

# Shared Questionnaire System for School Community Management

Hiroya Kubo      Hidehiro Ohashi      Masatoshi Tamamura      Takashi Kowata  
Ikuyo Kaneko

Graduate School of Media and Governance, KEIO University  
5322 Endo Fujisawa Kanagawa, Japan  
{hiroya,hohashi,tama,tkowata,iccil}@sfc.keio.ac.jp

## Abstract

*We developed a set of web applications called SQS(Shared Questionnaire System) based on XML technologies for supporting wide variety of social inquiry administrators such as community managers, governors and researchers. The core applications of SQS are distributed OMR(Optical Mark Recognition) systems developed upon XForms so that they have open processing model and open data formats. The integrated OMR systems enables the users in different communities to share informations about how to create hypothesis and how to design questionnaire.*

*We experimentally applied SQS to a survey of public policy issues in an elementary school community in Tokyo, Japan. The use of SQS shows possibility of decentralised and autonomous community management with small cost.*

## 1. Introduction

We developed a set of web applications called SQS(Shared Questionnaire System) that is a kind of integrated OMR(Optical Mark Recognition) System.

We experimentally applied the first version of SQS application components in a field of school community management. The result shows administrating questionnaires by SQS is cost-effective than existing method of administrating questionnaire by human-wave strategy.

The use of SQS leads to low-cost frequent community management. Each of the different communities can integrate SQS for filling their needs which are different by each communities. SQS provides new style of public policy analysis and management cycle in decentralised and autonomous manner.

In this paper, we discuss the background of this study in Section 2. and describe about the features of SQS applications in Section 3. and shows the implementation of current version of SQS in Section 4. and then we report an adapta-

tion of SQS in a field of school community management in Section 5. Finally We denote conclusion and future plan in Section 6.

## 2. Background

### 2.1. Supporting Autonomous School Community Management

Many agencies of various countries including the Organization for Economic and Cultural Development(OECD) has approved that a single school in possession of its own decision-making must provide better quality education than a school run by a centralized bureaucracy. [1][2][3]

In Japan, school management systems are in preliminary and immature state because the Prefectural Boards of Education and Ministry of Education, Culture, Sports, Science and Technology has been sustaining centralized governmental hierarchy. On the other hand, each local school community is aware of their different needs and potentials of educational resources. A new system of school governance which is decentralized and autonomous way is required. Kaneko have been proposing that local school communities should have the will and skill of management[4]. The Japanese government has recognised this problem so they have planned to revise the structure of education [5] [6]. However the reform is not in progress.

The school community management is not profit for local members. As for profit motivated organizations, the working results can be evaluated by numeric evidence (ie. the amount sold) but in non profit groups(ie. school communities), the working results cannot be appropriately evaluated by financial values. Therefore it is difficult to evaluate the results by heterogeneous people of the community. A new method of management information systems for not-for-profit groups is required[7].

We began this study for supporting autonomous school communities by developing a set of applications for social inquiry administration with a small cost. In addition,

it is difficult to administrate social inquiry for non professional people because it requires expertise of creating hypothesis, designing questionnaires and making the statistics. So we are developing e-learning contents of professional education of social inquiry in school community management procedures. Our goal is a widely distributed use of our social inquiry applications by community managers, governors and researchers for both heterogeneous inter-community management and homogenous intra-community management[8].

## 2.2. Reducing Cost of Social Inquiry in the Community

The OMR system is a good solution of reducing the cost of administrating inquiry. One of the most serious problems of administrating inquiries is the cost of extensive clerical. Financially speaking this method dose not achirve cost-effectiveness.

We surveyed several commercial OMR systems and found that most of OMR system vendors did not publish the file format of questionnaire so that the questionnaire definitions by different OMR companies to be incompatible. causing the questionnaire definitions to be incompatible with different OMR software companies. Moreover, most of the OMR applications are commercial-based and require software license fees.

We wanted to use generic questionnaire definition data in open file format and the free implementation of OMR system, so we examined XForms[9][10] technologies. However, in the list of “XForms Implementation” by W3C[11], there is no XForms processor with the OMR technology as of September 2003.

