Tivoli software

Enterprise Directory Query Facility and Resource Manager:

Deployment Services for IBM Tivoli Configuration Manager 4.2.1

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Revision History

Version	Date	Author	Summary of Changes
1.0			Initial version

Table of Contents

1 Preface

Enterprise Directory Query Facility and Resource Manager are newer components of IBM Tivoli Configuration Manager. They were introduced in version 4.2 of the product. Resource Manager provides a way to manage clients that have not been part of the Tivoli environment before, by supplying the bridge between these new clients and the traditional Tivoli environment. Resource Manager supports two types of new clients: pervasive devices (physical devices from Nokia, Palm, and WinCE for which there are no supported Tivoli endpoint agents) and LDAP users (abstract clients that are LDAP users linked to actual Tivoli endpoints).

1.1 About this paper

This paper provides a description of how Enterprise Directory Query Facility and Resource Manager work together to integrate LDAP (Lightweight Directory Access Protocol) data into a traditional IBM Tivoli Configuration Manager environment. The information in this paper relates to version 4.2.1 of IBM Tivoli Configuration Manager. In this paper, only the LDAP users will be discussed in relation to Resource Manager; pervasive devices will not be covered.

1.2 Who should read this paper

This paper should be helpful to anyone that is considering integrating LDAP data into their Configuration Manager environment. Anyone who has already decided to integrate LDAP users into their Configuration Manager environment will benefit from the basic deployment overview included in the paper. This paper assumes previous knowledge of Framework, Configuration Manager, and intermediate LDAP concepts.

1.3 About the Author

Gina Benzonelli is a technical course developer in Tivoli Worldwide Education at IBM. She has written course material on Configuration Manager topics including Web Gateway, Resource Manager, and Enterprise Directory Query Facility.

1.4 What this paper contains.

This paper contains the following sections:
- Overview of Resource Manager and Enterprise Directory Query Facility
- Introduction to resource groups
- Introduction to Enterprise Directory Query Facility
- How to link LDAP users to endpoints
- How to create and use directory queries
- Outline of installing Resource Manager and Enterprise Directory Query Facility
- Troubleshooting notes

2   Overview

Resource Manager provides a way to manage clients that have not been part of the Tivoli environment before, by supplying a connection between these clients and the traditional Tivoli environment. Resource Manager supports two types of new clients: pervasive devices (physical devices from Nokia, Palm, WinCE for which there are no supported Tivoli endpoint agents) and LDAP users (abstract clients that are LDAP users linked to actual Tivoli endpoints).

Resource Manager Icon

Pervasive devices require additional configuration of the Configuration Manager Web Gateway component in order to support access to the Tivoli environment through Resource Manager. LDAP users require additional configuration of the Configuration Manager Enterprise Directory Query Facility in order to support management of Tivoli endpoints through LDAP users. In this paper, only the LDAP users will be discussed in relation to Resource Manager.
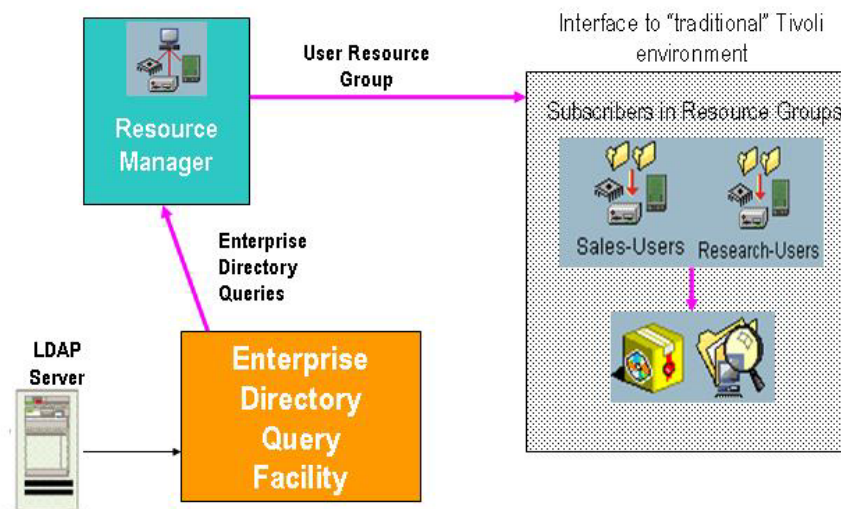

Resource Manager introduces the new object *resource group*. A resource group is created within a policy region, and contains a list of LDAP users that are linked to actual Tivoli endpoints. A resource group can become a subscriber to a profile manager, thus linking LDAP users to the "traditional" Tivoli environment. Note that you cannot select a resource group as a subscriber to a dataless profile manager, much in the same way that a profile manager cannot be selected as a subscriber to a dataless profile manager. You can think of the resource group as a type of profile manager for LDAP user and pervasive device subscribers.

Enterprise Directory Query Facility is used by Resource Manager to communicate with the LDAP server on behalf of Resource Manager. Enterprise Directory Query Facility will retrieve LDAP data and write any changes to the directory. Therefore, in order to implement selection of LDAP users as targets for Configuration Manager actions, you must install and configure Enterprise Directory Query Facility in addition to the Resource Manager component. You can think of the Enterprise Directory Query Facility as a type of RIM service for LDAP servers.

