

SAFEXPLAIN

Safe and Explainable
Critical Embedded Systems based on AI

Jaume Abella¹, Jon Perez², Cristofer Englund³, Bahram Zonooz⁴, Gabriele Giordana⁵, Carlo Donzella⁶, Francisco J. Cazorla¹, Enrico Mezzetti¹, Isabel Serra¹, Axel Brando¹, Irune Agirre², Fernando Eizaguirre², Thanh Hai Bui³, Elahe Arani⁴, Fahad Sarfraz⁴, Ajay Balasubramaniam⁴, Ahmed Badar⁴, Iliaria Bloise⁵, Lorenzo Feruglio⁵, Iliaria Cinelli⁵, Davide Brighenti⁷, Davide Cunial⁷

¹ Barcelona Supercomputing Center, Spain

² Ikerlan Technology Research Centre, Basque Research and Technology Alliance (BRTA), Spain

³ RISE Research Institutes of Sweden, Sweden

⁴ Navinfo Europe, The Netherlands

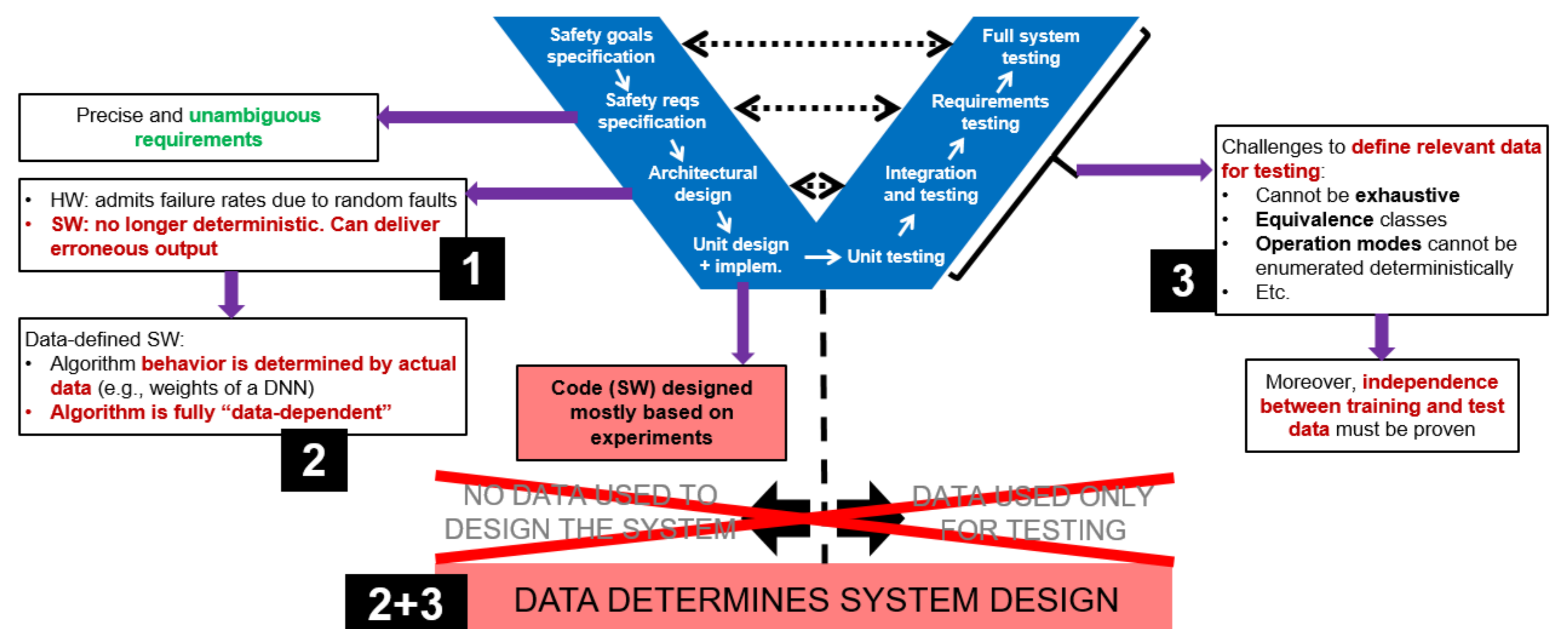
⁵ AIKO s.r.l., Italy

⁶ Exida Development s.r.l.
⁷ Exida Engineering s.r.l., Italy

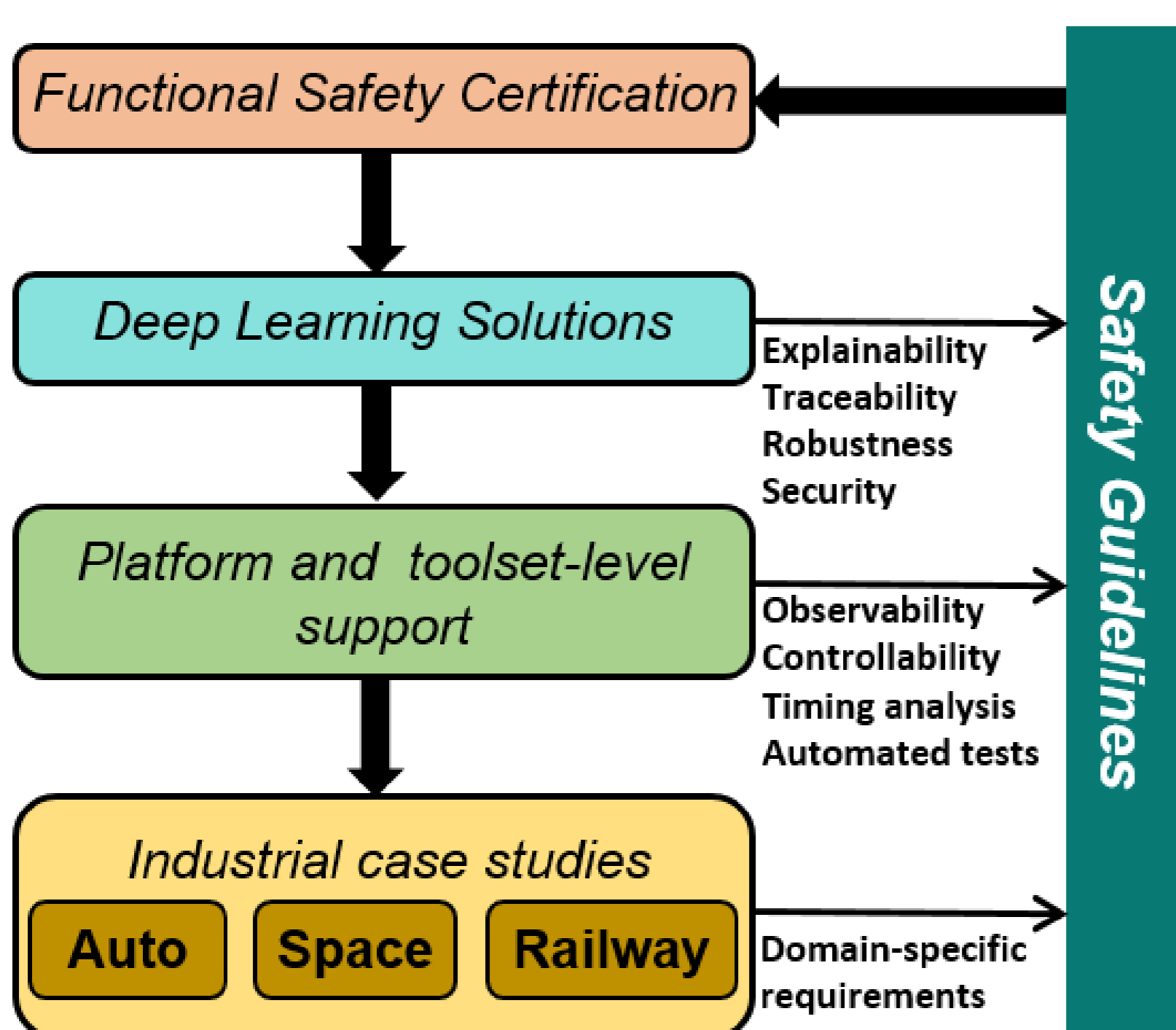


THE SCENE

- **Critical autonomous systems** rely on AI (automotive, space, railway, avionics, etc.)
- Those systems must undergo **certification/qualification**
- AI at odds with functional safety certification/qualification processes (**lack of explainability, lack of traceability, data-dependent** software, **stochastic** nature)



AMBITION and IMPACT



- Ambition: architecting DL solutions **enabling certification/qualification**
 - Making them **explainable** and **traceable**
 - Preserving **high performance**
 - Tailoring solutions to varying safety requirements by means of **different safety patterns**
- Impact
 - Provide **solutions** to industry that enable **fully-autonomous Critical Systems** (e.g. cars, trains, satellites) with **certified and economically viable** solutions
 - Bring increased **efficiency** of Critical Autonomous Systems
 - Allow **European Critical Autonomous Systems industry** benefit from DL functionalities and **remain competitive** in the future, while still **being trustable**

OVERALL PROCESS

- First-level iterative process
 - Tailor **DL solutions** to FUSA requirements
 - Adapt **FUSA standards** to DL design constraints
- Second-level iterative process
 - Tailor **DL implementations** to platform characteristics to preserve efficiency of original DL implementations
 - Tailor **platform configuration** and DL software deployment to achieve high and stable performance
 - Adapt **analysis methods and tools** to assess functional and timing aspects of FUSA-compliant DL solutions on the HPC platform
- Assessment
 - **Three industrial case studies** (automotive, space and railway)

