Université Paul Sabatier
TOULOUSE III

IRIT
Institut de Recherche en Informatique de Toulouse

CloudMIP

GreenIT and DFS research in the Cloud at Toulouse.

FranceGrilles

SEPIA

Plan

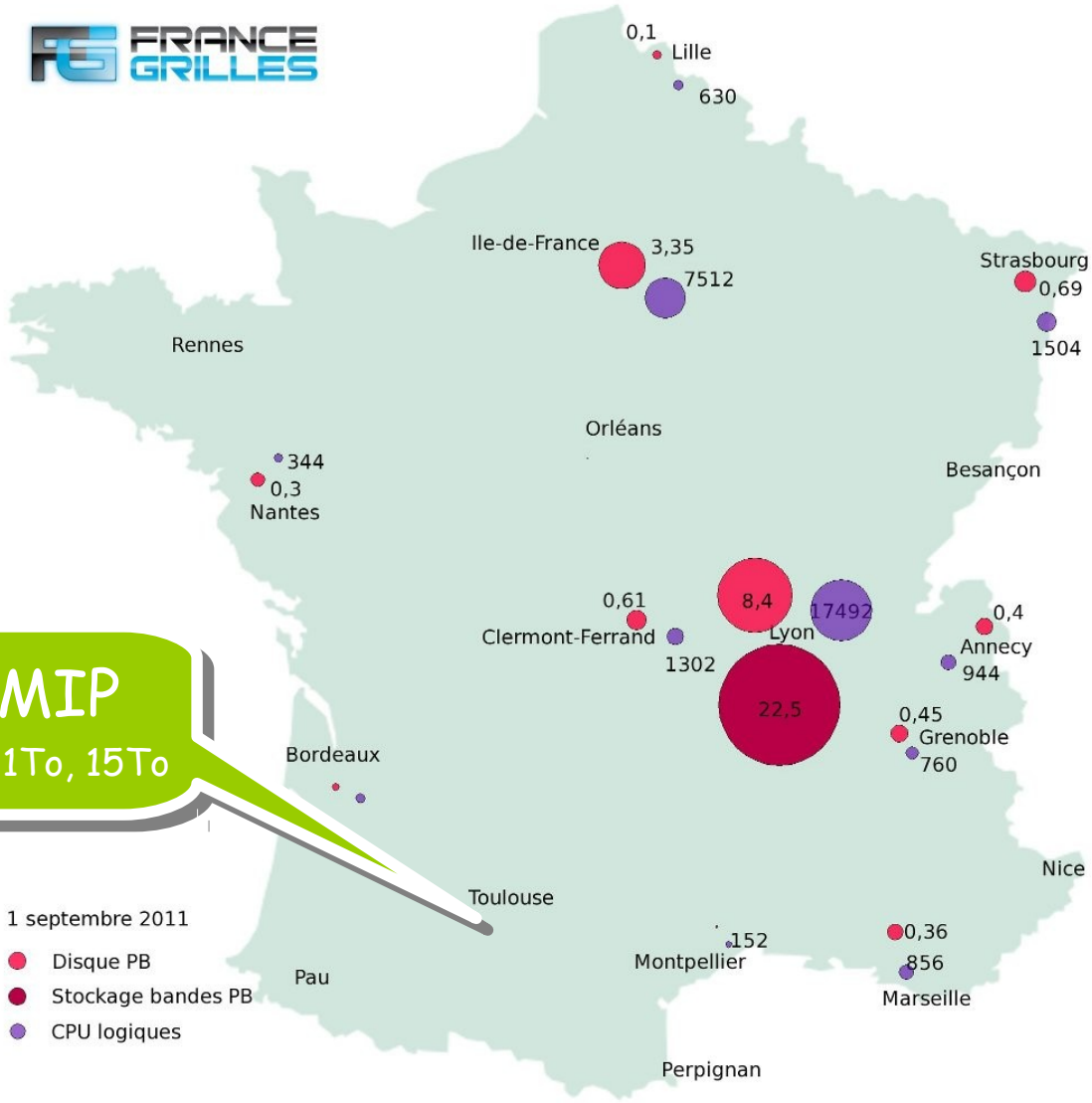
- France-Grilles CloudMIP,
- The SEPIA team,
- GreenIT (addon : extreme density data center with RECS*),
- Distributed Filesystems,
- Experiments timespan,
- Future work.

*Christmann Gmbh http://www.christmann.info

France-Grilles CloudMIP

GIS France-Grilles

- Grid production sites (e.g. EGEE tier1),
- Cloud researches and experiments platforms (Toulouse, Lyon ...).



CloudMIP
256 cores*, 1To, 15To

*512 cores with hyperthreading activated.

The SEPIA team

The SEPIA team (IRIT: Pr Jean-Marc Pierson / N7: Pr Daniel Hagimont) mainly focuses on GreenIT, autonomic and distributed systems (e.g. cloud filesystems).

10 permanents (4 Pr, 5 MCF, 1 Dr-engineer)

1 engineer (CoolEmAll project),
21 PhD students.

SOP and Control Green (ANR),
CoolEmAll (FP7),
SVC (Grand Emprunt).

Toulouse platforms :

Director : Pr Jean-Marc Pierson

- Grid5000-Toulouse (560),
- GridMIP (128),
- CloudMIP (256),
- Christmann 18nodes 1U board.

Pau platform :

- PireCloud (128).

