

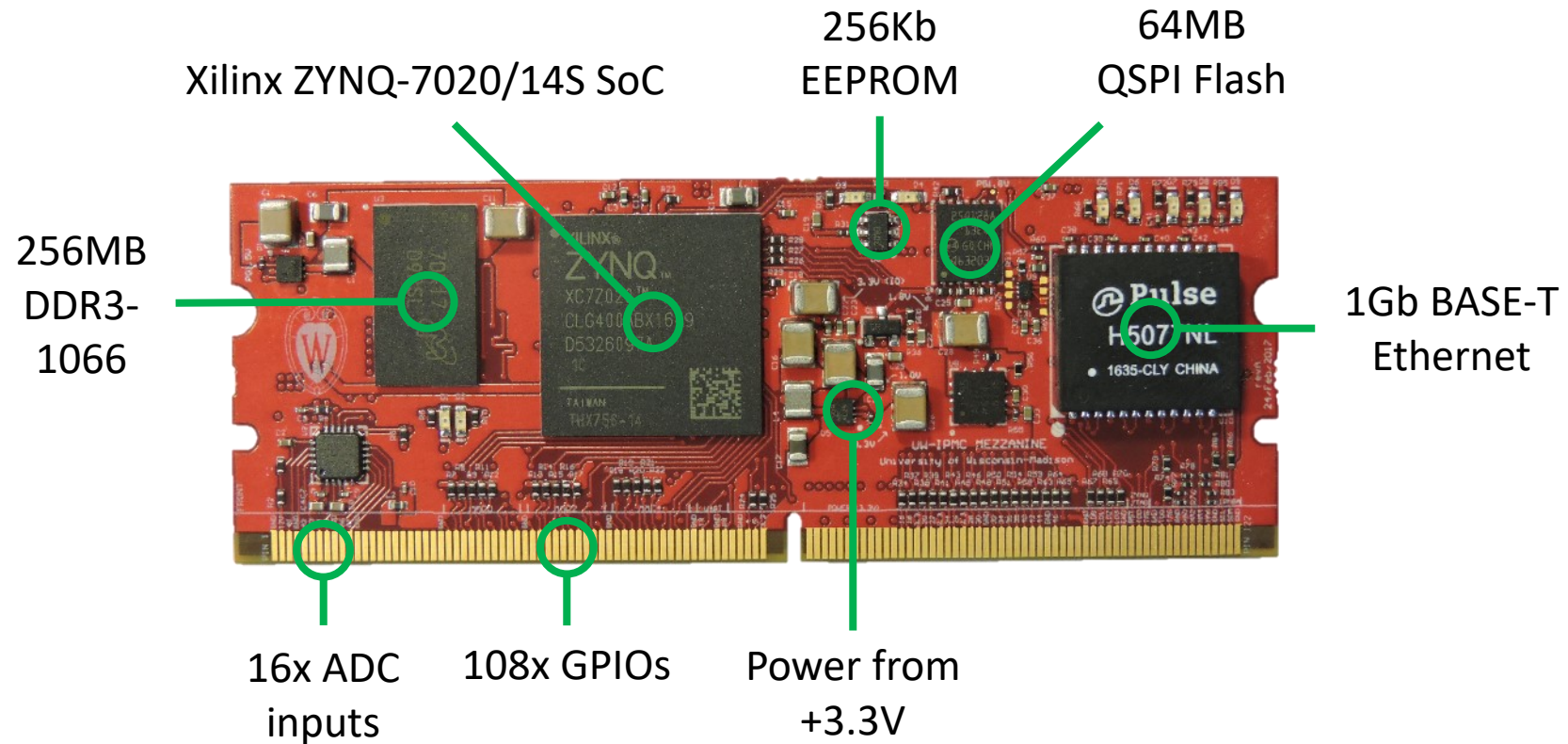
ZYNQ-IPMC Status Update

15th xTCA Interest Group Meeting

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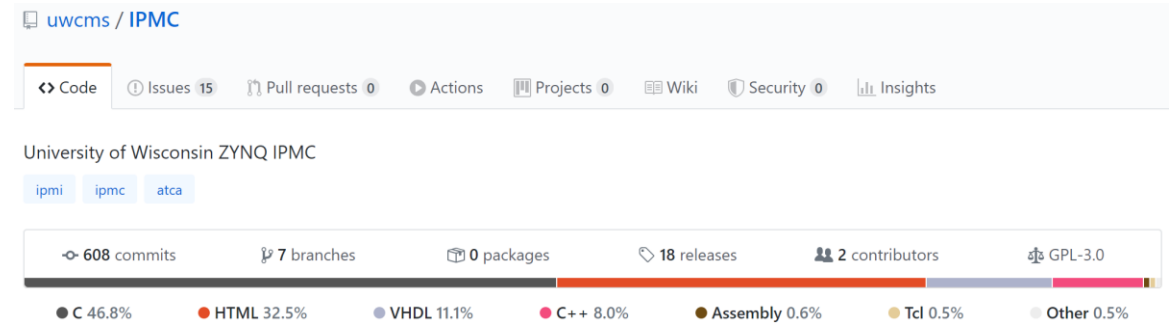
ZYNQ-IPMC



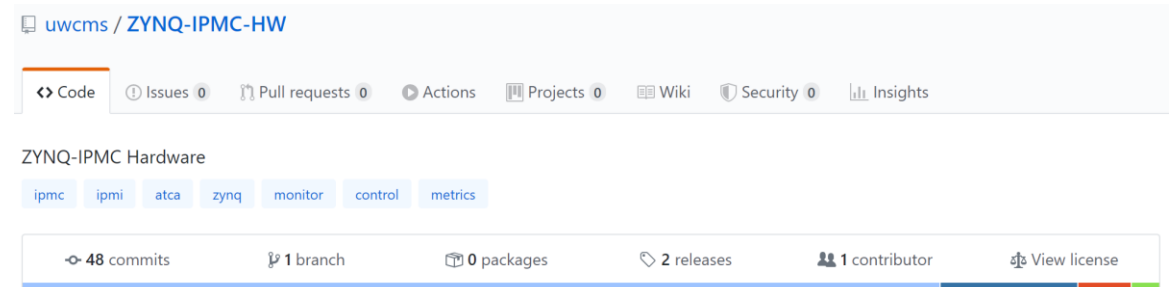
ZYNQ-IPMC

- Software Stack and Hardware design available on GitHub for download.
- Highlights:
 - Modern, open-source and configurable
 - Critical tasks executed in firmware
 - Sub-millisecond response to faults
 - Common FW and SW modules included
- Being used in multiple CMS designs:
 - APd1, ATH & CDB (UW-Madison)
 - BCP (U. Virginia & Notre Dame)
 - Interest from other groups
- [Datasheet Link](#) (in GitHub)

<https://github.com/uwcms/IPMC> (software stack)



<https://github.com/uwcms/ZYNQ-IPMC-HW> (hardware)



Features Set

- Power Management Zones
 - Post-mortem Analysis
 - Sensor Logging
 - IPMI Logging
 - Telnet Terminal
 - File Transfer Protocol (FTP)
 - Xilinx Virtual Cable (XVC)
 - Persistent Storage
 - Bring-up utilities
- And more...

