INTERSECT

Version 2019.2

Installation and Deployment Guide

Schlumberger

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Security notice

The software described herein is configured to operate with at least the minimum specifications set out by Schlumberger. You are advised that such minimum specifications are merely recommendations and not intended to be limiting to configurations that may be used to operate the software. Similarly, you are advised that the software should be operated in a secure environment whether such software is operated across a network, on a single system and/or on a plurality of systems. It is up to you to configure and maintain your networks and/or system(s) in a secure manner. If you have further questions as to recommendations regarding recommended specifications or security, please feel free to contact your local Schlumberger representative.

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Introduction

1.1 Platform availability

Platform	Operating system	Required software	Notes
Windows	Windows 7 Professional x64 SP1 Windows 10 Professional or Enterprise x64	Microsoft .NET 3.5 AND 4.5 or later Intel MPI 2018.1 (included but requires installation)	Minimum screen resolution for PC systems is 1024x768 32 bit is not supported
Linux	Redhat Enterprise Linux Server 6 Update 9 (x86_64) or later minor update Redhat Enterprise Linux Server 7 Update 4 (x86_64) or later minor update CentOS Linux Server 7 Update 4 (x86_64)	Intel MPI 2018.1 (included and automatically installed) Platform MPI 9.1 (included and automatically installed)	A scheduling system is recommended. LSF 9.1 or later When installing Redhat 6 choose the “Software Development Workstation” group to supply all the necessary libraries for INTERSECT to work correctly
Windows Cluster	Windows 2012 R2 HPC Update 2		Intel MPI not required

INTERSECT is supported on x86 Intel processor hardware, that support the AVX instruction set (introduced with Intel Sandy Bridge processors in 2011). Use with processors that support additional instructions, e.g. AVX2 (introduced with Intel Haswell processors in 2013) is recommended.

Note: Support for Platform MPI, Windows 7, Red Hat Enterprise (and Centos) Linux Server 6 will be removed from 2020.

1.2 Supported platforms for licensing

Windows

- The supported platforms are: Windows 7 64-bit; Windows 10 64-bit; and Windows Server 2012 R2.

Linux

- The supported platforms for Linux are Red Hat Enterprise Linux Server 6 Update 9 (x86_64); Red Hat Enterprise Linux Server 7 Update 4 (x86_64) and CentOS Linux Server 7 Update 4 (x86_64).

1.3 Prepare to install INTERSECT

INTERSECT can be installed independently of any previous major or incremental release of ECLIPSE or INTERSECT. It can also be installed over existing installations.

1. If you have an existing ECLIPSE installation you should always ensure that the macros directory is backed up before proceeding with the software installation.

   Note: To use INTERSECT, it is essential that the macros included with this release are installed over any older versions.

2. If ECLIPSE is already installed, INTERSECT must be installed to the same directory as ECLIPSE.

For all applications, the manuals are available in PDF (Portable Document Format) that can be browsed and printed with PDF readers.

Note: These instructions assume that the software is installed on a default path `/ecl` on Linux and `C:\ecl` on Windows.

The steps required to install INTERSECT are:

1. Install the INTERSECT software.
2. Install a license (if required).
3. Install Intel MPI on Windows, or Configure the MPI on Linux.
4. Test the installation of INTERSECT works correctly.

Install ECLIPSE and INTERSECT

INTERSECT includes components from ECLIPSE. We recommend that you install older versions in numeric order. You should install INTERSECT last if ECLIPSE and INTERSECT have the same version number.

1.4 DVD organization

INTERSECT software is distributed on a single DVD.

DVD 1

DVD 1 contains software for Windows and Linux. This includes:

- INTERSECT installation with documentation, data and examples.
- Utility resources for Windows and Linux.

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Install INTERSECT on Windows

Before installing INTERSECT, check that the following prerequisites are met:

- You have administrator privileges to install INTERSECT.
- The install directory path contains no spaces in the path name, not for example in `C:\Program Files\ecl`.
- We recommend you disable your virus checker temporarily during the installation process.

