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UrgentShake — Rapid Earthquake Modelling with TeRABIT

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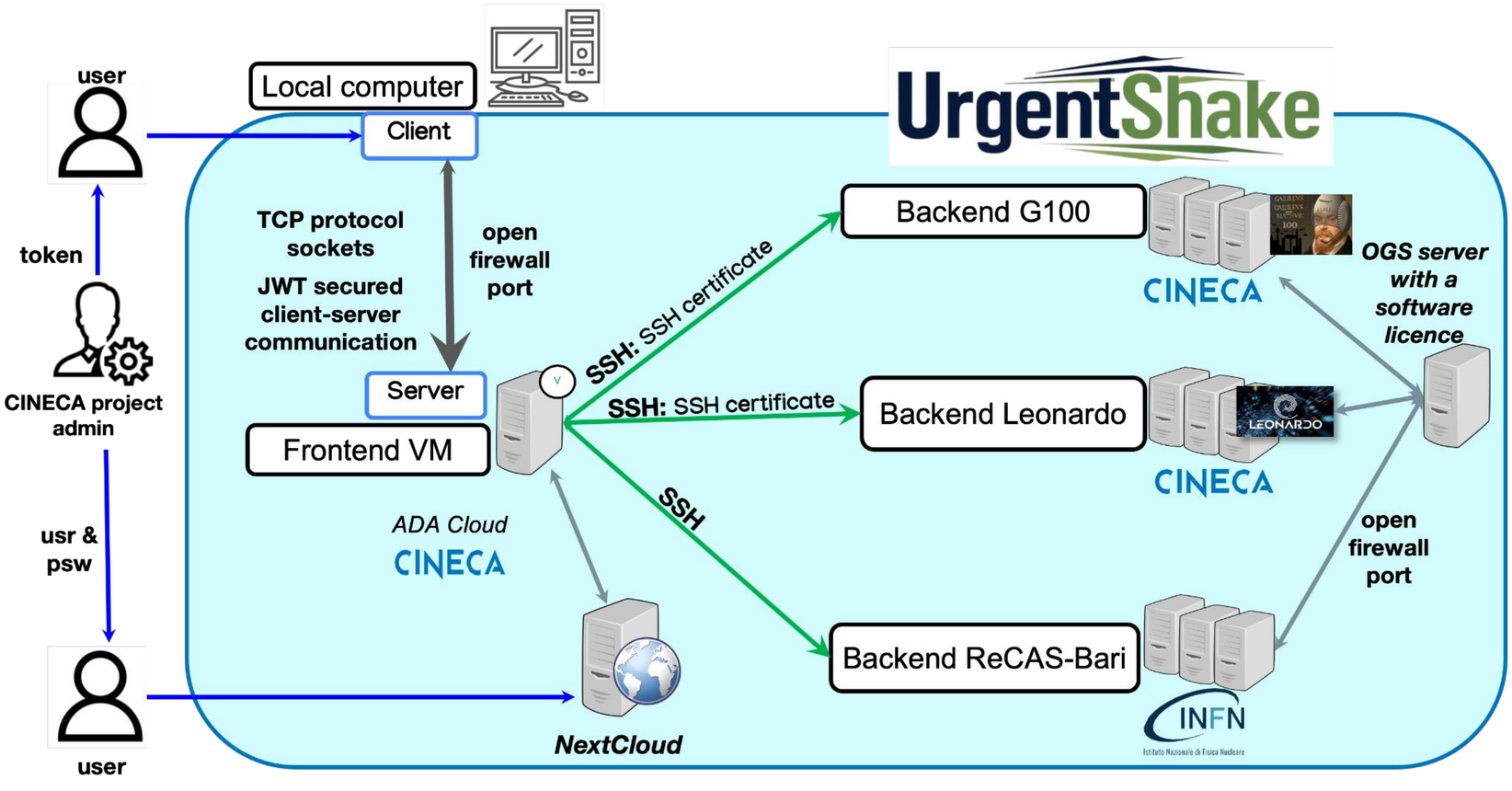
The TeRABIT Pilot Use Case

UrgentShake has been developed as the pilot use case for the TeRABIT Project, both to test the infrastructure and showcase its capabilities. At the same time, TeRABIT has enabled the development of UrgentShake itself - a physics-based system for near real-time earthquake modeling in North-Eastern Italy. It complements current ground shaking estimates, which rely on simplified empirical methods.

HPC Infrastructure



UrgentShake

Fully automated workflow:

- client-server access to multiple HPC backends (Leonardo, Galileo100, ReCAS-Bari);
- frontend virtual machine (VM) on CINECA's ADA Cloud infrastructure orchestrates the computational workflow without user intervention;
- Nextcloud provides a web interface through which results can be retrieved.

Urgent Computing Techniques

Various techniques applied to reduce queue times and minimize the time to solution (initially about 8–9 days on a single processor):

- Workflow Automation
- Scalability Testing and Optimal Core Allocation
- Code Parallelization and Optimizations
- Precomputed Mesh Merging
- Simultaneous Multi-Backend Execution
- Tiered Workflow / Progressive Results (ground shaking scenarios with increasing accuracy released ~10 min, 30 min, and 2.5 hours after the strongest expected earthquake in North-Eastern Italy)
- Elapsed time compatible with end-users requirements

Bibliographic Reference

Zuccolo, E., Bolzon, G., Pitari, F., Rodríguez Muñoz, L., Scaini, C., Vanini, M., Poggi, V., Salon; S. (2025). Advancing Rapid Response to Earthquakes with Tiered Physics-Based Ground-Shaking Simulations: The UrgentShake System. *Seismological Research Letters* 2025;; 96 (5): 2995–3011. doi: https://doi.org/10.1785/0220240472