OsmoBTS - Bug #3572
Incorrect TDMA frame number calculation on TCH channels
09/19/2018 11:45 AM - fixeria

Description
Unlike the other supported back-ends, osmo-bts-trx is involved in low-level burst processing, i.e. scheduling, collecting, and decoding. On the Downlink direction, osmo-bts-trx does receive bursts from TRX (transceiver, e.g. OsmoTRX or FakeTRX), which then are being stored in buffers of logical channels they belong to. As soon as a full set of bursts is collected, e.g. 4 bursts for xCCH channels, a L2 frame decoding attempt is performed. If this attempt was successful, a decoded L2 frame is forwarded upwards to the higher layers.

Every decoded L2 frame gets TDMA frame number, which corresponds to TDMA frame number of the first burst in set (e.g. bid 0/3 for xCCH). In case of xCCH channels, where one L2 frame is interleaved over 4 consecutive bursts, it's quite easy to assign a frame number - it's enough to store it in lachn's state every time the first burst is received. But TCH interleaving is a bit more complex, and the approach of storing frame number is not applicable here.

According to GSM TS 05.03, both TCH/F and TCH/H channels are using block-diagonal interleaving. It means that there is no simple relation between a burst and the L2 frame it belongs to. Instead, every single burst may carry 57 bits of one L2 frame, and 57 bits of another one (some kind of overlapping).

In case of TCH/F, the result of encoding of either a traffic, or a FACCH/F frame is 456 bits, which are then being interleaved over 8 consecutive bursts, using even numbered bits of the first 4 bursts, and odd numbered bits of the last 4 bursts. Please check out this great picture:

Diagonal-Interleaving-for-Speech-in-gsm-620x639.jpg
So, during the collecting / decoding process in osmo-bts-trx, a new L2 frame appears every 4 bursts. In other words, every set of 4 bursts do contain the ending (228 odd bits) of a previous frame, and the beginning (228 even bits) of a next frame.

For some reason, TDMA frame number of 5/8 (bid=0) burst is assigned to every decoded L2 frame. This is incorrect and should be fixed.

The world of TCH/H is even more complex, and moreover there is no such great picture like for TCH/F. The interleaving of traffic and FACCH/H is different:

- the result of encoding of a traffic frame is 228 codec bits, which are then being interleaved over 4 consecutive bursts, using even numbered bits of the first two bursts, and odd numbered bits of the last two bursts;
- the result of encoding of a FACCH/H frame is 456 codec bits, which are then being interleaved over 6 consecutive bursts, using even numbered bits of the first two bursts, all bits of the middle two bursts, and odd numbered bits of the last two bursts;

And like in case of TCH/F, L2 frames, decoded on TCH/H channel, also have incorrect frame numbers assigned. But, there is an example how to do it properly:

https://git.osmocom.org/osmocom-bb/commit/?id=1bffe899d93ab220c74c93fcf8cc1a6b4b309c70

Related issues:
Related to OsmoBTS - Bug #3803: fix frame number calculation in scheduler_trx

Resolved 02/15/2019

History

#1 - 09/19/2018 11:48 AM - fixeria
- Checklist item [ ] Share TCH/H TDMA frame mapping helpers in libosmocore added
- Checklist item [ ] Implement TCH/F TDMA frame mapping helpers in libosmocore added
- Checklist item [ ] Fix TDMA frame number calculation for TCH/F added
- Checklist item [ ] Implement basic TTCN-3 test coverage added

#2 - 03/31/2019 10:35 PM - fixeria
- Related to Bug #3803: fix frame number calculation in scheduler_trx added

#3 - 05/08/2019 06:08 PM - laforge
- Assignee set to sysmocom

#4 - 05/08/2019 06:08 PM - laforge

#5 - 05/12/2020 11:56 AM - laforge
- Status changed from New to Feedback
- Assignee changed from sysmocom to fixeria

fixeria what is the status of this ticket? Is it still a pending issue?

#6 - 05/12/2020 12:00 PM - Hoernchen

I've stumbled upon this last week, and suspected that it was already fixed by dexter fn calculation fixes.

#7 - 05/12/2020 12:04 PM - tnt

Also ... I don't get the issue really.

Yeah, we assume a L2 frame number that's "arbitrarily" the 5th burst of 8 bursts where data of the L2 frame is spread over. What's the problem exactly?
They will come at the right "rate" and be spread by the right amount of frame, so why does it matter if we take the first, 5th or last? What's that number even used for?

#8 - 05/12/2020 01:17 PM - fixeria

- Checklist item [x] Share TCH/H TDMA frame mapping helpers in libosmocore set to Done
- Checklist item [x] Implement TCH/F TDMA frame mapping helpers in libosmocore set to Done
- Checklist item [x] Fix TDMA frame number calculation for TCH/F set to Done
- Checklist item [x] Fix TDMA frame number calculation for TCH/H set to Done
- % Done changed from 0 to 80

Also ... I don't get the issue really.

Yeah, we assume a L2 frame number that's "arbitrarily" the 5th burst of 8 bursts where data of the L2 frame is spread over. What's the problem exactly?
They will come at the right "rate" and be spread by the right amount of frame, so why does it matter if we take the first, 5th or last? What's that number even used for?

The problem is that some lchan handlers report frame number of the first burst, some report frame number of the last burst... This inconsistency is what I really dislike, but to be honest, I don't know whether it's really that critical. Probably yes for the measurement processing, or maybe for DTX mode of operation (which we don't yet support to my best knowledge).

laforge wrote:

fixeria what is the status of this ticket? Is it still a pending issue?

05/16/2020
I quickly checked the source code of the recent master, and it looks good to me. Just submitted a cosmetic change:

https://gerrit.osmocom.org/c/osmo-bts/+/18218 osmo-bts-trx/scheduler: remove a left-over from UL TCH handlers

The libosmocore's frame (re)mapping API has some unit tests, but I have not seen anything covering osmo-bts-trx itself. Let me know if I should implement a TTCN-3 test case.

#9 - 05/12/2020 02:43 PM - laforge

On Tue, May 12, 2020 at 01:17:03PM +0000, fixeria [REDMINE] wrote:

The problem is that some lchan handlers report frame number of the first burst, some report frame number of the last burst... This inconsistency is what I really dislike, but to be honest, I don't know whether it's really that critical. Probably yes for the measurement processing, or maybe for DTX mode of operation (which we don't yet support to my best knowledge).

We should have one unified understanding of which frame numner we use for reporting the burst, as this is indeed important for parts of the common code such as measurement processing and uplink DTX - both or which are important and supported; DTX historically not for osmo-bts-trx, but I think actually also by now, dexter has done a lot of work on this in terms of correctly marking the related frames etc.

The libosmocore's frame (re)mapping API has some unit tests, but I have not seen anything covering osmo-bts-trx itself. Let me know if I should implement a TTCN-3 test case.

I think it's fine as-is, thanks.

#10 - 05/12/2020 02:55 PM - fixeria

- Status changed from Feedback to Closed

I think it's fine as-is, thanks.

Then I am closing this ticket, since there is nothing left to do.