



Agent Based Search in the PROTAGE prototype

Lead Editors: Magnus Geber, Albert Trias,

28/10/2010

Status: Draft

SEVENTH FRAMEWORK PROGRAMME THEME

ICT -1-4.1 Digital libraries and technology-enhanced learning

Project full title: PReservation Organizations using Tools in AGent Environments

Grant agreement no.: 216746



Introduction

The aim of this document is to have a brief understanding about how the *agents based search* works.

To illustrate the different search option there is the **Diagram 1: Search Options** page xx. In the follow text there are references to that diagram. The squares in the diagram are labelled with notations as **AA)**, **BA)**, **CD)** etc that is used for reference. Using the notations with A in beginning or end, like **AC)** or **CA)** refers to the whole row or column with the relevant heading in the actual square.

User profile settings

First of all we will introduce some aspects about the user profile. In the menu "User Profile" there are 4 tabs, "User Profile", "MAS Platform", "Local Repository" and "Access Point". In "Local Repository" and "Access Point" there are the settings to access the Local Repository and to get some data as the contacts status on the access point respectively. They do not affect directly on the behaviour of the search.

In the User Profile tab, we can specify the features of our user: the user type, location, preferred tools, and preferred collection type that is used in the search by Actionplan Profile. In the same tab there is also the option "Agent Support" to enable the agents search.

In the MAS Platform tab, there are 2 options that are also used for the "Profile search": Operative System Type and Network Connection Type. Furthermore, here there is the option "Only Email communication". When this option is enabled all the communication done by our application to others is done using emails. When there is some problem connecting the access point it is enabled automatically.

Non agent based search

Except for the Agent Search the prototype executes a local **non agent based search**, see **AB)** in the diagram. It uses keywords in the search box to obtain action plans that contain them. The results are presented in the Local Results table and are sorted by the amount of coincidences with the used keywords.

This search is always performed but it will just show the results from the local repository (database).

Agent Based Search

To activate **Agent Based Search** check the Agent Based Intelligent Search box, see Figure 1. You may also specify a Deadline for the question, default is one hour.

The agent based search tries to obtain a personalized action plan. The agents search first in the local repository. If there are no results, then it searches in the Access Point, and if there are still no results then it sends the question to its friends (friends may continue send to their friends, exploring the social network of this agent).

There are three main types of agent based search **Profile**, **Trust** and **Hybrid**. The distinction between these concerns two types of agent **behaviour**, **CA)** and **DA)**. But common for all the three search options are the **matching to find an Action Plans**, **BA)**.

Matching to find Action Plans, **BA)** is basically done by keyword. The function finds all similar patterns of letters both in the Name, Keywords and Description field of an Action Plan. Added to that

you can make an Actionplan Profile Preference filtering. That is done in the “Management>Agent Configuration>Searcher Agent>Agent Search Preferences, see Figure 2.

To evaluate if an Action Plan fulfils a Profile Preference is calculated with a value based on the relevant option for preference, like Author, Topic, Provider etc. In Advance Configuration you can specify the weights between these options yourself, se Figure 4. Depend on which of the chosen option are matching you will get a specific sum. That calculated value is expected to be more then the QoS (Quality of Service). QoS is default 50% but can in Agent Search Advanced Configuration, see Figure 4, be set to either normal =50%, good= 65% or very good=80%.

To give an example, if you chose to use author, topic and provider and set the weights 6, 11, 3 for them that will be recalculate to author 30%, topic 55% and provider 15%. The QoS is supposed to be normal, 50%. The chosen preference you have set in Figure 2, for example if that author should be user robert2 and topic Migration. If an Action Plan has the correct author and provider but not topic the sum will be $30 \times 1 + 55 \times 0 + 15 \times 1 = 45 \%$ being less then the QoS 50% and the AP is not selected. If an Action Plan has the correct topic but not author and provider sum will be $30 \times 0 + 55 \times 1 + 15 \times 0 = 55 \%$ being more then the QoS 50% and the AP is selected.

In Agent Search Basic Configuration, see Figure 3, you can't change the weights yourself but there are options with predefined profiles of weights. If you in Actionplan Profile Search Preference chose Similar Collection that is actually a preset profile with Author= 5%, Collection = 60%,Topic = 15%, Subtopic = 10%, Provider = 5% and Tested = 5%.

