An Open Source Middleware For Parallel, Distributed, Multicore Computing

ProActive Agent

The OASIS Research Team and ActiveEon Company

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An Open Source Middleware For Parallel, Distributed, Multicore Computing: ProActive Agent

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Chapter 1. ProActive Windows Agent

1.1. Context

In distributed systems, desktop computers can be a important source of computational power. Moreover one of the definitions of grid, stands for a type of parallel and distributed system that enables the sharing, selection, and aggregation of resources distributed across multiple administrative domains based on their (resources) criteria; availability, capacity and performance. In such a context the main purpose of the ProActive Windows Agent is to make the configuration of these criteria achievable (schedule working plan and limit the shared amount of RAM and CPU).

1.2. Functionalities

The ProActive Windows Agent is a Windows Service (a long-running executable that performs specific functions and which is designed not to require user intervention). The agent is able to create a ProActive computational resource on the local machine. This resource will be provided to ProActive applications (such as Resource Manager) according to a user defined schedule. A tray icon shows the state of the agent and allows the user to start/stop it, or modify its schedule. The ProActive Windows Agent does not interfere with the day-to-day usage of the desktop Windows machine.

Understanding of ProActive basic concepts is required for the comprehension of the following description.

The core client is a process which:

- Loads the user's configuration.
- Creates schedules according to the working plan specified in the configuration.
- Can be configured to run in screen saver mode.
- Spawns one or more jvm processes that will run a specified java class depending on the selected connection type. 3 types of connections are available:
  - **RMI Registration** - The specified java class will create a ProActive local node as a computational resource and register it in a local RMI registry.
  - **Resource Manager Registration** - The specified java class will create a ProActive local node as a computational resource and register it in the specified Resource Manager, thus being able to execute java or native tasks received from the Scheduler.

    It's is important to note that a jvm process running tasks can potentially spawn child processes.
  - **Custom** - The user can specify its own java class.
- Watches the spawned jvm process in order to comply to the following limitations:
  - **RAM limitation** - The user can specify a maximum amount of memory allowed for a jvm process and its children. If the limit is reached all processes are automatically killed.
  - **CPU limitation** - The user can specify a maximum CPU usage allowed for a jvm process and its children. If the limit is exceeded by the sum of CPU usages of all processes they are automatically throttled to reach the given limit.
- Restarts the spawned jvm process in case of failures with a timeout policy.

1.3. Example

This simple example illustrates how to create an active object on a ProActive node created with the ProActive Windows Agent, we suppose that the agent is already:

- Installed (see next chapter for installation) on a host with ip address 192.168.1.62
- Configured with the **RMI registration** as selected connection type and "toto" as node name.

Once the agent is started, the following java code gets a reference on a remote node and creates an active object on the remote node identified by the url "rmi://192.168.1.62:1099/toto"

```
public class Test {
```

```
public static void main(String [] args){
 try{
  final Node n = NodeFactory.getNode("rmi://192.168.1.62:1099/toto");

  System.out.println("Nb of active objects on the remote node: " + n.getNumberOfActiveObjects() + " local
runtime hashcode " + Runtime.getRuntime().hashCode());

  final Test stubOnTest = (Test)PAActiveObject.newActive(Test.class.getName(),null,n);

  final String receivedMessage = stubOnTest.getMessage();

  System.out.println("Nb of active objects on the remote node: " + n.getNumberOfActiveObjects() + " received
message: " + receivedMessage);
 }catch(Throwable t){
  t.printStackTrace();
 }
}

public Test(){}

public String getMessage(){return "A message from " + Runtime.getRuntime().hashCode();}
}
```

The output is:

```
 --> This ClassFileServer is listening on port 2027
Detected an existing RMI Registry on port 1099
Nb of active objects on the remote node: 0 local runtime hashcode 6588476
Generating class : pa.stub.org.ow2.proactive.resourcemanager.utils._StubTest
Nb of active objects on the remote node: 1 received message: A message from 26670261
```

