SymmetricDS Pro 3.2

Quick Start Guide

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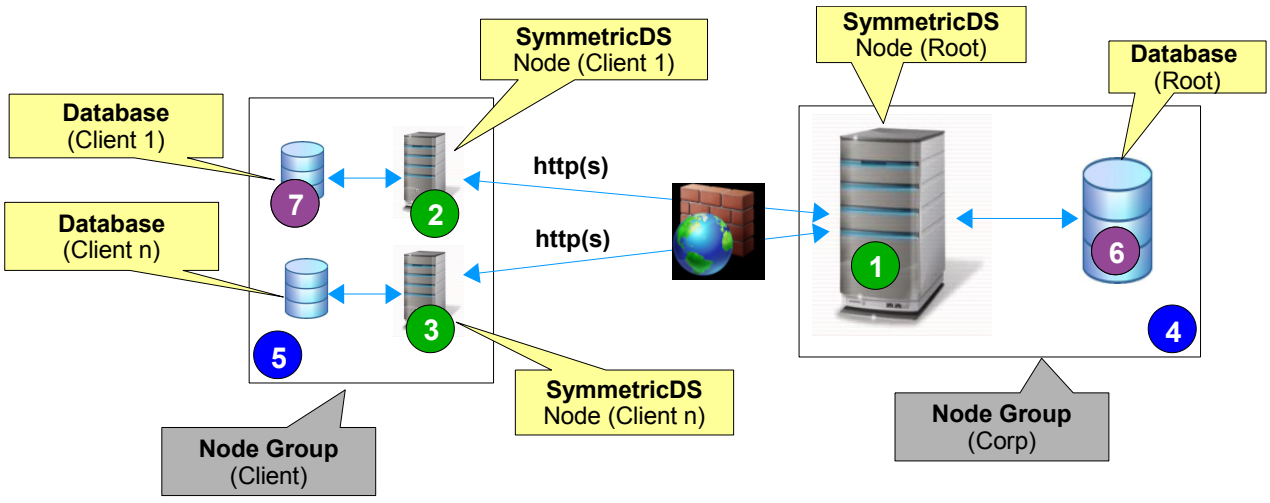
SymmetricDS Synchronization Concepts

SymmetricDS is a change data capture, replication solution that can be used to synchronize databases in near real time. Synchronization can be bi-directional, scale to a very large number of databases, work across low bandwidth connections, and withstand periods of network outage. It is a general purpose tool that can be deployed and configured in many different ways to solve a wide variety of synchronization concerns.

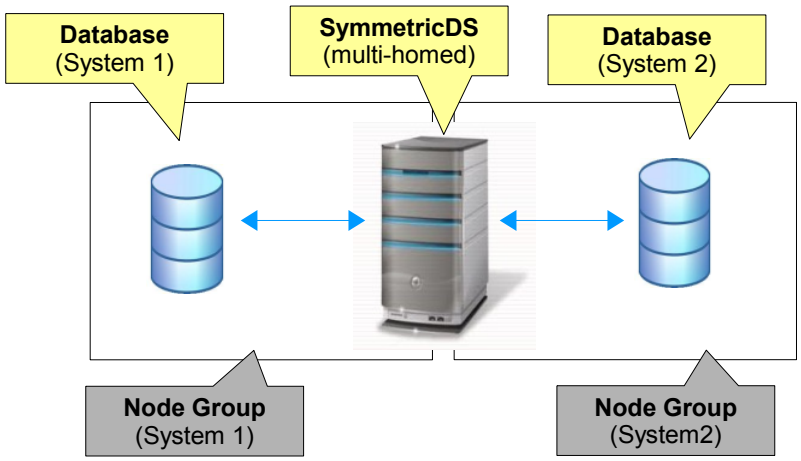
In order to get the solution up and running it is important to understand some base terminology. We'll use a simple retail business scenario that synchronizes data (information about pricing, inventory, transactions, etc.) between a central office database and multiple store databases to help explain the terms.

Term	Description
Node	A single installed and running instance of SymmetricDS that is attached to, and has responsibility for, keeping a database instance in synch. In the example below, #1, #2, and #3 are all examples of nodes in a SymmetricDS implementation
Root Node	The master or primary Node in the SymmetricDS implementation that is responsible for storing and coordinating all configuration information (metadata) about the synchronization scenario. The root node is also responsible for hosting the SymmetricDS web management console that allows you to configure, manage and monitor your solution. In the example below, #1 is the root node.
Node Group	A logical grouping of Nodes used in defining your synchronization configuration. A Node Group can be a single node, or it can be thousands of nodes. Node Groups are based on which Nodes share common synchronization configuration or rules. For example, all stores need to get pricing information from, and send transaction information to the Central Office. We don't want to define that configuration for each store (Node), but instead want to be able to define it for the group of stores as a whole (Node Group). Each Node must be contained within a Node Group. In our example below, we have two Node Groups defined, "Corp" which is #4 and "Stores" which is #5. The Stores node group includes each Node for every store, and the Corp includes the single instance that is the Root Node.
Root Database	The jdbc compliant database attached to the Root Node. This database usually contains both data you want synchronized, as well as all of the SymmetricDS configuration data for your synchronization solution. In the example below, #6 is the Root Database
Client Database	The jdbc compliant database attached to one of the other SymmetricDS nodes. This database contains data you want synchronized as well as SymmetricDS configuration data sent to it by the Rood Node from the Root Database. In the example below, #7 is a Client Database



In the retail scenario on the previous page, each database has its own instance of symmetric running on a server that is attached to the database (#1, #2 and #3). This one to one relationship between symmetric instance and database is called a single-homed setup.

It is also possible to have a multi-homed setup where a single instance of symmetric is attached to, and responsible for, multiple databases. We see this scenario frequently where people are synchronizing a smaller number of databases (i.e. 2 nodes) that are located physically close to each other (i.e. the same data center). We also see this multi-homed setup frequently when people are testing or prototyping SymmetricDS and want a simple, quick setup on a single machine. The following diagram shows a simple, multi-homed setup.

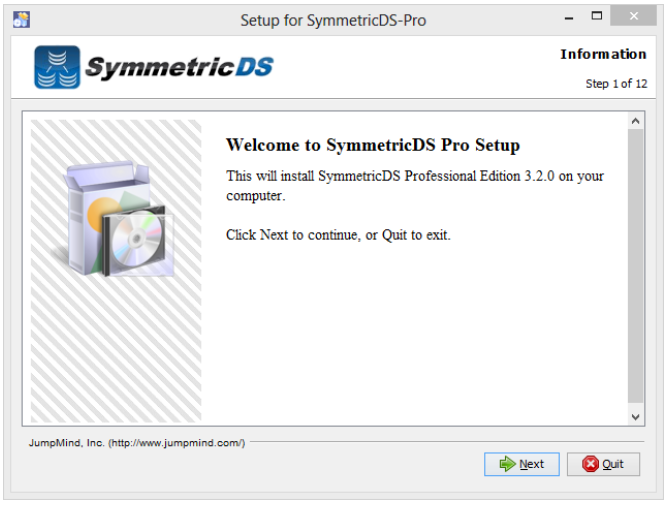


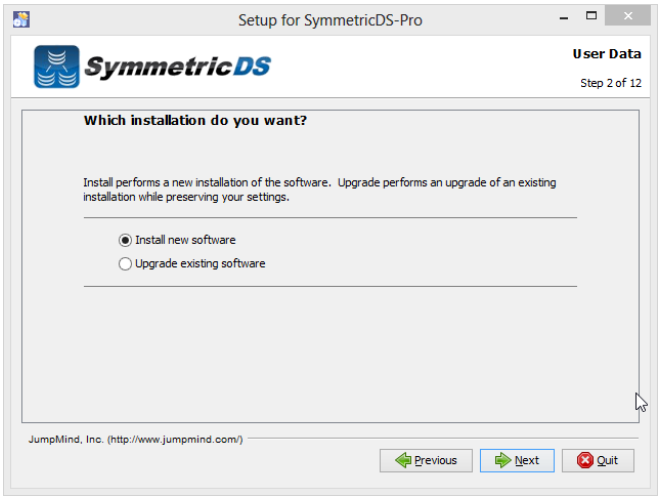
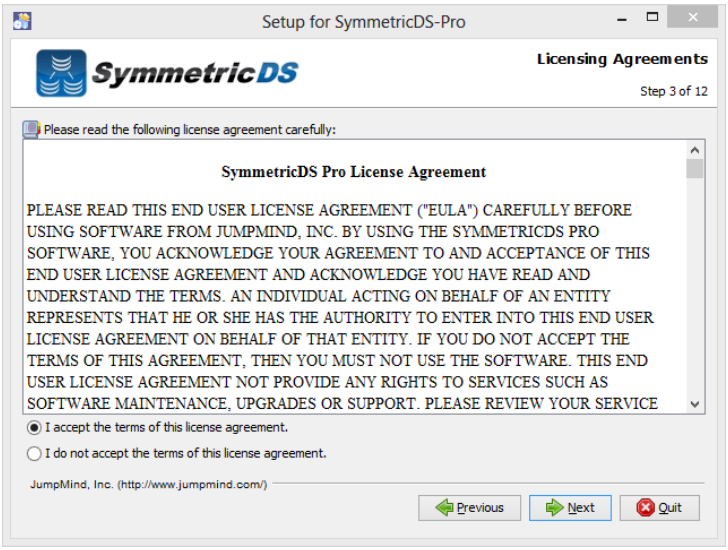
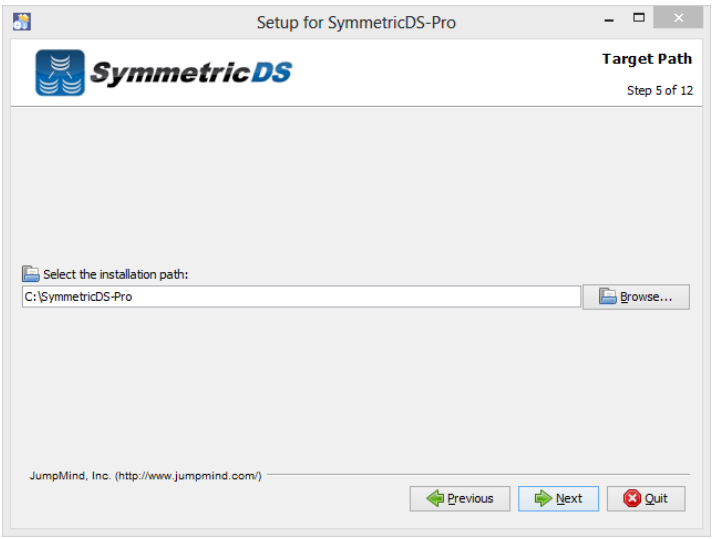
Installing SymmetricDS Pro

