



# Provisioning Guide

Version 2.1.0

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## Revision History

Version	Date
2.0.0	To be announced.
1.3.0	January, 2016

# Chapter 1. About This Document

This guide describes how to provision the end-user Trafodion binaries on top of an existing Hadoop environment. This install allows you to store and query data using Trafodion, either via Trafodion clients (see [Trafodion Client Installation Guide](#) or via application code you write.

If you want to install a Trafodion developer-build environment, then please refer to the [Trafodion Contributor Guide](#) for instructions.

## 1.1. Intended Audience

This guide assumes that you are well-versed in Linux and Hadoop administration. If you don't have such experience, then you should consider going through the steps required to install a Hadoop environment before attempting to install Trafodion.

The instructions contained herein apply to the following environments.

- **Single-Node Environments:** Typically used when you want to evaluate Trafodion.
- **Cluster (Multi-Node) Environments:** Typically used when you deploy Trafodion for application usage.



Trafodion can be provisioned on a single-node or multi-node environment. Unless specifically noted, the term **cluster** is used to mean both single- and multi-node environments.

The provisioning instructions applies to a diverse set of platforms:

- **Virtual Machines:** Often used for evaluations and Trafodion development.
- **Cloud:** Used for Product Environments as well as for Developer Environments.
- **Bare Metal:** Used for Product Environments as well as for Developer Environments.



The term **node** is used to represent a computing platform on which operating system, Hadoop, and Trafodion software is running. Unless specifically qualified (bare-metal node, virtual-machine node, or cloud-node), **node** represents a computing platform in your cluster regardless of platform type.

## 1.2. New and Changed Information

This is a new guide.

## 1.3. Notation Conventions

This list summarizes the notation conventions for syntax presentation in this manual.

- UPPERCASE LETTERS

Uppercase letters indicate keywords and reserved words. Type these items exactly as shown. Items not enclosed in brackets are required.

```
SELECT
```

- lowercase letters

Lowercase letters, regardless of font, indicate variable items that you supply. Items not enclosed in brackets are required.

```
file-name
```

- [ ] Brackets

Brackets enclose optional syntax items.

```
DATETIME [start-field TO] end-field
```

A group of items enclosed in brackets is a list from which you can choose one item or none.

The items in the list can be arranged either vertically, with aligned brackets on each side of the list, or horizontally, enclosed in a pair of brackets and separated by vertical lines.

For example:

```
DROP SCHEMA schema [CASCADE]  
DROP SCHEMA schema [ CASCADE | RESTRICT ]
```



- {} Braces

Braces enclose required syntax items.

```
FROM { grantee [, grantee ] ... }
```

A group of items enclosed in braces is a list from which you are required to choose one item.

The items in the list can be arranged either vertically, with aligned braces on each side of the list, or horizontally, enclosed in a pair of braces and separated by vertical lines.

For example:

```
INTERVAL { start-field TO end-field }
{ single-field }
INTERVAL { start-field TO end-field | single-field }
```

- | Vertical Line

A vertical line separates alternatives in a horizontal list that is enclosed in brackets or braces.

```
{expression | NULL}
```

- ... Ellipsis

An ellipsis immediately following a pair of brackets or braces indicates that you can repeat the enclosed sequence of syntax items any number of times.

```
ATTRIBUTE[S] attribute [, attribute] ...
{, sql-expression } ...
```

An ellipsis immediately following a single syntax item indicates that you can repeat that syntax item any number of times.

For example:

```
expression-n ...
```

- Punctuation

Parentheses, commas, semicolons, and other symbols not previously described must be typed as shown.

```
DAY (datetime-expression)
@script-file
```

Quotation marks around a symbol such as a bracket or brace indicate the symbol is a required character that you must type as shown.

For example:

```
"{" module-name [, module-name] ... "}"
```

- Item Spacing

Spaces shown between items are required unless one of the items is a punctuation symbol such as a parenthesis or a comma.

```
DAY (datetime-expression) DAY(datetime-expression)
```

If there is no space between two items, spaces are not permitted. In this example, no spaces are permitted between the period and any other items:

```
myfile.sh
```

- Line Spacing

If the syntax of a command is too long to fit on a single line, each continuation line is indented three spaces and is separated from the preceding line by a blank line.

This spacing distinguishes items in a continuation line from items in a vertical list of selections.

```
match-value [NOT] LIKE _pattern
    [ESCAPE esc-char-expression]
```

## 1.4. Comments Encouraged

We encourage your comments concerning this document. We are committed to providing documentation that meets your needs. Send any errors found, suggestions for improvement, or compliments to [user@trafodion.incubator.apache.org](mailto:user@trafodion.incubator.apache.org).

Include the document title and any comment, error found, or suggestion for improvement you have concerning this document.

## Chapter 2. Introduction

Trafodion is a Hadoop add-on service that provides transactional SQL on top of HBase. Typically, you use Trafodion as the database for applications that require Online Transaction Processing (OLTP), Operational Data Store (ODS), and/or strong reporting capabilities. You access Trafodion using standard JDBC and ODBC APIs.

You may choose whether to add Trafodion to an existing Hadoop environment or to create a standalone Hadoop environment specifically for Hadoop.

This guide assumes that a Hadoop environment exists upon which your provisioning Trafodion. Refer to [Hadoop Software](#) for information about what Hadoop software is required Trafodion.

### 2.1. Security Considerations

The following users need be considered for Trafodion:

- **Provisioning User:** A Linux-level user that performs the Trafodion provisioning tasks. This user ID requires `sudo` access and passwordless ssh among the nodes where Trafodion is installed. In addition, this user ID requires access to Hadoop distribution, HDFS, and HBase administrative users to change respective environment's configuration settings per Trafodion requirements. Refer to [Trafodion Provisioning User](#) for more information about the requirements and usage associated with this user ID.
- **Runtime User:** A Linux-level user under which the Trafodion software runs. This user ID must be registered as a user in the Hadoop Distributed File System (HDFS) to store and access objects in HDFS, HBase, and Hive. In addition, this user ID requires passwordless access among the nodes where Trafodion is installed. Refer to [Trafodion Runtime User](#) for more information about this user ID.
- **Trafodion Database Users:** Trafodion users are managed by the Trafodion security features (grant, revoke, etc.), which can be integrated with LDAP if so desired. These users are referred to as **database users** and do not have direct access to the operating system. Refer to [Register User](#), [Grant](#), and other SQL statements in the [Trafodion SQL Reference Manual](#) for more information about managing Trafodion Database Users.

Optionally, you can enable Trafodion Security. If you do not enable security in Trafodion, then a client interface to Trafodion may request a user name and password, but Trafodion ignores the user name and password entered in the client interface, and the session runs as the database **root** user, `DB__ROOT`, without restrictions. If you want to restrict users, restrict access to certain users only, or restrict access to an object or operation, then you must enable security, which enforces authentication and authorization. Refer to [Enable Security](#) for more information about this option.

## 2.2. Provisioning Options

Trafodion ships with a set of scripts (the Trafodion Installer) that takes care of many of the installation and upgrade tasks associated with the Trafodion software and its requirements. There is a separate set of scripts to remove Trafodion, if needed.

Currently, the Trafodion Installer is able to install Trafodion on select Cloudera and Hortonworks Hadoop distributions only. The Trafodion Installer limitations are noted as they apply in the different chapters below. For example, the Trafodion Installer is less capable on SUSE than it is on RedHat/CentOS; you have to install the prerequisite software packages outside the Trafodion Installer.

The Trafodion Installer automates many of the tasks required to install/upgrade Trafodion, spanning from downloading and installing required software packages and making required changes to your Hadoop environment via creating the Trafodion runtime user ID to installing and starting Trafodion. It is, therefore, highly recommend that you use the Trafodion Installer for initial installation and upgrades of Trafodion. These steps are referred to as "Script-Based Provisioning" in this guide. Refer to [Trafodion Installer](#) provides usage information.

If, for any reason, you choose not to use the Trafodion Installer, then separate chapters provide step-by-step recipes for the tasks required to install/upgrade Trafodion. These steps are referred to as **Recipe-Based Provisioning** in this guide. It is assumed that you are well-versed in Linux and Hadoop administrative tasks if using Recipe-Based Provisioning.

## 2.3. Provisioning Activities

Trafodion provisioning is divided into the following main activities:

- **Requirements:** Activities and documentation required to install the Trafodion software. These activities include tasks such as understanding hardware and operating system requirements, Hadoop requirements, what software packages that need to be downloaded, configuration settings that need to be changed, user IDs requirements, and so on.
- **Prepare:** Activities to prepare the operating system and the Hadoop ecosystem to run Trafodion. These activities include tasks such as installing required software packages, configure the Trafodion Installation User, gather information about the Hadoop environment, modify configuration for different Hadoop services, and so forth.
- **Install:** Activities related to installing the Trafodion software. These activities include tasks such as unpacking the Trafodion tar files, creating the Trafodion Runtime User, creating Trafodion HDFS directories, installing the Trafodion software, and so forth.

- **Upgrade:** Activities related to the upgrading the Trafodion software. These activities include tasks such as shutting down Trafodion, installing a new version of the Trafodion software, and so on. The upgrade tasks vary depending on the differences between the current and new release of Trafodion. For example, an upgrade may or may not include an upgrade of the Trafodion metadata.
- **Activate:** Activities related to starting the Trafodion software. These activities include basic management tasks such as starting and checking the status of the Trafodion components, performing basic smoke tests, and so forth.
- **Remove:** Activities related to removing Trafodion from your Hadoop cluster.

## 2.4. Provisioning Master Node

All provisioning tasks are performed from a single node in the cluster, which must be part of the Hadoop environment you're adding Trafodion to. This node is referred to as the "**Provisioning Master Node**" in this guide.

The Trafodion Provisioning User must have access to all other nodes from the Provisioning Master Node in order to perform provisioning tasks on the cluster.

## 2.5. Trafodion Installer

The Trafodion Installer is a set of scripts automates most of the tasks requires to install/upgrade Trafodion. You download the Trafodion Installer tar file from the Trafodion [download](#) page. Next, you unpack the tar file.

### Example

```
$ mkdir $HOME/trafodion-installer
$ cd $HOME/trafodion-downloads
$ tar -zxvf apache-trafodion-installer-1.3.0-incubating-bin.tar.gz -C $HOME/trafodion-
installer
$ ls $HOME/trafodion-installer/installer
bashrc_default          tools                  traf_config_check
trafodion_apache_hadoop_install traf_package_setup
build-version-1.3.0.txt traf_add_user          traf_config_setup
trafodion_config_default traf_setup
dcs_installer           traf_apache_hadoop_config_setup traf_create_systemdefaults
trafodion_install       traf_sqconfig
rest_installer          traf_authentication_conf_default traf_getHadoopNodes
trafodion_license       traf_start
setup_known_hosts.exp   traf_cloudera_mods98   traf_hortonworks_mods98
trafodion_uninstaller
$
```

The Trafodion Installer supports two different modes:

1. **Guided Setup:** Prompts for information as it works through the installation/upgrade process. This mode is recommended for new users.
2. **Automated Setup:** Required information is provided in a pre-formatted bash-script configuration file, which is provided via a command argument when running the Trafodion Installer thereby suppressing all prompts.

A template of the configuration file is available here within the installer directory: `trafodion_config_default`. Make a copy of the file in your directory and populate the needed information.

Automated Setup is recommended since it allows you to record the required provisioning information information ahead of time. Refer to [Automated Setup](#) for information about how to populate this file.

### 2.5.1. Usage

The following shows help for the Trafodion Installer.

```
./trafodion_install --help
```

This script will install Trafodion. It will create a configuration file (if one has not been created), setup of the environment needed for Trafodion, configure HBase with Hbase-trx and co-processors needed, and install a specified Trafodion build.

Options:

<code>--help</code>	Print this message and exit
<code>--accept_license</code>	If provided, the user agrees to accept all the provisions in the Trafodion license. This allows for automation by skipping the display and prompt of the Trafodion license.
<code>--config_file</code>	If provided, all install prompts will be taken from this file and not prompted for.

## 2.5.2. Install vs. Upgrade

The Trafodion Installer automatically detects whether you're performing an install or an upgrade by looking for the Trafodion Runtime User in the `/etc/passwd` file.

- If the user ID doesn't exist, then the Trafodion Installer runs in install mode.
- If the user ID exists, then the Trafodion Installer runs in upgrade mode.

## 2.5.3. Guided Setup

By default, the Trafodion Installer runs in Guided Setup mode, which means that it prompts you for information during the install/upgrade process.

Refer to the following sections for examples:

- [Guided Install](#)
- [Guided Upgrade](#)

## 2.5.4. Automated Setup

The `--config_file` option runs the Trafodion in Automated Setup mode.

Before running the Trafodion Installer with this option, you do the following:

1. Copy the `trafodion_config_default` file.

### Example

```
cp trafodion_config_default my_config
```

2. Edit the new file using information you collect in the [Gather Configuration Information](#) section in the [Prepare](#) chapter.
3. Run the Trafodion Installer in Automated Setup Mode

### Example

```
./trafodion_installer --config_file my_config
```





Your Trafodion Configuration File contains the password for the Trafodion Runtime User and for the Distribution Manager. Therefore, we recommend that you secure the file in a manner that matches the security policies of your organization.

## Example: Creating a Trafodion Configuration File

Using the instructions in [Gather Configuration Information](#) in the [Prepare](#) chapter, you record the following information.

ID	Information	Setting
ADMIN	Administrator user name for Apache Ambari or Cloudera Manager.	admin
BACKUP_DCS_NODES	List of nodes where to start the backup DCS Master components.	
CLOUD_CONFIG	Whether you're installing Trafodion on a cloud environment.	N
CLOUD_TYPE	What type of cloud environment you're installing Trafodion on.	
CLUSTER_NAME	The name of the Hadoop Cluster.	Cluster 1
DCS_BUILD	Tar file containing the DCS component.	
DCS_PRIMARY_MASTER_NODE	The node where the primary DCS should run.	
DCS_SERVER_PARM	Number of concurrent client sessions per node.	8
ENABLE_HA	Whether to run DCS in high-availability (HA) mode.	N
EPEL_RPM	Location of EPEL RPM. Specify if you don't have access to the Internet.	
FLOATING_IP	IP address if running DCS in HA mode.	
HADOOP_TYPE	The type of Hadoop distribution you're installing Trafodion on.	cloudera
HBASE_GROUP	Linux group name for the HBASE administrative user.	hbase
HBASE_USER	Linux user name for the HBASE administrative user.	hbase
HDFS_USER	Linux user name for the HDFS administrative user.	hdfs
HOME_DIR	Root directory under which the <code>trafodion</code> home directory should be created.	/home
INIT_TRAFODION	Whether to automatically initialize the Trafodion database.	Y
INTERFACE	Interface type used for \$FLOATING_IP.	
JAVA_HOME	Location of Java 1.7.0_65 or higher (JDK).	/usr/java/jdk1.7.0_67-cloudera
LDAP_CERT	Full path to TLS certificate.	
LDAP_HOSTS	List of nodes where LDAP Identity Store servers are running.	
LDAP_ID	List of LDAP unique identifiers.	
LDAP_LEVEL	LDAP Encryption Level.	
LDAP_PASSWORD	Password for LDAP_USER.	
LDAP_PORT	Port used to communicate with LDAP Identity Store.	
LDAP_SECURITY	Whether to enable simple LDAP authentication.	N
LDAP_USER	LDAP Search user name.	

