Découvrir l'Association AltaRica & Tour d'horizon des activités

Discover the AltaRica Association & Overview of activities

Friday June 14
2 p.m. to 3:30 p.m.

Anthony Legendre
Président de
l'Association AltaRica

Tatiana Prosvirnova
Trésorière de
l'Association AltaRica

Michel Batteux
Secrétaire de
l'Association AltaRica

André Leblond
Membre actif de
l'Association AltaRica

Summary

- General Presentation of the Association
- Research activities
- Brief introduction of AltaRica 3.0 technology
- Our future activities
- What the association offers
- Why join

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General Presentation of the Association

AltaRica association:

- was founded in **March 2014**.
- non-profit, non-governmental organization.
- managed on a strict volunteer base.

Main mission:

1. **”Promote and Develop the science and engineering of models”**
1. **“Foster collaboration among researchers, practitioners, and industries”**
1. **“Provide an organization and platform for knowledge and ideas exchange”**

The association has about 12 members:

- 10 individuals,
- 2 companies.

General Presentation of the Association

The association is composed by a Board and two Committees (developer and training).

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Management administration, treasury, secretariat, management of the actions of the association.

Board

Define roadmap on AltaRica 3.0 technology and Develop

Developer College

Trainer College

Share training support, Share training opportunities.

Key values:

- Innovation and excellence in system engineering, system modeling and RAMS.
- Commitment to advancing the field through education and research
- Inclusivity and support for community of diverse members

General Presentation of the Association

Background activities

Research and software development :

AltaRica 3.0
Open-PSA
Synthesis
S2ML
SmartSync
GraphXica

Trainings:

IMdR,
AFIS,
INSA-CVL,
INSA Toulouse,
Ecole Centrale Pékin,
Polytech Angers,
ENSEEIHT,
Supméca,
Paris-Saclay,
ESIEA,
…

Also in industries.

Publications:

Congress :
LambdaMu,
IMBSA,
ESREL,
CSDM
ISSE,
…
Journals :
JRR,
RESS,
Systems Engineering,
…

General Presentation of the Association

Activities and Initiatives

- Support the **intellectual property** of developments around the **AltaRica 3.0 technology,**
- Support **research and development projects** in the MBSA field,
- Establish and update the **specification of the AltaRica 3.0** modeling language,
- Develop and maintain **several software tools**,
- Organize **webinars, publish researches**, and participation to **conferences,**
- Develop and disseminate **educational materials** and **tutorials**,
- Facilitate **networking** and **collaboration opportunities** for members,
- Gather a **community around MBSA activities**,
- Allow **extended research** on Model-based engineering field.

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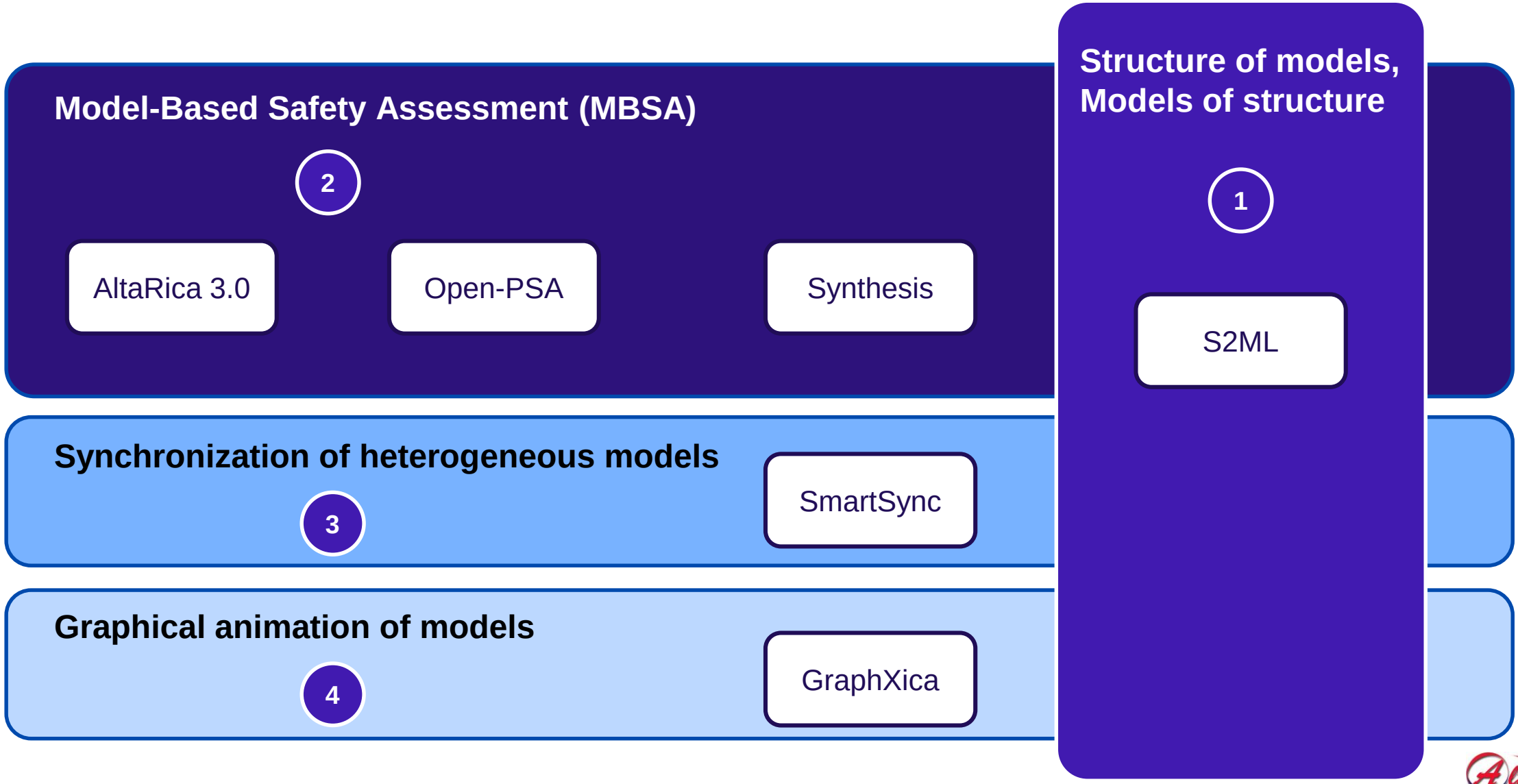
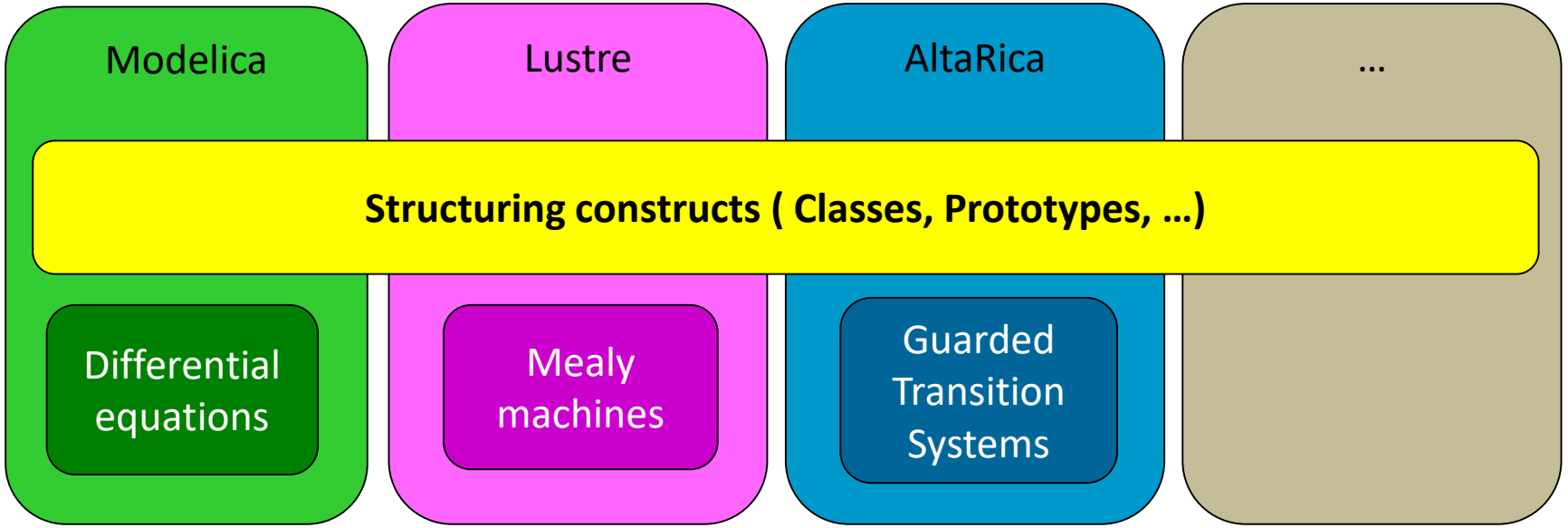
Research activities



Structure of models, models of structures

S2ML (System Structure Modelling language)

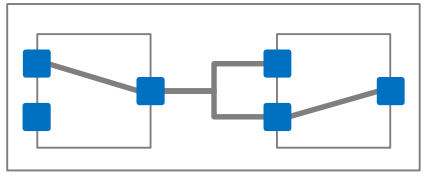


- Any **modeling language** is the **composition** of a **mathematical framework** and a set of constructs to **structure models**.
- **Structuring** helps to design, to debug, to share, to maintain and to synchronize models.
- The **structure** of models reflects the structure of the system, but only to a limited extent.