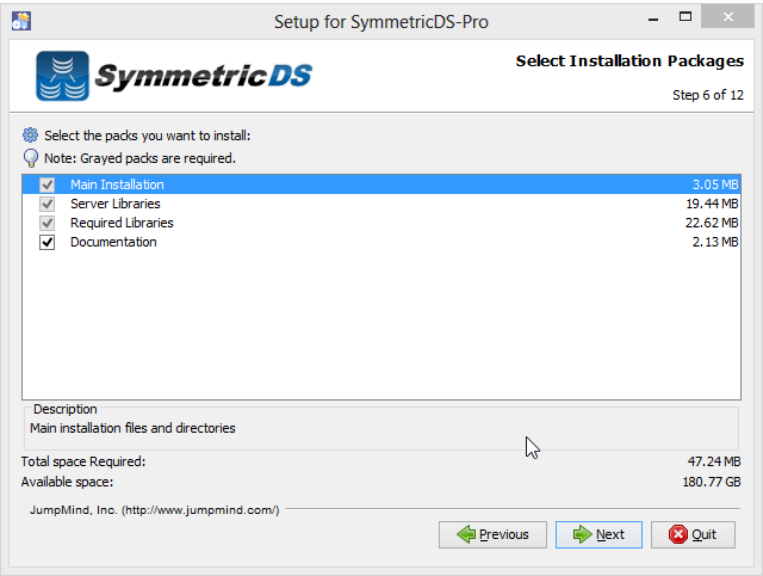
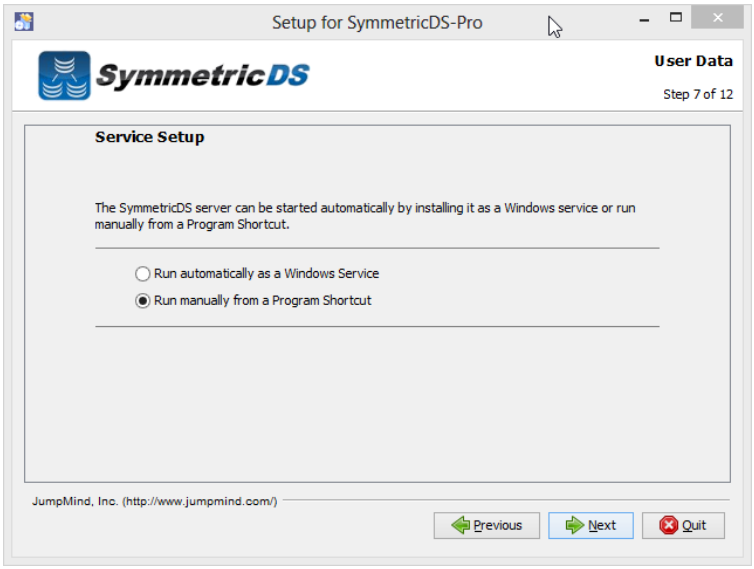
The base installation of SymmetricDS is the same, regardless of whether you are installing SymmetricDS multi-homed or single-homed. The following base installation steps will walk you through installing SymmetricDS for a given node (single-homed) or nodes (multi-homed).

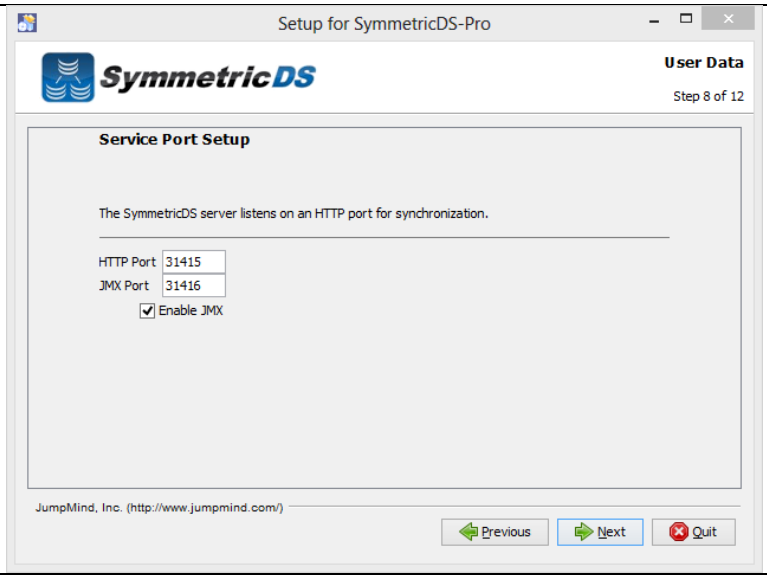
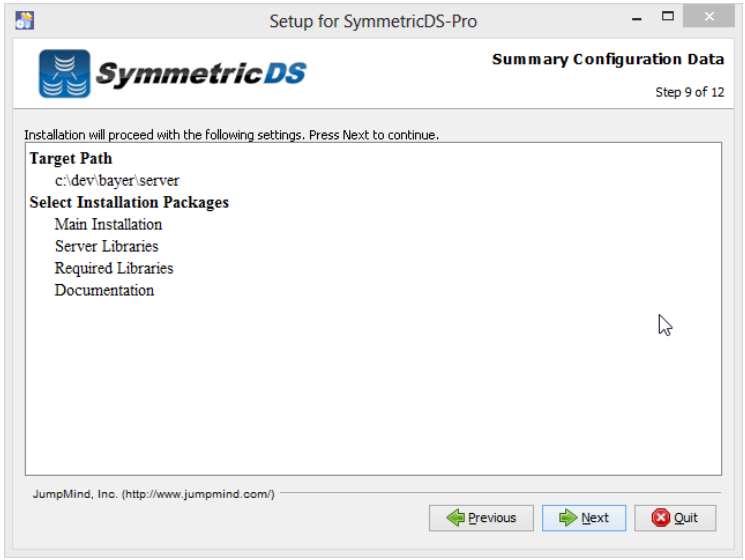
To begin installation of the root node:

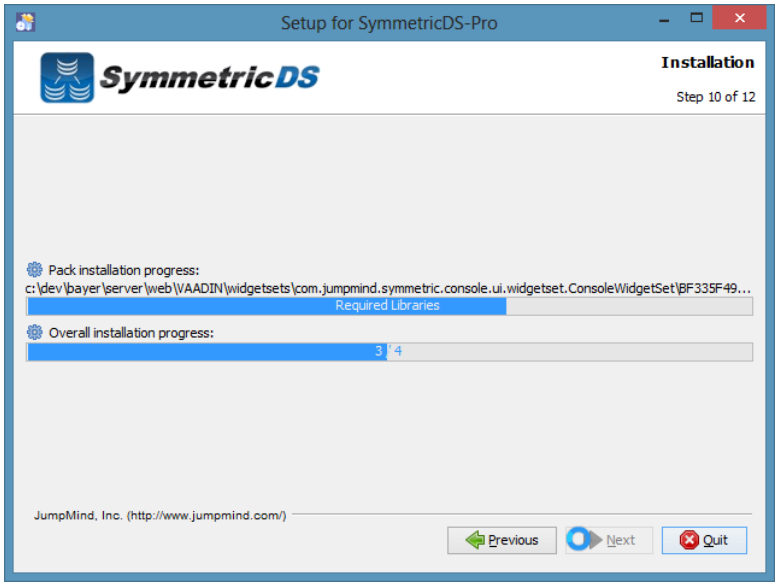
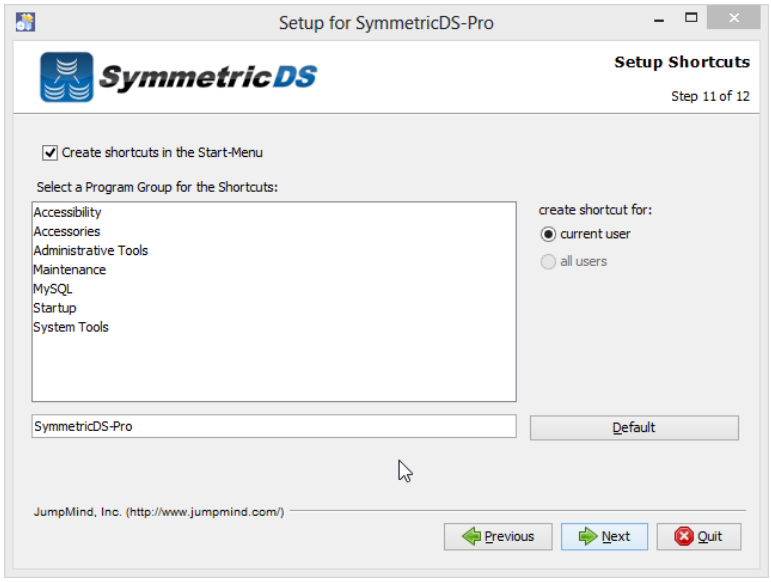
- Verify that you have the 1.5.x or 1.6.x Java Runtime Environment (JRE) installed on the Root Node computer.
- Verify that the JRE bin directory is in your path
- Run the SymmetricDS installer by double clicking the **symmetric-pro-3.2.x-install.jar**
- Click "Next" after reading the Welcome screen.

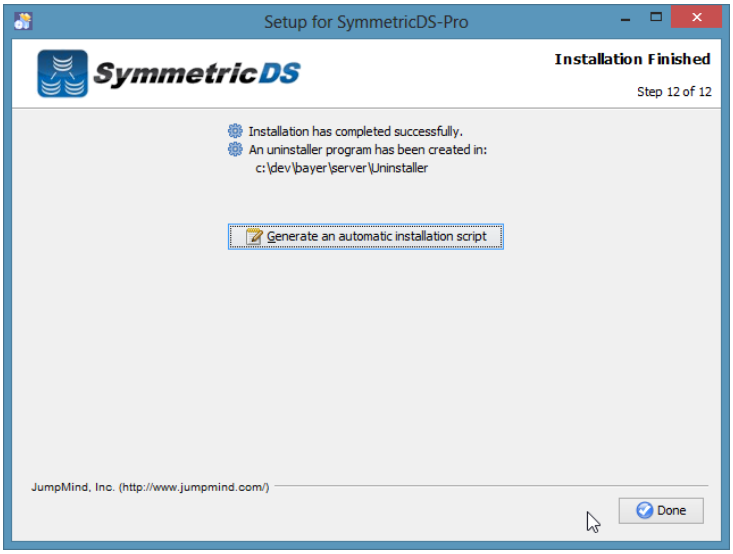


The install process allows you to either update an existing instance of SymmetricDS Pro, or install a new instance of SymmetricDS Pro. Select whether you are upgrading an existing install, or whether you would like a new install.	
Review and accept the license agreement	
Select the installation directory where the SymmetricDS application should be installed	

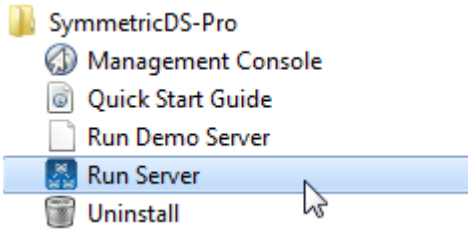
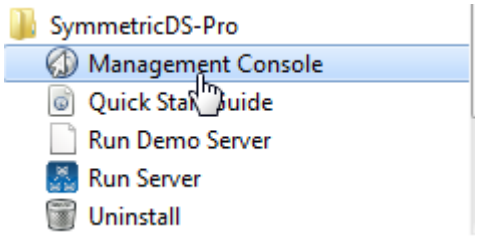
Select the components you would like to install.	
For Windows, SymmetricDS can be started manually from a Program Shortcut or as a Windows Service. Select one of the two options and click "Next."	

