

Aneka Installation Guide

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1. Introduction

Aneka is an Enterprise Grid and Cloud platform that normally consists of two types of container configuration including master and slave node installation. This document serves as a simple guide for users to install Aneka platform and configure the Aneka network to create an Enterprise Cloud infrastructure.

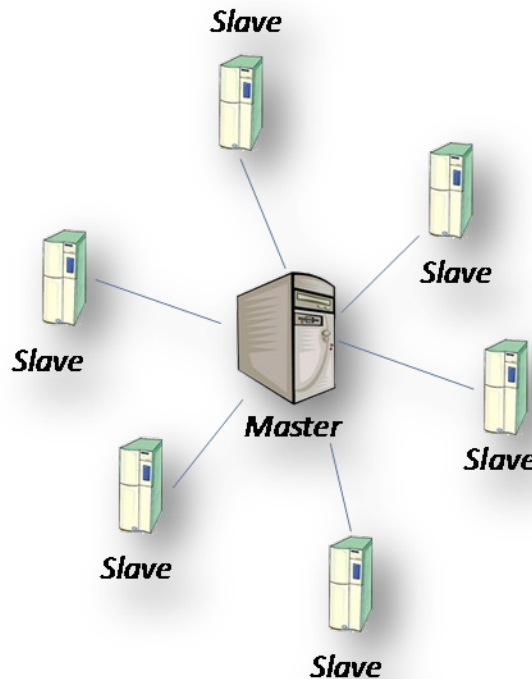


Figure 1: Typical Network Configuration

Figure 1 shows a typical configuration scenario for Aneka as a easy to use enterprise Grid infrastructure. The users normally need to first install one Aneka service on a reliable and more powerful machine as the master node. The master node will have very important services for scheduling as well as file, persistence, security services depending on users' configuration. As a minimum, the master node must have the scheduling service and file service (when transferring files between the client and the Aneka network is required). On the other hand, users also need to install and configure as many as slave nodes so that the Aneka network can actually have computing capabilities. A slave node may contain several kinds of services, however, normally only the execution services are required.

2. System Requirements

The basic system requirements for installing Aneka service are listed below:

Hardware Requirements:

1G RAM, 40 MB disk space

Software Requirements:

Microsoft Windows XP Professional Edition SP 2

Microsoft .NET framework 2.0+

Microsoft SQL Server 9.0.x / SQL Server Express 9.0.x / MySQL Server 5.1.3.0 (optional, if database support is required)

IIS 5.0+ (optional, if the role based security web service is required)

3. Installation

3.1 Typical Installation Scenario

The basic license allows user to install one master and 5 slave nodes. For example, the master machine is *node-0*, the user has to run the Aneka installer on the *node-0* machine and go through the master configuration as stated in the next section. The slave machines are *node-1*, *node-2*, *node-3*, *node-4* and *node-5*, the user needs to run the Aneka installer on each of the five machines and go through the slave configuration as stated in the next section.

3.2 Installation

The installation for master and slave shares the common process except that the user provide different configuration for them. To install Aneka service, run the Aneka installer under Windows and go through the steps from 1 to 5 are common to both master and slave. The following figures show the process of

the common installation.

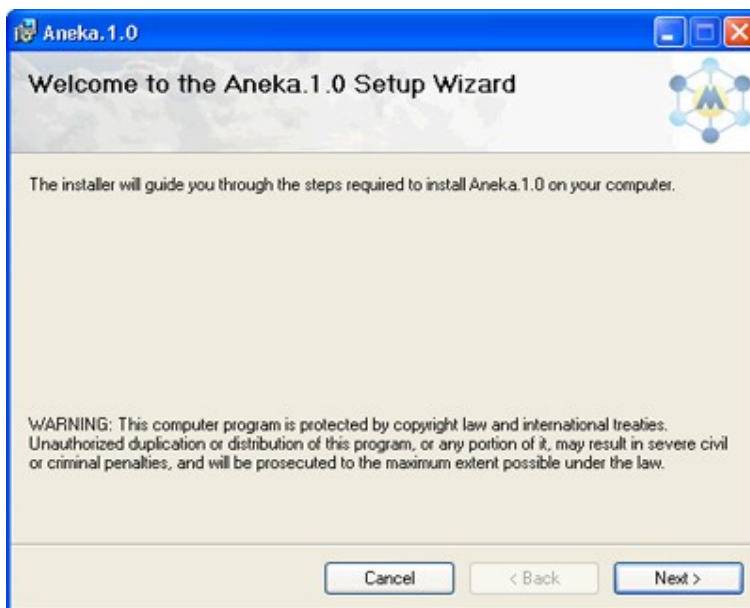


Figure 2: MSI Installer – Welcome Page

Figure 2 shows the common MSI Installer welcome page. By clicking on the next button it will be possible to enter the specific details about the Aneka Cloud that is going to be installed.

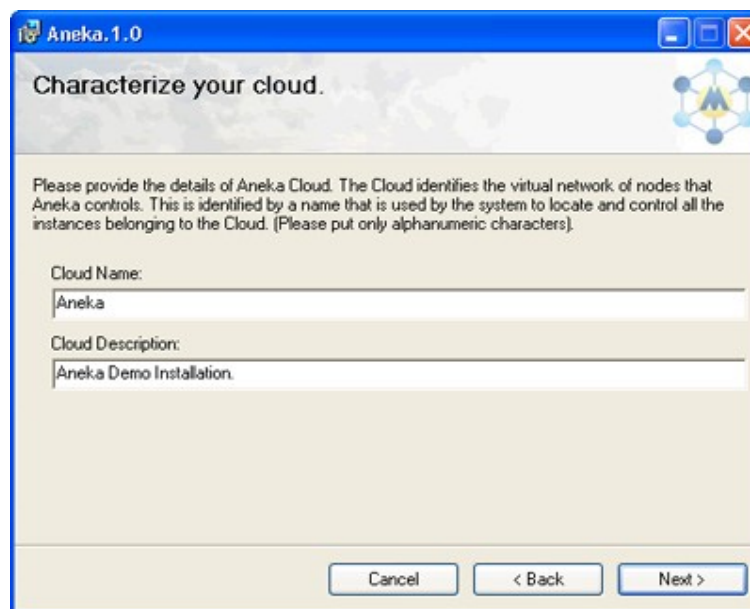


Figure 3: MSI Installer – Characterize Your Cloud Page

Figure 3 shows the Characterize your Cloud page. In this page the user has to specify the generic details of the Aneka Cloud such as the name of the Cloud and a brief description. The name of the Cloud is the one used to internally by the Aneka installer to set up the Windows Service for Aneka. As described in the wizard page this name should not contain any space or other punctuation

characters.

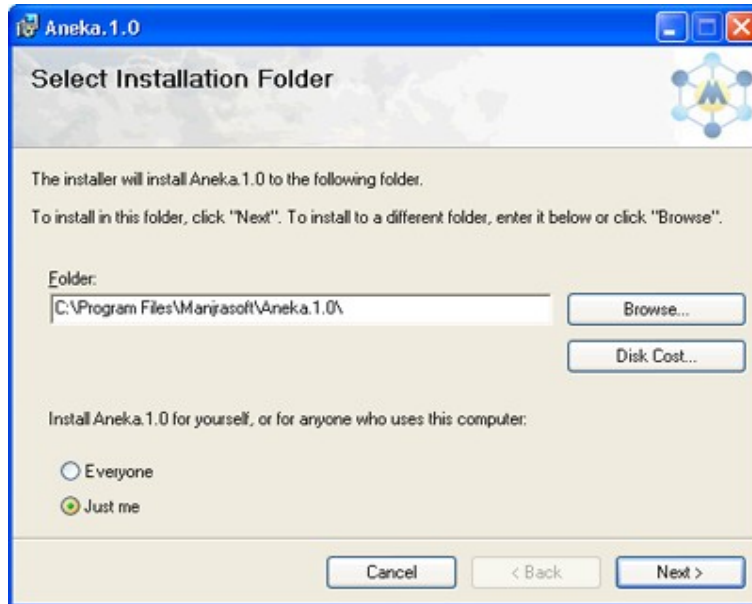


Figure 4: MSI Installer - Folder Selection Page

In Figure 4, the user can select the installation folder. By default Aneka is installed in the [Programs Folder]*Manjrasoft\Aneka.Version*. It is a good practice to name the installation folder either with the version or with the name of the Aneka Cloud the installation refers to. This could help the user to map the corresponding Windows service.

