SYMTA VISION

Automotive Networks – are new busses and gateways the answer or just another challenge?

Why new Busses and Architectures?

Wishful Thinking

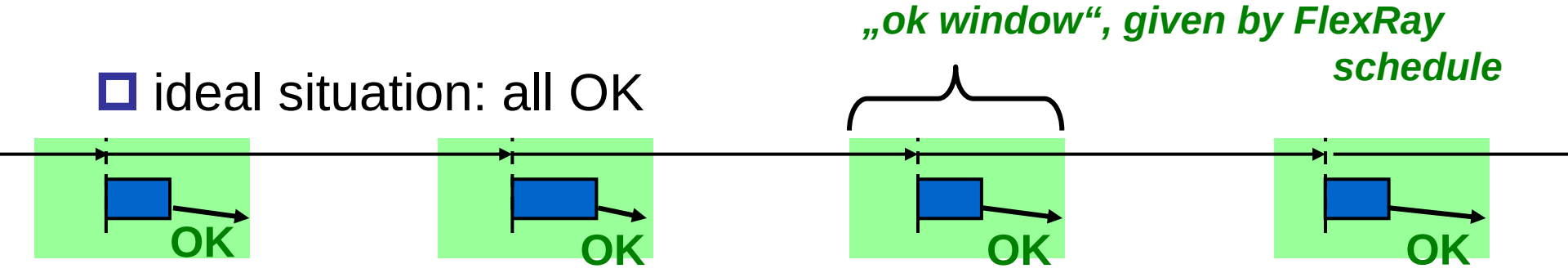
- FlexRay → Higher Performance, Determinism
- AUTOSAR → Better Re-Use and Flexibility

Reality: Higher Integration Complexity and Cost

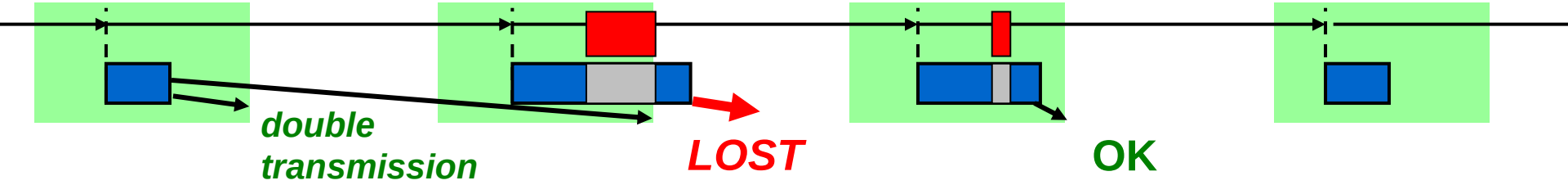
- FlexRay →
  - Optimization difficult → loss of bandwidth and flexibility
  - Determinism in evolving mixed async./sync. systems?
- AUTOSAR →
  - No good process for function to ECU mapping
  - No good process software-component integration