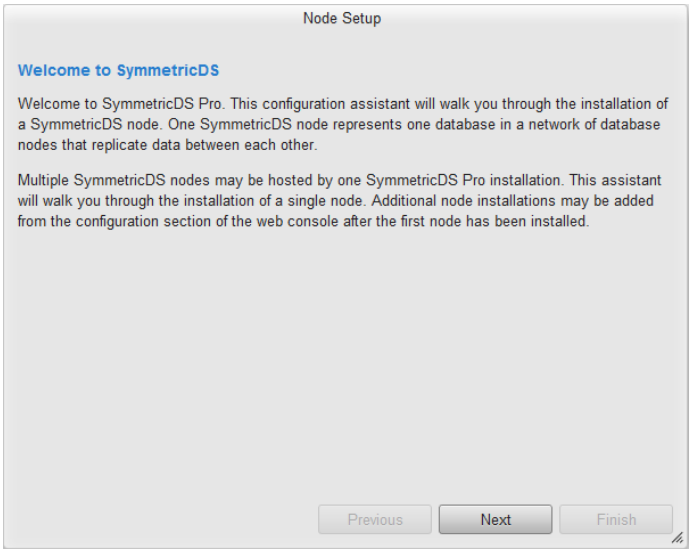
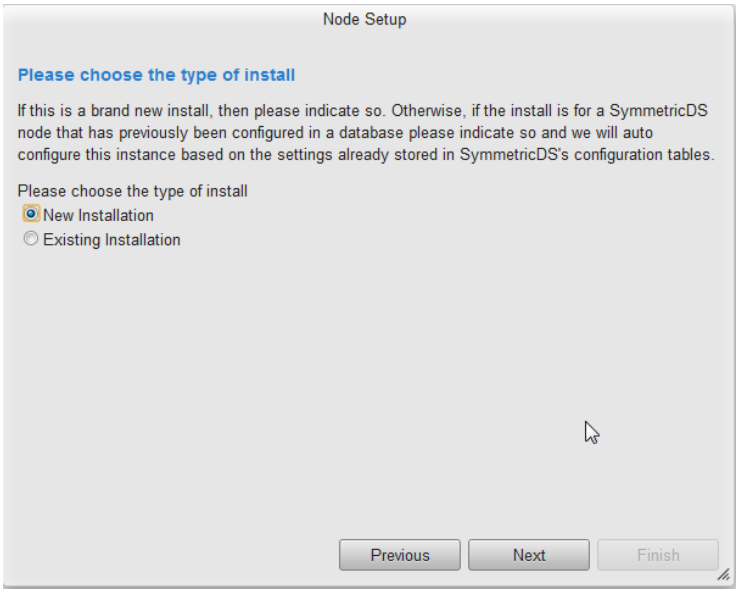
Specify the port number you would like SymmetricDS Pro to listen on, and also whether you would like to enable the JMX management capabilities. If enable JMX, you will also need to specify the JMX port.	
The Summary Configuration screen allows you to review your installation choices. Review and click "Next"	

Once the application files have been copied to the installation directory, click the “Next” button.	
The Setup Shortcuts screen allows you to specify where you would like shortcuts created for the SymmetricDS instance. Select a group and click the “Next” button.	

Installation of SymmetricDS Pro is now complete. Click the “Done” button.	

Starting and Configuring SymmetricDS Pro

Starting SymmetricDS depends on how it was installed. If installed as a service, start the SymmetricDS service from the services panel. If installed to start manually from a Program Shortcut, start the server by running “Run Server” from the SymmetricDS-Pro start menu folder.	
To access the management console, click the “Management Console” link from the SymmetricDS-Pro start menu folder.	

The first time the console is accessed, you will be prompted to configure a node. Read information about Node Setup and click "Next."	
The first thing you are able to select for Node Setup is whether this is a "New" or "Existing" installation. An "Existing" installation is one where SymmetricDS is already installed and configured for the node (i.e. SymmetricDS configuration tables already exist and contain your synchronization configuration). A "New" installation is one where SymmetricDS has not yet been configured for the node. Select "New Installation" or "Existing Installation" and select "Next."	

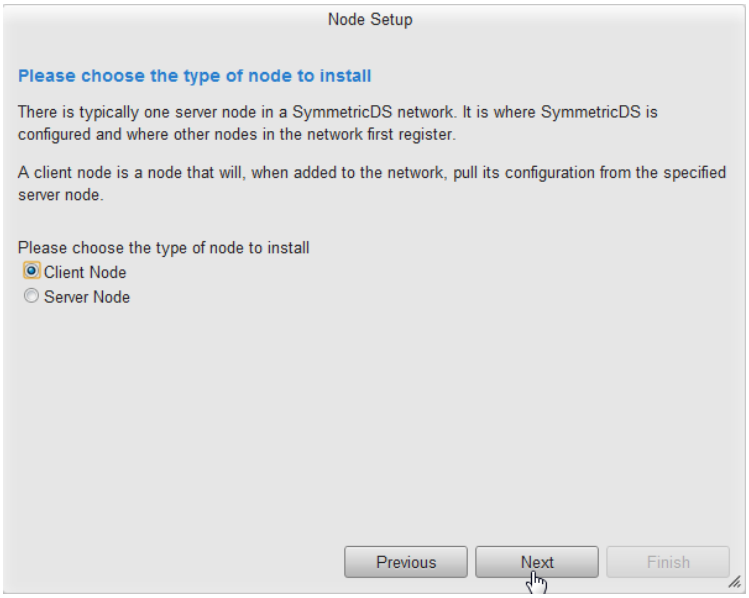
The next screen allows you to select the type of node, “Client Node” or “Server Node.” There is typically only one “Server” or “Root” node in each synchronization scenario. The “Server” or “Root” node is responsible for:

1. Storing and coordinating all configuration information (metadata) about the synchronization scenario
2. Hosting the SymmetricDS management console
3. Acting as the Registration Server for the synchronization scenario. The registration server manages which Nodes are allowed to participate in the synchronization scenario.

In most scenarios, the “Root” or “Server” Node is the SymmetricDS Node attached to your primary database in the synchronization scenario. That is, in a Store / Central office configuration, the Central Office database would be your Root node. In a Primary / Secondary synchronization solution, your Primary node would be the Root Node.

Typically, you set up your Root Node first, and then subsequently set up Client Nodes.

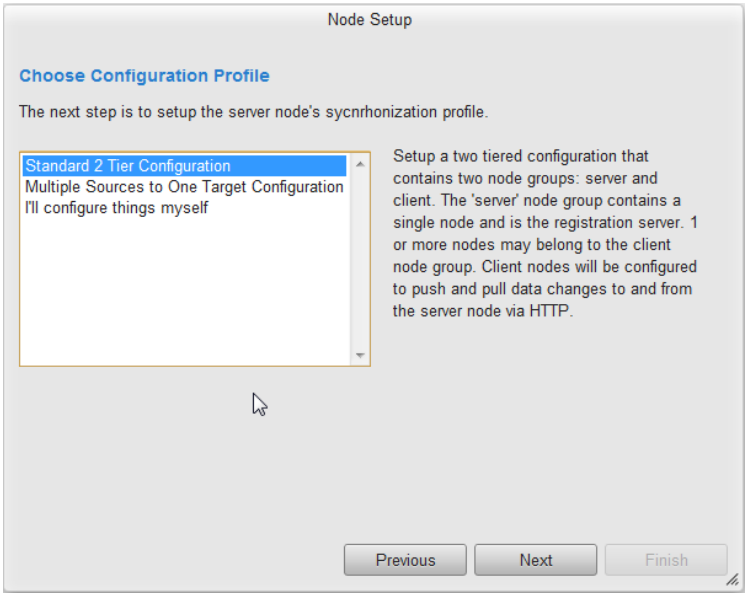
Select the type of Node you are setting up, and click “Next.”



SymmetricDS Pro has the concept of pre-configured synchronization profiles. These profiles are base configuration for some of the common scenarios we have seen in industry. Three of the options are:

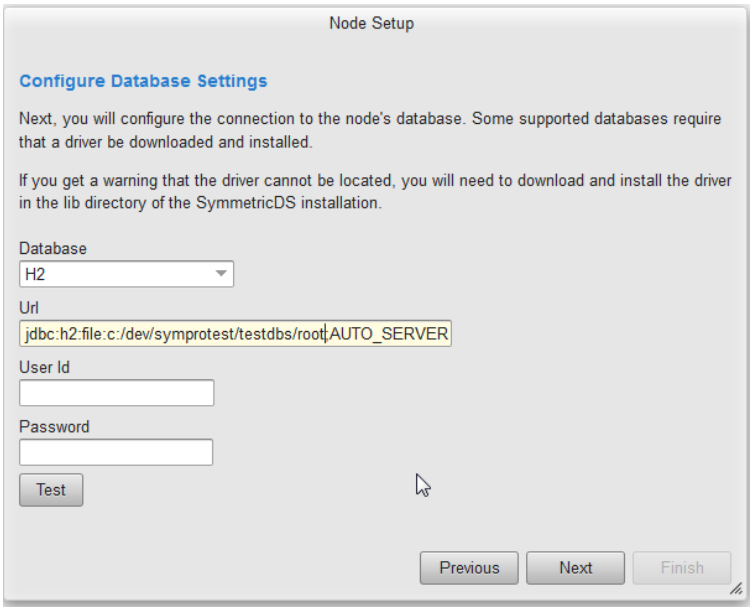
1. **Standard 2 Tier Configuration** – This is a basic two tier configuration. Note this doesn't mean two nodes, but two tiers of nodes. This can be anything from two databases that need synchronize with each other, to a primary root server with multiple client nodes. Two node groups are set up with the server node group containing a single node. This is the scenario we see most often
2. **Multiple Sources to One Target Configuration** – This scenario is typical in Data Warehousing. This scenario is for multiple source systems that desire to synch data to a central location. This differs from the Standard 2 Tier Configuration in that it creates a Root / Registration node that stands on its own, and all other nodes are clients. I.E. source systems and target systems are all clients, and the Root / Registration node
3. **I'll configure things myself** – This option doesn't set up any default configuration, allowing the user to set up the synchronization scenario from scratch.

For the purposes of the install guide, we'll complete a simple 2 Tier configuration, so select "Standard 2 Tier Configuration" and click "Next."



The next screen allows you to specify the connection information for the Root or Server Database.