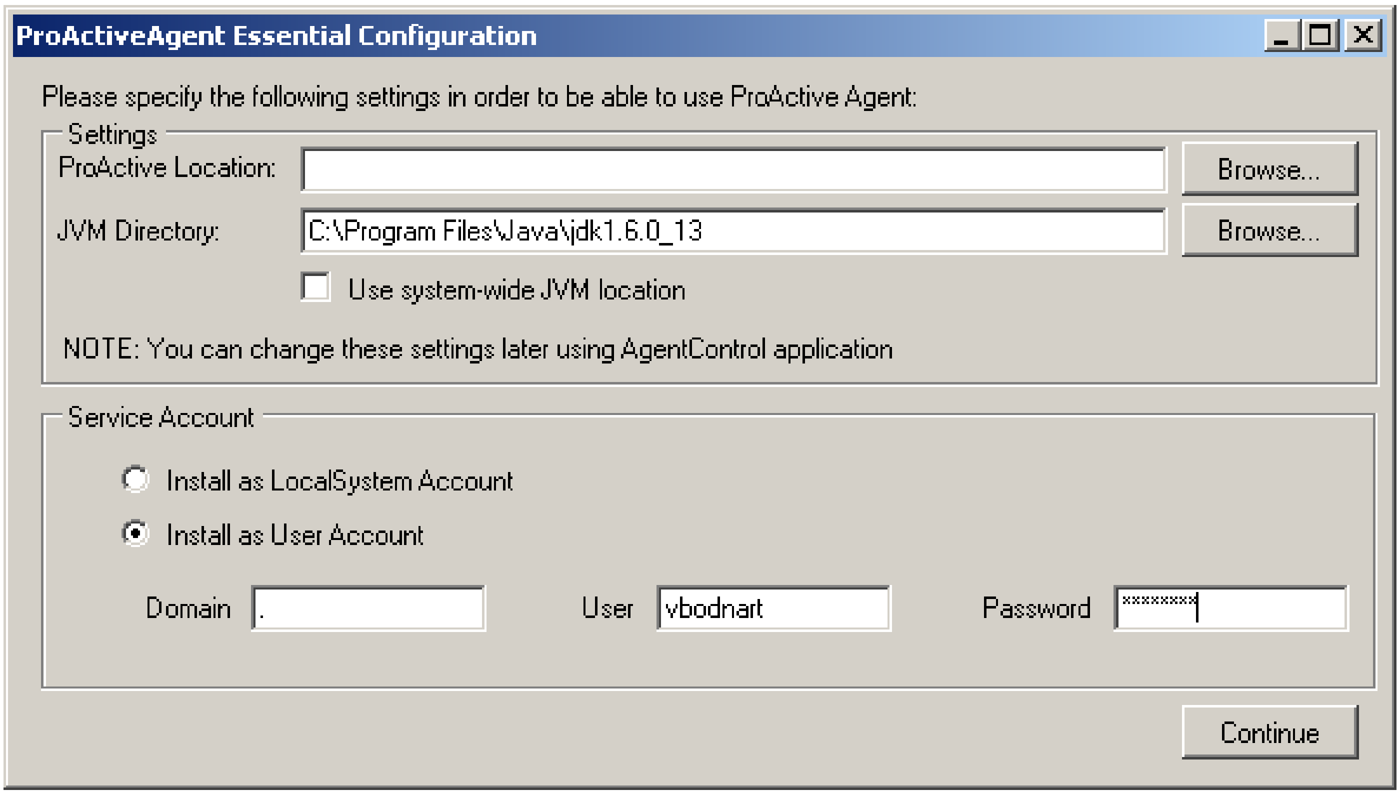
1.4. Installation

The ProActive Windows Agent installation pack is available on the official ProActive website. Follow the links and get the latest version.

Note the following requirements:

- .Net framework v3.5 or later should be installed on your system. If it is not, the installer will ask you to install it.

  Go to http://www.microsoft.com/downloads and download Microsoft .NET Framework Version 3.5 (or later) Redistributable Package.
- Visual C++ 2008 (or later) Redistributable Package is needed. The installer will install the packages if not found.


ProActiveAgent Essential Configuration

Please specify the following settings in order to be able to use ProActive Agent:

Settings

ProActive Location:

JVM Directory: C:\Program Files\Java\jdk1.6.0_13

[ ] Use system-wide JVM location

NOTE: You can change these settings later using AgentControl application

Service Account

( ) Install as LocalSystem Account

(●) Install as User Account

Domain: .