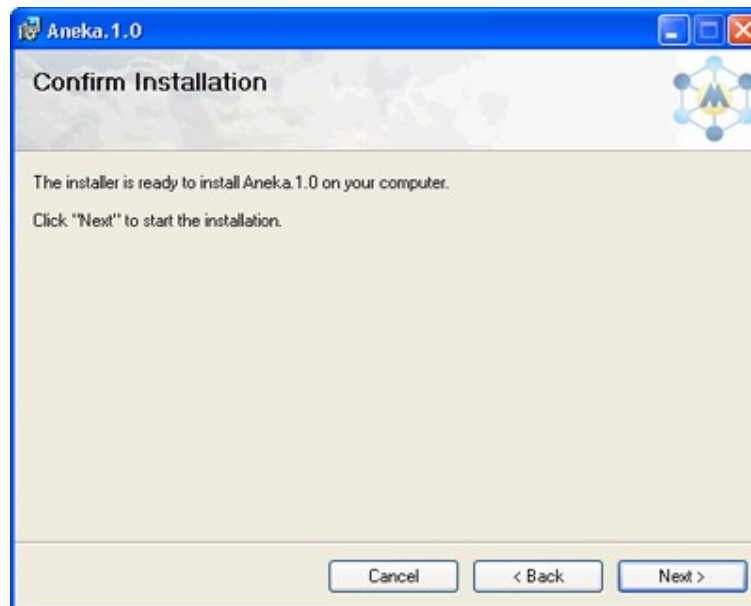


Figure 5: MSI Installer - Confirm Installation Page

The remaining wizard steps of the MSI Installer (see Figure 6) feature the Confirm Installation page and start the installation process. When clicking the

next button from Figure 5 to confirm installing the Aneka service, the program will proceed to the basic installation. After a while, the program will pop up a configuration form for users to configure the master or slave node.

4. Aneka Node Configuration

The Aneka installer provides a configuration wizard while installing the Aneka, it is useful to configure Aneka in a different manner such as Master or Slave. The following sections will explain how to configure master/slave step by step.

4.1 Node Type Selection

Writing the code for monitoring the application has been very straightforward. The only aspect that worth a further discussion is the synchronization management.

By selecting the *Master* node type (see Figure 6), the user decides to configure the Aneka as a master node. The port number specified will be the port used by the master node. By selecting the *Slave* node type (see Figure 7), the user decides to configure the Aneka as a slave node. The port number specified will be the port used by the slave node. The only difference here is that when configuring a slave node, the user must specify the master node address by giving the host name and the port number used by the master node. This is used for the slave to register itself to a certain master node in the Aneka network.

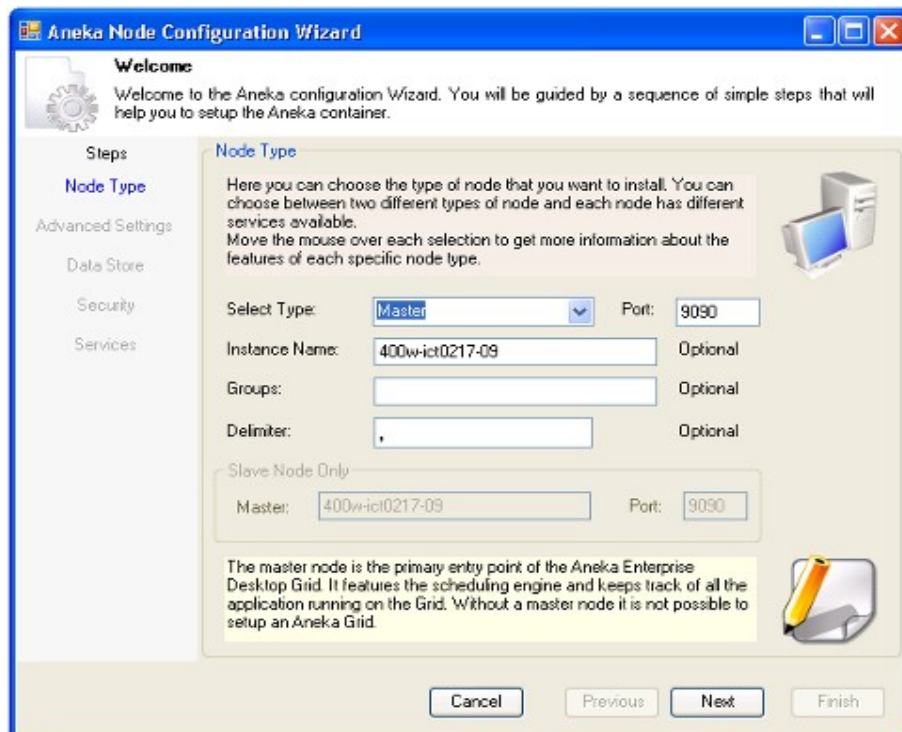


Figure 6: Configuration Wizard - Node Type: Master

4.2 Advanced Settings

Once the user select the type of the node that he/she wants to configure, the default configuration has been finished and the user can click finish to proceed the installation or the next button for more advanced settings such as persistence, security and services.

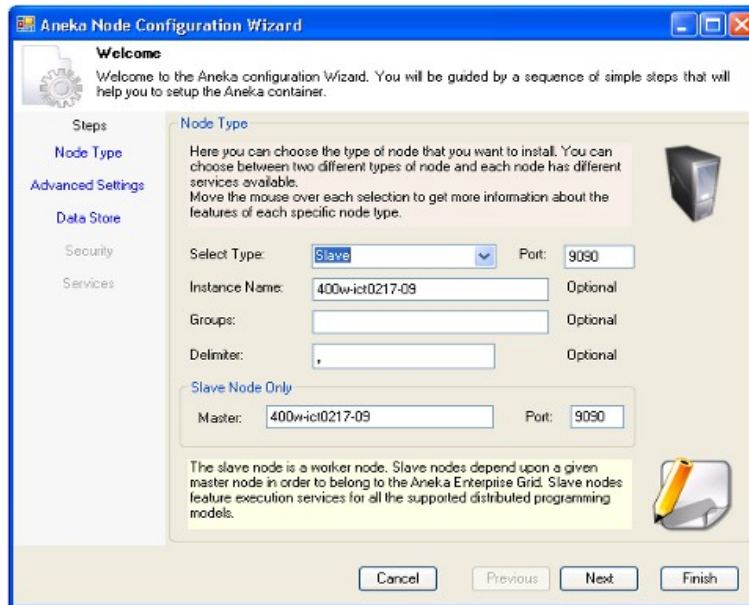


Figure 7: Configuration Wizard - Node Type: Slave

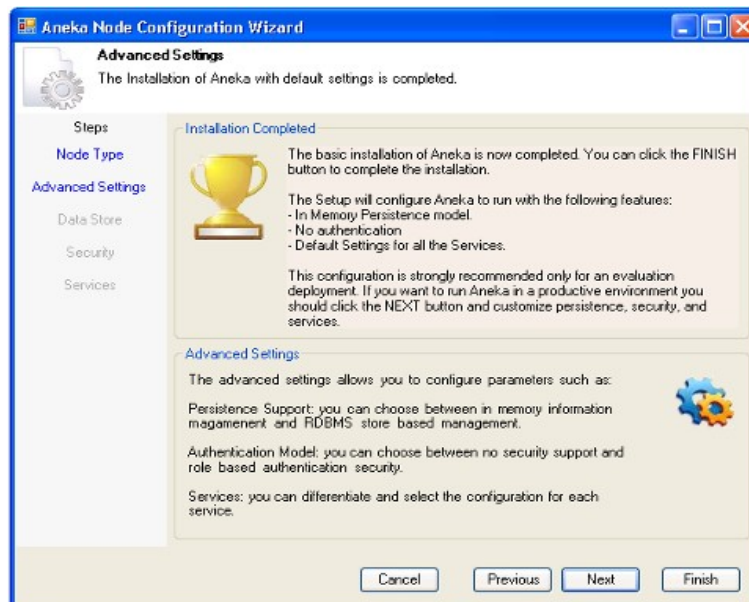


Figure 8: Configuration Wizard - Advanced Settings

4.3 Data Store Settings

There are two types of data store that a user can choose.

4.3.1 In Memory Mode

The default option for the store is the **In Memory Store** that can be used if user does not have SQL Server or SQL Server Express (Aneka current only support SQL Server and SQL Server Express). This store provide an in memory management of the applications running on Aneka and **DOES NOT** provide any persistence support: the content of the store is volatile and this means that it will be maintained as long as the process hosting the Aneka container is active. The advantage of this mode is that it is provide a quick access to the Aneka platform and it does not need to install extra software.