The CloudMIP platform

Facts and resources

- Who : Pr Jean-Marc Pierson (manager), Dr François Thiebolt (system), DTSI Network team,
- Where : hosted at the Paul Sabatier University's Data Center (along with Grid5000-Toulouse and GridMIP platforms),
- Taskforce : 1 Dr-enginner (40%), 1 software engineer (30%),
- Fluids consumption annual cost (est.) : between 4k€ and 10k€.

Dell M1000e 16 blades

Hardware, system, middleware ...

- 2 x Dell M1000e chassis each filled with 16 blades ⇨ 256 **physical** cores, 1TB RAM,
- System : Scientific Linux 6.3 x86_64,
- VM provisioning system : **OpenNebula** 3.8 (spice protocol support) with **KVM** hypervisor,
- Monitoring : Zabbix (http://www.zabbix.com) *---combine Nagios and Ganglia capabilities.*

+ power monitoring **+** seconds to launch a several Gb VMs **+** everything is open-source software

The CloudMIP platform

... additional details

- The front-end node : cloudmip.univ-tlse3.fr,
- The monitoring system : cloudmip.univ-tlse3.fr/zabbix*,
- 32 blades (8 cores @ 2.4Ghz, 32GB ram, 2 x 146GB SAS 15ktpm RAID0),
  - ⇨ means upto 256 VMs featuring 1 **physical** (not HT) CPU and 4GB ram)
- OpenNebula 3.8 (KVM) with Qcow2 delta images to speedup deployment,
  - ⇨ a hundred of VMs in just seconds :)
- 1s resolution power monitoring of each node (sent to Zabbix monitoring),
- A 24TB, 700MB/s NFS server shared with Grid5000 and GridMIP,
- Ways for the users to gain access to their VMs from the Internet :
  - ssh, vpn, display redirection (spice),
  - #1000 ports on the front-end node dedicated to routing (tests)**,
  - #60 dedicated public IPs with dynamic routing (on way).