Note: INTERSECT manuals, in PDF format, are installed by default. From the launcher, click the manuals button and a bookshelf displays.

Note: It is assumed throughout this section, that the installation location is `C:\ecl`.

If required you can download Acrobat Reader from http://get.adobe.com/reader/.

The recommended version is Adobe Reader XI. Alternatively, use a different PDF reader of your choice.

Note: If you have installed a previous version of INTERSECT 2019.2 you can upgrade it by installing this version of INTERSECT 2019.2. Uninstalling INTERSECT will remove the installation, including any simulator generated output files. Files shared with other Schlumberger product installations will not be removed.

2.1 Install INTERSECT

1. Insert the DVD in the DVD drive (or run setup if you have downloaded it).

   The Schlumberger installation panel should appear; if not use Windows Explorer to access the DVD and run `setup.exe`.
2. Click **Install Products**.
3. Click **INTERSECT** to install INTERSECT.
4. When the INTERSECT installation wizard opens, follow the instructions and click **Next** on each window to proceed.
5. By default, INTERSECT is installed to `C:\ecl`. To change the installation location, click the icon with three dots to the right of the location text box, and then select a folder.

   Note: If you already have ECLIPSE installed, you must install INTERSECT into the same location.

6. Then click **Install**, and when the installation is complete, click **Finish**.

Note: We do not support installation directories with a space in the name; for example: Program Files.

The IX Connector is installed locally under C:\ecl\20xx.x\IX\Connector (where x represents the product version). If Petrel is installed, you can choose this connector via File - Options - Install IX connector.

If required, install the Schlumberger Licensing Tool by following the instructions in the *Schlumberger Licensing User Guide*.

Install Intel MPI

Note: After installing INTERSECT, you need to install Intel MPI even if parallel simulations are not required.

To install Intel MPI:

1. From the Schlumberger Installation panel, select **Install Intel MPI**.
2. In the Location to Extract Files window, click **Extract** to use the default location. (INTERSECT may not work if you change this location.)
3. When the installation wizard opens, follow the instructions and click **Next** on each window to proceed.
4. In the Installation Summary page, click **Install** and when installation is complete click **Finish**.
5. On the Start menu, click **Intel(R) Software Development Tools**, and then click **Intel(R) MPI Library Runtime Environment**, and then click **Build environment for Intel64** , and then click **wmpiregister**.

   Note: You need to repeat this process after any change of login details.

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6. Enter your login details, and then click **Register**.

   Note: This should be a domain login.

   The message `"Password encrypted into the Registry"` should be displayed.
7. Click **Close**.