Structure of models, models of structures

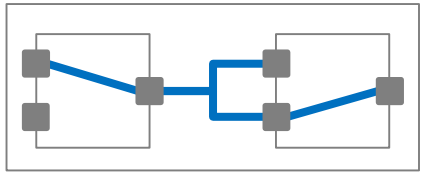
S2ML: a **structuring paradigm** that unifies **object-** and **prototype-orientation.**

Port



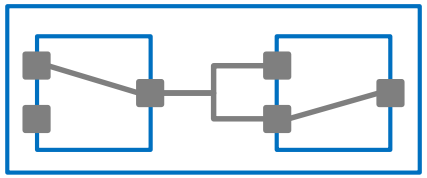
Variable, event…

Connection



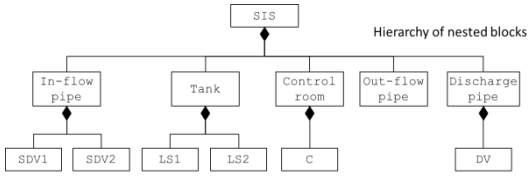
Equation, transition…

Container



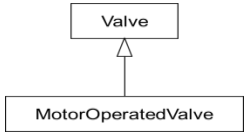
Model, component…

Composition



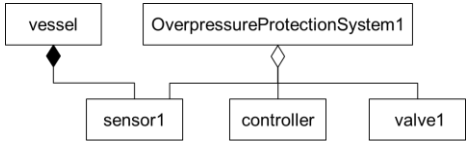
Is-part-of

Inheritance



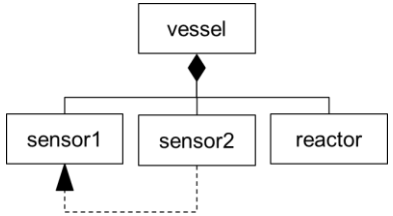
Is-a

Aggregation

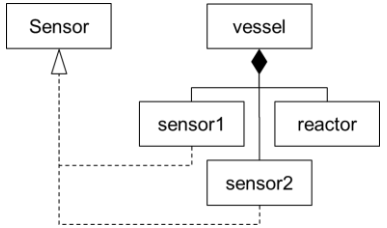


Uses

Prototype/Clone



Class/Instance



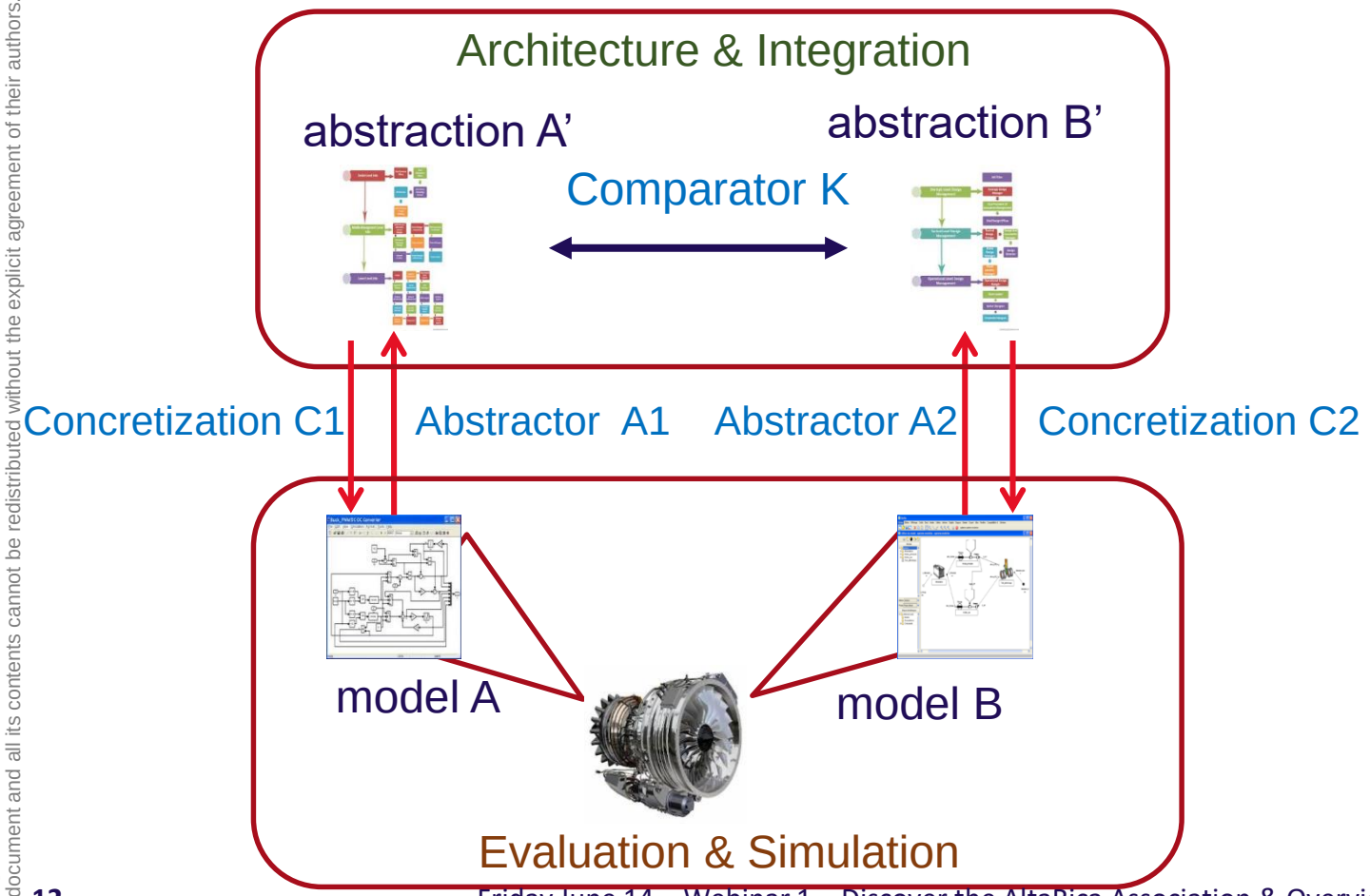
Publications

M. Batteux, T. Prosvirnova, and A. Rauzy. « From Models of Structures to Structures of Models », *IEEE International Symposium on Systems Engineering (ISSE 2018)*. Roma, Italy. October, 2018. Best paper award

