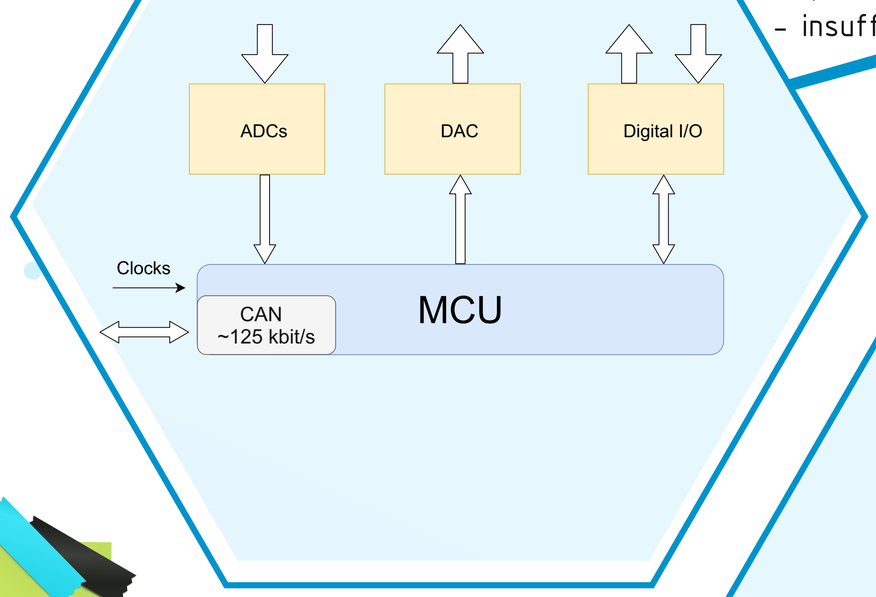
Pavel Cheblakov, Aleksey Gerasev, Sergey Karnaev, Dmitriy Senkov*
Budker Institute of Nuclear Physics, Novosibirsk, Russia

POWER SUPPLY CONTROLLER FOR FUTURE ACCELERATOR FACILITIES AT BINP

** P.B.Cheblakov@inp.nsk.su*

A design of a new power supply controller was initiated in BINP for upgrade of existing accelerator facilities and for demands of future projects. Any accelerator facility includes a set of diverse power supplies which controllers have different specifications: number and precision of DAC/ADC channels, speed and algorithm of operation. Therefore, the main idea is to elaborate a controller which consists of common digital part including an interface with a control system and specialized analog frontend that fits to power supplies requirements. The digital part provides easy integration to control system by means of some standard network protocol and performing some data processing and analysis. Ethernet is used for communication with controllers, MQTT is under consideration as a high level transport protocol in some cases and EPICS IOC was tested to be embedded into controller.

Old-fashioned

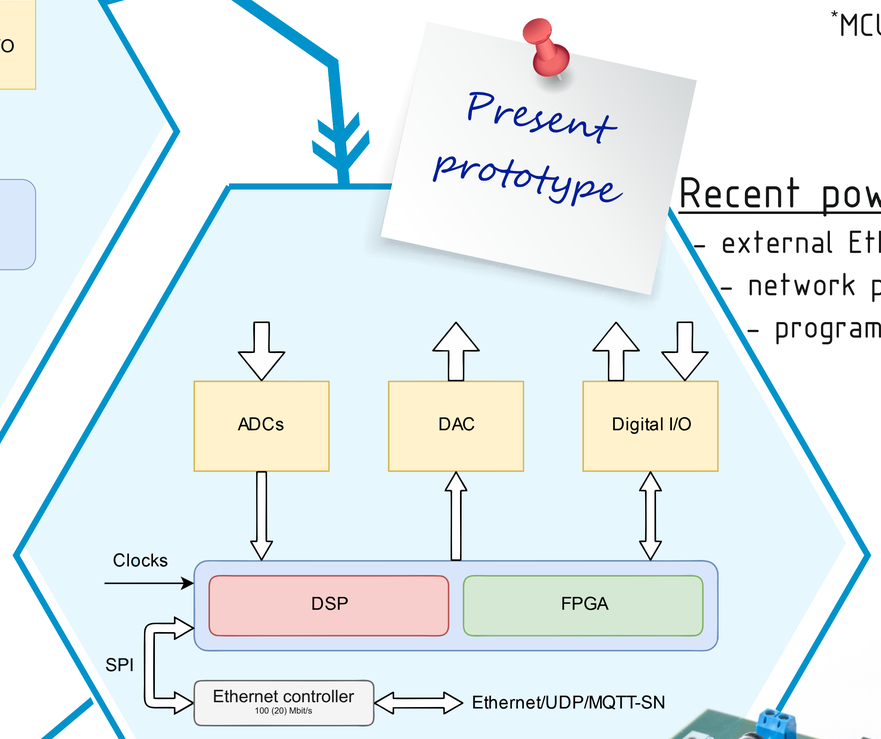


Presently used MCU*-based approach at BINP

- CAN – low network bandwidth – typical for long lines 125 kbit/s
- network debugging is complicated
- quite primitive network protocol with small payload (8 byte)
- insufficient MCU performance for data processing and analysis

