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M2M-Interaction in a production line – How to combine different things

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General remarks

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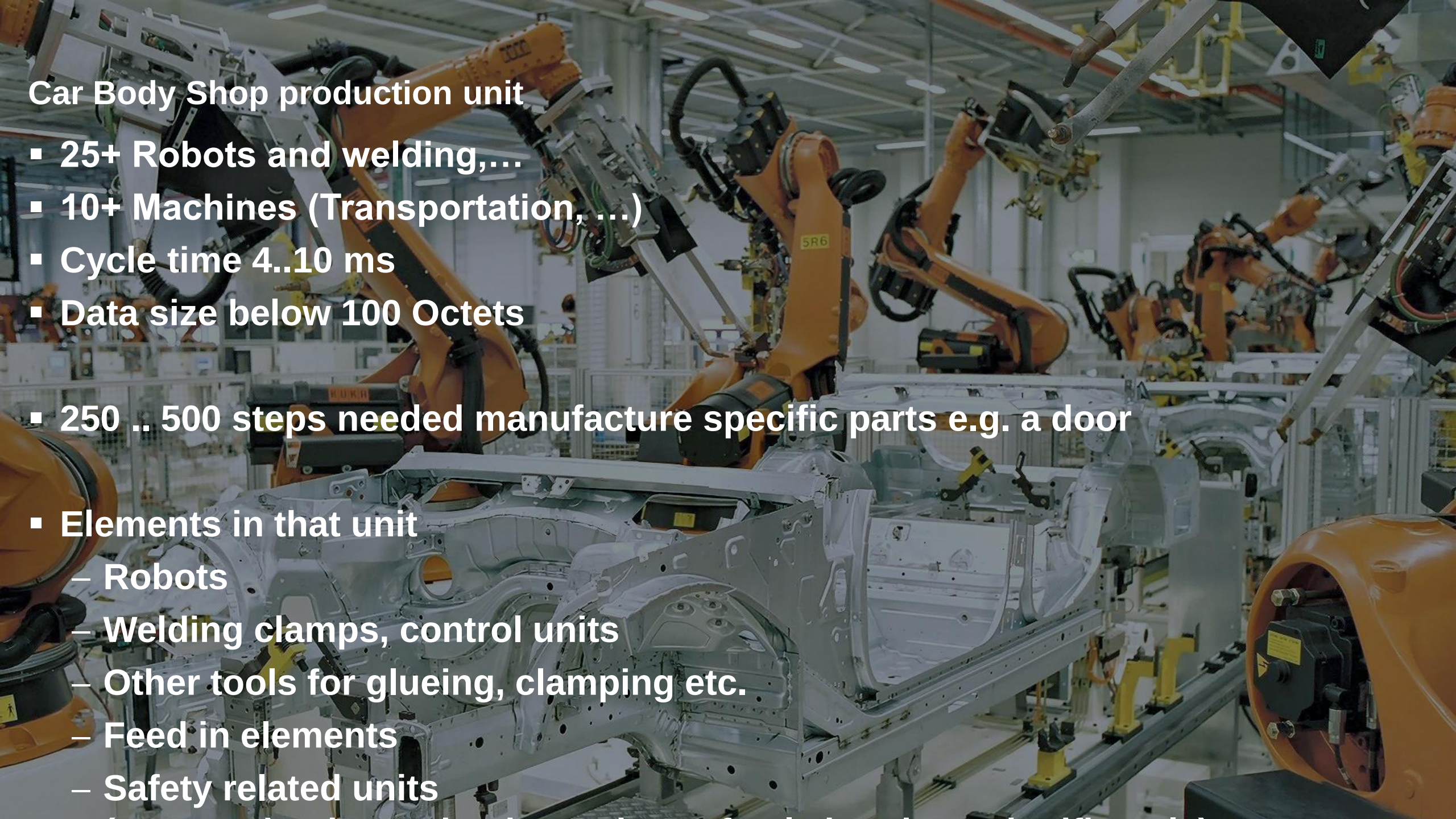
- Refer to https://www.ieee802.org/1/files/public/docs2018/60802-essler-additional-use-case-0718-v01.pdf for general requirements discussed here

- This presentation points out a specific example
  … and how do deal with different communication subsystems



Car Body Shop production unit

- 25+ Robots and welding,…
- 10+ Machines (Transportation, …)
- Cycle time 4..10 ms
- Data size below 100 Octets

- 250 .. 500 steps needed manufacture specific parts e.g. a door

- Elements in that unit
  - Robots
  - Welding clamps, control units
  - Other tools for glueing, clamping etc.
  - Feed in elements
  - Safety related units

Machine internal interaction and overlay communication (M2M)

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- Synchronous cell communication is a great TSN enhancement
  BUT requires coordination with machine internal actions!