User: vbodnart

Password: ********

Figure 1.1. Configuration during installation

- Run the **setup.exe** file.
- Enter the Java location, usually **C:\Program Files\Java\jdk1.6.0_12** .
- Enter the ProActive location, if you are using the ProActive Scheduler just provide the Scheduler location.
- Select the service account, if you want to install the agent under a specific user account enter the domain ("." or hostname is the local domain), user and location.

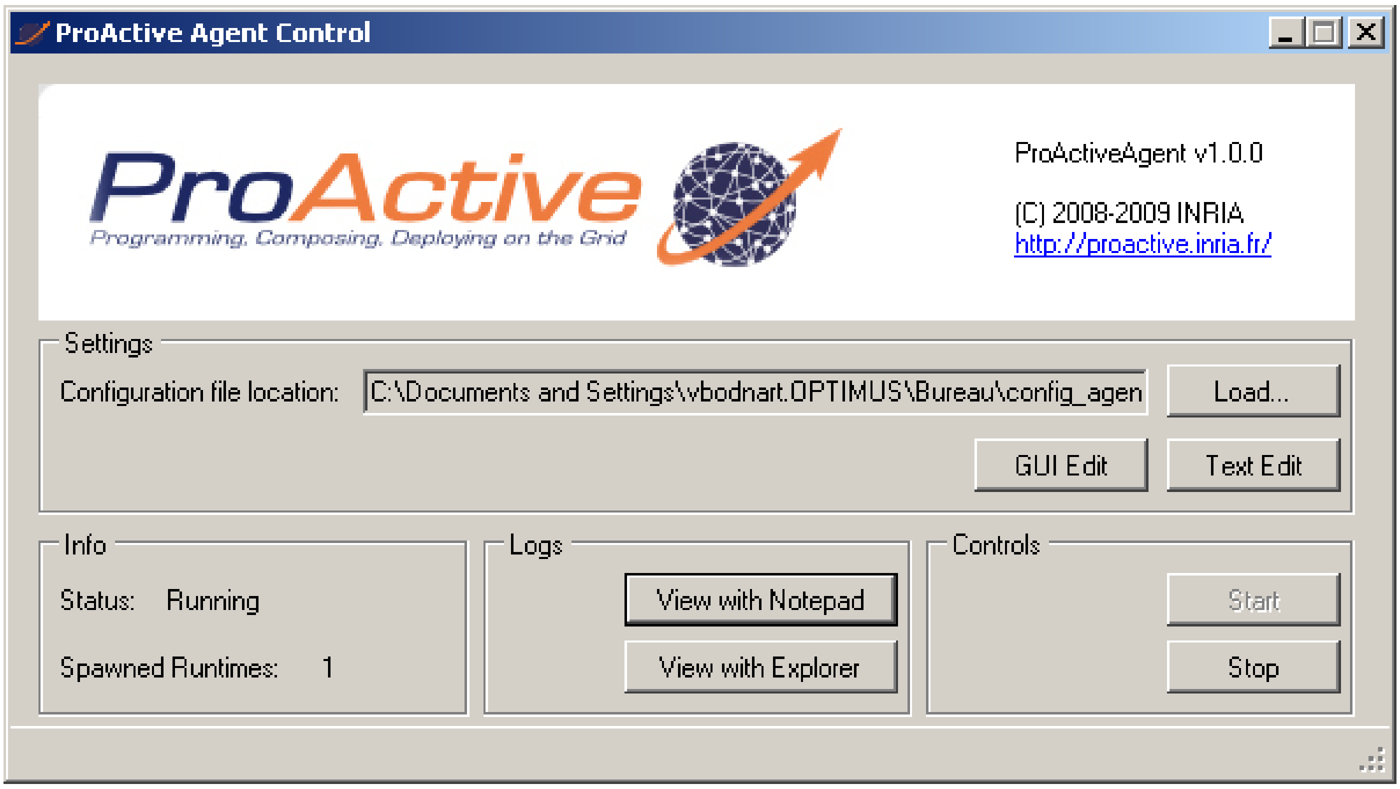
  Note that you can change these settings at anytime in the "services.msc" utility. ("Control Panel->Administrative Tools->Services")

At the end of the installation the user can choose to run the ProActive Agent Control utility. It is explained in the next section.