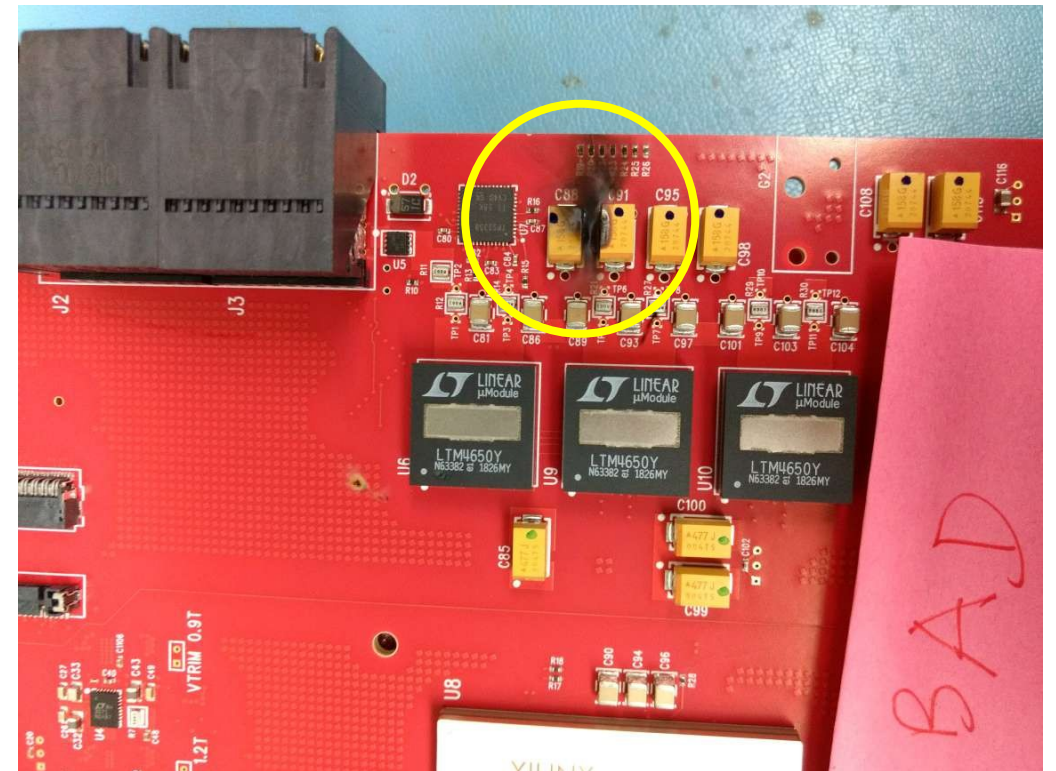


```
[NOTI] Request resent on ipmb0: 0.8c -> 0.20: 0a.11 (seq 40) [01 08 00 02] (retry 6)
[NOTI] Unexpected response received on ipmb0 (erroneous retry?): 0.20 -> 0.8c: 0b.11 (seq 00) [00 02 01 04]
[NOTI] Request resent on ipmb0: 0.8c -> 0.20: 0a.11 (seq 40) [01 08 00 02] (retry 7)
[NOTI] Unexpected response received on ipmb0 (erroneous retry?): 0.20 -> 0.8c: 0b.11 (seq 00) [00 02 01 04]
[NOTI] Request resent on ipmb0: 0.8c -> 0.20: 0a.11 (seq 40) [01 08 00 02] (retry 8)
[NOTI] Request resent on ipmb0: 0.8c -> 0.20: 0a.11 (seq 40) [01 08 00 02] (retry 9)
[NOTI] Unexpected response received on ipmb0 (erroneous retry?): 0.20 -> 0.8c: 0b.11 (seq 00) [00 02 01 04]
[WARN] Retransmit abandoned on ipmb0: 0.8c -> 0.20: 0a.11 (seq 40) [01 08 00 02]
```

```
$ iperf -c 192.168.250.252 -i 5 -t 60 -w 64k
-----
Client connecting to 192.168.250.252, TCP port 5001
TCP window size: 125 KByte (WARNING: requested 62.5 KByte)
-----
[ 3] local 192.168.1.8 port 46468 connected with 192.168.250.252 port 5001
[ ID] Interval      Transfer      Bandwidth
[ 3] 0.0- 5.0 sec    316 MBytes    531 Mbits/sec
[ 3] 5.0-10.0 sec   316 MBytes    531 Mbits/sec
[ 3] 10.0-15.0 sec  316 MBytes    529 Mbits/sec
[ 3] 15.0-20.0 sec  317 MBytes    531 Mbits/sec
[ 3] 20.0-25.0 sec  316 MBytes    531 Mbits/sec
[ 3] 25.0-30.0 sec  304 MBytes    510 Mbits/sec
[ 3] 30.0-35.0 sec  316 MBytes    531 Mbits/sec
[ 3] 35.0-40.0 sec  316 MBytes    531 Mbits/sec
[ 3] 40.0-45.0 sec  316 MBytes    531 Mbits/sec
[ 3] 45.0-50.0 sec  316 MBytes    531 Mbits/sec
[ 3] 50.0-55.0 sec  316 MBytes    531 Mbits/sec
[ 3] 55.0-60.0 sec  316 MBytes    531 Mbits/sec
[ 3] 0.0-60.0 sec   3.69 GBytes   529 Mbits/sec
```

Fault Detection

- Necessary for proper operation and to quickly identify small and repairable assembly defects during bring-up.
- Example:
 - Assembler installed wrong capacitors.
 - They burned during power-up, shorting.
 - IPMC detected and turned off power, preventing any further damage.
 - No further power-up allowed.
 - Card got repaired and became fully functional.