In Agent Search Basic Configuration there is an option to have the result being Aggressive or Conservative. Aggressive means that the levels of the calculations are changed having more APs accepted and Conservative means the opposite.

The **behaviour** is divided into **whether to send an Action Plan, CA)** and **selection of users to answer, DA)**. Whether to send an AP, **CA)** back in only relevant for Trust Search and Hybrid Search. That is done by comparing the trust level you have for your asking friend to the rating of the selected Action Plan, **CD)**. Here where an exception is for local agent based search, where rating of the APs are compared to level3, **CDx)**.

Selection of users to answer **DA)** is in Profile Search a consideration if a user actually should answer **DC)** and this is done by the answering agent checking if its user fulfils the condition set by user profile preference, se Figure 2. These calculations, concerning User Profile Preference filtering is similar to those of Actionplan Profile Preference filtering, describe above. In trust search the selection of users is instead done by the asking agent checking which trusted friends to send the question to, **DD)**

The logical step of the search options are described in the following.

I) Profile (user profile search): This search tries to get and action plan from a specific type of user specified by the profile, the user profile. In advanced search is possible to specify weights for each parameter, se Figure 4.

The algorithm used in this search is the following:

1. The agent searches a keyword in the local repository.
 - 1.1 If there are results in the local repository then the agent checks that its user profiles satisfies the “user profile of the search”. The value of this “weighted mean” has to be higher than a QoS.
 - 1.2 In the case that the user profile is satisfied, it is higher than the QoS, then the agent sends the result to the GUI. (END).
 - 1.3 If there is no result go to step 2

2. The agent searches the keyword in the access point.
 - 2.1 If a result is found it is returned to the GUI. END
 - 2.2 Else go to step 3
3. The agent sends the question to all its friends (contacts). To the friends that are online it sends an ACL Message, and Email to others.
4. When its friends receive its question, if they satisfy the user profile then they will search at their local repository.
 - 4.1 If there are results in the local repository of those matching friends, they are returned to the asking agent. (Go to step 5)
 - 4.2 Else the agents forward the question to their next friends. (Go to step 4)
5. If the agent receives an answer, it sends it back to the asking agent and at the time it sends a stop message to the other friends to stop the search. When the friends receive a stop message they forward it to their contacts that received the asking message.

II) Trust: The agent selects the friends next to be asked by means of **Trust** on users which guide who is asked next and whether the next agent will answer to the previous asking agent, in a game of give-and-take.

The agent's trust on other agents/users (contained in their agents' contact list) is based on the ratings of the action plans having been executed by the user itself. It is computed as a mean of the ratings (evaluation) of the action plans the agent received from that other agent/user. The rating of an individual action plan is a mean of the ratings given by the user after executing the action plan gathered from up to the 5 last executions.

The trust value is so to say computed as a mean value of mean values.

The algorithm used with **trust search** consists in the following steps:

1. The agent searches a keyword in the local repository.
 - 1.1 If there are results in the local repository the agent checks that they are good enough for his user. By default, it checks if the mean rating of the action plan is greater than 3 of 5. As 5 correspond to 100% 3 would correspond to 60%.
 - 1.2 In the case the mean rating is larger than or equal to 3, the agent checks that the action profile is satisfied.
 - 1.2.1 If it is satisfied the Result is returned to the GUI. END
 - 1.2.2 Else go to step 2.
 - 1.3 Else go to step 2.
2. The agent searches the keyword in the access point. By default, the access point is trusted (there is no average rating for any action plan in the access point).
 - 2.1 If a result is found then it is returned to the GUI. END
 - 2.2 Else go to step 3.
3. The agent asks to the most trusted friends in the contact list (the list of friends).
 - 3.1 The most trusted friends are based on the trust-level in each friend user, see above.