- **Machine ecosystem is organized in a different way depending on the machine type**

- **It is difficult to get a complete picture of what is going on in such a system**

Logical production line layout (example door production)

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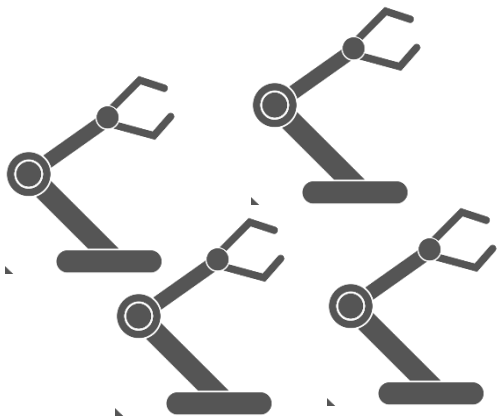
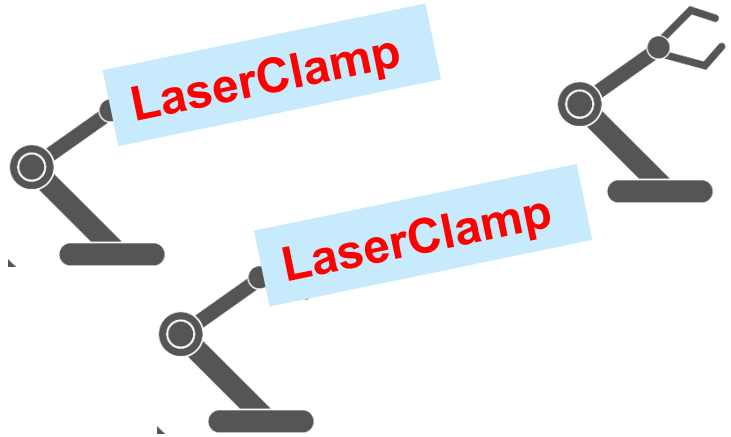
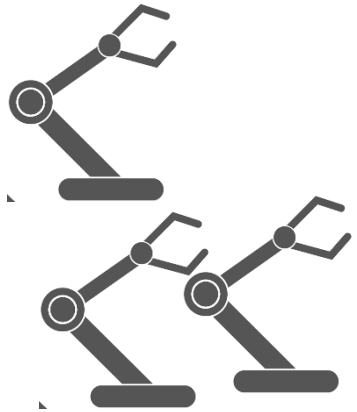


Preparation



Welding



Finish

Feed In

Starting point of the integration

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Begin with sequence of actions with time constrains

+Coordination between robots

= determination if the setup can fulfill the production rate requirements

Resiliency estimation needed to know the impact of errors

A communication interaction profile is one result

➔A calculus required that operates without detailed communication information.
Cycle time, Talker, Listener, and amount of Data are the given parameters.

- LNI 4.0 defines a general network outline with number of hops as additional parameter.