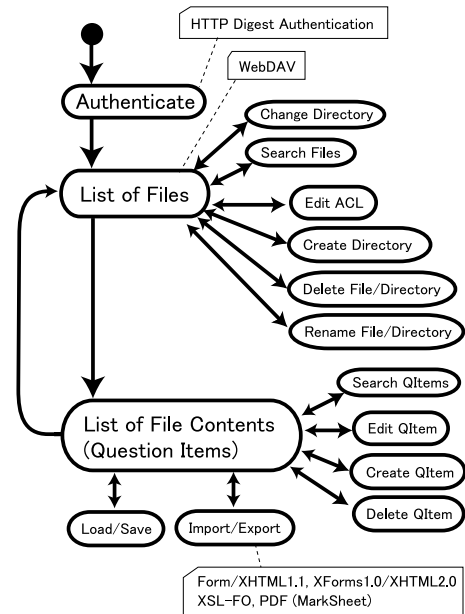
Because of these insufficiencies we decided to developing an original XForms standard compliant OMR processor as an opensource software[12][13].

The OMR software is free of cost and it can be freely distribute and itegrate local community inquiry service for estimating thier different needs, potentials and resources from different viewpoints[14].

## 3. Architecture

SQS is a set of web applications which are composed by a modular structure[15] and hosted on the Application Service Provider as the Questionnaire Administration Center(QAC).

The three main applications of SQS as follows: “SQS Form Wizard”, “SQS OMR Processor” and “SQS Report Manager”. These applications will be explained in this section. The usecases of the SQS applications are explained in **Figure 1**.



**Figure 2. SQS Form Wizard/Report Manager Process Flow**

SQS Form Wizard and SQS Report Manager are types of XML Editors with web interfaces on WebDAV repositories for designing and publishing questionnaires. Their process flows are illustrated in **Figure 2**.

### 3.1. SQS Form Wizard

SQS Form Wizard(**Figure 3**) is a web application with 3 usecases as follows:

1. Designing Hypothesis:
 

The first step of using SQS Form Wizard is for the usecase of “Designing Hypothesis”. The actors in this usecase are questionnaire designers. The hypothesis and questionnaire source documents are created and maintained in this step.
2. Designing Questionnaire:
 

The second step of using SQS Form Wizard is for the usecase of “Designing Questionnaire”. The actors in this usecase are questionnaire designers and/or questionnaire administrators. The documents representing device independent questionnaire form sheets are created and maintained in this step. These documents are describing the logical structure of the questionnaire (section structure, form type, form label, form description, etc.) by a subset of XForms1.0 and XHTML2.0[16] namespaces.
3. Publishing Questionnaire Form Sheet:

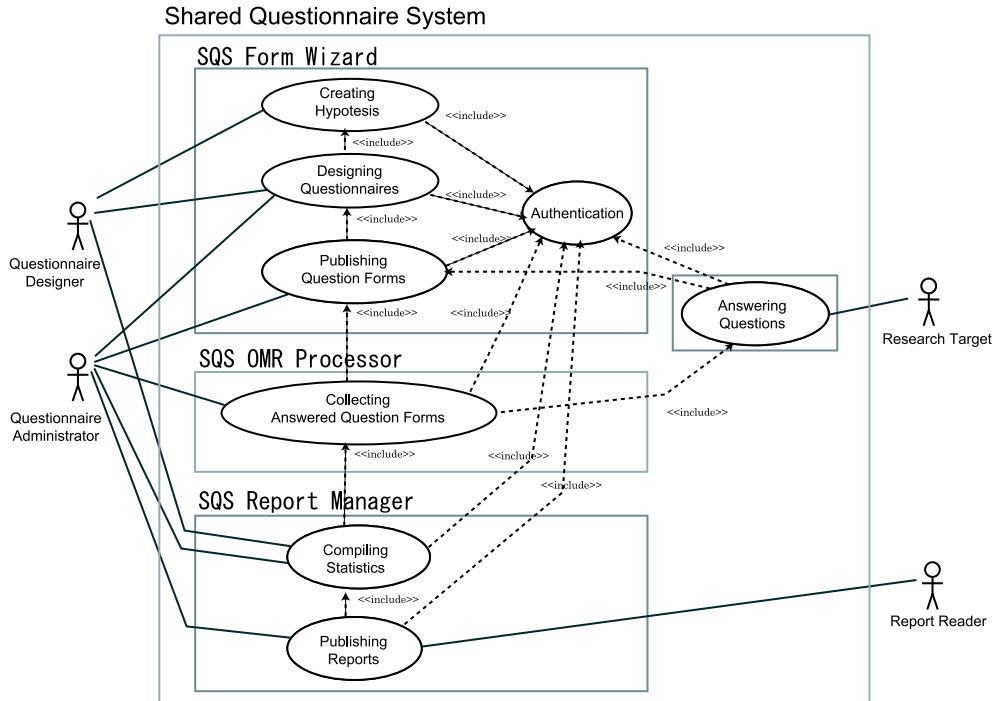


Figure 1. UML Usecase Diagram about SQS



Figure 3. SQS Form Wizard

The third step of using the SQS Form Wizard is for the usecase of “Publishing Questionnaire Form Sheet”. The actors in this usecase are questionnaire administrators. Resource files for multiple form publishing devices (Form/XHTML1.1/WebBrowser