3   Resource Groups

LDAP users and pervasive devices that are to be managed by Resource Manager must be members of one or more resource groups. This allows them to be subscribers to profile managers. The resource group is a new managed resource type within a policy region. Valid member types are **Pervasive_Device** and **User**. Note that members of differing types must be in separate resource groups — you cannot mix users and pervasive devices within a single resource group.
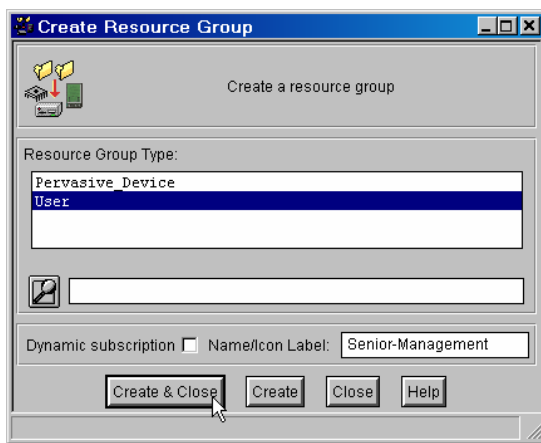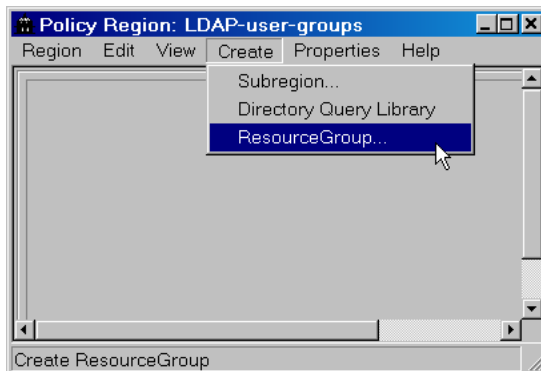
Resource groups are either static or dynamic. Static group members do not change unless the Tivoli administrator edits the group. Dynamic group members are determined at run time; the Tivoli administrator does not explicitly add or delete members in a dynamic resource group.
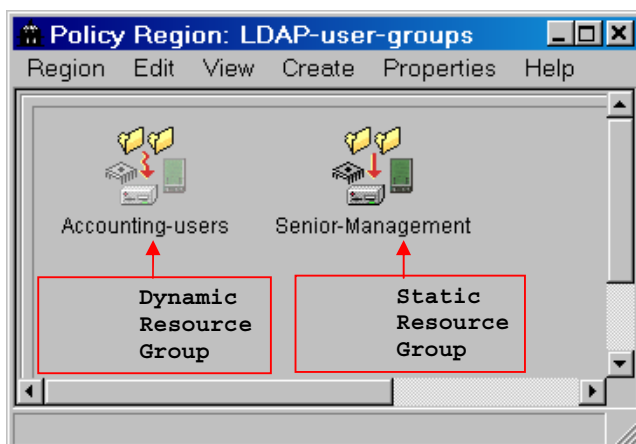
Potential LDAP user members are determined through the Enterprise Directory Query Facility. The Tivoli administrator will link existing LDAP users with existing Tivoli endpoints by use of a new CLI command. We will cover the details of linking users to endpoints later.

Only users linked to endpoints can be members of a resource group. Resource groups can filter their members with a Tivoli policy script or *directory query*. A directory query is a new Tivoli object that defines a query for LDAP data. You will usually want to filter a dynamic resource group via a directory query; otherwise, all available LDAP users will dynamically become members of the group.

3.1 Managing Members of Resource Groups

When you open a resource group, you have several management options. For static resource groups, you can manually add or remove members in the group. You can also enable a policy or a directory query which will filter the available (potential) members. These filters do not affect the current members of the group; they simply limit the list of members that are available to be manually added to the group.
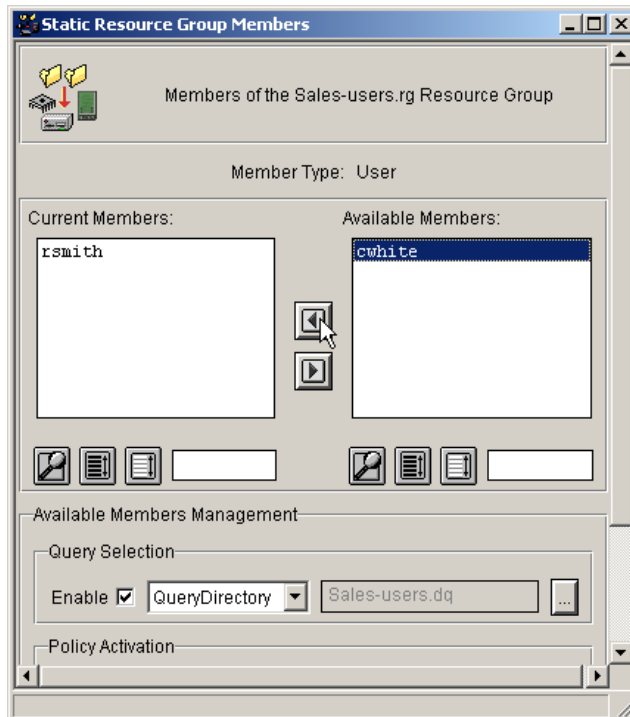
In the example above, this static resource group has only one current member (**rsmith**). The available members have been filtered by department through a directory query (**Sales-users.dq**), resulting in only one available member (**cwhite**) who is an LDAP user in the Sales department.

