



Report on the **Schools Interoperability Framework (SIF)**

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1. Foreward

This report is the first investigation of the Schools Interoperability Framework (SIF) by the CEN/ISSS WS-LT Project Team: “Interoperability frameworks for exchange of information between diverse management systems”. It examines the rationale behind SIF and its organisational structure. It then introduces key aspects of the architecture, infrastructure and data model in the SIF specification. Finally some initial conclusions are drawn on the Europeanisation of the specification and suggestions made as to which parts of the data model might need to be re-specified for a European context.

The SIF website at www.sifinfo.org contains details of the organisation and allows downloading of the current version of the specification (v1.1).

The Project Team is supporting the OASIS (Open Architecture in Schools and Society) initiative which is basing its work on SIF.

2. Rationale behind SIF

SIF is bringing together commercial, educational and governmental bodies in the US to develop an open specification to allow diverse school systems to exchange information. Its primary aim is to improve the administration of individual schools and the school sector as a whole. At the moment there are a number of different systems in use in schools which do not allow the transfer of data between them. Assuming the SIF specification is adopted by key vendors its benefits will be:

- ◆ reduced duplication of pupil data which minimises the time spent on data entry and the likelihood of errors
- ◆ avoidance of “lock-in” to a particular vendor and the ability to select the best software from a range of vendors
- ◆ improved and more cost-effective reporting facilities for teachers, school administration, IT managers and government
- ◆ pupil information available instantly to all systems as soon as pupils arrive at school
- ◆ reduced costs in supporting disconnected proprietary applications
- ◆ easier decision making when procuring administrative and management applications

SIF details several case studies on its website which show how the framework is being used. Peoria Unified School District (in the Phoenix area) for example was interested in solving interoperability issues between three systems: basic student information, automated library checkout and automated dialling for student absence notification. Data is now entered once into the student information system. Library accounts can be set up automatically by transferring data from the student information system. The voice response system allowing parents to call in and check information on student grades and attendance also now obtains basic student information automatically. Data can now be analysed more easily by researchers and decision makers.

In Orange County, Florida, the Ocoee Middle School is now able easily to correlate the results of national standardised tests with those students on the free and reduced lunch programme. This was previously done laboriously by hand.

In Minnesota, Ramsey Elementary School achieved significant savings in staff time by using SIF. Redundant entry of student data was eliminated and less paper is now moved between offices; they claim to have saved a full two weeks of data entry at the beginning of the school year. Data in the different systems is now synchronised and more secure. When a student is enrolled, the student system propagates this information to the library and phone messaging systems. Likewise when a student withdraws from the school, the changes made in the student system mean that the student is also immediately marked inactive in the library and phone messaging systems.

3. Organisation of SIF

SIF partners began meeting in 1997 to discuss ways of enhancing interoperability between school systems. The organisation now meets quarterly. It is entirely comprised of US-based organisations at present. As of 18th March there were 167 members listed on the SIF website (www.sifinfo.org). These include big IT players such as Microsoft, Oracle, Sun and Apple, vendors of VLE and communication systems such as Blackboard and Centrinity, various education departments and organisations, and some vendors of specialised software products such as food management and library management systems.

There are various levels of involvement in SIF. SIF Participants are organisations which have paid their membership fee to SIF and are participating in developing the specification. SIF Endorsers are organisations that are not formal members of SIF but are building products to the SIF specification. Products which have passed compliance testing (there are none as yet) will be known as SIF-compliant.

SIF is divided into 12 working groups as follows:

1. **Data Warehouse Working Group** – defining the data needed to improve pupil achievement and organisational effectiveness
2. **Compliance Working Group** – defining the process and procedures for certifying software as SIF-compliant
3. **Customer Involvement, Requirements, Communication & Accords (CIRCA) Working Group** – dissemination and building relationships between vendors and the schools sector
4. **Food Services Working Group**
5. **Grade Book Working Group**
6. **Human Resources & Financials Working Group**
7. **Infrastructure Working Group** – specification of a framework of messages and communications mechanisms to allow data to be exchanged between systems
8. **Instructional Services Working Group** – development of specifications for data objects; coordination of three subgroups: Instructional Management, Exceptionality Programs and Instructional Resources Management
9. **Library Automation Working Group**
10. **Marketing Working Group** – promotion of SIF to vendors, schools and other interested parties
11. **Student Information Systems Working Group** - development of data objects for student, teacher, school and enrollments
12. **Transportation and Geographic Information Working Group**

Most of the workshops are developing data objects which are outlined in Section 6 *Data Model* below.

4. Architecture

4.1 Overall architecture

The main reason for using SIF is where there are a number of applications in use which wish to share data with each other. This may for example be in a single school where there is a student information system, a catering system and a library system which all need to exchange data. These systems are grouped together into a “Zone” which is managed by a Zone Integration Server (ZIS). A ZIS can be larger than this and may encompass a range of schools within a district or region if required.