To uninstall the ProActive Windows Agent simply run "Start/Programs/ProActiveAgent/uninstall".

1.5. Usage

Launch "Start/Programs/ProActiveAgent/AgentControl" program or click on the notify icon if the "Automatic launch" is activated. Double click on the tray icon to open the ProActive Agent Control window.



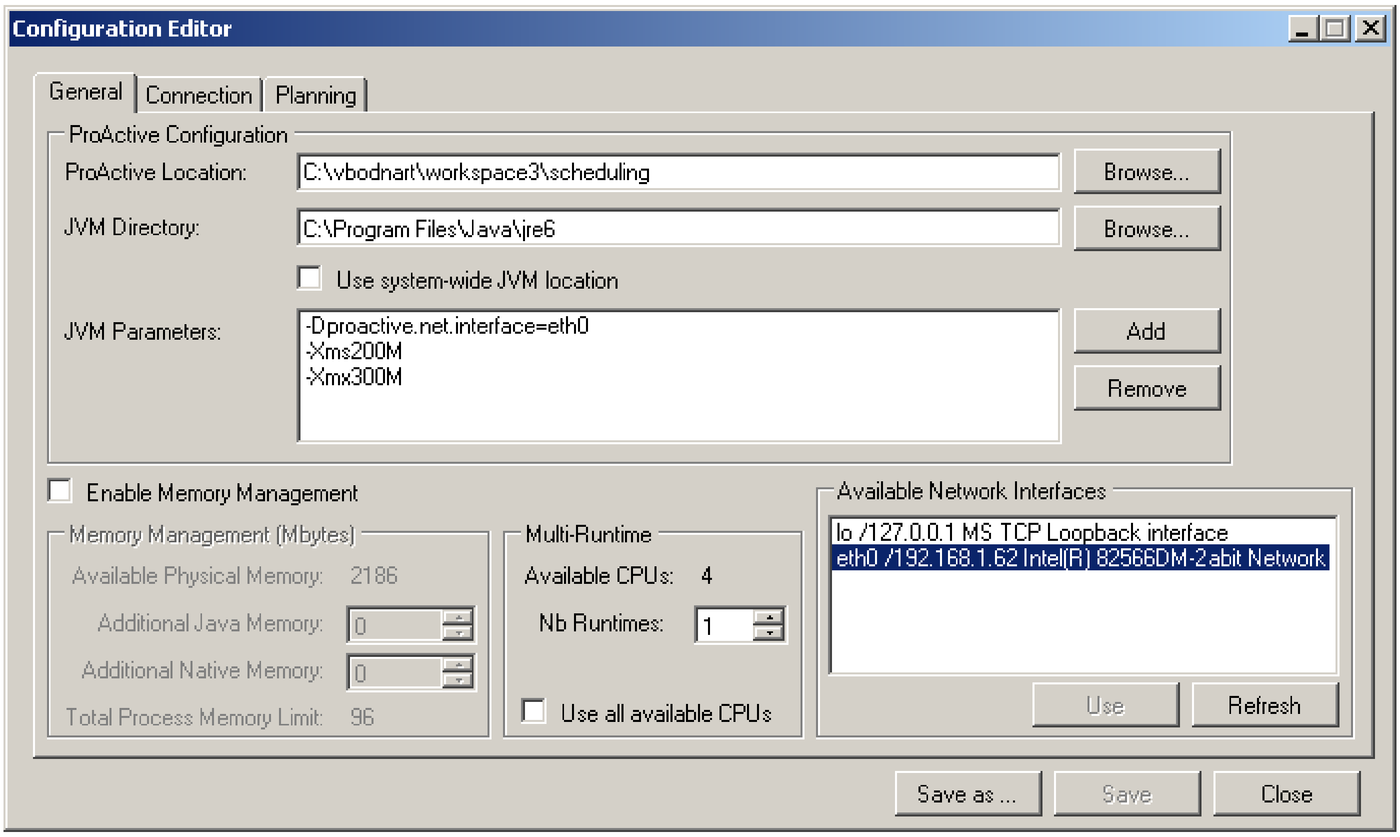
Configuration file location: C:\Documents and Settings\vbodnart.OPTIMUS\Bureau\config_agen

Status: Running

Spawned Runtimes: 1

Figure 1.2. ProActive Agent Control window

From the ProActive Agent Control window the user can load a configuration file, edit it, start/stop the service and view logs. A GUI for editing is provided (explained below). Even if it is not recommended you can edit the configuration file by your self with your favorite text editor.


