ViCA - A WWW based tool for visualizing project status

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Abstract

Easy-to-access and up-to-date project status feedback is an important aspect of effective project management. When project data is collected, a common problem is how to present the data in an understandable form to the right people at the right time. The Visualization Client Applet (ViCA) is a Java-based client program. It is designed for Internet-based visualizations and is currently piloted in several high-tech companies.

ViCA can be used even in a geographically distributed multi-project environment. The user is presented with a personalized up-to-date view of the project in which he is involved. The view is a fully configurable panel, which provides fast feedback of the project status. It can contain any number of metrics; each visualized by one or more charts. The user can navigate to a new panel by clicking a part of the chart.

This paper discusses the benefits of ViCA, as applied in several product development organizations.

1   Background

The LUCOS Project is a research project at the TAI Research Centre at the Helsinki University of Technology. The goals of the LUCOS project are to develop a method for improving the controllability of product development, as well as tools supporting the method. The LUCOS Method [6] is used for specifying goals and metrics for companies. The LUCOS Partners are five high-tech companies, three of them are presented here as pilot cases: Oy L M Ericsson Ab in Finland, Ericsson Telecomunicazioni S.p.A in Rome, Italy, and CompuPro, a small software company in Finland.

When project data is collected, a common problem is how to present the data in an understandable form to the right people at the right time. This paper presents one tool from a tool framework that is designed to help with this problem.

This paper is structured the following way: Chapter 2 discusses the architecture of the LUCOS Tool Framework a part of which the Visualization Client Applet (ViCA) is. Chapter 3 describes the most interesting features of ViCA. Chapter 4 discusses the visualization libraries in general and for project status measurement. Chapter 5 discusses the collection of data for metrics in general. Chapters 6 and 7 contain the company cases and chapter 8 the conclusions and future work.

2   The LUCOS Tool Framework

The LUCOS Tool Framework is presented in Figure 1. The tools are connected via Internet using an HTTP/1.0 based protocol [1]. External Data Modules (EDAM) are data converters that replicate necessary data to the Metrics Server (MESS). EDAMs are company specific programs that fetch data from the company's data sources using methods that are appropriate to the data source used. All client applications, including ViCA, use the database through MESS. The Method Tool (MeTo) is a client application that supports applying the LUCOS Method. MeTo enables the connection from the tools to the LUCOS Method for deploying relevant metrics linked to appropriate goals. When used, it enables e.g. that the user can jump to a section in the Control Plan [6] from a selected chart in a ViCA Panel. This tool is currently under development. In ViCA, one metric can be presented by one or more charts.

The architecture and server protocol are open: new clients can be added if there becomes a need for a special tool.
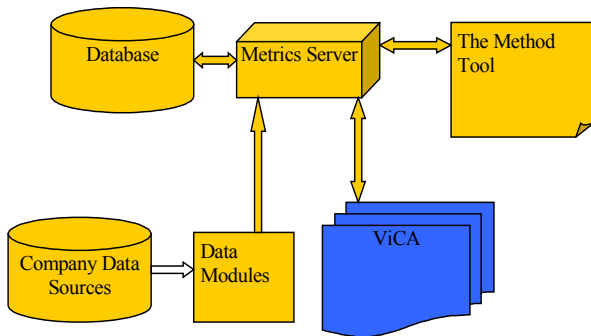
Figure 1: The LUCOS tool framework

3   ViCA

WWW based tools have clear benefits when compared to the non-WWW tools. They typically do not need any installation and they can be accessed everywhere which is especially important, when the tool is used for information sharing, as ViCA is.

ViCA is a Java program that works with WWW-browsers. Java [8] is a programming language that can be used for running programs with modern WWW-browsers. Java programs are as easy-to-access as any WWW-page. Using Java programs in a WWW-browser has a clear advantage: Java programs work in any platform that has a Java enabled browser, like Microsoft Internet Explorer versions from 4 and above and Netscape Communicator version 4.51 and above.

ViCA contains the functionality needed for working with the panels and charts and is a graphical user interface (GUI) client to MESS. ViCA is based on an idea of a project control panel [2] that could be like the control panel of an airplane or a car. From the project control panel project workers can immediately see feedback of the project status and make correct actions to keep the project on the right track. Users can have either own specific panels or use a common panel designed for their project. That way the right people have the right information. Although ViCA is developed as a tool to support the LUCOS Method, it also works as a general-purpose visualization tool together with MESS.

ViCA can be used for both viewing and creating the control panels. When ViCA is started, it opens either an empty panel or a default panel that is specified in a parameter value of the WWW-page that starts ViCA.