and Marksheet/PDF/paper) are created and maintained in this step. With use of XSLT processor[17] of the XForms1.0/XHTML2.0 documents are transformed into XSL-FO instances for printings on paper(Figure 4) or Form/XHTML1.1 instances for web browser.

### 3.2. SQS OMR Processor

The SQS OMR Processor work flow is illustrated in Figure 5. The questionnaire administrator receives answer sheets of questionnaires from the targets of inquiry, and scans the images of the answer sheets, processes OMR, then sends the results of mark reading information to the storage server through the network.

The cost of image scanings and OMR processings causes problems in SQS. Therefore using Java Web Start[18] helps to distribute the OMR components over the network and it enables the number of local community questionnaire administrators to work simultaneously.

### 3.3. SQS Report Manager

SQS Report Manager is the web application with 2 usecases as follows:

1. Compiling Statistics:

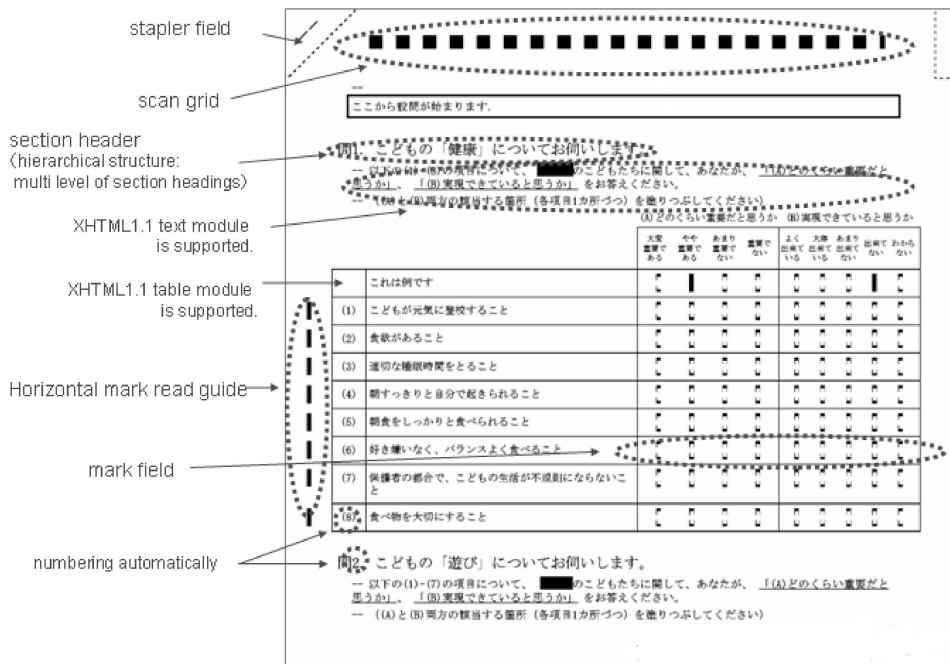


Figure 4. Questionnaire Form Sheet Printed Image

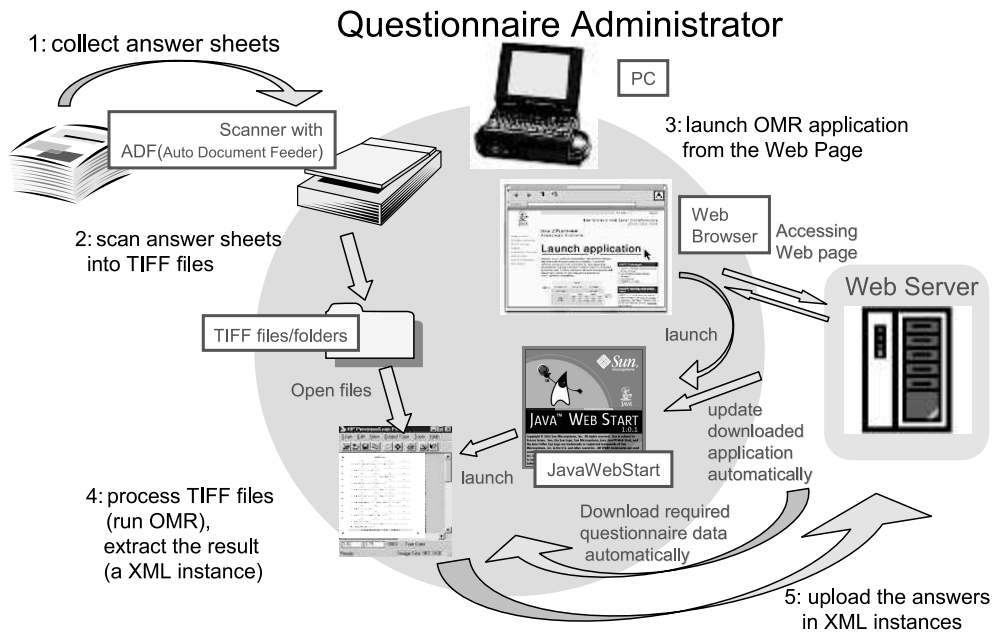


Figure 5. SQS OMR Processor

The authorised members can access the result of questionnaires and make analyses and generate visual reports with tables, charts and graphs via web interface.

## 2. Publishing Reports:

The authorised members can publish the report on WebDAV[19] storages with hierarchical role based access control.

## 4. Implementation

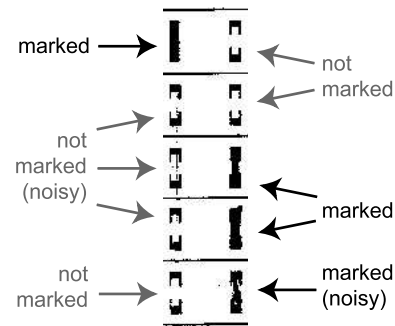
- We built a Questionnaire Administration Center in KEIO University with an IBM PC/AT compatible machine (Debian GNU/Linux 3.0, Dual Pentium Xeon 2.0GB, 2GB memory).
- We built a Distributed Local Questionnaire Administer Client System in KEIO University with an IBM PC/AT compatible machine (Windows XP Professional, Pentium4 1.6GB, 512MB memory, SCSI-II host) in addition to an automatic document feedable scanner(Panasonic S2026CN, reading speed 40 pages par minute, tray 120 sheets).
- SQS web applications are implemented by Java Servlets API 2.3 / JSP 1.2 and installed in Jakarta Tomcat 4.1.27[20] as the application server.
- Several SQS web applications relay on Xalan-Java 2.5.1[21] as XSLT processor and FOP 0.20.5 [22] as print formatter.
