEUS (Java Enterprise User Solution) provides the presentation layer of the OpenFrame web application server.

Before installing JEUS, install the Apache Ant package, which provides the libraries and command-line tools needed to install JEUS.

To install Apache Ant:

1. Download Ant binary using the following command:

```
[oframe7@ofdemo ~]$ wget
http://apache.mirror.cdnetworks.com/ant/binaries/apacheant-1.9.7-bin.tar.gz

--2016-09-12 02:50:24--
http://apache.mirror.cdnetworks.com/ant/binaries/apache-ant-1.9.7-bin.tar.gz
Resolving apache.mirror.cdnetworks.com (apache.mirror.cdnetworks.com)...
14.0.101.165 Connecting to apache.mirror.cdnetworks.com
(apache.mirror.cdnetworks.com)|14.0.101.165|:80... connected. HTTP request
sent, awaiting response... 200 OK Length: 5601575 (5.3M) [application/x-gzip]
Saving to: ‘apache-ant-1.9.7-bin.tar.gz.1’
100%[==========================================================================
========================= ==============================================>]
5,601,575    277KB/s   in 21s
2016-09-12 02:50:46 (258 KB/s) - ‘apache-ant-1.9.7-bin.tar.gz’ saved
[5601575/5601575]
```

2. Extract the binary file and move it to an appropriate location:

```
[oframe7@ofdemo ~]$ tar -xvzf apache-ant-1.9.7-bin.tar.gz
```

3. For efficiency, create a symbolic link:

```
[oframe7@ofdemo ~]$ ln -s apache-ant-1.9.7 ant
```

4. Update the bash profile with the following variables:

```
[oframe7@ofdemo ~]$ vi .bash_profile
# Ant ENV
export ANT_HOME=$HOME/ant
export PATH=$HOME/ant/bin:$PATH
```

5. Apply the modified environment variable:

```
[oframe7@ofdemo ~]$ source ~/.bash_profile
```

To install JEUS:

1. Expand the installer using the tar utility:

```
[oframe7@ofdemo ~]$ tar -zxvf jeus704.tar.gz
```

2. Create a **jeus** folder and unzip the binary:

```
[oframe7@ofdemo ~]$ mkdir jeus7
```

3. Change to the **setup** directory (or use the JEUS parameter for your own environment):

```
[oframe7@ofdemo ~]$ cd jeus7/setup/
```

4. Execute `ant clean-all` before performing the build:

```
[oframe7@ofdemo setup ~]$ ant clean-all
Buildfile: /home/oframe7jeus7/setup/build.xml

clean-bin:
delete-domain:
       [echo] Deleting a domain configuration: domain = jeus_domain
delete-nodesxml:
clean-config:
clean-all:
BUILD SUCCESSFUL
Total time: 0 seconds
```

5. Make a backup of the domain-config-template.properties file:

```
[oframe7@ofdemo ~]$ cp domain-config-template.properties domain-
configtemplate.properties.bkp
```

6. Modify the domain-config-template.properties file:

```
[oframe7@ofdemo setup]$  vi domain-config-template.properties

Before
jeus.password=jeusadmin nodename=Tmaxsoft

After
jeus.password=tmax1234 nodename=ofdemo
```

7. Use the `ant install` command to build JEUS:

```
[oframe7@ofdemo setup]$  ant install
```

8. Update the .bash_profile file with the JEUS variables:

```
# JEUS ENV
export JEUS_HOME=/opt/tmaxui/jeus7
PATH="/opt/tmaxui/jeus7/bin:/opt/tmaxui/jeus7/lib/system:/opt/tmaxui/jeus7/webserver/bin:$ {PATH}"
export PATH
```

9. Execute the bash profile:

```
[oframe7@ofdemo setup]$ . .bash_profile
```

10. *Optional*. Create an alias for easy shutdown and boot of JEUS components:

```
# JEUS alias

alias dsboot='startDomainAdminServer -domain jeus_domain -u administrator -p jeusadmin'
alias msboot='startManagedServer -domain jeus_domain -server server1 -u administrator -p jeusadmin'
alias msdown=‘jeusadmin -u administrator -p tmax1234 "stop-server server1“’
alias dsdown=‘jeusadmin -domain jeus_domain -u administrator -p tmax1234 "local-shutdown“’
```