Synchronization of heterogeneous models

SmartSync

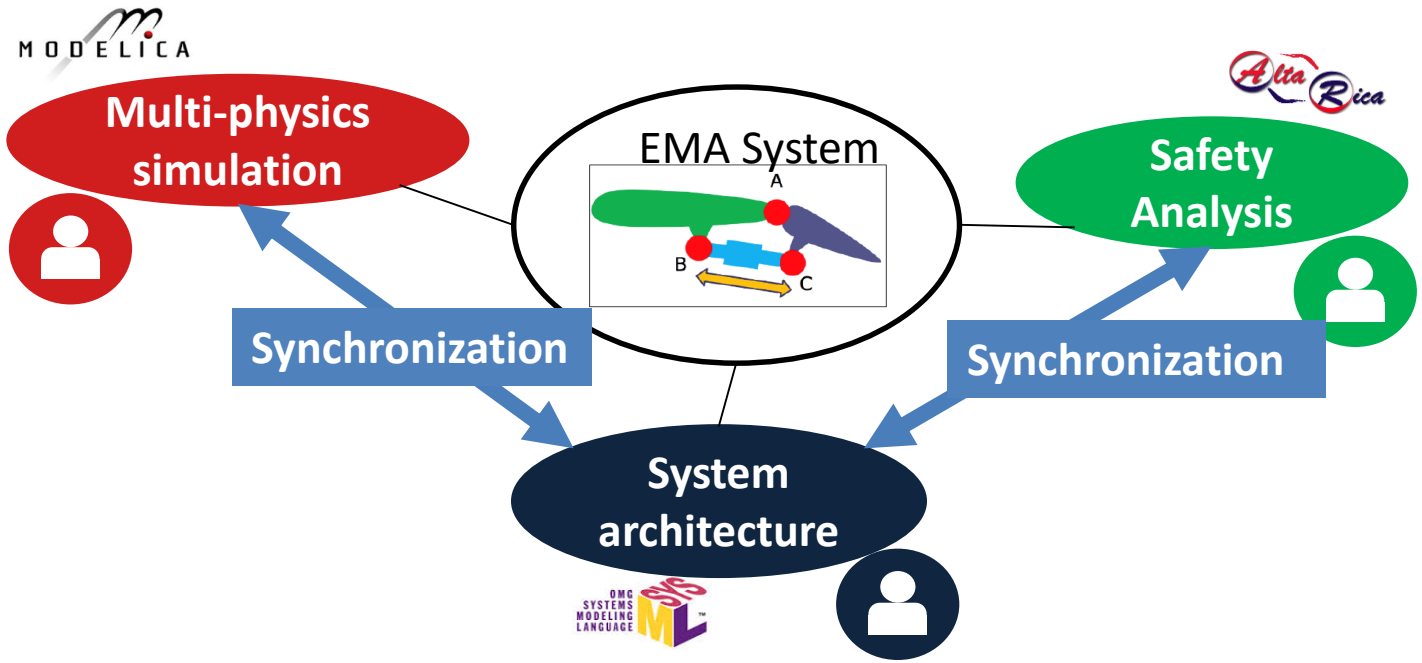
Synchronization = abstraction + comparison



- **SmartSync platform** = S2ML + Model synchronization
  - **S2ML: System Structure Modeling Language**
  - **Model synchronization**
    - Abstraction
    - Comparison
    - Concretization

Synchronization of heterogeneous models

SmartSync



Publications

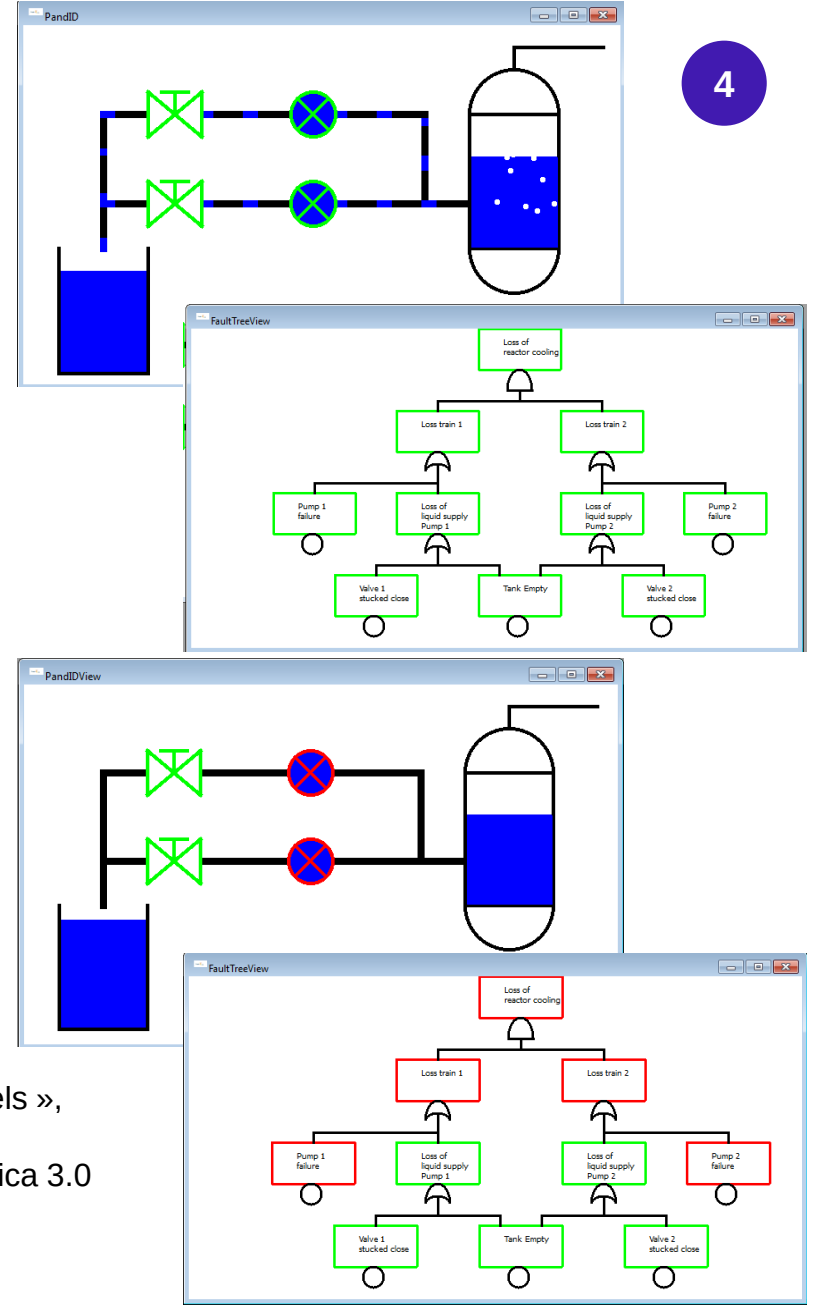
1. M.Batteux, T. Prosvirnova, A. Rauzy, « Model Synchronization: A Formal Framework for the Management of Heterogeneous Models », International Symposion on *Model-Based Safety and Assessment*, IMBSA 2019, Thessaloniki, Greece. Vol. 11842, pp 157–172, 2019.
2. M. Batteux, J.-Y. Choley, F. Mhenni, T. Prosvirnova, A. Rauzy, « Synchronization of system architecture and safety models: a proof of concept », *Proceedings of the IEEE 2019 International Symposium on Systems Engineering (ISSE)*. Edinburgh, Scotland. 2019.
3. M. Batteux, J.-Y. Choley, F. Mhenni, L. Palladino, T. Prosvirnova, A. Rauzy, M. Théobald, « Synchronization of system architecture, multi-physics and safety models », *Proceedings of the Complex Systems Design and Management international conference, CSDM 2019*. Paris, France. pp 37–48, 2019.

Graphical animation of models

GraphXica

- **GraphXica = S2ML + Animation rules**
  - Modelling language for graphical animation of models
  - **Animation rules**: instructions to change graphical representation according to the value of external variables
  - **S2ML**: System Structure Modeling language