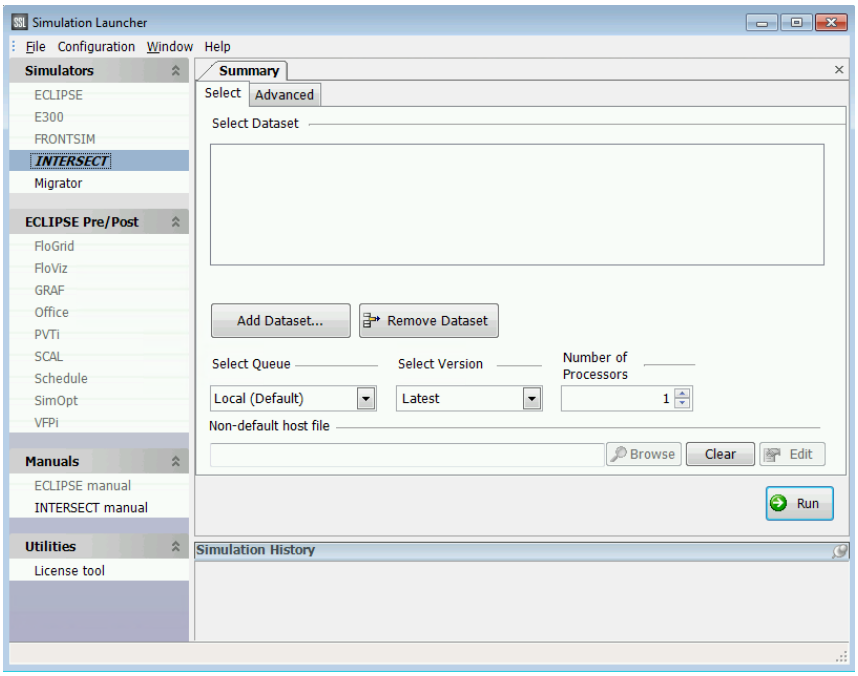
Test the INTERSECT installation

The INTERSECT installation can be tested either by using the Simulation Launcher or using the command line.

Test INTERSECT using the Simulation Launcher

To start the Simulation Launcher either double-click the desktop icon (if you selected previously to create a desktop shortcut) or click **Start** and then select **Program Files**, **Schlumberger**, **INTERSECT** and **Simulation Launcher**.

A screen similar to that shown below should appear.



A sample dataset is provided with the INTERSECT installation, located at `..\IX\Examples\Example_2\IX.DATA`.

To open the dataset:

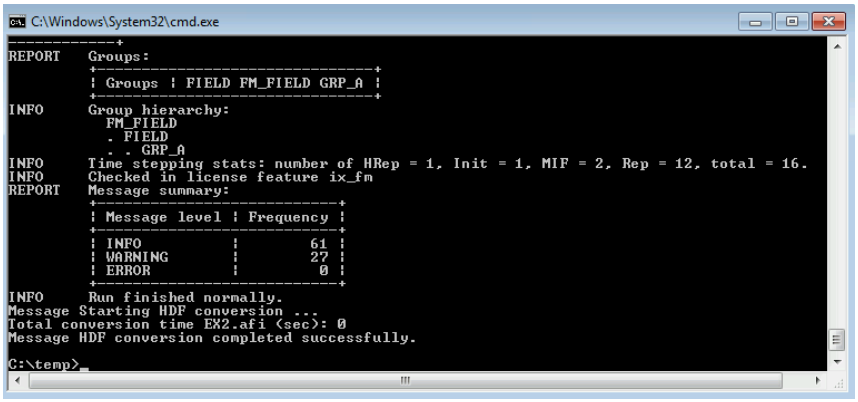
1. Select **Migrator** in the INTERSECT group.
2. Click **Add Dataset**, and select the `IX.DATA` file, and then click **Run**.
3. Select **INTERSECT** in the INTERSECT group.
4. Click **Add Dataset**, select the `IX.afi` file, and then click **Run**.

Alternatively, if you already have an AFI file skip the first two steps and go directly to running INTERSECT.

If you already have an ECLIPSE dataset that you wish to simulate in INTERSECT, use the **Migrator** option in the same manner to convert the dataset to AFI format.

Note: We recommend that you test the installation with one of the example datasets before running your own models.

The simulation should run and end as shown in the example below.



Test INTERSECT from the command line

The Migrator can convert an ECLIPSE keyword file into an AFI file, which can then be read by INTERSECT.

1. Use the following ECLRUN command line: `eclrun ecl2ix basename`, where **basename** is the root name of the input dataset. This command just generates the AFI file but does not run or simulate it.
2. To run or perform the actual simulation using the AFI file the following command is used: `eclrun ix basename`. INTERSECT will read the AFI file and perform the simulation.

If the input ECLIPSE dataset is altered, the AFI file must be regenerated from the dataset first before being given to INTERSECT to be simulated.

An AFI consists of **{basename}.afi**, and its associated files; **basename_ECL2IX.gsg**, **basename_ECL2IX_IX.ixf**, **basename_ECL2IX_FM.ixf**, **basename_fm_edits.ixf** and **basename_reservoir_edits.ixf**.