- Distributed SQS Form Receiver(OCR components) are lunched by Java Web Start 1.2.
- The report document of inquiry(statistics and analysis) are published from WebDAV service based on Jakarta Slide 1.0.16[23].
- Our original XForms processor in SQS is not the full implementation of "XForms1.0 Proposed Recommendation" specifications. XForms Processing Model and XForms Action are not supported either.

## 5. Adaptation in School Community Management

### 5.1. Experiment in Elementary School Community

We applied the SQS prototype to a survey of public policy issues of a local community in an elementary school district in Tokyo, Japan (Jul. 2003 - Oct. 2003). The survey procedures are described below:

1. We performed a basic survey on the local community by group interviews (1/2 day session).



**Figure 6. Example: Scanned Mark Images**

2. We made a qualitative analysis based on the result of the interviews and extracted 75 issues of public policy making.
3. We developed a quantitative questionnaire list which reveals level of importance and level of satisfaction about various issues(9 mark fields par issue).
4. We input the questionnaire list into SQS Form Wizard.
5. A PDF file which is a device dependent style of the questionnaire was translated from independent questionnaire representation.
6. Questionnaire form sheets on papers were distributed to the different groups in the community; school managers, teachers, students, parents and habitants around the school.
7. We received answered questionnaire form sheets.
8. 410 sets, 2,460 pages of the pencil-marked form answer sheets were scanned and transferred TIFF files. This process took in 180 minutes (14 page par minute). 2 files of cover sheet pages were removed automatically in all 6 pages, then 1640 files from scanned 2,460 files are selected 58.6 MB.
9. OMR processing on 276,750 marks(410 sets x 75 issues x 9 marks) in 1,640 TIFF files was completed in 62 minutes (about 26 pages par minute), with 100% accuracy of mark reading(**Figure 6**).
10. We analysed and visualised the questionnaire result by the SQS Report Manager. The issues with higher level importance and lower level satisfaction in the community were the main concern.
11. We wrote the results of the questionnaire and sent it to the Elementary School Community.