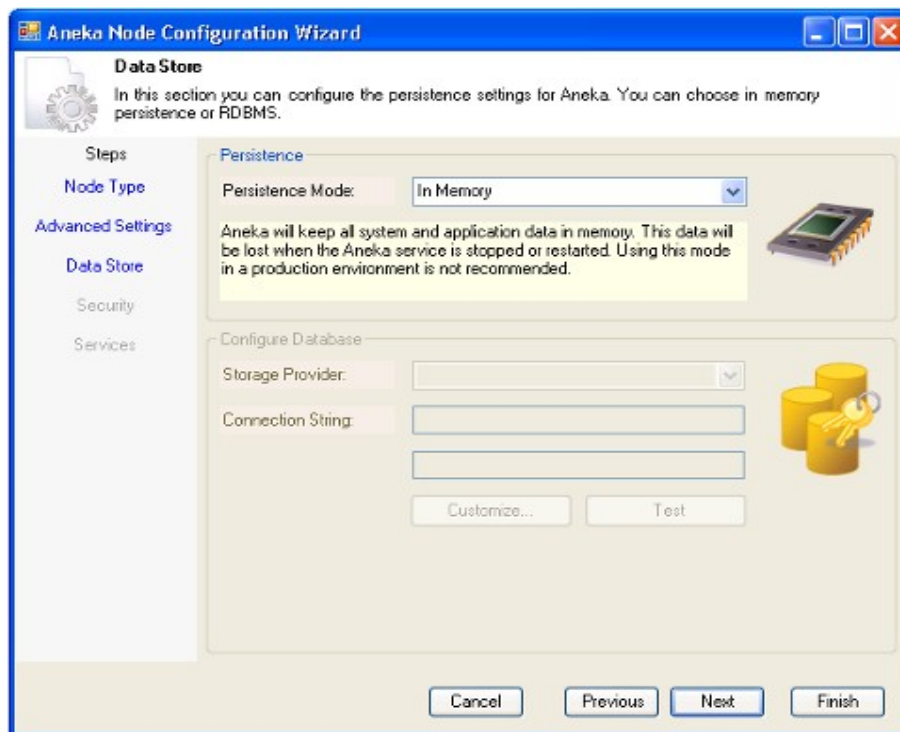


Figure 9: Configuration Wizard - In Memory Persistence Mode

NOTE: It is important to remember that the use of this option for the persistence mode is **NOT RECOMMENDED** in production environments. This option is basically used to have a quick setup of the system for development and testing purposes. In a production environment this option will not make the system survive to a crash of the master node (or simply the container process) and all the data concerning the status of the system would get lost.

4.3.2 Relational Database Mode

When selecting the relational database mode, the user need to specify the database provider, the connection string and the database name if there is no database table created in the relational database. The customized button

provide a way to generate the connection string.

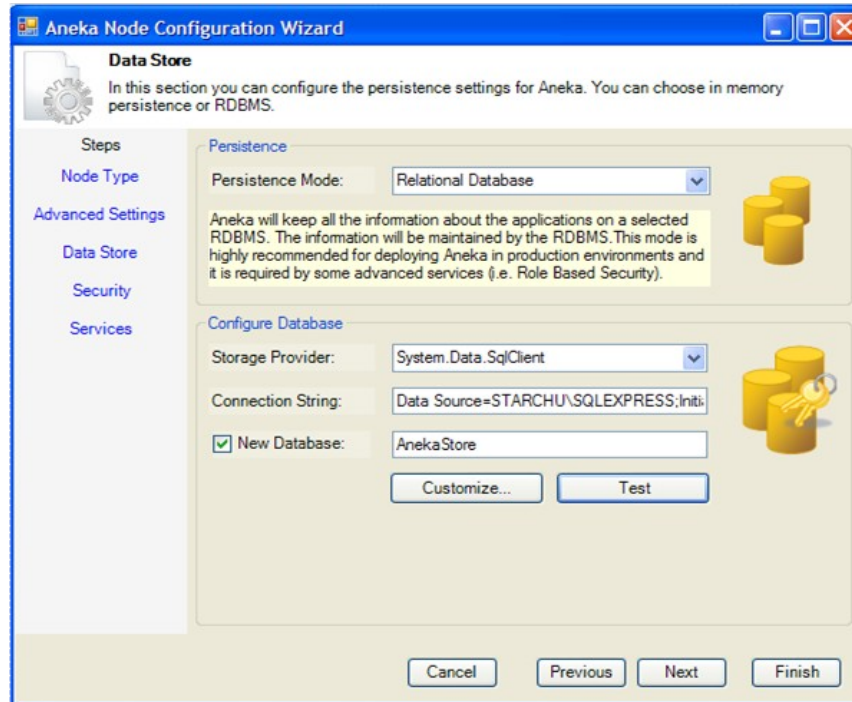


Figure 10: Configuration Wizard - Relational Database Persistence

The Figure 11 shows the additional form that is shown when pressing the customize button. The properties that are shown depend on the specific data provider selected in the **Storage Provider** combo box shown in Figure 10. At the moment there are only two data provider supported:

- **System.Data.SqlClient**: this provider allows Aneka to use SQL Server 2005 Databases (Version 9.0.3. onward) as a backend for the persistence store. In this case the properties that need to be set are the following: **User ID**, **Password**, **Data Source**, and **Initial Catalog**. Additional properties can be set by clicking the **Show all** check box at the bottom of the form.
- **MySql.Data.MySqlClient**: this provider allows Aneka to use MySQL Server Databases (Version 5.1.30 onward) as a backend for the persistence store. The configuration of this provider requires the setting of the following properties:
 - **Database**, **Port**, and **Server** under the **Connection** group. If you have a default installation on the same machine of the master node the values for the **Port** and the **Server** parameters are respectively **3306** and **localhost**.
 - **User Id** and **Password** under the **Security** group.
 - **Use Procedure Bodies** under the **Advanced** group set always to

False. This group is not displayed by default and in order to access the properties that it contains we need to check the **Show all** check box at the bottom of the form.

Once we have completed the setup of the connection string it is possible to test it without leaving the form and by simply click the **Test** button. Once the connection has been successfully tested it is possible to copy the values into the Connection String text field of the Data Store page (See Figure 11) by clicking the **Ok** button. If we simply close the form by clicking on the red button on the right top edge of the form the information about the connection string will not be copied.

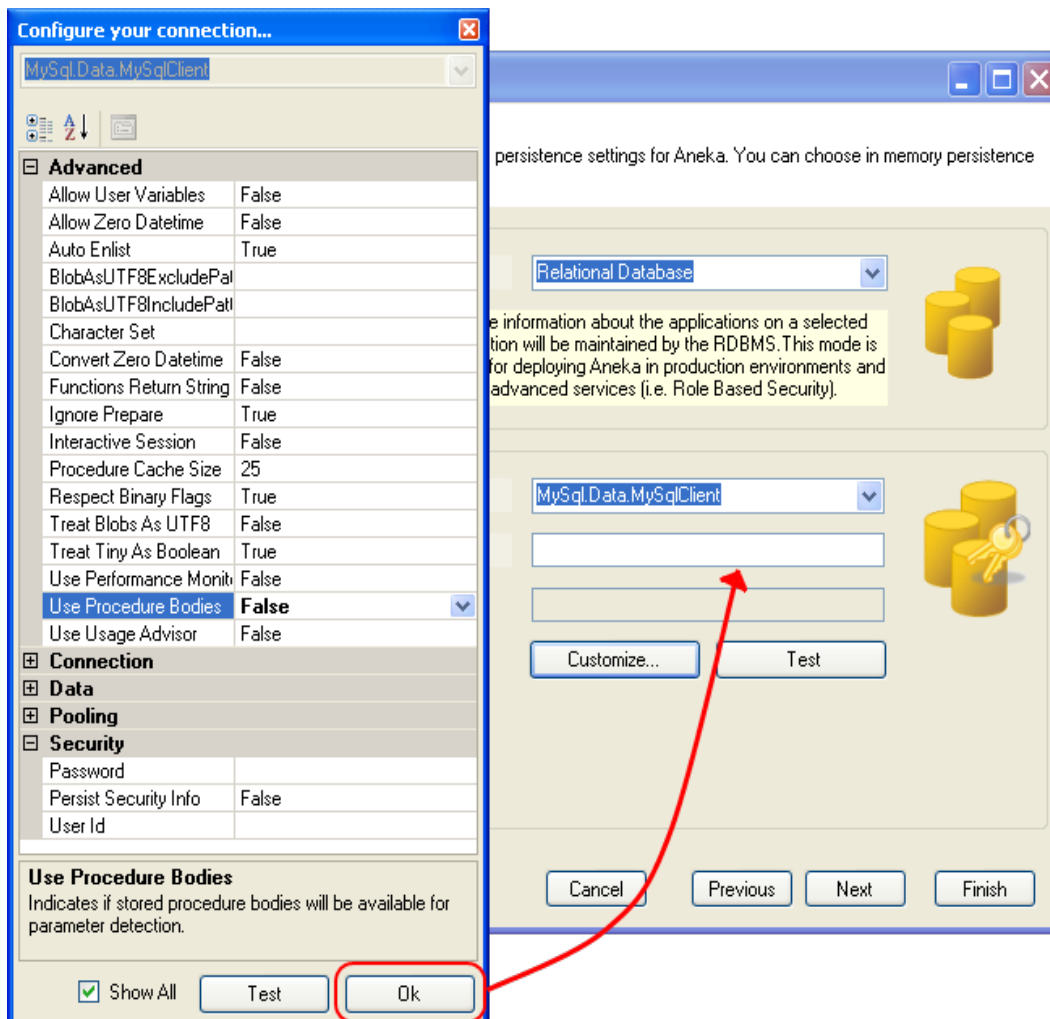


Figure 11: Configuration Wizard - MySql Data Provider Configuration

We also would like to remember that the configuration of the persistence mode **only concerns the master node**, which has access to the data store. For slave nodes the selection of the persistence mode is not available.

