Information Society Technologies

ATESST

"Advancing Traffic Efficiency and Safety through Software Technology"

Modelling Timing in EAST-ADL2

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Outline

20 minutes including questions

- Requirements on a Timing Model
- Chosen Meta Model
- Levels of Abstraction
- Examples
- Relation to other Timing projects

Requirements on a Timing Model

- Applicable to the abstraction levels of EAST ADL2
- Formulate all timing requirements
- Analyze timing requirements
- Break down timing requirements to modules and actors (companies), thus supporting contract based design
- Assess fulfilment of timing requirements
- Capable to describe an AUTOSAR implementation

What Timing Properties

Minimum / Maximum / Jitter

of

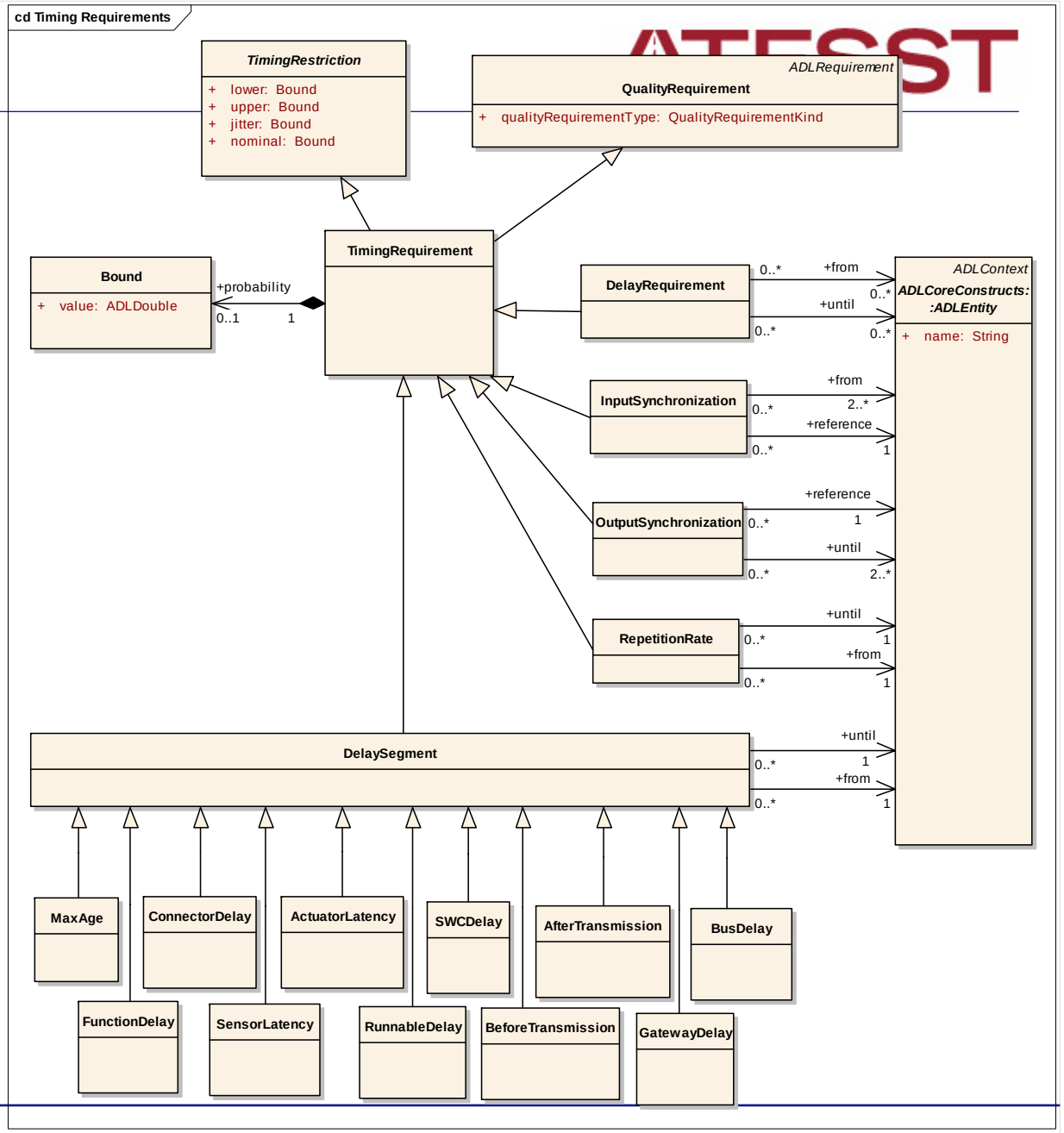
- Delay (age)
  - **The length of a certain timing chain (or segment of a chain)**
  - **One or several starting point, one or several ending points**
- Synchronization
  - **Input – input**
    (difference in time between two starting points before a join)
  - **Output – output**
    (difference in time between two ending points after a fork)
- Interval (period)
  - **Interval between two successive occurrences of a certain event**