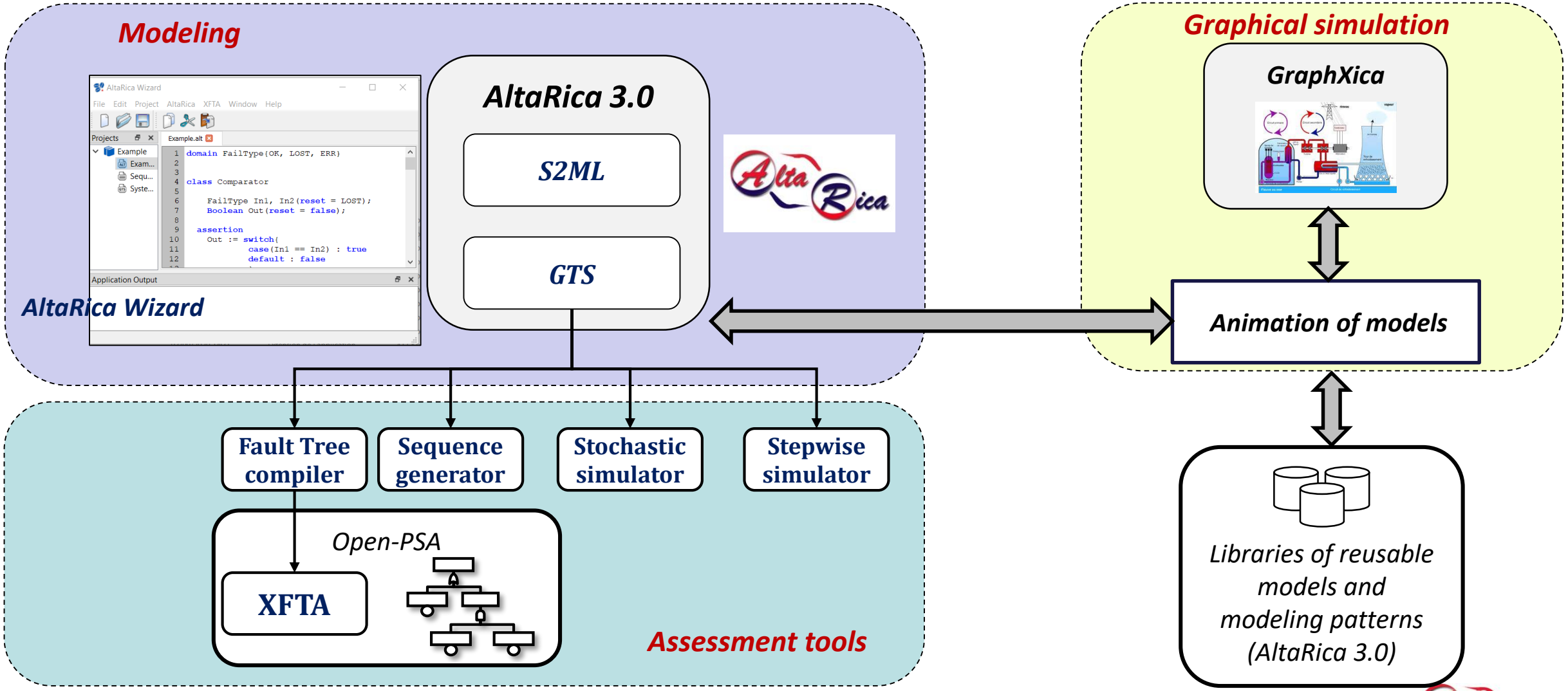
- GraphXica tools
  - Prototype of **GraphXica viewer**
  - Integration with AltaRica Wizard



Publications

1. T. Prosvirnova, M. Batteux, A. Maarouf, A. Rauzy, « GraphXica: a Language for Graphical Animation of models », *Proceedings of the European Safety and Reliability conference, ESREL 2013*.
2. M. Batteux, M. W. Bennaceur, T. Prosvirnova, A. Rauzy, « Benefits of graphical animation of advanced AltaRica 3.0 models », *Proceedings of the 31st European Safety and Reliability Conference, ESREL 2021*.

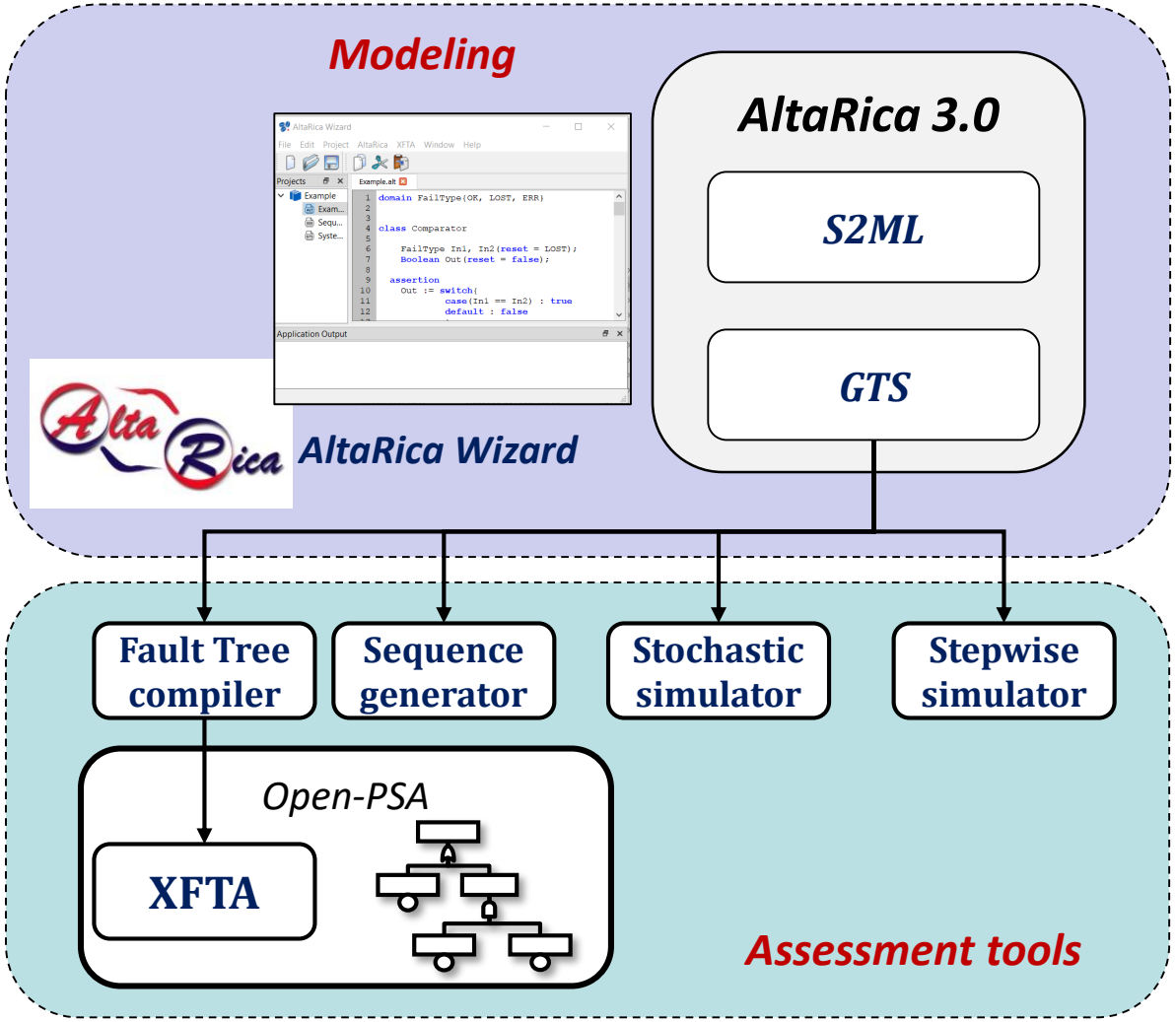
Graphical animation of models



Model-Based Safety Assessment (MBSA)

AltaRica 3.0 technology

- **AltaRica 3.0 = S2ML + GTS**
  - **GTS: Guarded Transition Systems**
    - Generalization of state/transitions formalisms such as (multiphase) Markov chains and stochastic Petri nets
  - **S2ML: System Structure Modeling Language**



PhD thesis

1. T. Prosvirnova, “AltaRica 3.0: a Model-Based approach for safety analysis”, 2014
2. P.A. Bramerer, “Calcul d’indicateurs de sûreté par la generation automatique de chaînes de Markov partielles”, 2015
3. B. Aupetit, “Calcul d’indicateurs de sûreté de fonctionnement de modèles AltaRica 3.0 par simulation stochastique”, 2020