For information on using ECLRUN, refer to the *ECLRUN User Guide* provided as a separate part of the INTERSECT install.

For information on using the Migrator, refer to the *Migrator User Guide* provided as a separate part of the INTERSECT install.

2.2 Installed directory structure

At the top level, the following directories are visible. Other directories may exist depending on whether other Schlumberger applications are installed.

`C:\ecl\2019.2`

`C:\ecl\macros`

`C:\ecl\tools`

2.3 Troubleshoot the Windows installation

Missing .NET 3.5

If you receive an error message that `mscoree.dll` could not be found when trying to run the INTERSECT launcher, .NET 3.5 is not installed. The redistributable package for the .NET Framework version 3.5 is available on the DVD in the `3rdparty\PC\resource\NETFRAMEWORK3.5` directory. For a newer operating system, such as Windows 10, the user is required to manually activate the .NET framework. The Microsoft support website contains guidance on activating .NET framework for these operating systems.

Windows HPC

Installing INTERSECT for Windows HPC is the same as installing ECLIPSE. For further information see the *ECLIPSE Installation Guide*. Contact Schlumberger Support for further help.

Note: Intel MPI is not required if Windows HPC is in use. Do not install it on the HPC cluster.

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Install INTERSECT on Linux

Before installing INTERSECT, check that the following prerequisites are met:

- You have root privileges to install the INTERSECT software.
- All the hosts have the same User and Address mappings, such as from NIS.
- Intel MPI is installed. This is automatic but you need to configure it before running INTERSECT.
- The file system you choose for installing INTERSECT is accessible from all nodes, for example an NFS share. The file system server must not be used for running simulations.
- If you use LSF, you must install LSF 9.1 or later on all the nodes.

Note: It is assumed throughout this section, that the installation location is `/ecl`.

3.1 Install INTERSECT

1. Mount the DVD and change the directory to the mounted path.
2. Change to the `UNIX/install` directory and run the `cdinst.csh` script.

```
Options for linux_x86_64 201x.x
1) INTERSECT
2) Tools
Select A - Install all of the above
       N - Install none of these
     S - Select a subset
Please enter choice:
```

3. Enter A to install all programs.
4. At the location prompt, enter the path to install the software, if different to the default path. This path should be available in the same place on all the machines in the cluster.

   Note: If ECLIPSE is already installed, you **must** install INTERSECT in the same location.

5. At the next prompt, enter Y to install the macros.

Note: To use INTERSECT it is essential that the macros included with this release must be installed over any older versions.

```
Available programs for linux_x86_64 201x.x
1) INTERSECT
2) Tools
Select A - Install all of the above
       N - Install none of these
       S - Select a subset
Please enter choice: a

Enter proposed location for installation (default /ecl):

Installing INTERSECT (size ********* bytes)
Installing Tools (size *******)

Do you want to install the macros [default n]? y

Installing macros (size ****** bytes)
```

6. Set up the environment so that users can access the software:
   a. If the user's shell is **TCSH** or **CSH**, edit the `.cshrc` file in the user's home directory. If it does not exist, create it. This file may contain many lines, however it should set the path to include the macros directory. If you have installed to a different path, you must replace `/ecl` with your chosen directory. You will need to log off and log on, or run `"source ~/.cshrc"` for these changes to take effect. An example is shown below:

```
set path= (/ecl/macros $path)
source /ecl/macros/@eclrunsetup.csh
setenv SLBSLS_LICENSE_FILE port@license_server
```

   b. If the user's shell is **BASH**, edit the `.bash_profile` file in the user's home directory to include the following lines:

```
export PATH=/ecl/macros:$PATH
export SLBSLS_LICENSE_FILE=port@license_server
export ECLPATH=/ecl
. /ecl/macros/@eclrunsetup.sh
```

Note: You must log off and log on for these changes to take effect.

