

SQL Race



In professional motorsport, many megabytes of data are logged per lap and analysed in depth by different engineers and specialists at the track and at the factory. On-car data is further enriched by simulation data.

SQL Race is an API (Application Program Interface) for Microsoft SQL Server[®] 2008. It provides the building blocks to store and manage immense volumes of track, simulation and set-up data in its many different formats. It does this in a fast, efficient and user-friendly way while still allowing access through custom and standard methods.

Main Features

SQL Race provides the following advantages:-

- Storage of data received at rates of many Msamples/s can be achieved; thousands of times faster than writing directly to a database.
- Storing data received from data loggers, simulation tools or test rigs in real-time. Data may be real-time, out of sequence or post event (offline).
- Retrieval of data as a set of converted samples ready for display or analysis in a fast and memory efficient manner.
- Seamless association and merging of data across runs.
- Automatic merging of samples across multifrequency periodic and non-periodic data.
- Attachment of constants, maps, videos and documents to the run data.
- Efficient synchronisation of data between databases.
- User friendly access to data via SQL Server or C# API.



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Fast Data Access

The essence of SQL Race is its ability to provide fast access to large quantities of time series data. Users may be viewing hundreds of parameters and hundreds of thousands of sample points and must be able to navigate guickly through the data with ease. SQL Race supports a rich set of data logging modes in real-time and offline. These include:

- Fixed frequency logging rates up to 1GHz
- Synchro logging, or near regular rate logging. This can be used for logging at fixed points on an engine cycle or the near regularity of a heart rate.
- Irregular logging, typically where many parameters • are collected at a single time point.
- Scaled and unscaled data, in which each parameter has an associated conversion function that takes the raw logged value to an engineering value.
- Variable rate logging, where a parameter may be made up of several channels, each logged at a different frequency and under different conditions. SQL Race will intelligently merge all channels.
- Out-of-order data storage. Telemetry systems and disparate wireless data sources cannot guarantee continuous coverage, but a user's requirement is to always be able to see most recent data, so a backfill is necessary. Data is available for read as soon as it is received and any merging tables are updated automatically.

Run Associations

Often there are multiple sources of data either from multiple loggers on a car or because diagnostic data is collected from the environment or rigs. Each run has a GUID (Globally Unique Identifier) and these GUIDs or collections of GUIDs may be opened together to create a super run in which all the runs are presented as one.

Attachments such as constants, data maps, notes, and videos may be associated with the whole run, a set of laps or specific time e.g. a wing setting for the first stint of a race or the time at which a video was recorded.

GUIDs may also be used to make associations between SQL Race runs and custom data that has its own schema, enabling tight coupling between all the electronically storable information about a run, whether it be the data from a probe, the vehicle/rig parts list, or other source.

Data Distribution

The Data Distribution API is based on SQL Server Service Broker and provides a way of keeping a run insync on multiple databases. A race team may have databases located at their factory, engine supplier and



at the race or test track. These databases may be managed by different organisations with their own IT policies. It is neither desirable nor practical to share a single database so the runs must be copied to each database. Furthermore there maybe confidential items in the data that are private to the engine or chassis side of the team. The API addresses these problems by:

- Synchronising on named columns
- Using signatures to compare datasets which • provides a quick check that the data is the same with out the need to send a copy.
- Handle synchronisation across databases with different schemas.
- Restricting access "Allowed" parameter groups.

SQL Race Queries

Although logged data samples are highly compressed, row-set providers facilitate querying the data through SQL queries, thus allowing Excel and other reporting tools to access the data without going through the API.

Viewing SQL Race Data with ATLAS

ATLAS is a separate product to SQL Race but integrates loggers, telemetry systems and simulation tools as data sources. The primary task of ATLAS is data viewing and comparing data from one or more runs both real-time and historic data.

SQL Race enables ATLAS to analyse greater sets of runs and to search for trends and patterns in collections of runs.

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