Configuration Editor

General | Connection | Planning

ProActive Configuration

ProActive Location: C:\vbodnart\workspace3\scheduling

JVM Directory: C:\Program Files\Java\jre6

☐ Use system-wide JVM location

JVM Parameters:
```
-Dproactive.net.interface=eth0
-Xms200M
-Xmx300M
```

☐ Enable Memory Management

Memory Management (Mbytes)

Available Physical Memory:	2186
Additional Java Memory:	0
Additional Native Memory:	0
Total Process Memory Limit:	96

Multi-Runtime

Available CPUs: 4

Nb Runtimes: 1

☐ Use all available CPUs

Available Network Interfaces

lo /127.0.0.1 MS TCP Loopback interface

eth0 /192.168.1.62 Intel(R) 82566DM-2abit Network

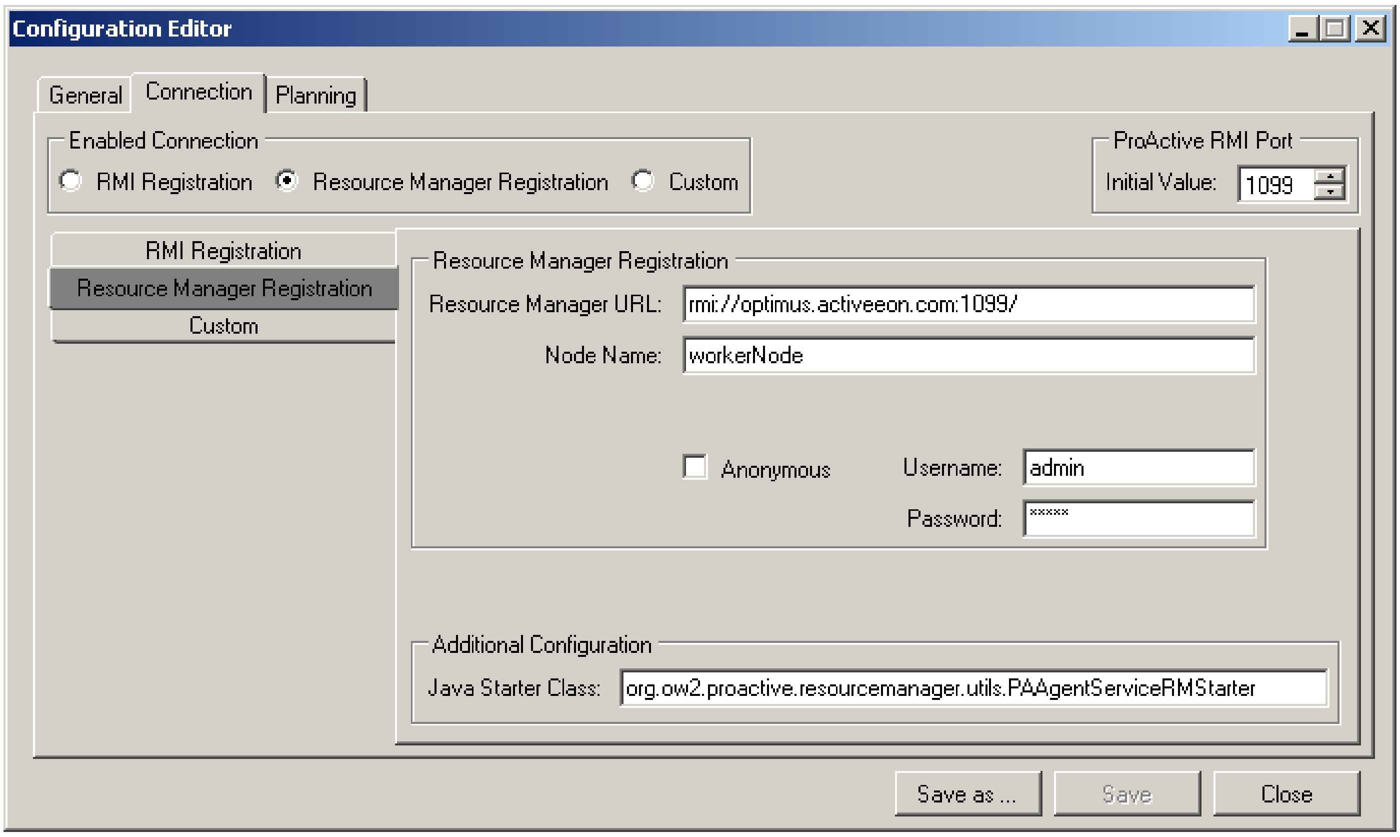
Figure 1.3. Configuration Editor window - General Tab

