SCA SOFTWARE SUITE

WHAT IS IT?

A comprehensive software solution for integrating the multi-purpose radiation tolerant GBT-SCA ASIC into data acquisition and detector control systems.

CONTAINS:

- The SCA Software package
  - SCA Software Library
  - SCA Simulator
  - Demonstrators
- The SCA OPC UA ecosystem
  - SCA OPC UA server
  - C++ client library for SCA OPC UA server
  - fwSCA SCADA easy integration tool

SOFTWARE MODULES

SCAPI
- high-level abstraction library to control user interface ports and the configuration of the SCA
- used to perform complex operations e.g. SPI/I²C configuration of an ASIC or programming a Xilinx FPGA via JTAG etc with simple API calls.

HDLC Back-end
- abstraction of the back-end to be used independent of the actual SCA interface provider
  - FELIX via netID (interprocess communication)
  - SCA Simulator via function calls
  - SCA evaluation board via USB

Synchronous Service
- synchronization of multiple threads accessing the same SCA
- allows for full concurrency among SCA channels

Accompanying Demonstrators
- able to perform standalone operations like JTAG write/read or ADC monitoring
- used for debugging and diagnostic tools
- as a template of the SCAPI usage

SCA Simulator
- generates SCA traffic, simulating realistic SCA behaviour
- allows for development and testing without real hardware

PERFORMANCE AND INTEGRATION

ATLAS NSW Sector Slice

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Performance:
- ~7800 SCA requests/s
- ~35000 SCA requests/s

Constant-throughput monitoring traffic:
- (<8GHz ADC
- Refresh rate ~2GHz
- 4 OPC UA clients
- Average CPU usage 25% on a Xeon E5-1650v4

SCA OPC UA Ecosystem
Ecosystem of middleware and client infrastructure components for SCA back-end integration, designed and implemented within the quasar framework.

SCA OPC UA Server
- divides the SCA channels into device classes, corresponding to the respective hardware function
- Global Statistics: collects and measure general statistics across the setup and to expose the collected metrics to the clients
- ScaSupervisor: oversees the state of the system and provides supervisory functionality such as automatic recovery of communication loss with SCAs

SCA OPC UA Clients
- New ATLAS sub-detector NSW
- Trigger/Daq configuration clients
- Peripheral servers for calorimeter traffic
- Diagnostic clients like UaExpert
- SCADA clients (WinCC OA etc.)

SCA Software
- SCA Software Suite
- SCA Software Library
- SCA Simulator
- SCA OPC UA Server
- SCA OPC UA Client

Integration Overview of the SCA Software Suite

Hardware

Interface

Microscope Solution

Clients

Synchronous Service

ADC
SPI
I2C
CP0
JTAG
DAC

HDLC Back-end

Synchronous Service

ADC
SPI
I2C
CP0
JTAG
DAC

The software stack provides:
- concurrent usage by multiple applications
- emphasizes reliability, availability, scalability
- a high-level abstraction for all ASIC functions
- communication and design aspects of the hardware largely transparent