Requirements vs. Properties

Possible for Same Timing Model Expressing Both:

- Requirements
- Properties

ATESST project focus on Requirements

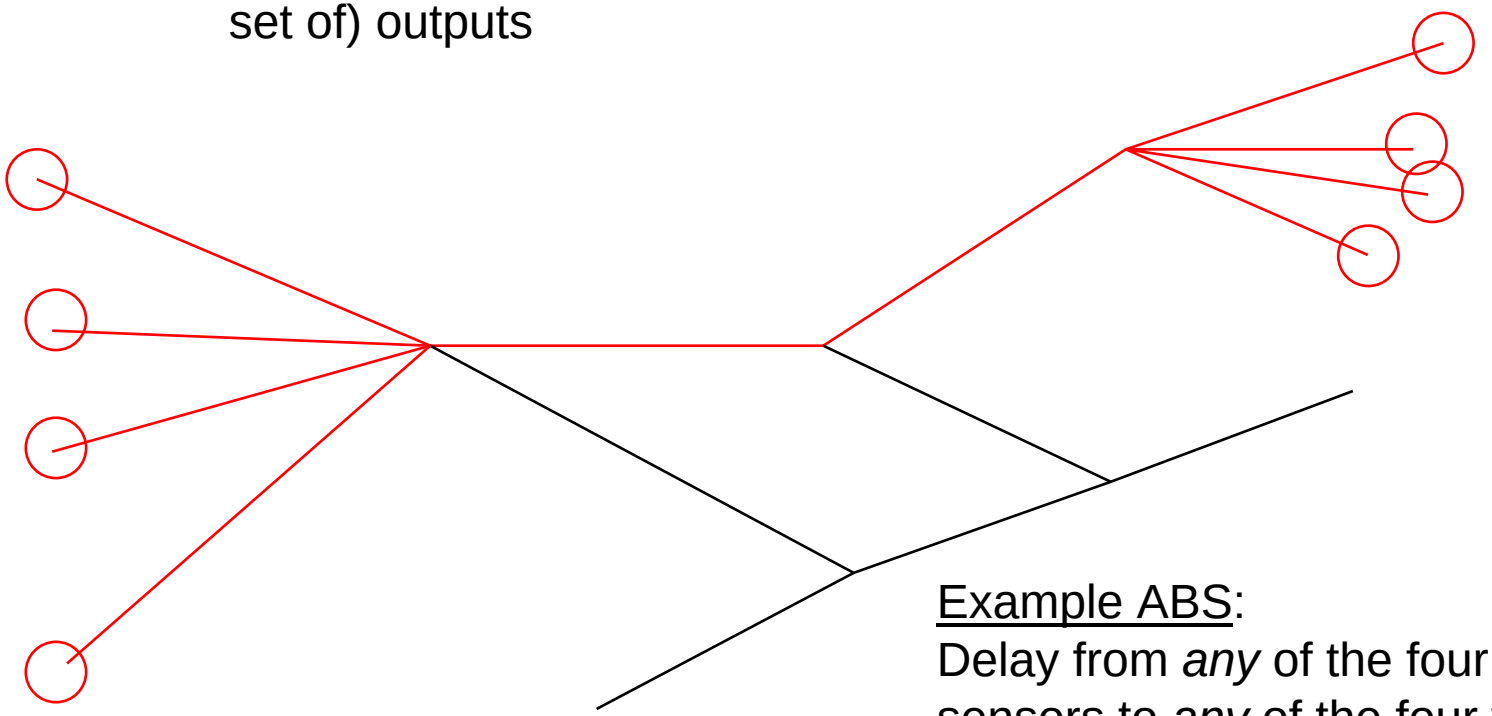

cd Timing Requirements
TimingRestriction
+ lower: Bound
+ upper: Bound
+ jitter: Bound
+ nominal: Bound
ADLRequirement
QualityRequirement
+ qualityRequirementType: QualityRequirementKind
TimingRequirement
Bound
+ value: ADLDouble
+probability
0..1
1
DelayRequirement
0..*
+from
+until
ADLContext
ADLCoreConstructs::ADLEntity
+ name: String
InputSynchronization
2..*
+reference
1
OutputSynchronization
RepetitionRate
DelaySegment
MaxAge
ConnectorDelay
ActuatorLatency
SWCDelay
AfterTransmission
BusDelay
FunctionDelay
SensorLatency
RunnableDelay
BeforeTransmission
GatewayDelay

Levels of Abstraction

- Vehicle Feature
  - **Timing may be expressed qualitatively (i.e. no quantitative measures)**
- Analysis
  - **Important to describe detailed and complicated requirements and properties w.r.t. algorithmic behaviour**
- Design
  - **Important to describe detailed and complicated requirements and properties w.r.t. algorithmic behaviour and its realization**
- Implementation
  - **AUTOSAR timing chains to be described on this level**
  - **Dealt with inside TIMMO and WPII-1.2/Timing within AUTOSAR**

