ELMA Crates

Specification

Access to board data using SNMP and I2C

ELMA
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Introduction

The ELMA crates are called to replace some old VME crates and to be used in new installations at CERN facilities. Taking into account that most of CERN facilities (accelerators, laboratories, test beds...) are critical, it is needed to have a good system monitor that allows to trace all the possible errors and a control of all the setups present in the installed crates.

For that purpose, ELMA crates have a board called Sysmon that monitors the internal parameters of a System Platform such as voltages, currents, temperatures and fan speeds. Sysmon is compliant to IPMI 2.0. The measured values are retrievable at any time via the RS232 serial interface and via Telnet over the provided Ethernet network interface.

SNMP is a Internet-standard protocol for managing devices on IP networks. It is widely used for networking devices (routers, switches) and for servers and other devices as well.

The main idea of this specification is to indicate the needed requirements to integrate the SNMP protocol on the ELMA crates' monitoring board.

Specification

SNMP

The Sysmon firmware should be SNMP compliant and export the specified data over this protocol. The version of the SNMP protocol implemented should be the latest at the writing of this document (SNMP v3 at that moment). It might be necessary in the future to implement older versions of the protocol.

The data to export will be a block of memory that contains 1024 registers of four bytes width for each VME slot.

The data will be always accessed with read and write rights.

The data will be the following:

- Block of memory that could indicate the internal state of the VME board or additional generic data read from the VME board.
- These data should be presented in raw with no consideration of format or type of data.
- The specific I2C location of each board is defined later on this document.
- Each register should be exported to SNMP with a generic name “slotX_itemN” and size of 4 bytes. Meaning the “X” the VME slot number and “N” the item number.

- Inside of the VME boards the available data is four bytes wide, so the firmware implementation should do an I/O operation to read/write the content of the 4-byte register exported on SNMP. See later on this document how to do it.
- The order will be little endian, i.e, the first byte read will be at the LSB part, the second after it and so on, until the fourth one will be saved in the MSB part of the 32-bit register.

slotX_item0
slotX_item1
slotX_item2
...
slotX_itemN

Table 1: Block memory schema for each slot.

I2C

The Sysmon firmware should provide generic access using I2C protocol over the corresponding VME lines. This feature should provide a command-line program to allow the engineer to read (write) values from (to) the plugged boards.

In case of exported SNMP data, the data should be retrieved/written using I2C protocol from the provided locations of the plugged VME boards using the following schema:

- The I2C address (7 bits) is calculated as 10xxxxx, where "x" is the value of the VME64x geographical addressing pins (GA-4... GA-0) for the corresponding slot.
- Read (write) one byte of data from (to) the board. There will be 4096 (2^{12}) registers of 1 byte length inside of the block of memory, i.e, the internal addresses will have 12 bits.
- To create the exported SNMP register (slotX_itemN) of 4 bytes length, it will be needed to read/write the corresponding data of the VME board over I2C.

See Table 2 for the calculated values.

VME slot	I2C address
1	0x5E
2	0x5D
3	0x5C
4	0x5B
5	0x5A
6	0x59
7	0x58
8	0x57
9	0x56
10	0x55
11	0x54
12	0x53
13	0x52
14	0x51
15	0x50
16	0x4F
17	0x4E
18	0x4D
19	0x4C
20	0x4B
21	0x4A

Table 2: I2C addressing

The implementation of the I2C protocol write operation in the firmware should be able to send two address bytes for addressing the internal memory of the I2C slave and four byte of data, following this schema:

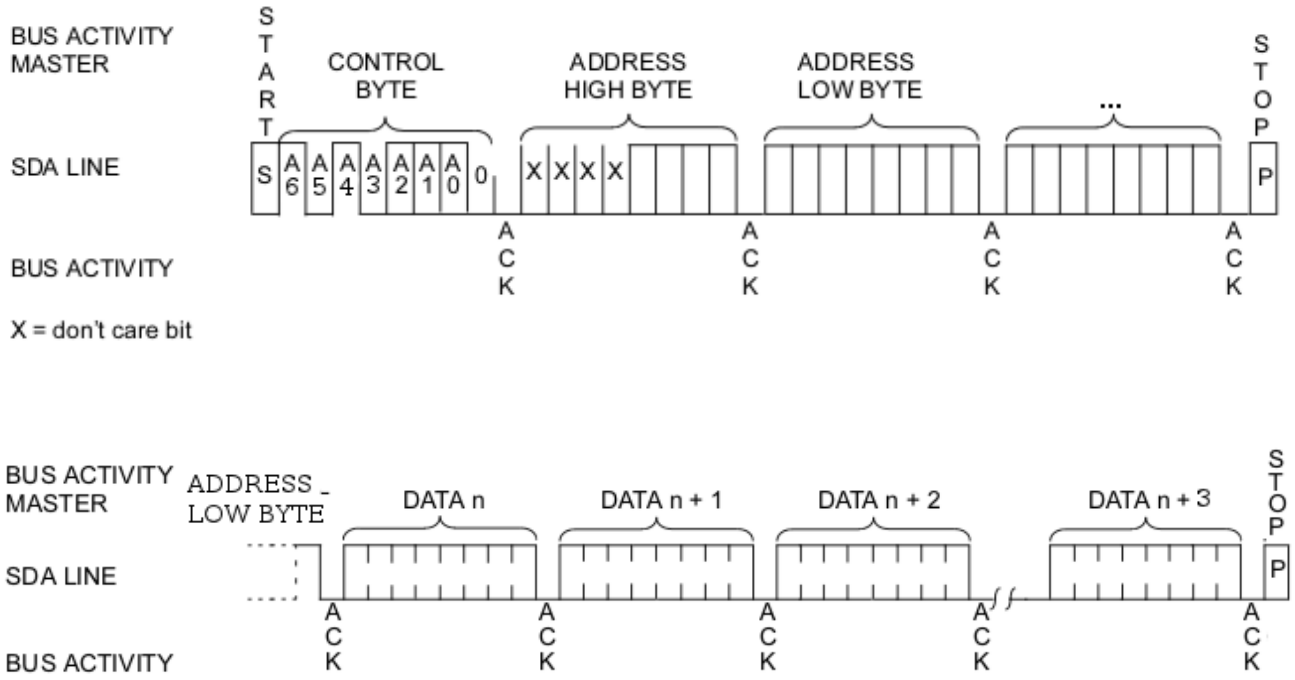

Image 1: Write operation over I2C.

In case of the read operation, the protocol will be the following:

The I2C master will do a write operation over I2C indicating only the internal address. Then the I2C slave, i.e. the corresponding VME board, will prepare the data for the next read operation.

After the write operation, the I2C master will execute a read operation over I2C protocol and it will read 4 bytes consecutively, as Image 2 indicates.

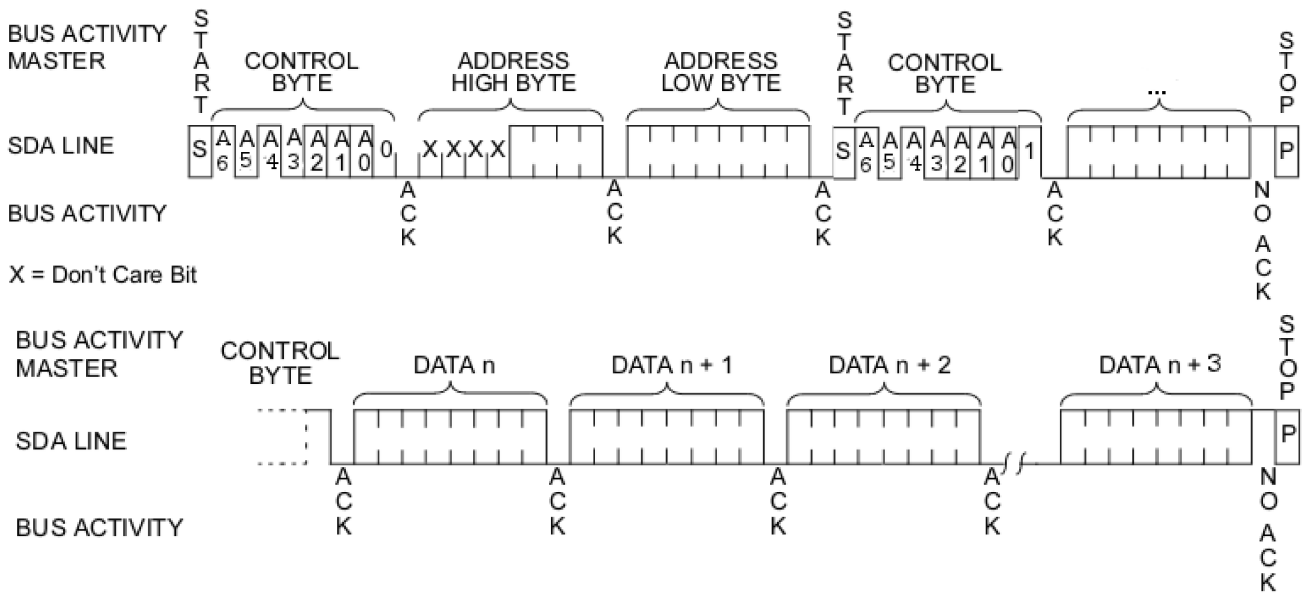

Image 2: Read operation over I2C.

Other considerations

The Sysmon FW should be designed in mind to allow to add new data registers to export over SNMP. The process to add new items should be easy to spot in the source code because these requirements could be modified in the future.

Following the Open Software and Open Hardware practices, all the source code, documents and files needed to build the firmware should be provided to CERN.