ID	Information	Setting
LOCAL_WORKDIR	The directory where the Trafodion Installer is located.	/home/centos/trafodion-installer/installer
MANAGEMENT_ENABLED	Whether your installation uses separate management nodes.	N
MANAGEMENT_NODES	The FQDN names of management nodes, if any.	
NODE_LIST	The FQDN names of the nodes where Trafodion will be installed.	trafodion-1 trafodion-2
PASSWORD	Administrator password for Apache Ambari or Cloudera Manager.	admin
REST_BUILD	Tar file containing the REST component.	
SQ_ROOT	Target directory for the Trafodion software.	/home/trafodion/apache-trafodion-1.3.0-incubating-bin
START	Whether to start Trafodion after install/upgrade.	Y
SUSE_LINUX	Whether your installing Trafodion on SUSE Linux.	false
TRAF_PACKAGE	The location of the Trafodion installation package tar file or core installation tar file.	/home/centos/trafodion-download/apache-trafodion-1.3.0-incubating-bin.tar.gz
TRAF_USER	The Trafodion runtime user ID. Must be <code>trafodion</code> in this release.	trafodion
TRAF_USER_PASSWORD	The password used for the <code>trafodion:trafodion</code> user ID.	traf123
URL	FQDN and port for the Distribution Manager's REST API.	trafodion-1.apache.org:7180

Next, you edit `my_config` to contain the following:

```
#!/bin/bash
# @@@ START COPYRIGHT @@@
#
# Licensed to the Apache Software Foundation (ASF) under one
# or more contributor license agreements. See the NOTICE file
# distributed with this work for additional information
# regarding copyright ownership. The ASF licenses this file
# to you under the Apache License, Version 2.0 (the
# "License"); you may not use this file except in compliance
# with the License. You may obtain a copy of the License at
#
# http://www.apache.org/licenses/LICENSE-2.0
#
# Unless required by applicable law or agreed to in writing,
# software distributed under the License is distributed on an
# "AS IS" BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY
# KIND, either express or implied. See the License for the
# specific language governing permissions and limitations
# under the License.
#
# @@@ END COPYRIGHT @@@
```

```

#=====
# Trafodion Configuration File
# This file contains default values for the installer.

# Users can also edit this file and provide values for all parameters
# and then specify this file on the run line of trafodion_install.
# Example:
# ./trafodion_install --config_file <Trafodion-config-file>
# WARNING: This mode is for advanced users!
#
#=====

#=====
#Must be set to 'true' if on a SUSE linux system. If on another type of system
#this must be set to false.

export SUSE_LINUX="false"

# The working directory where Trafodion installer untars files, etc.
# do not change this unless you really know what you are doing
export TRAF_WORKDIR="/usr/lib/trafodion"

# This is the directory where the installer scripts were untarred to
export LOCAL_WORKDIR="/home/centos/trafodion-installer/installer"

# The maximum number of dcs servers, i.e. client connections
export DCS_SERVERS_PARM="8"

# "true" if this is an upgrade
export UPGRADE_TRAF="false"

# Trafodion userid, This is the userid the Trafodion instance will run under
export TRAF_USER="trafodion"

# Trafodion userid's password
export TRAF_USER_PASSWORD="trafl23"

# a blank separated list of nodes in your cluster
# node names should include full domain names
#This can not be left blank!
export NODE_LIST="trafodion-1 trafodion-2"

# count of nodes in node list
export node_count="2"

# another list of the same nodes in NODE_LIST but specified in a pdsh usable format
# i.e. "-w centos-cdh[1-6]" or "-w node1 -w node2 -w node3"
export MY_NODES="-w trafodion-[1-2]"

# the directory prefix for the trafodion userid's $HOME directory
# i.e. /opt/home, not /opt/home/trafodion
export HOME_DIR="/home"

```

```

#JAVA HOME must be a JDK. Must include FULL Path. Must be 1.7.0_65 or higher.

export JAVA_HOME="/usr/java/jdk1.7.0_67-cloudera"

# If your machine doesn't have external internet access then you must
# specify the location of the EPEL rpm, otherwise leave blank and it
# will be installed from the internet
export EPEL_RPM=""

# full path of the Trafodion package tar file
export TRAF_PACKAGE="/home/centos/trafodion-download/apache-trafodion-1.3.0-incubating-
bin.tar.gz"

# if TRAF_PACKAGE wasn't specified then these two values must be specified
# TRAF_BUILD is the trafodion_server tar file
# DCS_BUILD is the DCS tar file
# REST_BUILD is the REST tar file
export TRAF_BUILD=""
export DCS_BUILD=""
export REST_BUILD=""
# Either "cloudera" or "hortonworks" (all lowercase)
export HADOOP_TYPE="cloudera"

# The URL for Cloudera/Hortonworks REST API (i.e. node1.host.com:8080)
export URL="trafodion-1.apache.org:7180"

# Cloudera/Hortonworks UI admin's userid and password
export ADMIN="admin"
export PASSWORD="admin"

# hadoop cluster name
export CLUSTER_NAME=""

# the Hadoop HDFS userid
export HDFS_USER="hdfs"

# the Hadoop HBase userid and group
export HBASE_USER="hbase"
export HBASE_GROUP="hbase"

# The hadoop HBase service name
export HBASE="hbase"

# full path of where to install Trafodion to
# Example is used below. If $HOME_DIR or $TRAF_USER have been changed
# then this will need to be changed.
# On an upgrade, it is recommend to choose a different directory.
# First time install : /home/trafodion/traf
# On Upgrade: /home/trafodion/traf_<date>
# By doing this the previous version will remain and allow for an easier rollback.
export SQ_ROOT="/home/trafodion/apache-trafodion-1.3.0-incubating-bin"

# Start Trafodion after install completes
export START="Y"

```

```
# initialize trafodion after starting
export INIT_TRAFODION="Y"

# full path to the sqconfig file
# Default is to leave as is and this file will be created.
export SQCONFIG=" "

export CONFIG_COMPLETE="true"

#Turn on simple security. MUST have existing LDAP configured.
export LDAP_SECURITY="N"

#Name of LDAP Config file
export LDAP_AUTH_FILE="traf_authentication_config_${HOSTNAME}"
```

Once completed, run the Trafodion Installer with the `--config_file` option.

Refer to the following sections for examples:

- [Automated Install](#)
- [Automated Upgrade](#)

## 2.6. Trafodion Provisioning Directories

Trafodion stores its provisioning information in the following directories on each node in the cluster:

- `/etc/trafodion`: Configuration information.
- `/usr/lib/trafodion`: Copies of the installer files.

## Chapter 3. Requirements

Trafodion requires an x86 version of Linux.

The current release of Trafodion has been tested with:

- 64-bit Red Hat Enterprise Linux (RHEL) or CentOS 6.5, 6.6, and 6.7
- SUSE SLES 11.3
- Cloudera CDH 5.2
- Cloudera CDH 5.3
- Hortonworks HDP 2.2

Other OS releases may work, too. The Trafodion project is currently working on better support for non-distribution version of Hadoop.

### 3.1. General Cluster and OS Requirements and Recommendations

64-bit x86 instruction set running a Linux distribution is required. Further, Trafodion assumes an environment based on the requirements of the tested Hadoop distributions/services.

#### 3.1.1. Hardware Requirements and Recommendations

##### Single-Node Cluster

It is possible to run Trafodion on a single-node sandbox environment. Typically, any sandbox running a Hadoop distribution can be used. A typical single-node configuration uses 4-8 cores with 16 GB of memory, and 20 GB free disk space.

##### Multi-Node Cluster

For multi-node end-user clusters, your typical HBase environment should suffice for Trafodion. Typically, memory configuration range between 64-128 GB per node with minimum requirement of 16 GB. The cluster size can span from 1 to  $n$  nodes; a minimum of two nodes is recommended. A minimum of two cores is required regardless of whether you're deploying Trafodion on a bare-metal or virtual environment.

Recommended configurations:

Attribute	Guidance
Processors per Node	<ul style="list-style-type: none"> <li>• Small: 2 cores</li> <li>• Medium: 4 cores</li> <li>• Large: 8+ cores</li> </ul>
Memory per Node	<ul style="list-style-type: none"> <li>• Small: 16 GB</li> <li>• Medium: 64 GB</li> <li>• Large: 128 GB</li> </ul>
Concurrency:Nodes	<ul style="list-style-type: none"> <li>• Two Small Nodes: Four concurrent queries</li> <li>• Two Medium Nodes: 64 concurrent queries</li> <li>• Two Large Nodes: 256 concurrent queries</li> </ul>

### 3.1.2. OS Requirements and Recommendations

Please verify these requirements on each node you will install Trafodion on:

Function	Requirement	Verification Guidance
Linux	64-bit version of Red Hat 6.5 or later, or SUSE SLES 11.3 or later.	
sshd	The <code>ssh</code> daemon is running on each node in the cluster.	<ul style="list-style-type: none"> <li>• <code>ps aux   grep sshd</code></li> <li>• <code>sudo netstat -plant   grep :22</code></li> </ul>
ntpd	The <code>ntp</code> daemon is running and synchronizing time on each node in the cluster.	<ul style="list-style-type: none"> <li>• <code>ps aux   grep ntp</code></li> <li>• <code>ntpq -p</code></li> </ul>
FQDN	<ul style="list-style-type: none"> <li>• <code>/etc/hosts</code> is set up for fully-qualified node names (FQDN).</li> <li>• <code>/etc/resolv.conf</code> is configured to use a name server.</li> </ul>	<ul style="list-style-type: none"> <li>• <code>hostname --fqdn</code> shows the fully-qualified node name, if any.</li> <li>• The fully-qualified node name is part of the <code>/etc/hosts</code> file.</li> <li>• <code>host -T &lt;FQDN&gt;</code> (responds if using a DNS server, times out otherwise)</li> <li>• Simply <code>ssh</code> among nodes using <code>ssh &lt;FQDN&gt;</code>.</li> </ul>
Port Availability	The Linux Kernel Firewall ( <code>iptables</code> ) has either been disabled or <a href="#">ports required by Trafodion</a> have been opened.	<ul style="list-style-type: none"> <li>• <code>lsmod   grep ip_tables</code> checks whether <code>iptables</code> is loaded. If not, no further checking is needed.</li> <li>• <code>sudo iptables -nL   grep &lt;port&gt;</code> checks the configuration of a port. An empty response indicates no rule for the port, which often means the port is <b>not</b> open.</li> </ul>
passwordless ssh	The user name used to provision Trafodion must have passwordless ssh access to all nodes.	ssh to the nodes, ensure that no password prompt appears.
sudo privileges	The user name used to provision Trafodion must sudo access to a number of root functions	<code>sudo echo "test"</code> on each node.
bash	Available for shell-script execution.	<code>bash --version</code>
java	Available to run the Trafodion software. Same version as HBase is using.	<code>java --version</code>
perl	Available for script execution.	<code>perl --version</code>
python	Available for script execution.	<code>python --version</code>

Function	Requirement	Verification Guidance
yum	Available for installs, updates, and removal of software packages.	<code>yum --version</code>
rpm	Available for installs, updates, and removal of software packages.	<code>rpm --version</code>
scp	Available to copy files among nodes in the cluster.	<code>scp --help</code>
curl	Available to transfer data with URL syntax.	<code>curl --version</code>
wget	Available to download files from the Web.	<code>wget --version</code>
pdsh	Available to run shell commands in parallel.	<code>pdsh -V</code>
pdcp	Available to copy files among nodes in parallel. part of the <code>pdsh</code> package.	<code>pdcp -V</code>

### 3.1.3. IP Ports

The following table lists the default ports used by the different Trafodion components plus the configuration file and configuration attribute associated with each port setting.

Default Port	Configuration File	Configuration Entry	Required	Range	Protocol	Comment
<b>4200</b>	rest-site.xml	trafodion.rest.port	Yes	1	REST	Trafodion REST Server.
<b>4201</b>	rest-site.xml	trafodion.rest.https.port	Yes	1	HTTPS	Trafodion REST Server (HTTPS).
<b>23400</b>	dcs-site.xml	dcs.master.port	Yes	<i>n</i>	binary	Start of Trafodion DCS port range. (37800 for Trafodion 1.1)
<b>24400</b>	dcs-site.xml	dcs.master.info.port	Yes	1	HTTP	DCS master web GUI. (40010 for Trafodion 1.1)
<b>24410</b>	dcs-site.xml	dcs.server.info.port	Yes	<i>n</i>	HTTP	Start of range for DCS server web GUIs. (40020 for Trafodion 1.1)
<b>50030</b>	mapred-site.xml	mapred.job.tracker.http.address	No	1	HTTP	MapReduce Job Tracker web GUI.
<b>50070</b>	hdfs-site.xml	dfs.http.address	No	1	HTTP	HDFS Name Node web GUI.
<b>50075</b>	hdfs-site.xml	dfs.datanode.http.address	No	1	HTTP	HDFS Data Node web GUI.
<b>50090</b>	hdfs-site.xml	dfs.secondary.http.address	No	1	HTTP	HDFS Secondary Name Node web GUI.
<b>60010</b>	hbase-site.xml	hbase.master.info.port	No	1	HTTP	HBase Master web GUI.
<b>60030</b>	hbase-site.xml	hbase.regionserver.info.port	No	1	HTTP	HBase Region Server web GUI.

There are two port ranges used by Trafodion.

- 23400 is a range, to allow multiple `mxosrvr` processes on each node. Allow a range of a few ports, enough to cover all the servers per node that are listed in the "servers" file in the DCS configuration directory.



- 24410 is a range as well, enough to cover the DCS servers per node, usually 1 or 2.

On top of the ports identified above, you also need the ports required by your Hadoop distribution. For example:

- [Cloudera Ports](#)
- [Hortonworks Ports](#)

Although not all the ports will be used on every node of the cluster, you need to open most of them for all the nodes in the cluster that have Trafodion, HBase, or HDFS servers on them.

## 3.2. Prerequisite Software

### 3.2.1. Hadoop Software

Trafodion runs as an add-on service on Hadoop distributions. The following Hadoop services and their dependencies must be installed and running on the cluster where you intend to install Trafodion:

- Hadoop Distributed File System (HDFS)
- YARN with MapReduce version 2
- ZooKeeper
- HBase
- Hive
- Apache Ambari (Hortonworks) or Cloudera Manager (Cloudera) with associated embedded databases.

The following distributions have been tested with Trafodion.<sup>1</sup>

Distribution	Version	HBase Version	Installation Documentation
Cloudera Distribution Including Apache Hadoop (CDH)	5.2 or 5.3	0.98	<a href="http://www.cloudera.com/downloads/manager/5-3-0.html">CHD 5.2 Installation http://www.cloudera.com/downloads/manager/5-3-0.html</a> <sup>2</sup>
Hortonworks Data Platform (HDP)	2.2	0.98	<a href="#">HDP 2.2 Installation</a>

1. Future releases of Trafodion will move away from distribution-specific integration. Instead, Trafodion will be tested with specific version of the Hadoop, HDFS, HBase, and other services/products only.
2. When possible, install using **parcels** to simplify the installation process.