When you open a dynamic resource group, you will only see the filter options — query selection or policy activation. Unlike static resource groups, these options will control the actual members of the dynamic group. If neither of these options is set, then the dynamic resource group will contain all available LDAP users (all users that are currently linked to Tivoli endpoints).
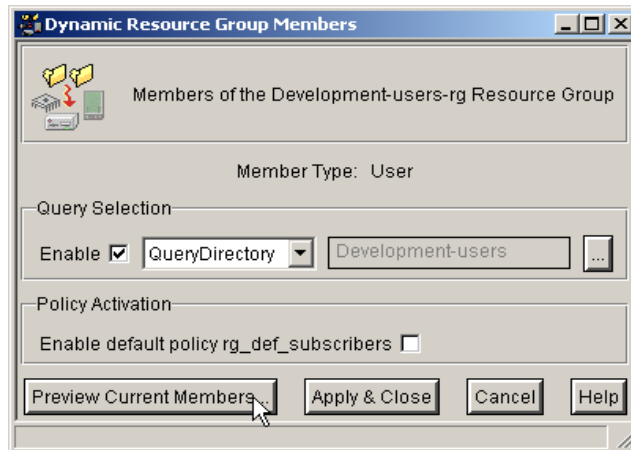
In the example above, the dynamic resource group is filtered with the directory query named **Development-users**. When you preview current members, the available LDAP users will be filtered by this directory query, which will select only users in the Development department. Of course, since this is a dynamic resource group, group membership is determined each time that you distribute a profile to the resource group.
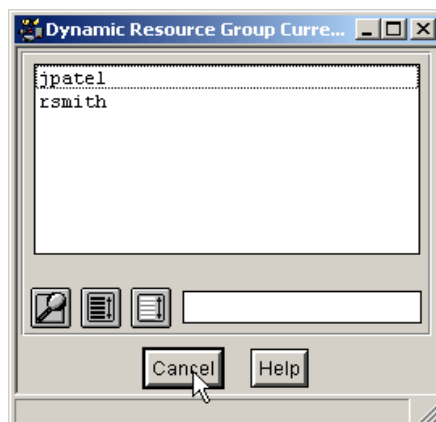
The example above shows the result of selecting **Preview Current Members**. LDAP users in the Development department are displayed.

4 Enterprise Directory Query Facility

Resource Manager relies on Enterprise Directory Query Facility to communicate with an LDAP server for information about users that are linked to Tivoli endpoints. Enterprise Directory Query Facility uses the LDAP application programming interface (API) to read/write directory data for Resource Manager.

New resources **QueryDirectoryLibrary** and **QueryDirectory** have been added to Configuration Manager, and can be used to query LDAP data within Tivoli. They are analogous to the TMF (Framework)-based query library and query.
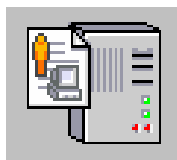

QueryDirectoryLibrary   **QueryDirectory**

To use directory queries, you will first add the resource type **Directory Query Library** to a policy region, and then create a new directory query library within the policy region. You can then create directory queries within the library.

New CLI commands have been added to the Tivoli environment to create, edit, view, and run directory queries; you can run these commands on the Tivoli server or any managed node where Enterprise Directory Query Facility is installed.

4.1   *Using Directory Queries in Activity Planner and Change Manager*

In order to select LDAP users as subscribers to traditional Tivoli profile managers, you must create a resource group and add the users as members. However, the newer components Activity Planner and Change Manager allow you to select a directory query as a target without explicitly creating and populating a resource group. When you choose a directory query as a target for Activity Planner or Change Manager, a temporary resource group will be created and populated for you based upon the results of the directory query. The Tivoli endpoints which are linked to the selected LDAP users will then become the actual targets for the activity plan or reference model.
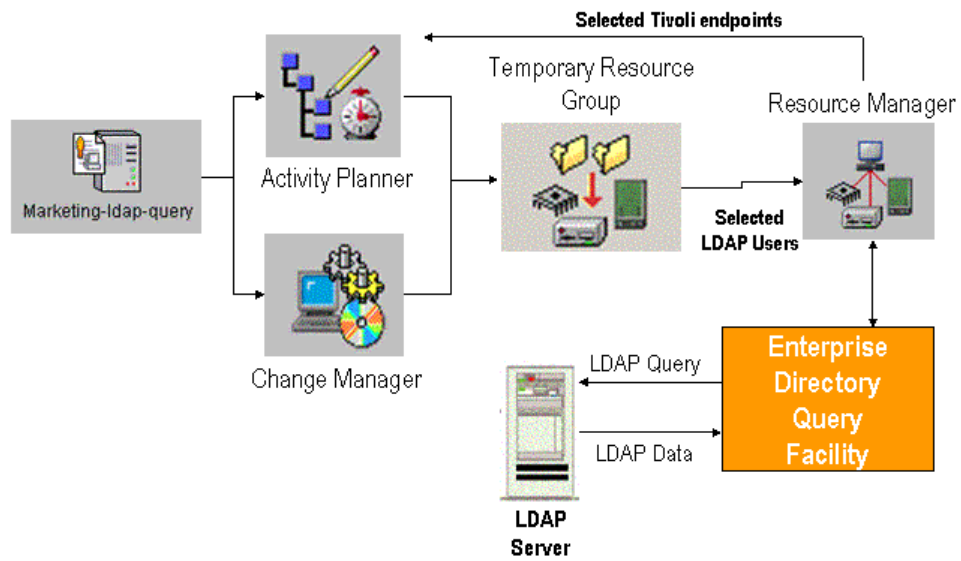
Note that you may see these temporary resource groups in your Tivoli environment. They will be deleted when they are no longer needed; do not delete them manually. Temporary resource group names will begin with _INTERNAL_RESGRP_.