- **Database** – The type of database (SQLServer, Oracle, MySQL, etc.)
- **JDBC URL** – The URL for your Root Database
- **User Id** – The user id for your Root Database. This Id will need Create, Read, Update, Delete (CRUD) privileges for tables
- **Password** – Associated password for the User ID for the Root Database

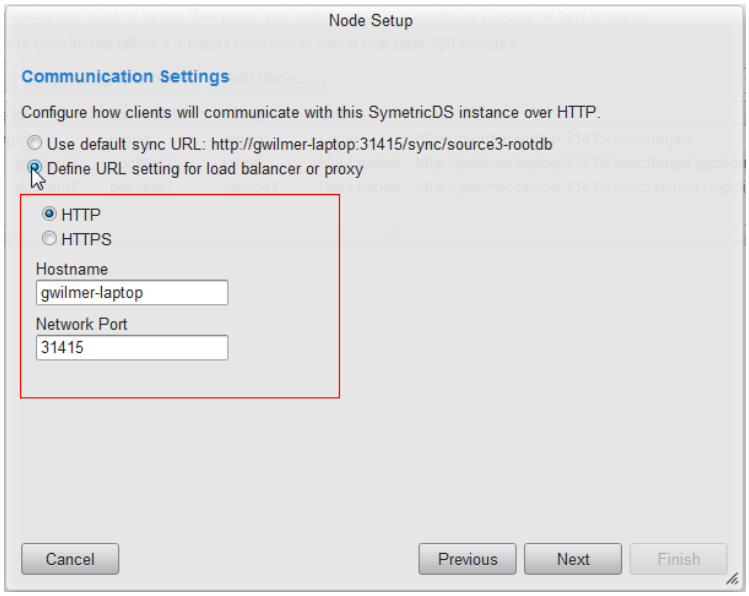


The next screen allows you to specify the protocol and port on which other nodes will communicate with this SymmetricDS node.

By default, "Use default sync URL" will be selected, and the information in the red box to the right will not appear. This is the most common option, and allows SymmetricDS Pro to detect the settings on the current machine and use the default sync URL.

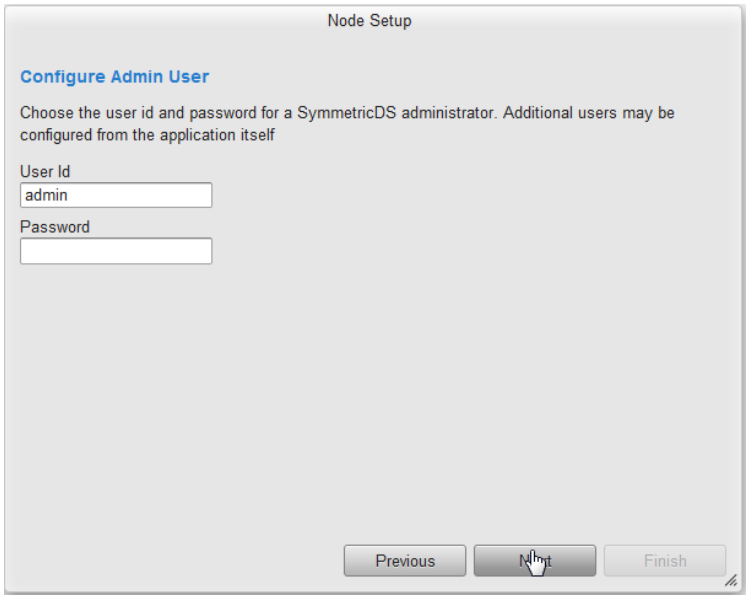
There are times (when you want to put a load balancer in front of the SymmetricDS server, when you want to communicate over HTTPS, or you want to specify a proxy) that you will want to define your own sync URL. In those cases, select "Define URL setting for load balancer or proxy", and the Node Setup Wizard will allow you to specify the details of your Sync URL.

For this demonstration, we will take the default and click "Next."



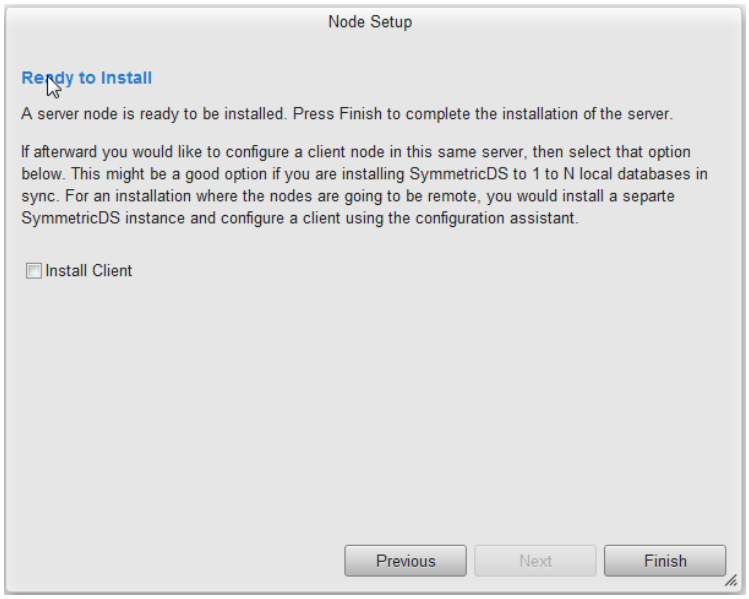
Next, you must specify a user id and password for the administrative console. This user id and password will be needed each subsequent time you use the console.

Select a user id and password, and click the Next button.

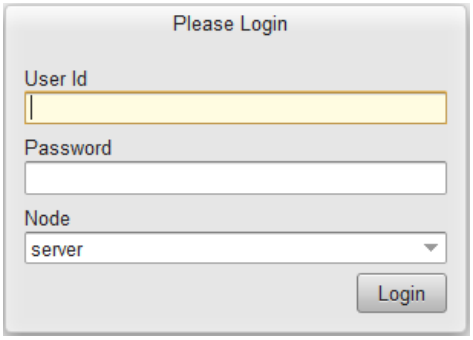


At this point, you have finished your initial configuration for the Root / Server Node.

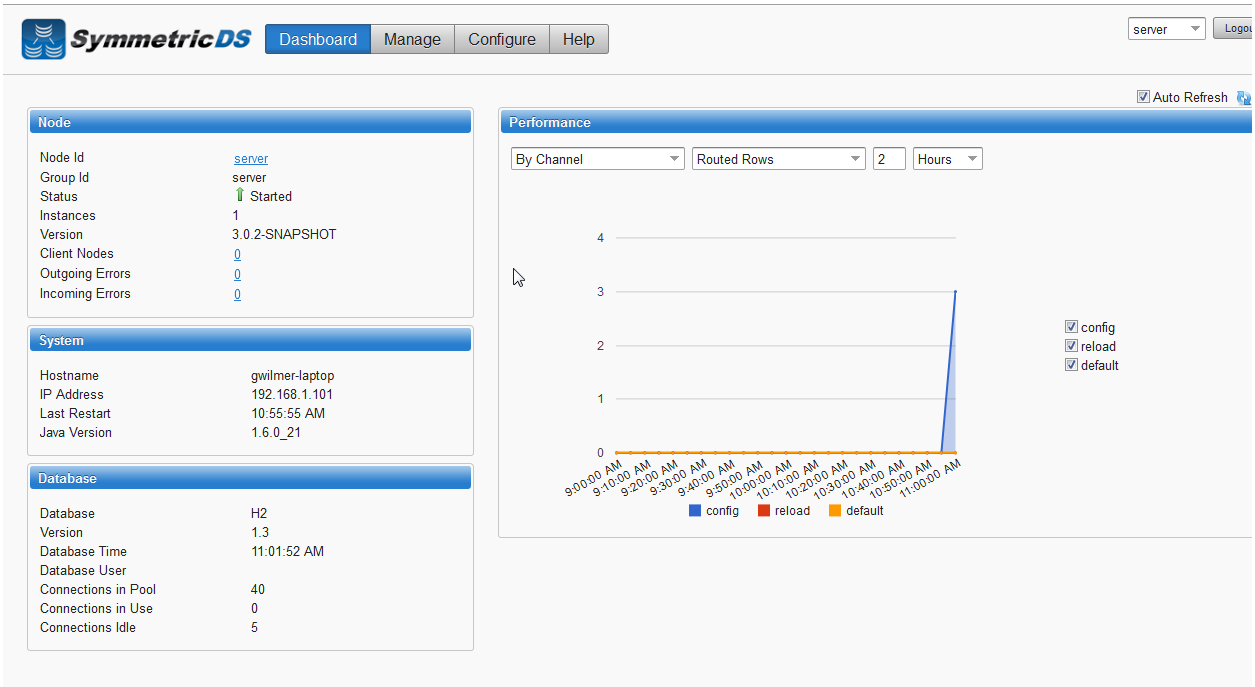
Click the "Finish" button.



After installing the Root Node, you will be asked to log into the Management Console again with the user id and password you set up earlier in the configuration. Enter the userid and password, and click "Login"



The next screen (shown below) is the main screen and dashboard for SymmetricDS Pro. From this screen you can configure and manage your synchronization scenario. The Configure menu allows you to set up your scenario. The Manage menu allows you to manage the day to day operations of that scenario. We'll start with the Configure menu option and configuring your scenario, but first, let's talk about some additional concepts.



SymmetricDS Configuration Concepts

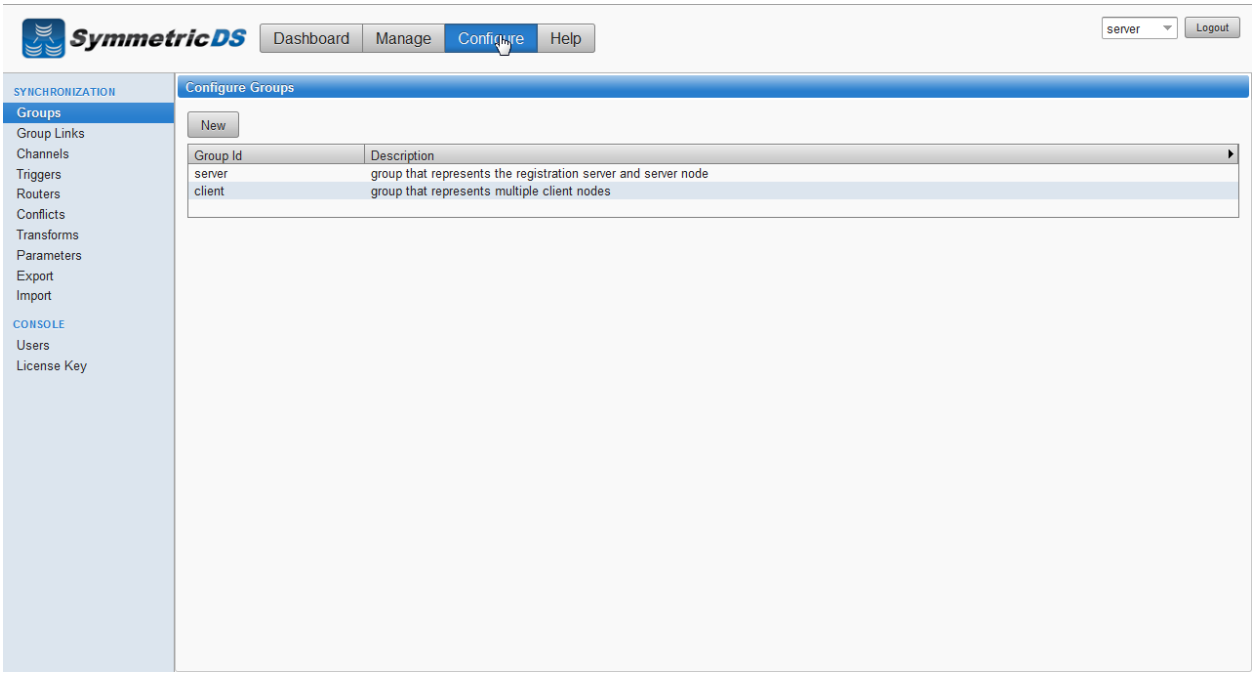
We've already talked about Nodes and Node Groups. Now we'll define terms that are needed to configure the data that is captured, how that data is logically grouped, and where the data should be sent.

