

CRISTAL-ISE Project

Deliverable 6.3 : Initial CIMAG-RA Roadmap

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Introduction

The aim of this document is to specify the architecture of the solution developed in the CRISTAL-ISE project, and define the interchanges between the software CIMAG-RA, CRISTAL server and the solver server (Optaplanner). The document also explains the REST API used in the project and how it calls it. This document also specifies the work that has to be done to complete the CIMAG-RA software until the end of CRISTAL-ISE. The current version of the software can be considered to be a *beta* version.

CIMAG-RA Module

CIMAG-RA is a new module of CIMAG HR software its features and exact implementation was detailed previously in D2.2. Briefly, it deals with the allocation of human resources to specific tasks regarding properties such as :

- Skills requirement
- Shifts definition
- Contracts and legal aspects
- Time scales
- Working patterns
- Shift assignments

All these properties define a resource allocation problem to solve to provide with a schedule. It means that we have to be as exhaustive as possible to anticipate future customer's needs. Nevertheless, thanks to the CRISTAL-ISE kernel flexibility, we can easily extend the domain definition. The Application domain properties are Items which are defined in CRISTAL-ISE.

Initially, these properties are extracted from a local SQL database and then mapped to the problem and solutions as Items in CRISTAL-ISE, finally we decided that the properties to map the problem will be extracted at the client and will be sent to the CRISTAL-ISE Server via the REST interface, to create the problem.

Next, the initial problem Item is sent to the solver to compute a solution. Following an iterative process the generated solution Item becomes a new problem Item and is computed again to provide with a better solution. In detail, using a tabu search algorithm, a solution (planning) is built and then sent to a rule engine (DROOLS) to compute the score of the proposed solution. The process run until a satisfying solution is provided to the final user. Figure 1 illustrates the solving process.

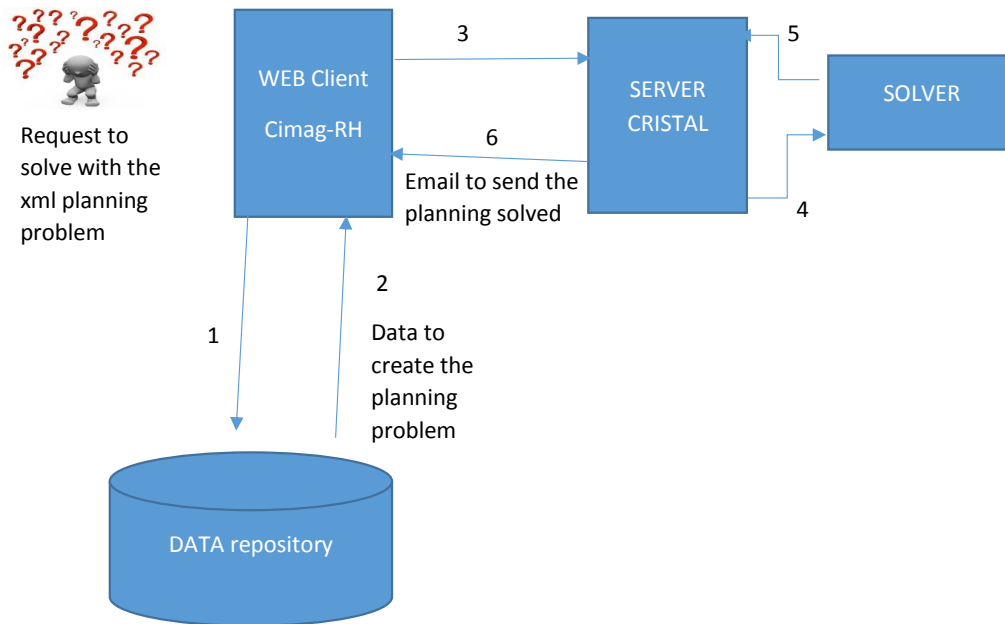


Figure 1 : Architecture of the solving process

The solution is built on the integration of CIMAG HR solution, CRISTAL-ISE and Optaplanner.

- CIMAG HR is an existing solution from A3I. This solution is dedicated to human resource management, with other features such as :
 - o Time and attendance management
 - o Day off requests management
- CIMAG RA is a new module of A3I. It is dedicated to resource allocation management and mainly deals with a solver and rule engine.
- OPTAPLANNER is mathematical optimization software. It solves constraint satisfaction problems with construction heuristic and metaheuristic algorithms. It is a open source solution.

