Canova Tech

The Art of Silicon Sculpting

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Partial Networking on a Mixing-Segment

IEEE 802.3 SPMD Study Group

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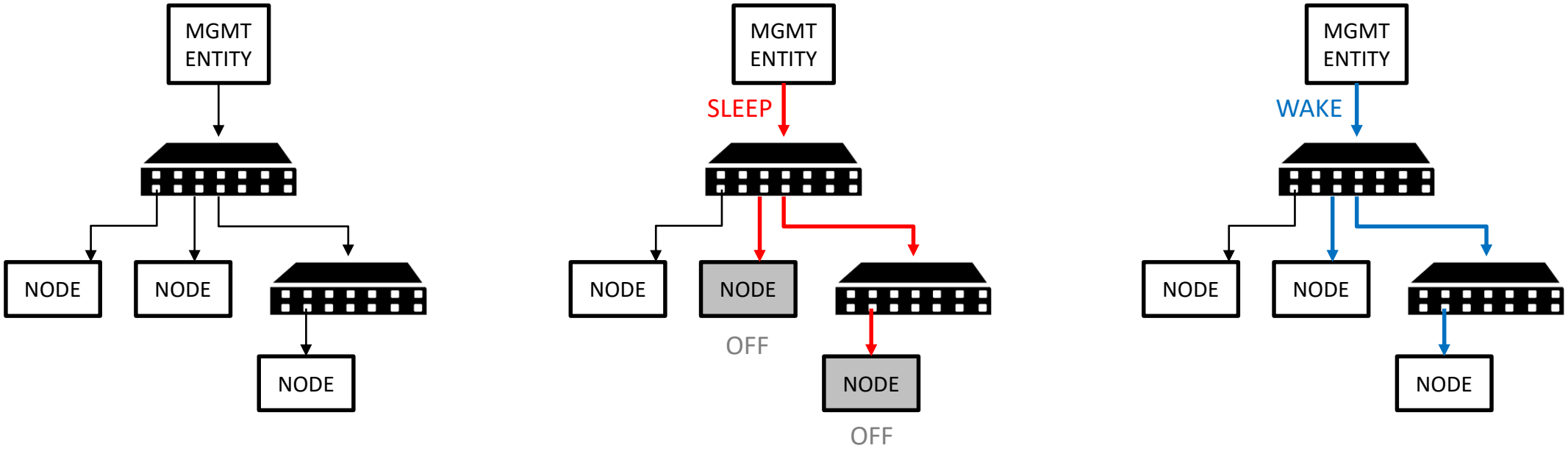
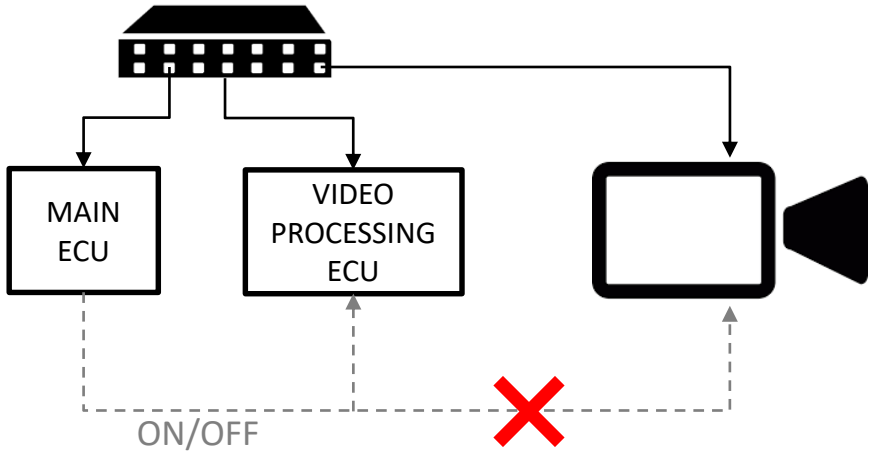
Outline

- What is partial networking?
  - Partial networking is the ability to shutdown individual nodes (when they are not needed) for the purpose of saving power.
  - The inactive (sleeping) nodes shall then be able to resume normal operation when a remote management entity propagates a global or individual wakeup request