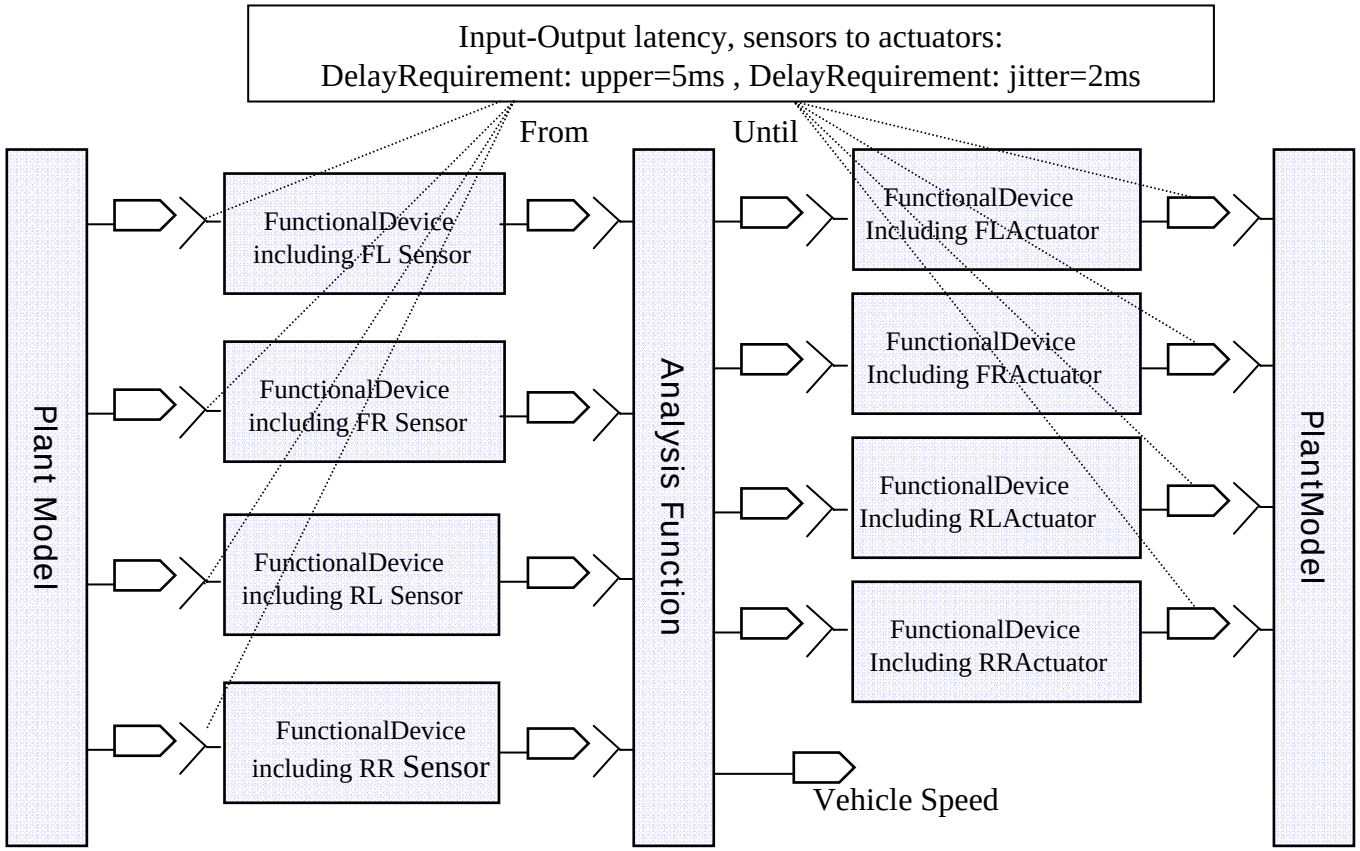
Timing Measures

Delay: How long time does it take from (a set of) inputs to (a set of) outputs



