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Internal Technical Report
On

Various approaches of ABCCOM PC / PIU
For new Online system

By

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Introduction

While discussing the In-house development of the control and monitor system, which the team has currently named : ONLINEv2, several topics of relevance are discussed and extensive brainstorming done. It was realized that the relevance of the ABC in the upgraded system which has (1) more powerful MCM cards (2) an Ethernet connection to each antenna (3) a more powerful servo computer - was not clear. Although this was realized earlier, no detailed study was available. Hence this study was undertaken and is presented as a note to the wider group.

For information, we also note that the new MCM is more powerful than the existing ABC in terms of internal memory space, programming and speed whereas Ethernet allows almost instantaneous communication. ABC was very important in the existing system due to serial communication and would have played a crucial role if the upgraded system was using serial communication.

The group examined three options namely - (1) PC as ABC (2) Dedicated embedded board as ABC and (3) No ABC. The role played by the ABC in the current system was examined and then the tasks which it will need to play in the upgraded system was examined. This note outlines the reasoning and concludes that with the upgraded system, there is no clear role of an ABC and hence removing it will reduce the RFI footprint.

This internal technical report discusses the role of ABCCOM PIU/PC and ABCCOM Software in the design of new Online System.

The three possibilities discussed below are as follows:

- Using PC (Miltec Make) as an ABCCOM PC.
- Using dedicated an Embedded board as ABCCOM PC.
- Removing the ABC in the new ONLINE system.

The Hardware requirement for above mentioned possibilities are as follows :

- Digital Optical Fiber link is required between CEB and all Antennas.
- An L2 network switch, with proper RFI Shield, is required at antenna base.
- An L3 network switch is required at central electronics building for implementing virtual LAN per antenna.
- IP enable devices like new MCM cards, PC104 cards and VoIP phone etc.
- A PC (Miltec make) with proper RFI shielding may be required at antenna base.

Before going on to discuss this point further, let's see what the role of the ABCCOM PIU/PC and ABCCOM software plays in the existing online system.

Role of existing ABCCOM

- ABCCOM has unique ID for to and fro communication with the Online System.

- Do FSK Modulation and demodulation of data.

- Form data frame to be sending back to COMH-Online Software.
  - 128 bit, multiplexed data frame.
  - Data bit sequencer and bit decoder.
  - Provides Sync pattern bits for start of Data frame.

- Talk to Servo System over serial line.

  ABC - SERVO RS422 communication link @ 9.6 Kbps. Calculate the Azimuth and Elevation co-ordinates and sent to Servo system after every 30 seconds with time information. In case of emergency like fiber link is cut, High wind, hitting Hardware limit switch and Software limit servo system takes care of driving antenna to safe position.

  All the commands to servo system and its responses pass through ABCCOM to Online system but ABCCOM do not take any decision. The ABCCOM PIU/PC and ABCCOM software code just act as conduit to facilitate communication.

- Talk to MCM 0,2,3,5,10,14 over serial line.
  - ABC - MCM RS485, multi-drop point, communication link @ 9.6 Kbps.

- Provides reset to ABCCOM and MCM cards.

    - Manual Reset.
    - Software reset through MCM 0.

- Supports voice communication.

    - Check the Telephone Hook Status.
    - Decode Dial pulses.
    - Hoots the Buzzer.

- Up converting Return Link telemetry signal to 205 MHz.

The IP enabled MCM card, IP Phone, Intelligent Network switch with digital OF link makes above listed ABCCOM PIU/PC tasks redundant. The Intelligent (a layer 3) switch can be used as gateway and router in all 3 cases.

Enhanced functionalities of New MCM

- The MCM card CPU works at 60 MHz Clock frequency.
- The MCM card has a 10/100 Base-T Ethernet port.
- A Serial RS485 and SPI interface is provided.
- 1 GB memory card for data storage.
- The MCM can monitor up to 64 analog/digital input voltages in the range of +/- 5 V.
- The MCM has 32 bit control port to send command to sub system.
- High level language is used for programming MCM card.