Term	Description
Node Group	A logical grouping of Nodes used in defining your synchronization configuration. See SymmetricDS Synchronization Concepts section earlier in this document for additional details.
Node Group Link	A Node Group Link defines how data flows between each of the Node Groups in your synchronization scenario. Each Node Group Link allows you to define a Source Node Group, a Target Node Group, and whether data is pulled or pushed between those Node Groups.
Channel	SymmetricDS supports the concept of Channels of data. Data synchronization is defined at the table (or table subset) level, and each managed table can be assigned to a *channel* that helps control the flow of data. A channel is a category of data that can be enabled, prioritized and synchronized independently of other channels. For example, in a retail environment, users may be waiting for inventory documents to update while a promotional sale event updates a large number of items. If processed in order, the item updates would delay the inventory updates even though the data is unrelated. By assigning changes to the item tables to an *item* channel and inventory tables' changes to an *inventory* channel, the changes are processed independently so inventory can get through despite the large amount of item data.
Trigger	SymmetricDS uses triggers to capture changes that need to be routed to other Nodes. SymmetricDS Triggers are standard database triggers supported by your database platform that are automatically created based on your configuration data.
Router	Routers are responsible for taking changes that are captured by Triggers and determining to which Node Groups those changes are delivered.

Configuring The Synchronization Solution

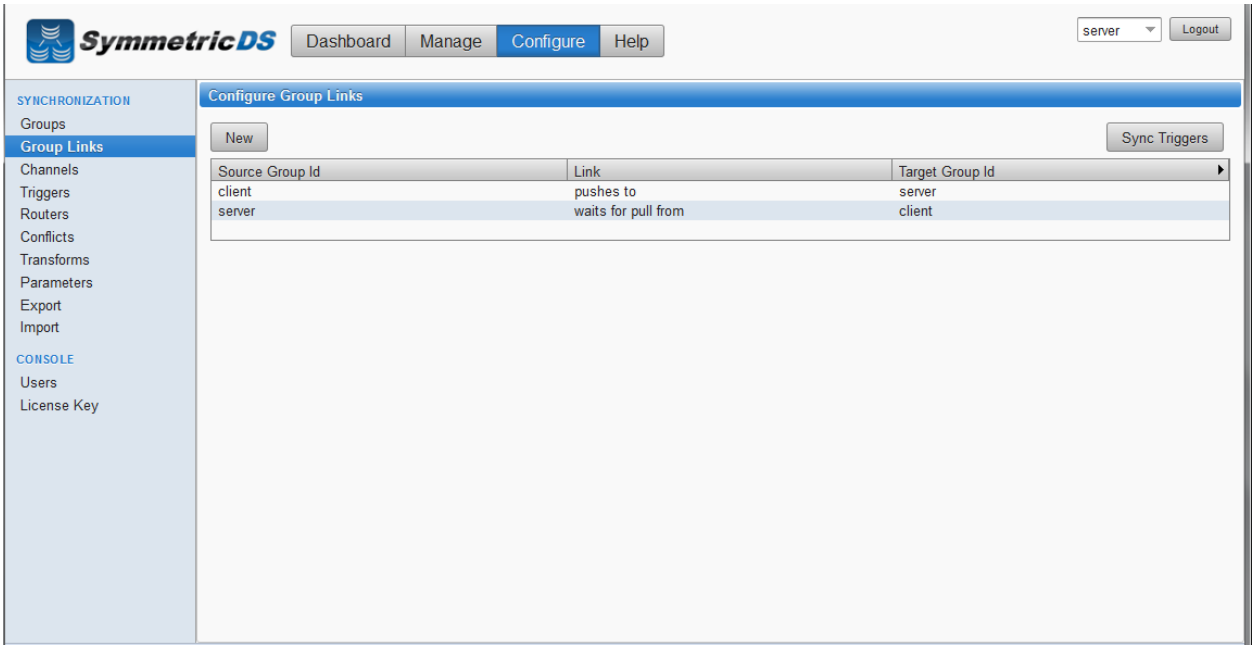
Node Groups - The first step in configuring your synchronization scenario is to set up your Node Groups (see Node Groups from the Synchronization Concepts page). Since we chose the Simple 2-Tier Configuration option, both Server and Client node groups have already been set up for us.

If additional Node Groups are desired, click the "New" button, fill in the Group Id (unique Id that identifies the Node Group) and a description and click "Save." You must have at least two Node Groups to continue the configuration of your scenario.



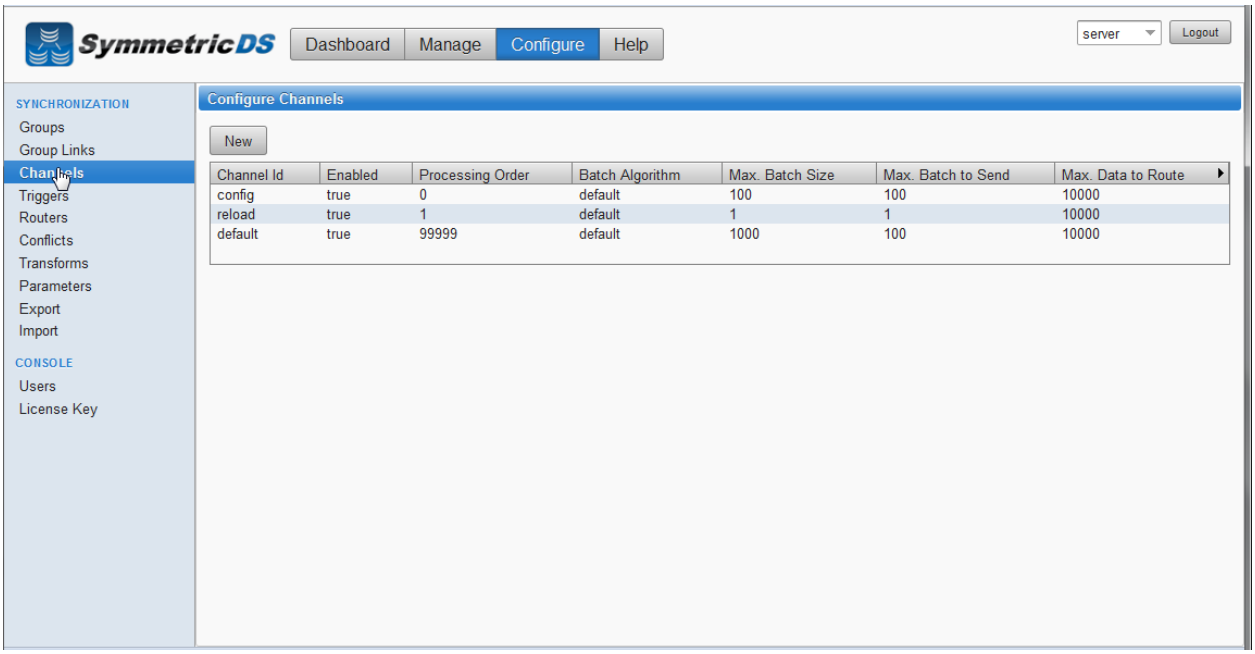
Node Group Links - The next step in configuration is setting up Node Group Links. The purpose of the links is to describe how data flows between the Node Groups. They define a source Node Group, a target Node Group, and a link type, namely whether the data changes are *pushed* or *pulled*. The push method causes the source Node Group to connect to the target Node Group and push data changes to it, while the pull method causes the source Node group to wait for the target Node Group to connect to it and pull the data changes that have been recorded on the source.

As part of the Simple 2-Tier setup, two node group links have already been set up for you. The two links are client pushing data to the server or root, and server or root waiting for data pulls from the client.



Data Channels - The next step is to configure Data Channels. In a nutshell, Data Channels allow you to logically group data that is being synchronized within your scenario. When SymmetricDS captures data changes in the database, the changes are captured in the order in which they occur. In addition, that order is preserved when synchronizing the data to other nodes. Frequently, however, you will have cases where you have different "types" of data with differing priorities. Some data might, for example, need priority for synchronization despite the normal order of events. For example, in a retail environment, users may be waiting for inventory documents to update while a promotional sale event updates a large number of items. SymmetricDS supports this by allowing tables being synchronized to be grouped together into Channels. A number of parameters that control the synchronization behavior of SymmetricDS are controlled at the Channel level. For example, Channels provide a processing order when synchronizing, a limit on the amount of data that will be batched together, and isolation from errors in other channels.

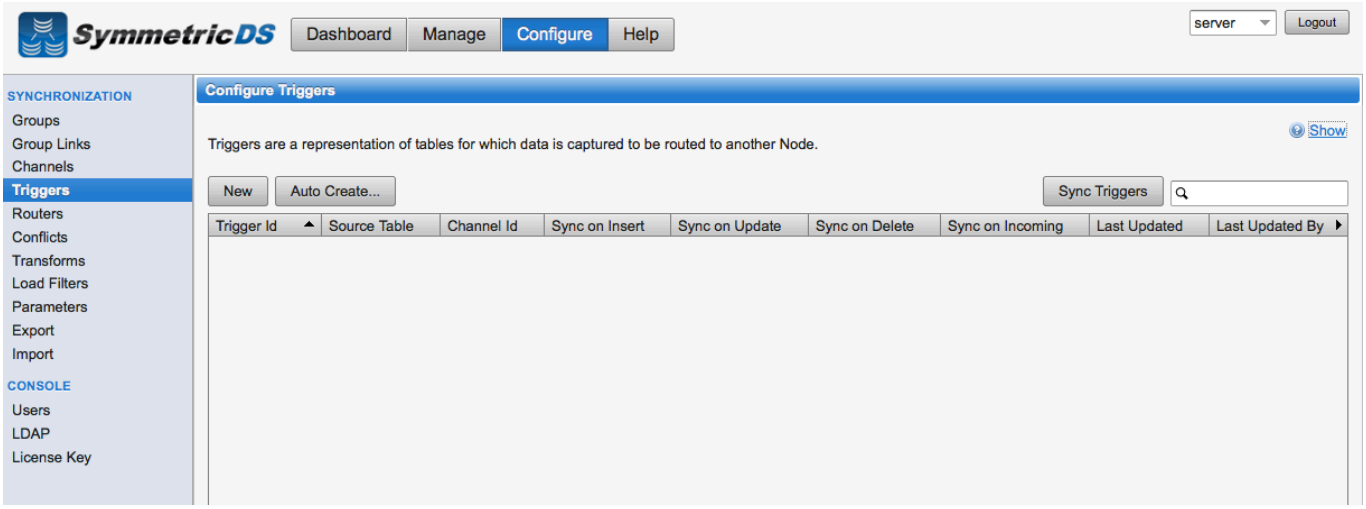
As part of the SymmetricDS install and the 2-tier configuration, three channels are set up for you. The config and reload channels are “system” channels that are used for synchronizing configuration and completing initial loads to other nodes. The default channel is the lone channel setup for all data synchronization in the 2-tier default setup. In this setup, all data will be synchronized over the “default” channel.