5 Linking LDAP Users to Tivoli Endpoints

Selecting LDAP users as targets for Configuration Manager actions will make no sense until the LDAP users are somehow connected to specific Tivoli endpoints. In order to link LDAP users to Tivoli endpoints, the mappings must be defined and stored for quick retrieval when needed. For this reason the endpoint/user mapping is stored in the LDAP directory. This means that the schema for your existing LDAP directory must be extended in order to be able to store additional Tivoli-specific data.

An LDAP *auxiliary* object class is used to add more attributes to an existing LDAP entry. Resource Manager provides a new auxiliary object class named **tmeTargetInfo**. This class defines three new optional attributes:

- **tmeObjectId**: Tivoli object ID (OID) of the endpoint
- **tmeObjectLabel**: Tivoli object label of the endpoint
- **tmeTrmId**: Unique ID created by Tivoli for user/endpoint pair
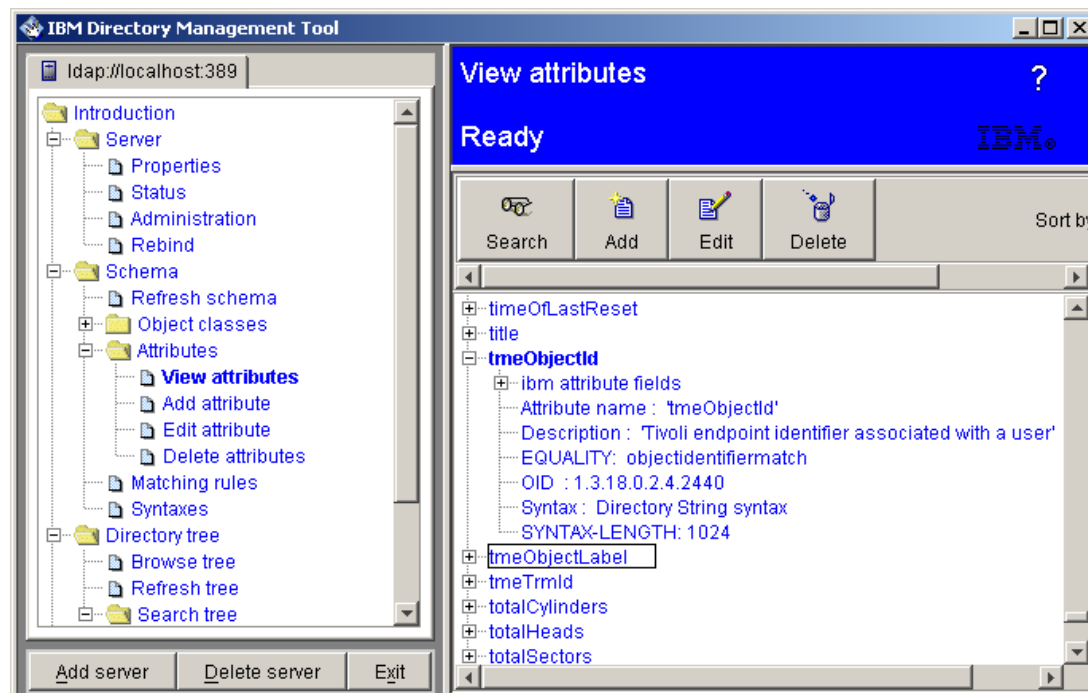
The LDAP attribute that Tivoli will use to identify the user is the *Common Name* (cn). When creating directory queries, you should always include this attribute, since it is the key to the user.

For the purpose of matching LDAP users with endpoints, the **tmeTrmId** attribute is used to uniquely identify a user/endpoint pair. Because the attribute **tmeTrmId** is the key to the user/endpoint pair, you can change the endpoint OID associated with a user, or the Common Name (cn) associated with an endpoint, while not affecting the static resource groups that the user/endpoint is assigned to.

