CHALLENGE ASPIS

FROM MBSE TO STRATEGY OPTIMISATION USING TIMED AUTOMATA

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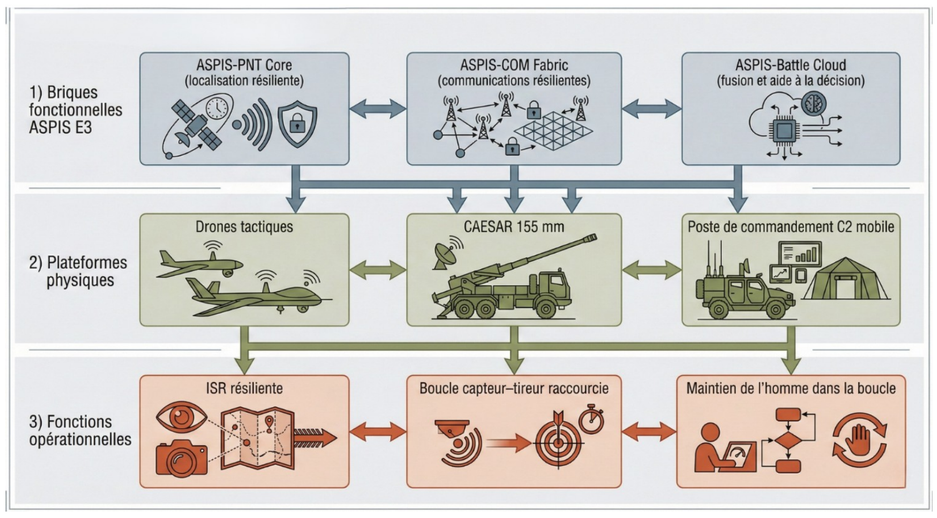
Recognition & outreach

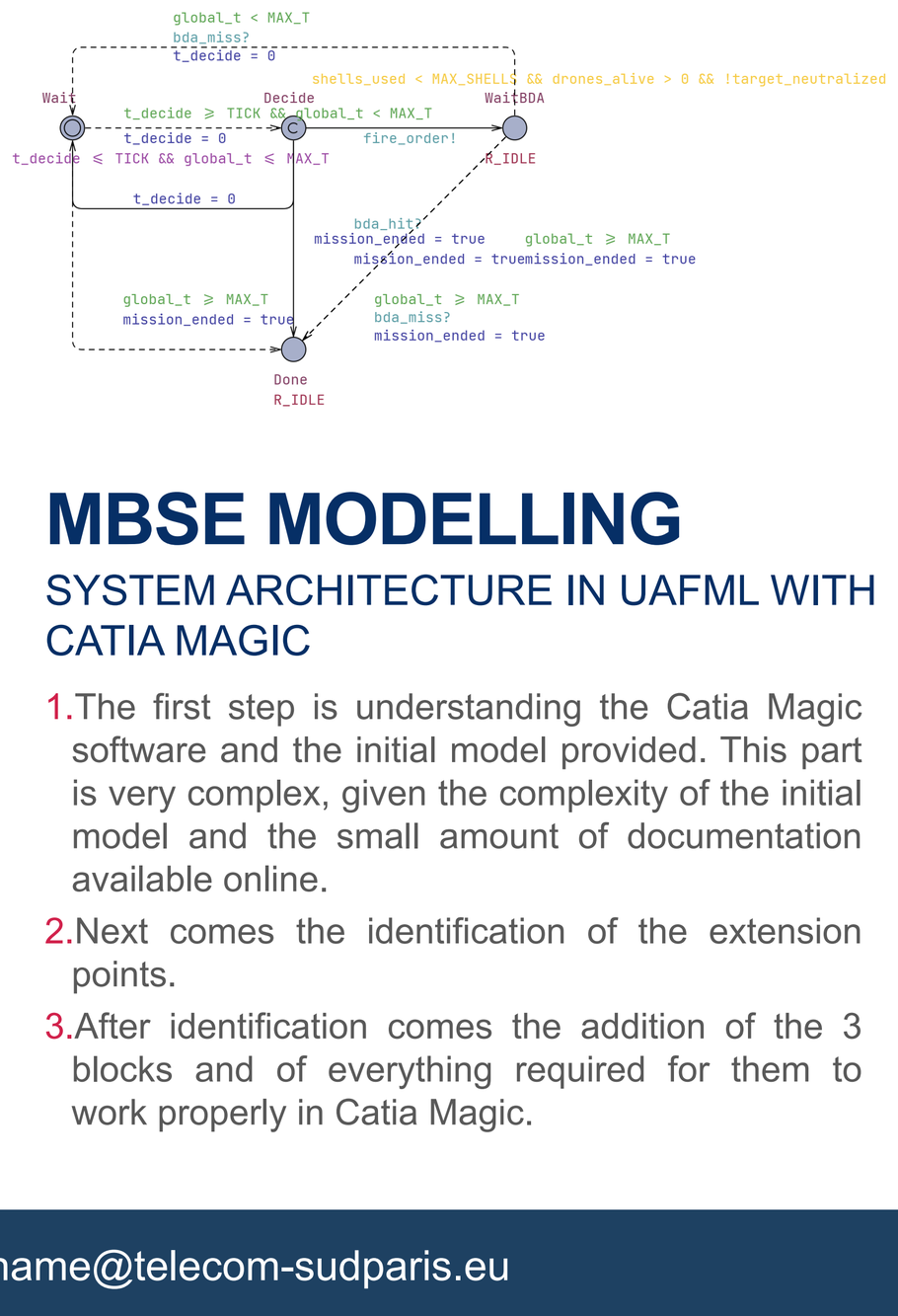
- 3rd place in the ASPIS challenge of the ASC chair
- Presentation of our work on Uppaal at a conference of the ASC chair

