

Panel: What can academia do for industry and what can industry do for academia to accelerate research in mission-critical systems? What's still missing in current mission-critical systems?

Chair: Lelio Di Martino / Rapporteur: Elias Duarte

Participants: Mario Azevedo (Vale), Maximillian Vieira (Petrobras), Marcio Veronesi (Nokia), JGiovanni Moura de Holanda (Fitec)

The chair/moderator (Lelio) started asking the participants to talk about what they feel is solved and good in current mission-critical systems, and what is still missing.

Mario (Vale): mentioned that the mining environment is very dynamic. Some of the main challenges include providing a robust infrastructure that is flexible, that can change as requirements change. He also mentioned challenges on managing the system.

Lelio mentioned that perhaps the industry would be tending to prefer a more centralized systems, instead of fully distributed. Phil mentioned that from his experience, industries go from distributed to centralized and back.

Mario (Vale): then mentioned that there are multiple cases, with different requirements, one size does not fit all. But all require solutions that are faster and more flexible.

Giovanni Moura de Holanda (Fitec): then mentioned that education is very important. It is essential to prepare the new generation to deal with the new intelligent technologies. Technologies change quickly. GenAI has had a huge impact on all technologies, and the new generation has to deal with this new paradigm. Education must give them the tools for that. As an example, he mentioned that in the past one started from a thesis and an antithesis to reach a synthesis, now one starts getting a huge amount of data, doing correlations to understand the data, and then a theory is constructed.

Henrique (Madeira): mentioned that the industry must clearly tell the academia their needs. Universities are also changing, and they need feedback on which kind of competences are needed.

Lelio: posed the first provocative question from the public (Domenico): he made an analogy of agility and reliability to dog and cat (not necessarily in this order). He asked the panelists to identify which is cat and which is dog in their industries.

Maximillian: mentioned that in Petrobrás reliability certainly comes first and is the cat.

Mario (Vale): mentioned that both are important, not in the same way in all instances. But overall reliability is the most important. Nevertheless costs also have to be taken into consideration.

Marcio (Nokia): Lelio asked about his experience across all those client industries. Technology changes very fast, that's the cat. The dog is dedicated R&D, that keeps up to necessities, to the latest technology that must be used.

Henrique (Madeira): mentioned that we need good technologies to ensure safety. Companies seek profit. There is a trade-off there. There are several techs but the industry doesn't always adopt the correct existing solutions.

Domenico (who made the question) mentioned that each domain must balance reliability & agility.

Ahmed: made a question also using the animal analogy -> "what is the elephant in the room that can take your jobs?"

Maximilliam: mentioned that in Petrobras they are deeply committed to adapt the industry to changes, and to the multiple requirements on those systems. As an example, gas emissions are an issue, and Petrobras is not ignoring. He mentioned that he sees that the "elephants" are not moving very fast.

Lucas (Vale): mentioned that changes are very quick, and asked whether we are prepared for the changes that will happen in the next 10 years. This includes the preparation of professionals for the multiple new resources and challenges, including those posed by AI.

Lelio: started a discussion on another angle of the problem. He mentioned that 5G is there, 6G is being worked on, but 4G is still used in several instances because it is a stabler, very well tested technology, safer to use. How to ensure that technologies that are made available to the public are safe in the first place?

Bruno (Crispo): mentioned that perhaps profit is the main drive for the delivery of new technologies, at least in some cases. Someone that manages a mission critical infrastructure having accountability requirements, will use safer technologies.

Alberto Rodrigues (Nokia): mentioned that from a tech provider point of view, by knowing the real needs of the different industries, the tech provider will be able to design and offer better solutions for each individual case.

Marco (Vieira) mentioned that accountability is specified in Europe even from open-source software

Phil: replied that the US is going the other way. Start-ups simply ignore safety. There is no accountability in several contexts.

Lelio (moderator) then made another provocative question from Phil: On a good day AI delivers 90% accuracy. How to plan to use that to build a 99.999% reliable system from that??

Answer from Lucas (Vale): that is simply not possible, perhaps in the future that will improve.

Mario (Vale): mentioned that it is unavoidable to start using AI, but we should be very careful. AI can be used in some parts of the system, but not in others. Guardrails are required. But overall it is a technology that cannot be ignored.