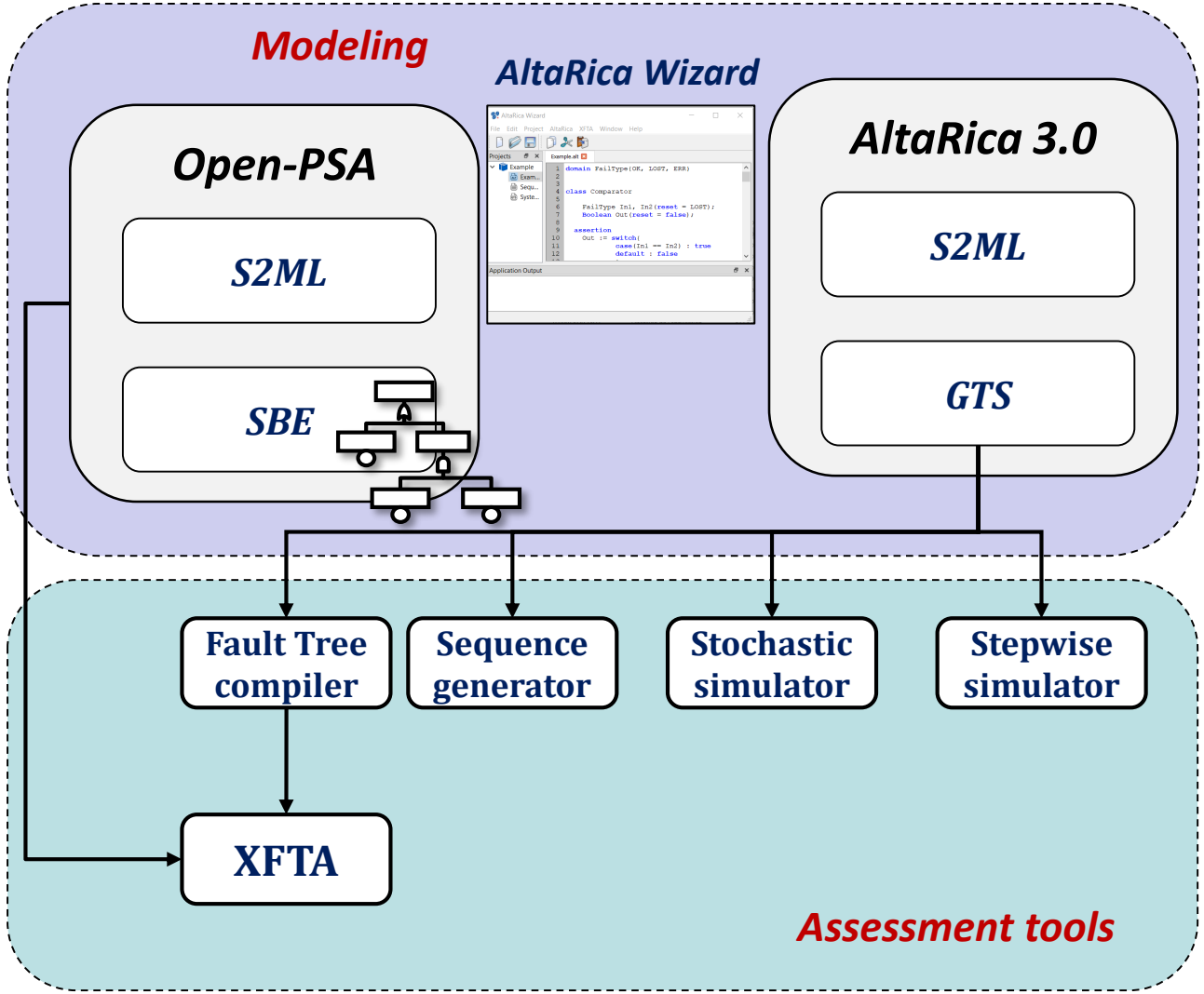
Publications are available on the web page:
http://www.altarica-association.org/Documentation/documentation.html

Model-Based Safety Assessment (MBSA)

Open-PSA

- **New Open-PSA = S2ML + SBE**
  - **SBE: Stochastic Boolean Equations**
    - Underlying mathematical formalism of Fault Trees and Reliability Block Diagrams
  - **S2ML: System Structure Modeling Language**

- **XFTA**
  - **Efficient calculation engine for Fault Trees and related models**
  - **Can be downloaded from**
    - http://www.altarica-association.org/members/arauzy/Software/XFTA/XFTA2.html
  - **Integrated inside ArbreAnalyst**
    - https://www.arbre-analyste.fr/



Publications

Antoine Rauzy. « Probabilistic Safety Analysis with XFTA », AltaRica Association, 2020, isbn: 978-82-692273-0-7

Model-Based Safety Assessment (MBSA)

Synthesis

- Static functional models consisting of interlinked components can be used to model complex systems at the « early validation » stage (AltaRica 3.0 Wizard tool)
- Minimal cutsets can then be generated by XFTA tool (more then 100000 cutsets are not unusual). Since the model is functional, cutsets are not quantified.

➢ Synthesis tool allows the analyst to compress these cutsets as quantified « global cutsets » i.e. « safety indicators » which reflect the safety level currently reached by the system

➢ These safety indicators can point out weaknesses in the design, suggest additional safety ressources, and therefore allow safety optimization

- “Synthesis: A new method for safety assessment of complex Avionic Systems” A. Leblond, M. Batteux, A. Rauzy, Proceedings of the Institution of Mechanical Engineers Part O Journal of Risk and Reliability – January 2024
- “SYNTHESIS : a tooled method for evaluating and optimizing safety performances of a complex system” A. Leblond, M. Batteux, A. Rauzy, Congrès Lambda Mu 22 de Maîtrise des Risques et Sûreté de Fonctionnement, Dijon, April 2021
- “Synthèse de coupes minimales fonctionnelles en coupes minimales composant” A. Leblond, Congrès Lambda Mu 19 de Maîtrise des Risques et Sûreté de Fonctionnement, Dijon, 21-23 Octobre 2014

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AltaRica versions

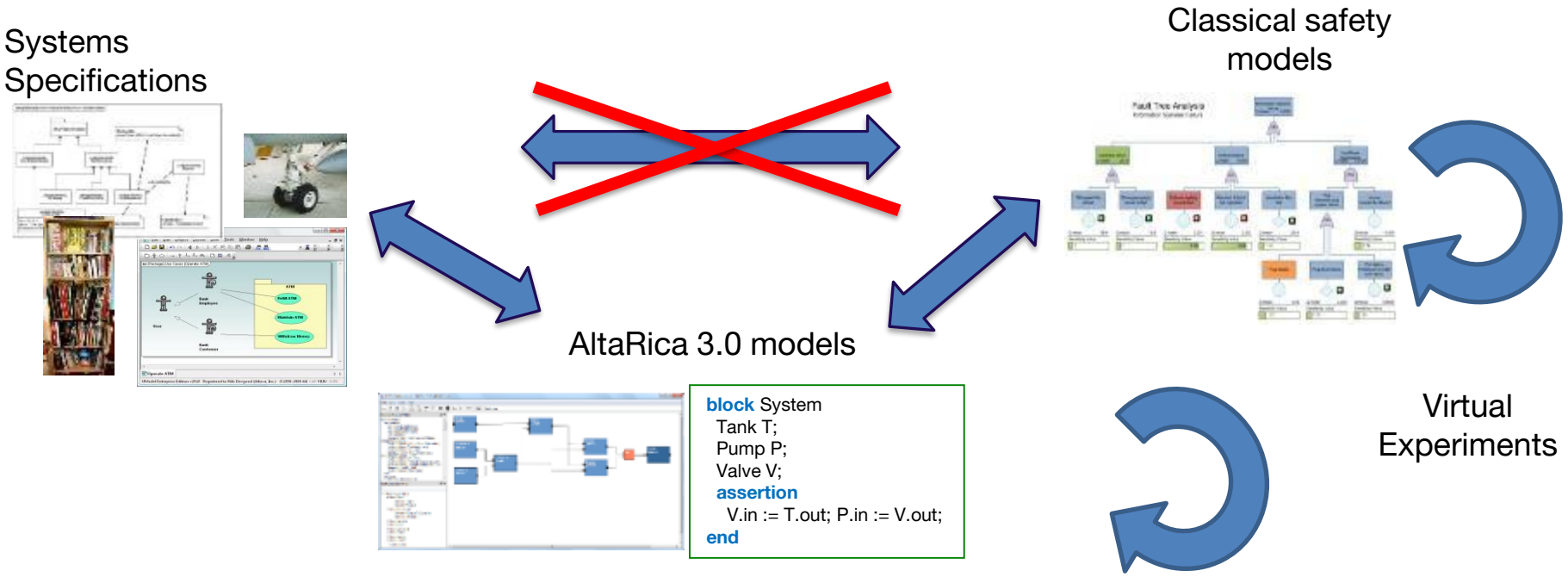
Language version	Semantics	Tools
AltaRica LaBRI [1]	Constraint automata	AltaRica Studio http://altarica.labri.fr/wp/
AltaRica DataFlow [2]	Mode automata	• Cecilia Workshop (SATODEV & Dassault Aviation) • SimfiaNeo (Airbus Protect)
AltaRica 3.0 [3]	Guarded Transition Systems	AltaRica 3.0 Workshop http://www.altarica-association.org/Products/Software/AltaRicaWizard/AltaRicaWizard.html

[1] The AltaRica Formalism for Describing Concurrent Systems, André Arnold, Alain Griffault, Gérald Point, and Antoine Rauzy, in Fundamenta Informaticae. IOS Press. Vol. 34, pp 109–124, 2000
[2] The AltaRica Data-Flow Language in Use: Assessment of Production Availability of a MultiStates System, Marie Boiteau, Yves Dutuit, Antoine Rauzy, and Jean-Pierre Signoret, in Reliability Engineering and System Safety. Elsevier. Vol. 91, Num. 7, pp 747–755, July, 2006,
[3] AltaRica 3.0 in 10 Modeling Patterns, Michel Batteux, Tatiana Prosvirnova, and Antoine Rauzy, in International Journal of Critical Computer-Based Systems, Inderscience Publishers, Vol. 9, Num. 1–2, pp 133–165, 2019

The AltaRica 3.0 technology

The **MBSA** concept: **modeling** the system at **higher level**, than classical safety formalisms

- **reduce the distance** between systems specifications and models,
- **without increasing** the complexity of calculations.