Panels may contain several *charts*, *buttons* and *images*. Charts are components that show a visualization of the data fetched from MESS. Buttons may be used for navigation to other panels or URLs, and images are static components used for decorating the panel with e.g. a company logo. Figure 2 presents an example of a panel containing six charts.

ViCA currently supports 14 different chart types such as line charts, Gantt charts, pie charts, and bar charts and some of their combinations. Parameterized navigation is possible from a chart to a panel so that the mouse click passes the value of the clicked part of the chart (e.g. bar label) to the target panel. In that way, the panels can be reused in other navigations too.

3.1   Users

Since ViCA is a tool for many different kinds of users with varying skills and work profiles, it has to be both easy to use and yet effective. To achieve this we have identified three possible user groups, which we call *the everyday users*, *the power users* and *the administrators*. The everyday users typically only check their default panels, use navigation and maybe open a specific panel. The power users may also want to modify the existing panels and create new ones from the existing charts. The administrators have to understand SQL in order to tell ViCA where the actual data is fetched. They also need to know which database fields go to the x-axis and which to the y-axis of a chart. The administrators create pre-defined charts for the power users.

3.2   Usability

We have made a usability test with potential users from different user groups in the Usability Laboratory at the Helsinki University of Technology. The test showed many problems in the user interface. These problems have been now taken into account in the current version of ViCA. One of the problems was inadequate tips and feedback from the user actions. So we decided to employ some commonly used techniques to overcome it.
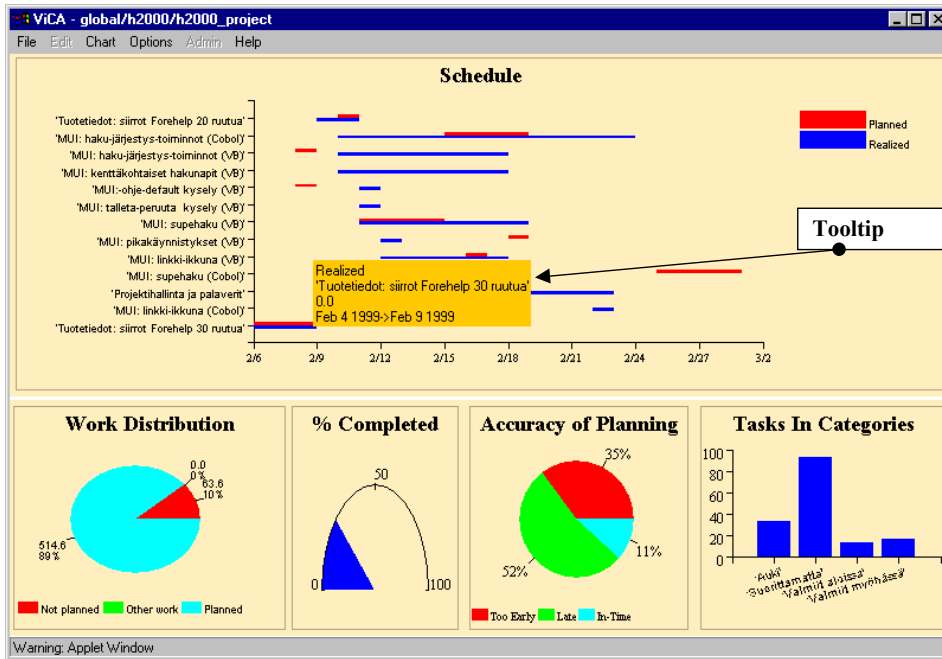
Figure 2: An example of a Panel

ViCA gives visual information when the user moves the mouse over the chart. ToolTips (See the small window in Figure 2) appear on top of the data item and the cursor changes to a hand icon when the navigation is possible. If there is a big amount of data in a chart, it can be made scrollable in both horizontal and vertical directions: a scrollbar appears when the mouse is moved near the edges of a scrollable chart.

