A Web Service-Oriented Approach to Teaching CS/IS1

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SUMMARY
Web services technology is a burgeoning technology that has received much attention in the software industry in recent years under the broader umbrella of service-oriented architecture (SOA). The popularity of the service-oriented paradigm is echoed by Microsoft’s Bill Gates, where in a memo to Microsoft's top managers and engineers, he states “The broad and rich foundation of the internet will unleash a ‘services wave’ of applications and experiences available instantly over the internet to millions of users” [1]. While Web services have been incorporated in many industries in the market place, they are only beginning to appear in the academia, primarily in upper division and graduate CS/IS curricula [2,3]. In this special session, we share our belief that Web services technologies can and should be introduced early in CS/IS curricula. We describe and demo a number of scenarios that illustrate how Web services can be integrated into CS1/IS1 to make these courses more interesting and more importantly, make the students better prepared for upper division classes and for the industry upon graduation. This special session also shares the results of our preliminary findings involving the aforementioned integration and introduces participants to the related courseware. Participants will also receive hands-on experience with some of the scenarios experimented in our study. The intended audience is CS/IS educators who are interested in a novel way of teaching CS1/IS1. NOTE: Participants are encouraged to bring a laptop with wireless access to the Web and with NetBeans.

Categories and Subject Descriptors
K.3 [Computers & Education]: Computer & Information Science
Education – Computer Science Education

General Terms
Design, Experimentation, Languages

Keywords
Web services, service-oriented architecture, Teaching CS1/IS1

1. OVERALL OBJECTIVE
The overall objectives of this special session are to: (1) disseminate the use of Web service-oriented approach to teaching CS1/IS1, (2) to explore educational innovations for indoctrinating students the state-of-the-art software development practices using SOA, and (3) to build a learning/research community of service-orientation-in-CS1/IS1 enthusiasts.

2. SESSION OUTLINE
The special session includes the project rationale, introduction to courseware using Web services, researcher experience report, brief hands-on demonstration for participants, and concludes with a group discussion/feedback component.

2.1 Project Rationale
Presenters: Drs. Billy Lim, Bryan Hosack, ISU.
Duration: 10 minutes
The rationale for the project, which began with research presented by Lim et al. in 2005 [4] and currently funded by a NSF CCLI grant [5], will be discussed. The importance of how current CS/IS curricula need to incorporate the current software practices (i.e., SOA), without compromising the core materials presently covered in many CS/IS introductory sequences, will be highlighted.

2.2 Courseware Showcase
Presenters: Drs. Billy Lim, Bryan Hosack, ISU.
Duration: 10 minutes
The presenters will briefly present the courseware, which consists of a collection of PowerPoint slides, lab exercises, programming assignments, and tutorials. These are freely available for use and can be downloaded from the project website. Sample student work for various labs and programming assignments will also be showcased. An educational compendium of Web services, WS4Intro, will be presented. WS4Intro is hosted on the presenters’ server and offers services that are freely available for educational use.

2.3 Experience Report
Presenters: Drs. Billy Lim, Bryan Hosack, ISU.
Duration: 10 minutes
Presenters will summarize the experiences of using the Web service-oriented approach in our CS1 and IS1 courses. Quantitative and qualitative data will be presented on the preliminary use of Web services in CS1/IS1. Analysis of student and faculty evaluation will be presented as well as student perceptions of Web services in the classroom. Presented data will include student demographics, student course performance, and pre-/post questionnaire comparison results.

2.4 Hands-On Experiments with Exercises
Presenter: Dr. Billy Lim, ISU.
Duration: 20 minutes
Participants are encouraged to bring a laptop with wireless access to the Web and with NetBeans (version 6.7.1 as of this writing, Web and Java EE edition; the NetBeans IDE can be freely downloaded from www.netbeans.org.) Participants can experiment with the various Web services incorporated into the

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courseware so far. Also, participants will experience as a student user, completing a programming assignment to get a feel of what it is like to engage in Web service-oriented approach. A possible sample module would function as follows:

Table 1: Web service scenario for the topic “Control Structures”

<table>
<thead>
<tr>
<th>Module Name</th>
<th>Sequence, Iterative, and Decision Structures</th>
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<tbody>
<tr>
<td>Typical Delivery:</td>
<td>These topics are typically covered by traditional discussion of scenarios that (1) necessitate a certain ordering be imposed to solve a problem, (2) require a loop be used, and (3) need an if-else structure be employed.</td>
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<tr>
<td>WS Delivery:</td>
<td>Instead of merely processing a collection of numbers or strings that may not resonate with students, one could present a scenario where the goal is to solve a problem by using the three fundamental structures and existing Web services to form a solution.</td>
</tr>
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<td>Example:</td>
<td>A plausible scenario would be to solve the problem of finding the warmest temperature in the entire U.S. by zip code. Further, the warmest area of the country needs to be plotted on a map. Lastly, get a route to go to the warmest area from a given location. This scenario may seem intractable in the traditional introduction environment. But there exist various publicly available Web services that can be composed together to solve this problem rather effortlessly. There exist Web services that retrieve all the US zip codes, finds the temperature for a given zip code, plot a particular area on a map given a zip code, and plot the route given two endpoints (MapPoint Web service, Google Maps API). Thus, one can cover the topic using a more interesting approach.</td>
</tr>
</tbody>
</table>

2.5 Group Discussion

Leader: Dr. Bryan Hosack, ISU.
Duration: 20 minutes

We would like to hear suggestions and feedback to the Web service-oriented approach from the attendees and the community at large. This discussion will focus on the presented material and activities, as well as the interest of the community in incorporating this approach at their institutions. The future plans of the project, including a faculty workshop in the summer of 2010, will be discussed.

3. EXPECTATIONS

The intended audience is CS/IS educators who are interested in a novel way of teaching CS1/IS1. It is expected that a fruitful discussion of how the pedagogical approach for CS1/IS1 can be advanced will result. The session provides a complete coverage of the preliminary project findings, from the fall 2009 semester up to the presentation, which would include part of the spring 2010 semester. In addition, companion courseware, user experience report and analysis, future plans, and several related research directions will be provided. The hands-on experience will allow participants to experiment with the Web service-oriented approach used in the classroom by students.

Given how SIGCSE attendees are typically very passionate about topics surrounding CS1, we anticipate about 25-30 participants in this special session.

Feedback from participants will be collected via a brief voluntary single page paper-based survey after the session.

4. MATERIALS PROVIDED

Each participant will receive a CD, containing a package of supporting materials, including (1) detailed notes of all presentations, (2) handouts for the hands-on experiments with the Web service-oriented scenarios, (3) screencast and step-by-step instructions on how to incorporate Web services. Laptops are recommended for the participation in hands-on experiments.

5. SUITABILITY FOR SPECIAL SESSION

The format and the organization of this proposal make it an ideal candidate for experimenting with the SIGCSE special session format. Unlike a regular paper or panel, the session is a mixture of short presentations, group reports, hands-on experiments, and group discussions. The interactivity planned will allow for a much better means to achieve the session objectives.

6. ACKNOWLEDGMENTS

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7. REFERENCES