MySql Database Engine Configuration

The SQL support for Aneka is based on Stored Procedures for all the supported backends. Stored Procedures in MySql have been introduced only since version 5.0 and their design and implementation is still at an early stage.

For a security reason the information about the stored procedures is not maintained in the same database for which the stored procedures have been implemented. This design choice causes security issues when trying to invoke the stored procedures with a user that does not have access to the database where they are defined. Since we cannot assume that the user will have access to that database we have designed the data interaction layer in order to work in an alternative way. This solution then requires that **Use Procedure Bodies** parameter set to **False**.

NOTE: The installation wizard assumes that the database is created in the DBMS system in use (Sql Server or MySQL) if the database is not present the installation will fail. Hence, in order to use the database support for the persistence mode it is important to create the database first.

4.4 Security Settings

There are two types of data store that a user can choose.

4.4.1 No Security Mode

This is the default mode for Aneka node and does not require any security features for the task to be executed.

This mode **is not suggested for production environments** because it does not provide any protection against malicious code execution and allows everyone to connect to the system and to submit applications for execution.

4.4.2 Windows Integrated Security Mode

By selecting the **Aneka Managed Security** mode, you will install the default security provider. The security model provided by Aneka is based on users and groups and it is completely separated from the user management system of the hosting machine. Users are identified by a user name and a password that are stored in Aneka. Their capabilities depend on the groups they belong to. Once the system is installed a default *Administrator* user with no password set is created for managing the Cloud. No groups are created by the installer and the Administrator user has complete power on the Aneka Cloud.

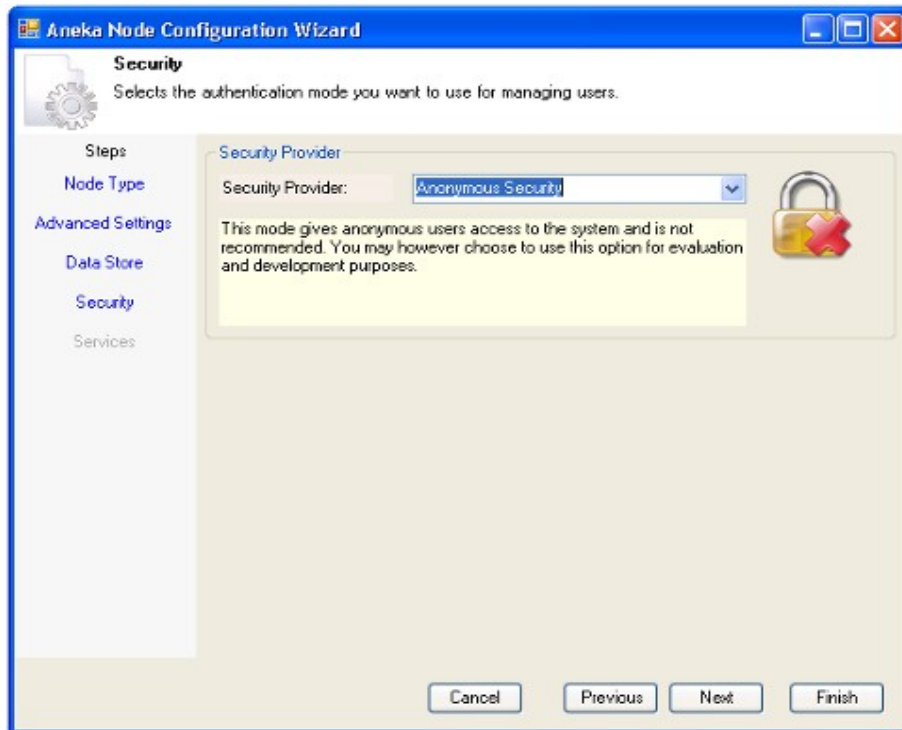


Figure 12: Configuration Wizard - No Security Mode

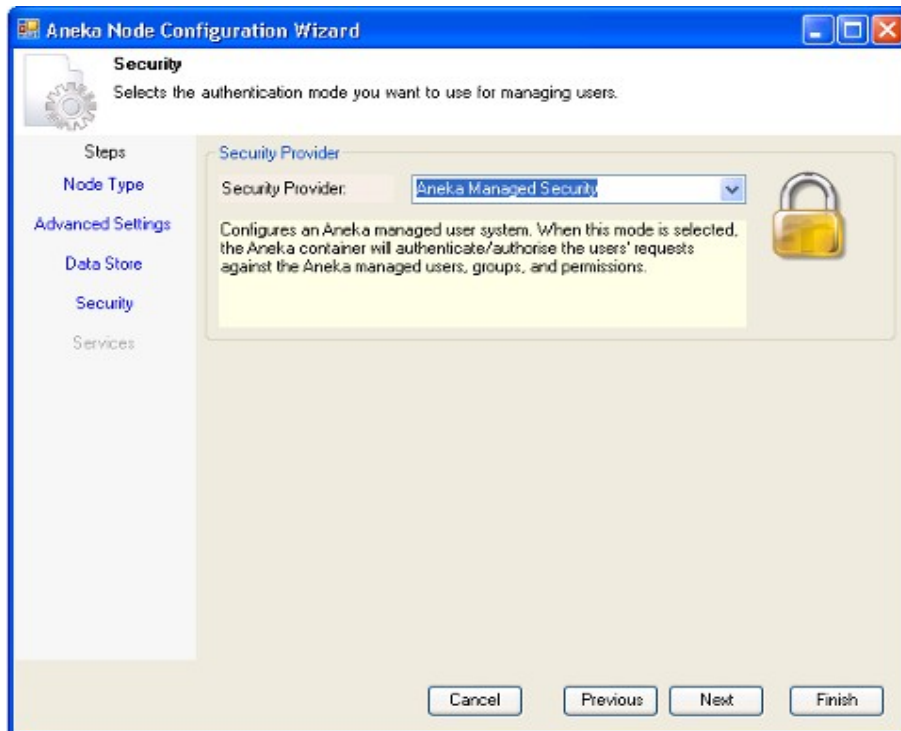


Figure 13: Configuration Wizard - Aneka Managed Security

It is possible to change add and edit users and groups by using the Manager Console (see section 6).

NOTE: It is highly recommended to change the Administrator password to something different from an empty password. The user Administrator has a complete empty password on the Aneka Cloud and can perform any task. Hence, the use of this user should be limited only to administrative tasks and not for running applications.

4.5 Service Settings

4.5.1 Master Node

The default installation for the master node features the a set of services that are already checked in the list of services available to install. These services are:

- *Task Scheduler service:* scheduling component for the Task programming model.
- *Thread Scheduler service:* scheduling component for the Thread programming model.
- *Storage service:* file store for applications.

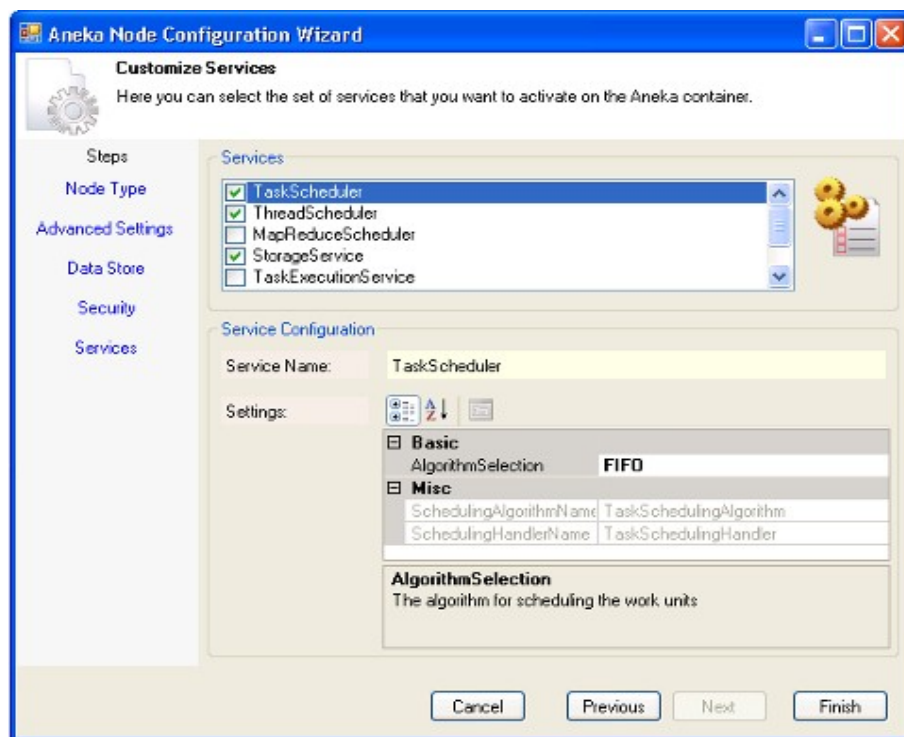


Figure 14: Configuration Wizard - Master Node Services Setup

Figure 14 shows the configuration parameters of the TaskScheduler service. It is possible to access the parameters of each service by clicking on the corresponding line in the list. In order to install the service it is necessary to

check the box on the left of the name. The only parameter that can be set for the TaskScheduler service is the specific algorithm used for scheduling tasks: *FIFO* or *ClockRatePriority*. The same applies to the ThreadScheduler service. For what concerns the Storage service it is possible to configure the different protocols that can be used for supporting file transfer. This is accomplished by clicking on the DataProviders property as shown in Figure 15.