The advantage of this solution, is to send the path of the XML if the solver could access to the file, or to use a POST request to send the XML, in order to create the planning problem. According to the resolving complexity (minutes or hours), a mail will sent to the administrator to state that the planning is solved, there is also an option to send the XML file with the solved planning or the path of the file.

CIMAG-HR	CRISTAL SERVER REST	SERVER (OPTAPLANNER) SOLVER
Launch personal data from the local database		
Send a request to create the planning problem		
	Send a request to create the solver and the planning problem	
		Create the planning problem and the solver
		Calculate the solution
		Send a Request to advice the solution is ready
	Send an email to state that the planning is ready	
Launch the planning solution on the GUI		

Figure 2 : Exchange between CIMAG-HR, CRISTAL-ISE and OPTAPLANNER

At the beginning, the user launches a process which queries the data which are stored in SQL database, this SQL database is used to store the human resources information. These business data are extracted and mapped to create the problem planning. When the problem is created, the user sends the XML planning problem with a REST API to the REST server of CRISTAL-ISE, the problem is stored on the server. Next, the CRISTAL-ISE kernel sends a request, via a REST API to the solver, to start the beginning of the resolution, once a solution is ready on the solver, the solver tells the CRISTAL-ISE Server that a solution has been found. To finish, the CRISTAL-ISE server sends an email to advice that the planning is ready, more, the XML file could be sent in the email, the user should launch the planning solution on the GUI, to decide if the solution is satisfactory, if not, the user could redo the solution.

CRISTAL-ISE Rest Methods

Representational State Transfer (REST) is a software architecture style consisting of guidelines and best practices for creating scalable web services. REST is a coordinated set of constraints applied to the design of components in a distributed hypermedia system that can lead to a more performant and maintainable architecture.

The REST service is designed to be extensible, so domains may implement their own specific extensions. The low level Kernel methods are therefore mapped to two contexts, so that domains may register additional ones.

CRISTAL-ISE Methods used

VERB	METHOD	PARAMETER	DESCRIPTION	RESULT
GET	createsolver	planningproblem (type String)	This function sends a request to the solver to create the planning problem with a cast of XML planning problem to a Java String	The path of the XML file which is stored
GET	createsolver	pathplanningproblem (type String)	This function sends a request to the solver to create the planning problem with the path of the XMLfile of planning problem	The path of the XML file which is stored
GET	planningsolved	pathplanningsolved (type String)	This function sends a mail to a user to state that the planning is solved	The path of the XML file which is stored

CIMAG-RA Methods Used

VERB	METHOD	PARAMETER	DESCRIPTION
GET	LoadPlanning	pathplanning (type String)	The function creates the planning problem with the XML file, and launches the solver to resolve the planning

Solving phases

Planning before Solver

Button to Start the solving

PLANNING COLLECTIF

Population 0000-TOTALITE

16/11/2015 22/11/2015

7 14 31 1

Compteur affiché Sans affichage compteur 0

	Lun. 16/11	Mar. 17/11	Mer. 18/11	Jeu. 19/11	Ven. 20/11	Sam. 21/11	Dim. 22/11
BAYEUX JACQUES	HP	HP	HP	HP	HP	HP	HP
BOR SYLVIE	HP	HP	HP	HP	HP	HP	HP
CAREL JEROME	HP	HP	HP	HP	HP	HP	HP
CHOR EVELYNE	HP	HP	HP	HP	HP	HP	HP
CIMES LOUIS	HP	HP	HP	HP	HP	HP	HP
DUSE ANNE	HP	HP	HP	HP	HP	HP	HP
FLAT FABRICE	HP	HP	HP	HP	HP	HP	HP
KHEL MARCEL	HP	HP	HP	HP	HP	HP	HP
YIR AUDREY	HP	HP	HP	HP	HP	HP	HP
YAMAN GILLES	HP	HP	HP	HP	HP	HP	HP
Total Général	0	0	0	0	0	0	0

