

New MCM Document

Insight in to Hardware and Software Architecture

By :

Charu Kanade

cpk@gmrt.ncra.tifr.res.in

Naresh Sisodiya

naresh@gmrt.ncra.tifr.res.in

Index

- Introduction
- New MCM Hardware Architecture
- New MCM software architecture
- Advantages of New MCM over old MCM

Introduction

New Monitoring and Controlling Module – New MCM is the general purpose card, designed using RCM4300 core module as processing unit. It has a motherboard, on which hardware for Multiplexing, Signal conditioning Digital data latching and serial communication is placed. On top of the motherboard, RCM4300 as daughter-board is placed.

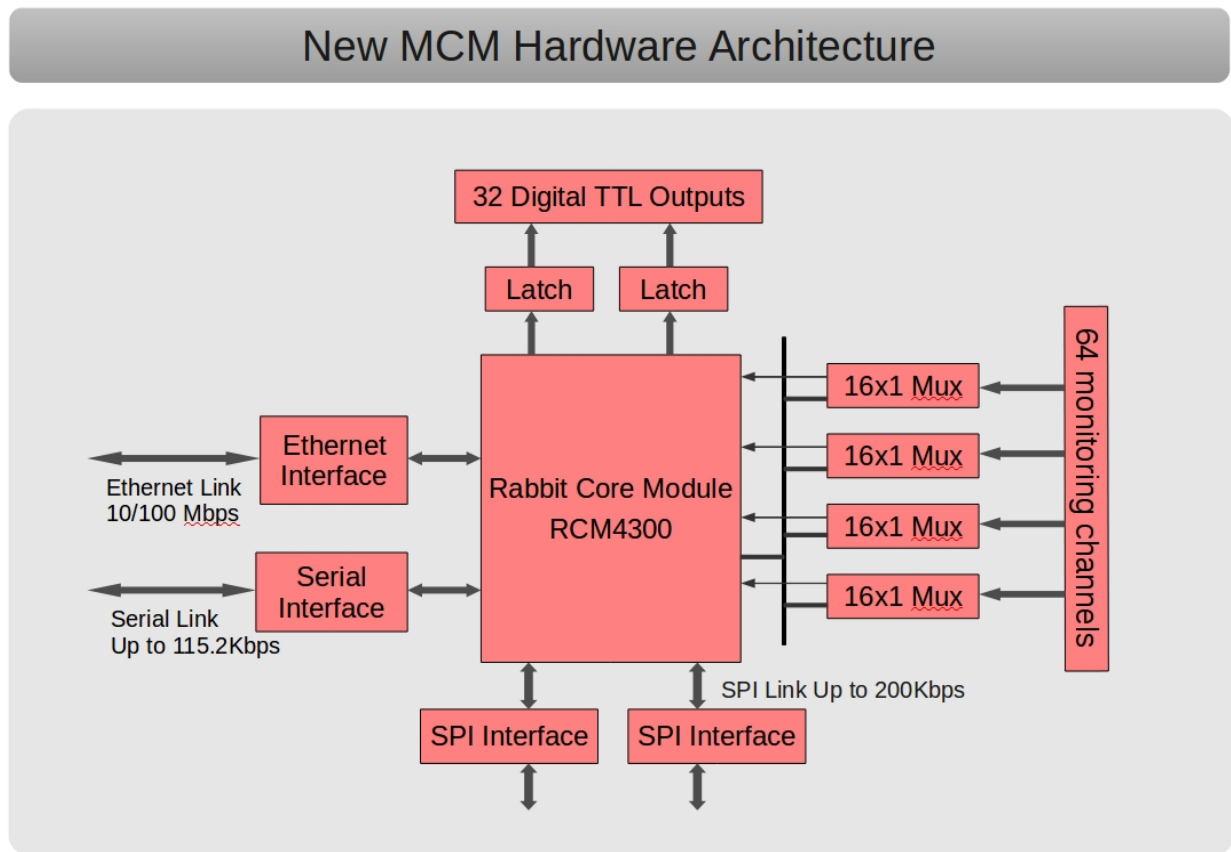
New MCM will be directly interfaced with other systems of GMRT like Front End, Fiber Optics, Analog Back End, Sentinel etc. New MCM will monitor as well as control the various parameters of such systems. It will also generate the alarm in the erroneous condition and it will take immediate precautionary action.

As compared to existing MCM, this New MCM is more powerful in terms of computing power, operating frequency, memory and the other features. Moreover it is more intelligent in terms of its software capabilities and command structure.

In this document we have explained Hardware and Software architecture of New MCM. Also comparison between New MCM and existing MCM is made to show how New MCM supersedes the existing one.