- 3.2 The amount of friends that will be asked is specified by “Max number of direct friends to ask in trust search” see in Figure 2. The default value is 5.
- 3.3 To those friends who are on-line ACL Messages is sent and Email to the others.
- 3.4 It is also possible to select these users manually, enabling the option Select direct friends to ask manually, see Figure 2.
4. When the agents’ friends receive the agent’s question, they will search at their local repository.
 - 4.1 If there are results in their local repository those agents check that they are good enough for the asking agent. That is checking if the “mean rating of the action plan” is larger or equal to “Trust value of the asking user” minus “distance implication decrease”. The idea of this is that you care more about what quality you return if it is a trusted friend who asks. The *distance implication decrease* means that the nearer an answering agent is to the questioner, the more implicated will it be to provide with a good action plan. Concretely this value is $0.5 \times \text{“current distance”}$.
 - 4.1.1 If an AP in the answering user’s repository is found and it satisfies the “action plan profile” then it is returned to the asking agent (the one who did send the question) (Goes to step 5)
 - 4.1.2 Else the value “maximum degrees of separation” (this value is contained in the question message itself) is compared to the actual distance between the asking user and the present answering user is examined.
 - 4.1.2.1 If the actual value has reached “maximum degrees of separation” (Goes to step 5)
 - 4.1.2.2 Else the answering agent will forward the question to its most trusted friends. (Goes to step 4)
5. If an agent receives an answer, it sends it back to the asking agent and at the same time sends a stop message to the other friends to stop the search. The friends that receive a stop message will forward the stop message to their friends that received the question.
6. When the deadline is close, and if there hasn’t been at stop message as a sign there has been another answer, the agent will send any Action Plan even if the rating are low. This is an exception in the agents behaviour, as there is not much chance of getting better Action Plan believe” that having a “fair answer” is better than not having any at all.

III) Hybrid: This search combines the features of trust and profile search.

Concerning **behaviour, whether to send an Action Plan, CE)** the conditions are the same as in Trust search. In **selection of users to answer, DE)** hybrid search can be said to be a logical OR-condition. Both the users relevant for Profile and Trust search are supposed to give answers.

Diagram 1: Search Options

Italics : Optional + : extra function / : alternative

	Matching (AP filtering) BA)	Behavior (AP to send selection) CA)	Behavior (User to answer selection) DA)
Non agent based search (only local) AB)	<i>Key word matching</i>		
Profile search AC)	<i>Key word matching Actionplan Profile Preference</i>		<i>User profile preference (answerer check) DC)</i>
Local AD) Trust search External	<i>Key word matching Actionplan Profile Preference</i>	Rating > 3 CDx) Check rated AP > trust in asking user + (distance 0.5 reduction) CD) <i>Aggressive – Conservative effects</i> + (last minute, send all)	DD) Selection of users, best trusted + Degrees of separation / <i>Friends ask manually</i>
Hybrid AE)	<i>Key word matching Actionplan Profile Preference</i>	CE) Check rated AP > trust in asking user + (distance 0.5 reduction) + (last minute, send all)	<i>User profile preference (answerer check) together with DE)</i> Selection of users, best trusted + Degrees of separation / <i>Friends ask manually</i>

Weights and QoS settable for Actionplan Profile Preference & User profile preference in Advanced configuration.

Basic Configuration gives some predefined standard weights.