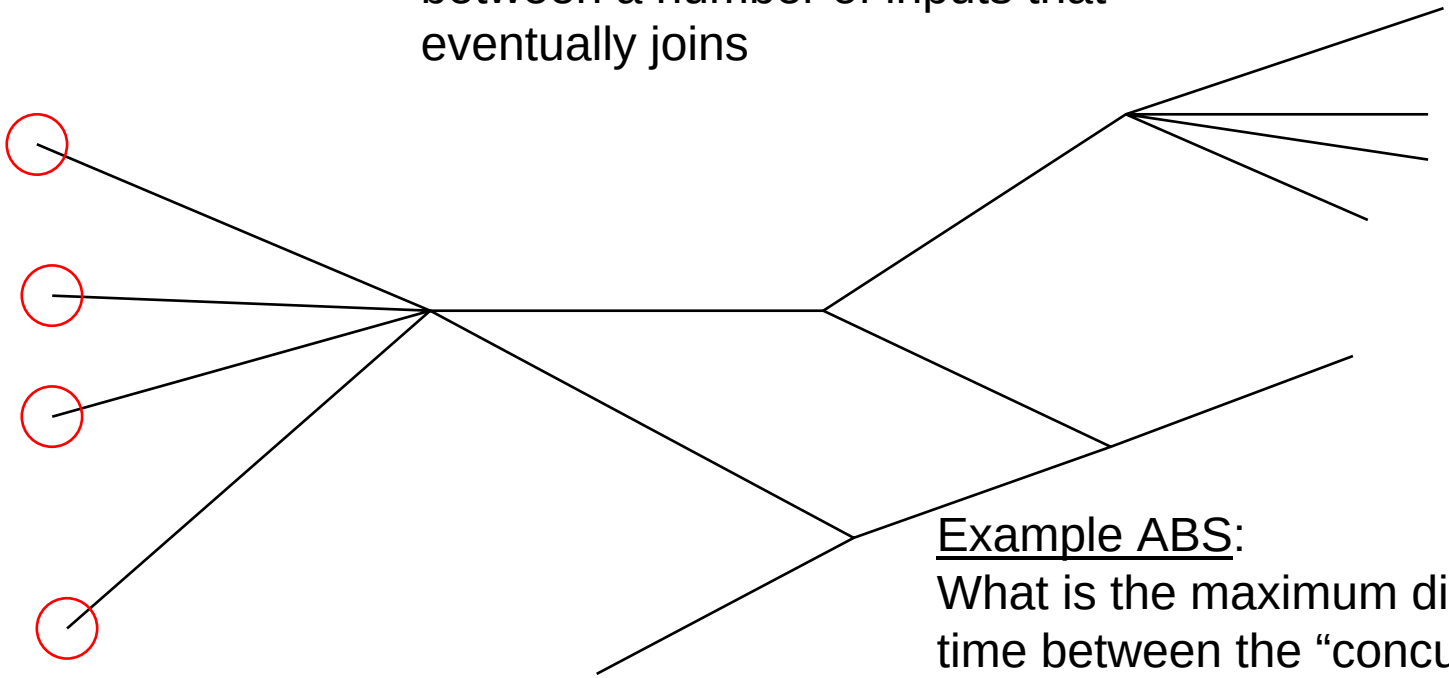
Example ABS:
Delay from *any* of the four wheel sensors to *any* of the four wheel brake actuators