The mechanism by which a user is mapped to a Tivoli endpoint is the new Tivoli command **wmanagedir**. When a user is linked to an endpoint, the LDAP entry corresponding to the distinguished name (DN) for that user is extended to include the new attributes for Tivoli. Once updated by Enterprise Directory Query Facility, the LDAP entry stores the user information as well as information about the endpoint that the user is linked to. The **–a** flag of the command will add a

new link to an LDAP user, which means that the optional Tivoli attributes will be populated with values, including a new and unique **tmeTRMId** value. The **–m** flag will modify an existing link, which means that the endpoint attributes of the given user will be modified, while the **tmeTRMId** will remain the same. The **–r** flag will remove the link between user and endpoint, meaning that all Tivoli attribute values will be cleared for the specified LDAP user.

5.1 Tivoli Directory Context

All information regarding how the Enterprise Directory Query Facility will communicate with the LDAP server is maintained in a Tivoli *directory context*. The directory context is analogous to a RIM object for RDBMS connections. It contains the information required to connect to a specific LDAP server. Information stored in the Tivoli directory context includes the LDAP server name, LDAP suffix (also called *naming context*) to be used, LDAP administrator name and password, and any SSL (Secure Sockets Layer) information, if SSL is enabled. You may create multiple directory contexts in order to access multiple directory servers, or multiple suffixes within a single directory server.

The default directory context is named **directory**. It is created when you install Enterprise Directory Query Facility. If you do not configure parameters during installation you must manually set the directory context parameters with the **wsetdirctx** command.

When you use the command **wresource ls User** to view the available LDAP users in the Tivoli environment, the **directory** directory context is used to retrieve the list. This directory context is also used when you access the Tivoli Desktop to do the equivalent function (select the Resource Manager icon and select to view users). All dynamic and static resource group members will be populated with LDAP users through the **directory** directory context. You cannot choose another directory context to select resource group members from, so do not delete the **directory** directory context.

5.1.1 Creating Endpoint/User Mappings

To create the endpoint/user mapping for Resource Manager, use the Enterprise Directory Query Facility command **wmanagedir**. You can specify either the endpoint label or the endpoint object ID.
```
     wmanagedir -a dn -l endpoint-label directory_context
```
Or:
```
     wmanagedir -a dn -o endpoint-OID directory_context
```

The *dn* variable is the distinguished name of the user. For example, to create a link between the user with a cn of **gbrown** and an endpoint named **win-ep**, you would use the following command. The user **gbrown** is located in the suffix **o=ibm,c=us**:
```
     wmanagedir –a cn=gbrown,o=ibm,c=us –l win-ep directory
```

The example above uses the default **directory** directory context, which has the suffix set as **o=ibm,c=us**. The command will use the Enterprise Directory Query Facility to update the directory entry for **gbrown**, using the LDAP connection information stored in the specified directory context.

Authorization required for the **wmanagedir** command is **admin**, **senior**, or **super**. The **wmanagedir** command also provides an option for using a file to make batch updates.

Note that when specifying the endpoint OID value, you must include at least a plus (+) at the end of the OID. If you do specify the object ID rather than endpoint label, you can make sure that you use the correct syntax when specifying the endpoint's OID by using the results of the command:
```
     wep endpoint-label get object
```

6   Creating and Using Directory Queries

You can use directory queries with Resource Manager by enabling query selection for static or dynamic resource groups. When enabled, the directory query will filter the available members of the resource group. Note that when you work with a resource group for pervasive devices, you must use TMF (Framework) queries for available membership management. For resource groups of users, you must use directory queries.

To create a directory query, you will first create a directory query library within a policy region. Within the directory query library you will create a directory query - this is very similar to creating a TMF query.

When creating a directory query, you will specify the directory context which the query will use – the default is **directory**. You will also specify the naming context (LDAP suffix) that you will be querying. If you select to use the default value, you will use the suffix that is stored in the selected directory context. In this example, the default suffix is **o=corp1, c=it**. This value was retrieved from the **directory** directory context.

In the **Search String** field, you may enter any valid LDAP search syntax. For scope, you can select **object**, **one level**, or **subtree**. These correspond to the LDAP query scopes **baseObject** (search at the suffix level only), **singleLevel** (search only immediate children of suffix) and **wholeSubtree** (search base object and all descendants).

In the **Chosen Attributes** area, you can enter the list of attributes which you want returned in the query. There is no selection list; you must type the attribute names in the **Attribute** field and select

Add or **Replace**. If you enter an attribute name incorrectly, you will not receive an error; however only valid attributes will be returned in the query results.

When you create a directory query which will be used as a filter for resource groups, there are two points to keep in mind:

- In selecting members of a user resource group, Resource Manager will use only the directory context named **directory**, so select this default value when creating directory queries to filter resource groups.
- Include the **tmetrmid** attribute in the directory query definition. If the key attribute **tmetrmid** is not a chosen attribute in a directory query, the directory query cannot be used to filter users in resource groups. It will not appear in the selection list in the resource group GUI, and it will generate an error if you specify the directory query in a **wresgrp** command to create or modify a resource group.

If you do not select any attributes to be returned in the query, all attributes will be returned when you run the query. Despite this, you must still explicitly select at least the **tmetrmid** attribute when creating queries for Resource Manager filtering. You will most likely want to include the **tmeobjectlabel** and **cn** attributes as well, in order to view the endpoint label and user. Once you set at least one attribute to return, only the attributes in the **Chosen Attributes** list are returned.