New MCM Hardware Architecture

New MCM hardware has been built around powerful rabbit core module RCM 4300, which has Rabbit-4000 processor onboard.



Above figure shows block diagram of Hardware architecture of the New MCM. Block diagram has been described below.

RCM 4300 Core Module :

The RCM4300 has a Rabbit 4000 microprocessor operating at up to 58.98 MHz, a fast program-execution SRAM, data SRAM, serial flash memory, an 8-channel A/D converter, two clocks (main oscillator and timekeeping), and the circuitry necessary for reset and management of battery backup of the Rabbit 4000's internal real-time clock and 512K of static RAM.

One 50-pin header brings out the Rabbit 4000 I/O bus lines, parallel ports, A/D converter channels, and serial ports.

The RCM4300's mass-storage capabilities make them suited to running the optional Dynamic C FAT file system module where data are stored and handled using the same directory file structure commonly used on PCs. A removable *microSD™ Card* can be hot swapped to transfer data quickly and easily using a standardized file system.

Analog Multiplexer :

The 64 input monitoring signals are handled by FOUR, 16 to 1 Analog multiplexers. Outputs of the FOUR multiplexer are connected to four input pins of 8 channel ADC .

Level Shifter Circuit :

The input voltage range of ADC used on RCM 4300 is from 0 V to +2V. The Level shifter circuit maps input signal voltage range of +/- 5 V to 0 to 2 V.

32 bit Output Port :

The 32 output lines of Output Port are TTL compatible for interacting with GMRT subsystems. All output lines are latched before appearing on output Connector.

Ethernet Interface :

New MCM has got an integrated 10/100 Based-T Ethernet Port.

Serial Interface :

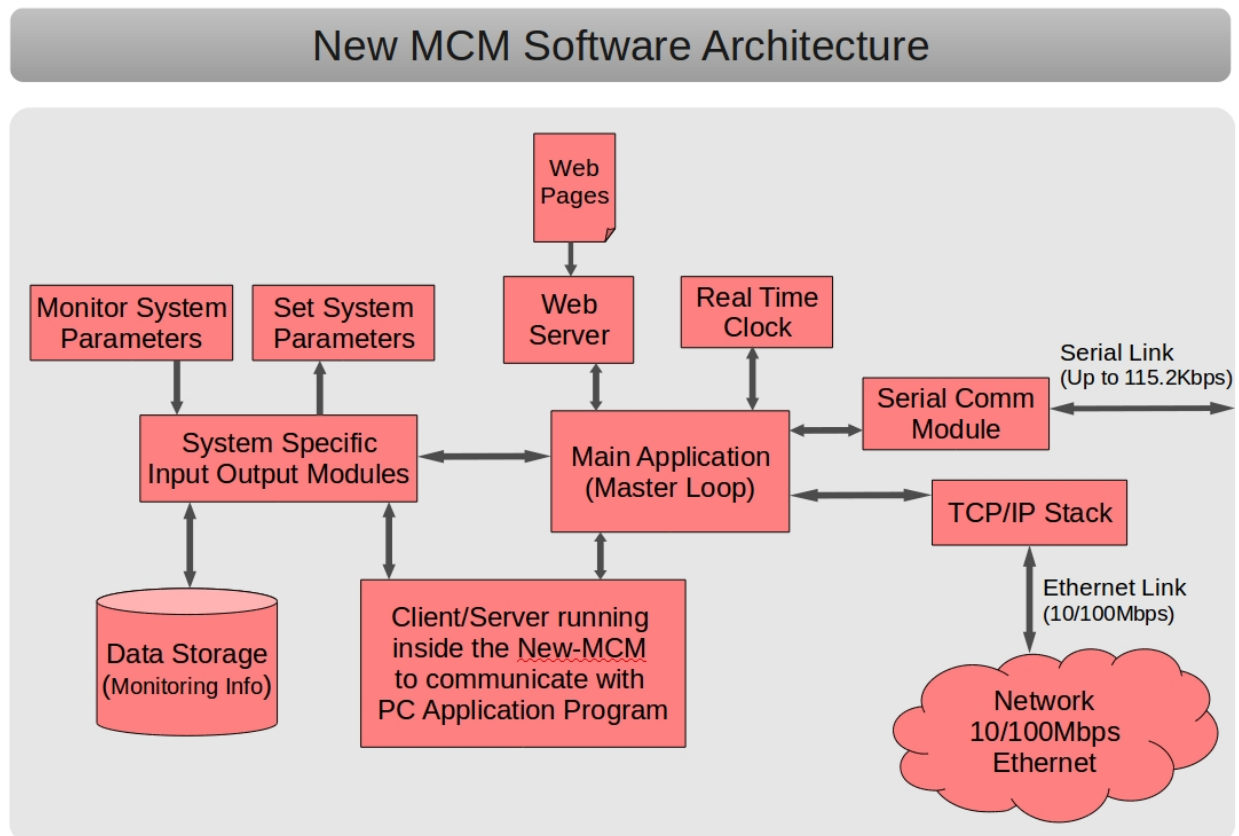
To support existing GMRT subsystems the Serial Interface at baud rate of 9600 bps. It supports RS485 in Half Duplex, multi-drop mode, differential transmission line.