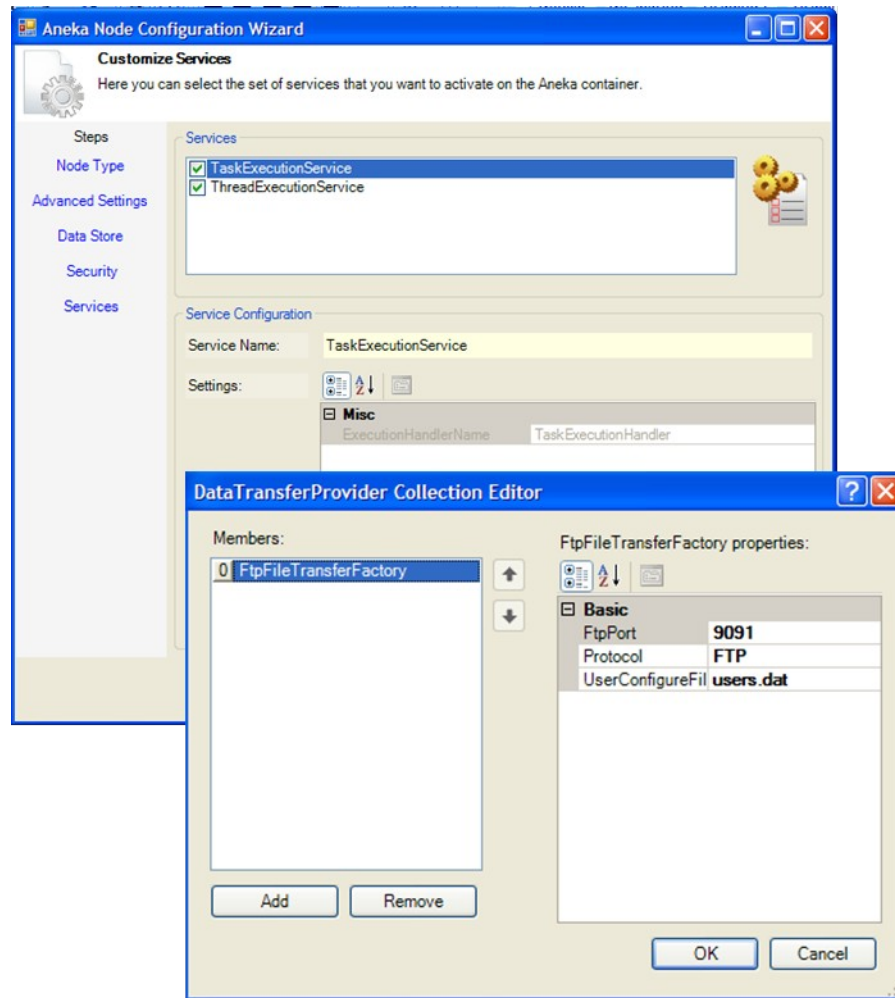


Figure 15: Configuration Wizard - Slave Node Service Setup

Currently Aneka only supports the FTP protocol, but third party can implement different data providers.

The user can decide to install additional services such as the corresponding execution services of the previously discussed scheduling services. This is not a suggested practice since execution services will increase the computation load of the master node and will constitute a performance bottleneck of the system.

There can be only two reasons to install execution services in the master node:

- The Aneka Cloud is composed by only one machine. In this case there

no other options for running the system.

- Testing and development. In this case this configuration creates a packaged system on a local machine that developers can use to test new services or client applications.

It is generally recommended to differentiate the execution services from the scheduling services in production installation. This makes the system more scalable and able to handle load.

4.5.2 Slave Node

The slave node service setting contains the execution services for Task/Thread/MapReduce programming model. The user can choose to have one or more of those services deployed in a single slave. Each type of the execution service will only handle the particular programming model.

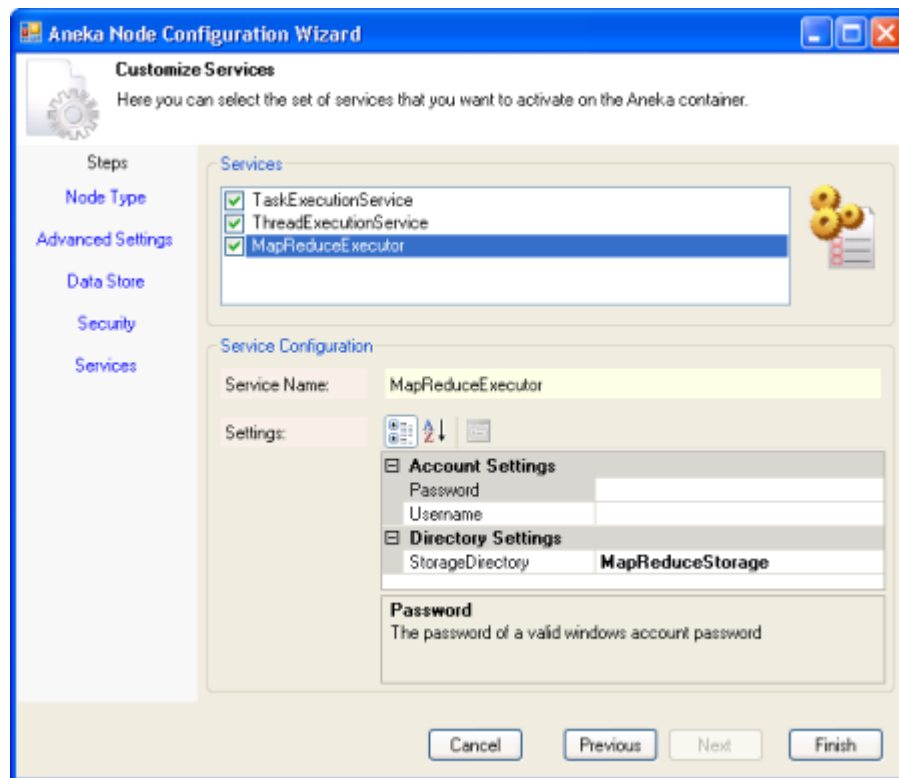


Figure 16: Configuration Wizard - Slave Node Service Configuration

4.5.3 Services Configuration

4.5.3.1 Task Model Services

TaskScheduler

- AlgorithmSelection: supports **FIFO** and **ClockRatePriority** algorithms

TaskExecutionService

- ExecutionDirectory: provides the directory for task execution
- KeepFiles: indicates whether to keep all the files generated by each execution (for debug purpose only)
- MaximumTime: sets the maximum time that a task execution can have, it provides a mechanism to prevent infinite task executions that occupy the resources.

4.5.3.2 Thread Model Services

ThreadScheduler

- AlgorithmSelection: supports FIFO and ClockRatePriority algorithms

ThreadExecutionService

- ExecutionDirectory: provides the directory for thread execution
- KeepFiles: indicates whether to keep all the files generated by each execution (for debug purpose only)
- MaximumTime: sets the maximum time that a thread execution can have, it provides a mechanism to prevent infinite thread executions that occupy the resources.

4.5.3.3 MapReduce Model Services

MapReduceScheduler

- Username: specifies the local Windows account name on scheduler machine to access the storage of MapReduce applications
- Password: specifies the local Windows account password on scheduler machine to access the storage of MapReduce applications
- StorageDirectory: specifies the directory where all the required files(input and output for MapReduce applications) are stored.

NOTE: if the MapReduceExecutor is configured on the same node, the StorageDirectory for the MapReduceScheduler has to be different from the one defined in the MapReduceExecutor

MapReduceExecutor

- Username: specifies the local Windows account name on executor machine to access the storage of MapReduce applications
- Password: specifies the local Windows account password on executor machine to access the storage of MapReduce applications
- StorageDirectory: specifies the directory where all the required files(input and output for MapReduce applications) are stored.

4.5.3.4 General Services

StorageService

- DataProviders: specifies the information about the file transfer providers. There is only one file transfer provider implemented.
- FtpFileTransferFactory
 - FtpPort: specifies the port number of Ftp server
 - Protocol: FTP
 - UserConfiguration: a configuration file to write for the server (no need to change the default value)
- DbConnectionString: specifies the connection string for connecting to database (this value is automatically set when choosing one of the DB provides in the previous configuration step)
- DbProvider: specifies the provider for the database connection. (this value is automatically set when choosing one of the DB provides in the previous configuration step)
- FileTransferProtocol: supports the different transfer protocols. Currently only FTP is a valid value.
- UseRDBMS: specifies whether the storage uses the database to store information.