The directory query results will include all users in the specified suffix, regardless of whether they are currently linked to a Tivoli endpoint. In most cases you will want to filter out the users that are not linked to endpoints. The next section describes how to do this.

6.1 LDAP Search Filter Syntax

In the **Search String** field of the directory query definition, you must use the LDAP search filter syntax. LDAP search filter form is:

```
atribute operator value
```

The table below shows the valid LDAP operators:

Operator	Description	Example
=	Returns entries whose attribute is equal to the value.	cn=John Smith finds the entry with common name John Smith.
>=	Returns entries whose attribute is greater than or equal to the value.	sn>=smith finds all entries from smith to z*.
<=	Returns entries whose attribute is less than or equal to the value.	sn<=smith finds all entries from a* to smith.
=*	Returns entries that have a value set for that attribute.	sn=* finds all entries that have the sn attribute.
~=	Returns entries whose attribute value approximately matches the specified value. Typically, this is an algorithm that matches words that sound alike.	sn~= smit might find the entry "sn=smith".

The asterisk (*) is wildcard, and when used alone (as in **sn=***) it will return only entries that have a value defined for the attribute. Note that you will usually want to include the search filter **tmeobjectid=*** in your directory query definitions. This will filter out any LDAP users that are not currently linked to Tivoli endpoints. If you do not include this filter, your directory query may return users who have not been linked to Tivoli endpoints, and that will cause a failed Configuration Manager operation.

You can combine search filters with Boolean operators:

Boolean operator	Description
&	Returns entries matching all specified filter criteria.
		Returns entries matching one or more of the filter criteria.
!	Returns entries for which the filter is not true. This operator can only be applied to a single filter. (!(filter)) is valid, but (!(filter1)(filter2)) is not.

Filters are combined using the syntax:
```
( & or | (filter1) (filter2) (filter3) ...) (! (filter))
```

Some examples of LDAP search filters:
- Surname is Smith or Smyth, and this LDAP user has been linked to a Tivoli endpoint:
  ```
  (&(| (sn=Smith)(sn=Smyth)) (tmeobjectid=*))
  ```
- Common Name is Sue, and Organizational Unit is Sales, and this LDAP user has been linked to a Tivoli endpoint:
  ```
  (& (cn=Sue)(ou=Sales)(tmeobjectid=*))
  ```

6.2   Using Directory Queries with Activity Plans

When you select directory queries to identify targets for activity plans, you can select to view the targets as either users or endpoints. Whichever type you select is the target type that will be displayed in the Activity Plan Monitor.

To use a directory query to select targets for an activity plan, select a directory query library from the drop-down list and a query attribute in the **Attributes** text box. The selected attribute must contain data compatible with the target type selected in the **Target types for browsing** selection.
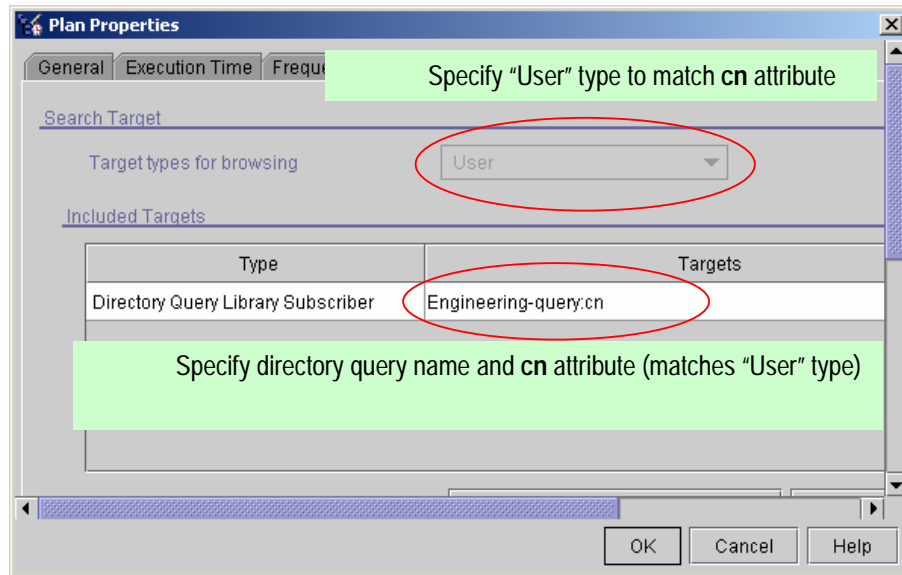
In the example above, **User** has been specified as the target type, so the attribute specified in the directory query selection is **cn**, the LDAP attribute that corresponds to **User**.

