

# Modeling of Graph Topologies Using Coq

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**Scientific Context.** Coq [2] is a proof assistant, namely, an environment in which a user can express a program, state a theorem and then develop the proof of this theorem. Proofs will be written interactively with the tool which mechanically checked them. Coq has been successfully used for various tasks such as mathematical developments as involved in the 4-colors or Feit-Thompson theorems, formalization of programming language semantics leading to the certification of a C compiler, certified numerical libraries, and verification of cryptographic protocols.

PADEC [1] is a Coq framework, developed in our team, in order to certify distributed algorithms. The framework imports into Coq the computational model for which the targeted algorithm is designed, formalizes the algorithm itself and its specification. Then the algorithm is proved using Coq including safety, convergence and also some performance analyses.

**Subject.** In this context, we propose, during this internship to develop a Coq library in order to represent some classical topologies of graph. Indeed, distributed algorithms are usually dedicated to a given shape of network, for example, rings, trees, grids...

The goal of the internship is to define a model of at least one topology, to write it in Coq, and then to develop tools to handle this model.

**Required Skills.** A background about sequential algorithmic, in particular proof of algorithms, is mandatory.

**Working context.** The internship is part of ANR project ESTATE<sup>1</sup>. The student will be integrated in the lab Verimag<sup>2</sup>.

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## References

- [1] Karine Altisen, Corbineau Pierre, and Stéphane Devismes. Padec: A framework for certified self-stabilization, 2016. <http://www-verimag.imag.fr/~altisen/PADEC/>.
- [2] The Coq Development Team. *The Coq Proof Assistant Documentation*, June 2012. <http://coq.inria.fr/refman/>.

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<sup>1</sup><https://wp-systeme.lip6.fr/estate/>

<sup>2</sup><http://www-verimag.imag.fr/>