

# Federating Grid'5000

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# Grid'5000 background

- ▶ Project started in 2003
- ▶ Initially: federation of geographically-distributed sites
- ▶ Currently (and since ~2007): still geo-distributed sites, but:
  - ◆ Single technical team + administrative domain
  - ◆ Centralized governance structure (with geo-distributed people)
    - ~> *Overlay teams* all over France
    - ~> More efficient ( $\ll$  1 FTE/site), easier to achieve consistency
- ▶ Until 2013, quite unique when considering scale (~1000 nodes), focus (HPC/Cloud research), features (reconfiguration at the hardware level)
  - ◆ Many peculiar issues and solutions
  - ◆ Not that many testbeds to federate with

# Federation?

- ▶ **Identity-level federation**
  - ◆ Enable users to use several testbeds with same credentials
  
- ▶ **API-level federation**
  - ◆ Provide the same interface on/for several testbeds
  
  
  
  
  
  
  
  
  
  
- ▶ **Data-plane federation**
  - ◆ Combine resources from several testbeds during an experiment

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- ◆ Difficult because Grid'5000 is very different from most testbeds
  - ★ Different language (e.g. resources reservations using a FIFO scheduler with backfilling, and advance reservations, with a specified duration)
  - ★ Hybrid: single testbed or federation of testbeds (sites)?
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- ◆ Two main use cases:
  - ★ Different testbeds (e.g. Mobile Cloud Computing experiments)
  
  - ★ Similar testbeds  $\leadsto$  more resources, more distributed

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But Grid'5000 is already quite large and distributed



# Historical Grid'5000 federation efforts

- ▶ 2006-2007: NAREGI (National Research Grid Initiative, Japan)
  - ◆ L2 circuit set up by network operators
- ▶ 2006-2010: DAS-3 testbed (Netherlands)
  - ◆ 1G circuit set up by network operators (RENATER/GEANT/SURFNET)
  - ◆ <https://www.grid5000.fr/w/DAS3-Grid5000>
    - ★ About a year before successful *ping*
  - ◆ Link shut down in 2010 (not much interest from users)
- ▶ 2009: Grid'5000 site in Porto Alegre, Brazil
  - ◆ Same administrative domain as rest of Grid'5000
  - ◆ Networking using VPN (OpenVPN)
- ▶ 2010: Sky Computing with FutureGrid (P. Riteau *et al*)
  - ◆ Using an overlay network (ViNe)
  - ◆ 3 FG sites, 3 G5K sites, 457 VMs

# Lessons learned and open challenges

- ▶ Data-plane federation is doable
  - ◆ Quite easy with overlay network or VPN
  - ◆ Was a hard and slow process if network operators were involved
  - ◆ Might be easier now with SDN technologies such as NSI?

# Lessons learned and open challenges

- ▶ Data-plane federation is doable
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  - ◆ Might be easier now with SDN technologies such as NSI?
- ▶ Challenges:
  - ◆ Technical:
    - ★ Define requirements: simultaneous experiments? performance guarantees (bandwidth reservation)? observability?
    - ★ Isolation on both ends? Stitching with a VLAN?
  - ◆ Social:
    - ★ Finding relevant use cases (actual experiments)  
But still, it would be useful as a PoC, to explore the status, usability, readiness of provisioning protocols and APIs
    - ★ Finding the right interlocutors throughout the path; identify all scenarios and select the best one  
Grid'5000 ↔ RENATER ↔ GEANT ↔ Internet2 ↔ Chameleon  
FELIX? Geant Testbed Services?