Triggers - SymmetricDS uses database triggers as the capture mechanism to record changes to be synchronized to other nodes. Based on the configuration you provide, SymmetricDS creates the needed database triggers automatically for you. The "triggers" you define are for a particular table that needs to be synchronized. There is a great deal of flexibility in terms of defining the exact conditions under which a data change is captured by the trigger. For each trigger you can also specify:

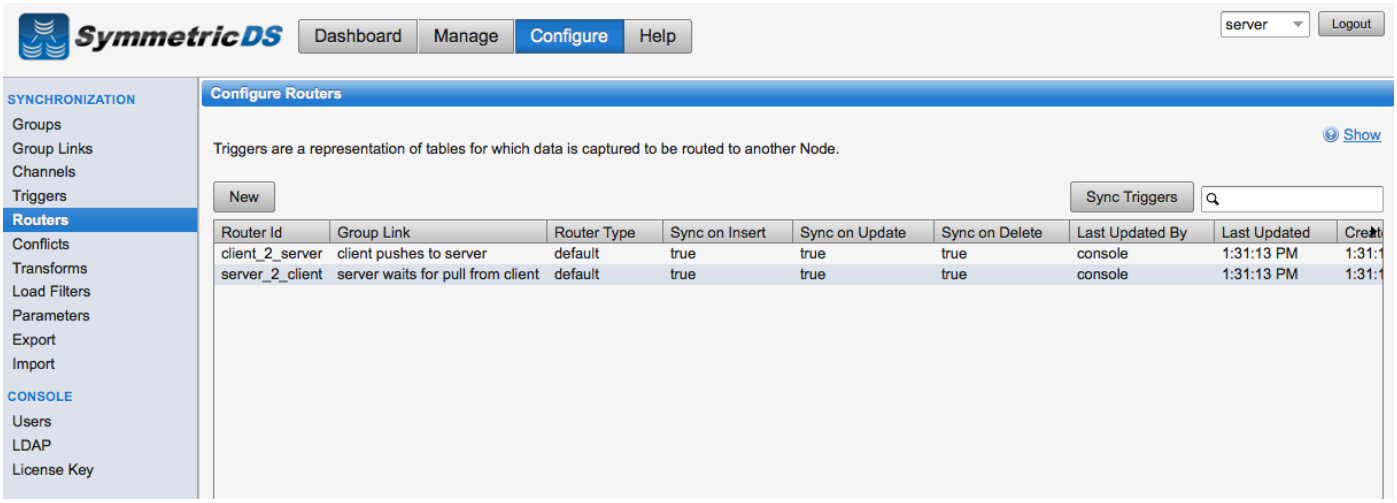
- Whether to install a trigger for updates, inserts, and/or deletes
- Conditions on which an insert, update, and/or delete fires
- A list of columns that should not be synchronized from this table
- A SQL select statement that can be used to hold data needed for routing (known as External Data)

You can create triggers one at a time by clicking the "New" button, filling in the appropriate details for the trigger, and clicking the "Save" button, or you can "Auto Create" them. The "Auto Create" button is a feature that allows you to browse your database table definitions and select tables for which you would like triggers created. You can select multiple tables, and then simply click the "Apply" button which will automatically create triggers for each table selected. Once triggers have been created with the "Auto Create" mechanism you can update each trigger's attributes indivdually by selecting them from the list, editing them, and saving them.



Routers - The triggers that have been defined in the previous section only define *when* data changes are to be captured for synchronization. They do not define *where* the data changes are to be sent. Routers, plus a mapping between Triggers and Routers (Trigger/Router), define the process for determining which Nodes receive the data changes.

As part of the 2-tier configuration, a default Router for each Node Group Link was automatically created for you. This Router defines the data route between your Node Groups (i.e. Node Group 1 pushes data to Node Group 2). All that is remaining to do is to define which triggers are associated with which Router. You can complete this mapping between Triggers and Routers on either the Routers page or the Triggers page. From the Triggers page, simply select a Trigger from the list, click the "Link Routers" button which appears once a Trigger is selected, and then check the routers to be mapped to the trigger. Or, from the Routers page, select a Router from the list, click the "Link Triggers" button that appears, and then select any of the Triggers which you want routed via the Router you selected.



After your Triggers and Routers have been configured, and the association between the two are mapped, you have completed your initial synchronization configuration.

Client Node Concepts

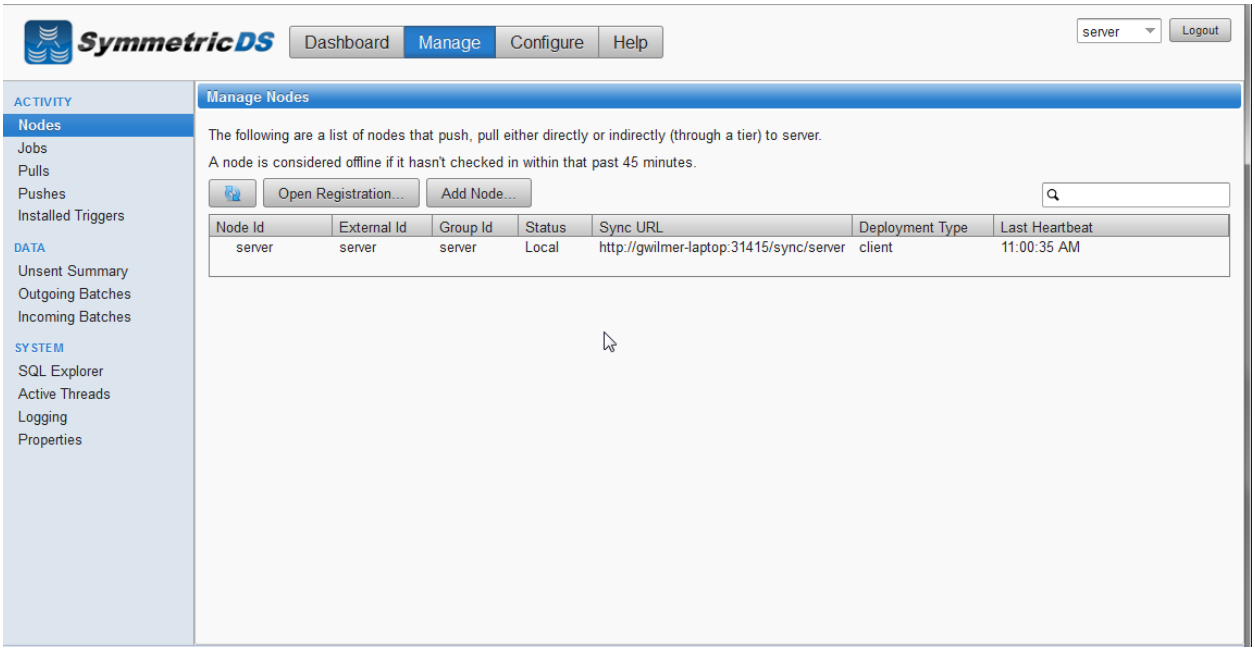
Now that we have our server or root instance installed and our synchronization scenario configured, the next steps are to install our client instances. The following are some terms that will help in understanding setting up the client.

Term	Description
Client Node	A SymmetricDS instance (other than the Rood Node) that is participating in the synchronization scenario
Node Registration	For a Node to participate in the synchronization it needs to ask for permission from the Registration Server. Node registration is the process of a Client Node requesting to be added to the synchronization scenario.
Registration Server	The Node (the Root Node) that is responsible for accepting Node Registration requests
Registration URL	The URL of the Root Node which is acting as the Registration Server. The URL includes the Name (or IP Address) and port that the SymmetricDS instance is running on
Initial Load	An initial load is the process of loading an initial set of data on a Client Node from the Root Node

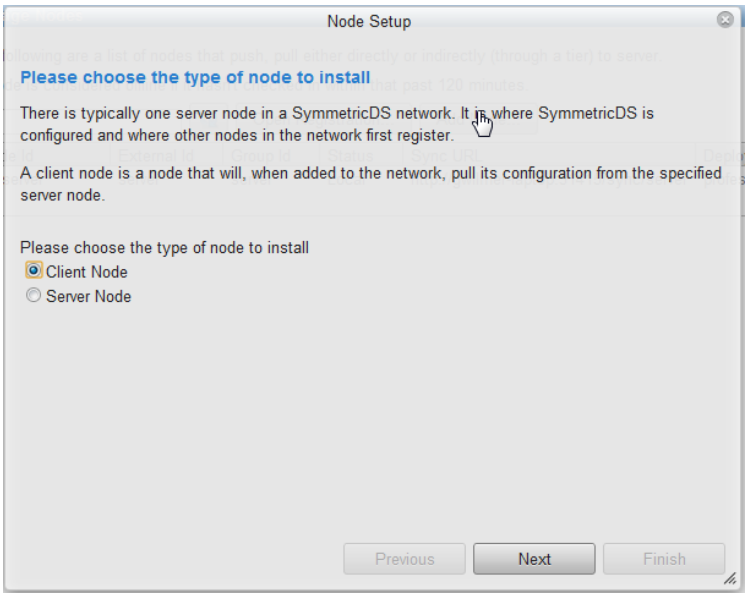
Installing the Client Node(s)

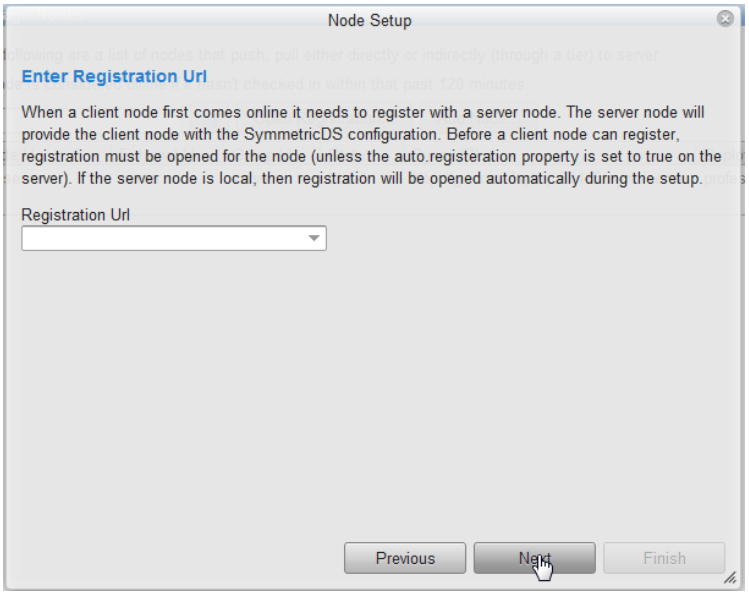
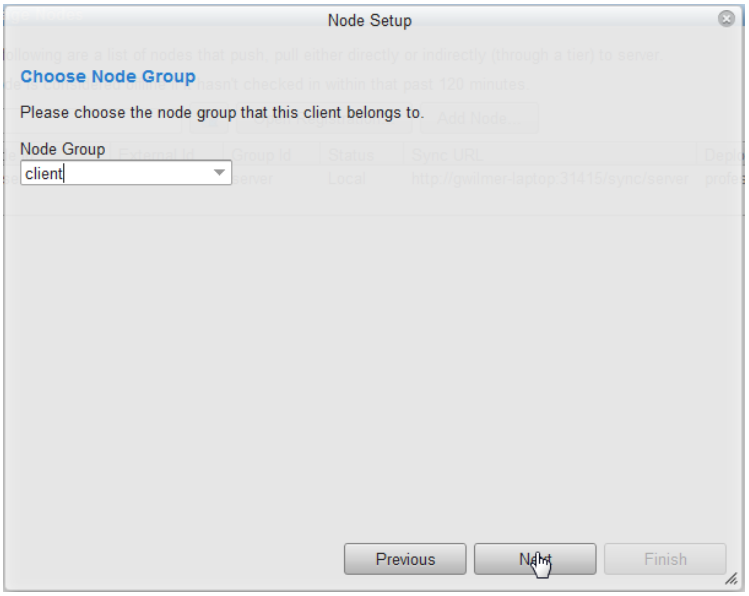
As discussed earlier, SymmetricDS can be installed in a multi-homed fashion where client and server databases are both synchronized by a single install of SymmetricDS, or, you can install an instance of SymmetricDS for the server and an instance of SymmetricDS for the client. In order to install another instance of SymmetricDS for your client node in a single-homed fashion, follow the same install steps from above for the installing the root server, except that when picking node type, select "client" versus "server."