Degrees of separation & Number of friends can be set

Figure 1: Action Plans including Search Action Plans

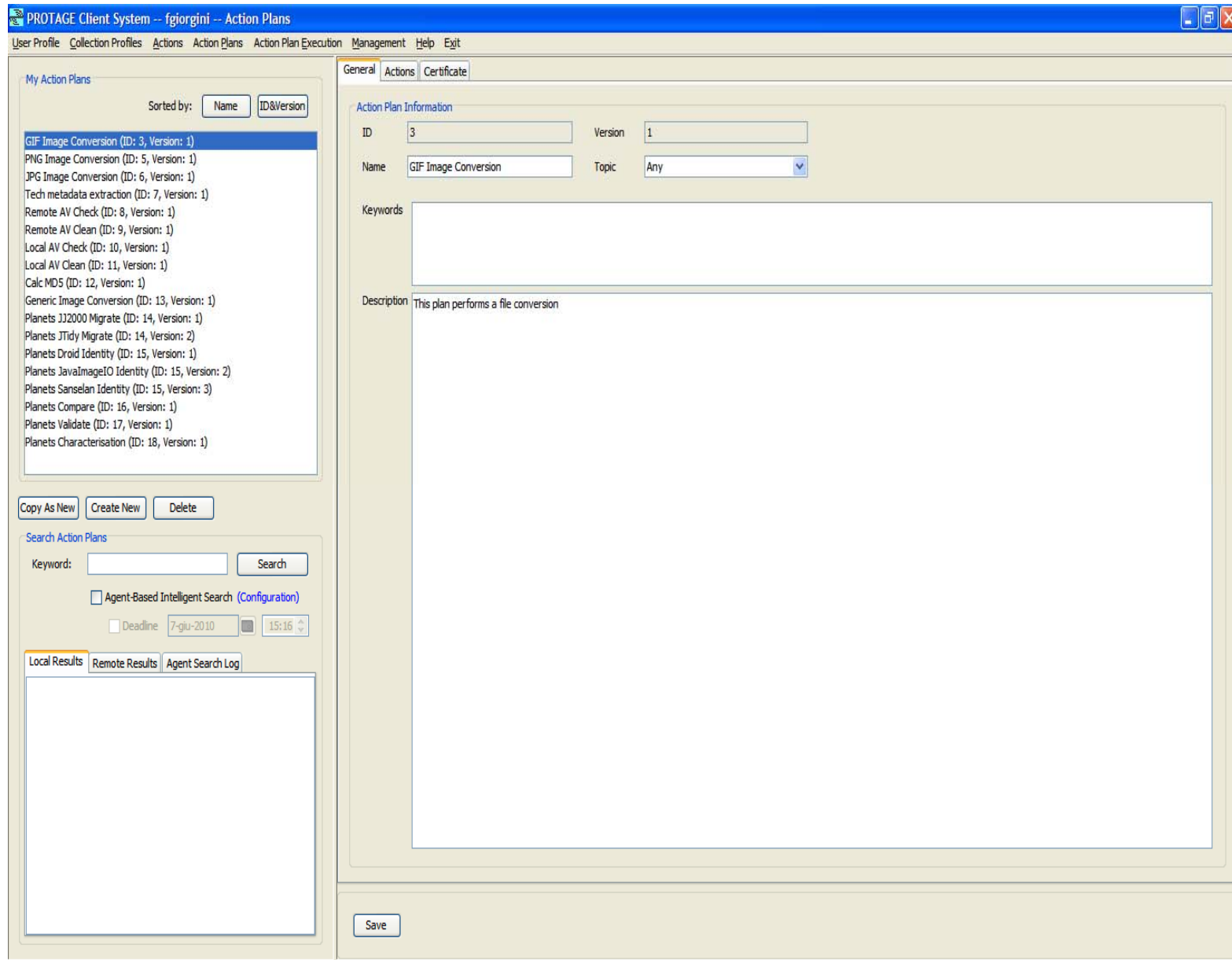


Figure 2: Agent Search Preferences

The screenshot shows a window titled "Agent Configuration" with two tabs: "Migration Support Agent" and "Searcher Agent". The "Searcher Agent" tab is active and contains three sub-tabs: "Agent Search Preferences", "Agent Search Basic Configuration", and "Agent Search Advanced Configuration". The "Agent Search Preferences" sub-tab is selected and contains the following settings:

Search type: Trust (dropdown) Basic configuration Advanced configuration

User Profile Preferences

User Type	Individual/Home User (dropdown)
Agency Name	Any (dropdown)
User Location	Spain (dropdown)
Collection Type	Audios (dropdown)
Data Type	Audio (dropdown)
Network Connection	>2Mbps DSL (dropdown)
Preferred Tools	Local tools (dropdown)
Operative System	Windows (dropdown)

Actionplan Profile Preferences

Author	(text input)
Collection	Any (dropdown)
Topic	Any (dropdown)
Subtopic	Any (dropdown)
Provider	(text input)
Tested	Any (dropdown)

Trust & Friends Preferences

Max number of direct friends to ask in trust search: 5 (spin box)

