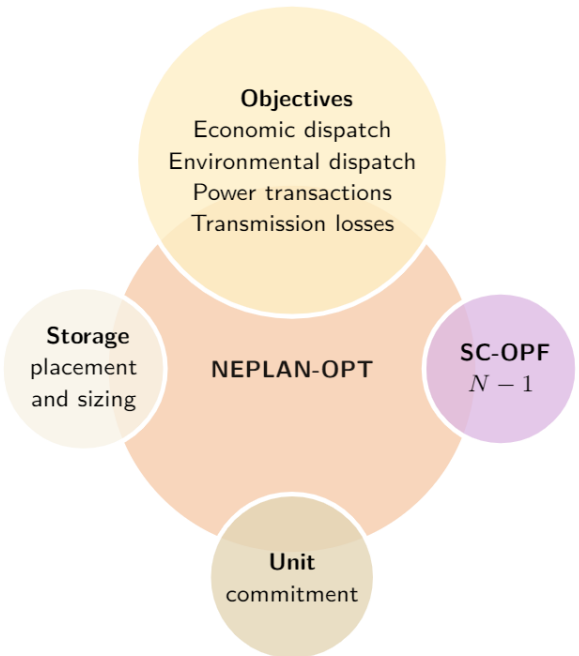
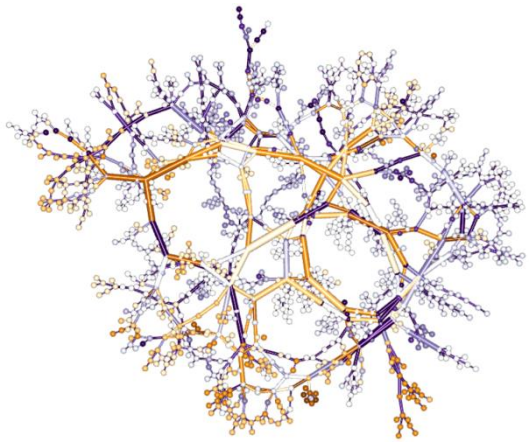
NEPLAN Optimization infrastructure

In 2019, Neplan adopts a novel architectural design for its optimal power flow core engine, developed from the ground up to provide robust and global convergence from any starting point for a variety of optimal control problems. Optimal control in Neplan becomes application aware, bringing a considerable amount of improvements over past technologies. The new optimization infrastructure enables the solution of previously intractable optimal control problems in power system operations and planning, such as multiperiod optimal power flow (MOPF), unit commitment (UC-OPF), security constrained optimal power flow (SC-OPF), and planning and sizing problems over long time horizons.

Smarter Optimization Core

The core of the new optimization engine is an in house developed optimal control solver, Neplan-NLP built from the ground up for modern multicore architectures in mind. Structure exploiting and data compression techniques have been integrated, bringing significant reductions to the number of arithmetic operations needed to achieve convergence of MOPF, UC-OPF, and SC-OPF problems. The new infrastructure offers extreme scalability and significantly lower memory footprint compared with the state of the art general purpose NLP solvers. A plethora of the most common objectives and constraints are implemented and a flexible framework allows users to define their own.





Application aware OPF Engine

OPF: Single period OPF problems are now using the in house developed Neplan-OPT solver exploiting multithread environments.

MOPF: The new optimal control engine is also multiperiod aware, allowing the efficient solution of MOPF problems specified over a large number of time periods, taking into account a variety of time coupling constraints such as generator ramping and energy storage device scheduling.

Planning and Sizing: Planning and sizing over long time horizons can now be solved in realistic time frames based on AC-OPF formulations without adopting any approximations.

UC-OPF: Based on new engine unit-commitment problems can be solved for sufficiently large number of storage devices and over long time horizons.

SC-OPF: The new engine allows a particularly efficient treatment of SC-OPF problems that benefits as well from structure exploiting algorithms and multithread architectures.