Each application in the zone requires a special piece of software to be written for it called an “Agent” which coordinates communication with the ZIS. Agents then communicate with each other via the ZIS which also enables strict control over which applications have access to which data. Agents never communicate with each other directly.

4.2 Data transfer

Data that is transferred between applications is defined using data objects in XML. An example of this is StudentPersonal which includes the name, address, email and the year in which the student is expected to leave school. All objects are labelled by a globally unique identifier (GUID). After adding, changing or deleting a data object, an application’s agent sends a **SIF_Event** message detailing the changes to the ZIS. The ZIS will pass it on to any agents which have expressed an interest in updates to that object.

An agent which wants to receive data is known as a “Requester” and sends the ZIS a **SIF_Request** message. Normally the requester does not specify who the responder will be ie which agent will be returning the requested data. In this case the data will be provided by the default responder for that object, known as the “Provider”. When a responder receives a request for an object it supports it generates one or more **SIF_Response** messages containing the requested data. The ZIS will route this to the requester. If it does not support the object it must return a response with an empty **SIF_ObjectData** element.

If an application wants to know about changes to data objects made by other applications its agent must inform the ZIS by sending a **SIF_Subscribe** message to the ZIS. Before being able to use the services of the ZIS ie to make requests, issue or receive events, the application must register by sending a **SIF_Register** message to the ZIS.

All messages should have a **SIF_MsgId** identifier which will be in GUID format. Messages should be validated by agents and ZISs using the XML Document Type Definition (DTD) for the SIF Message Specification. Any messages which do not conform to this should be discarded and an error message sent to the originator of the message.

Messages can be delivered to an agent either by “Push” or “Pull” models, specified by the agent when it registers with the ZIS. “Push” involves the ZIS actively sending out

messages to the agent without the agent having to initiate contact. “Pull” is used when an agent wishes to request a single message from the queue held for it within the ZIS. The ZIS either returns a message or replies that no messages are available.

SIF specifies message handling protocols which detail the precise tasks a ZIS or an agent must carry out when processing messages initially, registering, providing data objects, subscribing, generating events and requesting data.

4.3 Communication, security and control

Communication between agents via the ZIS is primarily asynchronous in order to ensure scalability and reliability. In contrast communication between agents and the ZIS is normally synchronous. Acknowledgements of receipt of events, requests or responses must be made synchronously with a **SIF_Ack**. When an agent sends a message it will receive such an acknowledgement as a response. This means that a provider can be confident that the ZIS will send on messages to an agent even if the agent is not currently available. Each agent and ZIS need to be able to store messages in permanent storage in case there are network or system problems.

A feature called Selective Message Blocking must be implemented by the ZIS to permit agents to request objects while processing event messages without causing a communication blockage. This works by the agent sending an “Intermediate” SIF_Ack message to stop the ZIS from delivering more event messages to the agent. When the agent has finished processing the event message it sends a “Final” SIF_Ack message to the ZIS. The ZIS then continues to send any SIF_Event messages which have built up for the agent.

A variety of communication protocols can be utilised however SIF HTTPS, a combination of the HTTP 1.1 and secure socket layer (SSL) protocols, is the default one and all agents and ZISs must be able to support it. This provides built-in support for encryption and authentication.

Security levels are specified in the header of each message. The **SIF_Security** element contains **SIF_AuthenticationLevel** – specifying whether certificates need to be presented and whether it is from a trusted authority - and **SIF_EncryptionLevel** – which specifies the symmetric key length (up to 128 bits).

An Access Control List (ACL) specifies how the ZIS controls access to data. For each agent there are details of the objects and whether the agent can provide it, subscribe for it, report events, request the object or respond to requests for the object.

The entire infrastructure API should be expressed in XML and have no dependencies on any underlying transport layer so that only XML is transferred between clients and server. All authentication, compression and encryption should be delegated to the transport layer.

Administration of a ZIS should normally be through a web-based front end so that it can be carried out remotely. Various tasks will be necessary such as starting and stopping a ZIS, adding and removing agents, analysing error and message logs, reporting on statistics and the agents that are registered, running and responding to the

ZIS. Communication protocols and security policies should also be controllable from this interface.

5. Infrastructure

SIF specifies the format of the elements **SIF_Header** and **SIF_Message** and then details each of the possible SIF_Messages which can be sent. A summary of these follows:

SIF_Ack: sent to acknowledge receipt of an infrastructure message

SIF_Event: an event which describes changes to a data object

SIF_Provide: announces the provision of data objects

SIF_Register: allows an agent to register with a ZIS

SIF_Request: used to request information in data objects from other agents including the fields in the object required, search criteria and conditions.

SIF_Response: a response to a request containing one or more data objects or parts of them

SIF_Subscribe: enables an agent to find out about changes to data objects in which it is interested

SIF_SystemControl: allows the flow of data between agents and the ZIS to be controlled

SIF_Unprovide: removes the message sender as a provider of the specified data objects

SIF_Unregister: allows an agent to stop its association with the ZIS; the ZIS will then remove the agent's provisions and subscriptions and any pending messages

SIF_Unsubscribe: removes the message sender as a subscriber to the specified events

In addition, all ZISs must provide a **SIF_ZoneStatus** object which provides information about itself such as its name, the vendor who is selling it, the providers and subscribers registered with it, authentication and encryption levels, supported protocols and supported versions of SIF.