  - TCP/IP stack is provided by Dynamic C. New MCM software calls library functions of the TCP/IP stack for establishing socket communication between the New MCM and the higher level application at 10/100 Mbps Ethernet link.
  - New MCM supports HTTP protocol so we can run web server on it.
  - FAT 16 file system is used to manage stored data in directories and files.
  - Math library is provided with Basic floating point functions and Derivative floating point functions.

- MCM can understand ASCII based commands.

If necessary, new MCM card can calculates the Azimuth and Elevation Co-ordinates and send to Servo system with time information after very 30 seconds as a backup plan. The MCM card can not be used as Gateway/Router.

Now, let's discuss Pros and Cons of these three schemes.

Approach – 1 : The PC (Miltec Make) as ABCCOM PC

The Miltec PC on Linux platform will act as ABCCOM to communicate with antenna subsystems.

Pros:

- A Local Data Storage.
- Local Test setup for New MCM Cards at antenna shell.
- Gateway/Router for IP enabled devices like MCM cards, IP Phone.
- Can calculate the Azimuth and Elevation co-ordinates and sent to Servo system after every 30 seconds with time information
- Interact with Online system and Servo System for passing data from one end to other.

Cons:

- Need to have piece of software running on the ABCCOM PC which will mainly pass the data to Online and MCM cards and vice versa.
- The cost of ABCCOM PC is high (Miltec make PC ~1.2Lacs).
- The PC maintenance will require time and manpower.
- The periodic RFI measurements need to do to keep check on the radiation level.

Approach – 2 : An Embedded card as ABCCOM PC.

The Embedded card like PandaBoard and BeagleBoard works on Linux platform could be used as ABCCOM PC. The monitor, keyboard and mouse can be connected to this board, if necessary.

Pros:

- A Local Data Storage.
- Local Test setup for New MCM Cards at antenna shell.
- Gateway/Router for IP enabled devices like MCM cards, IP Phone.
- Can calculate the Azimuth and Elevation co-ordinates and sent to Servo system after every 30 seconds with time information
- Interact with Online system and Servo System for passing data from one end to other
- The cost of the embedded board is ~15K which is cheaper than Miltec PC.

Cons:

- The Hardware cost is involved in embedded board.
- RFI Shielded box is required for the Embedded card.
- The periodic RFI measurements need to do to keep check on the radiation level.
- We will have to implement ABCCOM software tailored for particular Embedded board.

Approach – 3 : No ABCCOM PIU/PC

The new Online System and new MCM card will take care of role played by ABCCOM PIU/PC and ABCCOM software. The IP enabled MCM cards and PC104 cards will handle, to and fro data communication with Online System. The ABCCOM software calculates the Azimuth and Elevation Co-ordinates and sends to Servo system with time information after very 30 seconds. This job can be done by new Online software. The new Servo system will take care of parking antenna to safe position in cases like Fiber link cut, High wind etc. If necessary, new MCM card can calculate the Azimuth and Elevation Co-ordinates and send to Servo system with time information after every 30 seconds as a backup plan.

Pros :
- An Intelligent (a layer 3) manageable Network switch will act as Gateway/Router for implementing virtual LAN for antenna.
- At antenna shell an L2 switch for connecting IP enabled devices like MCM cards, PC104 card and IP Phone. However There is no need of PC as gateway at antenna shell.
- If necessary, new MCM card can calculate the Azimuth and Elevation Co-ordinates and send to Servo system with time information after very 30 seconds as a backup plan.
- A laptop, during maintenance, can be used for local data storage and testing.
- No need of PC and RFI shielded box. This could be cost effective.

Cons :
- Can not log the data for long duration without laptop.
- A laptop with all necessary test software will used for testing MCM cards.
- Laptops will be required for testing and maintenance of MCM cards.
- Difficult for Online-V2 to talk with existing MCM over serial line.

Conclusion

There is no need of ABCCOM PIU / PC and ABCCOM software running on PC at antenna site.

The benefits of above scheme can summarize as follows:

- Basically, duplication of code is avoided in this scheme.
- There is more benefit in terms of Lower RFI at antenna site.
- Lowers Hardware cost. Each Miltec PC cost is around INR ONE lacs. The cost saved is around INR 35 lacs for 35 such PCs.
- The PC maintenance, RFI measurement is not needed.
- New Online System can calculate Azimuth and Elevation Co-ordinates and send to Servo system with time information after very 30 seconds
- If necessary, new MCM can do step no. 5 as a back up plan.