Trafodion does not yet support installation on a non-distribution version of Hadoop; that is, Hadoop downloaded from the Apache web site. This restriction will be lifted in a later release of Trafodion.

### 3.2.2. Software Packages

In addition to the software packages required to run different Hadoop services listed above (for example, `Java`), Trafodion requires supplementary software to be installed on the cluster before it is installed. These are Linux tools that are not typically packaged as part of the core Linux distribution.



For RedHat/CentOS, the Trafodion Installer automatically attempts get a subset of these packages over the Internet. If the cluster's access to the Internet is disabled, then you need to manually download the packages and make them available for installation. You need to build and install `log4cxx` manually.

Package	Usage	Installation
EPEL	Add-on packages to completed the Linux distribution.	Download <a href="#">Fedora RPM</a>
pdsh	Parallelize shell commands during install and Trafodion runtime utilities.	<code>yum install pdsh</code>
log4cxx	Message logging.	Manual process <sup>1</sup>
sqlite	Internal configuration information managed by the Trafodion Foundation component.	<code>yum install sqlite</code>
expect	Not used?	<code>yum install expect</code>
perl-DBD-SQLite	Allows Perl scripts to connect to SQLite.	<code>yum install perl-DBD-SQLite</code>
perl-Params-Validate	Validates method/function parameters in Perl scripts.	<code>yum install perl-Params-Validate</code>
perl-Time-HiRes	High resolution alarm, sleep, gettimeofday, interval timers in Perl scripts.	<code>yum install perl-Time-HiRes</code>
protobuf	Data serialization.	<code>yum install protobuf</code>
xerces-c	C++ XML parsing.	<code>yum install xerces-c</code>
gzip	Data compress/decompress.	<code>yum install gzip</code>
rpm-build <sup>2</sup>	Build binary and source software packages.	<code>yum install rpm-build</code>
apr-devel <sup>2</sup>	Support files used to build applications using the APR library.	<code>yum install apr-devel</code>
apr-util-devel <sup>2</sup>	Support files used to build applications using the APR utility library.	<code>yum install apr-util-devel</code>
doxygen <sup>2</sup>	Generate documentation from annotated C++ sources.	<code>yum install doxygen</code>
gcc <sup>2</sup>	GNU Compiler Collection	<code>yum install gcc</code>
gcc_c++ <sup>2</sup>	GNU C++ compiler.	<code>yum install gcc_c++</code>

1. `log4cxx` was recently withdrawn from public repositories. Therefore, you will need to build the `log4cxx` RPM on your system and then install the RPM using the procedure described in [log4cxx Installation](#).

2. Software package required to build `log4c++`. Not required otherwise. These packages are **not** installed by the Trafodion Installer in this release.

The Trafodion Installer requires Internet access to install the required software packages.

## 3.3. Trafodion User IDs and Their Privileges

### 3.3.1. Trafodion Runtime User

The `trafodion:trafodion` user ID is created as part of the installation process. The default password is: `traf123`.

Trafodion requires that either HDFS ACL support or Kerberos is enabled. The Trafodion Installer will enable HDFS ACL support. Kerberos-based security settings are outside the scope of this guide. Please refer to the security information in [Apache HBase™ Reference Guide](#) for information about how to set up HBase security with Kerberos.

Also, Trafodion requires `sudo` access to `ip` and `arping` so that floating or elastic IP addresses can be moved from one node to another in case of node failures.



Do **not** create the `trafodion:trafodion` user ID in advance. The Trafodion Installer uses the presence of this user ID to determine whether you're doing an installation or upgrade.

### 3.3.2. Trafodion Provisioning User

Typically, the Trafodion Installer is used for Trafodion installations. It requires access to the user IDs documented below.

#### Linux Installation User

The user ID that performs the Trafodion installation steps. Typically, this User ID runs the Trafodion Installer.

#### Requirements:

- User name or group cannot be `trafodion`.
- Passwordless ssh access to all nodes in the cluster.
- Internet access to download software packages.
- `requiretty` must be disabled in `/etc/sudoers`.
- `sudo`<sup>1</sup> access to:

- Download and install software packages.
- Modify `/etc/sudoers.d` (allow the `trafodion` user to modify floating IP: `ip` and `arping`).
- Create the `trafodion` user ID and group.
- Install Trafodion software into the HBase environment.
- Run Java version command on each node in the cluster.
- Run Hadoop version command on each node in the cluster.
- Run HBase version command on each node in the cluster.
- Create directories and files in:
  - `/etc`
  - `/usr/lib`
  - `/var/log`
- Invoke `su` to execute commands as other users; for example, `trafodion`.
- Edit `sysctl.conf` and activate changes using `sysctl -p`:
  - Modify kernel limits.
  - Reserve IP ports.

<sup>1</sup> `sudo` is **required** in the current release of Trafodion. This restriction may be relaxed in later releases. Alternative mechanisms for privileged access (such as running as `root` or `sudo` alternative commands) are not supported.

## Distribution Manager User

A user ID that can change the configuration using Apache Ambari or Cloudera Manager. The Trafodion Installer makes REST request to perform configuration and control functions to the distribution manager using this user ID.

### Requirements:

- Administrator user name and password.
- URL to Distribution Manager's REST API.

## HDFS Administrator User

The HDFS super user. Required to create directories and change security settings, as needed. The Trafodion Installer uses `su` to run commands under this user ID.

**Requirements:**

- HDFS Administrator user name.
- Write access to home directory on the node where the Distribution Manager is running.

**HBase Administrator User**

The HBase super user. Required to change directory ownership in HDFS.

**Requirements:**

- HBase Administrator user name and group.
- Read access to `hbase-site.xml`.

## 3.4. Required Configuration Changes

Trafodion requires changes to a number of different areas of your system configuration: operating system, HDFS, and HBase.



These changes are performed by the Trafodion Installer, if used.

### 3.4.1. Operating System Changes

`/etc/security/limits.d/trafodion.conf` on each node in the cluster must contain the following settings:

```
# Trafodion settings
trafodion soft core unlimited
trafodion hard core unlimited
trafodion soft memlock unlimited
trafodion hard memlock unlimited
trafodion soft nofile 32768
trafodion hard nofile 65536
trafodion soft nproc 100000
trafodion hard nproc 100000
```

### 3.4.2. ZooKeeper Changes



These changes require a restart of ZooKeeper on all nodes in the cluster.

Trafodion requires the following changes to `zoo.cfg`:

Setting	New Value	Purpose
<code>maxClientCnxns</code>	0	Tell ZooKeeper to impose no limit to the number of connections to enable better Trafodion concurrency.

### 3.4.3. HDFS Changes



These changes require a restart of HDFS on all nodes in the cluster.

Trafodion requires the following changes to the HDFS environment:

Action	Purpose
<ul style="list-style-type: none"> <li>• Create <code>/hbase-staging</code> directory.</li> <li>• Change owner to HBase Administrator.</li> </ul>	
<ul style="list-style-type: none"> <li>• Create <code>/bulkload</code> directory.</li> <li>• Change owner to <code>trafodion</code>.</li> </ul>	Used to stage data when processing the Trafodion <a href="#">LOAD INTO table</a> statement and as a temporary directory to create links to actual HFile for snapshot scanning.
<ul style="list-style-type: none"> <li>• Create <code>/lobs</code> directory.</li> <li>• Change owner to <code>trafodion</code>.</li> </ul>	
<ul style="list-style-type: none"> <li>• Create <code>/apps/hbase/data/archive<sup>1</sup></code>.</li> <li>• Change owner to: <code>hbase:hbase</code> (Cloudera) or <code>hbase:hdfs</code> (Hortonworks)</li> <li>• Give the <code>trafodion</code> user RWX access to <code>/apps/hbase/data/archive</code></li> <li>• Set default user of <code>/apps/hbase/data/archive</code> to <code>trafodion</code></li> <li>• Recursively change <code>setfacl</code> of <code>/apps/hbase/data/archive</code> to RWX</li> </ul>	

1. These steps are performed **after** HDFS ACLs have been enabled.

The following changes are required in `hdfs-site.xml`:

Setting	New Value	Purpose
<code>dfs.namenode.acls.enabled</code>	<code>true</code>	Enable HDFS POSIX Access Control Lists (ACLs).

### 3.4.4. HBase Changes



These changes require a restart of ZooKeeper and HBase on all nodes in the cluster.

Trafodion requires that the following changes to the HBase environment:

Action	Affected Directories	Purpose
Install/replace Trafodion's version of hbase-trx	<ul style="list-style-type: none"> <li>• /usr/lib/hbase/lib/</li> <li>• /usr/share/cmf/lib/plugins/ (Cloudera)</li> <li>• /usr/hdp/current/hbase-regionserver/lib/ (Hortonworks)</li> </ul>	Trafodion transaction management relies on an enhanced version of hbase-trx.
Install/Replace Trafodion utility jar file.	<ul style="list-style-type: none"> <li>• /usr/lib/hbase/lib/</li> <li>• /usr/share/cmf/lib/plugins/ (Cloudera)</li> <li>• /usr/hdp/current/hbase-regionserver/lib (Hortonworks)</li> </ul>	TODO: Add purpose here.

The following changes are required in `hbase-site.xml`. Please refer to the [Apache HBase™ Reference Guide](#) for additional descriptions of these settings.

Setting	New Value	Purpose
hbase.master.distributed.log.splitting	false	Do not use the HBase Split Log Manager. Instead, the HMaster controls all log-splitting activities.
hbase.coprocessor.region.classes	org.apache.hadoop.hbase.coprocessor.transactional.TrxRegionObserver, org.apache.hadoop.hbase.coprocessor.transactional.TrxRegionEndpoint, org.apache.hadoop.hbase.coprocessor.AggregateImplementation	Install Trafodion coprocessor classes.
hbase.hregion.impl	org.apache.hadoop.hbase.regionserver.transactional.TransactionRegion	Trafodion needs to be able to read the Write Ahead Log from a coprocessor using the getScanner method. This method is protected in standard HBase. This change overloads the getScanner method to be public thereby allowing coprocessor code to use it.
hbase.regionserver.region.split.policy	org.apache.hadoop.hbase.regionserver.ConstantSizeRegionSplitPolicy	Tell HBase to use the ConstantSizeRegionSplitPolicy for region splitting. This setting causes region splitting to occur only when the maximum file size is reached.
hbase.snapshot.enabled	true	Enable the HBase Snapshot feature. Used for Trafodion backup and restore.
hbase.bulkload.staging.dir	hbase-staging	Use /hbase-staging as the bulk load staging directory.

Setting	New Value	Purpose
hbase.regionserver.region.transactional.tlog	true	The HBase Regions requests that the Transaction Manager re-drives in-doubt transactions.
hbase.snapshot.master.timeoutMillis	600000	HMaster timeout when waiting for RegionServers involved in the snapshot operation.
hbase.snapshot.region.timeout	600000	RegionServer timeout when waiting for snapshot to be created.
hbase.client.scanner.timeout.period	600000	Time limit to perform a scan request.
hbase.regionserver.lease.period	600000	Clients must report within this time limit or they are considered dead by HBase.
hbase.namenode.java.heapsize <sup>1</sup>	1073741824 (1GB)	Java Heap Size for the HDFS NameNode.
hbase.secondary.namenode.java.heapsize <sup>1</sup>	1073741824 (1GB)	Java Heap Size for the HDFS Secondary NameNode.

1. Applies to Cloudera distributions only.

## 3.5. Recommended Configuration Changes

The following configuration changes are recommended but not required.



The Trafodion Installer does **not** make these changes.

### 3.5.1. Recommended Security Changes

The `trafodion` user ID should not be given other `sudo` privileges than what's specified in this manual. Also, we recommend that this user ID is locked (`sudo passwd -l trafodion`) once the installation/upgrade activity has been completed. Users that need issue commands as the `trafodion` ID should do so using `sudo`; for example, `sudo -u trafodion -i`.

### 3.5.2. Recommended HDFS Configuration Changes

These settings are configured in the `hadoop-env.sh` file.

Property	Recommended Setting	Guidance
DataNode Java Heap Size	2 GB	Use this setting for a large configuration.
NameNode Java Heap Size	2 GB	Use this setting for a large configuration.
Secondary NameNode Java Heap Size	2 GB	Use this setting for a large configuration.



### 3.5.3. Recommended HBase Configuration Changes

Configuration Property	Recommended Setting	Guidance
hbase.rpc.timeout	10 minutes	This setting depends on the tables' size. Sixty (60) seconds is the default. Increase this value for big tables. Make it the same value as <code>hbase.client.scanner.timeout.period</code> . We have found that increasing the setting to six-hundred (600) seconds will prevent many of the timeout-related errors we encountered, such as <code>OutOfOrderNextException</code> errors.
hbase.client.scanner.timeout.period	10 minutes	Similar to the <code>hbase.rpc.timeout</code> setting. Sixty (60) seconds is the default. Depending on the size of a user table, we have experienced timeout failures on <code>count(*)</code> and update statistics commands from this setting. The underlying issue is the length of the execution of the coprocessor within HBase. NOTE: HBase uses the smaller of <code>hbase.rpc.timeout</code> and <code>hbase.client.scanner.timeout.period</code> to calculate the scanner timeout.
hbase.snapshot.master.timeoutMillis and hbase.snapshot.region.timeout	10 minutes	HBase's default setting is 60000 milliseconds. If you experience timeout issues with HBase snapshots when you use the Trafodion Bulk Loader or other statements, you can set the value for these two HBase properties to 10 minutes (600,000 milliseconds).
hbase.hregion.max.filesize	107374182400 bytes	HBase's default setting is 10737418240 (10 GB). We have increased the setting to 107374182400 (100 GB), which reduces the number of <code>HStoreFiles</code> per table and appears to reduce disruptions to active transactions from region splitting.
hbase.hstore.blockingStoreFiles	10	<a href="http://gbif.blogspot.com/2012/07/optimizing-writes-in-hbase.html">http://gbif.blogspot.com/2012/07/optimizing-writes-in-hbase.html</a>
hbase.regionserver.handler.count	<num>	This setting should match the number of concurrent sessions ( <code>mxosrvr</code> ). The default is 10.

## Chapter 4. Prepare

You need to prepare your Hadoop environment before installing Trafodion.

1. [Install Optional Workstation Software](#)
2. [Configure Installation User ID](#)
3. [Disable requiretty](#)
4. [Verify OS Requirements and Recommendations](#)
5. [Configure LDAP Identity Store](#)
6. [Gather Configuration Information](#)
7. [Install Required Software Packages](#)
8. [Perform Recipe-Based Provisioning Tasks](#)

### 4.1. Install Optional Workstation Software

If you are using a Windows workstation, then the following optional software helps installation process. We recommended that you pre-install the software before continuing with the Trafodion installation:

- putty and puttygen (download from [PuTTY web site](#))
- VNC client (download from [RealVNC web site](#))
- Firefox or Chrome browser
- SFTP client to transfer files from your workstation to the Linux server: WinSCP or FileZilla

### 4.2. Configure Installation User ID

Trafodion installation requires a user ID with these attributes:

- `sudo` access per the requirements documented in [Linux Installation User](#).
- passwordless ssh to all nodes on the cluster where Trafodion will be installed.