3.3 Security

All panels, charts and database tables contain security information so that access to sensitive panels can be restricted only to people that have correct access rights. The Access Rights system has similarities to the one used in Unix computer file systems. Users and subgroups can form groups. All entities of ViCA can contain one *read group, write group* and *admin group.* A read group specifies the group whose members can only read the entity. The write group members can read and write the entity and the admin group can, in addition to reading and writing, also administrate (i.e. change the properties) of the entity. Every user has a user name and password and sees only the entities to which he has at least read rights.
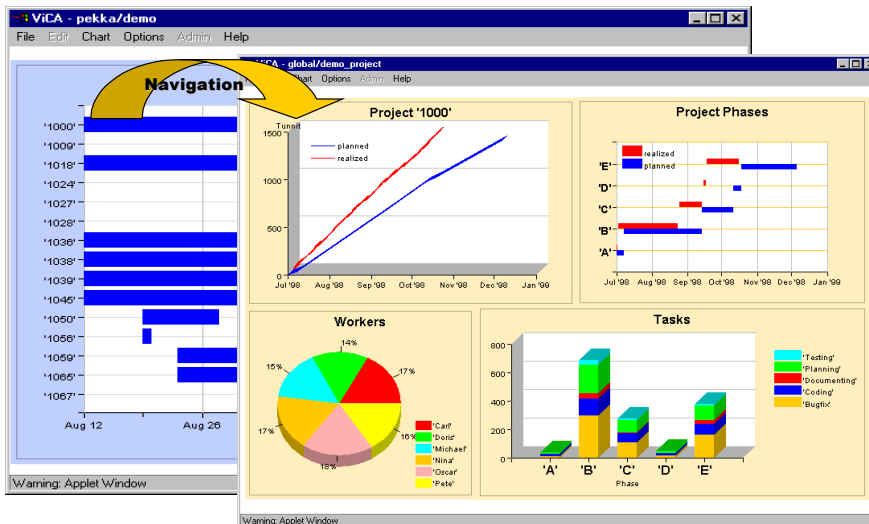

Figure 3: Navigation from a chart to a panel

3.4 Navigation

Navigation can be enabled from a Chart or a Button to any Panel. When navigation is enabled, a new panel will be opened by mouse clicking on the object (Figure 3).

In addition the target panel can be parameterized by variables like the pie chart's clicked slice, so clicking a different slice causes the same target panel to open, but its data is specific to the clicked item. In other words if you, for instance, click on a slice of a pie chart, you can go into the details of the data represented by the slice on the target panel.

3.5 Printing

Charts can be printed or copied to the clipboard by converting them first to GIF format with ViCA. Each chart is then shown as a picture in a new browser window

3.6 Managing visualizations

A chart needs an SQL query that fetches the data from MESS. The SQL query's result is then distributed into the chart's x- and y-axis. To help the writing of a SQL query ViCA has a SQL Editor that lets the queries be debugged. Charts and panels, like other entities, are stored in MESS's database. The user interface to the charts and panels looks like a normal file dialog with directories

New panels are created by selecting appropriate charts from an archive of previously created charts. In the panel, charts are references to the actual definitions, but visual attributes can be overridden, like size, location and colors. This makes possible to use one chart in many panels simply by loading an existing chart.

The Panel can also contain pictures in GIF or JPEG format for decorating purposes, e.g. a company logo. Button components can be used to navigate directly into a specific panel.

The Panel becomes available to other users when it is saved, depending on the access rights specified to it.

3.7 Event Logging

In order to collect some data about the usage of ViCA in companies we have added an event logging system into ViCA. That way we can have data, which we could analyze in order to find out e.g. the place where the users make most of the errors. Event logging is also useful for the companies: they can analyze how often their panels are used and how long time users spend looking them.

4 The visualization libraries

We define the visualization library as a collection of predefined charts for the same type of visualization needs. We have currently built one library for project status measurement. This library contains charts like cost variance with the curves of BCWP (Budgeted Cost of Work Performed), ACWP (Actual Cost of Work Performed), BCWS (Budgeted Cost of Work Scheduled) [5], Project Schedule, etc. commonly used project data visualizations.
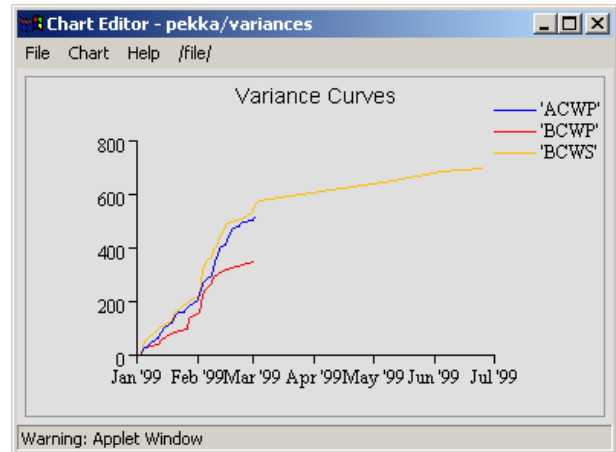

Figure 4: The Variance Curves Chart

The user adds instances of the charts from the visualization library with the help of a wizard. The wizard will ask the necessary information and options systematically from the user, finally showing a preview of the chart before it is added to the ViCA. This way user does not have to understand SQL; the wizard will generate the SQL Statement based on user selections for data retrieval.