The average throughput of mark reading by human eyes and filling in electric form by hand are about 1 page par minute. At this rate, processing 276,750 marks in 1,640 TIFF files requires 27 hours. Therefore it can be concluded

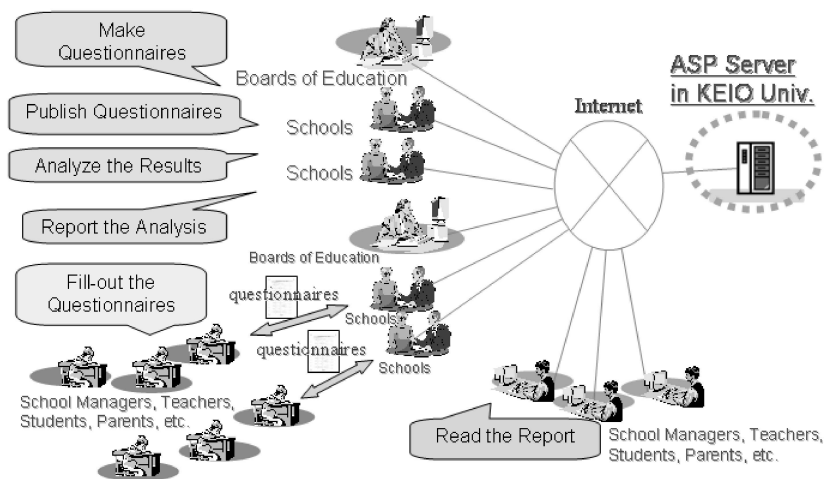


Figure 7. SQS Phase 1: Centralised Style

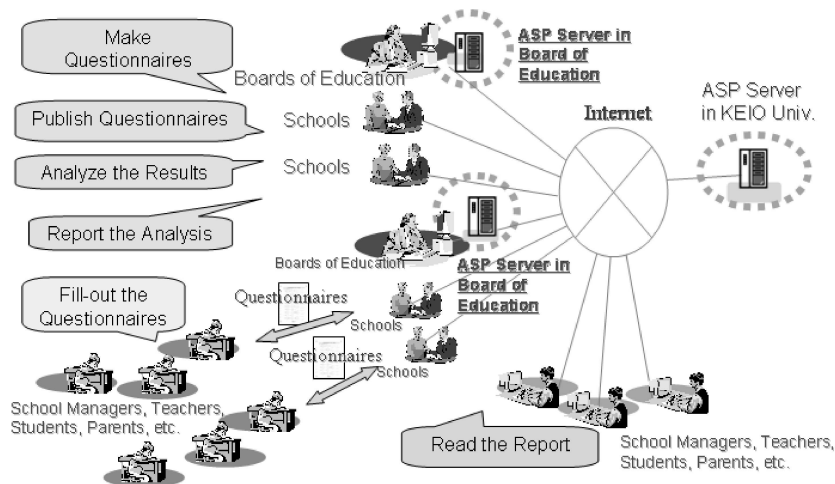


Figure 8. SQS Phase 2: Polycentric Style

that using SQS can reduce 86% of the time cost of OMR processing administration.

## 5.2. Experiment in Prefectural Boards of Education

Kaneko is a member of the Society for the Study of Decentralisation Reform and had several meetings with Prefectural Boards of Education, and reached agreement of using SQS in the 2003 academic year with 2 prefectures. And additional 7 prefectures also plan to be joined in 2004 or 2005 academic year.

It has two steps of deploying SQS network to the schools illustrated by **Figure 7** and **Figure 8**. Phase 1 is “Centralised Server Style” and Phase 2 is “Polycentric Server Style” of web application providing to the users over the Internet. The Phase 2 is planned to be started in 2006.

## 6. Conclusion

In this paper, we showed the design background, the features, and the implementation of SQS. We experimentally applied the first version of SQS components in a field of

school community management. The result shows administering questionnaires by SQS is more cost-effective than the existing method of administering questionnaire.

Our future plan is developing a cross-community-border semantic search engine of SQS resources. The description of the hypothesis of the questionnaire and implications from the questionnaire results will be written by RDF-triplets[24].

We suppose that SQS provides not only a low cost method of making inquiries and the result, but the communication space to learn from best-practices of the other SQS users and to increase political accountability of community governance.