Configure Intel or Platform MPI for Linux

The Intel or Platform MPI is automatically installed with INTERSECT. The Intel or Platform MPI uses SSH to set up the communication between nodes, so make sure that passwordless SSH is set up between any computers used to run INTERSECT.

Warning: If other applications rely on SSH to work, talk to your system administrator to check the following procedure will not cause any problems with other applications.

The objective of the steps below is to make sure that public and private keys exist for users and that the `authorized_keys` file exists and has the correct keys. However, what you need to do depends on the current setup.

Hint: It is usually a good idea to set the SSH configuration to automatically accept connections to new machines. If this step is not completed, then you have to log on to every machine in the cluster before you can guarantee that a MPI job will work correctly.

1. Check if everything is already working, by trying to connect to another machine in the cluster. For example, connecting from comp001 to comp002 using SSH should not require a password

```
comp001:/home/smessenger>ssh comp002
Last login: Thu Apr 9 10:37:03 2015 from comp001.geoquest
comp002:/home/smessenger>
```

2. If you can successfully connect to another machine in the cluster, skip to SSH configuration (p.9).
3. Evaluate your current setup. Figure 3.1 describes how to set up SSH.

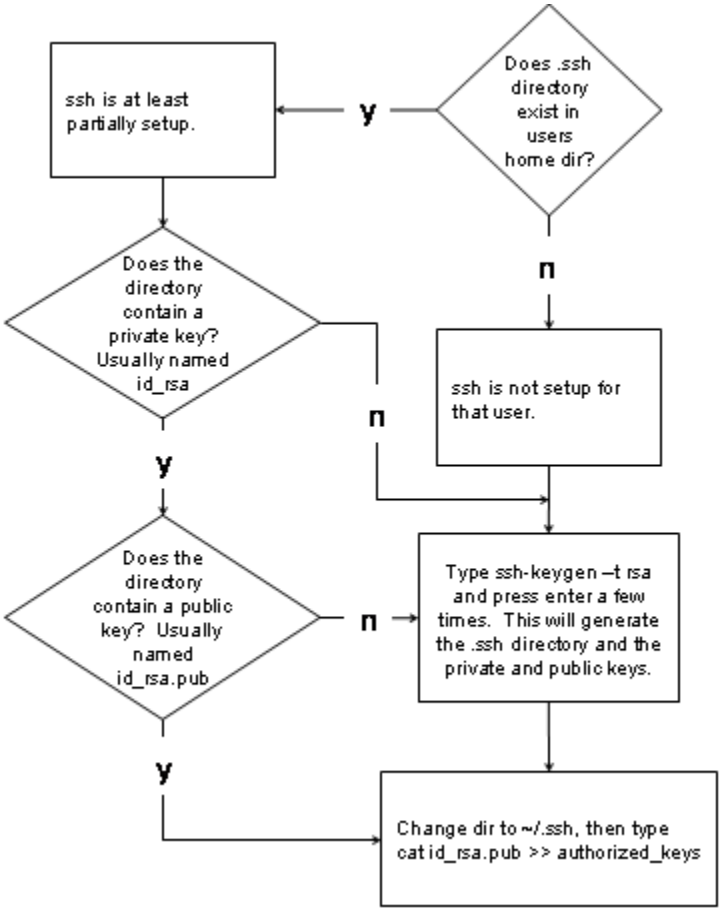

Figure 3.1. SSH Setup

SSH configuration

1. First check that SSH is set up to accept connections to new machines, as shown above.
2. Create a file called config in the users .ssh directory, or add the following line if the config file already exists.

```
comp002:/home/smessenger>cd .ssh
comp002:/home/smessenger/.ssh>cat config
StrictHostKeyChecking=no
```

3. Set permissions.
   - Set permissions for the config file to 400 to ensure that users have read permission.
   - Set permissions for the `authorized_keys` to 600.
   - Set permissions for $HOME and $HOME/.ssh to a minimum of 755. This makes sure that other users cannot write to those directories.