In this guide, we will show a multi-homed example, where the client and server are both managed by the same install of SymmetricDS. In order to add the client node in a multi-homed setup, click on the "Manage" menu item, and click the "Add Node…" button.

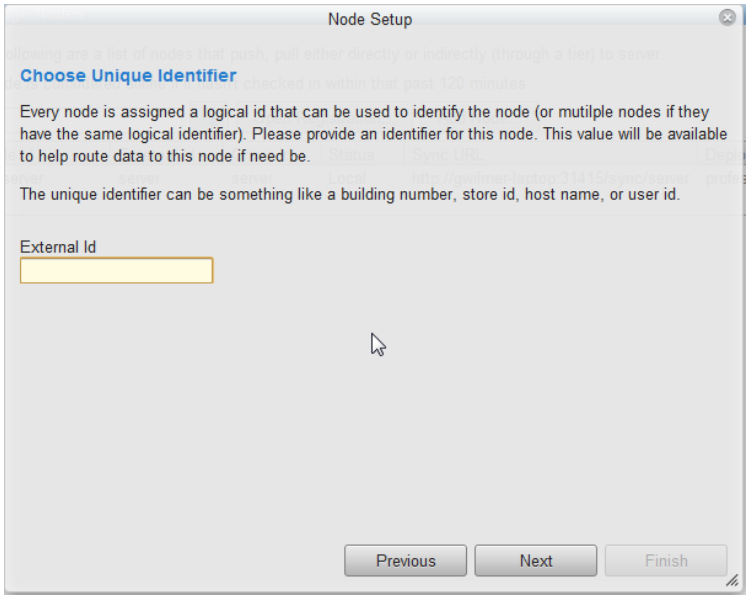


Similar to setting up the Server node, you need to select the Node type. For the client node, click "Client Node" and click "Next."



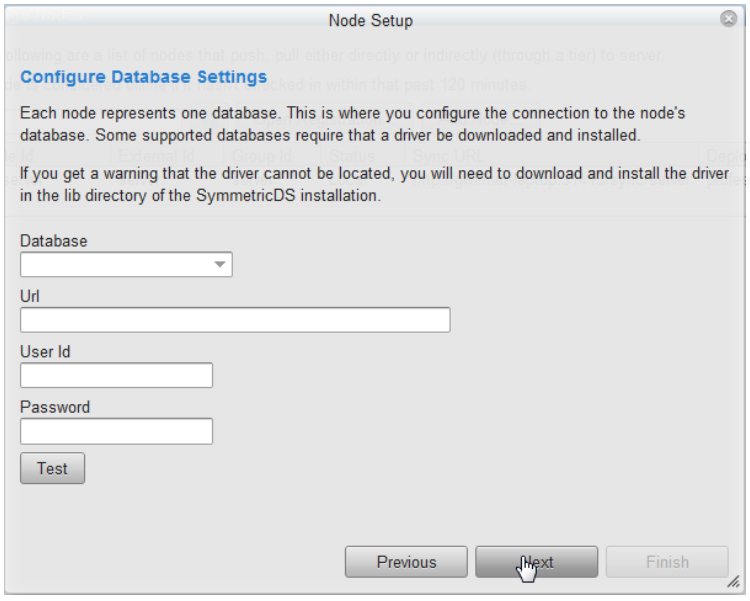
The next step in setting up the client is to specify the Registration URL. This is the URL that the Root Node Registration Server is listening on for registration requests. This parameter will allow the Client Node to request permission to participate in the synchronization. When installing the client in a multi-homed fashion, the registration server will be listed for you in the dropdown box. Select the registration URL, and click "Next."	
The next step is to specify the node group for the client you are installing. The available node groups will be listed in the drop down box, or you can type a new node group in the Node Group box. Select the node group (client for our example), and click "Next."	

The next step is to specify the External Id for the client node. The external Id is the unique identifier for this Client Node itself (each Node needs to have a unique identifier that allows other nodes in the synchronization scenario to identify it)

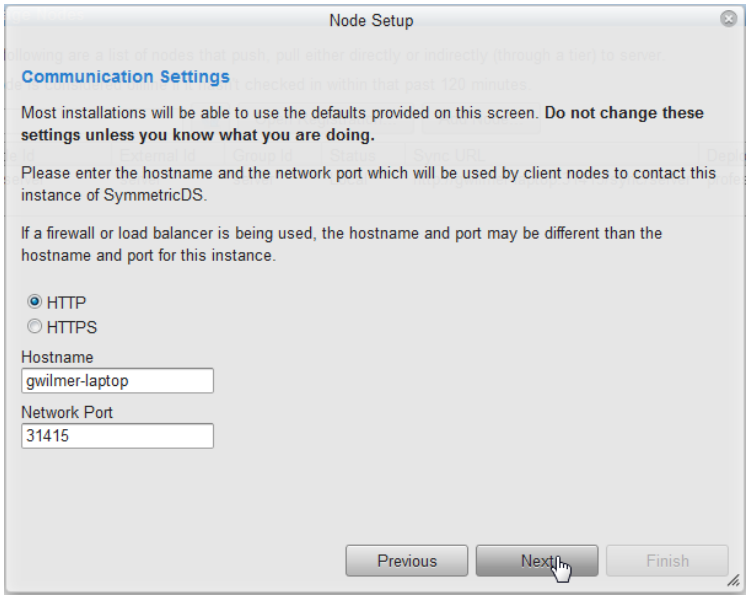


The next screen allows you to specify the connection information for the Client Database.

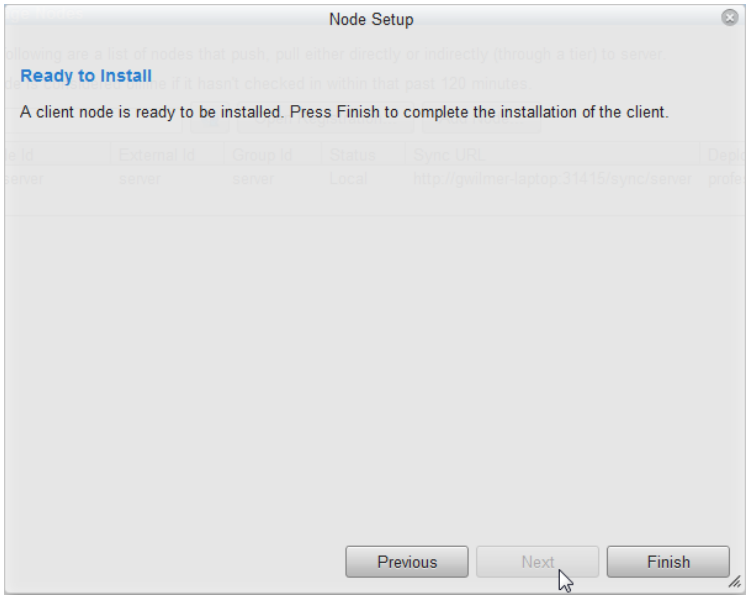
- **Database** – This is the type of database that will be used for the Client Database. Select your Client Node database type from the list
- **JDBC URL** – The URL for your Root Database
- **User Id** – The user id for your Root Database. This Id will need Create, Read, Update, Delete (CRUD) privileges for tables
- **Password** – Associated password for the User ID for the Root Database



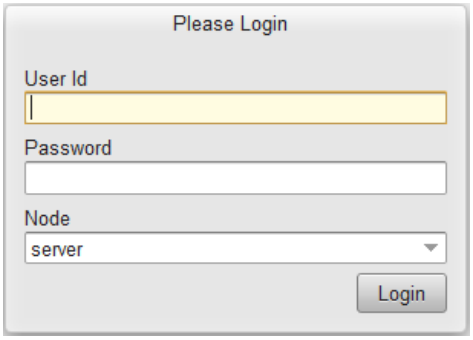
The next screen allows you to specify the port and protocol on which client synchronization requests will be carried out. We'll leave the default values.



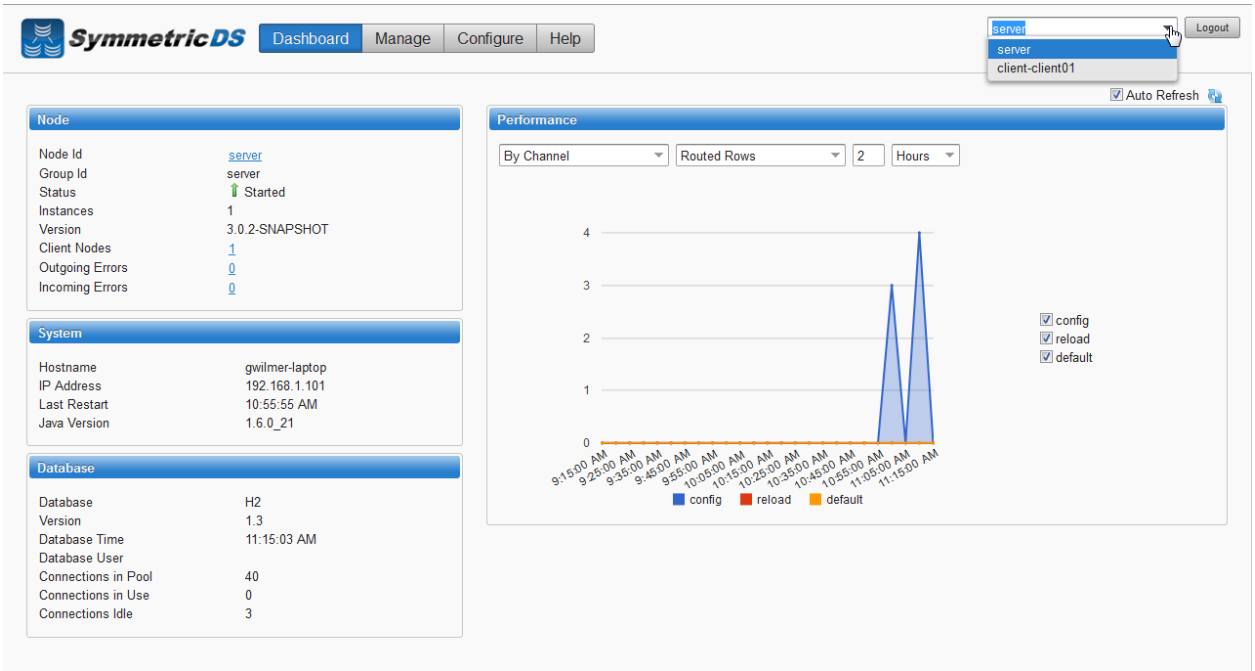
At this point, the client node is ready to install. Click the "Finish" button.