You may need to request permission from your cluster-management team to obtain this type of access.

The following example shows how to set up your user ID to have "passwordless ssh" abilities.

Do the following on the Provision Master Node:

```
echo -e 'y\n' | ssh-keygen -t rsa -N "" -f $HOME/.ssh/id_rsa
cat $HOME/.ssh/id_rsa.pub >> $HOME/.ssh/authorized_keys
echo localhost $(cat /etc/ssh/ssh_host_rsa_key.pub) >> $HOME/.ssh/known_hosts
echo "NoHostAuthenticationForLocalhost=yes" >> $HOME/.ssh/config
chmod 600 $HOME/.ssh/config
chmod 600 $HOME/.ssh/authorized_keys
chmod 700 $HOME/.ssh/
```

After running these commands, do the following:

- If necessary, create the `$HOME/.ssh` directory on the other nodes in your cluster and secure it private to yourself (`chmod 700`).
- If necessary, create the `$HOME/.ssh/authorized_keys` file on the other nodes in your cluster. Secure it with `chmod 600 $HOME/.ssh/authorized_keys`.
- Copy the content of the `$HOME/.ssh/authorized_keys` file on the Provisioning Master Node and append the to the `$HOME/.ssh/authorized_keys` file on the other nodes in your cluster.
- `ssh` to the other nodes in the cluster. Answer `y` to the prompt asking you whether to continue the connection. This adds the node to the `$HOME/.ssh/known_hosts` file completing the passwordless `ssh` setup.

### 4.3. Disable requiretty

You need to disable `requiretty` in `/etc/sudoers` on all nodes in the cluster to ensure that `sudo` commands can be run from inside the installation scripts.

Comment out the `Defaults requiretty` setting in the `/etc/sudoers` file to ensure that the `requiretty` option is NOT being used.

### 4.4. Verify OS Requirements and Recommendations

Please ensure that the [OS Requirements and Recommendations](#) are met for each node in the cluster where you intend to install Trafodion.

## 4.5. Configure LDAP Identity Store

If you plan to enable security in Trafodion, then you need to have an LDAP identity store available to perform authentication. The Trafodion Installer prompts you to set up an authentication configuration file that points to an LDAP server (or servers), which enables security (that is, authentication and authorization) in the Trafodion database.

If you wish to manually set up the authentication configuration file and enable security, then refer to the section on [Enable Security](#).

## 4.6. Gather Configuration Information

You need to gather/decide information about your environment to aid installation Trafodion, both for the Trafodion Installer and for recipe-based provisioning. (Listed in alphabetical order to make it easier to find information when referenced in the install and upgrade instructions.)

ID <sup>1</sup>	Information	Default	Notes
ADMIN	Administrator user name for Apache Ambari or Cloudera Manager.	admin	A user that can change configuration and restart services via the distribution manager's REST API.
BACKUP_DCS_NODES	List of nodes where to start the backup DCS Master components.	None	Blank separated FQDN list. Not needed if \$ENABLE_HA = N.
CLOUD_CONFIG	Whether you're installing Trafodion on a cloud environment.	N	N = bare-metal or VM installation.
CLOUD_TYPE	What type of cloud environment you're installing Trafodion on.	None	{ AWS   OpenStack   Other }. Not applicable for bare-metal or VM installation.
CLUSTER_NAME	The name of the Hadoop Cluster.	None	From Apache Ambari or Cloudera Manager.
DCS_BUILD	Tar file containing the DCS component.	None	Not needed if using a Trafodion package installation tar file.
DCS_PRIMARY_MASTER_NODE	The node where the primary DCS should run.	None	The DCS Master handles JDBC and ODBC connection requests.
DCS_SERVER_PARM	Number of concurrent client sessions per node.	16	This number specifies the concurrent sessions per node to be supported. Each session could require up to 1GB of physical memory. The number can be changed post-installation. For more information, refer to the <a href="#">Trafodion Client Installation Guide</a> .
ENABLE_HA	Whether to run DCS in high-availability (HA) mode.	N	You need the floating IP address, the interface, and the backup nodes for DCS Master if enabling this feature.
EPEL_RPM	Location of EPEL RPM.	None	Specify if you don't have access to the Internet. Downloaded automatically by the Trafodion Installer.

ID <sup>1</sup>	Information	Default	Notes
FLOATING_IP	IP address if running DCS in HA mode.	None	Not needed if \$ENABLE_HA = N. An FQDN name or IP address.
HADOOP_TYPE	The type of Hadoop distribution you're installing Trafodion on.	None	Lowercase. cloudera or hadoop.
HBASE_GROUP	Linux group name for the HBASE administrative user.	hbase	Required in order to provide access to select HDFS directories to this user ID.
HBASE_USER	Linux user name for the HBASE administrative user.	hbase	Required in order to provide access to select HDFS directories to this user ID.
HDFS_USER	Linux user name for the HDFS administrative user.	hdfs	The Trafodion Installer uses <code>sudo su</code> to make HDFS configuration changes under this user.
HOME_DIR	Root directory under which the <code>trafodion</code> home directory should be created.	/home	<b>Example</b>  If the home directory of the <code>trafodion</code> user is <code>/opt/home/trafodion</code> , then specify the root directory as <code>/opt/home</code> .
INIT_TRAFODION	Whether to automatically initialize the Trafodion database.	N	Does not apply to Recipe-Based Provisioning. Applies if \$START=Y only.
INTERFACE	Interface type used for \$FLOATING_IP.	None	Not needed if \$ENABLE_HA = N.
JAVA_HOME	Location of Java 1.7.0_65 or higher (JDK).	\$JAVA_HOME setting	Fully qualified path of the JDK. For example: <code>/usr/java/jdk1.7.0_67-cloudera</code>
LDAP_CERT <sup>2</sup>	Full path to TLS certificate.	None	Required of \$LDAP_LEVEL = 1 or 2.
LDAP_HOSTS <sup>2</sup>	List of nodes where LDAP Identity Store servers are running.	None	Blank separated. FQDN format.
LDAP_ID <sup>2</sup>	List of LDAP unique identifiers.	None	Blank separated.
LDAP_LEVEL <sup>2</sup>	LDAP Encryption Level.	0	0: Encryption not used, 1: SSL, 2: TLS
LDAP_PASSWORD <sup>2</sup>	Password for LDAP_USER.	None	If LDAP_USER is required only.
LDAP_PORT <sup>2</sup>	Port used to communicate with LDAP Identity Store.	None	Examples: 389 for no encryption or TLS, 636 for SSL.
LDAP_SECURITY <sup>2</sup>	Whether to enable simple LDAP authentication.	N	If Y, then you need to provide LDAP_HOSTS.
LDAP_USER <sup>2</sup>	LDAP Search user name.	None	If required. If so, must provide LDAP_PASSWORD, too.
LOCAL_WORKDIR	The directory where the Trafodion Installer is located.	None	Full path, no environmental variables.
MANAGEMENT_ENABLED	Whether your installation uses separate management nodes.	N	Y if using separate management nodes for Apache Ambari or Cloudera Manager.
MANAGEMENT_NODES	The FQDN names of management nodes, if any.	None	Provide a blank-separated list of node names.
NODE_LIST	The FQDN names of the nodes where Trafodion will be installed.	None	Provide a blank-separated list of node names. The Trafodion Provisioning ID must have passwordless and <code>sudo</code> access to these nodes.

ID <sup>1</sup>	Information	Default	Notes
PASSWORD	Administrator password for Apache Ambari or Cloudera Manager.	admin	A user that can change configuration and restart services via the distribution manager's REST API.
REST_BUILD	Tar file containing the REST component.	None	Not needed if using a Trafodion package installation tar file.
SQ_ROOT	Target directory for the Trafodion software.	\$HOME_DIR/trafodion	Trafodion is installed in this directory on all nodes in \$NODE_LIST.
START	Whether to start Trafodion after install/upgrade.	N	Does not apply to Recipe-Based Provisioning.
SUSE_LINUX	Whether your installing Trafodion on SUSE Linux.	false	Auto-detected by the Trafodion Installer.
TRAF_PACKAGE	The location of the Trafodion installation package tar file or core installation tar file.	None	The package file contains the Trafodion server, DCS, and REST software while the core installation file contains the Trafodion server software only. If you're using a core installation file, then you need to record the location of the DCS and REST installation tar files, too. Normally, you perform Trafodion provisioning using a Trafodion package installation tar file.
TRAF_USER	The Trafodion runtime user ID.	trafodion	Must be <code>trafodion</code> in this release.
TRAF_USER_PASSWORD	The password used for the <code>trafodion:trafodion</code> user ID.	traf123	Must be 6-8 characters long.
URL	FQDN and port for the Distribution Manager's REST API.	None	Include <code>http://</code> or <code>https://</code> as applicable. Specify in the form: <code>&lt;IP-address&gt;:&lt;port&gt;</code> or <code>&lt;node name&gt;:&lt;port&gt;</code> Example: <a href="https://susevm-1.yourcompany.local:8080">https://susevm-1.yourcompany.local:8080</a>

1. The ID matches the environmental variables used in the Trafodion Installation configuration file. Refer to [Trafodion Installer](#) for more information.
2. Refer to [Enable Security](#) for more information about these security settings.

## 4.7. Install Required Software Packages

### 4.7.1. Download and Install Packages

This step is required if you're:

- Installing Trafodion on SUSE.
- Using Recipe-Based Provisioning.
- Can't download the required software packages using the Internet.

If none of these situations exist, then we highly recommend that you use the Trafodion Installer.

You perform this step as a user with `root` or `sudo` access.

Install the packages listed in [Software Packages](#) above on all nodes in the cluster. Note the special handling for `log4c++`.

See [Install log4c++](#) below for more information.

## 4.7.2. Install log4c++

You perform this step as a user with `root` or `sudo` access.

This step is required regardless of the [Provisioning Options](#) used.

1. Download the log4c++ RPM from the Trafodion [Download](#) page.
2. Copy and Install the log4c++ RPM on All Nodes

Use either `rpm -U` or `yum install`.

### Example

```
# Repeat for all nodes in the cluster from the Provisioning Master Node
scp log4cxx-0.10.0-13.el6.x86_64.rpm <other-node>:$PWD

ssh <other-node>
sudo yum -y install log4cxx-0.10.0-13.el6.x86_64.rpm
exit
```



### 3. Verify RPM Installation on Every Node

Use the following command to verify that `log4cxx` has been installed on every node in the cluster.

```
# Repeat for all nodes in the cluster
sudo rpm -qa | grep log4cxx
log4cxx-0.10.0-13.el6.x86_64
```

## 4.8. Download Trafodion Binaries

You download the Trafodion binaries from the Trafodion [Download](#) page. Download the following packages:

- Trafodion Installer (if planning to use the Trafodion Installer)
- Trafodion Server



You can download and install the Trafodion Clients once you've installed and activated Trafodion. Refer to the [Trafodion Client Install Guide](#) for instructions.

### Example

<http://apache.cs.utah.edu/incubator/celix/celix-1.0.0.incubating/celix-1.0.0.incubating.tar.gz>

```
$ mkdir $HOME/trafodion-download
$ cd $HOME/trafodion-download
$ # Download the Trafodion Installer binaries
$ wget http://apache.cs.utah.edu/incubator/trafodion/trafodion-1.3.0.incubating/apache-
trafodion-installer-1.3.0-incubating-bin.tar.gz
Resolving http://apache.cs.utah.edu... 192.168.1.56
Connecting to http://apache.cs.utah.edu|192.168.1.56|:80... connected.
HTTP request sent, awaiting response... 200 OK
Length: 68813 (67K) [application/x-gzip]
Saving to: "apache-trafodion-installer-1.3.0-incubating-bin.tar.gz"

100%[=====
=====>] 68,813          124K/s   in 0.5s

2016-02-14 04:19:42 (124 KB/s) - "apache-trafodion-installer-1.3.0-incubating-
bin.tar.gz" saved [68813/68813]
```

```

$ # Download the Trafodion Server binaries
$ wget http://apache.cs.utah.edu/incubator/trafodion/trafodion-1.3.0.incubating/apache-
trafodion-1.3.0-incubating-bin.tar.gz
Resolving http://apache.cs.utah.edu... 192.168.1.56
Connecting to http://apache.cs.utah.edu|192.168.1.56|:80... connected.
HTTP request sent, awaiting response... 200 OK
Length: 214508243 (205M) [application/x-gzip]
Saving to: "apache-trafodion-1.3.0-incubating-bin.tar.gz"

100%[=====
=====>] 214,508,243 3.90M/s   in 55s

2016-02-14 04:22:14 (3.72 MB/s) - "apache-trafodion-1.3.0-incubating-bin.tar.gz" saved
[214508243/214508243]

$ ls -l
total 209552
-rw-rw-r-- 1 centos centos 214508243 Jan 12 20:10 apache-trafodion-1.3.0-incubating-
bin.tar.gz
-rw-rw-r-- 1 centos centos      68813 Jan 12 20:10 apache-trafodion-installer-1.3.0-
incubating-bin.tar.gz
$

```

## 4.9. Preparation for Recipe-Based Provisioning



This step should be skipped if you plan to use the Trafodion Installer

### 4.9.1. Modify OS Settings

Ensure that the `/etc/security/limits.d/trafodion.conf` on each node contains the limits settings required by Trafodion. Refer to [Operating System Changes](#) for the required settings.

### 4.9.2. Modify ZooKeeper Configuration

Do the following:

1. Modify the ZooKeeper configuration as follows:

Attribute	Setting
maxClientCnxns	0

2. Restart ZooKeeper to activate the new configuration setting.

### 4.9.3. Modify HDFS Configuration

Do the following:

1. Modify the HDFS configuration as follows:

Attribute	Setting
dfs.namenode.acls.enabled	true

2. Restart HDFS to activate the new configuration setting.

### 4.9.4. Modify HBase Configuration

Do the following:

1. Modify the HBase configuration as follows:

Attribute	Setting
hbase.master.distributed.log.splitting	false
hbase.coprocessor.region.classes	org.apache.hadoop.hbase.coprocessor.transactional.TrxRegionObserver,org.apache.hadoop.hbase.coprocessor.transactional.TrxRegionEndpoint,org.apache.hadoop.hbase.coprocessor.AggregateImplementation
hbase.hregion.impl	org.apache.hadoop.hbase.regionserver.transactional.TransactionRegion
hbase.regionserver.region.split.policy	org.apache.hadoop.hbase.regionserver.ConstantSizeRegionSplitPolicy
hbase.snapshot.enabled	true
hbase.bulkload.staging.dir	hbase-staging
hbase.regionserver.region.transactional.tlog	true
hbase.snapshot.master.timeoutMillis	600000
hbase.snapshot.region.timeout	600000
hbase.client.scanner.timeout.period	600000
hbase.regionserver.lease.period	600000
hbase.namenode.java.heapsize <sup>a</sup>	1073741824
hbase.secondary.namenode.java.heapsize <sup>a</sup>	1073741824

a) Applies to Cloudera distributions only.

