

Cluster Installation Guide

Overview

PyroSim's cluster-based FDS execution mode makes it possible to combine the power of multiple computers (i.e. a cluster) to run a single simulation. Very large simulations that require more resources than a single computer can provide are the ideal candidates for this approach. Because of the increased burden of network communication, smaller simulations often complete much faster when run using the parallel or serial FDS execution modes.

Each computer involved in a cluster simulation must meet the following requirements:

- all computers must be running a Windows operating system¹,
- all computers must be running the MPI cluster service, and
- all computers must have an account with the same username and password.

Cluster simulations are similar to MPI-based parallel simulations - each MESH is run as a different process. In the case of cluster runs, these processes can be on multiple computers.

Licensing

The standard PyroSim license permits clusters of up to two computers: the current (PyroSim) computer and one other computer. There is no limit on the number of MESHs (i.e. processes) that can be run on each machine. To remove the two computer limitation, an "Unlimited Cluster" license add-on is available for purchase.

Installing the MPI Cluster Service

The MPI cluster service must be installed on all computers involved in the cluster simulation (i.e. cluster nodes), including the computer running PyroSim.

To set up a machine to be a cluster node:

1. Download the Cluster Node Installer². This file can be obtained at the download site provided with your license purchase.
2. Run the installer. The installer will require administrator permissions to install the MPI service.

¹ It may be possible to manually perform the necessary MPI configuration to run on multiple operating systems. However, only the Windows-only configuration is covered by this guide and supported by Thunderhead Engineering.

² Installers are available for 32-bit and 64-bit machines. A 64-bit machine can support both versions side-by-side.

Cluster-based FDS Execution in PyroSim

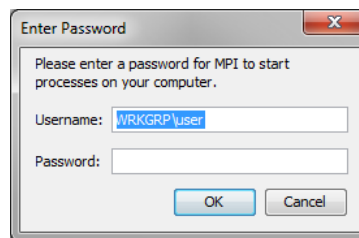
Once each computer in the cluster has been configured to be a cluster node (see previous section), you can launch cluster-based FDS simulations in PyroSim using the **Run FDS Cluster...** option in the **FDS** menu.

Troubleshooting

This section illustrates several common problems users may encounter when running FDS in a cluster environment. For additional technical support, please contact support@thunderheadeng.com

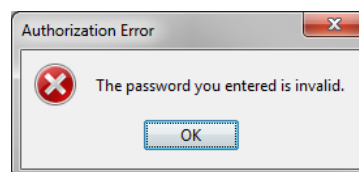
Authentication Issues

When a parallel or cluster simulation is initiated, the MPI process selects a users account to use for authentication when running the simulation. MPI stores this information in the system registry and if it has not yet had an opportunity to do so, the user will be prompted to enter a username and password.

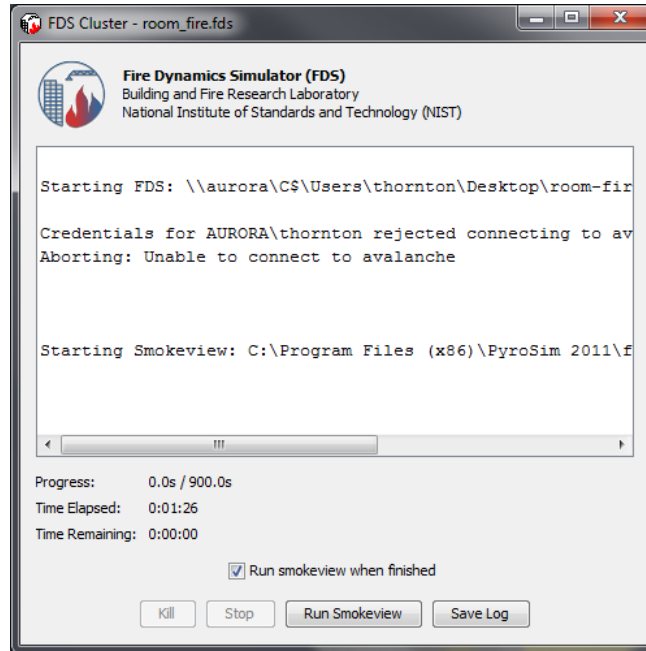


To run cluster simulations, the username and password given in this dialog must exist on all cluster nodes. It is not necessary for this data to match the currently logged-in account.

If the username/password combination is invalid, the following dialog will appear.