Block diagram of proposed online system without ABCCOM hardware
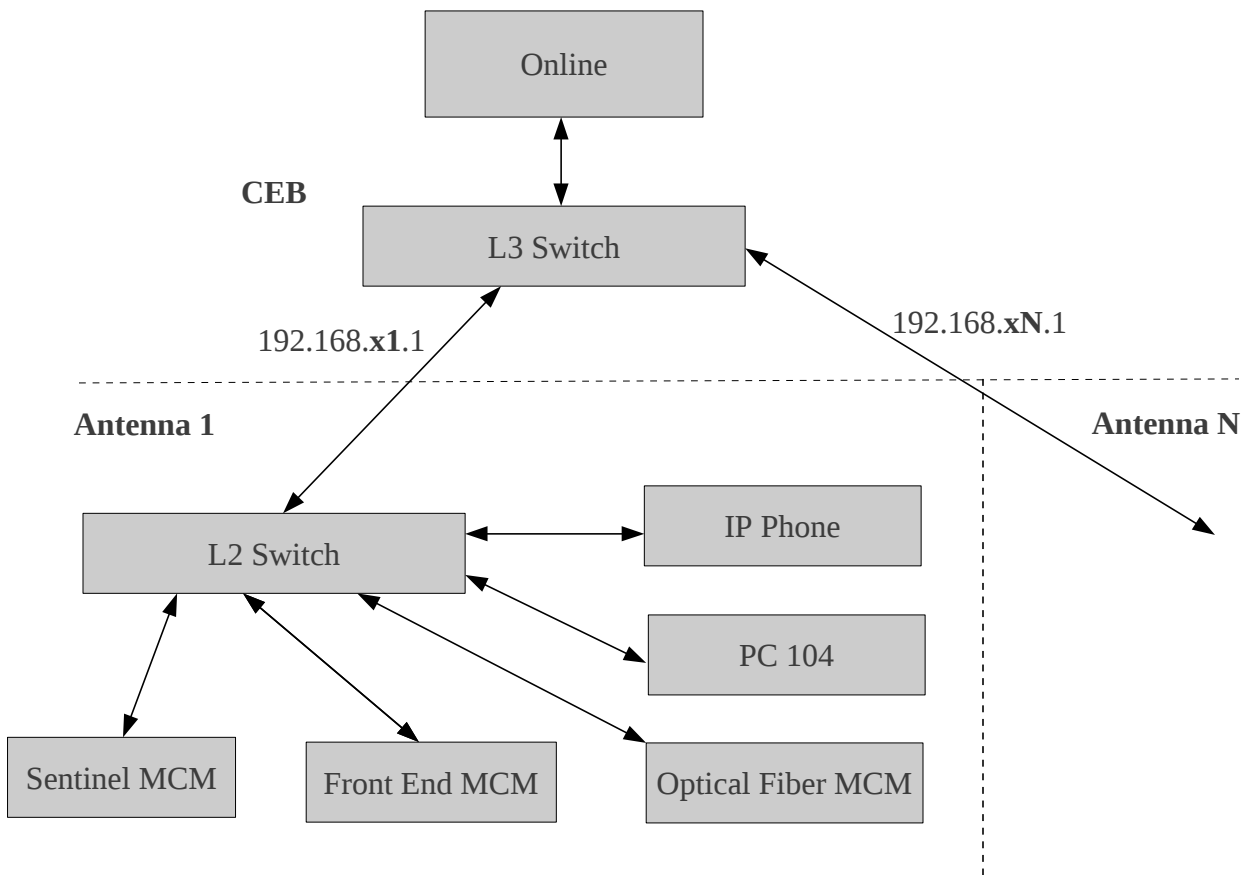
Future Work

We will circulate this report to other members for their opinions and to discuss it in a wider forum and arrive at a decision regarding the best possible model for GMRT'.

Acknowledgement