SPI Bus :

The New MCM card supports SPI Bus to interface with FSW based new LO system. The SPI Bus speed is 200 Kbps. Two SPI ports are provided on the MCM card.

New MCM Software Architecture

New MCM software has been developed from the scratch using dynamic C, which supports co-operative multitasking. It uses the infinite while loop approach instead of using the OS. Moreover, the New MCM software has been designed carefully, so it can include all necessary features and exhibit good performance.



Software architecture of New MCM supports the Communication over the Ethernet as well as Serial link, 64 channel monitoring, 32 bit controlling, upto 1Gb data storage using FAT-16 file system. Furthermore, it will have Real Time Clock and Web server running inside.

- Main Application or Master loop takes care of entire new MCM software, it handles all the parallel tasks to be done by New MCM, like to establish connection with remote device, listen for command over either Ethernet or serial link, to do background monitoring, to serve web pages etc.
- Client/Server running inside new MCM establishes socket connection with Server/Client running on remote PC on particular port address.

- System specific input/output modules looks at received command, It looks for the
 - System name like ; IF, LO, FE, Sentinel etc.
 - Operation to be performed like ; Set, Monitor Raw data/Summery
 - Parameters to be set like ; Attenuation, Bandwidth, LO frequency, Filter selection etc
 - Arguments to the parameters
- Monitoring system parameters actually performs the monitoring task by running the ADC operations. First raw data is generated by scanning all 64 monitoring channels. Then summery is prepared based on gathered raw data. Raw count 0 is generated for +5V, 1000 for 0V and 2000 for -5V.
- Set system parameters generates 32 bit patterns for setting the system specific parameters. Unlike old MCM, New MCM has inbuilt logic that reads the intelligent command and internally generates 32 bit pattern rather then receiving it from higher level application.
- Data storage modules stores monitoring data as well as keeps the log of command received and executed by MCM. FAT 16 file-system is used to manage stored data in directories and files.
- Web Server serves the web pages which is used either to get any local monitoring information or to do local testing or system debugging.
- RTC module reads as well as sets real time clock of New MCM. RTC is used for synchronizing MCM with higher level application.
- TCP/IP stack is provided by Dynamic C. New MCM software calls library function of the TCP/IP stack for establishing socket communication between the New MCM and the higher level application at 10/100 Mbps Ethernet link.
- Serial communication Module is used to do communication over serial link at 9600bps. It supports communication of New MCM with existing system over RS-485 serial communication link.

Moreover, Command structure for communication between MCM and higher level application is designed intelligently so that it can carry all the necessary information in one go and with minimum command length. Command are pure ASCII characters bound in command structure.

Advantages of New MCM over existing MCM

	New MCM	Existing MCM
<i>Processor</i>	Rabbit 4000	8051 based 80535
<i>Operating Frequency</i>	60MHz	3.6MHz
<i>Memory</i>	SRAM : 1Mb (512+512) Flash : 1Mb MicroSD : up to 1Gb	RAM : 256 bytes ROM : 64 Kb
<i>ADC</i>	11 bits; 8 channels	8 bits; 8 channels
<i>Real Time Clock</i>	Yes	No
<i>Battery Back-up</i>	Yes – 3.3V onboard battery	No
<i>Monitoring Channels</i>	64	64
<i>Control Bits</i>	32	16
<i>Communication Channels</i>	Serial (RS485) @ 9.8Kbps Ethernet @ 10/100Mbps 2 SPI ports	Serial (RS485) @ 9.8Kbps
<i>Programming Method</i>	Serial programming	EPROM burning
<i>Programming Language</i>	Dynamic C	Assembly
<i>Command Structure</i>	ASCII based	Protocol based
<i>MCM Address setting</i>	Hardware + Software IP based	Hardware only
<i>Access from Online Application</i>	Direct or via ABC	Via ABC only
<i>Configurable for RFI reduction</i>	Yes – using Spectrum spreader, Clock divider	No