Example: Delay



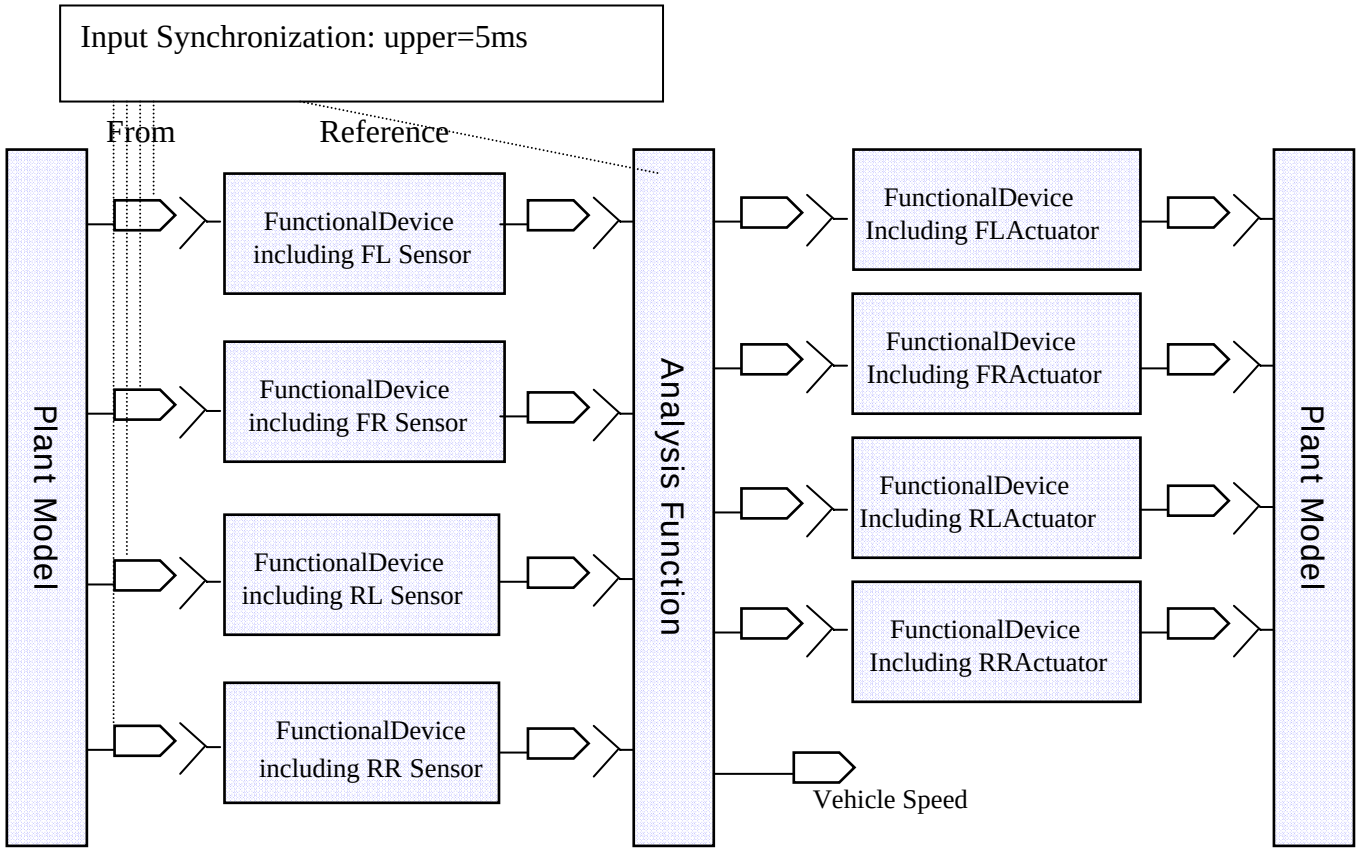
Timing Measures

Input Synchronization: What is the difference in time between a number of inputs that eventually joins