Use LSF queuing

If you are using LSF, you need to edit the LSF startup file `/etc/init.d/lsf` to add an entry for `ulimit` so that the Intel or Platform MPI can run when under LSF control. To do this, open the file and add the entry for `ulimit` as shown here:

```
#!/bin/sh
# $Id: startup.svr4,v 1.10 2015/04/08 06:13:09 xltang Exp $
#
# Start and stop LSF daemons, System V / OSF version
# Make sure we're running a shell that understands functions
#
# The following is for the Linux chkconfig utlility
# chkconfig: 35 99 01
# description: Load Sharing Facility
#
# The following is for the Linux insserv utility
### BEGIN INIT INFO
# Provides: lsf
# Required-Start: $remote_fs
# Required-Stop: $remote_fs
# Default-Start: 3 5
# Default-Stop: 0 1 2 6
# Description: Start LSF daemons
### END INIT INFO

#line added so INTERSECT can run over Infiniband when under LSF control.
ulimit -l 1024000000

if test "$SH5" != "/bin/sh5" -a -r /bin/sh5
then
SH5=/bin/sh5
export SH5
exec /bin/sh5 "$0" "$@"
fi
check_env () {
if [ x$LSF_ENVDIR = x ]; then
# Using default path of lsf.conf...
LSF_CONF=/lsftop/lsf/conf/lsf.conf
```

Note: By default, LSF saves temporary files in a hidden directory called `.lsbatch` which is inside the user's home directory. This can cause problems if the home directories do not have much free space, or quotas are enabled. Avoid this issue by adding the following setting in `lsf.conf`:

`LSB_STDOUT_DIRECT=Y`

You must restart LSF for this change to take effect.

Note: You may encounter problems running INTERSECT with Platform MPI using a version of LSF earlier than 9.1. Although simulations finish as usual, LSF may behave as if the simulation is still running, and stop other jobs from starting. You can either run the Intel MPI version of INTERSECT (the default version), or upgrade LSF. You must use LSF 9.1 or later.

We no longer recommend LSF HPC. However if you wish to use LSF and the Intel MPI, you may need to edit the Intel MPI location in the `intelmpi_wrapper` script. The following assumes that INTERSECT has been installed in `/ecl`, and LSF has been installed in `/lsf`. If you have installed it elsewhere, you must use the appropriate path.

1. In the LSF directory (`/lsf` in this example), edit the file

   ```
   /lsf/9.1/linux2.6-glibc2.3-x86_64/bin/intelmpi_wrapper
   ```

2. Search for the line `MPI_TOPDIR="........"`
3. Replace the line with the correct location of the Intel MPI. If the default settings have been used, this line should look like

   ```
   MPI_TOPDIR="/ecl/tools/linux_x86_64/intel/mpi/5.0.2/"
   ```

4. Find all occurrences of `"$MPI_TOPDIR/bin"` and replace with `"$MPI_TOPDIR/bin64"`
5. If you wish to use SSH to start the MPI daemons:
   a. Search for the line

      ```
      MPDBOOT_CMD="$MPI_TOPDIR/bin64/mpdboot"
      ```

   b. And change to

      ```
      MPDBOOT_CMD="$MPI_TOPDIR/bin64/mpdboot -r /usr/bin/ssh"
      ```

Intel MPI settings

The Intel MPI should detect and use the correct interface. If not, setting an environment variable will force an interconnect to be chosen:

Device type	Description	Setting
uDAPL	uDAPL interface is used by 10G IWarp and InfiniBand cards.	dapl
Std Ethernet	Standard 100Mbs, 1Gbs and 10Gbs network cards.	tcp
InfiniPath	InfiniPath cards from QLogic	tmi
OFED	OFED interface used by many Infiniband cards	ofa This is the preferred setting.