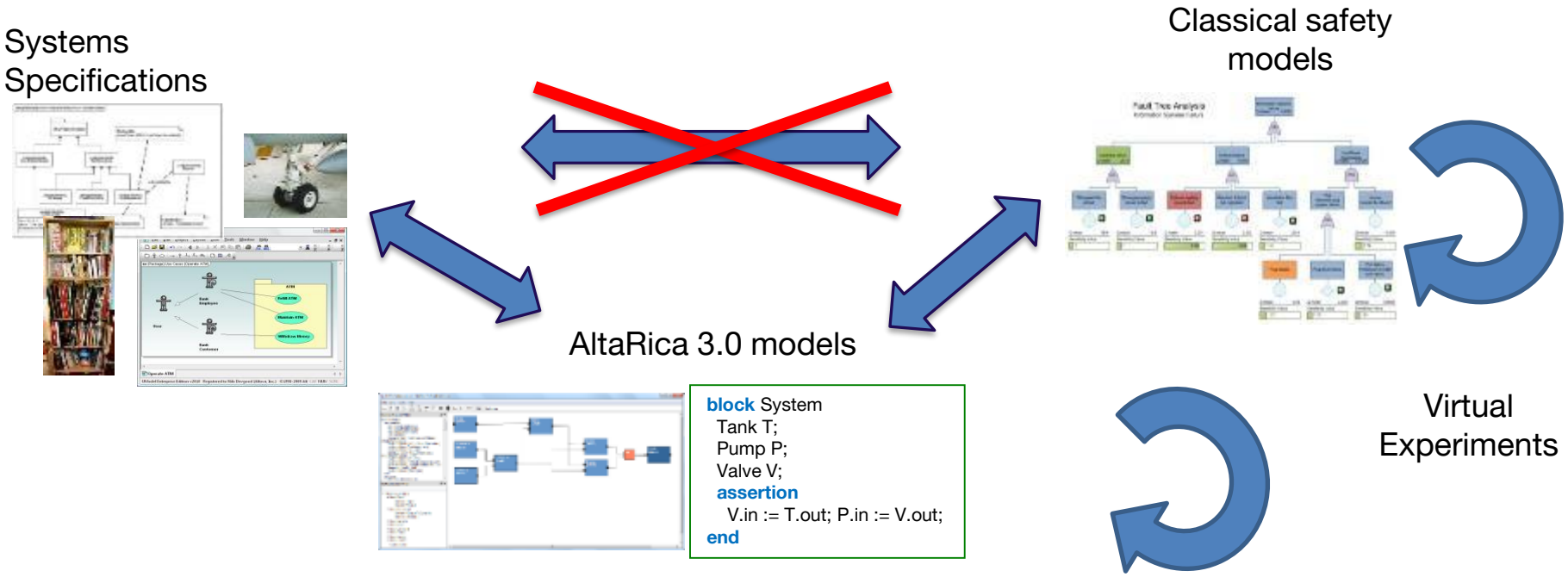
The AltaRica 3.0 technology

AltaRica 3.0

A **(behavioral) modeling language** dedicated to **risk/safety analysis**.

It is an **implementation** of the MBSA concept.

But not only!



The AltaRica 3.0 technology

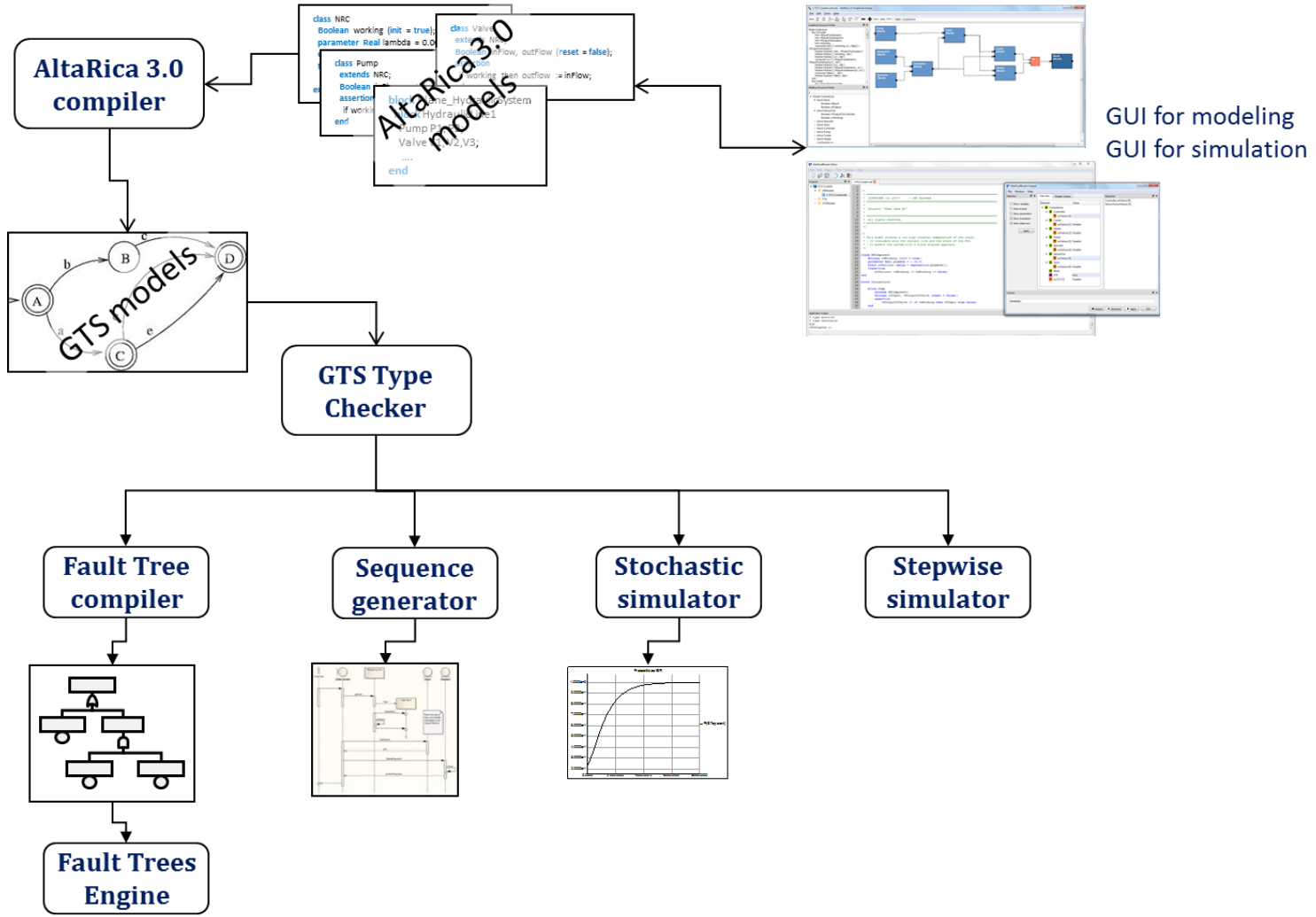
AltaRica 3.0 is an **object oriented** modeling language.
Its semantics is defined in terms of **Guarded Transition Systems**, a particular kind of stochastic discrete event systems.
AltaRica provides all dedicated assessment tools for virtual experiments used in risk/safety analyses (qualitative and quantitative/probabilistic studies)

- Either directly onto AltaRica models, e.g. **Monte-Carlo simulations** or **model-checking techniques**
- Or by compiling AltaRica models to classical risk/safety formalisms: e.g. **fault trees** or **Markov chains**, and using dedicated assessment techniques and tools.