5. Running Aneka

Once Aneka has been set up it is possible to start it or configure it again from the *Start Menu*. Under the *Programs* folder the installer has created a *Manjrsoft* folder that contains a folder named as the Cloud name that has been entered during the installation process.

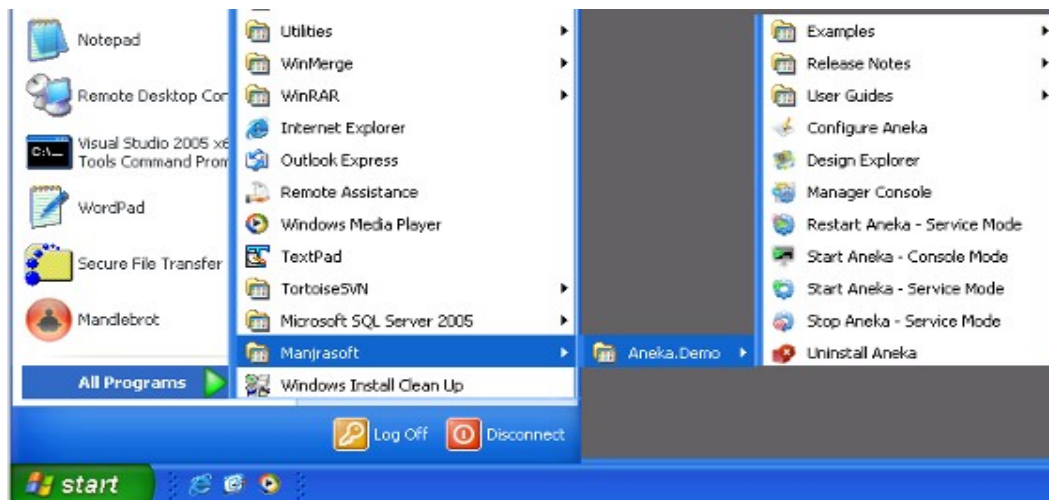


Figure 17: Accessing Aneka from the Start Menu

The installer has also created links to the SDK and the examples that are available in the Aneka distribution. By looking at the menu we have the following options:

- *Start Aneka - Console Mode*: starts the Aneka container from the operating system console.
- *Start Aneka - Service Mode*: starts the Aneka container as a Windows service.
- *Stop Aneka - Service Mode*: stops the Windows service that is hosting the Aneka container.
- *Restart Aneka - Service Mode*: stops the Windows service that is hosting the Aneka container if any, and starts it again.
- *Uninstall Aneka*: removes the Aneka Cloud from the machine.
- *Configure Aneka*: pops up the node configuration wizard and allows changing the configuration of the Aneka Container.
- *Manager Console*: opens the Aneka Enterprise Cloud Management studio that allow administrators to manage the Aneka Cloud
- *Design Explorer*: opens the Design Explorer application that allows users to quickly prototype distributed application, and run them on the Aneka Cloud, out of existing legacy applications by using the parameter sweeping model.
- *Examples*: gives access to the samples that are installed with Aneka. These samples are simple applications that are built on top of the Programming Model supported by Aneka.
- *Release Notes*: gives access to the release notes.
- *User Guides*: gives access to the Aneka Installation Guide, the Design Explorer Manual, and the programming guides for the Task, Thread, and MapReduce models.

5.1 Running Modes

Aneka can be run in two modes : Console mode and Service mode. Console mode makes Aneka as a standard windows console application which it is only valid if the user log into the Windows and start the process. It is not recommended for a production environment because the management tools do not work with the Console mode of Aneka. The Service mode is highly recommended and it should be run as a default choice as it is running as a Windows service which will not be affected by single users.

After the installation, you can start Aneka service by using the command provided in the program menu. The *Start Aneka (Service Mode)* menu will start the Aneka as a service mode and the *Start Aneka (Console Mode)* will start Aneka in Console mode. The *Stop Aneka (Service Mode)* is used to stop the Aneka windows service. The *Aneka Manager Console* will start the

Management tool for Aneka (Service mode) only. Moreover, the Configuration tool allows user change the current configuration of the Aneka service on the local machine.

5.2 Known Issues

In order to successfully run the Aneka service and execute the user's applications without problem, there are a few requirements regarding to the firewall and network settings.

5.2.1 Firewall Settings

For Aneka service, there is a single port for communication that needs to be opened under a firewall restricted network. For example, if the user configures Aneka under port 9090, the 9090 port must be granted exceptions under the firewall configuration. Also for applications that involve file transfers, the FTP port configured while installation need to be granted as well, it is normally set as port 9091.

For Manager Console to work properly, it is required to have the Windows file sharing service enabled under the firewall.

5.2.2 Network Types

The Manager Console will only works in an intranet based network where all the machines are under the same administration domain, otherwise the user can not control the Aneka services if they are under different administration domain.

6. Managing Aneka

After a successful installation of Aneka, the user can utilize the management tool provided to remotely control and manage the Aneka nodes in the network. On the master node machine, start the Aneka Manager Console under the Aneka program menu, the initial view looks like the following figure.

Figure 18: Aneka Manager Console

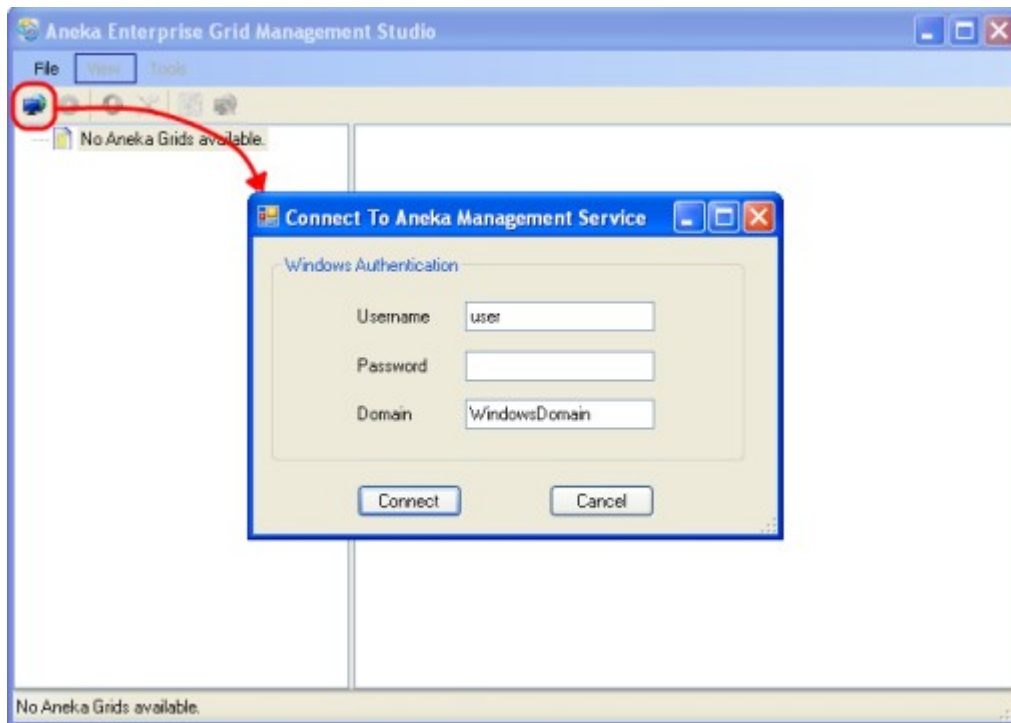


Figure 19: Console Manager - Authentication

By clicking the connect button on the toolbar, the user will be asked to provide the windows authentication information. Note it is very important that there is a single administrator user for all the machines that need to be managed within this Manager Console. It means that the windows credential the user uses for the manager console should be valid in other machines that have installed the slave Aneka service.

After the successfully authenticating the user's credential, the user is able to add an Aneka node to the Console that needs to be managed as shown below.