## References

- [1] Levačić, R.: *Local Community Management of Schools Analysis and Practice*. Open University Press. (1995).
- [2] Brow, D.J.: *Decentralization and School-based Management*. London and New yourk: Falmer Press. (1990).
- [3] Caldwell, B.: *Principles and Practices in Resource Allocation to School under Conditions of Radical Decentralization*. Development in School Finance: pp.123-136. (1996).
- [4] Kaneko, I., Suzuki, H., Shibuya, K.: *An Idea of Community School(in Japanese: Community School Kousou)*, Iwanami Shoten, Tokyo. (2000).
- [5] Ministry of Education, Culture, Sports, Science and Technology: *Elementary and Jounior High School Teaching Office Teaching Curriculum Section, Important Problems Sheet –School Year 2002– (in Japanese: SYOTOU CHUTOU KYOUIKU-KYOKU KYOUIKU KATEI KA JUUTEN KADAI SHEET HEISEI 14 NENDO)* (2003).
- [6] Ministry of Education, Culture, Sports, Science and Technology: *Achievement Evaluation Report –School Year 2002– (in Japanese: JISSEKI HYOUKA SYO –HEISEI 14 NENDO–)* [http://www.mext.go.jp/a\\_menu/hyouka/kekka/03073102.htm](http://www.mext.go.jp/a_menu/hyouka/kekka/03073102.htm) (2003).
- [7] Shimokobe, A., Kaneko, I., Matsuoka, S. : *Birth of the Voluntary Economy – The Emargence of Economy and Community (in Japanese: Volantary KEIZAI NO TANJOU – JI-HATSU SURU KEIZAI TO Community)*. Jitsugyo no Nihonsha, Tokyo. (1998).
- [8] Kaneko, I.: *Community Solution – problem solving by voluntary participants (in Japanese: Community Solution – Voluntary NA MONDAI KAIKETSU NI MUKETE)*. Iwanami Shoten, Tokyo. (1999).
- [9] W3C: XForms 1.0 Proposed Recommendation. <http://www.w3.org/TR/xforms/>
- [10] Boyer, J. and Honkala, M.: *The XForms Computation Engine: Rationale, Theory and Implementation Experience*, Proc. of the 6th IASTED International Conference, Internet and Multimedia Systems, and Applications, (IMSA 2002), (2002).
- [11] W3C: XForms - the next generation of Web forms. <http://www.w3.org/MarkUp/Forms/>
- [12] DiBona, Ch., Ockman, S. and Stone, M.(eds): *Open Sources Voices from Open Source Revolution*. O' Reilly & Associations, Inc. (1999).
- [13] Open Source Initiative: The Open Source Definition. [http://www.opensource.org/docs/definition\\_plain.php](http://www.opensource.org/docs/definition_plain.php)
- [14] Hengst, M., Sol, H.: *The Impact of Information and Communication Technology on Interorganizational Coordination: Guidelies from Theory*. Information Science, Special Series of Information Exchange in Electronic Markets Volume 4 No 3. (2001).
- [15] Parnas, D.L., Clemens, P.C. and Weiss, D.M. :*The modular structure of complex systems*. IEEE Transactions on Software Enginerring 11(3): p.259-266. (1985).
- [16] W3C: XHTML 2.0 Module-based XHTML W3C Recommendation. <http://www.w3.org/TR/xhtml2/>
- [17] W3C: Extensible Stylesheet Langage (XSL) Version 1.0. <http://www.w3.org/TR/xsl/>
- [18] Sun Microsystems: Java Web Start. <http://java.sun.com/products/javawebstart/>
- [19] Goland,Y., Whitehead, E., Faizi,A. , Carter,S. and Jensen,D.: HTTP Extensions for Distributed Authoring – WEBDAV, RFC2518 (1999).
- [20] Jakarta Apache Project: Tomcat. <http://jakatra.apache.org/tomcat/>
- [21] The Apache XML Project: Xalan-Java. <http://xml.apache.org/xalan-j/>
- [22] The Apache XML Project: FOP (Formatting Objects Processor). <http://xml.apache.org/fop/>
- [23] Jakarta Apache Project: Jakarta Slide. <http://jakatra.apache.org/slide/>
- [24] W3C: W3C Resource Description Framework (RDF), <http://www.w3.org/RDF/>
- [25] KEIO SFC SQS Development Team, *SQS Home Page*, <http://sqs.cmr.sfc.keio.ac.jp/>