6. Data model

The SIF data model describes the data objects and elements which may be transferred between agents via the ZIS. While many of the data models within SIF are appropriate only in a US context, it is likely that much would be of use in the European school sector. An adaptation of the data model could form the basis for a CWA from this Project Team. It is highly likely that there would need to be more than one European data model because of the differences between European countries and their school sectors. The data model elements, with initial indications of what may require to be changed for a European context are shown below. Dialogue is taking place between the Project Team and OASIS to clarify these issues.

6.1 Common elements

Address: an address which will occur within objects and elements such as *StaffPersonal* and *StudentPersonal/StudentAddress*. Some elements of Address are unique to the US and would need to be altered.

Demographics: this describes ethnicity, country of birth etc. Some of the elements within it such as *EnglishProficiency* may be inappropriate.

Email: email addresses of people within the system.

GridLocation: a latitude and longitude used within other elements such as *BusStopInfo* and *Address*.

MeetingTime: the meeting times and periods for a course.

OtherID: lists other IDs associated with objects such as barcodes and identifiers of schools.

PhoneNumber: of people within the system.

6.2 Food services objects

Student meal: communicates the current meal status of a pupil. This certainly would require to be adapted for national contexts.

6.3 Human resources and financials objects

Billing: specifies an amount to be billed. Currency is not currently specified.

Payment: contains information about the payment of a billing object. Again currency is not specified.

6.4 Library automation objects

LibraryPatronStatus: this is a complex object detailing library books held, fines due etc which again would require adaptation not only for a European context but also probably nationally.

6.5 Student information objects

AttendanceCodeInfo: used for attendance records ie absences, reasons for absences etc.

RoomInfo: information about rooms in a school – their size, capacity etc.

RoomType: the type of room eg cafeteria, classroom etc.

SchoolCourseInfo: information about courses. There are elements such as *StateCourseCode* which would not necessarily be appropriate in European countries.

SchoolInfo: information about the school such as contact details and name of principal. Again some elements are US-centric.

SectionInfo: a section appears to be a part of a course. This way of defining parts of courses might have to be re-examined completely in a European context.

StaffPersonal: personal information relating to a staff member. Most of these elements are defined already in *Name, Email, Address* etc.

StudentContact: similar to *StaffPersonal* this contains contact details for a pupil's "contacts" eg a parent.

StudentDailyAttendance: time in and time out for a pupil on a particular day together with notes if necessary.

StudentPersonal: all personal information related to a pupil. Most of this is contact details.

StudentPicture: contains a picture or the URL of a picture of the pupil.

StudentSchoolEnrollment: when a pupil enrolled at the school, their current academic level etc. Some work may be required to Europeanise this element.

StudentSectionEnrollment: similar to the above but relating to a student's enrollment in a section of a course.

TermInfo: information about a term, its start and end date etc.

6.6 Transportation and geographic information objects

BusEquipment: may refer to a wheelchair for instance.

BusInfo: details about a bus, its capacity and any special equipment on it.

BusRouteDetail: the schedule for a bus route, its stops and times.

BusRouteInfo: all information about a bus route including the name of the driver, the distance and duration of the route. Some European adaptation may be necessary.

BusStopInfo: information about a bus stop – a description and location.

StudentTransportInfo: transportation information about a student – their eligibility and a reference to a *BusRouteDetail* for instance. This requires further work for the European context.

7. Initial conclusions

It should be noted that creating unified systems for the management of school data requires more than the implementation of SIF. Schools, school districts and national education bodies need to undertake extensive analyses of what data is collected and how it should be shared. While this process has begun to take place in the US through SIF, European schools must go through the same process in both a European and a national context.

OASIS is attempting to obtain data from three European ministries of education so it can be compared with SIF. A questionnaire was sent out more widely with limited success.

There is US federal interest in SIF due to the possibilities of achieving a seamless vertical flow of information from school to district to state to federal level. Data mining could extract the relevant information from these lower levels, reducing a lot of expensive administrative work. European education departments may find such administrative and economic benefits equally attractive.

SIF is interested in internationalising the specification. This of course expands the marketplace for vendors who have implemented SIF-enabled products. At the moment there are not many products available and it appears that some vendors would like to be able to work with SOAP rather than the HTTPS model proposed by SIF.

SIF's plans for internationalisation involve bringing international members into single working groups for infrastructure, compliance and data and inviting them to attend quarterly meetings. There are also plans to create geography-specific working groups to evaluate existing data sets and create new data objects if the existing ones are not appropriate in non-US contexts. There would also be global working group meetings to support local and regional developments.

There are close links between SIF and IMS with considerable cross membership between the organisations. IMS does not yet define transport mechanisms and may find the model defined by SIF useful.

8. References

Schools Interoperability Framework website (2003) www.sifinfo.org

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