** login : green, passwd : cloudmip* ***#> spicy -h cloudmip.univ-tlse3.fr -p 10000*

The CloudMIP platform

- Pool of public IP to CloudMIP*

195.220.53.1
195.220.53.2
||||||||||||||||||||
195.220.53.57

subnet 195.220.53.0/26

cloudmip.univ-tlse3.fr

vm-112-102
vm-112-103
vm-112-104
vm-112-101

nfs.cloudmip.univ-tlse3.fr

wn[1..32].cloudmip.univ-tlse3.fr

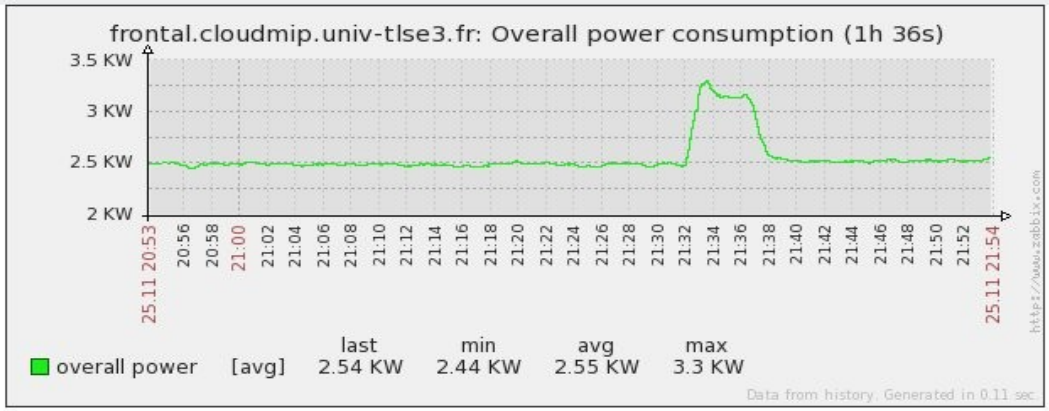
GreenIT : power metering

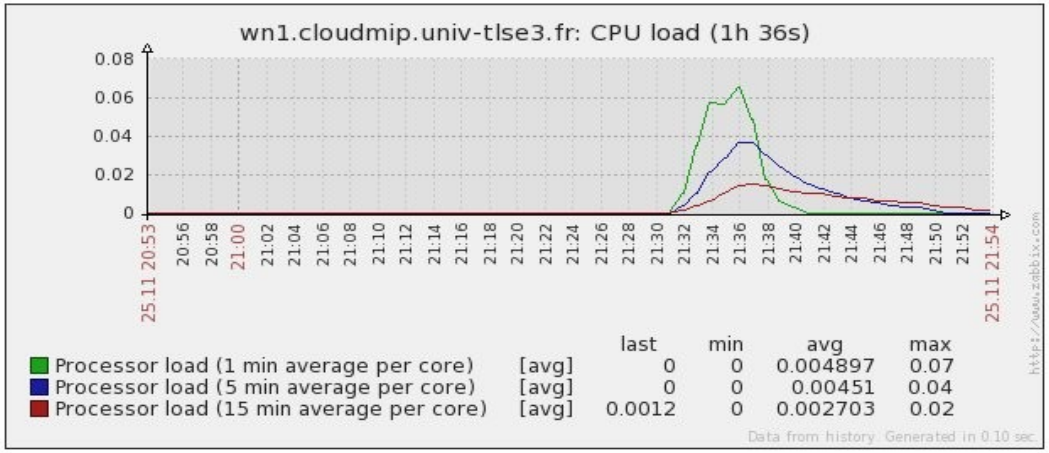
Launching 248 VMs

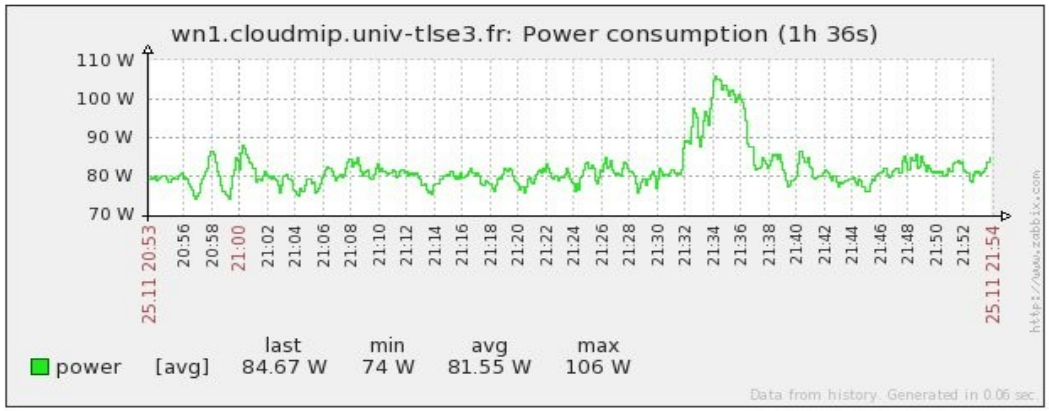
```
#> onetemplate instantiate SL63 -m 248
```

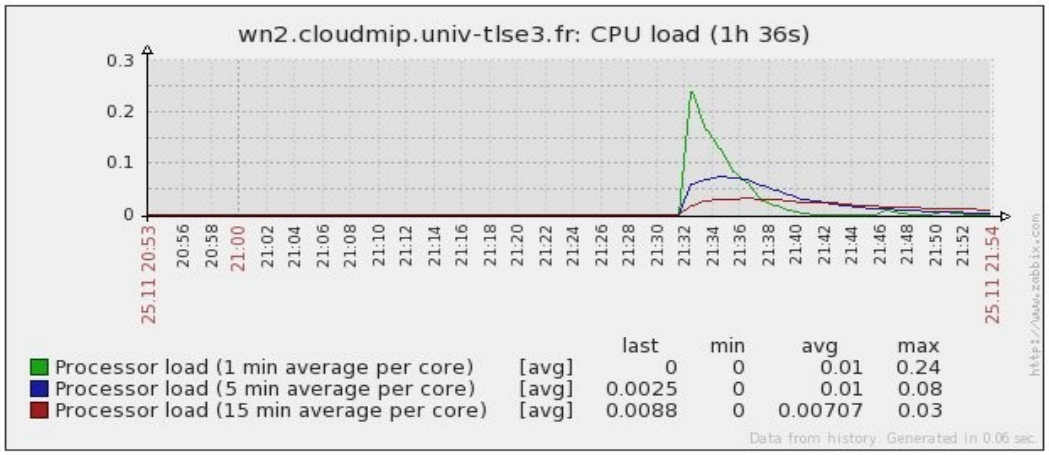
==> leads to eight VMs on each of the 31 nodes, thus each VM using one physical CPU.