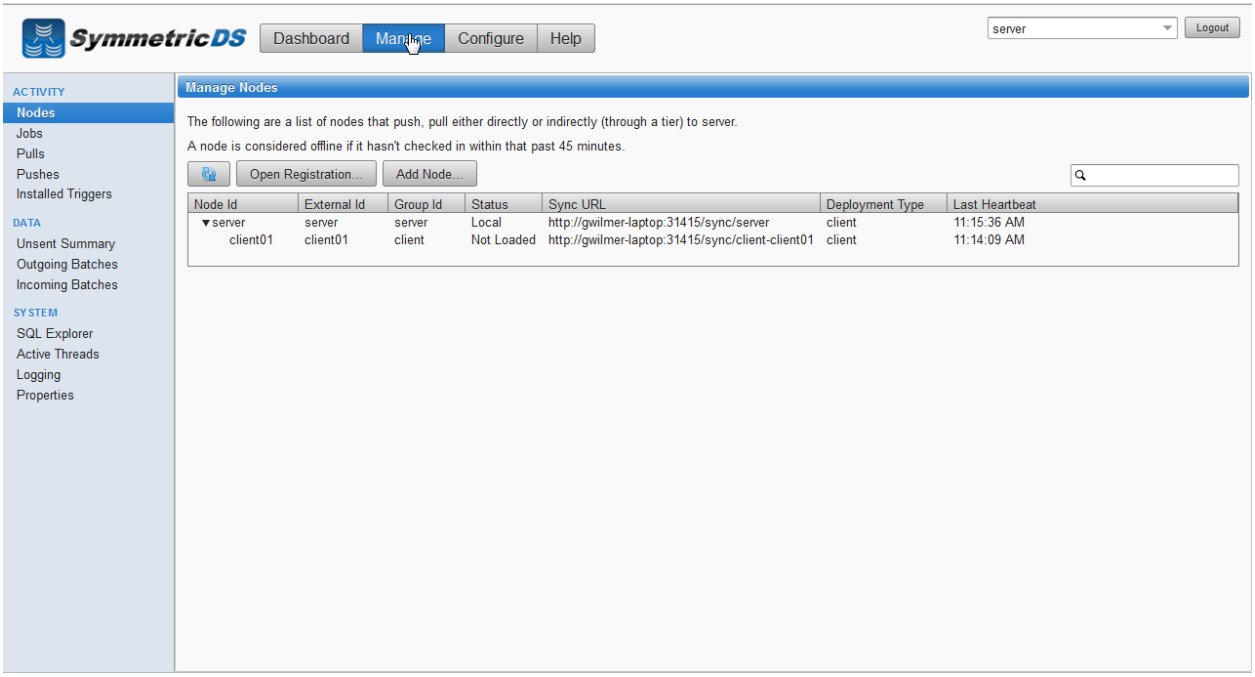
After the client node is installed, you will be asked to log into the console again. Specify your user id and password and click "Login"



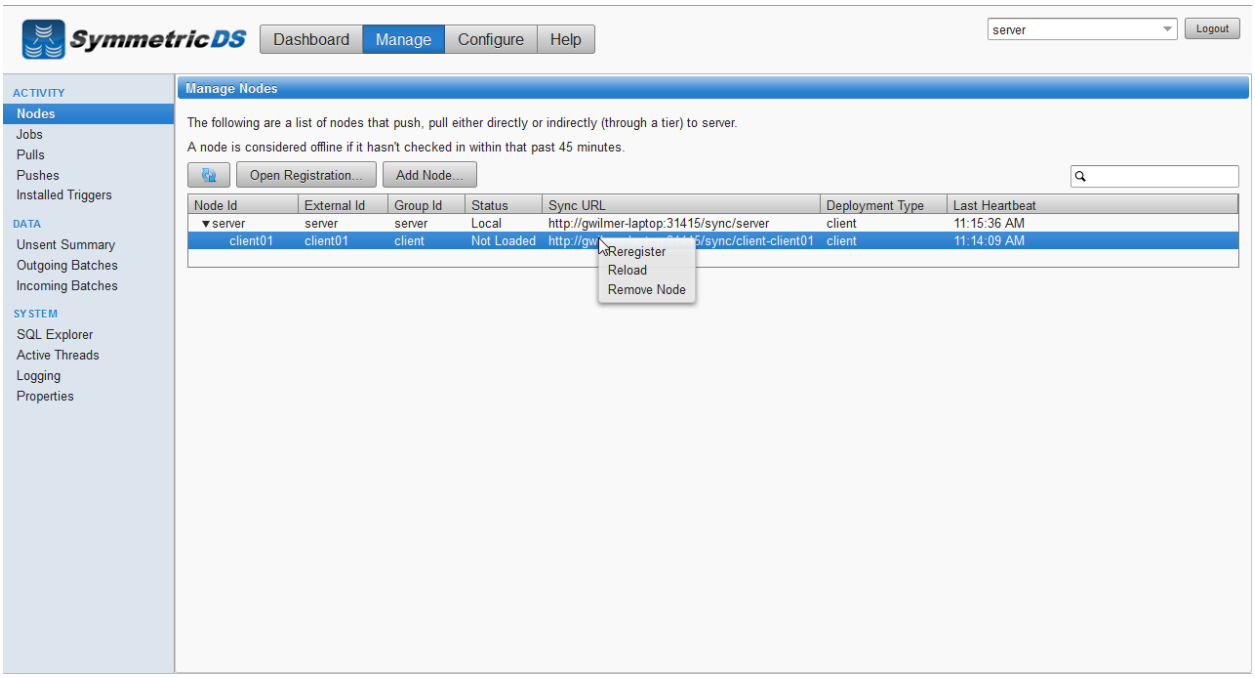
Once you have logged back into the console, the SymmetricDS dashboard will again be displayed. Since this is a multi-homed instance of SymmetricDS, the dropdown in the upper right corner allows you to switch to any node that is multi-homed in this installed instance of SymmetricDS Pro. We want to continue configuring the server instance, so select "server" from the dropdown box.



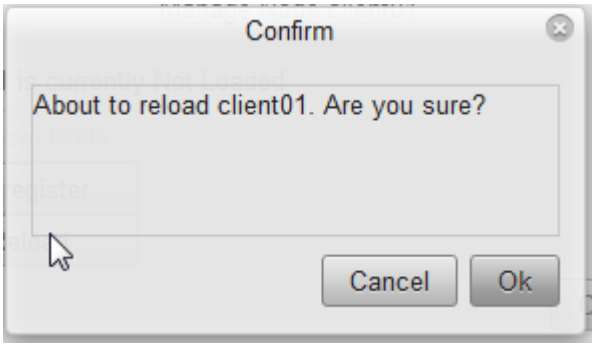
Once the client has been started, it will automatically request registration from the registration server that you specified during the client install. With SymmetricDS you can specify whether you want registration to be allowed automatically, or whether you want to manually specify whether each node is allowed to register. The default setting when you have a multi-homed instance is for SymmetricDS to automatically grant permission for the client node to register. To view nodes and whether they are registered, click the "Manage" menu item.



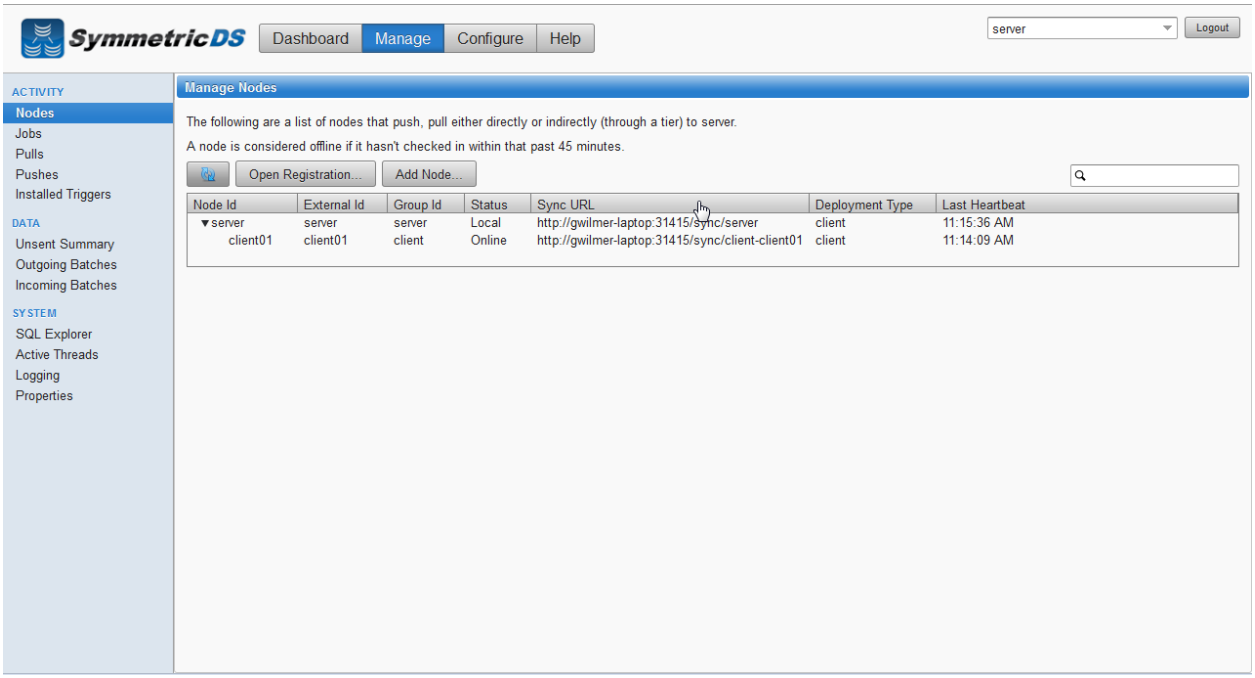
In the screenshot above, you will notice two Nodes in the "Manage Nodes" listbox. The first row is the Server Node, and the second row is the client node that was automatically registered. Note the Status is "Not Loaded" as an intial load was not performed on the client node. To perform an intial load, right click on the client01 node and click "Reload."



You will be prompted to ensure you want to reload the client. Click "Ok"



After the initial load is complete, the manage nodes screen will look as follows. Note the status now says "Online."



At this point, your initial synchronization configuration is complete.

Common Questions

- **Installing JDBC Drivers** – SymmetricDS Pro ships with most JDBC drivers included in the install program. The Oracle JDBC driver is NOT included with the SymmetricDS Pro distribution. If you want to use Oracle as your Root or Client database, you must install the Oracle JDBC driver manually by copying the ojdbc<version>.jar file to the lib directory of your SymmetricDS Pro install directory.