Generally Interesting Data

Common data area

Thu, Apr 3, 2008

"Generally Interesting Data" refers to the contents of a 32-byte area of memory that exists in all front ends based at 0x000660. Its purpose is to hold data that all nodes should have, which they usually get updated via a multicast setting message. This note describes how some fields in this area are used.

GID layout

The current layout of fields in the 32-byte GID area is as follows:

Field	*Offset*	*Size*	*Meaning*
MDYHM	0	6	historic setting of time-of-day, *n.u.*
CYCLES02	6	2	#cycles since clock event 0x02
CYCNEW	8	4	global cycle counter, (low, high) word order
–	12	4	*n.u.*
GMT0CR	16	8	GMT time-of-day, in seconds, microseconds
–	24	8	*n.u.*

The first 6 bytes of the GID area are historic. But as the target of a setting, the first 5 bytes are interpreted as a BCD format date and time as MoDaYrHrMn, passed to the DaTime task via the page application display, just as if a user typed in a date and time on the top line. (If one types in such a date and time today, this particular setting method is not used.) The code in SETGID (in SetType) should be changed to remove this unneeded setting logic.

The 16-bit word at offset 6 holds the number of 15 Hz cycles since the last clock event 0x02, an event that occurs every 5 seconds driven by an accurate crystal. It is not synchronized to accelerator 15 Hz. This is needed for support of the Fast Time Plot protocol, which is handled by the FTPM local application. This word is both updated and used by FTPM. One can see it counting from 0x0000 to 0x004B.

Time-of-day

Node0616 runs the local application called TIME, which obtains the time-of-day from a network time protocol server every minute, forwarding this time to all nodes via node09F9. The memory-based setting of 8 bytes targets address 0x000788, where this time-of-day is maintained in each front end. It is an 8-byte setting, with the time given in BCD in the format Yr-Mo-Da-Hr-Mn-Sc-Cy-ms. In between 60 second updates, it updates this time every 15 Hz cycle. The last two bytes are the cycle# (00–14) in BCD followed by the time since the start of the cycle in binary half-millisecond units. For a 15 Hz front end, this time ranges from 0x00-0x86. This last byte is used for nodes that do not run at 15 Hz, such as a node that is missing a Tevatron clock signal and therefore runs at an asynchronous 12.5 Hz. In all cases, the cycle number in BCD is maintained in units of 15 Hz. A node running at 10 Hz, then, will find that the Cy value increments by 2 on some successive cycles. For nodes running at 15 Hz, the ms byte does not change; otherwise, it accumulates the time in half millisecond units, carrying into the Cy value when it exceeds 0x85-0x86.

Global cycle counter

At offset 8 are two words, which together form the globally-known 32-bit cycle counter, which is received by node06C3, which runs ACLK to listen to the Acnet ethernet multicast event message. This node sends it out as a multicast setting to node09F9 every 17 seconds, so that all front ends receive it. (Note that the word order is low order word first.) In between updates, of course, an internal copy of the low order word (CYCNUM at 0x0006A6) is

updated each cycle, with any carry propagated to the high word word at GID offset 10. The low order word (CYCNUM) is used for various schemes of returning time-stamped data, including CYCLE data (listypes 88, 89) or 7.5 Hz data via RETDAT. (The latter supports return of a structure that includes the cycle counter plus two cycles of 15 Hz data.) The entire 32-bit cycle counter is used in the reply header needed for the GETS32 protocol cycle timestamp. (Note that there is a separate internal 32-bit cycle counter global (CYCLECNT) that is incremented every cycle to measure the "age" of a node since reboot, which is likely to be different for each node.)

Note that the above scheme of distributing the global cycle counter across all front ends requires that only one node listen to the 15 Hz Acnet event message that is sent out soon after event 0x0F, which occurs about 50 ms after Booster reset event time. The cycle counter in the header of this message is seen by one node and multicast to all other nodes every 256 cycles, or about 17 seconds. Every front end has clock event decoding hardware that is used to know about the occurrence of clock events. The multicast event message arrives too late in each 15 Hz cycle to be useful for a front end.

At offset 16 is an 8-byte buffer that receives the GMT time from the same node that runs the TIME LA to deliver the time-of-day every 17 seconds. The GMT format consists of two 32-bit values. The first is the number of seconds since the start of the year 1900. (At this moment, its value is 0xCB9E5B3C.) The second 32-bit value is the number of microseconds since the start of the current second, ranging from 0–999999. The particular instant of time denoted by the GMT format is the time of the most recent 15 Hz clock event 0x0C, which occurs every accelerator cycle at Booster reset event time.

In between 17 second intervals, the GMT0C copy, immediately following the GID area at 0x000680, is updated every cycle, based upon a calibrated crystal reference. The calibration monitors the 0x8F clock event, occurring every exact calendar second, against its own internal μs counter. This permits calculating a correction factor to apply to its own crystal frequency, so that these updates are accurate until the next 17 second multicast update.

Several notes cover related subjects. For more details, see

FTPMAN Timestamps	Nov 11, 1991
Network Time Protocol Client	Apr 21, 1994
DST Adjustment	Mar 31, 2000
Beam-correlated Data Acq	May 19, 2000
SSDN Nuances	May 30, 2000
Calendar Time	Apr 23, 2002
Daylight Savings Time	Apr 25, 2002
BLM Correlated Data	Nov 1, 2002
Clock Event Handling	Jun 21, 2003
Correlated 15 Hz Data	Nov 8, 2004
Recent 15 Hz Samples	Nov 16, 2004
GETS32 Protocol Notes	Oct 25, 2006
GETS32 Protocol Support	Oct 30, 2006
GETS32 Time Stamps	Aug 8, 2007
RETDAT-GETS32 Data Options	Mar 14, 2008