11. To verify the installation, start the domain admin server:

```
[oframe7@ofdemo ~]$ startDomainAdminServer -domain jeus_domain -u administrator -p jeusadmin
```

12. Verify by weblogin. For example:

```
http://192.168.92.133:9736/webadmin/login
http: //  < IP > : < PORT > /webadmin/login
```

The logon screen appears:

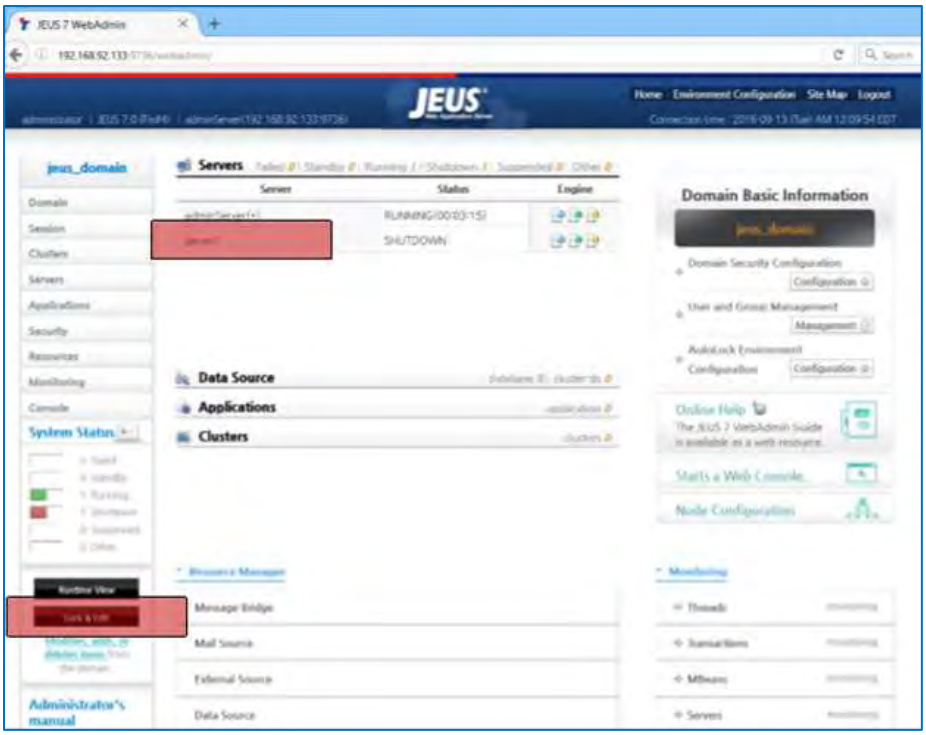
ⓘ **NOTE:** If you experience any issues with port security, open port 9736 or disable the firewall (`systemctl stop firewall`).

13. To change the hostname for server1, click **Lock & Edit**, then click **server1**. In the Server window, change the hostname as follows:

    a. Change **Nodename** to **ofdemo**.

    b. Click **OK** on the right side of the window.

    c. Click **Apply changes** on the lower left side of the window and for description, enter "Hostname change."



14. Verify that the configuration is successful in the confirmation screen.

15. Start the managed server process "server1" using the following command:

```
[oframe7@ofdemo ~]$ startManagedServer -domain jeus_domain -server server1 -u
administrator -p jeusadmin
```

Install OFGW

OFGW Is the OpenFrame gateway that supports communication between the 3270 terminal emulator and the OSI base and manages the sessions between the terminal emulator and OSI.

