Virtual Planning Room - Analytical Mine Planning Work, Based on Tools Integration and a Robust Cloud Information System

Alejandro Ehrenfeld*, Sergio López[2], Nelson Morales[1], Javier Testart[2]

1. *Advanced Mining Technology Center-Universidad de Chile*
2. *ProactiveOffice, Chile.*

ABSTRACT

Mine planning teams receive input information from various areas such as finance, maintenance, operations and plants. Depending on the company flows, this information is more, or less standardized and the update periodicities varies too; availability, cycle times, maintenance, geotechnics, production requirements and other inputs get planning area in different formats and grades of validation accuracy. Moreover, plans delivery times (five-year, bi-annual and monthly) are strict and besides they are the input of various management and operational areas, which require different levels of detail.

As a result of this, the time for analysis, evaluation of multiple scenarios and to test work methodologies, to make continuous mine planning process improvement is scarce. Indeed, important part of the time is spent on obtaining and validating data and not to the analysis of different scenarios probabilities.

In order to address these difficulties, we propose a tool to make available for planning groups organized, useful and pre-processed information and a system to manage work methodologies, which connects to different current software solutions and centralizes the information in the cloud.

The objective of this project is then to produce an improved and integrated management of all aspects in mine planning work, on large mine sites, to let that planning teams can spend their time analysing different runs and adding value to the plan.

Development work is organized in a collaborative manner in which ProactiveOffice.com provides a mature cloud system infrastructure to support the Virtual Planning Room, which integrates information system, Delphos mine planning tools and other commercial stablished tools.

INTRODUCTION

With government funding from CORFO, Delphos Laboratory [1] and ProactiveOffice [2] have spent last years developing what we have called the Virtual Planning Room. This idea is based on previous deep research about how mine planners work at big copper mining companies in Chile. Through last seven years Delphos Mine Planning Lab has being involved in the development of new and state of the art tools that solves different mine planning problems. As part of this work, researchers have been in contact with several mine planners and receive lots of feedback about how they work and which are the problems they have.

Starting with a first stage of CORFO fund called Line 1, we spent six months interviewing mine planners at different operations. In a Focus Group manner three Delphos Lab researchers asked about different topics to groups formed by Superintendents, Engineers and Technicians. The same way we did a couple of deep interviews with Managers. Topics were about use of technology, use of different software tools, input information used to make mine plans, methodologies about making those plans, common problems and more.

In a second stage, which is actually running yet, funded by Line 2 of CORFO, we are building a platform that will solve most important set of issues that were detected at first stage. Those are information organization issue, mine planning methodology flexibility issues, multiple application combination issues and lack of time for analysis issues.

This design and development process has been carried on in association with ProactiveOffice, a well stablished and successful software factory, that has taken advantage of their PPM - Project & Portfolio Management Software ProactiveOffice.com core to implement part of the Virtual Planning Room. This paper is to tell about philosophy behind this design and development, considering both the prototype stage, which is already finishing and the dream about what will be finally, with client incorporation in the process, the commercial application we intend to produce.

METHODOLOGY

The Virtual Planning Room it is developed as a robust information system combined with a methodology manager, which integrates different applications or utilities used in a mine plan construction. In a first prototype those mine planning tools are provided almost all through Doppler, the Delphos Open Pit Planner. The platform has been developed in a team manner by people in ProactiveOffice mainly and in Delphos Lab too.

Design

The system was designed considering ProactiveOffice software basic modules as core and there has been several further developments. Most important of them is an Application Programming Interface - API that allows to connect to core modules from two main client applications. First one is called VPR Client, which is a local computer software module, which is constantly synchronizing

the mine planning application project folder. Second one is a Web interface that shows contents of information system and gives visualization of different graphics, over historical and block model variables. Of them one of the most useful is a graphical Time Line where all actions of all users are registered along time.

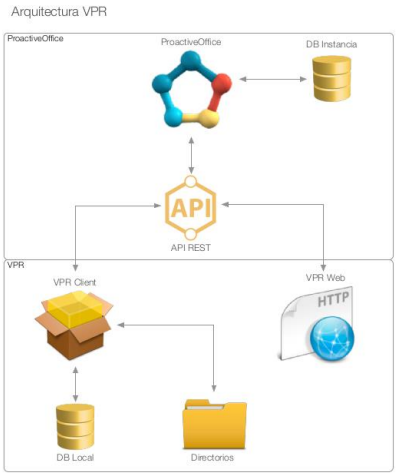

Figure 1: VPR architecture design was selected in order to integrate to any software data that is used on the mine planning process.

