ONLINE COLLABORATION OF PROJECT MANAGEMENT APPLICATIONS

Jinxing Cheng[1], Kincho H. Law[2], and Bimal Kumar[3]

ABSTRACT

Software development has increasingly shifted toward integrating existing components and building Web-enabled services. Meanwhile, although various computer applications are employed to assist in project management, each application is largely independent and isolated from others. Without a mechanism to coordinate these tools, the functionalities are limited to their own domains. This paper proposes a prototype system framework to enable the online collaboration of heterogeneous systems, so that additional services can be provided based on existing tools. An example is provided in which users can review the impact of weather conditions by using the system to coordinate various project management tools.

KEYWORDS

Collaboration, Process Specification Language

[1] *PhD Student, Civil and Environmental Engineering Department, Stanford University, Stanford, CA 94305-4020, email: cjx@stanford.edu*
[2] *Professor, Civil and Environmental Engineering Department, Stanford University, Stanford, CA 94305-4020, email: law@cive.stanford.edu*
[3] *Professor, School of the Built and Natural Environment, Glasgow Caledonian University, UK, email: b.kumar@gcal.ac.uk*

1. INTRODUCTION

As computer programs becomes ever more complex, software development has shifted from focusing on programming toward focusing on integration (Beringer et al. 1998). In parallel to this trend, there is another shift from stand-alone applications toward Web-based or Web-enabled services. As a result, future software will be based more and more on the collaboration of existing software components.

In the engineering and construction industry, many computer applications (e.g. Microsoft Project, Microsoft Excel, Primavera Project Planner, and AutoCAD) are widely adopted to assist in project management. These tools provide volumes of information and specialize in various aspects; nevertheless, when problems occur, it may still be difficult for project managers to coordinate them in order to solve the problems. For instance, weather forecasting services can provide necessary weather information for planning construction operations, and Primavera Project Planner can help managers schedule projects. However, when unexpected weather conditions occur, managers may have difficulties to quickly evaluate their impact and to dynamically adjust the schedule.

This paper introduces a framework to facilitate the collaboration of heterogeneous systems. An overview of the prototype system is provided, followed by discussions of the implementation efforts. An example is then presented to illustrate the potential of the system.

2. THE FRAMEWORK OF THE PROTOTYPE SYSTEM

As shown in Figure 1, the prototype system consists of multiple layers and is implemented based on work stemming from various projects. The Flow-based Infrastructure for Composing Autonomous Services (FICAS) (Liu et al. 2003) is utilized to invoke distributed services and to direct data flow among different services. The wrappers developed in the process specification and simulation project are employed to integrate legacy tools (Cheng et al. 2003).

To coordinate heterogeneous services over the network, FICAS, a service composition infrastructure for building megaservices, is employed in this research. FICAS supports platform independency and loose coupling. In addition, FICAS is efficient in transferring large volumes of engineering data due to its distributed data flow implementation (Liu et al. 2003).
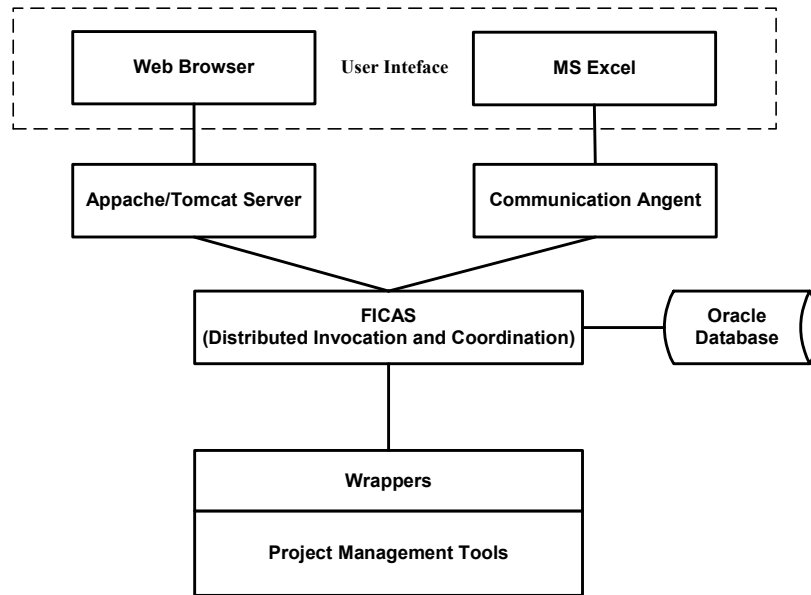
Figure 1: the Framework of the System

Selected tools have been integrated into the system, including Primavera Project Planner, Microsoft Project, Vite SimVision, and a weather forecasting service. To achieve interoperability among these heterogeneous services, wrappers for each tool have been developed to convert the information into standard formats. In this research, the Process Specification Language (PSL) (ISO 2003) is chosen as the basic ontology standard for two major reasons:

- PSL is designed specifically for process information. This feature is important since project management frequently involves volumes of information.