2. Restart HBase to activate the new configuration setting.

## Chapter 5. Install

This chapter describes how to use the Trafodion Installer to install Trafodion. You use the Trafodion Provisioning ID to run the Trafodion Installer.



Prior to version 2.0.0, you **must** install log4c++ on all nodes in the cluster prior to running the Trafodion Installer. Refer to [Build and Install log4c++](#) for instructions.

### 5.1. Unpack Installer

You should already have downloaded the Trafodion Binaries per the instructions in the [Download Trafodion Binaries](#) in the [Prepare](#) chapter. If not, please do so now.

The first step in the installation process is to unpack the Trafodion Installer tar file.

#### Example

```
$ mkdir $HOME/trafodion-installer
$ cd $HOME/trafodion-downloads
$ tar -zxvf apache-trafodion-installer-1.3.0-incubating-bin.tar.gz -C $HOME/trafodion-
installer
$ ls $HOME/trafodion-installer/installer
bashrc_default          tools                  traf_config_check
trafodion_apache_hadoop_install traf_package_setup
build-version-1.3.0.txt traf_add_user          traf_config_setup
trafodion_config_default traf_setup
dcs_installer           traf_apache_hadoop_config_setup traf_create_systemdefaults
trafodion_install       traf_sqconfig
rest_installer           traf_authentication_conf_default traf_getHadoopNodes
trafodion_license        traf_start
setup_known_hosts.exp   traf_cloudera_mods98   traf_hortonworks_mods98
trafodion_uninstaller
$
```

### 5.2. Automated Install

The `--config_file` option runs the Trafodion in Automated Setup mode. Refer to [Trafodion Installer](#) in the [Introduction](#) chapter for instructions of how you edit your configuration file.

Edit your config file using the information you collected in the [Gather Configuration Information](#) step in the [Prepare](#) chapter.

The following example shows an automated install of Trafodion on a two-node Hortonworks Hadoop cluster.



By default, the Trafodion Installer invokes `sqlci` so that you can enter the `initialize trafodion;` command. This is shown in the example below.

## Example

1. Run the Trafodion Installer in Automated Setup mode.

```
$ cd $HOME/trafodion-installer/installer
$ ./trafodion_install --config_file my
*****
  TRAFODION INSTALLATION START
*****

***INFO: testing sudo access
***INFO: Log file located at /var/log/trafodion/trafodion_install_2016-02-16-21-12-03.log
***INFO: Config directory: /etc/trafodion
***INFO: Working directory: /usr/lib/trafodion

*****
  Trafodion Configuration File Check
*****

***INFO: Testing sudo access on node trafodion-1
***INFO: Testing sudo access on node trafodion-2
***INFO: Testing ssh on trafodion-1
***INFO: Testing ssh on trafodion-2
***INFO: Getting list of all hortonworks nodes
***INFO: Getting list of all hortonworks nodes
***INFO: hortonworks list of nodes:  trafodion-1 trafodion-2
***INFO: Testing ssh on trafodion-1
***INFO: Testing ssh on trafodion-2
***INFO: Testing sudo access on trafodion-1
***INFO: Testing sudo access on trafodion-2
***DEBUG: trafodionFullName=trafodion_server-1.3.0.tgz
***INFO: Trafodion version = 1.3.0
***DEBUG: HBase's java_exec=/usr/jdk64/jdk1.7.0_67/bin/java

*****
  TRAFODION SETUP
*****

***INFO: Starting Trafodion environment setup (2016-02-16-21-12-31)
=== 2016-02-16-21-12-31 ===
# @@@ START COPYRIGHT @@@
#
# Licensed to the Apache Software Foundation (ASF) under one
# or more contributor license agreements.  See the NOTICE file
```

```

# distributed with this work for additional information
# regarding copyright ownership. The ASF licenses this file
# to you under the Apache License, Version 2.0 (the
# "License"); you may not use this file except in compliance
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9. Accepting Warranty or Additional Liability. While redistributing
the Work or Derivative Works thereof, You may choose to offer, and
charge a fee for, acceptance of support, warranty, indemnity, or
other liability obligations and/or rights consistent with this
License. However, in accepting such obligations, You may act only
on Your own behalf and on Your sole responsibility, not on behalf
of any other Contributor, and only if You agree to indemnify, defend,
and hold each Contributor harmless for any liability incurred by,
or claims asserted against, such Contributor by reason of your
accepting any such warranty or additional liability.

END OF TERMS AND CONDITIONS

BY TYPING "ACCEPT" YOU AGREE TO THE TERMS OF THIS AGREEMENT: ***INFO: testing sudo
access
***INFO: Checking all nodes in specified node list
trafodion-1
trafodion-2
***INFO: Total number of nodes = 2
***INFO: Starting Trafodion Package Setup (2016-02-16-21-12-35)
***INFO: Installing required packages
***INFO: Log file located in /var/log/trafodion
***INFO: ... EPEL rpm
***INFO: ... pdsh on node trafodion-1
***INFO: ... pdsh on node trafodion-2
***INFO: Checking if log4cxx is installed ...
***INFO: Checking if sqlite is installed ...
***INFO: Checking if expect is installed ...
.
.
.
***INFO: trafodion user added successfully
***INFO: Trafodion environment setup completed
***INFO: creating sqconfig file
***INFO: Reserving DCS ports

*****
TRAFODION MODS
*****

***INFO: Hortonworks installed will run traf_hortonworks_mods98
***INFO: Detected JAVA version 1.7
***INFO: copying hbase-trx-hdp2_2-1.3.0.jar to all nodes
PORT=:8080
##### Performing 'set' hbase.master.distributed.log.splitting:false on
(Site:hbase-site, Tag:version1)

```

```
##### PUTting json into: doSet_version1455657199513777160.json
.
.
.
Starting the REST environment now
starting rest, logging to /home/trafodion/apache-trafodion-1.3.0-incubating-
bin/rest-1.3.0/bin/./logs/rest-trafodion-1-rest-trafodion-1.out
SLF4J: Class path contains multiple SLF4J bindings.
SLF4J: Found binding in [jar:file:/home/trafodion/apache-trafodion-1.3.0-incubating-
bin/rest-1.3.0/lib/slf4j-log4j12-1.7.5.jar!/org/slf4j/impl/StaticLoggerBinder.class]
SLF4J: Found binding in [jar:file:/usr/hdp/2.2.9.0-3393/hadoop/lib/slf4j-log4j12-
1.7.5.jar!/org/slf4j/impl/StaticLoggerBinder.class]
SLF4J: See http://www.slf4j.org/codes.html#multiple_bindings for an explanation.
SLF4J: Actual binding is of type [org.slf4j.impl.Log4jLoggerFactory]

DcsMaster is not started. Please start DCS using 'dcsstart' command...

Process           Configured      Actual          Down
-----
DcsMaster         1              0              1
DcsServer         2              0              2
mxosrvr          8              8

You can monitor the SQ shell log file : /home/trafodion/apache-trafodion-1.3.0-
incubating-bin/logs/sqmon.log

Startup time  0 hour(s) 1 minute(s) 9 second(s)
Apache Trafodion Conversational Interface 1.3.0
Copyright (c) 2015 Apache Software Foundation
>> initialize trafodion;
--- SQL operation complete.
>>

End of MXCI Session

***INFO: Installation completed successfully.

*****
TRAFODION INSTALLATION COMPLETE
*****

$
```

2. Switch to the Trafodion Runtime User and check the status of Trafodion.

### Example

```
$ sudo su - trafodion
$ sqcheck
Checking if processes are up.
Checking attempt: 1; user specified max: 2. Execution time in seconds: 0.
```

The SQ environment is up!

Process	Configured	Actual	Down
-----	-----	-----	----
DTM	2	2	
RMS	4	4	
MXOSRVR	8	8	

\$

Trafodion is now running on your Hadoop cluster. Please refer to the [Activate](#) chapter for basic instructions on how to verify the Trafodion management and how to perform basic management operations.

## 5.3. Guided Install

The Trafodion Installer prompts you for the information you collected in the [Gather Configuration Information](#) step in the [Prepare](#) chapter.

The following example shows a guided install of Trafodion on a two-node Cloudera Hadoop cluster.



By default, the Trafodion Installer invokes `sqlci` so that you can enter the `initialize trafodion;` command. This is shown in the example below.

### Example

1. Run the Trafodion Installer in guided mode.

```
$ cd $HOME/trafodion-installer/installer
$ ./trafodion_install

*****
TRAFODION INSTALLATION START
*****

***INFO: testing sudo access
***INFO: Log file located at /var/log/trafodion/trafodion_install_2016-02-15-04-45-30.log
***INFO: Config directory: /etc/trafodion
***INFO: Working directory: /usr/lib/trafodion
```



```

*****
Trafodion Configuration Setup
*****

***INFO: Please press [Enter] to select defaults.

Enter trafodion password, default is [traf123]: traf123
Enter list of nodes (blank separated), default []: trafodion-1 trafodion-2
Enter Trafodion userid's home directory prefix, default is [/home]: /home
Specify full path to EPEL RPM (including .rpm), default is None:
***INFO: Will attempt to download RPM if EPEL is not installed on all nodes.
Specify location of Java 1.7.0_65 or higher (JDK), default is []:
/usr/java/jdk1.7.0_67-cloudera
Enter full path (including .tar or .tar.gz) of trafodion tar file []:
/home/centos/trafodion-download/apache-trafodion-1.3.0-incubating-bin.tar.gz
Enter Hadoop admin username, default is [admin]:
Enter Hadoop admin password, default is [admin]:
Enter Hadoop external network URL:port (no 'http://' needed), default is []:
trafodion-1.apache.org:7180
Enter HDFS username, default is [hdfs]:
Enter HBase username, default is [hbase]:
Enter HBase group, default is [hbase]:
Enter directory to install trafodion to, default is [/home/trafodion/apache-
trafodion-1.3.0-incubating-bin]:
Total number of client connections per node, default [16]: 8
Enable simple LDAP security (Y/N), default is N: N
***INFO: Configuration file: /etc/trafodion/trafodion_config
***INFO: Trafodion configuration setup complete

*****
Trafodion Configuration File Check
*****

The authenticity of host 'trafodion-1 (10.1.30.71)' can't be established.
RSA key fingerprint is 83:96:d4:5e:c1:b8:b1:62:8d:c6:78:a7:7f:1f:6a:d7.
Are you sure you want to continue connecting (yes/no)? yes
***INFO: Testing sudo access on node trafodion-1
***INFO: Testing sudo access on node trafodion-2
***INFO: Testing ssh on trafodion-1
***INFO: Testing ssh on trafodion-2
***INFO: Getting list of all cloudera nodes
***INFO: Getting list of all cloudera nodes
***INFO: cloudera list of nodes: trafodion-1 trafodion-2
***INFO: Testing ssh on trafodion-1
***INFO: Testing ssh on trafodion-2
***INFO: Testing sudo access on trafodion-1
***INFO: Testing sudo access on trafodion-2
***DEBUG: trafodionFullName=trafodion_server-1.3.0.tgz
***INFO: Trafodion version = 1.3.0
***DEBUG: HBase's java_exec=/usr/java/jdk1.7.0_67-cloudera/bin/java

*****

```

```

TRAFODION SETUP
*****

***INFO: Starting Trafodion environment setup (2016-02-15-07-09-58)
=== 2016-02-15-07-09-58 ===
# @@@ START COPYRIGHT @@@
#
# Licensed to the Apache Software Foundation (ASF) under one
# or more contributor license agreements. See the NOTICE file
# distributed with this work for additional information
# regarding copyright ownership. The ASF licenses this file
# to you under the Apache License, Version 2.0 (the
# "License"); you may not use this file except in compliance
# with the License. You may obtain a copy of the License at
#
#
#
and hold each Contributor harmless for any liability incurred by,
or claims asserted against, such Contributor by reason of your
accepting any such warranty or additional liability.

END OF TERMS AND CONDITIONS

BY TYPING "ACCEPT" YOU AGREE TO THE TERMS OF THIS AGREEMENT:ACCEPT
***INFO: testing sudo access
***INFO: Checking all nodes in specified node list
trafodion-1
trafodion-2
***INFO: Total number of nodes = 2
***INFO: Starting Trafodion Package Setup (2016-02-15-07-11-09)
***INFO: Installing required packages
***INFO: Log file located in /var/log/trafodion
***INFO: ... pdsh on node trafodion-1
***INFO: ... pdsh on node trafodion-2
***INFO: Checking if log4cxx is installed ...
***INFO: Checking if sqlite is installed ...
***INFO: Checking if expect is installed ...
***INFO: Installing expect on all nodes
.
.
.
***INFO: modifying limits in /usr/lib/trafodion/trafodion.conf on all nodes
***INFO: create Trafodion userid "trafodion"
***INFO: Trafodion userid's (trafodion) home directory: /home/trafodion
***INFO: testing sudo access
Generating public/private rsa key pair.
Created directory '/home/trafodion/.ssh'.
Your identification has been saved in /home/trafodion/.ssh/id_rsa.
Your public key has been saved in /home/trafodion/.ssh/id_rsa.pub.
The key fingerprint is:
4b:b3:60:38:c9:9d:19:f8:cd:b1:c8:cd:2a:6e:4e:d0 trafodion@trafodion-1
The key's randomart image is:
+--[ RSA 2048 ]-----+

```

```

|      .      |
|      . . .  |
|    o * X o  |
|  . E X S    |
|  . o + +    |
|    o . o    |
|    o..      |
|    oo       |
+-----+
***INFO: creating .bashrc file
***INFO: Setting up userid trafodion on all other nodes in cluster
***INFO: Creating known_hosts file for all nodes
trafodion-1
trafodion-2
***INFO: trafodion user added successfully
***INFO: Trafodion environment setup completed
***INFO: creating sqconfig file
***INFO: Reserving DCS ports

*****
TRAFODION MODS
*****

***INFO: Cloudera installed will run traf_cloudera_mods98
***INFO: Detected JAVA version 1.7
***INFO: copying hbase-trx-cdh5_3-1.3.0.jar to all nodes
***INFO: Cloudera Manager is on trafodion-1
***INFO: Detected JAVA version 1.7
***INFO: copying hbase-trx-cdh5_3-1.3.0.jar to all nodes
***INFO: Cloudera Manager is on trafodion-1
% Total      % Received % Xferd  Average Speed   Time    Time     Time  Current
.
.
.
***INFO: Hadoop restart completed successfully
***INFO: waiting for HDFS to exit safemode
Safe mode is OFF
***INFO: Setting HDFS ACLs for snapshot scan support
***INFO: Trafodion Mods ran successfully.

*****
TRAFODION START
*****

/usr/lib/trafodion/installer/..
***INFO: Log file location /var/log/trafodion/trafodion_install_2016-02-15-07-08-
07.log
***INFO: traf_start
*****
*****
*****
*****
/home/trafodion/apache-trafodion-1.3.0-incubating-bin

```

```

***INFO: untarring build file /usr/lib/trafodion/apache-trafodion-1.3.0-incubating-
bin/trafodion_server-1.3.0.tgz to /home/trafodion/apache-trafodion-1.3.0-incubating-
bin
.
.
.
***** Generate public/private certificates *****

Cluster Name : Cluster%201
Generating Self Signed Certificate....
*****
Certificate file :server.crt
Private key file :server.key
Certificate/Private key created in directory :/home/trafodion/sqcert
*****

*****
Updating Authentication Configuration
*****
Creating folders for storing certificates

***INFO: copying /home/trafodion/sqcert directory to all nodes
***INFO: copying install to all nodes
***INFO: starting Trafodion instance
Checking orphan processes.
Removing old mpijob* files from /home/trafodion/apache-trafodion-1.3.0-incubating-
bin/tmp

Removing old monitor.port* files from /home/trafodion/apache-trafodion-1.3.0-
incubating-bin/tmp

Executing sqipcrm (output to sqipcrm.out)
Starting the SQ Environment (Executing /home/trafodion/apache-trafodion-1.3.0-
incubating-bin/sql/scripts/gomon.cold)
Background SQ Startup job (pid: 7276)
.
.
.
Zookeeper is listening on port 2181
DcsMaster is listening on port 23400


```

Process	Configured	Actual	Down
-----	-----	-----	----
DcsMaster	1	1	
DcsServer	2	2	
mxosrvr	8	8	

```

You can monitor the SQ shell log file : /home/trafodion/apache-trafodion-1.3.0-
incubating-bin/logs/sqmon.log

Startup time  0 hour(s) 1 minute(s) 9 second(s)
Apache Trafodion Conversational Interface 1.3.0

```

```

Copyright (c) 2015 Apache Software Foundation
>> initialize trafodion;
--- SQL operation complete.
>>

End of MXCI Session

***INFO: Installation completed successfully.

*****
  TRAFODION INSTALLATION COMPLETE
*****

$

```

## 2. Switch to the Trafodion Runtime User and check the status of Trafodion.

```

$ sudo su - trafodion
$ sqcheck
Checking if processes are up.
Checking attempt: 1; user specified max: 2. Execution time in seconds: 0.

The SQ environment is up!

