Introduction to Grid'5000 (G5k)

Overview & First Steps

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Why do experiments[1] ?

"Beware of bugs in the above code;
I have only proved it correct, not tried it"
(Donald Knuth)

"In theory there is no difference between theory and practice. In practice there is."
(Yogi Berra)

[1] *Extract from a talk at NSFCloud in 2014 by Kate Keahey (Argonne Nat. Lab.)*

What ?

Grid'5000 | Overview

- A national scientific intrument with a reconfigurable testbed infrastructure for experimental research on computer science targeting and tackling large-scale domains

  Big Compute (parallel and distributed systems – Cloud, HTC, HPC), Big Data, Datacenters, High Performance Networking.

- But it's not a grid but "Bare Metal as a servce"
- GIS created in 2012 but 15 years already...
  - a very active community (researchers, engineers, techs)
  - ±600 active users and ~120 publications per year
  - ±60 millions core hours used in 2019

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Liberté Égalité Fraternité

cnrs
dépasser les frontières

Inria
INVENTEURS DU MONDE NUMÉRIQUE

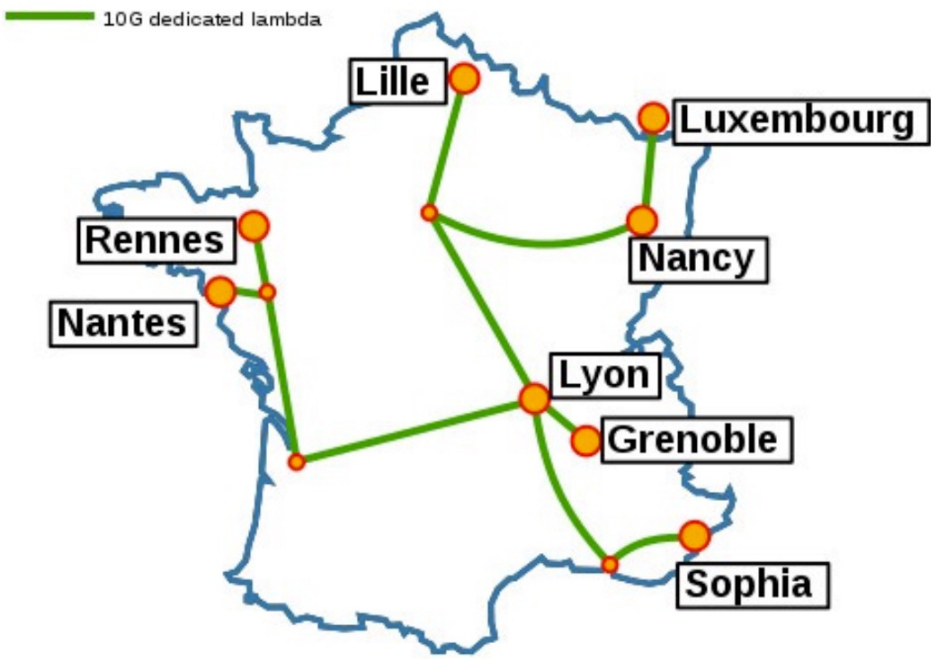
RENATER
CONNECTEUR DE SAVOIRS

cat.opidor.fr/index.php/Grid%275000

Where ?

Grid'5000 | Key Features[1]

- 8 sites, 39 clusters, ±800 nodes,
- ±16000 CPU cores and ±300 GPU
- ±100 TiB RAM + 6 TiB PMEM
- R_{peak} 614.3 TFLOPS (excluding GPUs)
- 511 SSDs and 1004 HDDs on nodes (total: 1.44 PB)
- Dedicated 10-Gbps backbone network



[1] Source : https://www.grid5000.fr/w/Hardware

Where ?

Grid'5000 | Resources @ Nantes site[1]

Site	Cluster	Access Condition	Date of arrival	Nodes	CPU	Cores	Memory	Storage	Network
Sophia	uvb		2011-01-04	30	2 x Intel Xeon X5670	6 cores/CPU	96 GiB	**250 GB HDD**	1 Gbps (SR-IOV) + 40 Gbps InfiniBand
Rennes	paranoia		2014-02-21	8	2 x Intel Xeon E5-2660 v2	10 cores/CPU	128 GiB	**1 x 600 GB HDD** + 4 x 600 GB HDD	1 Gbps (SR-IOV) + 2 x 10 Gbps (SR-IOV)
Rennes	parapide		2010-01-25	17	2 x Intel Xeon X5570	4 cores/CPU	24 GiB	**500 GB HDD**	1 Gbps + 20 Gbps InfiniBand
Rennes	parapluie		2010-11-02	16	2 x AMD Opteron 6164 HE	12 cores/CPU	48 GiB	**250 GB HDD**	1 Gbps + 20 Gbps InfiniBand
Rennes	parasilo		2015-01-13	27	2 x Intel Xeon E5-2630 v3	8 cores/CPU	128 GiB	**600 GB HDD** + 4 x 600 GB HDD* + 200 GB SSD*	2 x 10 Gbps (SR-IOV)
Rennes	paravance		2015-01-13	72	2 x Intel Xeon E5-2630 v3	8 cores/CPU	128 GiB	**1 x 600 GB HDD** + 1 x 600 GB HDD	2 x 10 Gbps (SR-IOV)
Nantes	econome		2014-04-16	22	2 x Intel Xeon E5-2660	8 cores/CPU	64 GiB	**2.0 TB HDD**	10 Gbps (SR-IOV)
Nantes	ecotype		2017-10-16	48	2 x Intel Xeon E5-2630L v4	10 cores/CPU	128 GiB	**400 GB SSD**	2 x 10 Gbps (SR-IOV)
Nancy	graffiti	**production** queue	2019-06-07	13	2 x Intel Xeon Silver 4110	8 cores/CPU	128 GiB	**479 GB HDD**	10 Gbps