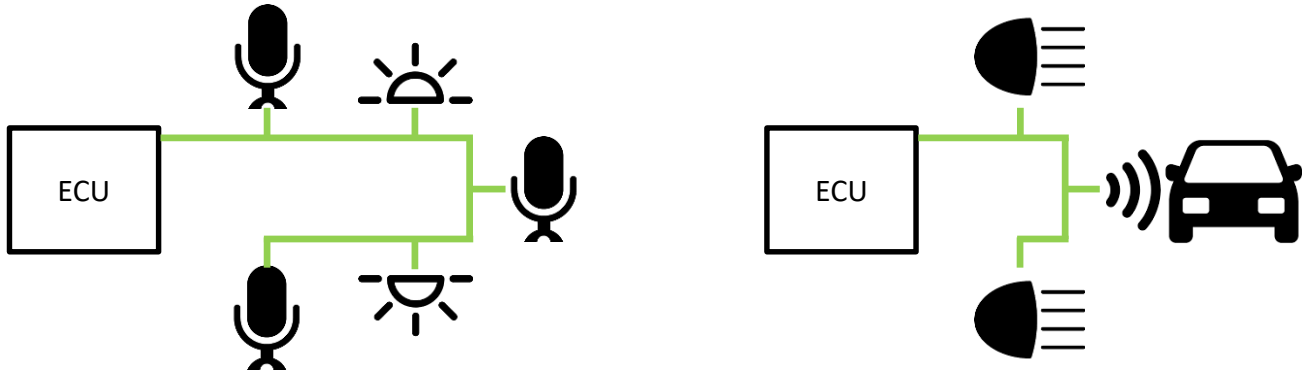


Automotive Example



- The rear camera of a car is needed only when the reverse gear is engaged
- The camera itself and any related video processing control unit should be switched off otherwise
- Having a dedicated wire for ON/OFF would add weight and costs
- Partial networking helps!

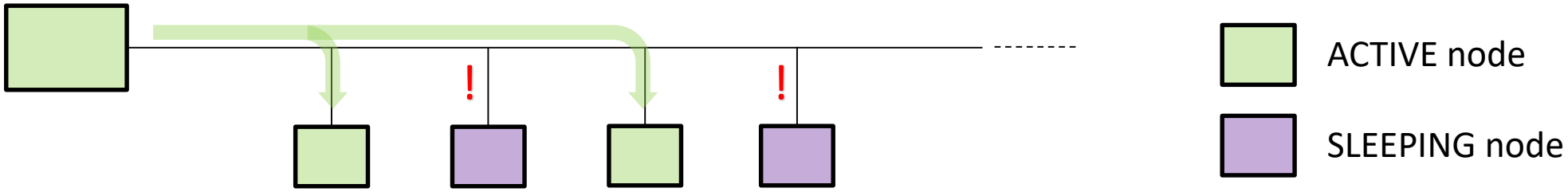
Automotive Example (multidrop)



- A radar may share the media with the lights, or other sensors
- Microphones may share the media with internal lightning, user controls or similar …

Remarks

- Partial networking is **not** Low-Power-Idle (as defined in EEE)
  - Nodes are meant to be switched off entirely
  - Target power consumption in OFF state is typically very limited
    - OPEN Alliance TC10 defines a 35 µA limit to be able to detect the wakeup signal
    - PHY is therefore supposed to use energy detection for waking up
- On a mixing-segment the nodes are connected to the same media



- Traffic generated by the active nodes may wake-up the sleeping nodes!

Issues (work for the TF)

- CONFLICTING REQUIREMENTS:
  - Sleeping nodes shall be awakened by some specific wakeup signal on the line (but decoding is precluded)
  - Sleeping nodes should NOT be awakened by normal traffic / alien Xtalk noise from active nodes
- How to convey individual sleep requests?
- Individual wakeup requests appears not to be possible on a mixing-segment (nodes can only detect energy)
  - Only individual sleep / global wake seems feasible (is this acceptable?)

Ideas for 10BASE-T1S

- There's a sweet-spot in the frequency range between 500 KHz and 1 MHz where a signal could be distinguished (by analog means) from the DME (Differential Manchester Encoding) which is used for normal 10BASE-T1S data.
  - This could be used for the wakeup signal!
- Define the wakeup signal to be a "square" wave of 1.6µs period (625 KHz). Duration: ~10 ms
  - Can be generated by currently specified 10BASE-T1S transmitter with no architectural changes
  - May affect droop specifications

Proof-of-Concept

- This idea has been verified by designing the analog energy detection block and simulating the worst case conditions with a typical MDI (100 nF line caps, 100 Ohm terminations).
- Scenario #1: Node is asleep and shall always wake in presence of a wakeup signal.
  - Transmitter of wakeup signal at the edge of a 25m worst-case IL/RL cable
  - All other nodes (7) located at the other edge of the cable (lumped config)
  - Transmitting a signal with the lowest PSD allowed by 802.3cg specs (~ 0.8 Vpp)
  - PASS criteria: no nodes remain in sleep mode in presence of the wakeup signal
- Scenario #2: Node is asleep and shall NOT wake in presence of normal communication
  - Transmitter of normal traffic connected to a single sleeping node with a 0-len cable
  - Transmitting with the highest PSD allowed by 802.3cg specs (~ 1.3 Vpp)
  - Transmitting a sequence of DME 'zeroes' (lowest frequency, i.e. 6.25 MHz) for 10 ms
  - PASS criteria: the sleeping node does not detect energy and remains in sleep mode
- Results: tests passed with reasonable margin on the currently specified upper PSD

Conclusions

- OPEN Alliance TC10 specifies add-ons to existing IEEE PHYs to support partial networking
  - E.g. the 100BASE-T1 (802.3bw) specs are extended to convey sleep/wakeup commands to/from the link partner
  - Work for 10BASE-T1S is in progress
- But partial networking is not just for automotive, it's a common problem
  - Why not start addressing this problem in SPMD, at least for 10BASE-T1S?
- Supporting partial networking on a mixing-segment looks technically feasible

THANK YOU!