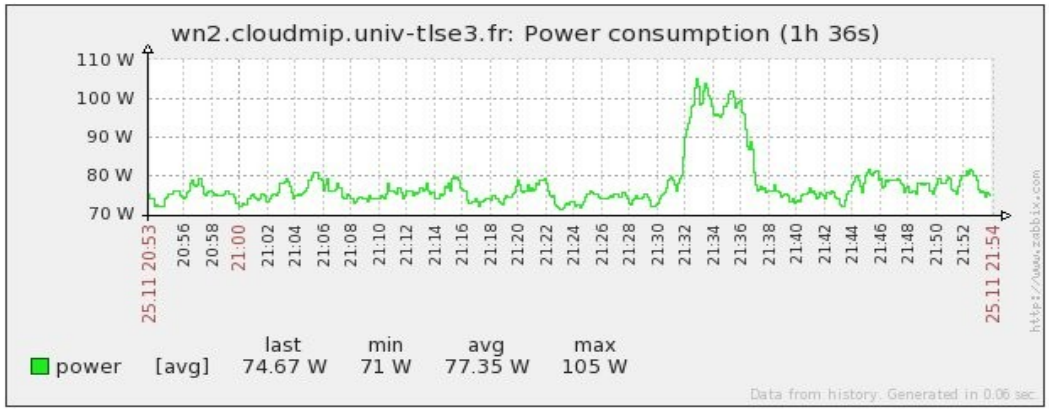
==> Max. power consumption is 3.3kw









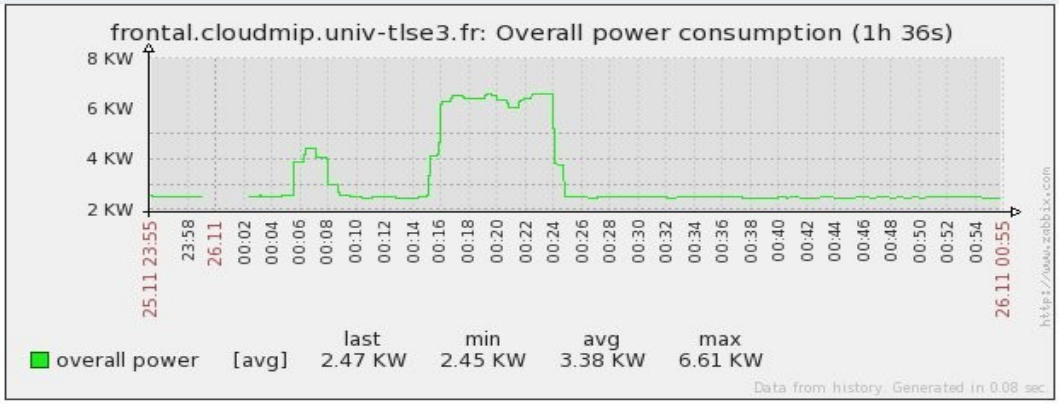


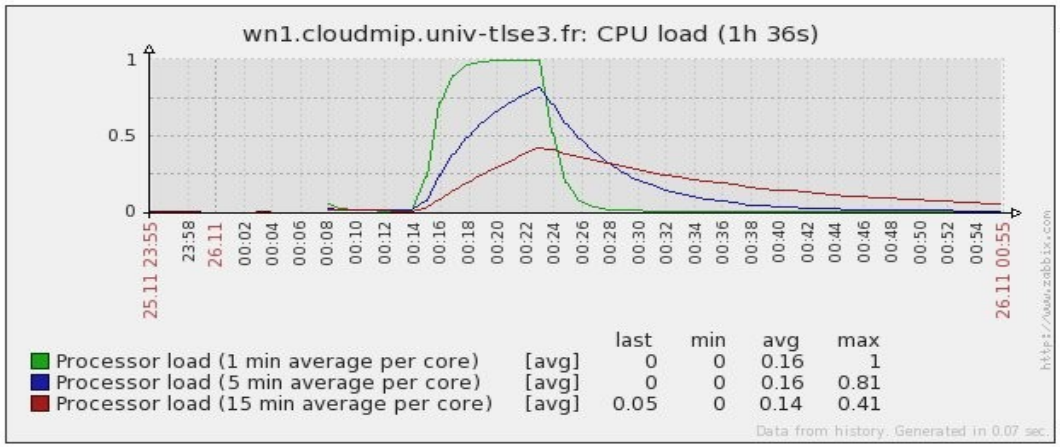
GreenIT : power metering

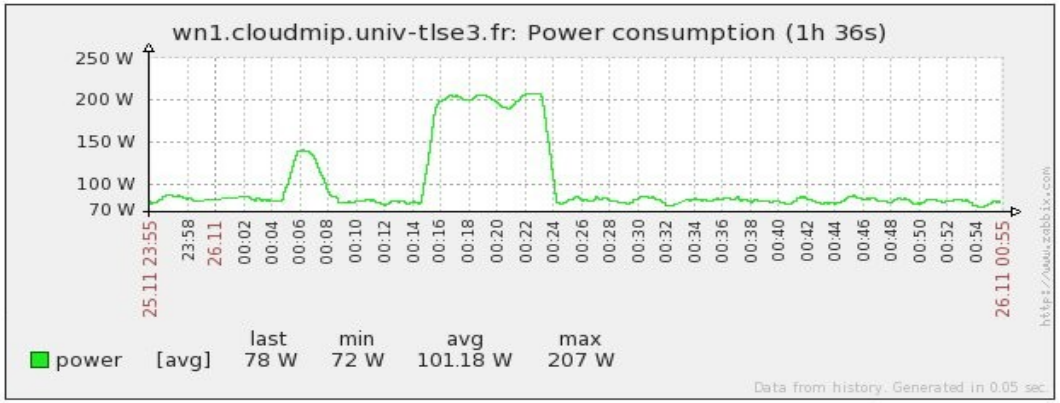
Launching stress test on all nodes

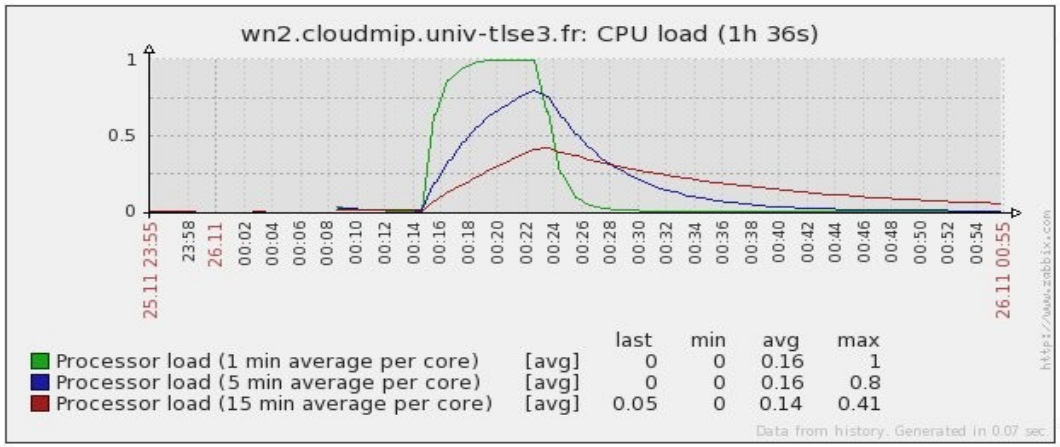
```
#> pdsh -w wn[1..32] -- openssl speed -multi 8
```