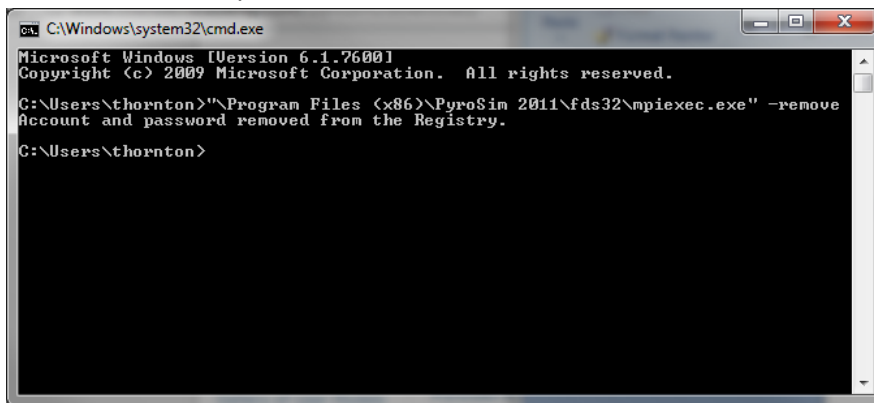
If the username/password combination is valid, but does not give necessary credentials to function on all cluster nodes, FDS will issue an error message and exit. The following screen capture illustrates the error when using a local machine account (AURORA/thornton) that is not valid on a different machine (AVALANCHE).



To correct this error, you must first remove the authentication data MPI has stored in the system registry. Until this is done, MPI will continue to use the original login data and you will not be prompted to enter a new username/password combination.

To remove MPI account and password data from the system registry:

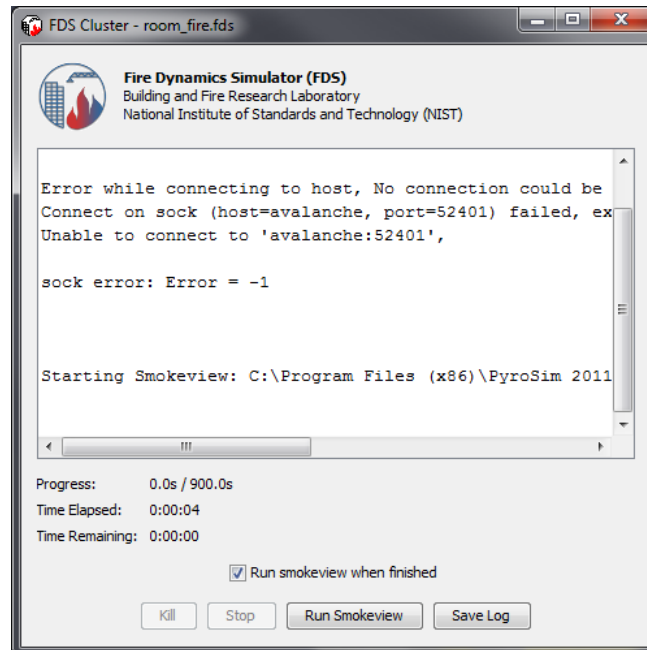
1. Open a command prompt (On the start menu, run the command "cmd").
2. Run MPIEXEC with the `-remove` flag. MPIEXEC can be found in PyroSim's `fds32` folder in 32-bit installs and PyroSim's `fds64` folder in 64-bit installs.



After issuing this command, the next time PyroSim launches a parallel or cluster FDS run the user will be prompted to enter a username/password combination.

Error Connecting to Host

If FDS displays the error message " Error while connecting to host, No connection could be made because the target machine actively refused it. (10061)", this indicates that at least one of the cluster nodes did not respond to MPI's initialization.



Common causes of this error are:

- One or more of the cluster machines has not been set up as a cluster node.
- One or more of the cluster machines has been set up as a 32-bit cluster node, but PyroSim is being run as a 64-bit process and requires 64-bit cluster nodes (or vice versa).
- One or more of the cluster machines has a firewall enabled.

It should be possible to resolve all of these issues by running the appropriate Cluster Node Installer on the machine indicated in the error message (e.g. in the image above "Unable to connect to 'avalanche:52401'" indicates that the non-responsive machine is AVALANCHE).

The cluster node installer is designed to create the necessary firewall exceptions for it to function properly. However, if you'd like to manually test your firewall settings, the 64-bit version uses ports **52500** and **52501**. The 32-bit version uses ports **52400** and **52401**. Rather than creating explicit exceptions for these ports, the installer creates a firewall exception for the executable `smpd.exe` on the local subnet.