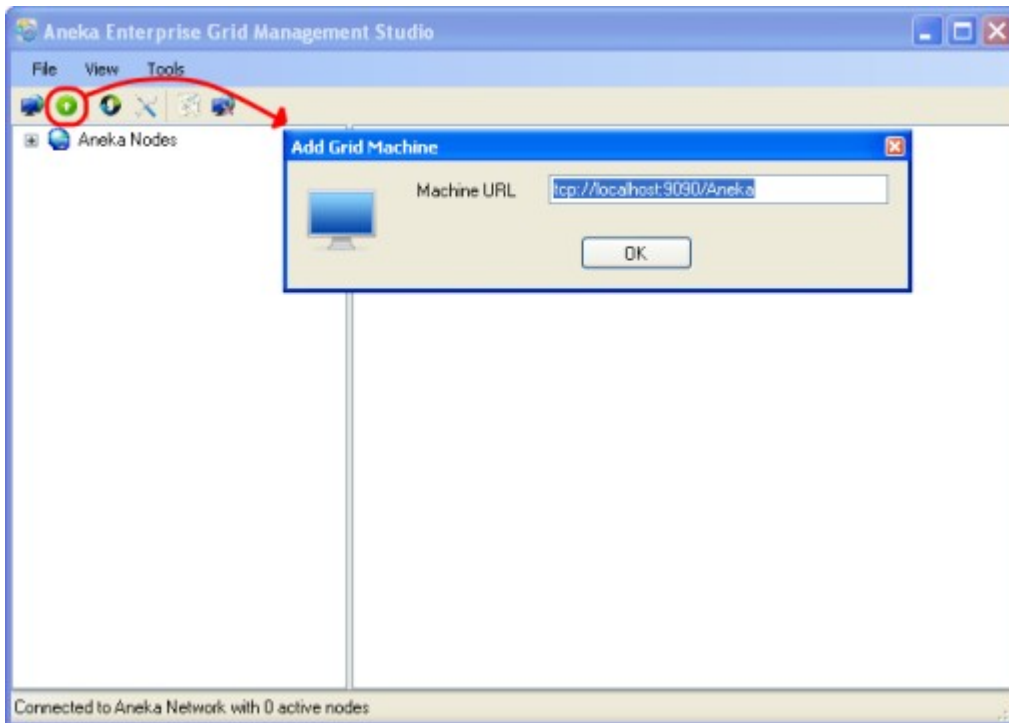


Figure 20: Console Manager - Adding a Machine

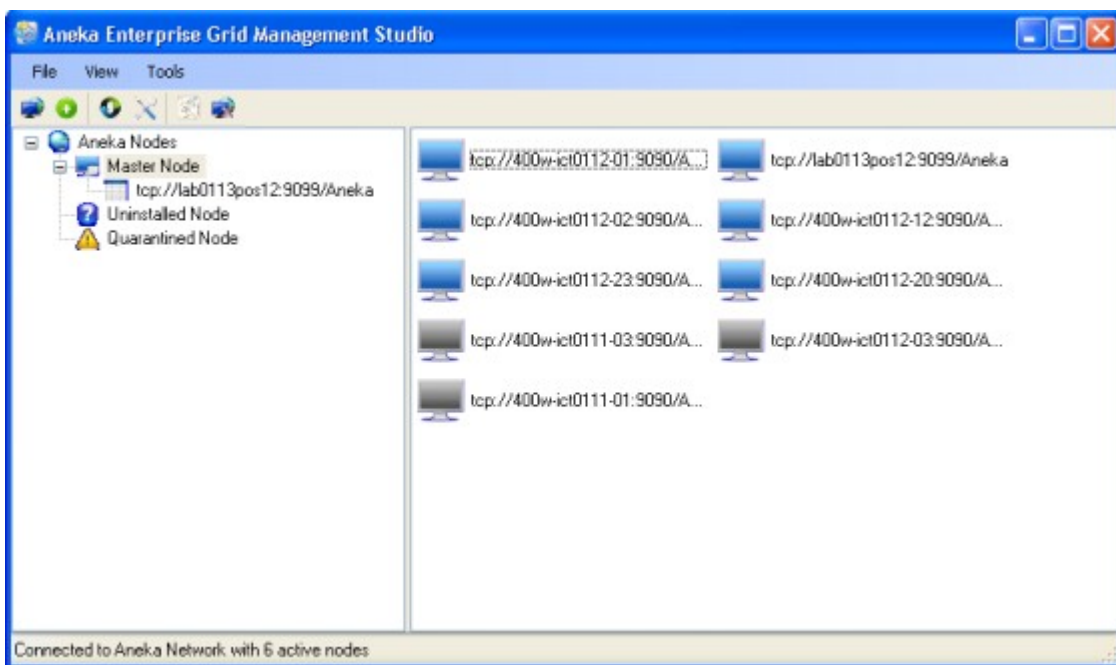


Figure 21: Manager Console - Aneka Network Overview

The format of the machine URL is like ***tcp://[machine-hostname]:[port]/Aneka***. The user can add as many as nodes that he/she wants to manage through the Console. For example, suppose the user installed one master and 9 slave machines, the user need to add those machine URLs into the Console, and then the user can start/stop/monitor the Aneka node via the

Console. The following figure shows the scenario which there is one master node *lab0113pos12* and 9 slave nodes. The blue workstation means that the node is active. In contrast, the black workstation means that the node is not active.

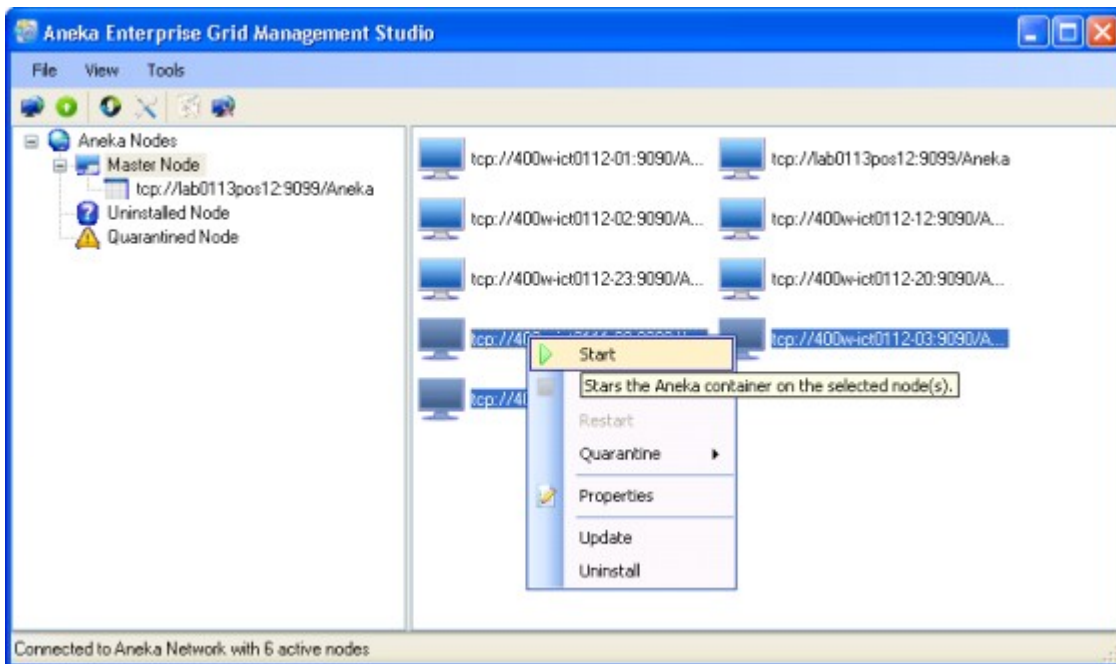


Figure 22: Console Manager - Starting Aneka Containers

The user is able to start/stop the Aneka node as they like. Figure 21 shows how it is possible to **start** inactive nodes from the console. In Figure 22 we can see the operations that are allowed on active nodes: it is possible to **restart** and **stop** the node. For both active and inactive nodes it is possible to execute the following operations:

- **Update:** updates the current installation of the node with a new version of Aneka. By selecting this option the user will be asked to specify the directory from where to copy the Aneka binaries.
- **Uninstall:** this operations first stops the service hosting the Aneka container on the selected nodes and then removes the service and the Aneka binaries from the machines.
- **Properties:** this operation only applies to a single node and it pops up a form to browse different information from the node. The forms shows a tabbed panel where the user can browse the hardware information, the services installed an the dynamic performance of the node via a graphical representation.
- **Quarantine:** the quarantine operation opens another menu where the user can select whether to put the nodes under quarantine or remove them from the quarantine. The quarantine is a status that prevents a node to be selected by the scheduler for assigning to it tasks to be executed. When a node is under quarantine it will never receive any job

to execute. This feature is useful when the administrator detects that some nodes do not behave properly and wants to temporarily exclude them from the set of eligible nodes for job execution until the problem is fixed. Once a node has been put under quarantine it will disappear from the icon panel showing active and inactive nodes and will be put under the **Quarantined Node** panel. To remove a node from the quarantine, simply select the Quarantined Node panel, select the quarantined node and choose the **Quarantine -> Remove from Quarantine** from the context menu.