Of course, the attribute that you want to query for must be included in the directory query definition. In this example, the **cn** attribute has been included in the **Engineering-query** directory query definition.
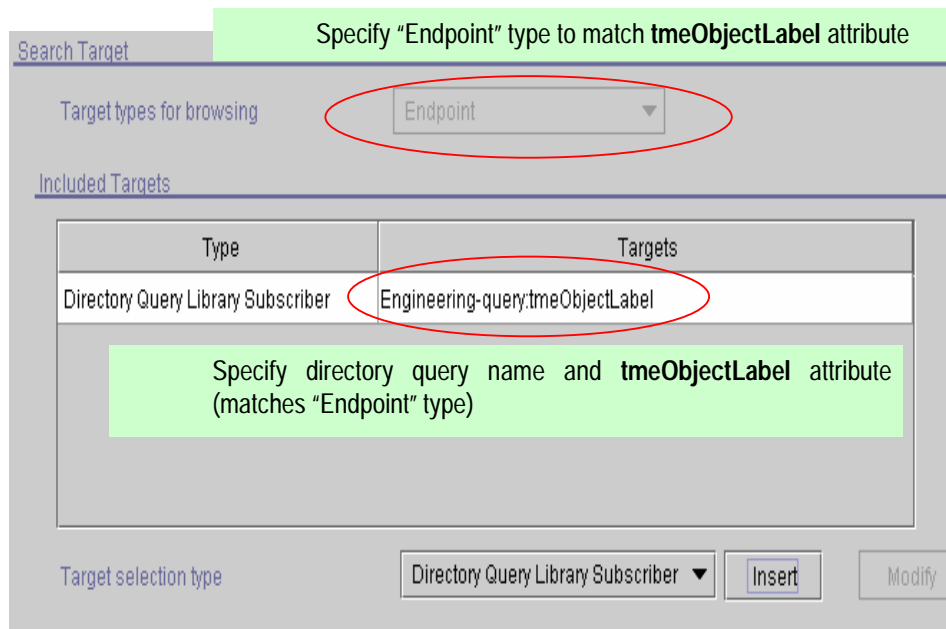
In this example, the target type is now **Endpoint**, so the attribute selected in the directory query **is tmeObjectLabel**, the LDAP attribute that corresponds to endpoint label. The **tmeObjectLabel** field is included in the definition of **Engineering-query**.

Note that the only valid choices are **Endpoint** or **User** when selecting a target selection type of **Directory Query Library Subscriber**.

Directory query subscribers are only one method of selecting LDAP users as targets for activity plans. If you have resource groups defined, you can select them as targets. If you have a specific list of user names which are targets for an activity plan, you can either select **List of target names** for target selection type and enter the user names, or you can select **File of target names**, and specify a file which contains the users. In either case, make sure that search target type is **User**. Of course, the LDAP users specified must have previously been linked to an endpoint with the **wmanagedir** command.

7 Installing Resource Manager and Enterprise Directory Query Facility

7.1 Installing Resource Manager

You will install the Resource Manager component on the Tivoli server, and on any managed node where you will be executing Resource Manager CLI commands. Note that for LDAP user management, you will not install the Resource Manager Gateway component – this component is used for pervasive device support only.

Resource Manager and Inventory will usually share the same tablespace. However, if the Resource Manager component is installed before Inventory component, the **trm** database is created for use by the Resource Manager component. Likewise, if the RIM object **inv_query** is defined before Resource Manager installation, the Resource Manager component uses the **inv_query** RIM object. Otherwise, the **trm** RIM object is created.

After you install Resource Manager, you must run the script **$BINDIR/TRM/RegisterUser.sh** in order to register **User** as a valid resource type. An equivalent script named **RegisterPervasive.sh** enables pervasive devices to be managed by Resource Manager. Note that if you install Resource Manager using ISMP (InstallShield Multi-Platform), both of the scripts mentioned above will be run automatically for you.

7.1.1 Resource Manager Tables

The following tables are created in the configuration repository during Resource Manager installation:

- **TRM_GROUPS**: Stores the list of users that are members of static resource groups. This table also tracks pervasive device group members, when pervasive management is enabled. The table fields are:
  - **GROUPID**: Name of resource group as specified by Tivoli administrator when creating it.
  - **RESOURCEID**: For users, this is an integer assigned to a user/endpoint pairing when using the **wmanagedir –a** command to create a new pairing (**tmeTrmId**). This ID corresponds to a user that is a member of the group specified by GROUPID.
  - **TYPE**: Type of resource – valid values are USER or PERVASIVE_DEVICE.
- **TRM_TYPES**: Lists the types of resources that Resource Manager is configured to handle. Currently valid values are USER and PERVASIVE_DEVICE.
- **TRM_DISTRIBUTIONS, TRM_RESOURCES**: Used for pervasive device support only.

7.2 Installing Enterprise Directory Query Facility

You must install both Resource Manager and Enterprise Directory Query Facility to manage LDAP users. Because the Enterprise Directory Query Facility installation runs a Resource Manager CLI command (**wresource**) , you should install Resource Manager before installing Enterprise Directory Query Facility.

If you install the Enterprise Directory Query Facility component before installing the Resource Manager component, you must run the **update_trm_query.sh** script after installing Resource Manager. The script is located in the directory **BINDIR/TAS/DirQuery/SCRIPTS** .

Before installing Enterprise Directory Query Facility, the Tivoli server must have access to the LDAP server. For installation, you will need the LDAP communication port (usually port 389 for standard communications or 636 for SSL communications).