The AltaRica 3.0 platform can be downloaded from this link
http://www.altarica-association.org/Products/Software/AltaRicaWizard/AltaRicaWizard.html

The AltaRica 3.0 technology

The **AltaRica 3.0 platform**
An integrated platform to **design** and **assess** AltaRica 3.0 models

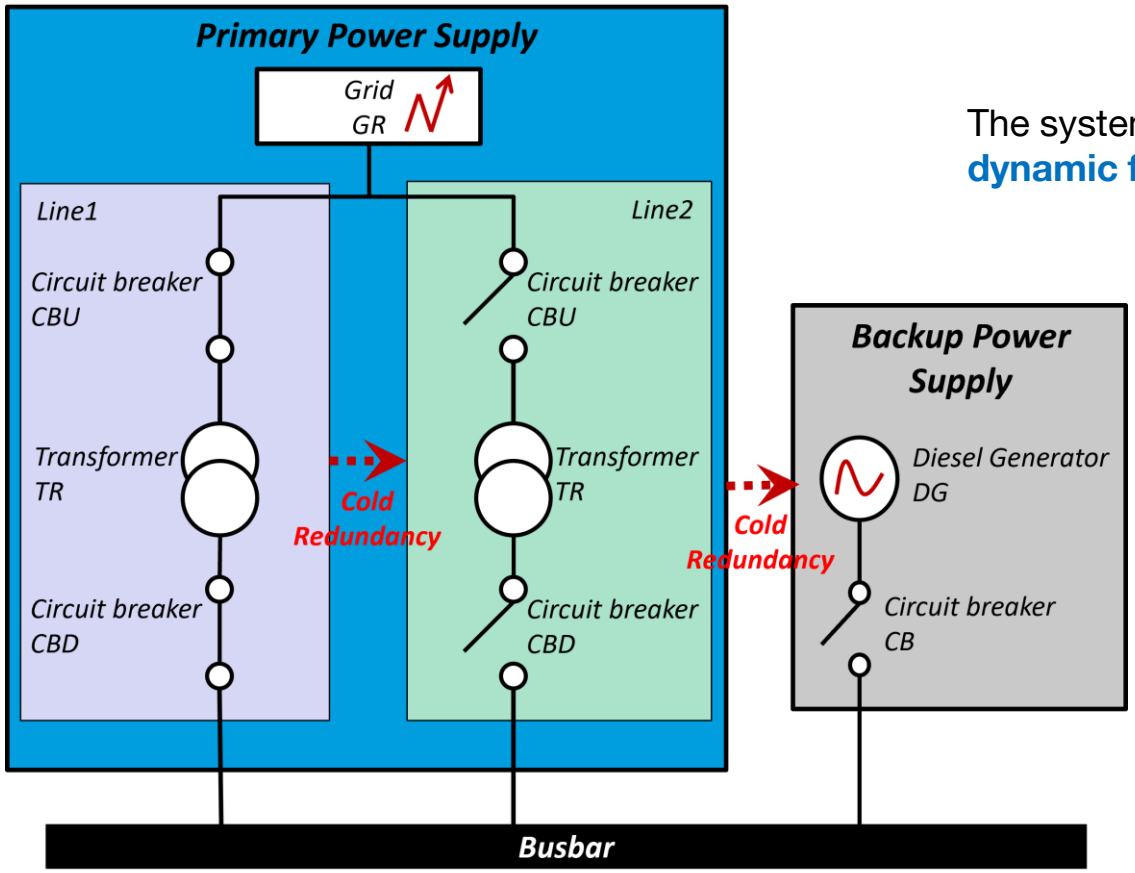


Michel Batteux, Tatiana Prosvirnova, and Antoine Rauzy. "AltaRica Wizard: an integrated modeling and simulation environment for AltaRica 3.0". In *Actes du congrès Lambda-Mu 21 (actes électroniques)*. Reims, France. October, 2018.

The AltaRica 3.0 technology

Example 1: the **Power Supply System**

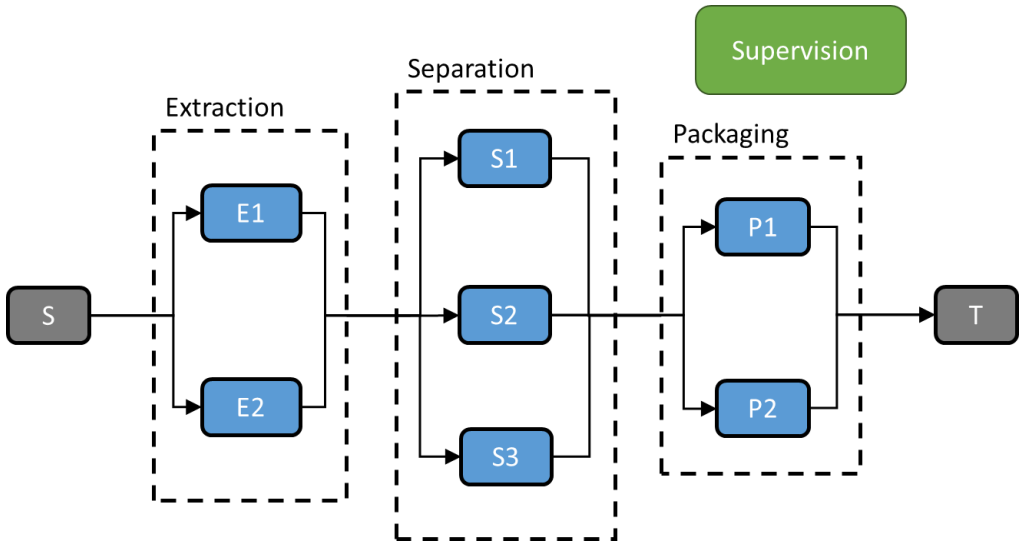
Assess the probability that the Busbar cannot be powered and find the sequences of events that lead to this situation



The system contains **dynamic features**

The AltaRica 3.0 technology

Example 2: **Combination of maintenance policies**



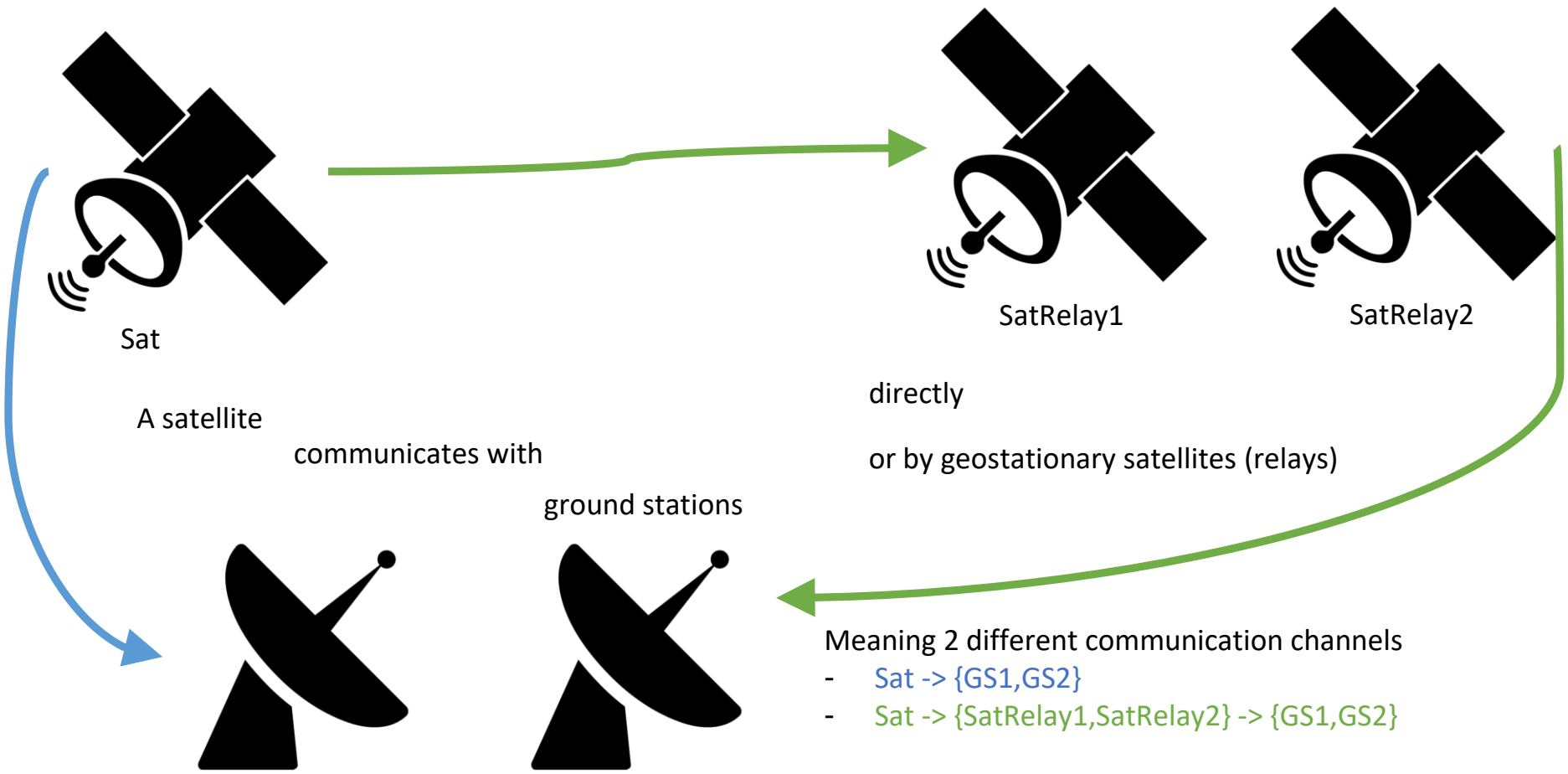
- **Different kinds of components in interaction**
  - 'production'
  - 'supervision'
- **Different kind of maintenance policies**
  - corrective
  - preventive