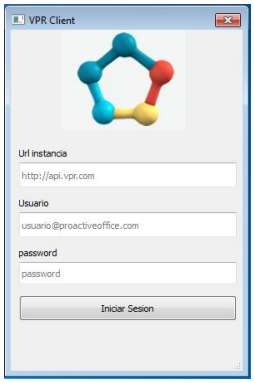

Figure 2: VPR client prototype wich is used to run on client computer in order to synchronize files and planner information while it run in background on the user laptop. VPR client uses the configuration already made on the web for privacy and planner program that is going to be used.

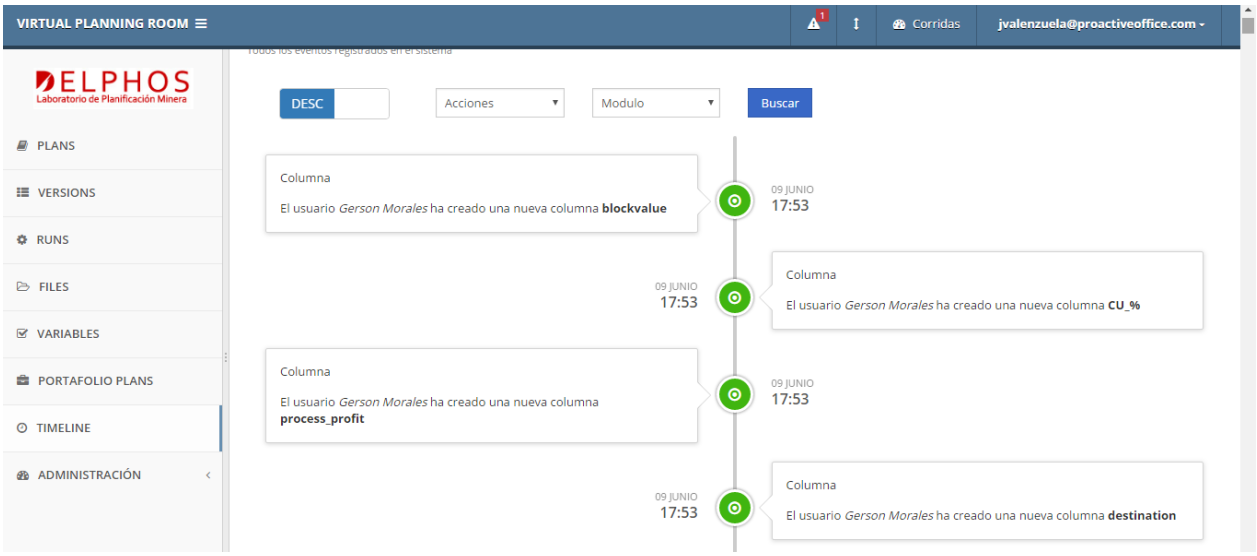

Figure 3: Timeline functionality that makes tracking to any change on the data use for one "run". The system even allows to track any change on columns on the block model. This is abled thought the implementation of a driver library that informs to the system how the data should be interpreted on the planner software (i.e.: Whittle, Doppler).

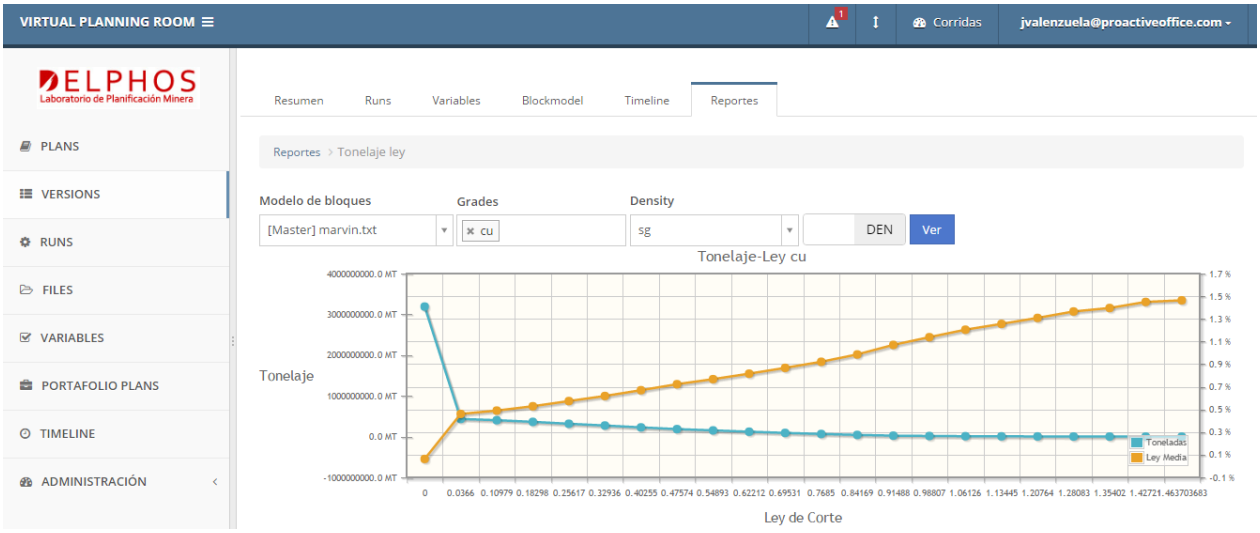

Figure 4: Visualization of a Ton-Ore curve on a test block model. The system allows to easily visualize the data on the system for any ore types included in a block model.

