SIRI (Service Interface for Real-time Information)

Management Overview - White Paper

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What is SIRI?

Public transport services rely increasingly on information systems to ensure reliable, efficient operation and widely accessible, accurate passenger information. These systems are used for a range of specific purposes: setting schedules and timetables, managing vehicle fleets, issuing tickets and receipts, providing real-time information on service running, and so on.

The Service Interface for Real Time Information (SIRI) specifies a European interface standard for exchanging information about the planned, current or projected performance of real-time public transport operations between different computer systems.

- SIRI comprises a carefully modularised set of discrete functional services for operating public transport information systems. Services cover planned and real time timetable exchange; vehicle activity at stops; vehicle movement; and information to assist in the provision of reliable connections between vehicles.
- SIRI aims to incorporate of the best of various national and proprietary standards from across Europe and deliver these using a modern XML schema and TransModel terminology and modelling concepts.
- All SIRI services are provided over a standardised Communications layer, based on a Web Services Architecture. The Communications layer upholds a consistent approach for all the functional services to Security, Authentication, Version Negotiation, Recovery/Restart, and Access Control/Filtering. To support different operating requirements, two main patterns of interactions are supported: an immediate Request/Response protocol; and an asynchronous Publish/Subscribe protocol. The Publish/Subscribe can be further elaborated with a fetched delivery interaction to optimise the use of bandwidth.

SIRI is extensible and it is expected that additional services will be added over time using the same communications bearer.

SIRI's modularisation allows an incremental approach: only the subset of services actually required needs to be implemented for a particular application. The expectation is that users may start with just one or two services and over time increase the number of services and the range for supported options. Similarly Suppliers may extend their support for SIRI in their products incrementally.
SIRI takes a 'joined' up look at all real-time information services, data, data models, transport, and mediation. Considering the whole context is important because for efficiency, real-time services are often only exchanging real-time changes to data, requiring precision about the underlying model assumed by the participants.
A Web Services Discovery process is defined allowing data providers to make the capabilities of their services known to other interested parties.

Why was SIRI created?

Across Europe, well-defined, open software interfaces have a crucial role in improving the economic and technical viability of Public Transport Information Systems of all kinds.

- Using standardised interfaces, systems can be implemented as discrete pluggable modules that can be chosen from a wide variety of suppliers in a competitive market, rather than as monolithic proprietary systems from a single supplier.
- Well defined interfaces also allow the systematic automated testing of each functional module, vital for managing the complexity of the increasing large and dynamic systems that internetworking leads to.
- Individual functional modules can be replaced or evolved, without unexpected breakages of obscurely dependent function.
- The use of common interfaces allows real-time data from different areas to be linked up seamlessly both within and across European borders, enabling true trans-European journey information systems.

The primary motives of Stakeholders are thus:

- *Purchasers* of systems want a straightforward, watertight way of procuring different components of a public transport information system from different suppliers, and to have confidence that these various components will work together. They also want a long term protection of investment, such that there is a continuing support for their systems, a coherent process for evolving the systems, and the comfort that additional components that may be purchased in the future will also integrate into the system.
- *Suppliers* of systems want to develop products for a Europe wide market, ensuring that their systems can be used in every country without needing to implement different interface standards in each region. They also want protection of investment, and an incremental approach that will allow them to spread their investment in standards over an extended period, and to make allowance for different national data sets and business processes for managing data.

SIRI also addressed a growing need to update various national and proprietary standards to conform with modern methodologies and technologies, notably modern data exchange standards (XML), to use standard Public Transport application domain terms and modelling concepts in line with the European TransModel standard, and to build on other relevant CEN, ISO and W3C technical standards for example, for geospatial position, language codes, and so forth.

Who created SIRI?

SIRI has been created by equipment suppliers, transport authorities, transport operators and transport consultants from eight European countries (CZ, D, DK, F, NO, SE, UK) with the backing of VDV in Germany, the Direction des Transports Terrestres of the French Ministry for Transport, and RTIG in the UK, and building on the work of the EU Trident project. The workgroup was convened by CEN TC278 WG3, it was organised by VDV (D) with editorship provided by RTIG (UK) and Transmodel expertise by France.

What Services are available?

SIRI currently comprises the following functional services:

The Production Timetable Service

The Production Timetables service (PT) exchanges information about the expected operation of a transport network for a specified day in the near future. Typically this is produced a few hours or days before the day in question and incorporates any changes to the timetables known at that stage. A Production Timetable can be filtered by Operator,

Line and Date Range, allowing only the section of the timetable of interest to be selected. Suited for provisioning AVL systems and smart devices with base timetables.

The Estimated Timetable Service

The Estimated Timetable service (ET) provides details of the operation of the transport network for a period within the current day, detailing real time deviations from the timetables and control actions affecting the Timetable (cancellations, additional Journeys and Detours). An estimated timetable can be filtered by Operator or by Line, allowing only the section of the timetable that is of interest to be selected. Suited for provisioning AVL systems and smart devices with real-time timetables

The Stop Services (Stop Timetable and Stop Monitoring)

The Stop Timetable (ST) and Stop Monitoring services (SM) provide **stop-centric information** about current and forthcoming vehicle arrivals and departures at a nominated stop or Monitoring Point, typically for departures within the next 20-60 minutes for display to the public. The SM service is suited in particular for providing departure boards on all forms of device.

