A.13: Data logging system enhancements for Indus accelerators

Indus accelerator complex consists of Microtron, Booster, Transport Lines and Indus-1 & Indus-2 synchrotron radiation sources. These machines and systems require many sub-systems like Magnet Power Supply, Vacuum System, RF System, Beam Diagnostics System etc. for their successful operation. These sub-systems should work in a stable manner. A fast and reliable data logging of machine and sub-system parameters is an important requirement as it plays a useful role in analyzing and understanding machine behavior. The data logging scheme of Indus has been upgraded to log all machine parameters at a faster rate of 1 second interval which provides better diagnostics and understanding of Indus operations.

The old scheme catered to limited machine parameters with logging interval varying from one second to one minute. This was due to performance limitations observed when going to higher logging rates and with increased number of parameters. The new scheme handles all the limitation in old data logging scheme with several performance improvements. Major challenge involved in this new data logging scheme was synchronization of various execution processes and ensuring no data loss, without compromising the performance.
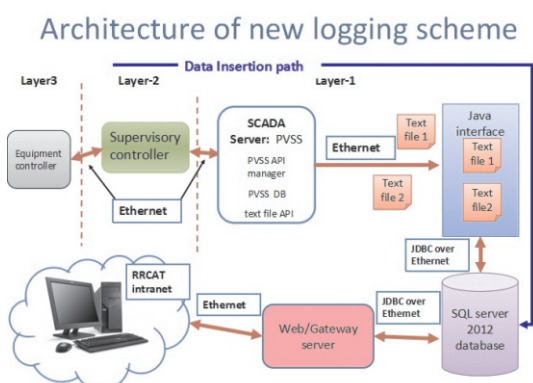

Fig. A.13.1: Architecture of new Indus data logging scheme

The major enhancements done for realizing this scheme include bulk insertion into database using text file and a new database layout design at the back end. The major benefits achieved are increased data availability and segregation of control system with database interface. This has resulted in a faster and flexible data logging system.

Database scheme (Fig. A.13.1) is designed using sliding window scenario of table partitioning feature of SQL server 2012. Besides data logging at 1Hz rate, data retrieving

modules in the form of SQL stored procedures are designed for each sub-system. These modules provide required formatted data to the web server thus reducing the processing time at client side.

An error reporting panel has also been designed to monitor the complete data logging system. It tracks the status of data logging of each sub-system of Indus-1 and Indus-2 and raises alarm for any undesired condition.

Highlights of new data logging scheme:

- Data safety is enhanced by retaining data in text file during unresponsive condition of database server or network.
- Data insertion performance is improved though bulk insert process.
- Indus Control system SCADA server is now independent from database server. Thus any data logging activity does not cause hindrance in the control operations.
- Database schema is designed and classified on the basis of "data-type". This allows to reduce table join operations hence improve performance.
- Data is retrieved and formatted before serving to web server. Hence, data formatting and query compiling jobs have been shifted to database from web server.
- Security has been enhanced by encapsulating all the data retrieving code inside Stored Procedures.
- Sampling of retrieved data is made flexible. User can choose the sampling time interval for retrieving the history data. Maximum resolution with respect to time is 1 second.

Present Status:

Nearly 11,000 parameters are being logged at one second interval in round the clock mode of operation. About 1GB data is logged per day for all the Indus-1 and Indus-2 sub-systems.Certain data logging issues like data blocking, file not found errors, time lag in the available data etc. were encountered and have been resolved with time. The enhanced logging system has been proven over last few months for reliable operation with no data loss.

Future Scope:

High availability of Indus data needs to be ensured. SQL server 2012 provides an Always-ON feature which creates multiple nodes as the hot-standby database server. It can sustain central database failure condition automatically without requiring changes in data insertion and retrieving application programs. The same is being worked out as next important database enhancement.

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