OSEK (preemptive OS) synchronized with FlexRay

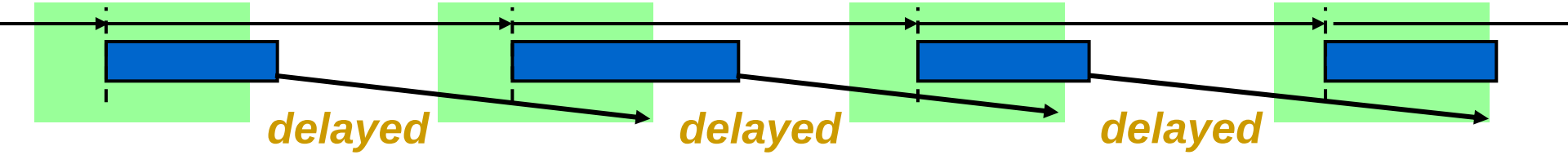
- ideal situation: all OK



- typical situation: some ok, some double, some lost



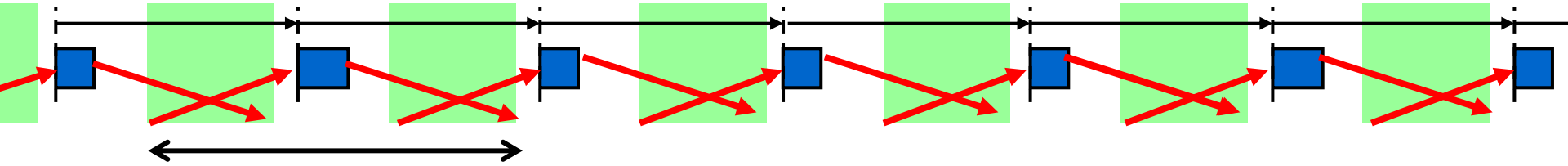
- no loss but all delayed by one full FlexRay cycle



OSEK ECU Asynchronous to FlexRay

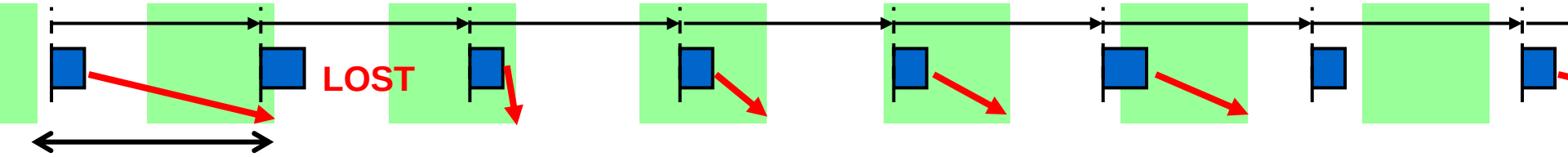
„ok window“, given by FlexRay schedule

- bad synchronization → bad responsiveness

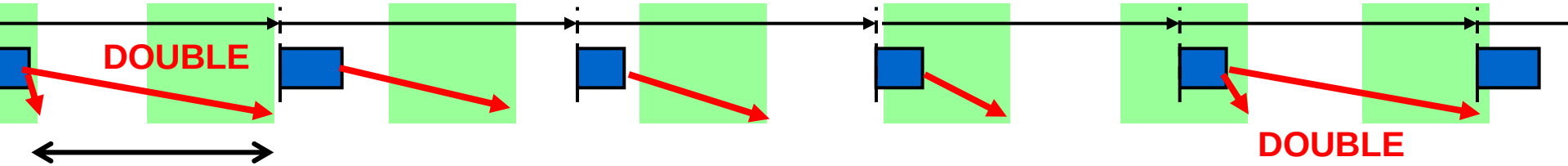


2 FlexRay cycles (more when using mux)

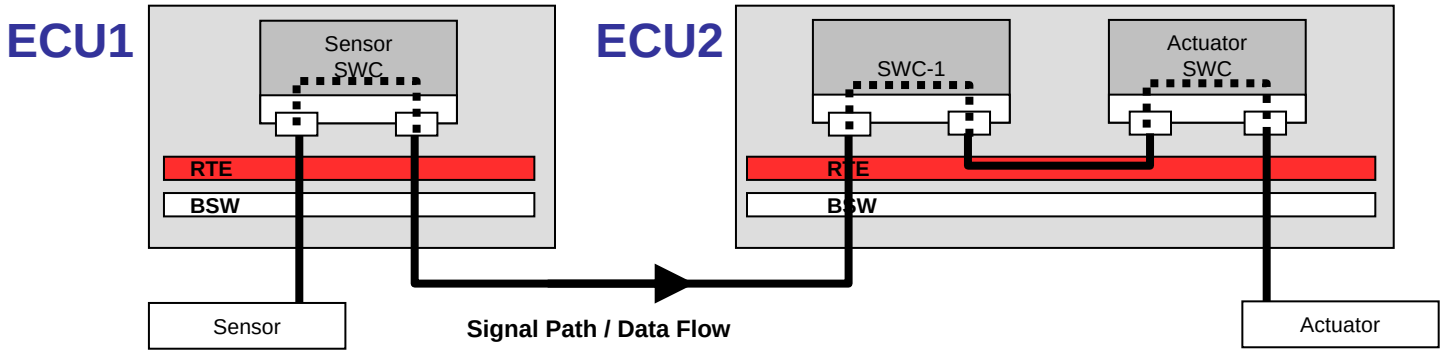
- clock skew effects → large send & receive signal jitters