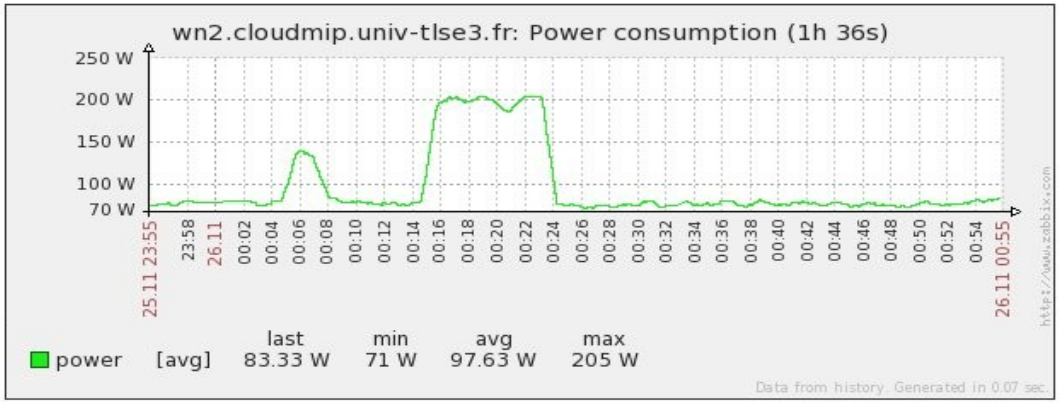
==> Peak power consumption is about 6.6kw











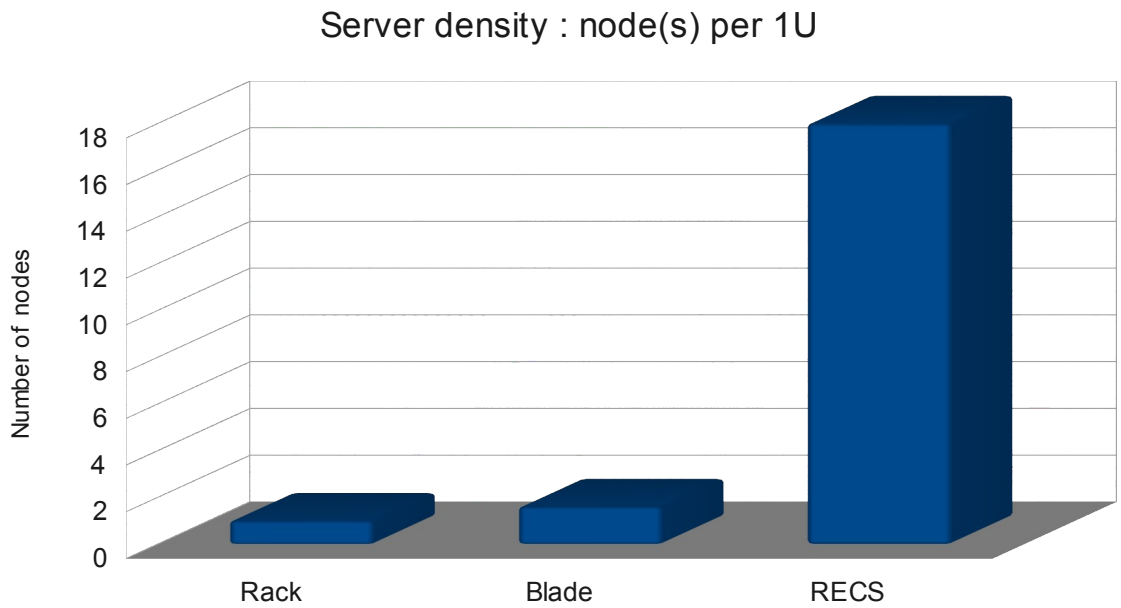
GreenIT : RECS platform

RECS : extreme density servers from Christmann Gmbh*

RECS enables up to 18 nodes* (Atom, i7, ARM ...) to fit in a standard 1U rack !