The visualization libraries use a virtual table interface that are called database views that can be built into database systems. The built database views are SQL statements that convert the "raw" data in the Lucos server database into the "standard" form that visualization libraries use. The views must generated before a company can use the visualization libraries. We provide the necessary information and tools (View Wizard) to do this. Once the views are completed, they can be reused later with other visualization libraries.

Using this technique, we can easily provide more visualization libraries for different purposes.

5 Collecting the project data

The problem of what data to collect and why is beyond the scope of this paper; it is discussed in the LUCOS Method [6]. The data collection is here discussed from the structural point of view.

The project data is usually gathered from many sources like everyday applications and various databases. In order to utilize the data up-to-date, the necessary part of data must be transferred to MESS on a timely basis. Usually the solution for gathering the data from company databases is writing an EDAM for each data source. Since the data sources are very specific to companies, it is not possible to write a general program that would do all of the data collecting automatically. To help the writing of an EDAM we provide a C language library that contains functions that encapsulate the LUCOS Server protocol commands into simple function calls.

We are also developing helpful application specific data transfer programs for some common everyday applications like MS Excel and MS Project. In addition, a general-purpose Comma Separated Values -formatted (CSV) file transfer program has been developed.

6   The CompuPro case

CompuPro's main business is developing and maintaining a tailored software product. They have over 200 customers. CompuPro has collected data from their activities for years. They visualized their data earlier in MS Excel. The visualization was not working very well because the data was in many files in many places inside the company and the transferring to MS Excel had to be made by hand each time the data was changed. This lead to old data and the feedback came too late. Visualizations were mainly used to learn from the past; they could not be used for project status visualization on a daily basis. This meant also that visualizations could not be used for increasing controllability.

After the EDAMs, that collect the data from the data sources to MESS were made, CompuPro created their first visualizations in ViCA. Figure 5 shows the how LUCOS Tools are used in CompuPro. Note that they are using a CSV converter and EMIX (a data transfer program that works inside Excel) provided with LUCOS Tools to transfer data from their everyday applications. The APK Database contains the data, which is collected when serving customers.

Figure 2 shows one of their current visualization panels. It contains a Gantt Chart, which shows the planned tasks against the realized schedule. It also shows the work distribution in a Pie Chart, percentage of the work completed in a Speedo(=Needle) chart and the accuracy of planning, and finally the number of tasks in different categories. This panel also contains navigation; the user can click on a task in a Gantt chart and a new panel appears. This new panel contains the amount of work hours done per resource and the amount of effort left for the selected task.

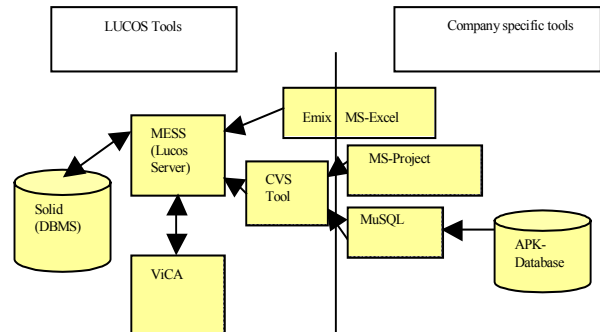In the future, CompuPro will also connect financial data to MESS.

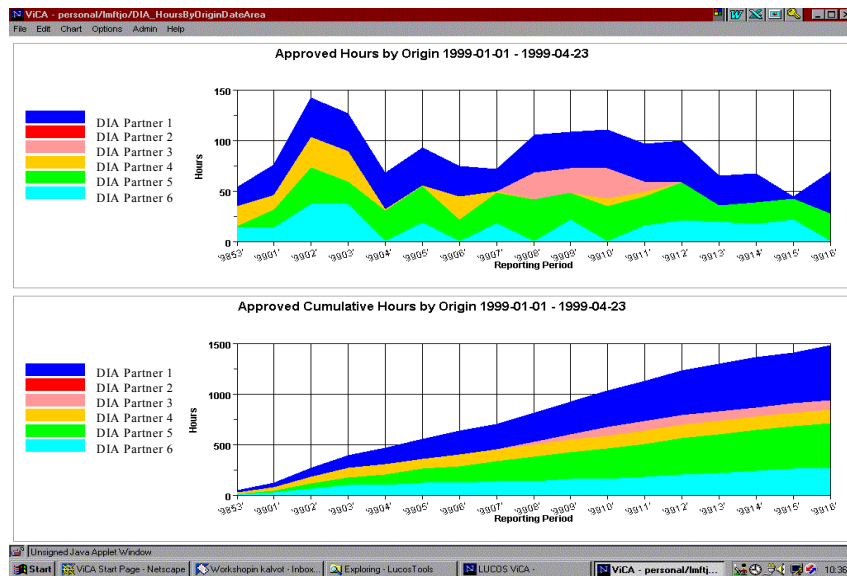

Figure 5: The CompuPro Architecture

Figure 6: The distribution of working hours in a project at Ericsson R&D, Finland

7   The Ericsson case

Ericsson has a long history of collecting and measuring data in their NPD. They were looking for methods and tools to help in utilizing the collected data.