The Vehicle Monitoring Service

The Vehicle Monitoring service (VM) provides information about of the **current location** and expected activities of a particular **vehicle**, and can give the current and subsequent Journey and the Calling points on each journey, together with the scheduled and expected arrival times. The VM service is suited in particular for onboard displays, and visualisation of vehicle movement, and for exchanging information on roaming vehicles between different control systems. It also constitutes a detailed logging feed suitable for collecting historic about performance against schedule.

The Connection Protection Services (Connection Timetable and Connection Monitoring)

The Connection Timetable service (CT) and Connection Monitoring service (CM) allow transport operators to exchange information about the real-time management of interchanges between feeder and distributor vehicles arriving and departing at a connection point, for example, to let passengers on a delayed train know that a local bus service will wait for them. It can be used in particular for Guaranteed Interchange ('Connection protection') services.

General Messaging Service

The General Message Service (GM) provides a structured way to exchange arbitrary informative messages between participants, such as travel news, operational advice. Can be used to link together incident management systems in a store and forward architecture.

How can I specify SIRI in a tender?

Tenders need to state the specific SIRI functional services that are in scope, and what variant options should be used, for example the data system for stop numbering. SIRI is a quite large, modular standard that allows appropriate subsets to be deployed for particular implementations. For certain aspects of the standard, SIRI offers alternative variants of specific functions so as to allow efficient deployment, and also to ease the transition from

existing implementation in use within the EU. In order to fully specify SIRI in an ITT some further details as to the specific variants and options to be provided should be given. All variant features are identified and named as optional capabilities in the SIRI specification that can be rigorously specified in the procurement documentation.

A checklist of issues that should be considered when specifying or implementing SIRI is included in the Technical Document - see section 'Checklist for Implementing SIRI' (Section 9).

Regional SIRI Guidance Notes are available with advice on recommended options for implementing SIRI in particular areas. These notes will recommend preferred technical options; provide hints and tips of migrating from existing regional or national standards and on the preparation of shared entity identifiers. These guidance notes can be downloaded from the SIRI website.

The following paragraphs introduce the primary considerations for a tender.

- Identify the required **SIRI Services** and the **optional functionality** within each of these services. A Capability Matrix specific to each SIRI Service is included within the Technical Specification and this may be useful when defining the required options for each Service.
- It will be necessary to agree the standards on how to **refer** to **data entities** such as Stop Points, Lines and Connection Points. Is there a convenient agreed referencing system shared by both partners or will a local agreement and referencing system required? The appropriate Regional SIRI guidance Note may contain useful recommendations of how to approach data referencing issues.
- Consider starting with a simple implementation and increasing functionality over time. This increased functionality may be by adding additional SIRI Services, by adding capabilities to existing SIRI Services or by implementing additional generic functions to increase efficiency or capacity, such as subscriptions, or multi-part delivery.
- Consider starting with a Request/Response structure and evolve to a subscription model over time. The Request/Response approach is the simplest but uses more bandwidth than the subscription model, which reduces the data rate by ensuring that only data that changes is transmitted.

A tender should define the required performance criteria, indicating the required data accuracy, acceptable response times, required data throughput and typical and maximum data sizes.

The tenderer should also consider issues around data ownership and the allowable use for this data. Who owns the data required and provided by the operational services? Are any permissions needed to exchange the data as intended? Is Access Control necessary to limit participant's ability to access particular data? What restrictions should be placed on use of the data. It may be necessary to establish legal agreements with the various participants and to clarify these issues

How can I implement SIRI as a supplier?

Identify the SIRI Services and SIRI Service Capabilities that are relevant to your products.

Identify the regions in which your organisation wishes to start promoting SIRI and identify the recommended functionality from the Regional SIRI Guidance Notes.

Add product interfaces that conform to the SIRI schemas and validate them.

Ensure that your implementation is modularised to allow additional Services and capabilities to be added without requiring significant rework of existing code.

Start with simple Request/Response communications and move to a subscription model over time.

Use mainstream technology; SIRI has been tested with most mainstream validators and there are bindings leading open source XML tools such as with JAXB etc.

Develop unit test and regression testes that exercise your service and prove that it still works after a system upgrade.

Identify other organisations that have a matching client or service to test with and exchange data with them. Make sure your services validate properly against the schema before engaging other companies.

Make all your services and clients version aware – detect the version number in the document and process it accordingly. Design your software to support two or three levels concurrently so you can remove specific system dependencies when upgrading.

How does SIRI work (Architecture)?

SIRI is intended to be used to exchange information between servers containing real-time public transport vehicle or journey time data. These include the control centres of transport operators and information systems that utilise real-time vehicle information to operate the system, and the downstream systems that deliver travel information to the public over stop and onboard displays, mobile devices, etc.