Improved Firmware Updating

- Upload via File Transfer Protocol (FTP).
- Flash partitions: **Primary**, **Backup**, **Test** and **Fallback** (application-agnostic).
- Update flashes Backup partition.
 - Automatic image swapping if successful.
- Several checks take place before flashing:
 - Expected image structure,
 - Target Zynq matches hardware,
 - IPMI state (only allowed in M1),
 - MD5 checksum.
- Rollback/image selection through terminal.

From in-network Linux machine:

```
[tgorski@beck ZYNQ-IPMC-Images]$ ls
APd1-7z014s-v1.0.11.BOOT.bin  ATH-7z020-v1.0.2.BOOT.bin
APd1-7z014s-v1.0.12.BOOT.bin  fallback-7z014s-v0.9.6.BOOT.bin
APd1-7z014s-v1.0.13.BOOT.bin  fallback-7z020-v0.9.6.BOOT.bin
APd1-7z020-v1.0.13.BOOT.bin  flash_upload.py
ATH-7z014s-v1.0.2.BOOT.bin   ipmc_card_db_sync.py
[tgorski@beck ZYNQ-IPMC-Images]$ ./flash_upload.py -h 192.168.250.110 APd1-7z014s-v1.0.13.BOOT.bin update
```

IPMC terminal:

```
[NOTI] Transitioned to M6
[NOTI] Transitioned to M1
[NOTI] New FTP client, sending 220
[NOTI] Data connection established
[NOTI] Receiving file virtual/update.bin
[NOTI] Received 6774608 bytes
[NOTI] Image 1: fsbl.elf (98312 bytes)
[NOTI] Image 2: ipmc_bd_wrapper.bit (2309920 bytes)
[NOTI] Image 3: IPMC.elf (4359564 bytes)
[NOTI] Image 4: version.json (632 bytes)
[NOTI] Uploaded QSPI image is VALID: Version APd1-7z014s-v1.0.13 (5c09b62a), built by jtikaltsky@sonata.hep.wisc.edu at Fri May 1 10:40:40 EDT 2020
[CRIT] Update lock set. It is not possible to go to M4 without restarting.
[NOTI] (0%) Programming sector 0x01000000
[NOTI] (1%) Programming sector 0x01010000
[NOTI] (2%) Programming sector 0x01020000
[NOTI] (3%) Programming sector 0x01030000
[NOTI] (4%) Programming sector 0x01040000
[NOTI] (5%) Programming sector 0x01050000
[NOTI] (6%) Programming sector 0x01060000
[NOTI] (7%) Programming sector 0x01070000
```

Persistent Fault Logging

- Non-volatile logging of sensor faults in EEPROM
 - Build on top of Persistent Storage.
 - Accessible via terminal.
 - Aids post-mortem fault diagnostic.

Example with temperature sensor over threshold:

```
> faultlog.dump
Time                Fault Information
2020-05-12T01:24:10Z IPMI:04012201595f5a Sensor 34 (T_CARDTOP)    val 47.500 is beyond ucr+ 45.000.
2020-05-12T01:25:16Z IPMI:040122015b6564 Sensor 34 (T_CARDTOP)    val 50.500 is beyond unr+ 50.000.
Found 2 entries (capacity 127).
```

- Tracks time-of-fault, sensor IDs, raw values, threshold, etc.

Geographic IP Address Assignment



- Address ATCA elements by crate/slot, not by card.
 - Fully automatic, hot swap without table edits.
 - Supports multiple endpoints per card (e.g. IPMC, ELM 1GbE/10GbE).
- Use DHCP Client IDs formed from crate/slot info:
 - Crate/backplane FRU data via Shelf Manager.
 - IPMC provides hardware address (slot ID).
 - Crate/slot info passed to ATCA SoC via UART link.
- Geographic Client IDs contain 3 pieces of geographic info: **crate**, **slot**, **component**
 - e.g. `atca-s2e10-46-84-ipmc`, `atca-s2e10-46-84-elm`

Thank you!

More info:

[14th xTCA Interest Group Meeting](#)

[2018 IPMC Workshop](#)