In the general tab the user can specify :

- The ProActive (or Scheduler) location.
- The jvm location (usually something like C:\Program Files\Java\jdk1.6.0_12).
- The jvm parameters.
- The user can enable the memory management (disabled by default) in order to limit the amount of RAM used by the jvm process.

  By default the limit is set to 96 mbytes, thus each time the jvm process asks more memory it will be killed as well as its child processes.

  The user can extend this limit by giving more memory for java tasks (executed by the jvm process) or for native tasks (child processes spawned by the jvm process).
- The ProActive Agent can spawn more than one jvm (Multi-Runtime). The number of runtimes should not exceed the number of CPUs.
- It is possible to list all available network interfaces by clicking on the "Refresh" button and add the selected network interface name as a value of the "proactive.net.interface" property by clicking on "Use" button (not available if java 5 is used). See the ProActive documentation for further information.


Configuration Editor

General | Connection | Planning

Enabled Connection: RMI Registration [✓ Resource Manager Registration] Custom

ProActive RMI Port — Initial Value: 1099

RMI Registration
Resource Manager Registration
Custom

Resource Manager Registration

Resource Manager URL: rmi://optimus.activeeon.com:1099/

Node Name: workerNode

Anonymous [ ]

Username: admin

Password: *****

Additional Configuration

Java Starter Class: org.ow2.proactive.resourcemanager.utils.PAAgentServiceRMStarter