To install OFGW:

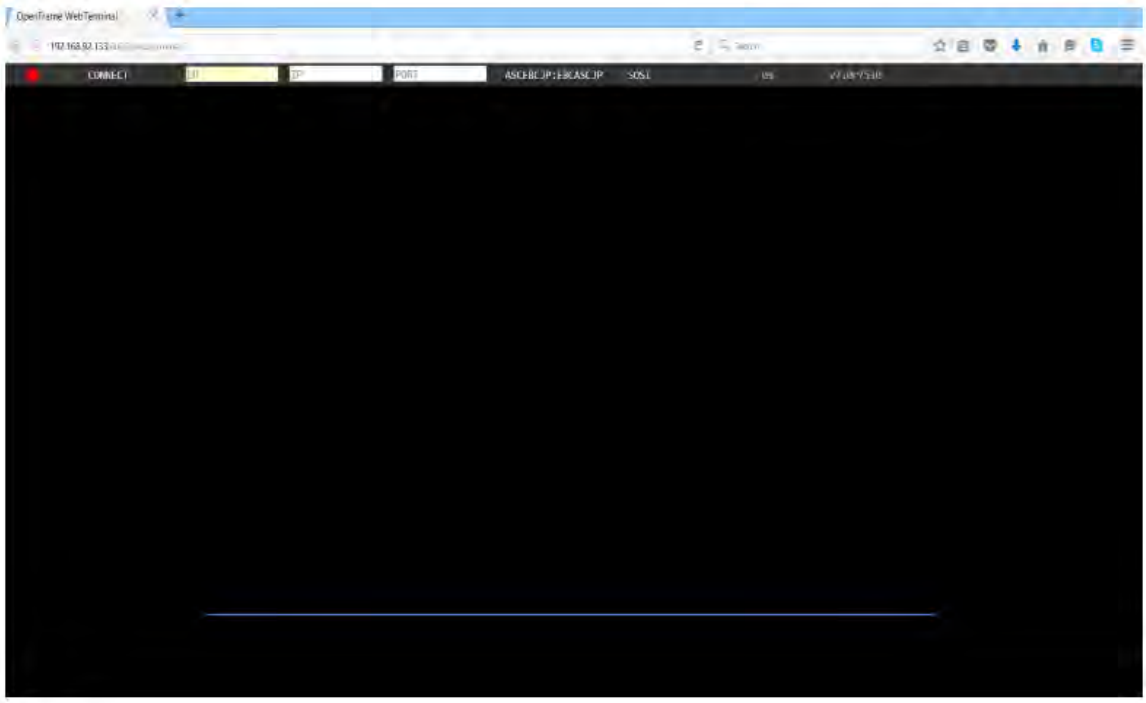
1. Make sure that JEUS was installed successfully, then verify that the OFGW7_0_1_Generic.bin installer file is present.
2. Execute the installer:

   ```
   [oframe7@ofdemo ~]$ ./OFGW7_0_1_Generic.bin
   ```

3. Use the following locations for the corresponding prompts:
   - JEUS Home directory
   - JEUS Domain Name
   - JEUS Server Name
   - Tibero Driver
   - Tmax Node ID ofdemo
4. Accept the rest of the defaults, then press Enter to exit the installer.
5. Verify that the URL for OFGW is working as expected:

   ```
   Type URL
   http://192.168.92.133:8088/webterminal/ and press enter
    < IP >               :8088/webterminal/
   ```

   The following screen appears:



Install OFManager

OFManager provides operation and management functions for OpenFrame in the web environment.

To install OFManager:

1. Verify that the OFManager7_Generic.bin installer file is present.
2. Execute the installer:

   ```
   OFManager7_Generic.bin
   ```

3. Press Enter to continue, then accept the license agreement.
4. Choose the install folder.
5. Accept the defaults.
6. Choose Tibero as the database.
7. Press Enter to exit the installer.
8. Verify that the URL for OFManager is working as expected:

   ```
   Type URL http://192.168.92.133:8088/ofmanager and press enter <  IP >  : < PORT >  ofmanager Enter ID:   ROOT
   Password: SYS1
   ```

   The start screen appears:

That completes the installation of the OpenFrame components.

Learn more

If you are considering a mainframe migration, our expanding partner ecosystem is available to help you. For detailed guidance about choosing a partner solution, refer to the Platform Modernization Alliance.

For more information about working with Azure, see the following resources:

- Get started with Azure
- Host Integration Server (HIS) documentation
- Azure Virtual Data Center Lift-and-Shift Guide