PPSi

PTP Ported to Silicon

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Overview

PTP (Precision Time Protocol) is a standard for clock synchronization of computers and electronic appliances to be achieved through an ethernet network.

It was defined by the IEEE 1588-2002 standard and revised in IEEE 1588-2008, also known as PTP2.

Our work focuses on PTP2 standard.
Background

- The IEEE 1588 standard defines the data structures to be implemented by any software implementation.
- A PTP implementation is PTPd, which is practically the reference implementation.
- The first WR software implementation (ptp-noposix) is a fork of PTPd and made it runnable on WR switch and WR node, with not too much worries about “clean coding”.
- PPSi was thought to replace ptp-noposix and has now reached a good level of robustness and completely covers the needs for SPEC board.
PPSi general “philosophy”

PPSi is thought to be a general-purpose PTP application, hosting any present or future extension, and portable to any hw architecture.

Code handles as separate modules the different PTP engine variants:

- Architecture (arch): gnu-linux, bare-linux, lm32 (spec) etc...
- Extension (proto-ext): Standard, White Rabbit, others...?
- Transport Network protocol: UDP, RAW ethernet

Thus, no constraints are predefined for a specific PTP implementation:

- Should anyone need to implement WR on its own hw, it is only needed to provide the specific set of functions used by PPSi engine.
- On another side, if current SPEC hw should provide a further extension, let's say “Black Rabbit”, what is needed is the implementation of a new proto-ext, with no modifications to arch.
PPSi src organization

$ 11
totale 120
drwxrwxr-x 3 colosimo colosimo 4096 ott 18 10:04 arch-bare-linux
drwxrwxr-x 3 colosimo colosimo 4096 nov 21 16:24 arch-gnu-linux
drwxrwxr-x 3 colosimo colosimo 4096 nov 27 17:14 arch-spec
drwxrwxr-x 2 colosimo colosimo 4096 nov 27 17:14 diag
drwxrwxr-x 3 colosimo colosimo 4096 ott 18 10:04 include
drwxrwxr-x 2 colosimo colosimo 4096 nov 27 17:14 lib
drwxrwxr-x 2 colosimo colosimo 4096 nov 27 17:14 proto-ext-whiterabbit
drwxrwxr-x 2 colosimo colosimo 4096 nov 24 16:01 proto-standard
drwxrwxr-x 2 colosimo colosimo 4096 nov 20 13:13 tools
-rw-rw-r-- 1 colosimo colosimo 1644 ott 18 10:04 AUTHORS
-rwxrwxr-x 1 colosimo colosimo 184 nov 24 13:51 compile_all-gnu-linux
-rwxrwxr-x 1 colosimo colosimo 527 nov 24 13:53 compile_all_spec
-rw-rw-r-- 1 colosimo colosimo 17987 ott 18 10:04 COPYING
-rw-rw-r-- 1 colosimo colosimo 26527 ott 18 10:04 COPYING.LIB
-rw-rw-r-- 1 colosimo colosimo 1805 nov 21 11:06 fsm.c
-rw-rw-r-- 1 colosimo colosimo 251 ott 18 10:04 HOWTO.EASY
-rw-rw-r-- 1 colosimo colosimo 2564 nov 24 15:55 Makefile
-rw-rw-r-- 1 colosimo colosimo 9622 ott 18 10:04 README
PPSi engine: arch API

[... From include/ppsi/ppsi.h]
/* The channel for an instance must be created and possibly destroyed. */
extern int pp_open_instance(struct pp_instance *ppi,
    struct pp_runtime_opts *rt_opts);

extern int pp_close_instance(struct pp_instance *ppi);

extern int pp_parse_cmdline(struct pp_instance *ppi, int argc, char **argv);

/* Network stuff */
extern int pp_net_init(struct pp_instance *ppi);
extern int pp_net_shutdown(struct pp_instance *ppi);
extern int pp_recv_packet(struct pp_instance *ppi, void *pkt, int len,
    TimeInternal *t);
extern int pp_send_packet(struct pp_instance *ppi, void *pkt, int len,
    int chtype, int use_pdelay_addr);
    /* chtype: PP_NP_GEN || PP_NP_EVT */

/* Timers */
extern int pp_timer_init(struct pp_instance *ppi); /* initializes timer common
    structure */
extern int pp_timer_start(uint32_t interval, struct pp_timer *tm);
extern int pp_timer_stop(struct pp_timer *tm);
extern int pp_timer_expired(struct pp_timer *tm); /* returns 1 when expired */
/* pp_adj_timers is called after pp_set_tstamp and must be defined for those
    * platform who rely on system timestamp for timer expiration handling */
extern void pp_timer_adjust_all(struct pp_instance *ppi, int32_t diff);
[...]

PPSi current status

This table shows the current status of PPSi arch and protocol support:

<table>
<thead>
<tr>
<th>ARCH</th>
<th>PTP PROTOCOL</th>
<th>NET TRANSPORT PROTOCOL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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<tr>
<td>spec</td>
<td>X</td>
<td>X</td>
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<tr>
<td>gnu-linux</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

- On SPEC, ppsi can:
  - Provide its stand-alone application (mostly for ppsi debug)
  - Act as a plugin to wrpc-sw architecture (with shell, etc...)
- On gnu-linux, ppsi act as ptpd daemon, mostly with the same options.
- With respect to ptpd-v2.0 daemon, ppsi has a major upgrade, that is the support of IEEE802.3 (raw ethernet socket) transport protocol
Next Steps

• Code cleanup and final test on the current supported variants of ppsi. Estimated official release deadline: 15/12/2012

• Implement white rabbit extension on arch-gnu-linux, e.g. for Switch hw

• Implement UDP support on arch-spec, for increased compatibility with the pptp world.
Thank you for the attention.
Any question?