1312 cores
7.552 GiB Mem
±64 TB (dont 19TB SSD)

- `econome` {Dell PE C6220}
- `ecotype` {Dell PE R630}

Processors counts per families

Processor family	Grenoble	Lille	Luxembourg	Lyon	Nancy	Nantes	Rennes	Sophia	Processors total
AMD EPYC		16		10	14				**40**
AMD Opteron				28			32		**60**
Intel Xeon	88	62	28	92	612	140	248	60	**1330**
POWER8NVL	24								**24**
ThunderX2				8					**8**
Sites total	**112**	**78**	**28**	**138**	**626**	**140**	**280**	**60**	**1462**

Accelerator cores

Accelerator model
AMD Radeon Instinct MI50 32GB
Intel Xeon Phi 7120P
Nvidia A100-PCIE-40GB
Nvidia GeForce GTX 1080 Ti
Nvidia GeForce GTX 980
Nvidia GeForce RTX 2080 Ti
Nvidia Quadro RTX 6000
Nvidia Tesla K40m
Nvidia Tesla M2075
Nvidia Tesla P100-PCIE-16GB
Nvidia Tesla P100-SXM2-16GB
Nvidia Tesla T4
Nvidia Tesla V100-PCIE-32GB
Nvidia Tesla V100-SXM2-32GB

[1] *Source : https://www.grid5000.fr/w/Nantes:Hardware*

How ?

Grid'5000 | Usage Policy[1] & Conditions of use[2]

"reserve your physical resource on-fly"

- Limited access during workdays (9h – 19h) for smaller-scale experiments and priority to large-scale jobs during nights and holidays/week-ends.
- Limitation per cluster → max 2 hours on all the cores of the cluster.
- If your intended usage does not fit within the detailed rules presented in the Usage Policy, you can request a special permission to the executive committee.
- Reserved resources are force-removed once the reservation is done

[1] https://www.grid5000.fr/w/Grid5000:UsagePolicy
[2] https://www.grid5000.fr/w/Grid5000:General_Conditions_of_Use

How ?

Grid'5000 | Request an account

- Justify of a use of Grid'5000 for its intended purposes.
  E.g. *"I am a PhD student working on AI and networking and will use Grid'5000 for simulating network performance for the XXX experimental project"*
- Go to the request a new account page, fill up informations
  - **SSH Public Keys**
  - Group Granting Access = **LS2N**
  - Inria Research Center = **Not Affiliated to INRIA**
  - **Project & Team**
  - Motivation & **Intended Usage**
- The account manager will be notified and validate your request.

How ?

Grid'5000 | Demo time[1] !

github.com/randria/talks/tree/main/20210923-ls2n-csi-g5k_demo

1. First connection with SSH
2. Discovering and visualizing resources
3. Allocating and accessing resources
4. Reconfiguring and deploying resources

[1] Source: https://www.grid5000.fr/w/Getting_Started

Help ?

Grid'5000 | On your bookmarks

grid5000.fr

grid5000.fr/w/Nantes

Who ?

Grid'5000 | LS2N Contact & Support

- Richard **RANDRIATOAMANANA**,
  - Reseach Support Team and main lab tech contact for infra/g5k
  - By email: randria@ls2n.fr or soutien-ia@ls2n.fr
- Adrien **LEBRE** (Team leader)
  - Team LS2N/STACK
  - Account manager G5k-Nantes
  - G5k Scientific Site Committee Member
- Jean-Marc **MENAUD** (Samurai)
  - Team LS2N/STACK
  - CPER project Leader
  - G5k Scientific Site Committee Member
- Remous-Aris **KOUTSIAMANIS** and Rémy **POTTIER** (*until end of Oct.*)
  - Team LS2N/STACK
  - Support and technical contacts

Credits & Thank you!

- https://www.grid5000.fr
- **Formation Groupe Calcul** “Utilisation de Grid’5000 pour la réalisation de benchmarks”, *S. Delamare / A. Cadiou / L. Pouillloux, Oct. 2020* *https://calcul.math.cnrs.fr/2020-04-formation-g5k.html*
- **OCIF Talk** “Using Grid’5000” de *Remous-Aris Koutsiamanis (IMTA), 2019*
- “The data-centers facet of SILECS (a.k.a G5k)” de *Frédéric Desprez et Lucas Nussbaum, 2019, https://www.grid5000.fr/mediawiki/images/Grid5000.pdf*
- **TP Inria Lille** “Premiers pas avec G5k” de *Simon Delamare (LIP Lyon), 2014* *https://www.grid5000.fr/w/User:Sdelamare/Lille_Tutorial*