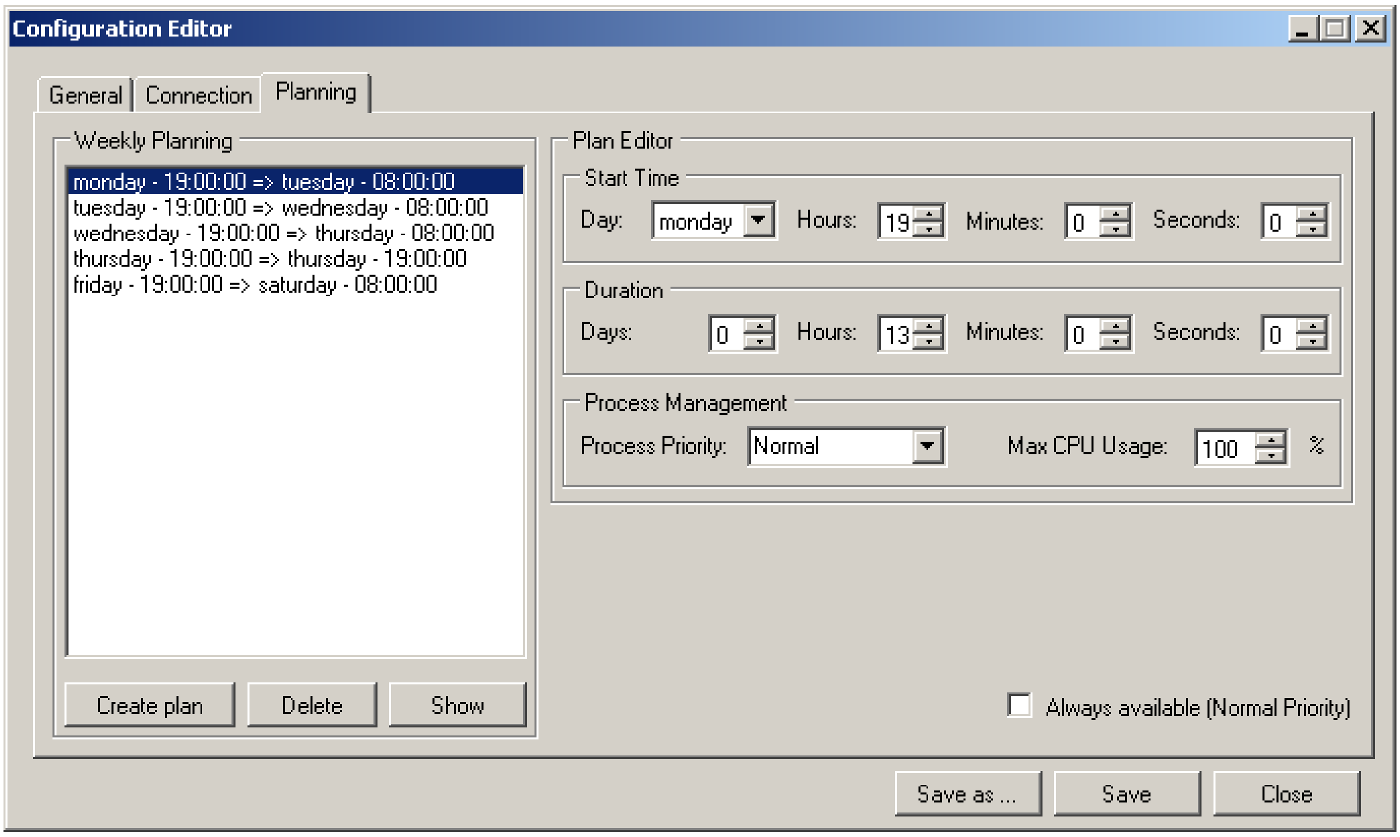
Save as ... | Save | Close

Figure 1.4. Configuration Editor window - Connection Tab (Resource Manager Registration)

In the Connection tab the user can select between three types of connections:

- **RMI Registration** - creates a local ProActive node and registers (advertises) it in a local RMI registry. The node name is optional.
- **Resource Manager Registration** - creates a local ProActive node and registers it in the specified Resource Manager. The url must be like 'protocol://host:port/'. The node name is optional. Since the Resource Manager requires an authentication a username and a password are required.
- **Custom** - the user specifies its own java starter class and the arguments to be given to the main method. The java starter class must be in the classpath when the jvm process is started.

Note that if there is more than one jvm (ie Multi-Runtime) in order to avoid ProActive RMI port collision a different value must be specified for each jvm (the "-Dproactive.rmi.port=" property is automatically specified). The initial value is by default 1099 it will be incremented and used if and only if the port is available.



Weekly Planning

monday - 19:00:00 => tuesday - 08:00:00
tuesday - 19:00:00 => wednesday - 08:00:00
wednesday - 19:00:00 => thursday - 08:00:00
thursday - 19:00:00 => thursday - 19:00:00
friday - 19:00:00 => saturday - 08:00:00

Plan Editor

Start Time
Day: monday Hours: 19 Minutes: 0 Seconds: 0

Duration
Days: 0 Hours: 13 Minutes: 0 Seconds: 0

Process Management
Process Priority: Normal Max CPU Usage: 100 %

☐ Always available (Normal Priority)

Figure 1.5. Configuration Editor window - Planning Tab

In the Planning Tab, depending on the selected connection type the agent will initiate it according to a weekly planning where each plan specifies the connection start time as well as the working duration. The agent will end the connection as well as the ProActive Runtime process and its child processes when the plan duration has expired.

Moreover it is possible to specify the jvm process Priority and it's CPU usage limit. The behavior of the CPU usage limit works as follows: if the jvm process spawns other processes they will also be part of the limit so that if the sum of CPU% of all processes exceeds the user limit they will be throttled to reach the given limit. Note that if the Priority is set to RealTime the CPU % throttling will be disabled.

The "Always available" makes the agent to run permanently with a Normal Priority and Max CPU usage at 100%.

1.6. Other information

The agent was successfully tested on Windows XP, 2003, Windows Vista. Some problems with service installation can occur on Windows NT.

The ProActive Windows Agent is written in C# and uses .Net Framework 3.5

Third-party libs used:

- C# JobObjectWrapper Api (JobManagement.dll) under Microsoft Permissive License (Ms-PL) v1.1
- C# Log4Net Api (log4net.dll - 1.2.10.0) under Apache License v2.0