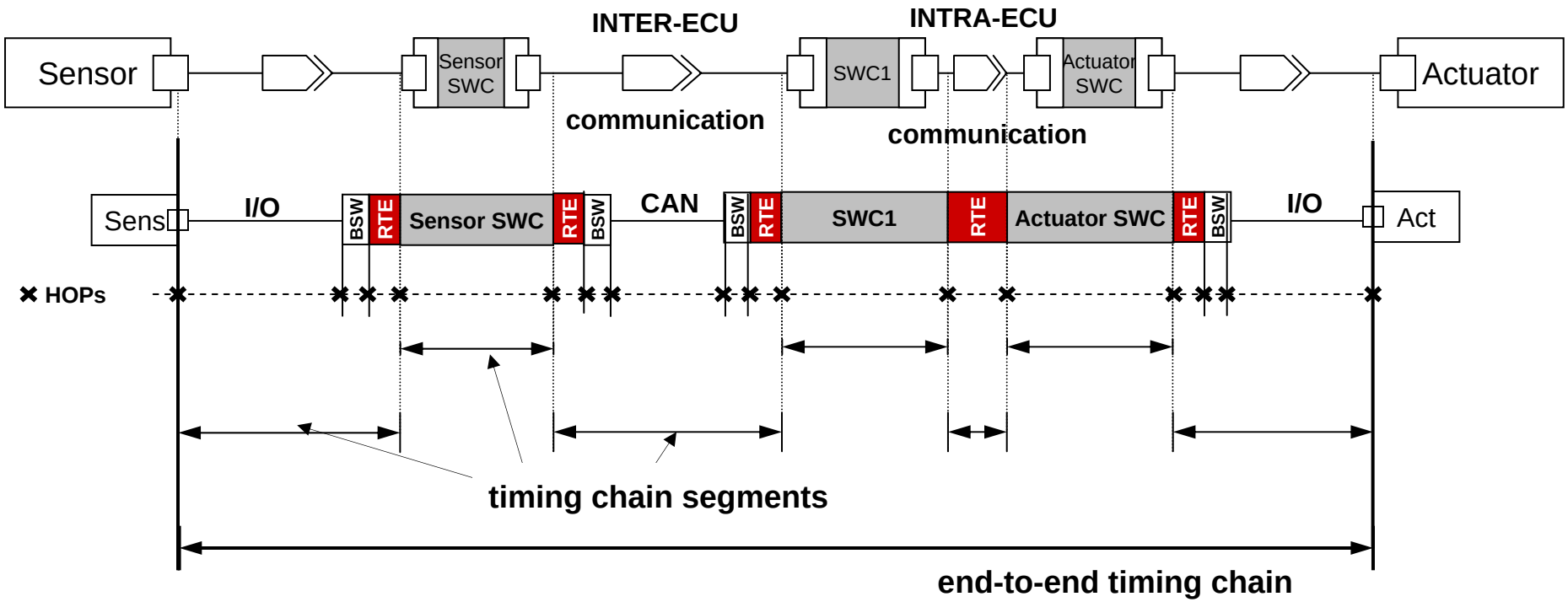


full FlexRay cycle (more when using mux)