THE ASPIS CHALLENGE

OPERATIONAL CONTEXT AND PROPOSED SOLUTION

1. The ASPIS challenge calls for the design of a solution for a given system, enabling it to carry out a mission in a degraded environment
2. The mission: neutralise a threat in a degraded environment (active EW, degraded communications, etc.). A system of systems able to carry out the mission in a non-degraded environment is provided.
3. Our solution: 3 software blocks providing more resilience, more reliable information and more confidence in decision-making.
4. 1st block ASPIS-PNT Core: multi-signal aggregation for positioning in GNSS-denied environments.
5. 2nd block ASPIS-COM Fabric: complementary layers for a resilient communication architecture.
6. 3rd block ASPIS-Battle Cloud: sensor/effector data fusion (lightweight digital twin) accounting for uncertainties, to propose a firing solution to the operator.





PTMDP OPTIMISATION

STRATEGY SYNTHESIS IN UPPAAL STRATEGO

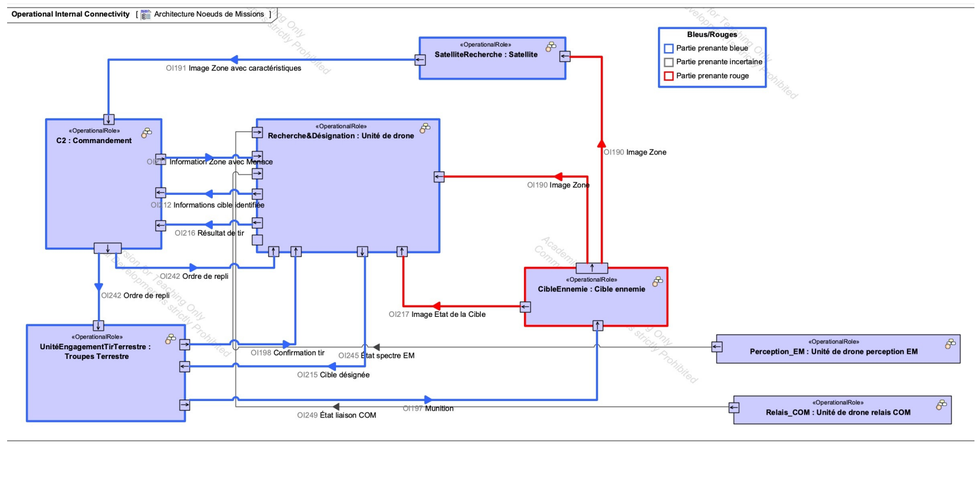
1. To demonstrate the relevance of the PTMDP formalism (*Priced Timed Markov Decision Process*), we extracted the engagement loop of our solution and modelled it as timed automata in Uppaal Stratego.
2. Stratego synthesises three strategies by Q-learning: MaxNeut (maximises neutralisation), SafeMaxNeut (under a budget constraint of ≤ 250 k€), Refined (hierarchical refinement: the least costly among the behaviours of MaxNeut).
3. Results (1000 Monte-Carlo simulations, 2 drones / 6 shells / 60 min):

- P(neutralisation): 36 % → 93 % *(+57 pts vs baseline)*
- P(success within budget): 94 % with SafeMaxNeut
- Consumption: 1.53 shells, cost 60 k€

MBSE MODELLING

SYSTEM ARCHITECTURE IN UAFML WITH CATIA MAGIC

1. The first step is understanding the Catia Magic software and the initial model provided. This part is very complex, given the complexity of the initial model and the small amount of documentation available online.
2. Next comes the identification of the extension points.
3. After identification comes the addition of the 3 blocks and of everything required for them to work properly in Catia Magic.



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