The mentioned robust information system to support the mine planners work and analysis capacity resides in a Cloud. A data model has been designed to support block models and other different mine planning process input and output files.

Methodology manager allows to design different ways to elaborate a mine plan. Conceptually this utility allows to use Virtual Planning Room to incorporate multiple scenario analysis, sensibility

analysis or simply to be able to change a specific line of work, for example, in long term planning, incorporating a new stage, like applying other sequencing algorithm, to compare with a previous one, without having to invest time in configuration issues.

PROTOTYPE

As line 2 from CORFO funding gives a two-year period to deliver a pre competitive prototype, researchers and development team decided to implement core modules to fulfil the requirements of an open pit long term plan, from nested pits calculation to production plan, with different sequencing options, including worst, best and intermediate cases.

As Virtual Planning Room platform pretends to be able to be integrated or to partially control or at least to be synchronized with project folders of several mine planning applications, this first prototype is being implemented as fully integrated with long term open pit mine planning tools developed by Delphos Lab. At the same time a very complete study of a group of commercial applications potential of being remotely controlled and their project folders characteristics has been carried on, including very well known Whittle [3] application.

The prototype has the complete set of modules implemented to have long term mine plans, with all their inputs and outputs registered in the cloud repository and all the actions done as part of the Time Line register.

DATA MODEL

The Virtual Planning Room data model considers three categories; first and most abstract one is the Plan, the second is the Version, and the third is the Run. Plan is for example a Life of Mine type of plan, which defines few high level characteristics of it. Then the Version is for example the 2016 LOA in which a work group is working right now; here we have a base block model and other parameters defined. The Run is all set of actions and software utilities used for one experiment or plan generation. There we have a set of inputs, a group of software utilities and a sequence of actions, coming from the methodology manager that defines the experiment or Run. One of those Runs along the work process will be the Release, or the result of the Version.

Doppler for VPR

As said before for prototype the only application that will be synchronized with VPR is Doppler. The Delphos Open Pit Planner is a software utility that makes use of several open pit mine planning tools developed at Delphos Lab that are together in a library called MineLink [4]. For VPR, Delphos Lab developers have created a special version of Doppler that communicates with VPR Client, giving information about user actions that allows a better synchronization. For this version a new development has been carried on to generate an intermediate case for production plan sequence, based on the UDESS [5] tool, a Delphos general tasks sequencer, originally developed to integrate mine construction and production planning in underground mining.

RESULTS AND DISCUSSION

Virtual Planning Room it is a mature concept, reaching at it is first stable prototype. Next stage is to do a case study. The system is designed to be sold in a consultancy manner. It means that the case study will bring the opportunity to modify and to develop new modules that accomplish client needs.

The platform is thought to adapt itself to different work methodologies, files formats, applications and ways for use them. The ability to generate different runs of a process, as a production plan based in a set of parameters, can be an opportunity to evaluate different scenarios in a direct and fast way. The advantages to have registered in a cloud all Runs on a Plan Version are that planners can visualize diverse graphics over historical variables, as cost, price or grade. This allows a more analytical planning process.

As ProactiveOffice is a mature, commercial and very stable software, those modules that Virtual Planning Room has inherited from it, make it possible to have a very robust platform, with Cloud performance and all basic user access and visualization capacities included.

Modules that have been produced for this platform are result of very deep collaboration between Delphos Lab developers and ProactiveOffice teams. The professionalism and state of the art concepts applied are the base of a very modular tool, that is capable to provide means for several desired analysis loops in mine planning, that are not done today, due to lack of time and results driven processes.

Level of integration of Doppler with the platform is very complete, this is a very interesting result in terms of technology transference; it means that tools developed at University of Chile are being transferred to industry using a very robust and proved cloud software technology.

CONCLUSION

With steps done through this R&D process Delphos Laboratory and ProactiveOffice are delivering first cloud based integrated environment for mine planning. This is a fundamental to allow the incorporation of scenario analysis, variability and uncertainty analysis and flexible work methodology to mine planning standard activity. The Virtual Planning Room will grow to be a very complete platform that will manage all mine planning information in a very organized way and will interact with a big set of mine planning tools. Besides, as cloud system it will connected with all mine sources of information directly, so actual lines of communications among different areas of big mining operations that feeds mine planning activity will be more integrated and automatized.

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