```

Process	Configured	Actual	Down
-----	-----	-----	-----
DTM	2	2	
RMS	4	4	
MXOSRVR	8	8	

```

$

```

Trafodion is now running on your Hadoop cluster. Please refer to the [Activate](#) chapter for basic instructions on how to verify the Trafodion management and how to perform basic management operations.

## Chapter 6. Upgrade

This chapter describes how to use the Trafodion Installer to upgrade Trafodion. You use the Trafodion Provisioning ID to run the Trafodion Installer.

### 6.1. Download Updated Trafodion Binaries

You perform this step as the Trafodion Provisioning User.

You download the updated Trafodion binaries from the Trafodion [Download](#) page. Download the following packages:

- Trafodion Installer (if planning to use the Trafodion Installer)
- Trafodion Server

Refer to [Download Trafodion Binaries](#) in the [Prepare](#) chapter for examples.

### 6.2. Unpack Installer

You perform this step as the Trafodion Provisioning User.

You unpack the updated Trafodion Installer into a new directory.

#### Example

```
$ mkdir $HOME/trafodion-installer-2.0
$ cd $HOME/trafodion-downloads
$ tar -zxf apache-trafodion-installer-2.0.0-incubating-bin.tar.gz -C $HOME/trafodion-
installer
$ ls $HOME/trafodion-installer/installer-2.0
bashrc_default          tools                  traf_config_check
trafodion_apache_hadoop_install traf_package_setup
build-version-2.0.0.txt traf_add_user          traf_config_setup
trafodion_config_default traf_setup
dcs_installer           traf_apache_hadoop_config_setup traf_create_systemdefaults
trafodion_install       traf_sqconfig
rest_installer          traf_authentication_conf_default traf_getHadoopNodes
trafodion_license       traf_start
setup_known_hosts.exp   traf_cloudera_mods98   traf_hortonworks_mods98
trafodion_uninstaller
$
```

## 6.3. Stop Trafodion

You perform this step as the Trafodion Runtime User.

### Example

```
$ sudo su trafodion
$ sqstop
Shutting down the REST environment now
stopping rest.
Shutting down the DCS environment now
stopping master.
trafodion-1: stopping server.
trafodion-2: stopping server.
stopped $zlobsrv0
stopped $zlobsrv1
Shutting down (normal) the SQ environment!
Wed Feb 17 05:12:40 UTC 2016
Processing cluster.conf on local host trafodion-1
[$Z000KAE] Shell/shell Version 1.0.1 Apache_Trafodion Release 1.3.0 (Build release
[1.3.0-0-g5af956f_Bld2], date 20160112_1927)
ps
```

```

[$Z000KAE] %ps
[$Z000KAE] NID,PID(os)  PRI  TYPE  STATES  NAME          PARENT      PROGRAM
[$Z000KAE] -----
[$Z000KAE] 000,00064198 000  WDG   ES--A--  $WDG000      NONE        sqwatchdog
[$Z000KAE] 000,00064199 000  PSD   ES--A--  $PSD000      NONE        pstartd
[$Z000KAE] 000,00064212 001  GEN   ES--A--  $TSID0       NONE        idtmsrv
[$Z000KAE] 000,00064242 001  DTM   ES--A--  $TM0         NONE        tm
[$Z000KAE] 000,00065278 001  GEN   ES--A--  $ZSC000      NONE        mxsscp
[$Z000KAE] 000,00065305 001  SSMP  ES--A--  $ZSM000      NONE        mxssmp
[$Z000KAE] 000,00001219 001  GEN   ES--A--  $Z0000ZU     NONE        mxosrvr
[$Z000KAE] 000,00001235 001  GEN   ES--A--  $Z00010A     NONE        mxosrvr
[$Z000KAE] 000,00001279 001  GEN   ES--A--  $Z00011J     NONE        mxosrvr
[$Z000KAE] 000,00001446 001  GEN   ES--A--  $Z00016B     NONE        mxosrvr
[$Z000KAE] 000,00024864 001  GEN   ES--A--  $Z000KAE     NONE        shell
[$Z000KAE] 001,00025180 000  PSD   ES--A--  $PSD001      NONE        pstartd
[$Z000KAE] 001,00025179 000  WDG   ES--A--  $WDG001      NONE        sqwatchdog
[$Z000KAE] 001,00025234 001  DTM   ES--A--  $TM1         NONE        tm
[$Z000KAE] 001,00025793 001  GEN   ES--A--  $ZSC001      NONE        mxsscp
[$Z000KAE] 001,00025797 001  SSMP  ES--A--  $ZSM001      NONE        mxssmp
[$Z000KAE] 001,00026587 001  GEN   ES--A--  $Z010LPM     NONE        mxosrvr
[$Z000KAE] 001,00026617 001  GEN   ES--A--  $Z010LQH     NONE        mxosrvr
[$Z000KAE] 001,00026643 001  GEN   ES--A--  $Z010LR8     NONE        mxosrvr
[$Z000KAE] 001,00026644 001  GEN   ES--A--  $Z010LR9     NONE        mxosrvr
shutdown
[$Z000KAE] %shutdown
exit
Issued a 'shutdown normal' request

Shutdown in progress

# of SQ processes: 0
SQ Shutdown (normal) from /home/trafodion Successful
Wed Feb 17 05:12:47 UTC 2016
$

```



## 6.4. Automated Upgrade

You perform this step as the Trafodion Provisioning User.

The `--config_file` option runs the Trafodion in Automated Setup mode. Refer to [Trafodion Installer](#) in the [Introduction](#) chapter for instructions of how you edit your configuration file.

At a minimum, you need to change the following settings:

- LOCAL\_WORKDIR
- TRAF\_PACKAGE
- SQ\_ROOT

### Example

```
$ cd $HOME/trafodion-configuration
$ cp my_config my_config_2.0
$ # Pre edit content

export LOCAL_WORKDIR="/home/centos/trafodion-installer/installer"
export TRAF_PACKAGE="/home/centos/trafodion-download/apache-trafodion-1.3.0-incubating-
bin.tar.gz"
export SQ_ROOT="/home/trafodion/apache-trafodion-1.3.0-incubating-bin"

$ # Use your favorit editor to modify my_config_2.0
$ emacs my_config_2.0
$ # Post edit changes

export LOCAL_WORKDIR="/home/centos/trafodion-installer-2.0/installer"
export TRAF_PACKAGE="/home/centos/trafodion-download/apache-trafodion-2.0.0-incubating-
bin.tar.gz"
export SQ_ROOT="/home/trafodion/apache-trafodion-2.0.0-incubating-bin"
```

The following example shows an upgrade of Trafodion on a two-node Hortonworks Hadoop cluster using Automated Setup mode.



The Trafodion Installer performs the same configuration changes as it does for an installation, including restarting Hadoop services.

### Example

1. Run the updated Trafodion Installer using the modified `my_config_2.0` file.

```

$ cd $HOME/trafodion-installer-2.0/installer
$ ./trafodion_install --config_file $HOME/trafodion-configuration/my_config_2.0
*****
  TRAFODION INSTALLATION START
*****

***INFO: Testing sudo access on node trafodion-1
***INFO: Testing sudo access on node trafodion-2
***INFO: Testing ssh on trafodion-1
***INFO: Testing ssh on trafodion-2
***INFO: Getting list of all hortonworks nodes
***INFO: Getting list of all hortonworks nodes
***INFO: hortonworks list of nodes:  trafodion-1 trafodion-2
***INFO: Testing ssh on trafodion-1
***INFO: Testing ssh on trafodion-2
***INFO: Testing sudo access on trafodion-1
***INFO: Testing sudo access on trafodion-2
***INFO: Trafodion scanner will not be run.
***DEBUG: trafodionFullName=trafodion_server-2.0.0.tgz
***INFO: Trafodion version = 2.0.0
***DEBUG: HBase's java_exec=/usr/jdk64/jdk1.7.0_67/bin/java

*****
  TRAFODION SETUP
*****

***INFO: Installing required RPM packages
***INFO: Starting Trafodion Package Setup (2016-02-17-05-33-29)
***INFO: Installing required packages
***INFO: Log file located in /var/log/trafodion
***INFO: ... pdsh on node trafodion-1
***INFO: ... pdsh on node trafodion-2
***INFO: Checking if log4cxx is installed ...
.
.
.
DcsMaster is not started. Please start DCS using 'dcsstart' command...

Process           Configured      Actual          Down
-----
DcsMaster         1               0               1
DcsServer         2               0               2
mxosrvr          8               8

You can monitor the SQ shell log file : /home/trafodion/apache-trafodion-2.0.0-
incubating-bin/logs/sqmon.log

Startup time  0 hour(s) 1 minute(s) 9 second(s)
Apache Trafodion Conversational Interface 1.3.0
Copyright (c) 2015 Apache Software Foundation
>>Metadata Upgrade: started

```

```

Version Check: started
  Metadata is already at Version 1.1.
Version Check: done

Metadata Upgrade: done

--- SQL operation complete.
>>

End of MXCI Session

***INFO: Installation completed successfully.

*****
  TRAFODION INSTALLATION COMPLETE
*****

$

```

## 2. Switch to the Trafodion Runtime User and check the status of Trafodion.

```

$ sudo su - trafodion
$ sqcheck
Checking if processes are up.
Checking attempt: 1; user specified max: 2. Execution time in seconds: 0.

The SQ environment is up!

```

Process	Configured	Actual	Down
-----	-----	-----	-----
DTM	2	2	
RMS	4	4	
MXOSRVR	8	8	

```

$

```

Trafodion is now running on your Hadoop cluster. Please refer to the [Activate](#) chapter for basic instructions on how to verify the Trafodion management and how to perform basic management operations.

## 6.5. Guided Upgrade

You perform this step as the Trafodion Provisioning User.

As in the case with an installation, the Trafodion Installer prompts you for the information you collected in the [Gather Configuration Information](#) step in the [Prepare](#) chapter. Some of the prompts are populated with the current values.

```
export LOCAL_WORKDIR="/home/centos/trafodion-installer/installer" export TRAF_PACKAGE="/home/centos/trafodion-
download/apache-trafodion-1.3.0-incubating-bin.tar.gz" export SQ_ROOT="/home/trafodion/apache-trafodion-1.3.0-
incubating-bin"
```

The following example shows a guided upgrade of Trafodion on a two-node Cloudera Hadoop cluster.

### Example

1. Run the updated Trafodion Installer in Guided Setup mode to perform the upgrade. Change information at prompts as applicable.

```
$ cd $HOME/trafodion-installer-2.0/installer
$ ./trafodion_install
*****
  TRAFODION INSTALLATION START
*****

***INFO: testing sudo access
***INFO: Log file located at /var/log/trafodion/trafodion_install_2016-02-17-08-15-
33.log
***INFO: Config directory: /etc/trafodion
***INFO: Working directory: /usr/lib/trafodion

*****
  Trafodion Configuration Setup
*****

***INFO: Please press [Enter] to select defaults.

Enter trafodion password, default is [traf123]:
Enter list of nodes (blank separated), default []: trafodion-1.apache.org trafodion-
2.apache.org
Specify location of Java 1.7.0_65 or higher (JDK), default is
[/usr/java/jdk1.7.0_67-cloudera]:
Enter full path (including .tar or .tar.gz) of trafodion tar file []:
/home/centos/trafodion-download/apache-trafodion-2.0.0-incubating-bin.tar.gz
Enter Hadoop admin username, default is [admin]:
Enter Hadoop admin password, default is [admin]:
Enter Hadoop external network URL:port (no 'http://' needed), default is []:
trafodion-1.apache.org:7180
Enter HDFS username, default is [hdfs]:
```

```

Enter HBase username, default is [hbase]:
Enter HBase group, default is [hbase]:
Enter directory to install trafodion to, default is [/home/trafodion/apache-
trafodion-1.3.0-incubating-bin]: /home/centos/apache-trafodion-2.0.0-incubating-bin
Start Trafodion after install (Y/N), default is Y:
Total number of client connections per node, default [16]: 8
Enable simple LDAP security (Y/N), default is N:
***INFO: Configuration file: /etc/trafodion/trafodion_config
***INFO: Trafodion configuration setup complete

*****

Trafodion Configuration File Check
*****

***INFO: Testing sudo access on node trafodion-1
***INFO: Testing sudo access on node trafodion-2
***INFO: Testing ssh on trafodion-1
***INFO: Testing ssh on trafodion-2
***INFO: Getting list of all cloudera nodes
***INFO: Getting list of all cloudera nodes
***INFO: cloudera list of nodes: trafodion-1 trafodion-2
***INFO: Testing ssh on trafodion-1
***INFO: Testing ssh on trafodion-2
***INFO: Testing sudo access on trafodion-1
***INFO: Testing sudo access on trafodion-2
***INFO: Checking cloudera Version
***INFO: nameOfVersion=cdh5.3.0
***INFO: HADOOP_PATH=/usr/lib/hbase/lib
***INFO: Trafodion scanner will not be run.
***DEBUG: trafodionFullName=trafodion_server-1.3.0.tgz
***INFO: Trafodion version = 1.3.0
***DEBUG: HBase's java_exec=/usr/java/jdk1.7.0_67-cloudera/bin/java

*****

TRAFODION SETUP
*****

***INFO: Installing required RPM packages
***INFO: Starting Trafodion Package Setup (2016-02-17-08-16-11)
***INFO: Installing required packages
***INFO: Log file located in /var/log/trafodion
***INFO: ... pdsh on node trafodion-1
***INFO: ... pdsh on node trafodion-2
***INFO: Checking if log4cxx is installed ...
***INFO: Checking if sqlite is installed ...
***INFO: Checking if expect is installed ...
***INFO: Checking if perl-DBD-SQLite* is installed ...
***INFO: Checking if protobuf is installed ...
***INFO: Checking if xerces-c is installed ...
***INFO: Checking if perl-Params-Validate is installed ...
***INFO: Checking if perl-Time-HiRes is installed ...
***INFO: Checking if gzip is installed ...
***INFO: creating sqconfig file

```

```

***INFO: Reserving DCS ports

*****
TRAFODION MODS
*****

***INFO: Cloudera installed will run traf_cloudera_mods98
***INFO: Detected JAVA version 1.7
***INFO: copying hbase-trx-cdh5_3-1.3.0.jar to all nodes
***INFO: Cloudera Manager is on trafodion-1
.
.
.
Zookeeper is listening on port 2181
DcsMaster is listening on port 23400

Process           Configured      Actual          Down
-----
DcsMaster         1               1
DcsServer         2               2
mxosrvr          8               8

You can monitor the SQ shell log file : /home/trafodion/apache-trafodion-2.0.0-
incubating-bin/logs/sqmon.log

Startup time  0 hour(s) 1 minute(s) 9 second(s)
Apache Trafodion Conversational Interface 1.3.0
Copyright (c) 2015 Apache Software Foundation
>>

End of MXCI Session

***INFO: Installation completed successfully.

*****
TRAFODION INSTALLATION COMPLETE
*****

$

```

2. Switch to the Trafodion Runtime User and check the status of Trafodion.

```
$ sudo su - trafodion
$ sqcheck
Checking if processes are up.
Checking attempt: 1; user specified max: 2. Execution time in seconds: 0.
```

The SQ environment is up!