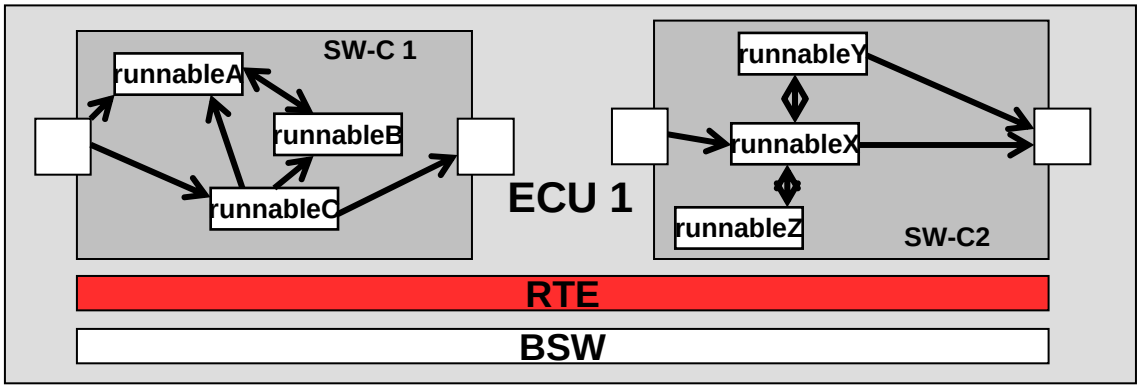
AUTOSAR System Timing Aspects





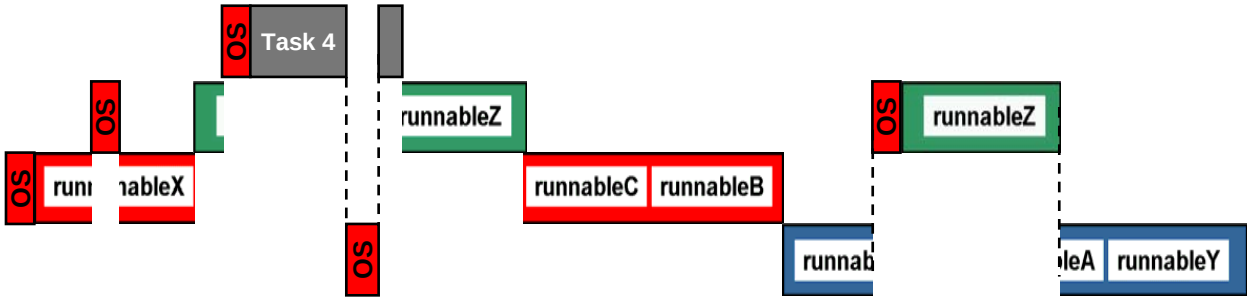
AUTOSAR SW-C vs. "Runnables" and Tasks

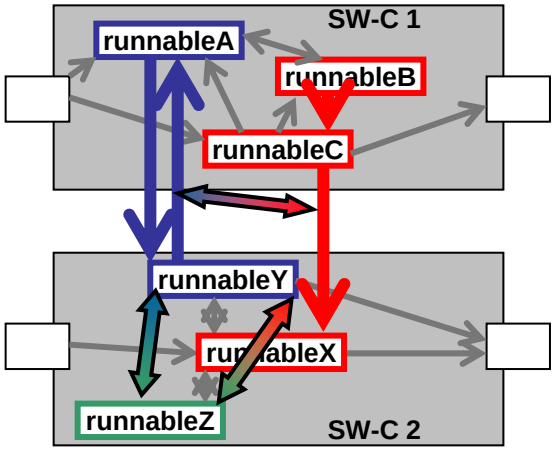
- SW architecture:
  2 SW components,
  6 runnables