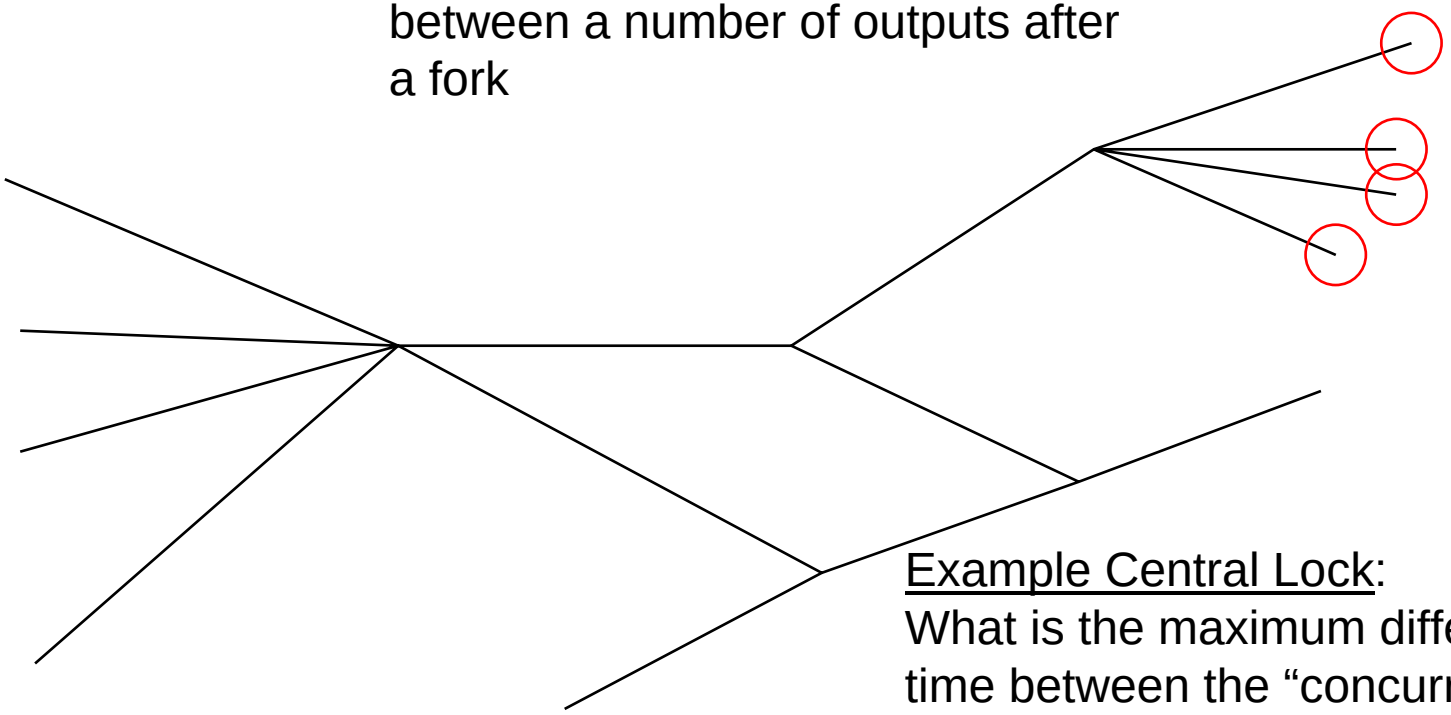
Example ABS:
What is the maximum difference in time between the “concurrent” samples of the four wheel sensors.