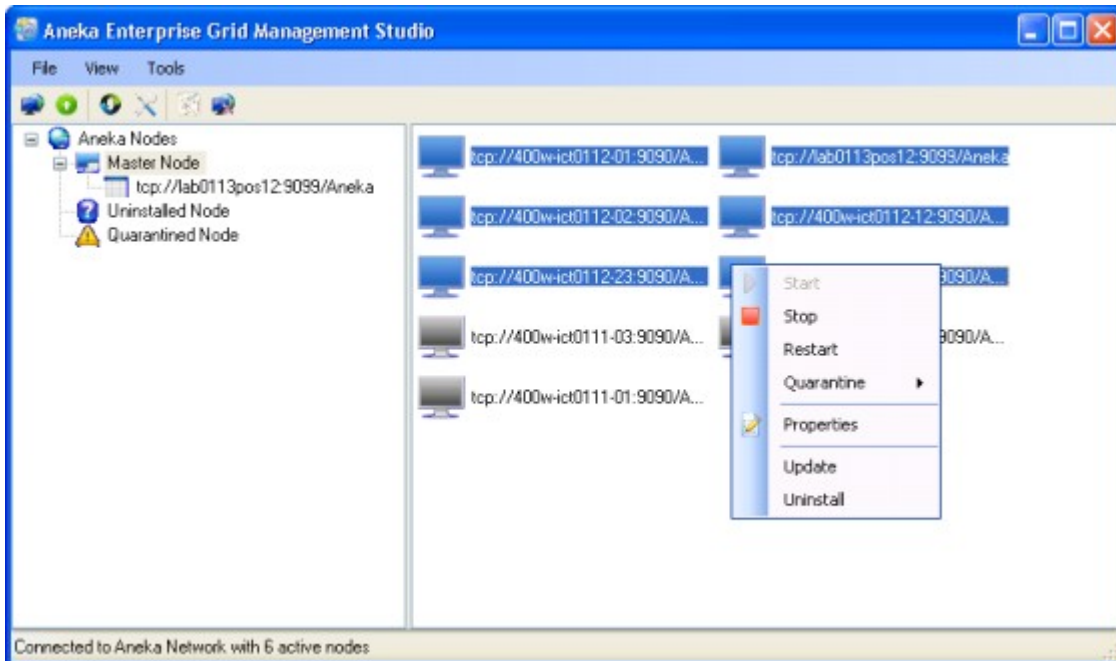


Figure 23: Console Manager - Active Nodes Properties

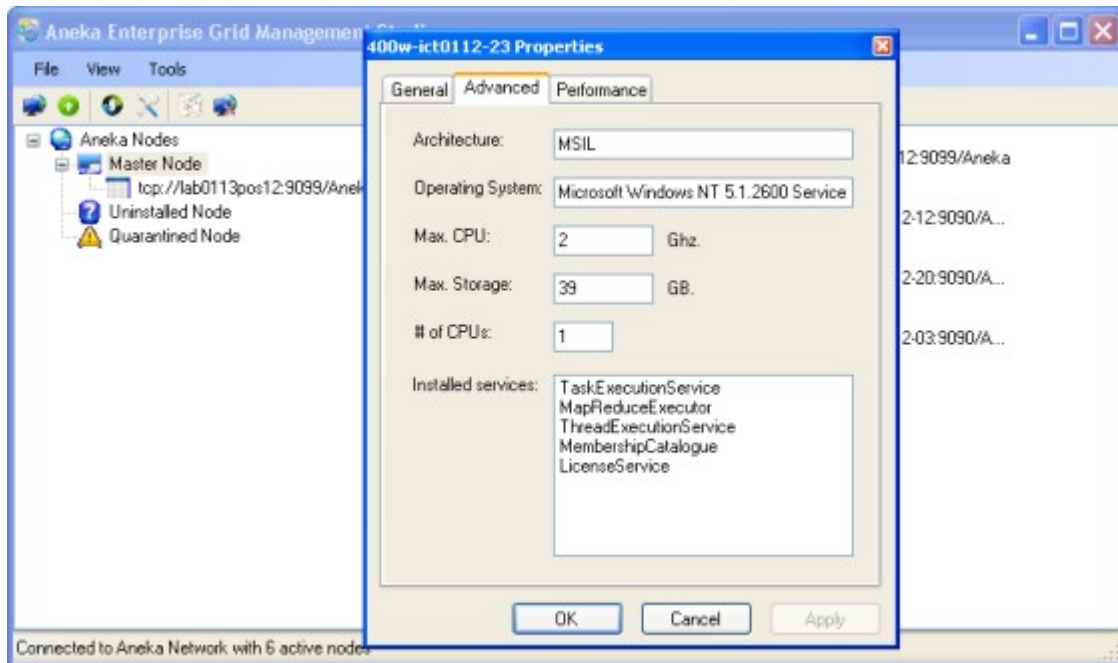


Figure 24: Console Manager - Node Properties

It is also possible for the user to monitor the overall performance statistics via the Console. By clicking the statistics button on the toolbar, the user is able to view the aggregate information about the Aneka Grids under different master nodes. The following figure shows one example of this facility. The figure will dynamically change when the load within the Grids changes. For example, if the user submits any applications and those works are running within the Grid, the CPU availability/usage curve will change from time to time in a real time manner.

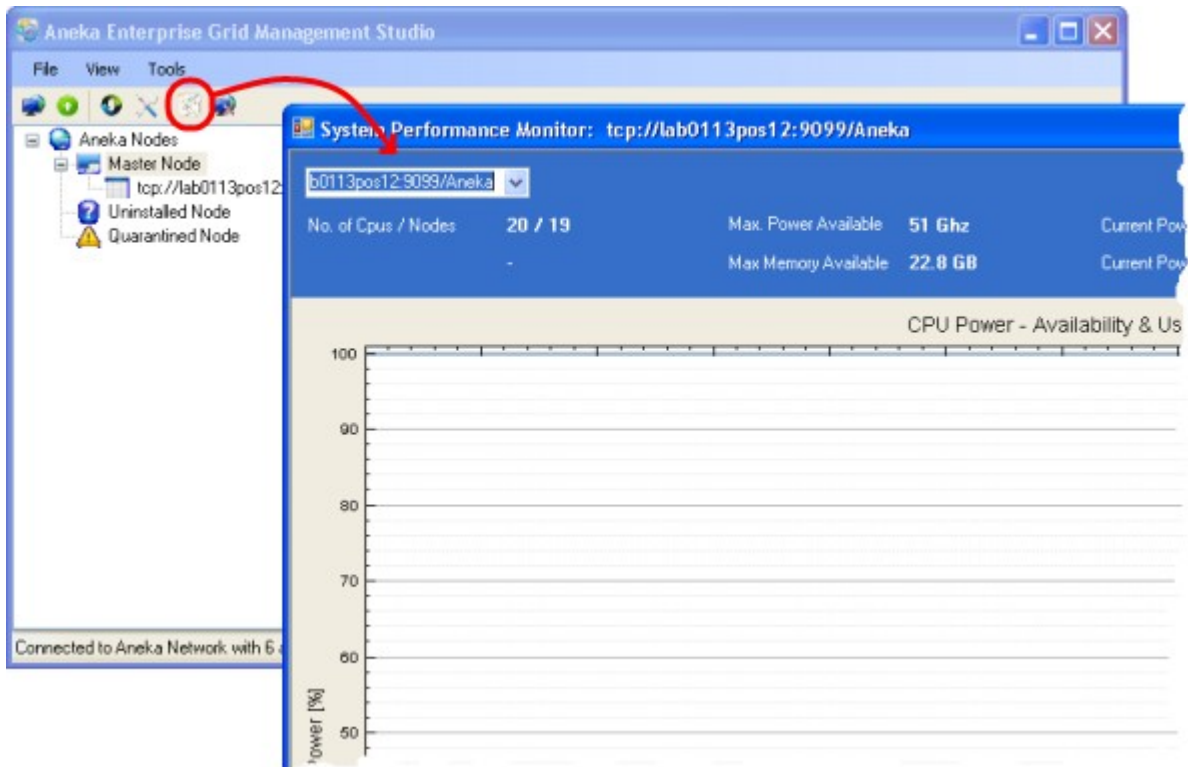


Figure 25: Console Manager - System Performance Monitor

Moreover, the user can also install the Aneka node via the Manager Console. Instead of going to each machine, the user is able to use the Manager Console to install or update the installation of all the required Aneka nodes. The following figure shows the usage of install/update menu. The user needs to specify the Aneka installation source directory and the target installation directory on the machine, and by clicking the *Customize Aneka* button, the user will get the same wizard as they have while running the installer program. Once the user finishes the wizard and press the *Proceed* button, the new installation will automatically go through the network.

NOTE: the install/update process uses the Windows file share protocol to transfer files from the node where the manager console is to the selected node. Hence, in order to successfully complete the process the user under which the Manager Console is running needs to have the proper permissions to access the Windows File Share service and needs to be able to **access with administrative rights** the nodes where he wants to install or update Aneka.

Figure 26: Console Manager - Installing a Node

7. Conclusions

In this guide we have shown how to install Aneka and provided a step by step guide on how to set up the configuration of a master and a slave nodes through the configuration wizard shipped with the MSI installer. This guide has covered all the possible configuration settings that can be set by using the wizard such as:

- Node type selection
- Persistence mode
- Security settings
- Services configuration

This guide has also explained how to run in the two different modes (as a window service or a console program) and how to manage the Aneka ecosystem from the Manager Console.

This guide does not fully cover advanced configuration issues that can be achieved via the direct manipulation of the configuration file. This is a practice that is generally not suggested for beginner users and that requires a good knowledge of the Spring.NET persistence framework.