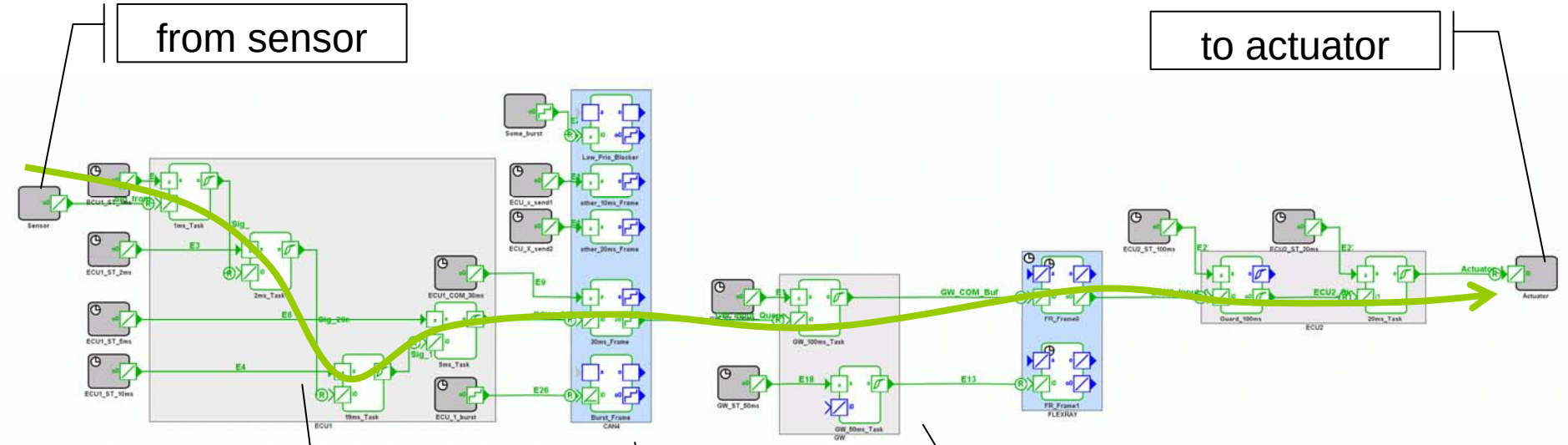
- Implementation: 3 Tasks

- Schedule and timing dependencies

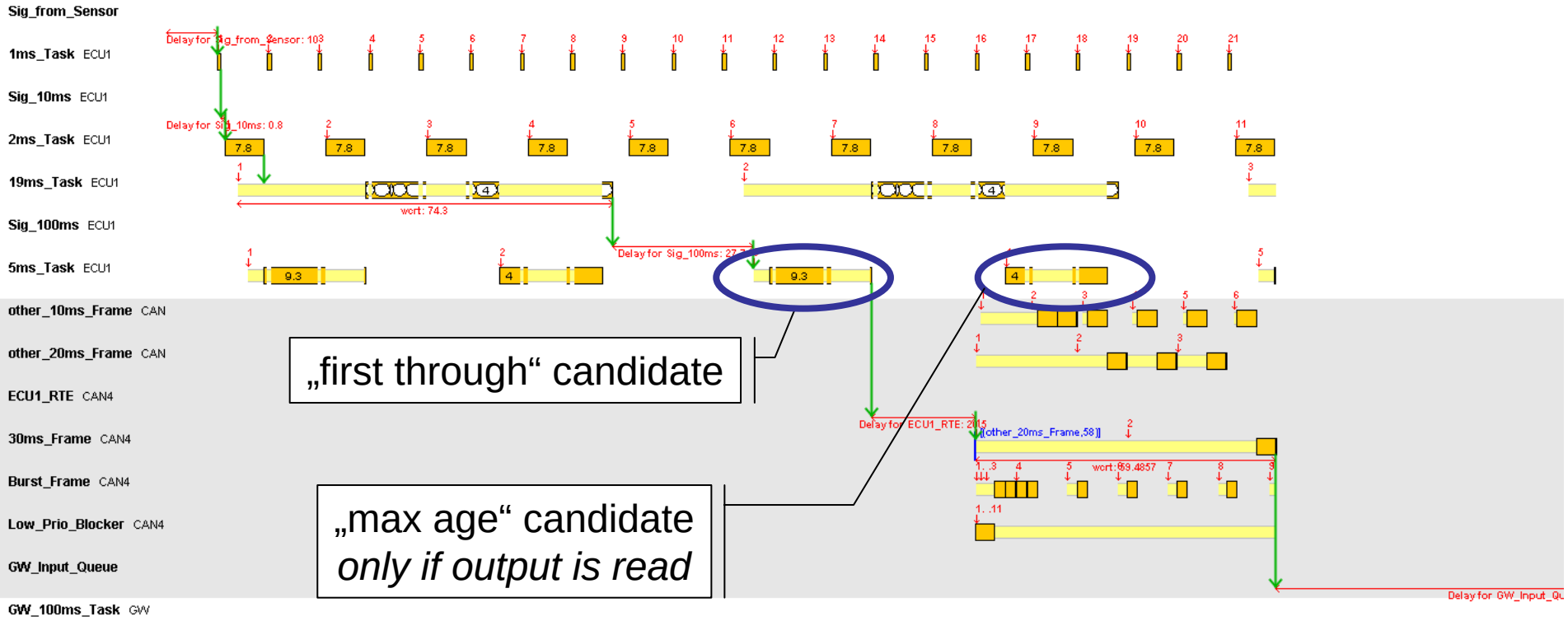




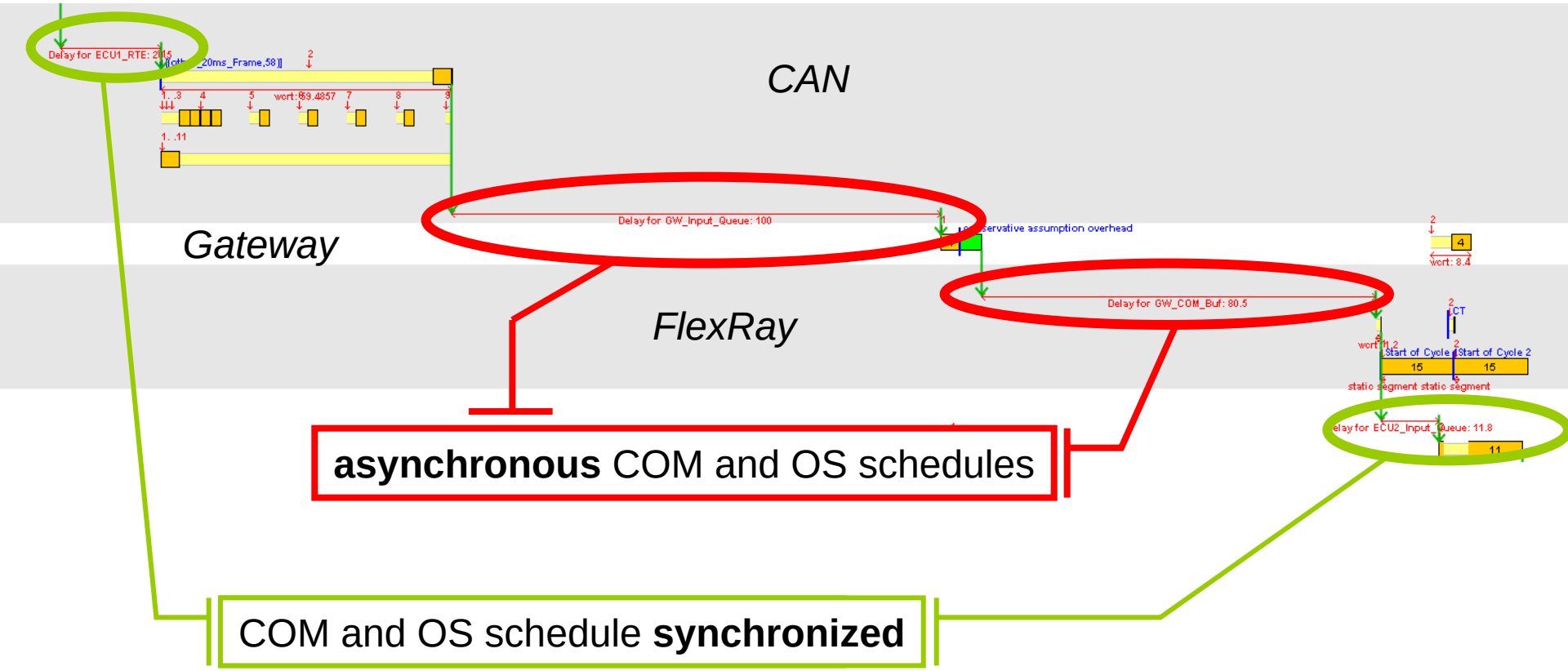
End-to-End Analysis



Oversampling in Detail



Synchronization in Detail



Impact of **new busses and architectures**

- Integration challenges have little to do with specific architectures or protocols. They will not go away!
- A paradigm-shift is required:
  Performance and timing *design* must be treated as equal citizen to function design
- TODOs
  - Standardized timing semantics and requirements
  - Novel processes between application designer and network designer, also across OEM – supplier boundary
- Scheduling analysis is the missing link between architecture exploration and Network / ECU configuration