*MCU – Microcontroller Unit

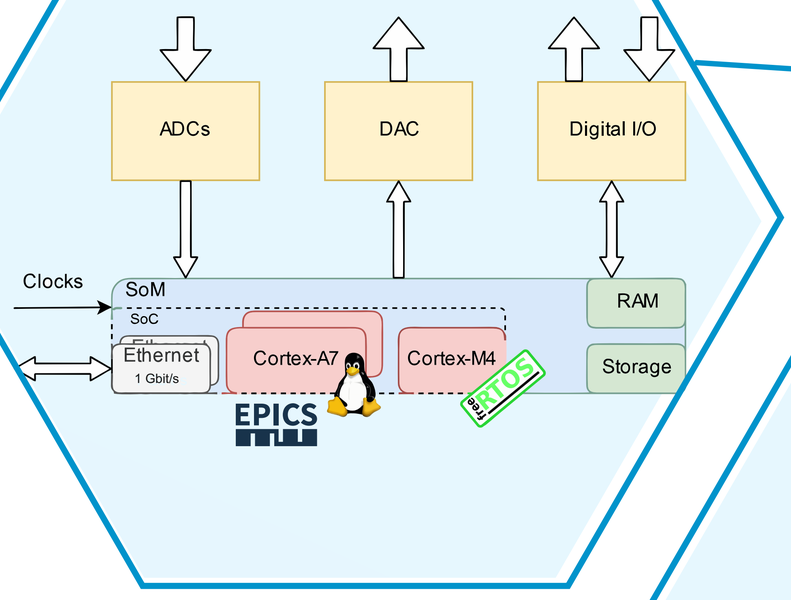
Present prototype



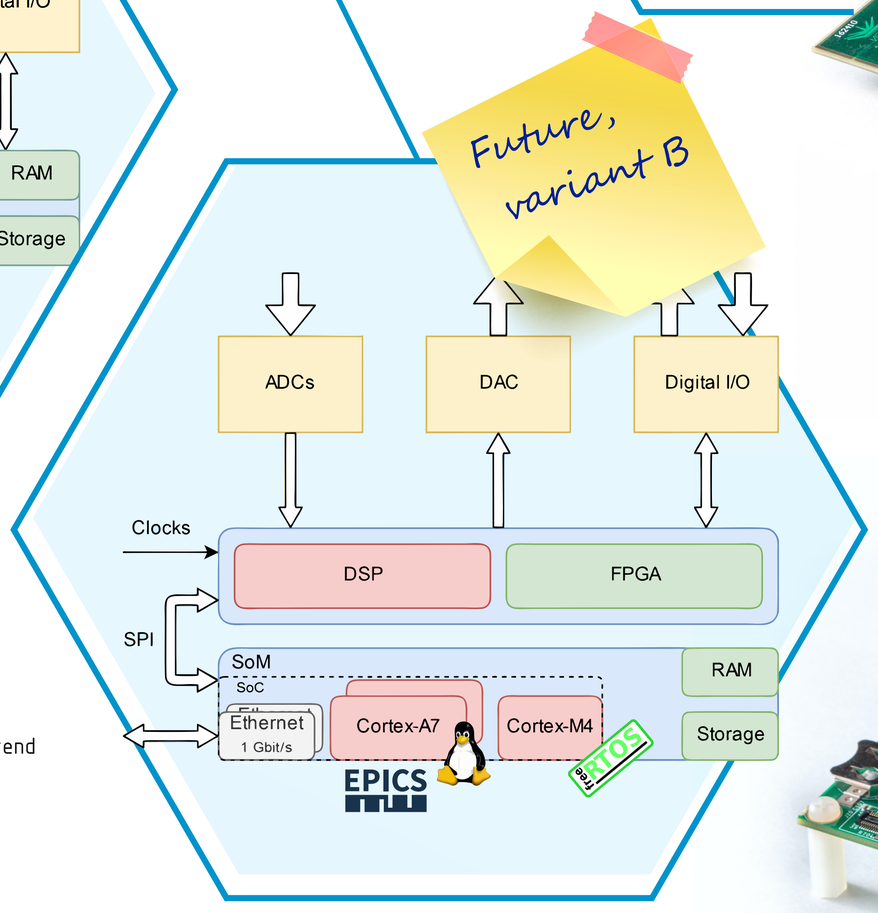
Recent power supply controllers design

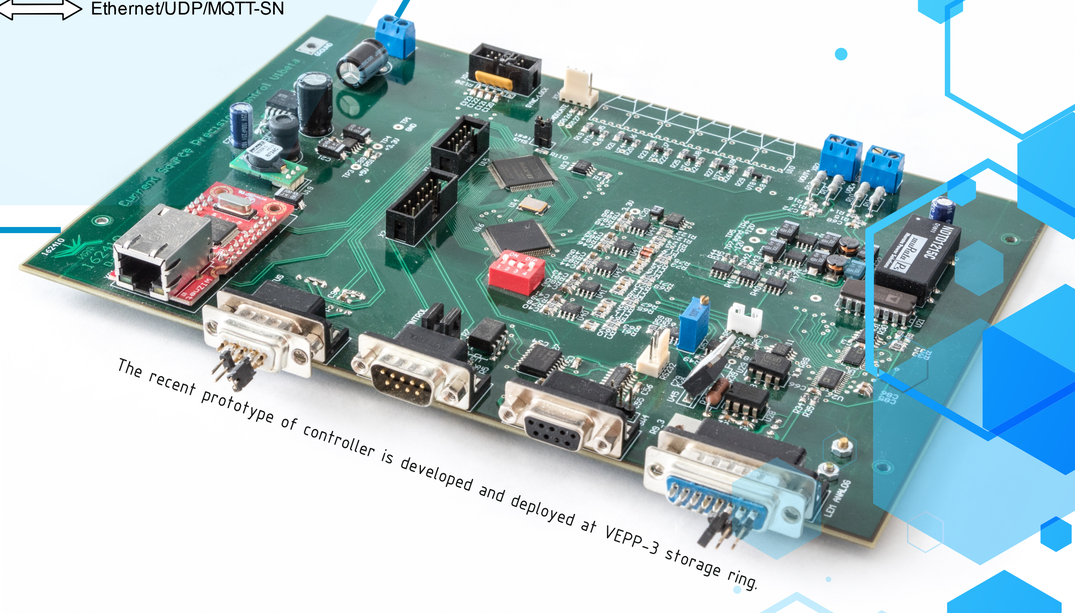
- external Ethernet controller has a low performance
- network protocols and software are limited by MCU
- programming is quite complex

Future, variant A



Future, variant B

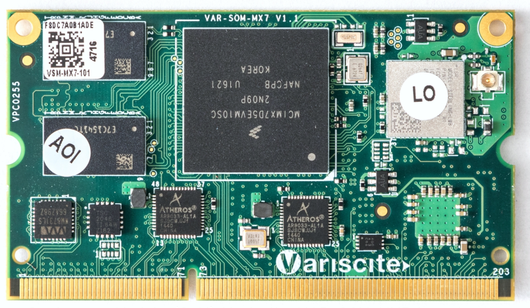




The recent prototype of controller is developed and deployed at VEPP-3 storage ring.

New approach for power supply controllers design

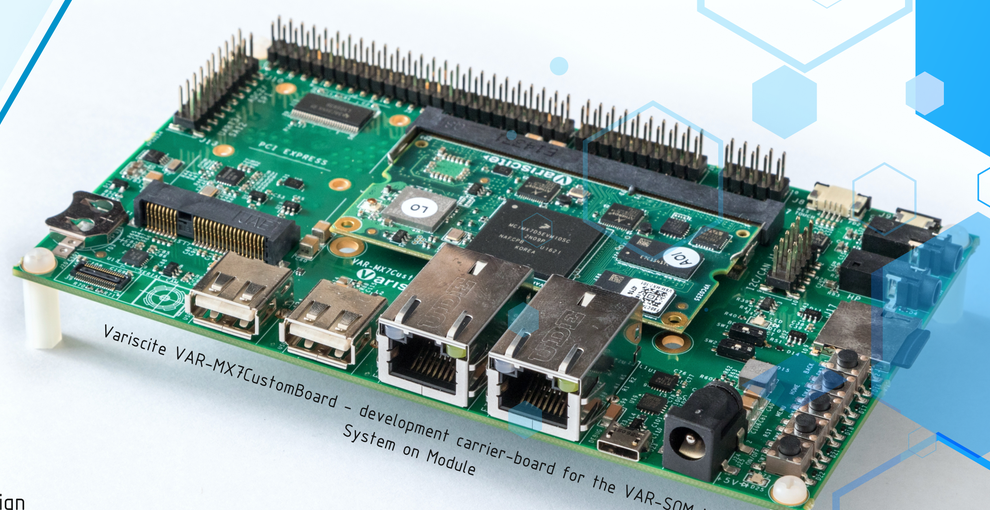
- System on Module (SoM) incorporates Arm Cortex-A7 cores and Arm Cortex-M4 core
- SoM provides 1 Gbit/s Ethernet controller (up to 2x)
- Linux operates on Cortex-A7, while Cortex-M4 can be used for real-time applications
- Linux provides high quality TCP/IP stack
- control system frameworks like EPICS run on Linux
- Cortex-M4 provides communication with analog and digital frontend
- SoM hides a high degree of development complexity



System on Module (SoM) Variscite VAR-SOM-MX7 based on NXP/Freescale's i.MX7

Evolutionary approach

- SoM may be integrated with present or legacy design
- this approach integrates additional processors (e. g. DSP) with SoM for special requirements
- SoM provides a lot of additional functionality for legacy design



Variscite VAR-MX7CustomBoard – development carrier-board for the VAR-SOM-MX7 System on Module