NGAUTO

sleep/wake-up concept

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supporters

- Natalie Wienckowski | GM
- Doug Oliver, James Lawlis | Ford
- … further supporters until Berlin meeting?

motivation

- Discussions on sleep/wake-up had come up in the 10SPE adhoc. (http://grouper.ieee.org/groups/802/3/cg/public/adhoc/villanueva_3cgah_01_051017.pdf slide 3)
- Also in RTPGE there had been some discussion on sleep/wake-up. (http://grouper.ieee.org/groups/802/3/RTPGE/public/july12/hoganmuller_02a_0712.pdf)
- 100BASE-T1 and 1000BASE-T1 are lacking of a sleep/wake-up concept for automotive use cases and supplementary documents are provided for 100BASE-T1 by OPEN Alliance.

This presentation shows

- the basic needs why automotive industry requires sleep/wake-up.
- What are the key functions and requirements.

Why does automotive industry need sleep/wake-up?

- In some today (and future) use cases only parts of the network are active
  - different use case scenarios require only part of the network
  - Update over the air while vehicle is parked (locked & engine off)
  - Communication to wall box during charging of EV

  In these cases only a few ECUs are up and running, while others are not needed.

- Due to this scenarios some ECUs are directly supplied by battery (without ignition switch).

Why does automotive industry need sleep/wake-up?

- These ECUs directly connected to battery supply consume power all the time, even when vehicle is parked.

→ To avoid empty batteries there are stringent requirements for ECUs on the quiescence current (typically <100µA, see e.g. http://grouper.ieee.org/groups/802/3/RTPGE/public/july12/hoganmuller_02a_0712.pdf).

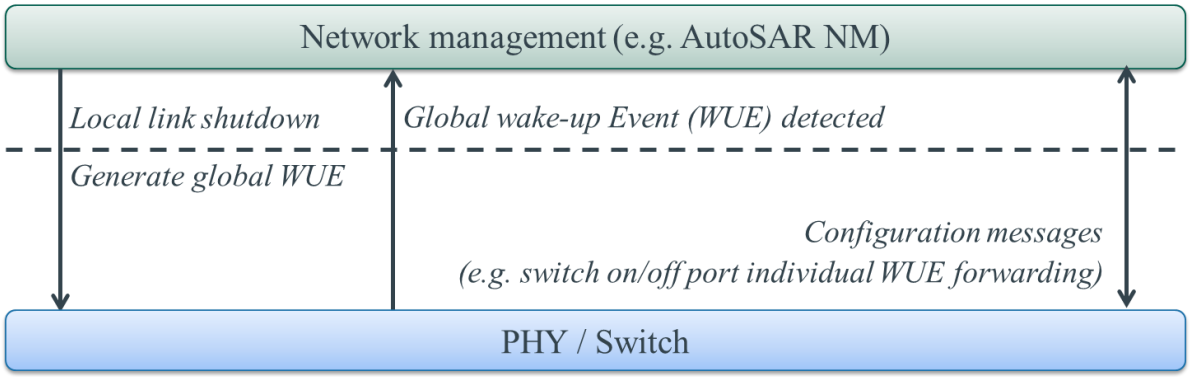
→ There is the need have ways to wake-up this ECUs to normal operation (Wake-up over Dataline) and to set them to sleep.

Wake-up over Dataline – principle services

A principal application example for CAN can e.g. be found under:
http://www.nxp.com/documents/data_sheet/TJA1041.pdf page 15

To do partial networking the following services are needed:

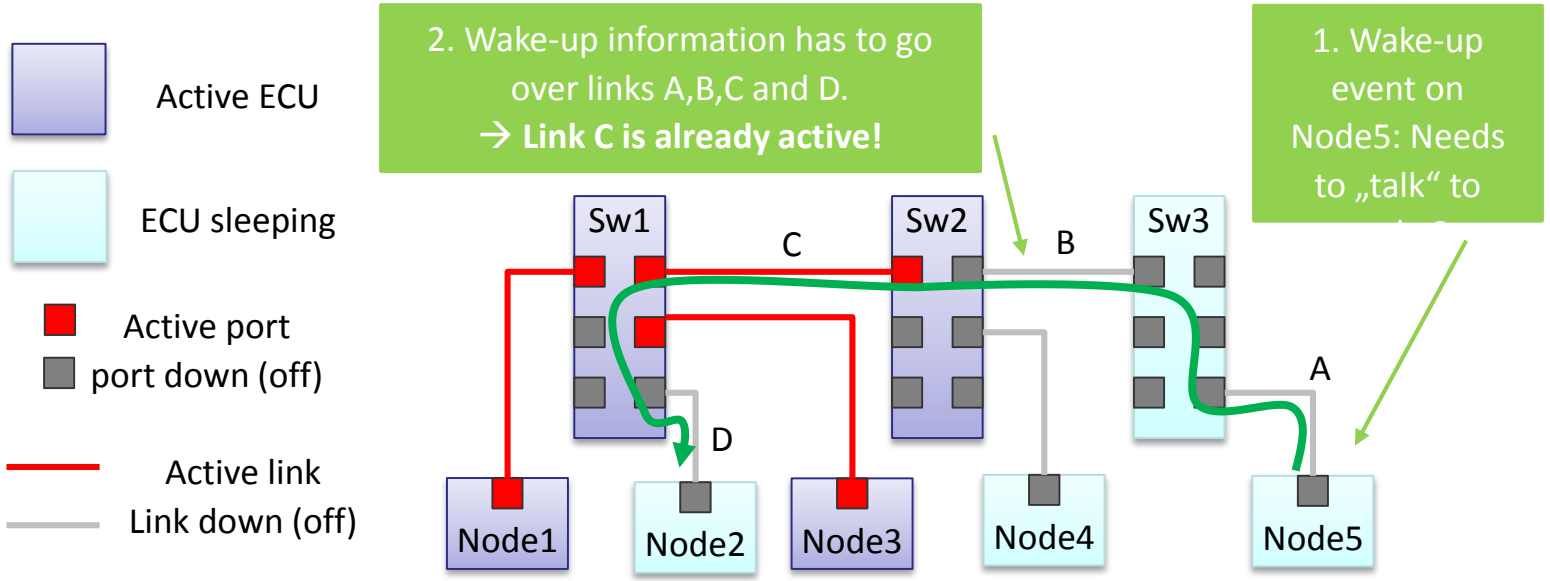
- generation and detection of global wake-up events.
- possibility to shut down individual links (sleep handshake).
- signaling/communication of WUEs to network management.



Wake-up over Dataline – principal services

Due to the network structure wake up signaling must run through disabled links as well as through active links:

- Wake-up event signaling over a disabled (passive) link (i.e. link down) preferably with a defined wake-up pulse (as OPEN Alliance TC10 for 100BASE-T1)
- Wake-up event signaling over an active link



Wake-up over Dataline - requirements

These are just first numbers - to be iterated ! ! !

Current consumption

- quiescence current **<30µA** per port (This is a typical number for a CAN transceiver, a switch may be somehow scaled by number of ports)

Timings

- Time to finalize a sleep handshake on a link (not critical): <50ms
- Time for wake-up:
  From OEM perspective a complete network with multiple switches should be woken up within e.g. <100ms. This includes also start up of unpowered ECUs (switch on voltage regulator and initialize PHY, estimated with 10ms per ECU). A reasonable number for transmitting a wake-up event over a single link might be **<2ms**.

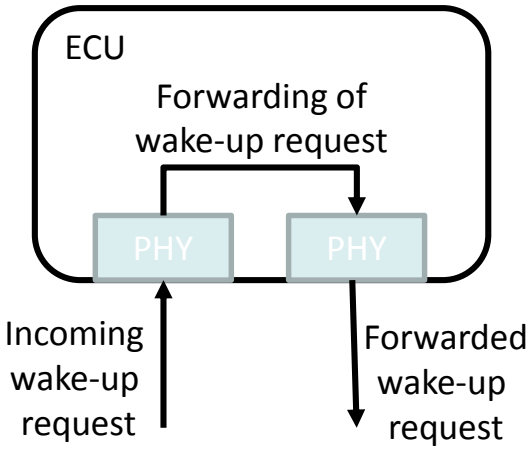
→ Reliable timings are necessary to allow a network management protocol to reliably transition wake/sleep

Wake-up over Dataline - requirements

Further Requirements

- Same EMC requirements on emission and immunity apply as to normal operation.

- To forward a wake-up information between two individual PHYs on a PCB some “local” interface is necessary



- Interoperable with existing solutions for other speeds (100Mbps, local interface: OPEN Alliance TC10, going to ISO)
  Remark: Sleep/Wake-up was not defined as an objective for 100BASE-T1 (http://grouper.ieee.org/groups/802/3/RTPGE/public/july12/hoganmuller_02a_0712.pdf) but OPEN afterwards added a supplement definition due to the automotive need.

Conclusion

- Discuss about a sleep/wake-up concept today.