ViCA is being piloted in the R&D divisions of two local design centers within the Ericsson Corporation - Oy L M Ericsson Ab in Finland and Ericsson Telecomunicazioni S.p.A in Rome, Italy. Both have a staff of about 600 people.

The status today is that they have two full time LUCOS resources and leadership commitment to continue this pilot. In Finland the LUCOS Method and tools are used for tracking the Key Performance Indicators of NPD (Balanced Scorecard [4]). One unit, the Mobile Switching Systems and one of its large NPD projects from the GSM field is selected for piloting the LUCOS Tools. One of the goals of this pilot is to establish a connection between different organizational levels and to bring the NPD strategy down to individual projects. ViCA is used as a tool to concretize these connections.

The manager of the DIA-research project uses the visualization presented in Figure 6 for tracking the distribution of working hours between the organizations that are participants in the DIA project. Because there are many participants from different organizations that have their own cost management, it is important for the manager to know the distribution. The upper chart shows the distribution of working hours on a weekly basis and the lower chart is showing the cumulative sum.

In Italy, the LUCOS Tools are used in the portfolio management [3] of NPD projects. The individual projects should be connected to it this summer when ViCA will be used also in tracking the progress of individual projects. They need to increase the visibility of their projects to satisfy CMM [7] level four.

In the near future, the goal is to make LUCOS Tools the official tools of the whole Ericsson organization. The goal is also to make the LUCOS Tools the best-practice measurement technology and furthermore the tools could then have their own help desk system which is needed if ViCA is used widely inside the Ericsson corporation.

Ericsson has many databases in different formats and in different countries. In Ericsson Finland, they did not use EDAMs to transfer data into the LUCOS Server. Instead, they used a proxy database solution shown in Figure 7.
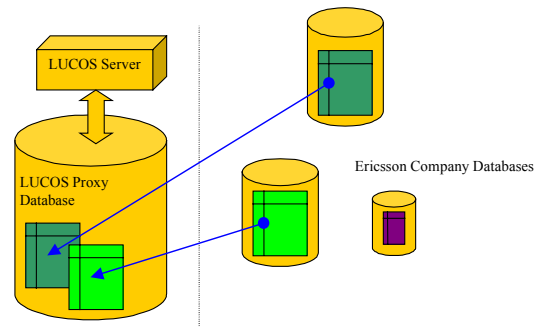

Figure 7: Ericsson's proxy database solution
This database is connected to the LUCOS Database using a virtual database. When the LUCOS database is accessed, it works as if the data was in a local database. This solution does not however solve the problem of data access being slow to databases that are in different countries or in old computer systems.

Ericsson Finland is also researching how embedded systems like PDA devices can be applied to the LUCOS Tool Framework.

8   Conclusions and future work

The pilot companies have given us a lot of courage to continue working. They have given us a field in real life where we have tested our ideas and tools. We strongly believe that our ideas also work in real life because the methods and tools have been tested and utilized in the pilot companies and the feedback has been positive.

8.1   Problems

When working with our partners from different brands of industry we have faced some problems concerning the visualization of collected data in practice. Interconnecting and transferring the data from various sources is one big problem. However there is no easy and simple solution to it. We have developed some general tools (see Chapter 4) but the solution is always company specific anyway. Another problem is the SQL knowledge required when creating charts. That possibly requires one technically oriented resource in the company. To help the creation of SQL statements we are researching ways to hide SQL under a graphical query generator.

When deploying ViCA there are also problems related with psychological aspects like motivation and the resistance to change, like in the case of any new tool. It is essential that the panels contain important and interesting information for the person that is using the panel, otherwise it is not very likely that he is motivated to utilize the information stored in the panel.

8.2 Performance

Connections in Intra/Internet may take a long time due to network traffic, slow computers, distance or complex database queries. To live with this fact we are developing a proactive cache system into MESS that tries to predict the necessary data and loads it during the idle time. In addition, the caching at the client side (i.e. ViCA) will be necessary. Therefore caching the recently used data will be necessary.

9　References

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