- With the underling logic, PSL has the potential for conflict resolution and consistency checking (Cheng et al. 2003).

Web browsers and Microsoft Excel serve as the user interface in the prototype system. Apache and Tomcat servers are employed so that users can use Web browsers to communicate with various project management tools. A communication agent has been developed so that Microsoft Excel can send requests to FICAS and respond to replies from FICAS. All control messages, including the messages between FICAS and Web servers, are encoded in XML.

3. DEMONSTRATION

To demonstrate the potential of the prototype system, we use the Arnold's House project from the tutorial example of Vite SimVision. The goal of the project is to build a

residential house on time and within budget. The example demonstrates how the system incorporates weather conditions, coordinates various computer tools, and allows users to review the impacts of weather conditions.

Weather has a significant impact on scheduling for many projects. Heavy rain as well as strong winds may cause many construction activities to be suspended. A project planning system, which incorporates weather conditions, can be helpful in dynamically adjusting project schedules. The following discuss how to incorporate weather conditions and how to evaluate their impact.

A weather parser has been developed to parse the information from a weather forecasting service (in HTML formats) and to convert it into XML formats. Figure 2 shows the original weather information from the Yahoo forecasting service as well as the generated information in XML.
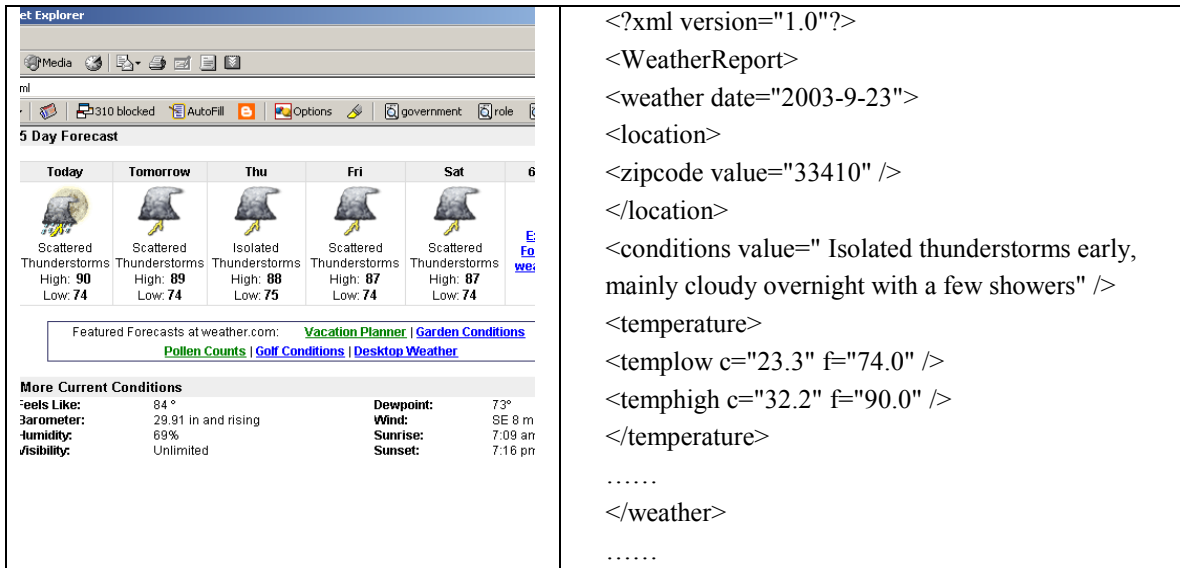


```
<?xml version="1.0"?>
<WeatherReport>
<weather date="2003-9-23">
<location>
<zipcode value="33410" />
</location>
<conditions value=" Isolated thunderstorms early,
mainly cloudy overnight with a few showers" />
<temperature>
<templow c="23.3" f="74.0" />
<temphigh c="32.2" f="90.0" />
</temperature>
……
</weather>
……
```