Process	Configured	Actual	Down
-----	-----	-----	-----
DTM	2	2	
RMS	4	4	
MXOSRVR	8	8	

\$

Trafodion is now running on your Hadoop cluster. Please refer to the [Activate](#) chapter for basic instructions on how to verify the Trafodion management and how to perform basic management operations.

## Chapter 7. Activate

### 7.1. Manage Trafodion

You use the Trafodion runtime user ID to perform Trafodion management operations.

The following table provides an overview of the different Trafodion management scripts.

Component	Start	Stop	Status
<b>All of Trafodion</b>	sqstart	sqstop	sqcheck
<b>RMS Server</b>	rmsstart	rmsstop	rmscheck
<b>REST Server</b>	reststart	reststop	-
<b>LOB Server</b>	lobstart	lobstop	-
<b>DCS (Database Connectivity Services)</b>	dcstart	dcstop	dccheck

#### Example: Start Trafodion

```
cd $MY_SQROOT/sql/scripts
sqstart
sqcheck
```

### 7.2. Validate Trafodion Installation

You can use sqlci (part of the base product) or trafci (requires separate install; see the [Trafodion Client Installation Guide](#)) to validate your installation.

#### 7.2.1. Smoke Test

A simple smoke test to validate that Trafodion is functioning.

```
get schemas;
create table table1 (a int);
invoke table1;
insert into table1 values (1), (2), (3), (4);
select * from table1;
drop table table1;
exit;
```



**Example**

```

$ sqlci
Apache Trafodion Conversational Interface 1.3.0
Copyright (c) 2015 Apache Software Foundation
>>get schemas;

Schemas in Catalog TRAFODION
=====

SEABASE
_MD_
_REPOS_

--- SQL operation complete.
>>create table table1 (a int);

--- SQL operation complete.
>>invoke table1;

-- Definition of Trafodion table TRAFODION.SEABASE.TABLE1
-- Definition current  Mon Feb 15 07:42:02 2016

(
    SYSKEY                                LARGEINT NO DEFAULT NOT NULL NOT DROPPABLE
    NOT SERIALIZED
, A                                INT DEFAULT NULL SERIALIZED
)

--- SQL operation complete.
>>insert into table1 values (1), (2), (3), (4);

--- 4 row(s) inserted.
>>select * from table1;

A
-----

      1
      2
      3
      4

--- 4 row(s) selected.
>>drop table table1;

--- SQL operation complete.
>>exit;
$

```

Assuming no errors, your installation has been successful. Next, do the following:

- Install the Trafodion client software. Refer to the [Trafodion Client Installation Guide](#).
- Use Trafodion. Refer to the [Trafodion SQL Reference Manual](#).
- Review other Trafodion documentation. Refer to the [Trafodion documentation](#).

## 7.3. Troubleshooting Tips

If you are not able to start up the environment or if there are problems running `sqlci` or `trafci`, then verify that the all the processes are up and running.

- `sqcheck` should indicate all processes are running.

If processes are not running as expected, then:

- `sqstop` to shut down Trafodion. If some Trafodion processes do not terminate cleanly, then run `killall`.
- `sqstart` to restart Trafodion.

If problems persist please review logs:

- `$MY_SQROOT/logs`: Trafodion logs.

## Chapter 8. Remove

You use the Trafodion Provisioning User for these instructions.



You do not need to use the `trafodion_uninstaller` script if upgrading Trafodion. Instead, use the `trafodion_install` script, which automatically upgrades the version of Trafodion. Please refer to the [Install](#) chapter for further instructions.

Run the commands from the first node of the cluster. Do not run them from a machine that is not part of the Trafodion cluster.

### 8.1. Stop Trafodion

Do the following:

```
su trafodion
cd $MY_SQROOT/sql/scripts or cds
sqstop
exit
```

#### Example

```
[admin@trafodion-1 ~]$ su trafodion
[trafodion@trafodion-1 scripts]$ cds
[trafodion@trafodion-1 scripts]$ sqstop
Shutting down the REST environment now
stopping rest.
Shutting down the DCS environment now
stopping master.
trafodion-1: stopping server.
trafodion-2: stopping server.
stopped $zlobsrv0
stopped $zlobsrv1
Shutting down (normal) the SQ environment!
Mon Feb 15 07:49:18 UTC 2016
Processing cluster.conf on local host trafodion-1
.
.
.
```

```

[$Z000HDS] 001,00024772 001 GEN ES--A-- $Z010K7S NONE mxosrvr
[$Z000HDS] 001,00024782 001 GEN ES--U-- $ZLOBSRV1 NONE mxlobsrvr
shutdown
[$Z000HDS] %shutdown
exit
Issued a 'shutdown normal' request

Shutdown in progress

# of SQ processes: 0
SQ Shutdown (normal) from /home/trafodion/apache-trafodion-1.3.0-incubating-
bin/sql/scripts Successful
Mon Feb 15 07:49:26 UTC 2016
[trafodion@trafodion-1 scripts]$ exit
[admin@trafodion-1 ~]$

```

## 8.2. Run `trafodion_uninstaller`

The `trafodion_uninstaller` completely removes Trafodion.

### Example

```

[admin@trafodion-1 ~]$ cd $HOME/trafodion-installer/installer
[admin@trafodion-1 installer]$ ./trafodion_uninstaller
Do you want to uninstall Trafodion (Everything will be removed)? (Y/N) y
***INFO: testing sudo access
***INFO: NOTE, rpms that were installed will not be removed.
***INFO: stopping Trafodion instance
SQ environment is not up.
Going to execute ckillall

Can't find file /home/trafodion/.vnc/trafodion-1:1.pid
You'll have to kill the Xvnc process manually

***INFO: restoring linux system files that were changed
***INFO: removing hbase-trx* from Hadoop directories
pdsh@trafodion-1: trafodion-1: ssh exited with exit code 1
pdsh@trafodion-1: trafodion-2: ssh exited with exit code 1
pdsh@trafodion-1: trafodion-1: ssh exited with exit code 1
pdsh@trafodion-1: trafodion-2: ssh exited with exit code 1
***INFO remove the Trafodion userid and group
***INFO: removing all files from /home/trafodion/apache-trafodion-1.3.0-incubating-bin
***INFO: removing all files from /usr/lib/trafodion and /var/log/trafodion
***INFO: removing all files from /etc/trafodion
***INFO: Trafodion uninstall complete.
[admin@trafodion-1 installer]$

```

## Chapter 9. Enable Security

If you do not enable security in Trafodion, then a client interface to Trafodion may request a user name and password, but Trafodion ignores the user name and password entered in the client interface, and the session runs as the database **root** user, `DB__ROOT`, without restrictions. If you want to restrict users, restrict access to certain users only, or restrict access to an object or operation, then you must enable security, which enforces authentication and authorization. You can enable security during installation by answering the Trafodion Installer's prompts or after installation by running the `traf_authentication_setup` script, which enables both authentication and authorization. For more information, see [Authentication Setup Script](#) below.

Trafodion does not manage user names and passwords internally but does support authentication via directory servers that support the OpenLDAP protocol, also known as LDAP servers. You can configure the LDAP servers during installation by answering the Trafodion Installer's prompts, or you can configure the LDAP servers manually after installation. For more information, please refer to [Configuring LDAP Servers](#) below.

Once authentication and authorization are enabled, Trafodion allows users to be registered in the database and allows privileges on objects to be granted to users and roles (which are granted to users). Trafodion also supports component-level (or system-level) privileges, such as `MANAGE_USERS`, which can be granted to users and roles. Refer to [Manage Users](#) below.

### 9.1. Configuring LDAP Servers

To specify the LDAP server(s) to be used for authentication, you need to configure the text file `.traf_authentication_config`, located (by default) in `$MY_SQROOT/sql/scripts`. This file is a flat file, organized as a series of attribute/value pairs. Details on all the attributes and values accepted in the authentication configuration file and how to configure alternate locations can be found in [.traf\\_authentication\\_config](#) below.

A sample template file is located in `$MY_SQROOT/sql/scripts/traf_authentication_config`.

Attributes and values in the authentication configuration file are separated with a colon immediately following the attribute name. In general, white space is ignored but spaces may be relevant in some values. Attribute names are always case insensitive. Multiple instances of an attribute are specified by repeating the attribute name and providing the new value. For attributes with only one instance, if the attribute is repeated, the last value provided is used.

```
Attribute1: valueA
Attribute2: valueB
Attribute1: valueC
```

If `Attribute1` has only one instance, `valueC` is used, otherwise, `valueA` and `valueC` are both added to the list of values for `Attribute1`.

Attributes are grouped into sections; this is for future enhancements. Attributes are declared in the `LOCAL` section, unless otherwise specified.



Section names, attribute names, and the general layout of the authentication configuration file are subject to change in future versions of Trafodion and backward compatibility is not guaranteed.

Specification of your directory server(s) requires at a minimum:

Setting	Description	Example
<b>LDAP Host Name(s)</b>	One or more names of hosts that support the OpenLDAP protocol must be specified. Trafodion attempts to connect to all provided host names during the authentication process. The set of user names and passwords should be identical on all hosts to avoid unpredictable results. The attribute name is <code>LDAPHostName</code> .	<code>LDAPHostName:</code> <code>ldap.company.com</code>
<b>LDAP Port Number</b>	Port number of the LDAP server. Typically this is 389 for servers using no encryption or TLS, and 636 for servers using SSL. The attribute name is <code>LDAPPort</code> .	<code>LDAPPort: 389</code>
<b>LDAP Unique Identifier</b>	Attribute(s) used by the directory server that uniquely identifies the user name. You may provide one or more unique identifier specifiers.	<code>UniqueIdentifier:</code> <code>uid=,ou=users,dc=com</code>
<b>Encryption Level</b>	A numeric value indicating the encryption scheme used by your LDAP server. Values are: <ul style="list-style-type: none"> <li>• 0: Encryption not used</li> <li>• 1: SSL</li> <li>• 2: TLS</li> </ul>	<p><code>LDAPSSL: 2</code></p> <p>If your LDAP server uses TLS you must specify a file containing the certificate used to encrypt the password. By default the Trafodion software looks for this file in <code>\$MY_SQROOT/cacerts</code>, but you may specify a fully qualified filename, or set the environment variable <code>CACERTS_DIR</code> to another directory. To specify the file containing the certificate, you set the value of the attribute <code>TLS_CACERTFilename</code>, located in the Defaults section.</p> <p><b>Example</b></p> <pre> ` TLS_CACERTFilename: mycert.pem TLS_CACertFilename: /usr/etc/cert.pem ` </pre>
<b>Search username and password</b>	Some LDAP servers require a known user name and password to search the directory of user names. If your environment has that requirement, provide these "search" values.	<p><code>LDAPSearchDN:</code> <code>lookup@company.com</code></p> <p><code>LDAPSearchPwd: LookUp123</code></p>

There are additional optional attributes that can be used to customize Trafodion authentication. As mentioned earlier, they are described in [.traf\\_authentication\\_config](#) below.

You can test the authentication configuration file for syntactic errors using the `ldapconfigcheck` tool. If you have loaded the Trafodion environment (`sqenv.sh`), then the tool automatically checks the file at `$MY_SQROOT/sql/scripts/.traf_authentication_config`. If not, you can specify the file to be checked.

### Example

```
ldapconfigcheck -file myconfigfile
File myconfigfile is valid.
```

If an error is found, then the line number with the error is displayed along with the error. Please refer to [ldapconfigcheck](#) below for more information.



The authentication configuration file needs to be propagated to all nodes, but there is a script that does that for you described later. For now, you can test your changes on the local node.

You can test the LDAP connection using the utility `ldapcheck`. To use this utility the Trafodion environment must be loaded (`sqenv.sh`), but the Trafodion instance does not need to be running. To test the connection only, you can specify any user name, and a name lookup is performed using the attributes in `.traf_authentication_config`.

```
ldapcheck --username=fakename@company.com
User fakename@company.com not found
```

If `ldapcheck` reports either that the user was found or the user was not found, the connection was successful. However, if an error is reported, either the configuration file is not setup correctly, or there is a problem either with your LDAP server or the connection to the server. You can get additional error detail by including the `--verbose` option. Please refer to [ldapcheck](#) for more information.

If you supply a password, `ldapcheck` attempts to authenticate the specified username and password. The example below shows the password for illustrative purposes, but to avoid typing the password on the command line, leave the password blank (`--password=`) and the utility prompts for the password with no echo.

```
ldapcheck --username=realuser@company.com --password=StrongPassword
Authentication successful
```

## 9.2. Generate Trafodion Certificate

Trafodion clients such as `trafci` encrypt the password before sending it to Trafodion. A self-signed certificate is used to encrypt the password. The certificate and key should be generated when the `sqgen` script is invoked. By default, the files `server.key` and `server.crt` are located in `$HOME/sqcert`. If those files are not present and since Trafodion clients does not send unencrypted passwords, then you need to manually generate those files. To do so, run the script `sqcertgen` located in `$MY_SQROOT/sql/scripts`. The script runs `openssl` to generate the certificate and key.

