Title: AS8202NF Big Bang Configuration Constraints

Subject: TASM Software / Specification

Description:

The specification of the Big Bang algorithm does not meet the intention of avoiding cold start cliques.

Detailed Description:

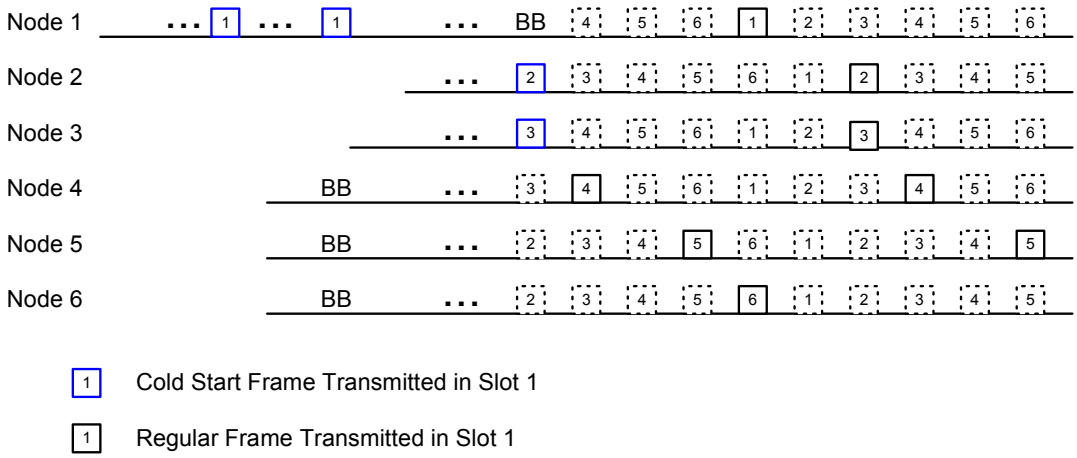

Figure 1: Cold Start Cliques

The Big Bang algorithm was originally introduced to avoid that any controller will integrate on a cold start frame if this frame collided with another cold start frame (in the absence of faults). To achieve this, the specification states that a controller shall not use the first cold start frame it ever receives in listen state (even if this controller has sent cold start frames itself already) for integration but shall start the listen timeout upon reception of the frame.

This specification of the algorithm does not meet the intention. If a node stops sending cold start frames (because it has transmitted the number of cold start frames it is granted by the respective MEDL parameter), some controllers may have perceived the last cold start frame transmitted by this frame as Big Bang and may integrate on a cold start frame (transmitted by some other cold starter) that was part of a collision. Figure 1 provides an illustration of this (boxes with solid lines denote transmission slots of the respective node, dotted lines denote reception slots): node 1 was started early and has transmitted all its cold start attempts before any controller accepted one for integration. The last cold start frame transmitted by node 1 was the first cold start frame to be received by node 4, node 5, and node 6, which consider the frame the Big Bang. Node 2 and node 3 are started a bit later than nodes 4, 5, and 6 and do not perceive the Big Bang frame. The cold start frames transmitted subsequently by nodes 2 and 3 collide, node 1 receives one of the collided frames correctly and considers it the Big Bang frame, node 4 receives the cold start frame of node 3 while nodes 5 and 6 receive the cold start frame of node 2. In the next slot node 1 receives the frame of node 4 and uses it for integration: two cold start cliques have evolved.

Conclusion, Work-around:

There are several ways to avoid this problem:

- Only two nodes are allowed to transmit cold start frames: if only two nodes are allowed to transmit cold start frames, there can only be a single collision of cold

start frames. The Big Bang algorithm as currently specified will avoid cold start cliques in case of a single collision.

- Only four nodes are allowed to participate in cold start (all are enabled to send cold start frames and to integrate on cold start frames): the scenario as depicted in Figure 1 requires at least three cold starting nodes. If there are only four cold start-enabled nodes, there is only one node that may integrate on one of the collided cold start frames. All nodes will adopt to this TDMA scheme within a TDMA round.
- The cluster consists of four nodes only: this is a special case of the previous item.
- If the worst case offset between a node powered up early and a node powered up lately is known, the number of cold start frames a node is allowed to transmit may be set to a value that guarantees that the cold starter will send at least two cold start frames after the node with the longest power up time has entered listen state: in this case, there will be at most one cold start collision, which will be covered by the Big Bang algorithm.
- The number of cold start frames a node is allowed to transmit is not constrained: this is a special case of the previous item.
- Only one node is allowed to send cold start frames and the number of cold start frames it may send is not constrained.
- Demonstrate that a collision of frames will never be perceived in the way described above (i.e. in the way necessary to create cliques).

Note, that any (or any combination) of the above listed measures will solve the problem.

Reference:

This issue is tracked in the TTTech-internal issue tracking system as *issue15748*.