Select direct friends to ask manually

Buttons: Ok, Cancel

Figure 3: Agent Search Basic Configuration

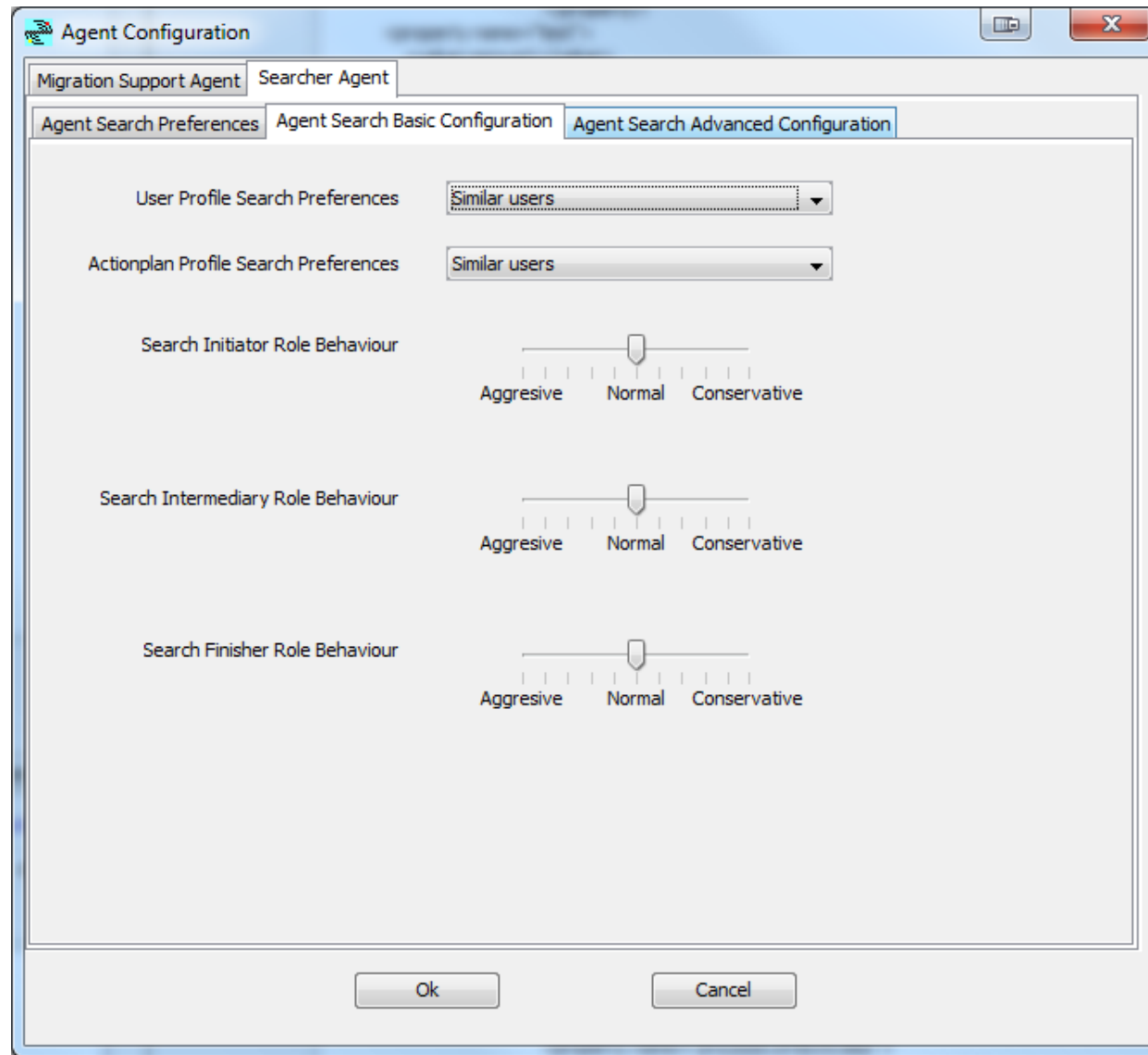


Figure 4: Agent Search Advanced Configuration

Agent Configuration

Migration Support Agent Searcher Agent

Agent Search Preferences Agent Search Basic Configuration Agent Search Advanced Configuration

User Profile Weights

User Type	0
Agency Name	0
User Location	0
Collection Type	0
Data Type	0
Network Connection	0
Preferred Tools	0
System Specifications	0

Actionplan Profile Weights

Author	0
Collection	0
Topic	0
Subtopic	0
Provider	0
Tested	0

Profile Search QoS: Good

Weights Trust/Profile: Trust bigger

Maximum Degrees of Separation: 2

Ok Cancel