The more complete picture

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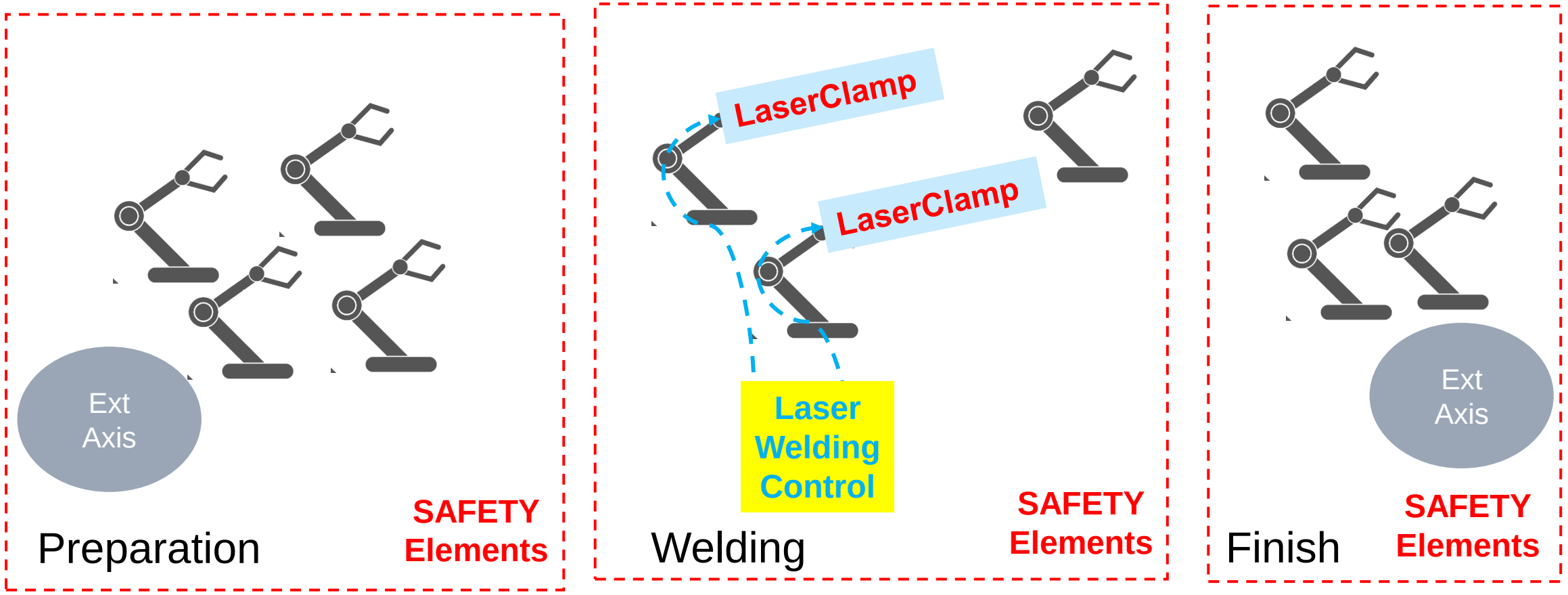

The problem statement

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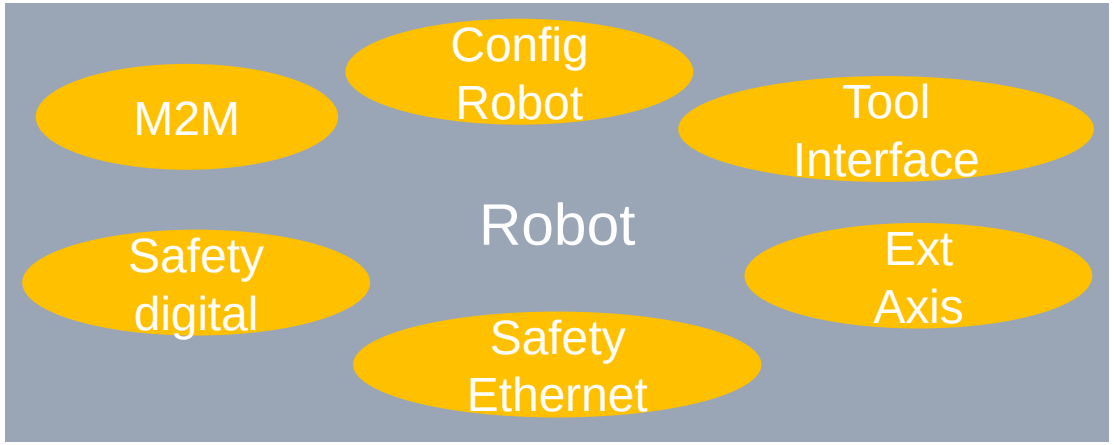
- **The different aspects need different experts**
- Coordination is done as required
- Quite a few different communication Interfaces from a single robot



- It is not trivial to overcome proven structures ….
  But the integration of heterogenous applications shall be with TSN

General Ideas

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- Definition of a common communication platform for various application
  = providing guidance for various applications

- Mathematical model needed in the early stage to determine the communication time impact
  important to work with an (incomplete) offline data model
  ➔ Input dimensioning for RA Classes of RAP

- The establishment of various streams can be made with a single protocol (RAP) when the needed components are up and running (without extra instance)

- LNI4.0 is an approach for e.g. production lines which may be combined with further elements