To run `openssl` manually, follow the example:

```
openssl req -x509 -nodes -days 365 -subj
'/C=US/ST=California/L=PaloAlto/CN=host.domain.com/O=Some Company/OU=Service
Connection'
- newkey rsa:2048 -keyout server.key -out server.crt
```

Option	Description
<code>-x509</code>	Generate a self-signed certificate.
<code>-days &lt;validity of certificate&gt;</code>	Make the certificate valid for the days specified.
<code>-newkey rsa:&lt;bytes&gt;</code>	Generate a new private key of type RSA of length 1024 or 2048 bytes.
<code>-subj &lt;certificateinfo&gt;</code>	Specify the information that is incorporated in the certificate. Each instance in a cluster should have a unique common name(CN).
<code>-keyout &lt;filename&gt;</code>	Write the newly generated RSA private key to the file specified.
<code>-nodes</code>	It is an optional parameter that specifies NOT to encrypt the private key. If you encrypt the private key, then you must enter the password every time the private key is used by an application.
<code>-out &lt;filename&gt;</code>	Write the self-signed certificate to the specified file.

Both the public (`server.crt`) and private (`server.key`) files should be placed in the directory `$HOME/sqcert`. If you do not want to use the `HOME` directory or if you want to use different names for the private and/or public key files, then Trafodion supports environment variables to specific the alternate locations or names.

- Trafodion first checks the environment variables `SQCERT_PRIVKEY` and `SQCERT_PUBKEY`. If they are set, Trafodion uses the fully qualified filename value of the environment variable.

You can specify either one filename environment variable or both.

- If at least one filename environment variable is not set, Trafodion checks the value of the environment variable `SQCERT_DIR`. If set, then the default filename `server.key` or `server.crt` is appended to the value of the environment variable `SQCERT_DIR`.
- If the filename environment variable is not set and the directory environment variable is not set, then Trafodion uses the default location (`$HOME/sqcert`) and the default filename.



## 9.3. Authentication Setup Script

The final step to enable security is to change the value of the environment variable

TRAFODION\_ENABLE\_AUTHENTICATION from NO to YES and turn on authorization. This is achieved by invoking the `traf_authentication_setup` script, which is located in `$MY_SQROOT/sql/scripts`.

### Usage

```
Usage: traf_authentication_setup [options]
```

Options:

```
--file <loc>  Optional location of OpenLDAP configuration file
--help        Prints this message
--off         Disables authentication and authorization
--on          Enables authentication and authorization
--setup       Enables authentication
--status      Returns status of authentication enablement
```

Option	Description
--file	If specified, then filename is copied to <code>\$MY_SQROOT/</code> . Users working in their own private environment can refer to a site-specific configuration file from a central location.
--on	<p><code>traf_authentication_setup</code> invokes <a href="#">ldapconfigcheck</a> to verify the configuration file is syntactically correct. It also invokes <a href="#">ldapcheck</a> to verify that a connection can be made to an LDAP server.</p> <p>If both checks pass, the script sets the environment variable <code>TRAFODION_ENABLE_AUTHENTICATION</code> to YES in the file <code>\$MY_SQROOT/sqenvcom.sh</code>, and propagates <code>sqenvcom.sh</code> and <code>.traf_authentication_config</code> to all nodes in the cluster.</p> <p>The last step is to enable authorization by creating privilege-related metadata tables and set up default permissions with a call to the database. The list of privilege-related metadata tables, users, roles, and component privileges are logged in <code>\$MY_SQROOT/logs/authEnable.log</code>.</p> <p>Specifying <code>--on</code> requires that a valid <code>.traf_authentication_config</code> file exists and the Trafodion metadata initialized.</p>
--off	<p>If specified, then <code>traf_authentication_setup</code> sets the environment variable <code>TRAFODION_ENABLE_AUTHENTICATION</code> to NO in <code>\$MY_SQROOT/sqenvcom.sh</code> and propagates the file to all the nodes in the cluster.</p> <p>The last step is to disable authorization by removing any privilege-related metadata and permissions with a call to the database. The results of this operation is logged in <code>\$MY_SQROOT/logs/authEnable.log</code>.</p>
--setup	Use this option if the Trafodion metadata has not been initialized. This option enables authentication but does not call the database to create privilege-related metadata tables. Later, when Trafodion metadata is initialized, privilege-related metadata tables and default permissions are automatically created.

Option	Description
<code>--status</code>	Reports the value of the environment variable <code>TRAFODION_ENABLE_AUTHENTICATION</code> in <code>\$MY_SQROOT/sqenvcom.sh</code> on the current node and reports the status of security features in the database.

### Example

```
INFO: Start of security (authentication and authorization) script Wed Mar 25 15:12:50
PDT 2xxx.

INFO: *** Trafodion security (authentication and authorization) status ***
      Authentication is ENABLED
      Authorization (grant/revoke) is ENABLED

INFO: End of security (authorization and authentication) script Wed Mar 25 15:12:54 PDT
2xxx.
```



Any time the environment file (`sqenvcom.sh`) is changed (and propagated to all nodes), Database Connectivity Services (DCS) must be restarted to pick up the new value. If the configuration file is changed, it re-reads in 30 minutes (by default), but you can have changes take effect immediately by restarting DCS.

To restart DCS, run the scripts `stop-dcs.sh` and `start-dcs.sh`, located in `$MY_SQROOT/dcs-<x>.<y>.<z>/bin`.

## 9.4. Manage Users

Users are registered in the Trafodion database and are used to enforce authorization. If security is disabled, any user can register any user at any time. However, once security is enabled, user administration is considered a secure operation, and registration of users is restricted to `DBROOT` or any user granted the `MANAGE_USERS` component privilege. To initially register a user, connect to Trafodion with the external user mapped to `DBROOT` (also known as the Trafodion ID).

When security is enabled, the `DBROOT` user is registered as the `TRAFODION` external user name. It is recommended that the `DBROOT` user be mapped to the external user name that is used to connect for root operations. To do this, start a `sqlci` session and perform the `ALTER USER` command, for example:

```
ALTER USER DB__ROOT SET EXTERNAL NAME trafodion_rootuser_in_ldap;
```

To learn more about how to register users, grant object and component privileges, and manage users and roles, please see the [Trafodion SQL Reference Manual](#).

## 9.5. .traf\_authentication\_config

The `.traf_authentication_config` file is user to enable the Trafodion security features.

### 9.5.1. File Location

By default, the Trafodion authentication configuration file is located in `$MY_SQROOT/sql/scripts/.traf_authentication_config`. If you want to store the configuration file in a different location and/or use a different filename, then Trafodion supports environment variables to specify the alternate location/name.

Trafodion firsts checks the environment variable `TRAFAUTH_CONFIGFILE`. If set, the value is used as the fully-qualified Trafodion authentication configuration file.

If the environment variable is not set, then Trafodion next checks the variable `TRAFAUTH_CONFIGDIR`. If set, the value is prepended to `.traf_authentication_config` and used as the Trafodion authentication file.

If neither is set, Trafodion defaults to `$MY_SQROOT/sql/scripts/.traf_authentication_config`.

## 9.5.2. Template

```
# To use authentication in Trafodion, this file must be configured
# as described below and placed in $MY_SQROOT/sql/scripts and be named
# .traf_authentication_config. You must also enable authentication by
# running the script traf_authentication_setup in $MY_SQROOT/sql/scripts.
#
# NOTE: the format of this configuration file is expected to change in the
# next release of Trafodion. Backward compatibility is not guaranteed.
#
SECTION: Defaults
  DefaultSectionName: local
  RefreshTime: 1800
  TLS_CACERTFilename:
SECTION: local

# If one or more of the LDAPHostName values is a load balancing host, list
# the name(s) here, one name: value pair for each host.
  LoadBalanceHostName:

# One or more identically configured hosts must be specified here,
# one name: value pair for each host.
  LDAPHostName:

# Default is port 389, change if using 636 or any other port
  LDAPPort:389

# Must specify one or more unique identifiers, one name: value pair for each
  UniqueIdentifier:

# If the configured LDAP server requires a username and password to
# to perform name lookup, provide those here.
  LDAPSearchDN:
  LDAPSearchPwd:

# If configured LDAP server requires TLS(1) or SSL (2), update this value
  LDAPSSL:0

# Default timeout values in seconds
  LDAPNetworkTimeout: 30
  LDAPTimeout: 30
  LDAPTimeLimit: 30

# Default values for retry logic algorithm
  RetryCount: 5
  RetryDelay: 2
  PreserveConnection: No
  ExcludeBadHosts: Yes
  MaxExcludeListSize: 3
```

### 9.5.3. Configuration Attributes

Attribute Name	Purpose	Example Value	Notes
LDAPHostName	Host name of the local LDAP server.	ldap.master.com	If more than one LDAPHostName entry is provided, then Trafodion attempts to connect with each LDAP server before returning an authentication error. Also see the description related to RetryCount and RetryDelay entries.
LDAPPort	Port number of the local LDAP server.	345	Must be numeric value. Related to LDAPSSL entry. Standard port numbers for OpenLDAP are as follows: <ul style="list-style-type: none"> <li>• Non-secure: 389</li> <li>• SSL: 636</li> <li>• TLS: 389</li> </ul>
LDAPSearchDN	If a search user is needed, the search user distinguished name is specified here.	cn=aaabbb, dc=demo, dc=net	If anonymous search is allowed on the local server, then this attribute does not need to be specified or can be specified with no value (blank). To date, anonymous search is the normal approach used.
LDAPSearchPWD	Password for the LDAPSearchDN value. See that entry for details.	welcome	None.
LDAPSSL	A numeric value specifying whether the local LDAP server interface is unencrypted or TLS or SSL. Legal values are 0 for unencrypted, 1 for SSL, and 2 for TLS. For SSL/TLS, see the section below on Encryption Support.	0	None.
UniqueIdentifier	The directory attribute that contains the user's unique identifier.	uid=,ou=Users,dc=demo,dc=net	To account for the multiple forms of DN supported by a given LDAP server, specify the UniqueIdentifier parameter multiple times with different values. During a search, each UniqueIdentifier is tried in the order it is listed in the configuration file.

Attribute Name	Purpose	Example Value	Notes
LDAPNetworkTimeout	Specifies the timeout (in seconds) after which the next LDAPHostName entry is tried, in case of no response for a connection request. This parameter is similar to NETWORK_TIMEOUT in ldap_conf(5). Default value is 30 seconds.	20	The value must be a positive number or -1. Setting this to -1 results in an infinite timeout.
LDAPTimelimit	Specifies the time to wait when performing a search on the LDAP server for the user name. The number must be a positive integer. This parameter is similar to TIMELIMIT in ldap_conf(5). Default value is 30 seconds.	15	The server may still apply a lower server-side limit on the duration of a search operation.
LDAPTimeout	Specifies a timeout (in seconds) after which calls to synchronous LDAP APIs aborts if no response is received. This parameter is similar to TIMEOUT in ldap_conf(5). Default value is 30 seconds.	15	The value must be a positive number or -1. Setting this to -1 results in an infinite timeout.
RetryCount	Number of attempts to establish a successful LDAP connection. Default is 5 retries before returning an error.	10	When a failed operation is retried, it is attempted with each configured LDAP server, until the operation is successful or the number of configured retries is exceeded.
RetryDelay	Specifies the number of seconds to delay between retries. Default value is 2 seconds. See description of RetryCount.	1	None.
PreserveConnection	Specifies whether the connection to LDAP server is maintained (YES) or closed (NO) once the operation finishes. Default value is NO.	YES	None.

Attribute Name	Purpose	Example Value	Notes
RefreshTime	Specifies the number of seconds that must have elapsed before the configuration file is reread. Default is 1800 (30 minutes).	3600	If set to zero, the configuration file is never read. The connectivity servers must be restarted for changes to take effect if this value is zero. This attribute is not specific to either configuration and must be defined in the DEFAULTS section.
TLS_CACERTFilename	Specifies the location of the certificate file for the LDAP server(s). Filename can either be fully qualified or relative to \$CACERTS_DIR.	cert.pem	This attribute applies to both configurations. If a configuration does not require a certificate, then this attribute is ignored. This attribute must be defined in the DEFAULTS section.
DefaultSectionName	Specifies the configuration type that is assigned to a user by the REGISTER USER command if no authentication type is specified. In the initial Trafodion release, only one configuration is supported.	LOCAL	This attribute must be defined in the DEFAULTS section. If the DefaultSectionName attribute is specified, then a section by that name (or equivalent) must be defined in .traf_ldapconfig. Legal values are LOCAL and ENTERPRISE. This syntax is likely to change.

## 9.6. Ldapcheck

### 9.6.1. Usage

```

ldapcheck [<option>]...
<option> ::= --help|-h           display usage information
            --username=<LDAP-username>
            --password[=<password>]
            --primary             Use first configuration
            --local               Use first configuration
            --enterprise          Use first configuration
            --secondary           Use second configuration
            --remote              Use second configuration
            --cluster             Use second configuration
            --verbose             Display non-zero retry counts
                                and LDAP errors

```

### 9.6.2. Considerations

- Aliases for primary include enterprise and local. Aliases for secondary include cluster and remote. If no configuration is specified, primary is assumed.
- The equals sign is required when supplying a value to username or password.

- To be prompted for a password value with no echo, specify the password argument but omit the equals sign and value.
- Passwords that contain special characters may need to be escaped if the password is specified on the command line or within a script file.
- If the password keyword is not specified, only the username is checked. The tool can therefore be used to test the LDAP configuration and connection to the configured LDAP server(s) without knowing a valid username or password.

## 9.7. ldapconfigcheck

This page describes the `ldapconfigcheck` tool, which validates the syntactic correctness of a Trafodion authentication configuration file. Trafodion does not need to be running to run the tool.

### 9.7.1. Considerations

If the configuration filename is not specified, then the tool looks for a file using environment variables. Those environment variables and the search order are:

1. `TRAFAUTH_CONFIGFILE`

A fully qualified name is expected.

2. `TRAFAUTH_CONFIGDIR`

Filename `.traf_authentication_config/` is appended to the specified directory

3. `MY_SQROOT`

`/sql/scripts/.traf_authentication_config` is appended to the value of `MY_SQROOT`.



## 9.7.2. Errors

One of the following is output when the tool is run. Only the first error encountered is reported.

Code	Text
0	File filename is valid.
1	File filename not found.
2	File: filename
	Invalid attribute name on line <b>line-number</b> .
3	File: filename
	Missing required value on line <b>line-number</b> .
4	File: filename
	Value out of range on line <b>line-number</b> .
5	File: filename
	Open of traf_authentication_config file failed.
6	File: filename
	Read of traf_authentication_config file failed.
7	No file provided. Either specify a file parameter or verify environment variables.
8	TLS was requested in at least one section, but TLS_CACERTFilename was not provided.
9	Missing host name in at least one section.
	Each LDAP connection configuration section must provide at least one host name.
10	Missing unique identifier in at least one section.
	Each LDAP connection configuration section must provide at least one unique identifier.
11	At least one LDAP connection configuration section must be specified.
12	Internal error parsing .traf_authentication_config.

## Chapter 10. Install Recipe

To be written.

## Chapter 11. Upgrade Recipe

To be written.