Lelio (moderator): then asked what about using a human instead of AI? Is it safer?? Which poses a higher risk.

Phil mentioned that this also depends on the system, for some a reliability of 90% is OK, for others definitely not.

Jay (Lala) gave an example in the context of human versus AI: to match the reliability of an average human driver, the reliability of an AI model would have to be 7-9s! He also mentioned that the industry assumes that much lower reliability levels are actually required.

He mentioned another issue: when quantifying safety, reliability requirements of the industry, several talks of the morning mentioned that the goal seemed to be zero faults/accidents. That is

commendable, but impossible to achieve. He mentioned one needs a non-zero number to design practical systems.

Mario (Vale): mentions that zero-accidents is the ultimate goal, even if it is not achievable. Other more feasible goals can be established after that, based on what is possible to do. An issue is to reduce problems created by the intrinsic unreliability of human beings.

Long: mentioned that the goal also depends on the scenario.

Lelio (moderator): made another provocative question from Phil: how do you change the importance of safety for an organization BEFORE a disaster happens.

Maximillian (Petrobras): mentioned that industries should have the ambition for zero disasters and zero life loss. Petrobras has had accidents with life losses, and every year lives are lost. It is impossible to change. But they have a focus on educating people. Industry today is safer than it used to be. For example, human divers are not employed at Petrobras anymore. But this is a very long process.

Jay stressed that he believes it is commendable for the industries to have the zero disaster goal. But gave another amazing example of an extremely low bar that is used in practice.

Lucas (Vale): reported that the Brumadinho accident did change the mentality of people at Vale. He thinks that companies in which no accident has ever happened are not fully aware of all safety requirements, vulnerabilities. After having to deal with an accident, people are more able to ensure safety.

Marco: there are only 2 ways to change: social pressure and legislation (including lawsuits, according to Jay).

Maximillian (Petrobras) mentioned that accountability is also very important.

Henrique Madeira asked: "there are reliable components available to build systems. Why are non-reliable components still used?" Lelio also asked a related question: "why standard fault-tolerance is not always used when needed?"

Lelio posed the final question: if a panelist had a wish to ask for a "genie in the bottle" to solve your industry problem, what would that be.

Mario (Vale): help reduce costs, by introducing reliable and non-expensive technologies.

Lucas (Vale): make tools easier to integrate to the system

Maximillian (Petrobras): improve the collaboration between cat and dog

Giovanni (Fitec): how will gen AI act? What to expect from these new technologies?

Now a vote for the best provocative question: Domenico and Phil got the prizes :-)

Report on The Panel

What can academia do for industry and what can industry do for academia to accelerate research in mission-critical systems?

What's still missing in current mission-critical systems?

Rapporteur: **Elias** Procópio Duarte Jr.
Universidade Federal do Paraná (UFPR)
The 87th Meeting of the IFIP WG 10.4
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Questions & Discussion

- **What do you feel is already solved? What is not solved? And what is missing?**
- Very dynamic industries have requirements that change quickly
- Education is an issue: technologies change very fast
- One size does not fit all
- The industry must tell the academy their needs

An analogy of agility and reliability to dog and cat (not necessarily in this order)

- Reliability certainly comes first (Vale)
- Technology changes very fast, that's the cat. The dog is dedicated R&D, that keeps up to necessities
- (Henrique) we need good technologies to ensure safety; the industry doesn't always adopt the best (or even a good) existing solution

What is the elephant in the room that can take your jobs?

- In Petrobras they are deeply committed to adapt the industry to changes
- Are we prepared for the changes that will happen in the next 10 years?
- 5G is there, 6G is being worked on, but 4G is still used in several instances because it is a stabler, very well tested technology, safer to use
- Profit is the main drive for the delivery of new technologies, at least in some cases

Accountability

- Marco: accountability is specified in Europe even from open-source software
- Phil: replied that the US is going the other way. Start-ups simply ignore safety

AI & Safety

- On a good day AI delivers 90% accuracy. How to plan to use that to build a 99.999% reliable system from that??
- It is unavoidable to start using AI
- It is not possible to use AI and ensure safety
- Human factors?
- Zero accidents?