- Objective (for example) assess the availability or the level of production of the system
  - During a mission time
  - Including the maintenance policies

Michel Batteux, Tatiana Prosvirnova, and Antoine Rauzy. "Modélisation de combinaisons de maintenances en AltaRica 3.0". In *Actes du congrès Lambda-Mu 22 (actes électroniques)*. Le Havre, France. October, 2020.

The AltaRica 3.0 technology

Example 3: **Multi-Phased System**



Sat orbits the Earth for 300 laps, each orbital lap contains four phases

Our objective: assess the reliability of this phased-mission system for a 3600 hours mission

Meaning 2 different communication channels

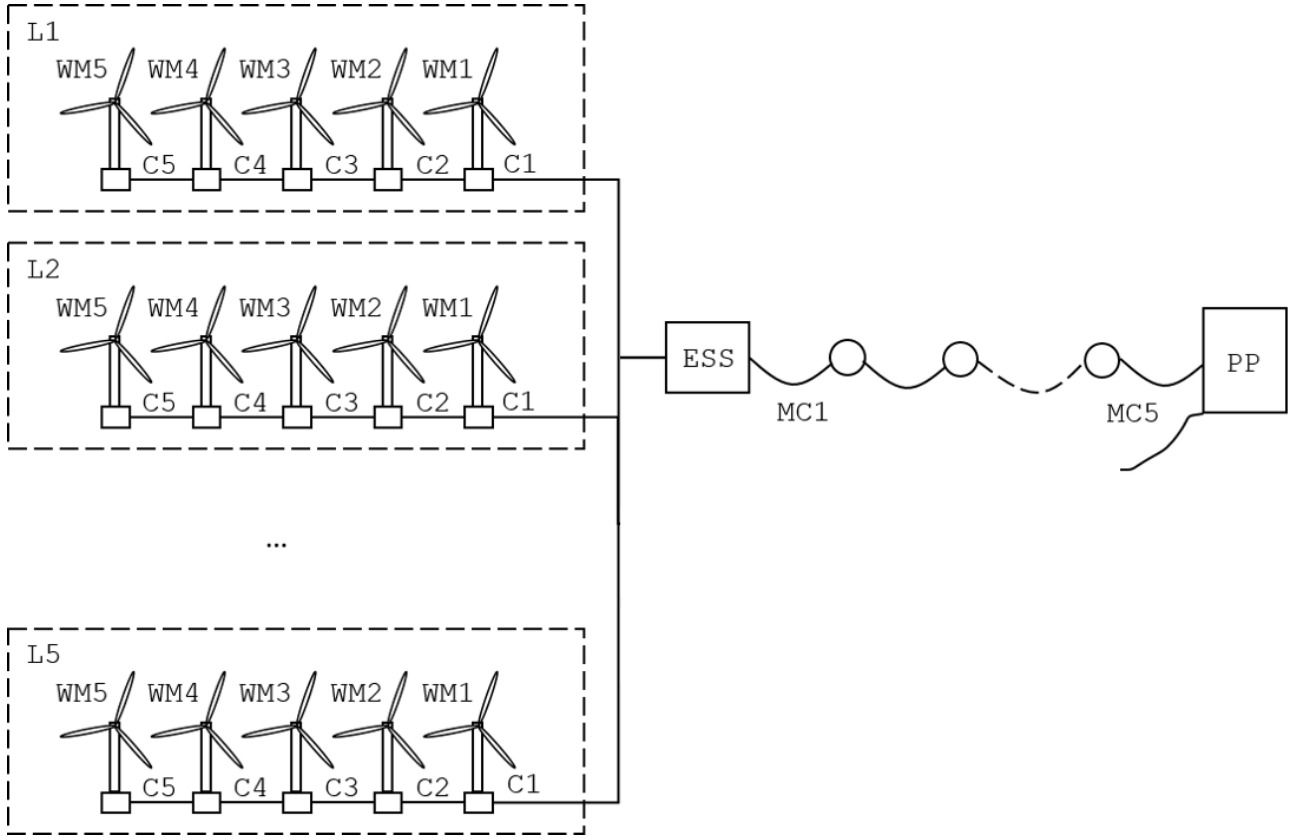
- Sat -> {GS1,GS2}
- Sat -> {SatRelay1,SatRelay2} -> {GS1,GS2}

M. Batteux, T. Prosvirnova, A. Rauzy, and L. Yang. "Reliability assessment of phased-mission systems with AltaRica 3.0" , In International Conference on System Reliability and Safety. 2018.

The AltaRica 3.0 technology

Example 4: **Windmill Farm System**

- Force of the wind
- Power production demand coming from clients (seasons and times of the day)
- Limited number of repairers for maintenances



Estimate

- the power production of the offshore windmill farm over a year
- the difference between the power demand and the power production over a year

M. Batteux, T. Prosvirnova and A. Rauzy. "Performance assessment of an offshore windmill farm with AltaRica 3.0", International Symposium on Model Based Safety Assessment, IMBSA 2022. Munich, Germany. September 2022.

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Our future activities (1/2)

COMMUNICATION

- Conduct more communication on networks
  - Promote events (congress, webinaire, training, …)
  - Promote research work
  - Promote development
  - Promote training

  LinkedIn
  Mail List

- Organization of webinars open to all
  - A serie of 3 webinaires is plan for this year.

- Share publicly “Step-by-step” module - Series of practical exercises to learn to use AltaRica 3.0 Workshop.

- Conference participations (Lambda-Mu, ESREL)

- Share more contents
  - Share ressources (training, development, research, standard) to members,
  - Share ressources (research, practical example, events, books) to public.

Our future activities (2/2)

CANVASSING

- Solicit / Exchange to get more membership to join :
  - Companies and schools,
  - Get in contact with more enterprise,
  - Facilitated membership for company and schools.

Connection with schools and businesses.

DEVELOPMENT

- Definition of a vision of “developments”
- Preparation/Release of version 1.5 of the AltaRica 3.0 Workshop
- Continued development/testing of tools

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What the association offers

Development Services :

Access to expert and development support
Assistance for MBSA methodologies implementation

Networking Opportunities:

Connect with a community of MBSA professionals and enthusiasts
Participate to conferences and special interest groups

Educational Resources:

Comprehensive tutorials and step-by-step guides
Webinars and workshops on various topics

Opportunities to contribute:

Participate to development or training committees

Research and Development Support:

Collaboration and Discussion with entities

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Why join

- Participant in the General Assembly
- Contribute to training/development
- Share the association's philosophy
- Obtain support for supervising internships or theses
- Speak/Present your topics during webinars
- Organizer of days with the association
- Access members' private sharing space
- Provide visibility on our AltaRica website
- Ensuring the sustainability of R&D
- Take part in R&D directions

How to join us ?

- Complete the membership form
- Find 2 sponsors (1 founding member and 1 member of the association)
- Pay membership fees

Call to action

- Join us !

- Contact us if you wish to exchange benefits or for more information : contact@altarica-association.org

- To join the AltaRica Association (and request a membership form), please contact us.

Announcement

The second webinar will take place on
Friday September 27.
The subject:
Focus on AltaRica 3.0 tools and technology.

Thanks you for your participation

Do you have any questions ?