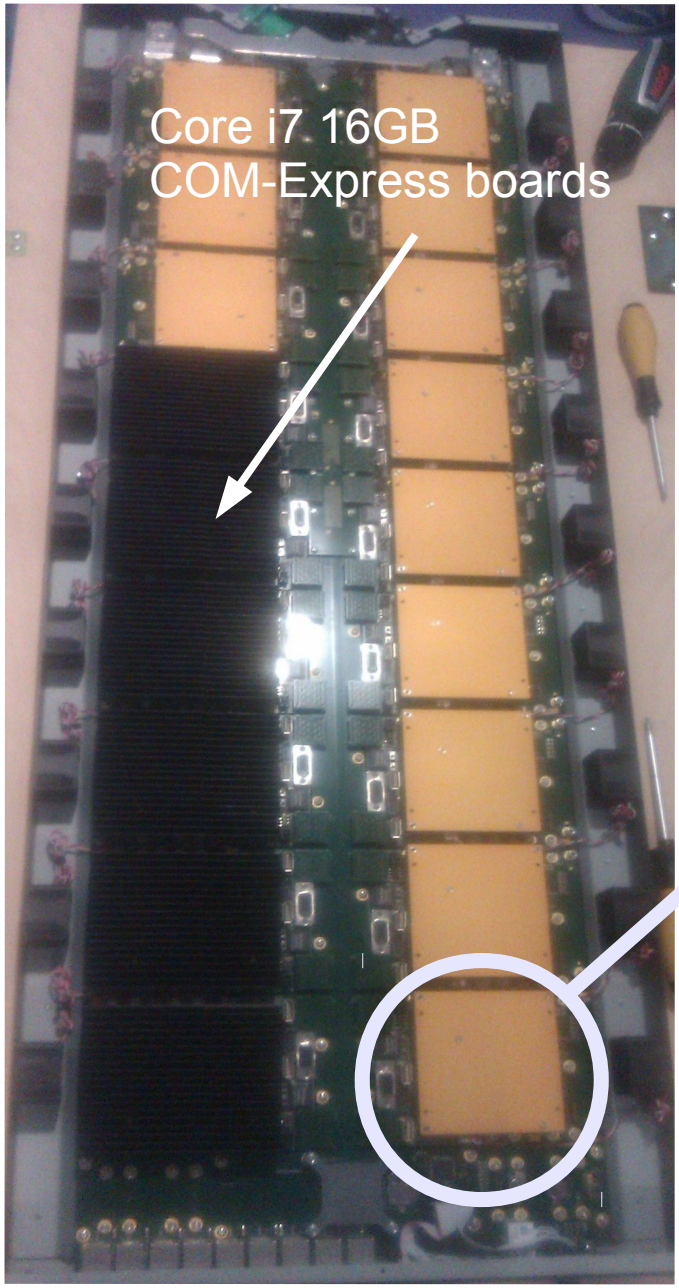
*COM-Express boards

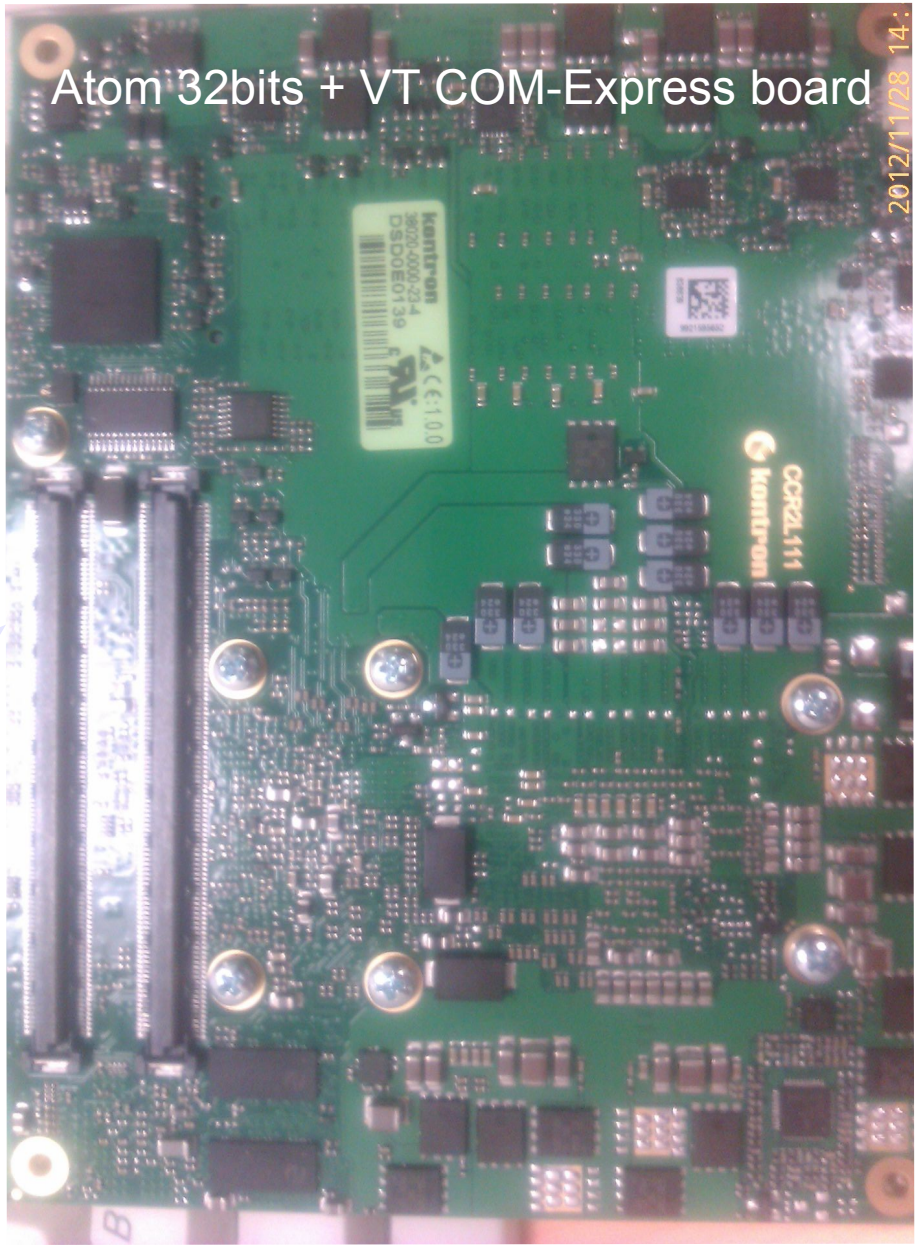
CHRISTMANN
INFORMATIONSTECHNIK + MEDIEN



*http://www.christmann.info/ *Member of the CoolEmAll project (FP7)*

GreenIT : RECS platform

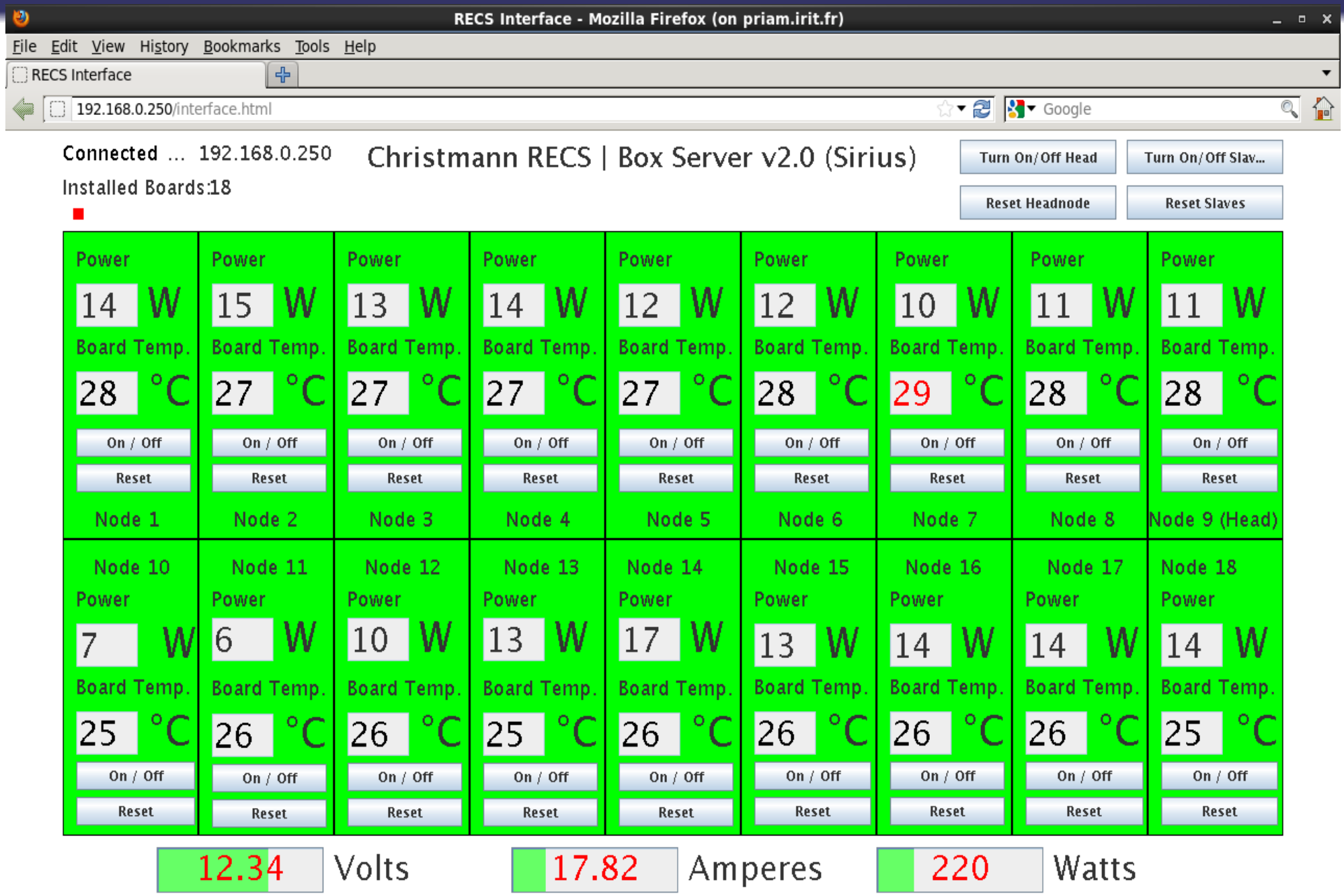




GreenIT : RECS platform

... external 12v power supply connection detail

GreenIT : RECS platform



GreenIT : what's next ?

Power consumption of processes*

Tools to estimate the power consumed on each running process of the machine

Several sensors: PerfCounters, CPU%, Memory, CPU temperature, etc.

Two estimators implemented

Inverse model (PE_IC): needs a power meter $$P^{PID} = \frac{P^{Node} \times CPU^{PID}_{time}}{CPU^{Node}_{time}}$$

Linear model (PE_MMC2): $$P^{PID} = \frac{(P^{Node}_{max} - P^{Node}_{min}) \times CPU^{PID}_{time}}{CPU^{Node}_{time}} + \frac{P^{Node}_{min}}{procs}$$