- Set the `I_MPI_FABRICS_LIST` environment variable as follows:

  ```
  setenv I_MPI_FABRICS_LIST ofa,tcp
  ```

  This sets Intel MPI to try the chosen devices in order.
- `I_MPI_FALLBACK` and `I_MPI_DEVICE` are no longer required and should be removed if set.
- To print out the connection or interface type used set the following environment variable:

  ```
  setenv I_MPI_DEBUG 2
  ```

- To switch off platform specific optimization set the following environment variable:

  ```
  setenv I_MPI_PLATFORM 0
  ```

  This allows you to run across non identical platforms.

3.2 Install OFED drivers

A version of the Open Fabrics Enterprise Distribution (OFED) drivers is part of the Red Hat installation. It may, however, be necessary to upgrade these drivers using the instructions found on the Open Fabrics website http://www.openfabrics.com.

The latest OFED version at the time of release is available on the DVD in the `3rdparty/linux/resources/OFED` directory.

Note: If you use InfiniPath, download the drivers and instructions from http://www.qlogic.com.

General InfiniBand notes

To use InfiniBand cards, you must assign an IP address to the card. This also allows you to "ping" the other computers using the InfiniBand interface. If the ping succeeds then you know all the hardware is physically connected properly.

Follow the install instructions from the InfiniBand supplier. However, the following additional steps may be necessary. A good indication is when IP over InfiniBand is working properly, but INTERSECT is not.

1. Edit the file `/etc/security/limits.conf`.
2. Add the following two lines:

```
* soft memlock 102400000000
* hard memlock 102400000000
```

The value represents the number of kilobytes that may be locked by a process. The `limits.conf` file contains further documentation.

3.3 Schlumberger licensing

Following the installation of INTERSECT, you must install the Schlumberger Licensing tool. You can find this in the `3rdparty/PC/resource/Slblicensing` directory on the installation DVD.

3.4 Test the INTERSECT installation

The following information may be useful for a simple test of INTERSECT.

Run from the command line

The Migrator can convert an ECLIPSE keyword file into an AFI file, which can then be read by INTERSECT.

- The following ECLRUN command line generates the AFI file but does not run or simulate it: `eclrun ecl2ix basename` where **basename** is the root name of the input dataset. This command just generates the AFI file but does not run or simulate it.
- To run or perform the actual simulation using the AFI file the following command is used: `eclrun ix basename`. INTERSECT reads the AFI file and performs the simulation.

If the input ECLIPSE dataset is changed, the AFI file must be regenerated from the dataset first, before being given to INTERSECT to be simulated.

An AFI consists of **{basename}.afi**, and its associated files **basename_ECL2IX.gsg**, **basename_ECL2IX_IX.ixf**, **basename_ECL2IX_FM.ixf**, **basename_fm_edits.ixf** and **basename_reservoir_edits.ixf**.

For information on using ECLRUN, see the *ECLRUN User Guide* provided as a separate part of the INTERSECT installation.

Test INTERSECT with an example data file

1. Create a temporary directory, and copy the example `IX.DATA` from `../ix/Examples/Example_2/` into the directory.
2. Change to the temporary directory and run the example using the command `eclrun ecl2ix IX`.

You should see a simulation run and exit normally, as below:

```
...
REPORT   Keyword migration summary:
         +-------------------------+
         | Fully migrated     | 53 |
         | Partially migrated | 4  |
         | Not migrated       | 6  |
         | Ignored            | 8  |
         | Total              | 68 |
         +-------------------------+
INFO IX.afi is created.
INFO     Migration complete. Elapsed time 0hrs:0mins:10secs (10secs)
REPORT   Message summary
         +---------------------------+
         | Message Level | Frequency |
         +---------------------------+
         | INFO          |        32 |
         | WARNING       |        14 |
         | ERROR         |         0 |
         +---------------------------+
INFO Run finished normally.
```