Example: Input Synchronization



Timing Measures

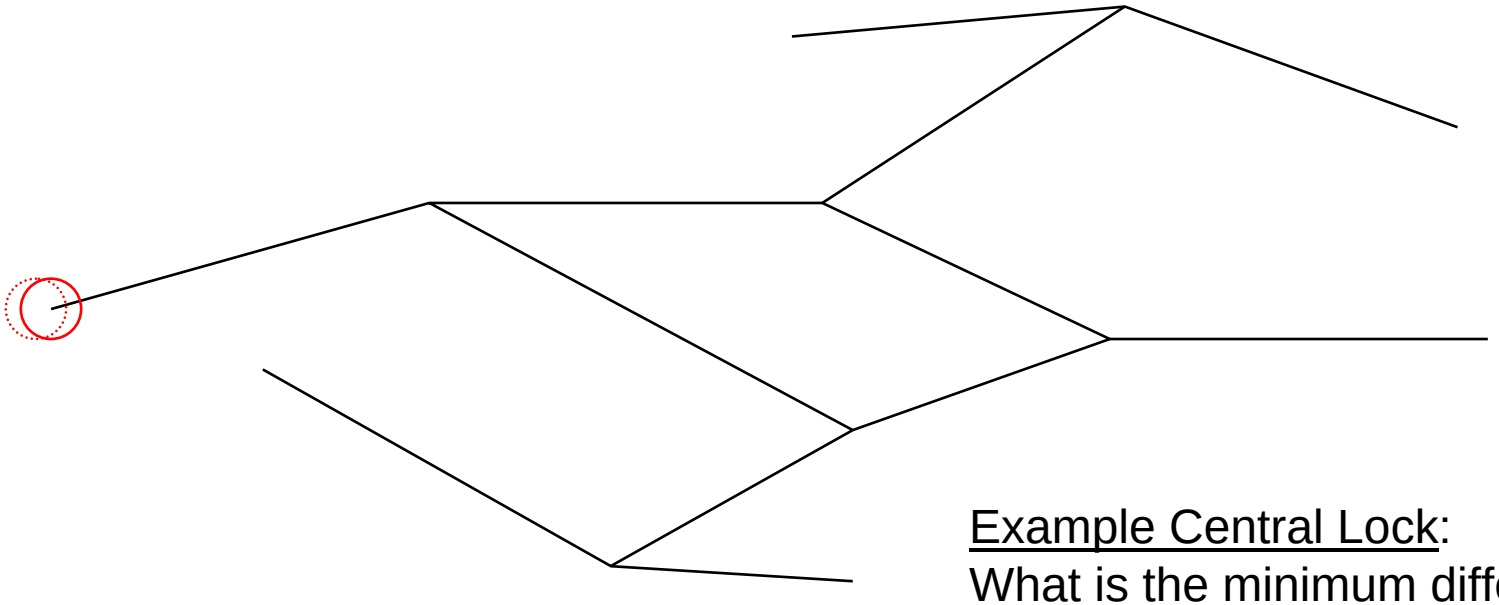
Output Synchronization: What is the difference in time between a number of outputs after a fork



Example Central Lock:
What is the maximum difference in time between the “concurrent” opening of the four doors.

Timing Measures

Interval: What is the difference in time between two occurrences of the same event



Example Central Lock:
What is the minimum difference in time between two consecutive requests for lock and unlock from the remote control.

Relation to Other Projects

General Meta Model in EAST-ADL2

Harmonization to MARTE

Specific AUTOSR topics continue outside ATESST

- TIMMO
- AR WPII-1.2/Timing