Supported LDAP Servers for Version 4.2.1 of Configuration Manager are:
- IBM Tivoli Directory Server 4.1
- Active Directory for Windows 2000
- Novell Directory Server for NetWare, version 6

Additional prerequisites for Enterprise Directory Query Facility are:
- Tivoli Management Framework 4.1 or higher
- Java 1.3.0 for Tivoli
- The Resource Manager component

7.2.1   Configuring Enterprise Directory Query Facility During Installation

During a "fresh" ISMP installation of Configuration Manager, if you select the **typical** installation option, Enterprise Directory Query Facility will be installed but not configured. You will have to configure the component after installation. If you select **custom** installation, you can select whether to install Enterprise Directory Query Facility. If you select to install it during a custom install, you will be prompted for parameters to configure the component during installation.

To configure the Enterprise Directory Query Facility, you must provide the following parameters. which will be used to set the default directory context named **directory**:
- LDAP Server host name
- LDAP Server port numbers (standard and SSL)
- DN and password of LDAP Administrator for LDAP Server
- Naming Context (The DN that is the naming context, also called a *suffix*, for the users which you will associate with endpoints)
- If you enable SSL communications between the Enterprise Directory Query Facility and the LDAP server, you must enter the keystore path as well

7.2.2   Configuring Enterprise Directory Query Facility After Installation

Use the **wsetdirctx** command to set the default directory context after installation. Use the **wgetdirctx** command at any time to see the parameters for a given directory context. This returns values for:
- Server: LDAP Server host name
- Port: LDAP communications port (usually 389)
- SSL Port: LDAP SSL communications port (usually 636)
- User: DN of LDAP Administrator (for example **cn=root**)
- Provider: LDAP service provider used by the Enterprise Directory Query Facility to access the LDAP service. Default is **com.sun.jndi.ldap.LdapCtxFactory**, and should not be changed. This service is part of the Java Naming and Directory Interface (JNDI), a set of APIs that assist with the interface to multiple naming and directory services.

If the LDAP administrator password was not set during installation, it will be initially blank for the default directory context. Set the password by using the command:

```
wsetdirctxpw directory "" new-password
```

An example of using the **wsetdirctx** command to configure the default directory context is shown below. In this example, the LDAP server host name is **dirsvr**, the LDAP administrator account is **cn=root**, and the suffix to be used is **o=mycorp,c=us**:

```
wsetdirctx -s dirsvr -u cn=root -c o=mycorp,c=us directory
```

To review the current configuration of the default directory context, use the command:

```
wgetdirctx directory
```

Do not delete the default directory context named **directory** once it is created. If you remove this directory context, you will not be able to access directory queries from Resource Manager. If you do inadvertently delete it, you must recreate it and then use an IDL call to set the directory context for Resource Manager.

7.3   Extending the LDAP Directory Schema

Before an LDAP directory can be used by Resource Manager, the schema must be extended to store the additional Tivoli attributes. A new auxiliary object class named **tmeTargetInfo** is added to the schema. In this object class, attributes **tmeObjectLabe**l, **tmeObjectID**, and **tmeTrmId** are specified as optional attributes.

Scripts have been provided by Tivoli for the supported LDAP servers. The LDAP scripts are located on the Tivoli server, in the directory **$BINDIR/TAS/DirQuery/SCRIPTS**:
* **IBMupd.ldf**: Used for IBM Tivoli Directory Server
* **ADupd.ldf**: Used for Active Directory (Windows 2000)
* **NDSupd.ldf**: Used for Netware

Scripts are written in LDIF (LDAP Data Interchange Format). To extend the schema of the LDAP server, you will copy the appropriate script to the LDAP server and run the LDIF utility provided by the LDAP server.

As an example, to update the directory schema on an IBM Tivoli Directory Server that is on a UNIX system:
* Back up your LDAP directory before applying any changes to it
* Copy the **IBMupd.ldf** script from the Tivoli server to the LDAP server
* Use the **ldapmodifyd** command in the *LDAPdir*/**IBMldapc/bin** directory:

```
/opt/IBMldapc/bin/ldapmodifyd -h ldaphost -p 389 -D cn=root
      -w password -a -v -f IBMupd.ldf
```

When using Microsoft Active Directory as the LDAP Server, you will edit the **ADupd.ldf** script to fit your domain before applying it. In the Active Directory script you must change the default values of **DC=swd,DC=com** to whatever the domain naming convention is in your environment. Then use the Windows Active Directory utility **ldifde** to run the script:

```
ldifde -i -v -f ADupd.ldf
```

8 Troubleshooting

Enterprise Directory Query Facility uses port 9090 to communicate internally. This process runs on the Tivoli server, so make sure that there are no conflicts with other software. This port can conflict with administration consoles such as WebSphere; the WebSM service on AIX also uses port 9090. You can change the default Enterprise Directory Query port using the Tivoli environment variable **DQ_PORT**.

To change the default port for Enterprise Directory Query Facility, use the following steps:
```
odadmin environ get > /tmp/environ.out
vi  /tmp/environ.out
     (add the line:  DQ_PORT=new-port )
odadmin environ set <  /tmp/environ.out
odadmin shutdown all
odadmin start all
```

Use similar steps to set **DQ_TRACE=1** to create trace files for Enterprise Directory Query Facility. This will create two trace files in **$DBDIR**:
- DirQueryEngine0.trc
- DirQueryCli0.trc

Be warned that the LDAP administrator password is written to the **DirQueryEngine0.trc** file in clear text.