Review of last year's firmware developments

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MSK Firmware development team
Statistics Redmine

Redmine data: since (02.2013)

- Reported issues: 131
- Closed issues: 65
- In progress: 18

reported issues
- bugs: 30
- features: 21
- improvement: 21
- new implementations: 52
- others: 7

closed issues
- bugs: 20
- features: 8
- improvement: 10
- new implementations: 24
- others: 2
Statistics SVN

SVN data:

- 17 developers (6 with minimum of 5% of input)
- 600 commits
- Around 19000 changes committed
Main development points:

Boards in framework:
- SIS8300
- SIS8300L
- uTC v1.3
- uVM v1.2, v2.0
- DAMC - TCK7
- TMCB v1.0
- DAMC2 v1,v2
- uFMC20 rev.A
- PZ16M
- RTMs: DWC10, DWC8VM1, PZT4, AD84

Application in framework:
- LLRF slave and master controllers
- LLRF slave and master controllers for CW operation
- Single cavity controller
- Toroid detection
- DCM
- REFM
- Laser locking controller
- PIEZO controller
- Radiation monitor
- KLM
- Test application

All shares the same libraries:
PCIe with DDR DMA access, MIG (DDR) arbiter, DAQ components, LLL – optical links supervisor, generic FIFO, Internal Interface (address management), I2C controller + chips support, etc.
Main development projects:

> LLRF for FLASH installation

Most of functionality works in operation since January 2014, projects included:

- SIS8300L – field detection application for LLRF controller
- uTC v1.3 – main LLRF controller application
- uVM v1.2 – VM part of LLRF controller
- SIS8300 – toroid detection application for beam loading compensation
- PZ16M – PIEZO controller firmware

> Single cavity controller

Field detection and main LLRF controller on one board.

- SIS8300L – single cavity controller for GUN
- SIS8300L – single cavity controller for HZDR
- SIS8300L – single cavity controller for REGAE
Main development projects:

> LLRF for CW operations at CMTB
  - SIS8300, SIS8300L – field detection application for CW LLRF controller
  - uTC v1.3, TCK7, uVM2.0 – main LLRF controller application for CW operations

> Laser locking controller
  - SIS8300L – controller based on Simulink
  - uFMC20, PZT4 – PIEZO controller

> BSP for DAMC TCK7
  - Board support package with basic functionality for external company

> Test application for SIS8300L
  - Implementation of functionality for post production tests of board,

...  

In total around 20 projects in many facilities to support.
General framework improvements

➤ TCL scripting
  • Automation of generation of projects,
  • Auto versioning of firmware, repository revision of firmware and compilation timestamp visible in firmware registers,
  • Independent of platform, supported by Xilinx tools,
  • Build and map file creation automation,
  • Ready to be used on build server,

➤ Simulink integrating
  • Scripts makes possible to build application from Simulink and generate firmware for selected board (currently only SIS8300)
  • Based on TCL scripts

➤ DOXYGEN
  • Scripts in the repository allows for generation of documentation based on the code comments
Repository structure

SVN repository: main development tool

- Framework structured:
  - separation of applications, libraries, boards and modules support (FMC, RTM)

- All together is combined into the projects,

- Main development is done in branches, when done moved to the trunk.
Framework structure

project.tcl
( board name + application name + board configuration + application configuration)

ENT_TOP - top entity

PKG_BOARD
Board configuration

PKG_APPLICATION
Application configuration

ENT_BOARD_PAYLOAD

User logic

FMC,RTM module

Interfaces:
Logic, ADC,DAC, DDR, PCIe, LLL, SPI, I2C etc...

Board interface

Board.tcl

application.tcl

module.tcl
Build Server

Build server under test (currently Jenkins solution under test)

- Every project has a specified job,
- Compiles firmware on the server using scripts,
- Checks integrity of repository,
- Provides bit, map file and reports as a build output
- Automated deployment: Able to load build output to the station
- Able to run testing scripts,
- Possibility to connect Redmine issue to the build number,

Still need to write many scripts,
Current development

> General:

- PCIE update: payloads with more than 1DWORD, new DMA schemes, DMA for all memory space, AXI4 bus, and others,
- Change of Internal interface library, AXI4lite, separate read/write transactions, map file in XML format
- Build server, TCL improvements,

> Boards in framework:

- uFMC25
- uFMC20revB
- DS800

> Applications

- LLRF controller for XFELL/FLASH on TCK7 and uVM2.0
- Beam based feedback, BCM+BAM
- DCM integration,
Conclusion

> Number of issues are growing faster then we can close them,
  - Missing manpower assign only for firmware development

> Framework ready for automation,
  - Projects scripts,
  - Builds, deployment,
  - Tests of solution in progress

> Universal modules and libraries components that can be used in many projects,
Thank you for your attention