PLANNING COLLECTIF

Population 0000-TOTALITE

16/11/2015 22/11/2015

7 14 31 1

Compteur affiché Sans affichage compteur 0

	Lun. 16/11	Mar. 17/11	Mer. 18/11	Jeu. 19/11	Ven. 20/11	Sam. 21/11	Dim. 22/11
BAYEUX JACQUES	HP	HP	HP	HP	HP	HP	HP
BOR SYLVIE	HP	HP	HP	HP	HP	HP	HP
CAREL JEROME	HP	HP	HP	HP	HP	HP	HP
CHOR EVELYNE	HP	HP	HP	HP	HP	HP	HP
CIMES LOUIS	HP	HP	HP	HP	HP	HP	HP
DUSE ANNE	HP	HP	HP	HP	HP	HP	HP
FLAT FABRICE	HP	HP	HP	HP	HP	HP	HP
KHEL MARCEL	HP	HP	HP	HP	HP	HP	HP
YIR AUDREY	HP	HP	HP	HP	HP	HP	HP
YAMAN GILLES	HP	HP	HP	HP	HP	HP	HP
Total Général	0	0	0	0	0	0	0

Loading...

Planning after Solver

Possibility to choose the planning view week to month

PLANNING COLLECTIF

Population 0000-TOTALITE

16/11/2015 22/11/2015

7 14 31 1

Compteur affiché Sans affichage compteur 0

	Lun. 16/11	Mar. 17/11	Mer. 18/11	Jeu. 19/11	Ven. 20/11	Sam. 21/11	Dim. 22/11														
BAYEUX JACQUES	RH	RH	22:30-06:30	08:30-12:00	12:30-16:30	RH	RH														
BOR SYLVIE	14:30-22:30	08:30-12:00	12:30-16:30	RH	14:30-22:30	08:30-14:30	08:30-14:30														
CAREL JEROME	RH	14:30-22:30	RH	14:30-22:30	14:30-22:30	RH	14:30-22:30														
CHOR EVELYNE	RH	RH	08:30-12:00	12:30-16:30	RH	14:30-22:30	RH														
CIMES LOUIS	RH	RH	RH	RH	08:30-12:00	12:30-16:30	RH														
DUSE ANNE	08:30-12:00	12:30-16:30	22:30-06:30	RH	14:30-22:30	RH	14:30-22:30														
FLAT FABRICE	RH	RH	14:30-22:30	08:30-14:30	RH	RH	08:30-12:00	12:30-16:30													
KHEL MARCEL	RH	RH	08:30-14:30	08:30-14:30	RH	22:30-06:30	08:30-12:00	12:30-16:30													
YIR AUDREY	08:30-14:30	08:30-14:30	14:30-22:30	RH	RH	14:30-22:30	22:30-06:30														
YAMAN GILLES	RH	RH	08:30-14:30	08:30-14:30	08:30-14:30	08:30-14:30	08:30-14:30														
Total Général	2	2	1	2	2	1	3	3	1	4	3	0	3	3	1	3	3	1	3	3	1

Overlooking one week

PLANNING COLLECTIF

Couleurs 01/11/2015 30/11/2015 7 14 31 1 ? ↶ ↷

Population 0000-TOTALITE Anomalies Affectation Totaux Compteur affiché Sans affichage compteur 0

	Dim.	Lun.	Mar.	Mer.	Jeu.	Ven.	Sam.	Dim.	Lun.	Mar.	Mer.	Jeu.	Ven.	Sam.	Dim.	Lun.	Mar.	Mer.	Jeu.	Ven.	Sam.	Dim.	Lun.
	01/11	02/11	03/11	04/11	05/11	06/11	07/11	08/11	09/11	10/11	11/11	12/11	13/11	14/11	15/11	16/11	17/11	18/11	19/11	20/11	21/11	22/11	23/11
BAYEUX JACQUES	M		RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH
BOR SYLVIE	M		RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH
CAREL JEROME	M		RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH
CHOR EVELYNE	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH
CIMES LOUIS	M		RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH
DUSE ANNE	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH
FLAT FABRICE	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH
KHEL MARCEL	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH
VIR AUDREY	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH
YAMAN GILLES	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH	RH
Total Général	3	3	1	2	2	1	1	3	1	3	1	3	1	3	1	3	1	3	1	3	1	3	1

Overlooking one month

Conclusion

Comment [JS1]: Time to market ?!

The next step of the integration process is the development of a commercial software, we need :

TASK	DEADLINE
To have the possibility to create multiple planning	End of January 2016
To have the possibility to store the different planning	February 2016
To choose the complexity of the solver resolution	February 2016
To create a specific and friendly user interface to create the drools file	March 2016