Figure 2: Express Weather Information in XML files


```
<?xml version = "1.0"?>
<weatherScheduling>
<actImpact actid = "ALL" suspendOnRain = "yes"
        suspendOnWind= "no" />
<actImpact actid = "ID190" suspendOnRain = "No"
        suspendOnWind = "Yes" />
<actImpact actid = "ID220" suspendOnRain = "No" />
<actImpact actid = "ID230" suspendOnWind = "No" />
</weatherScheduling>
```
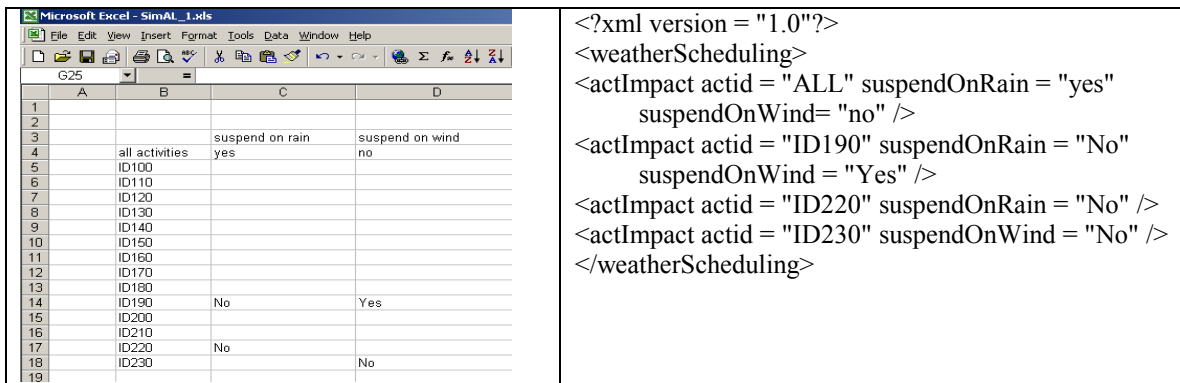
Figure 3: Encode Domain Knowledge in XML

The exact influence of weather conditions varies from activity to activity. For example, pouring concrete may have to be suspended due to rain, while interior work can be performed as usual. Thus, a table in Microsoft Excel is used to allow users to specify such domain knowledge. Figure 3 shows the table and the corresponding expressions in an XML file.

Let's assume that the project encounters prolonged rainy season, and users want to review its impact. The system first extracts weather information from a forecasting service and encodes it XML. The information is then used by Primavera Project Planner to adjust the schedule. The updated schedule is stored in PSL and transferred to Vite SimVision for further analysis, for example, simulating the task backlog. Figures 4 and 5 show the impact on the project schedule and on task backlogs, respectively. As shown in Figure 4, the activity "*Lay Foundation*" has been prolonged from 25 to 30 days, which, in turn, cause the delays in other activities. In Figure 5, we can see that the pattern of task backlogs becomes different. For instance, both the peak value and the associated date have been changed.
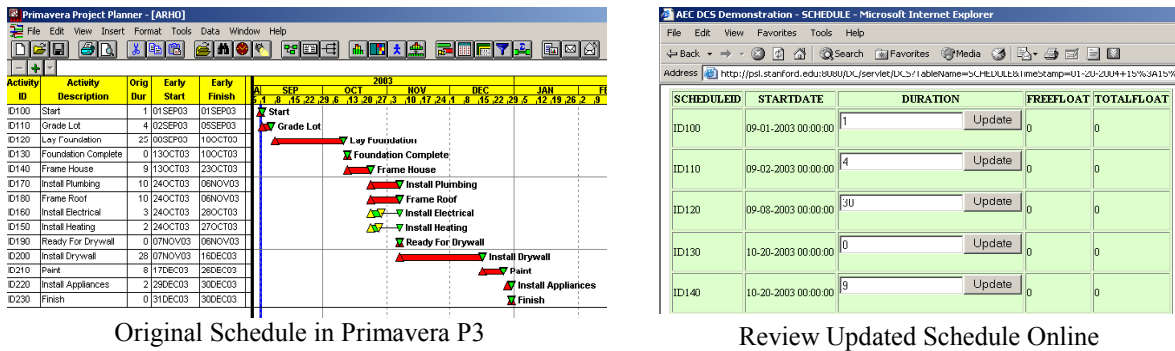