- SIRI uses on eXtensible Markup Language (**XML**) to define its messages. A careful separation is made between **Transport** (how the data is transported) and **Payload** (the domain data exchanged), so that SIRI messages may be exchanged as either XML documents with http POST or using Simple Object Access Protocol (SOAP) A Web Service Definition Language (WSDL) binding is also defined for the latter.
- The payload model is wrappered in a **Mediation** layer, also described with XML, that both provides common management functions and also formally describes as policies the parameterised aspects of mediation or exchange behaviour or that can be carried out by a service.
- CEN **TransModel** terminology and relationships are followed in the underlying PT application data model.

SIRI is designed for efficient operation in a wide variety of contexts. It can be used both for the bulk pipelining of large amounts of data between different computer systems, and for lower traffic ad-hoc queries.

SIRI uses a consistent set of general communication protocols to exchange information between client and server. The same common patterns of message exchange are used in all the different functional interfaces. Two well-known specific patterns of client server interaction are used: *Request/Response* and *Publish/Subscribe:*

- *Request/Response* allows for the ad hoc exchange of data on demand from the client.

- *Publish/Subscribe* allows for the repeated asynchronous push of notifications and data to distribute events and Situations detected by a Real-time Service. This can be much more efficient for some types of communication as the client does not need to poll to detect changes to the data; rather the notifying service triggers a data exchange only when it detects an event. The SIRI *Publish/Subscribe* Protocol prescribes particular *mediation* to filter the number of messages returned, for example, only creating updates if real time predictions change by more than a certain threshold from a previous value.

The use of the *Publish/Subscribe* pattern of interaction follows that described in the Publish-Subscribe Notification for Web Services (WS-PubSub) specification, and as far as possible, SIRI uses the same separation of concerns and common terminology for publish/subscribe concepts and interfaces as used in WS-PubSub. WS-PubSub breaks down the server part of the *Publish/Subscribe* pattern into a number of separate named roles and interfaces (for example, subscription, publication and notification production, notification consumer): in an actual SIRI implementation certain of these distinct interfaces may be combined and provided by a single entity.

For the delivery of data in responses (to both requests and subscriptions), SIRI for efficiency, supports two common patterns of message exchange, as realised in existent national systems:

- A one step '*Direct Delivery*', as per the classic client-server paradigm, and normal WS-PubSub publish subscribe usage; and;
- A two step '*Fetched Delivery*' which elaborates the delivery of messages into a sequence of successive messages pairs to first notify the client, and then to send the data when the client is ready.

The respective delivery patterns allow different trade-offs for implementation efficiency to be made as appropriate for different target environments. A SIRI implementation may support either deliver methods; in order to make the most efficient use of the available computational and communication resources.

The Interaction patterns and the Delivery patterns are independent aspects of the SIRI protocol and may be used in any combination in different implementations. Care is taken to separate concerns of message transport from those of functional service content. For a given SIRI Functional Service type (Connection Monitoring, Stop Monitoring etc), the message payload content is the same regardless of whether information is exchanged with a *Request/Response* or *Publish/Subscribe* pattern, or whether it is returned by *Direct* or *Fetched* Delivery.

SIRI takes a consistent approach to handling common functions needed for all services, such as subscription management, recovery and restart, version negotiation, access control (which clients may use which functions), capability discovery, and error handling.

All optional features are explicitly parameterised as named capabilities and the schema includes a configuration profile that a client system can use to automatically detect the capabilities of another system. This makes it possible for suppliers to create adaptive systems that adjust their behaviour automatically to optimise.

What support is available to help me to implement SIRI?

Several different forms of documentation are available to support the use of SIRI. Expertise can be found through respective different national standards bodies such as

- **Web site:** (www.siri.org.uk). An online web site provides resources and links to National organisations and Companies offering services.

- **National Web site :** An online web site provides resources and links to National organisations and Companies offering services, and including National Implementation guidelines
- **Schema:** A robust XML schema is available. The schema is encoded as a W3C .xsd schema, and is modularised into a number of reusable sub schemas and type packages. The schema and has been validated against mainstream validators and there are working applications using common tools such as JAXB.
- **WSDL** Binding the schema is accompanied by a WSDL binding for creating SOAP services.
- **Specification:** The SIRI documentation, prepared as an electronic document to CEN standards, describes the architectural principles as well as the detailed functional services.
- **Examples:** There are example XML documents providing instances of request and response messages for all the different functional services.

Do I have to pay to use SIRI? Who owns the IPR?

The SIRI schema is available for use free of charge and without warranty under public Licence. Copyright is retained by the respective national organisations that developed SIRI.

In line with CEN regulations, the Published Specification Documentation must be obtained through the respective National Standards Bodies such as the British Standards Institute, or industry bodies such as VDV or RTIG.

Can I migrate my existing services?

Yes. SIRI has been developed as an evolution and a harmonisation of existing National Standards such as VDV, Trident and RTIG and a simple mapping of existing elements and data types onto the revised format has been established for the contributing standards. It should be straightforward to migrate a working service to use the SIRI format.

What developments are planned for the future?

SIRI is designed to be extensible: new services may be added within the framework, and individual services might be enhanced by additional function, following a systematic versioning scheme. A number of additional SIRI Services are under consideration which would complement the existing services.