Original Schedule in Primavera P3

Review Updated Schedule Online

Figure 4: Review the Impact of Weather Conditions in a Web Browser

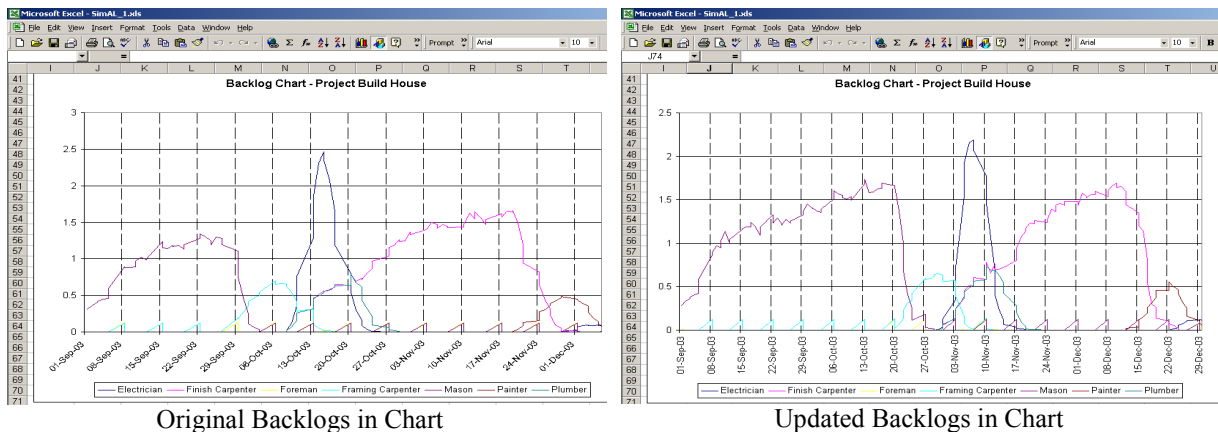Original Backlogs in Chart

Updated Backlogs in Chart

Figure 5: Review the Impact of Weather Conditions in MS Excel Charts

It must be noted that the whole process is automated. As the project goes on, managers can quickly review the impact and adjust the schedule accordingly whenever there is concern for weather conditions. It must also be noted that project management services reside on different location and platforms, as shown in Figure 6. For example, the Oracle database server and the Vite SimVison are located at Stanford University, the scheduling services reside at Glasgow University, and the Yahoo weather forecasting is an outside service from the industry.
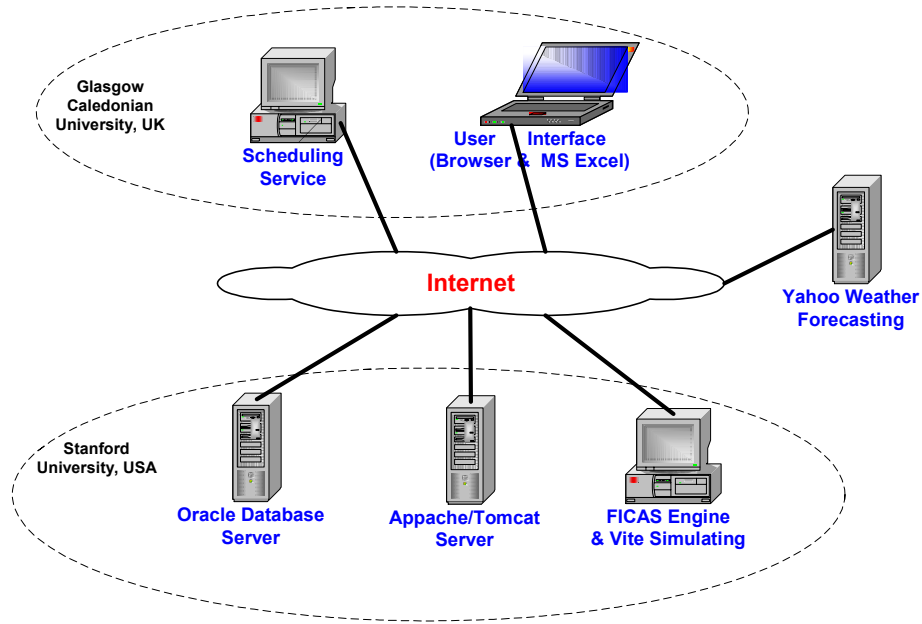
Figure 6: the Example Demonstration

4. SUMMARY

In this paper, we have presented a framework to enable the collaboration of heterogeneous systems. We have discussed the implementation efforts required in developing the prototype system. In particular, PSL is used as a standard for data exchange, and XML is used to encode control messages. By developing a wrapper for each application and employing FICAS, project management applications can be coordinated to provide additional services. Using an example of weather conditions, we have demonstrated that the prototype system has the potential to coordinate heterogeneous project management services.

5. ACKNOWLEDGEMENT

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