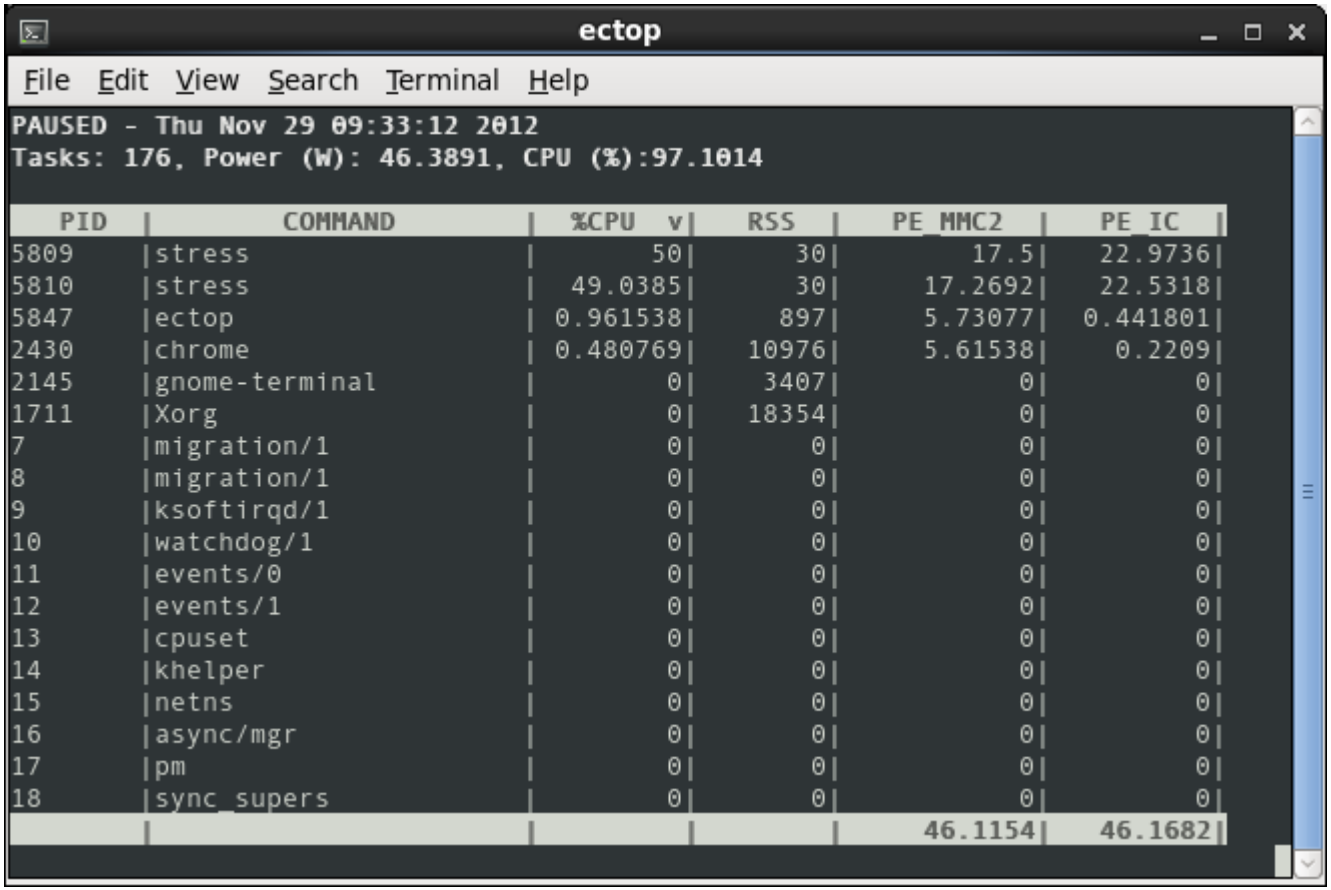
KVM hypervisor ==> each VM is a process thus leading to a possible evaluation of the power consumption of each VM!

**ongoing researches from Leandro Fontoura Cuppertino email:fontoura@irit.fr*

GreenIT : what's next ?

Power consumption of processes (cont.)

ECTop (GPL license, available at http://coolemall.eu,
alternate at http://www.irit.fr/~Georges.Da-Costa/code.html)



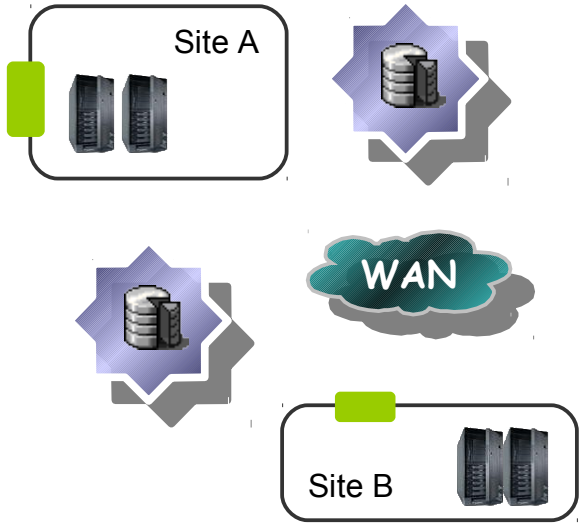
PID	COMMAND	%CPU v	RSS	PE_MMC2	PE_IC
5809	stress	50	30	17.5	22.9736
5810	stress	49.0385	30	17.2692	22.5318
5847	ectop	0.961538	897	5.73077	0.441801
2430	chrome	0.480769	10976	5.61538	0.2209
2145	gnome-terminal	0	3407	0	0
1711	Xorg	0	18354	0	0
7	migration/1	0	0	0	0
8	migration/1	0	0	0	0
9	ksoftirqd/1	0	0	0	0
10	watchdog/1	0	0	0	0
11	events/0	0	0	0	0
12	events/1	0	0	0	0
13	cpuset	0	0	0	0
14	khelper	0	0	0	0
15	netns	0	0	0	0
16	async/mgr	0	0	0	0
17	pm	0	0	0	0
18	sync_supers	0	0	0	0
				46.1154	46.1682

Data access in the Cloud

The Secure Virtual Cloud (SVC) project

- Who : iTrust* company (leader), Bull, IRIT/SEPIA** ...,
- Budget : 14M€ / 3years (grand emprunt).

SVC project has a strong emphasis on security to both VMs and data in the Cloud.

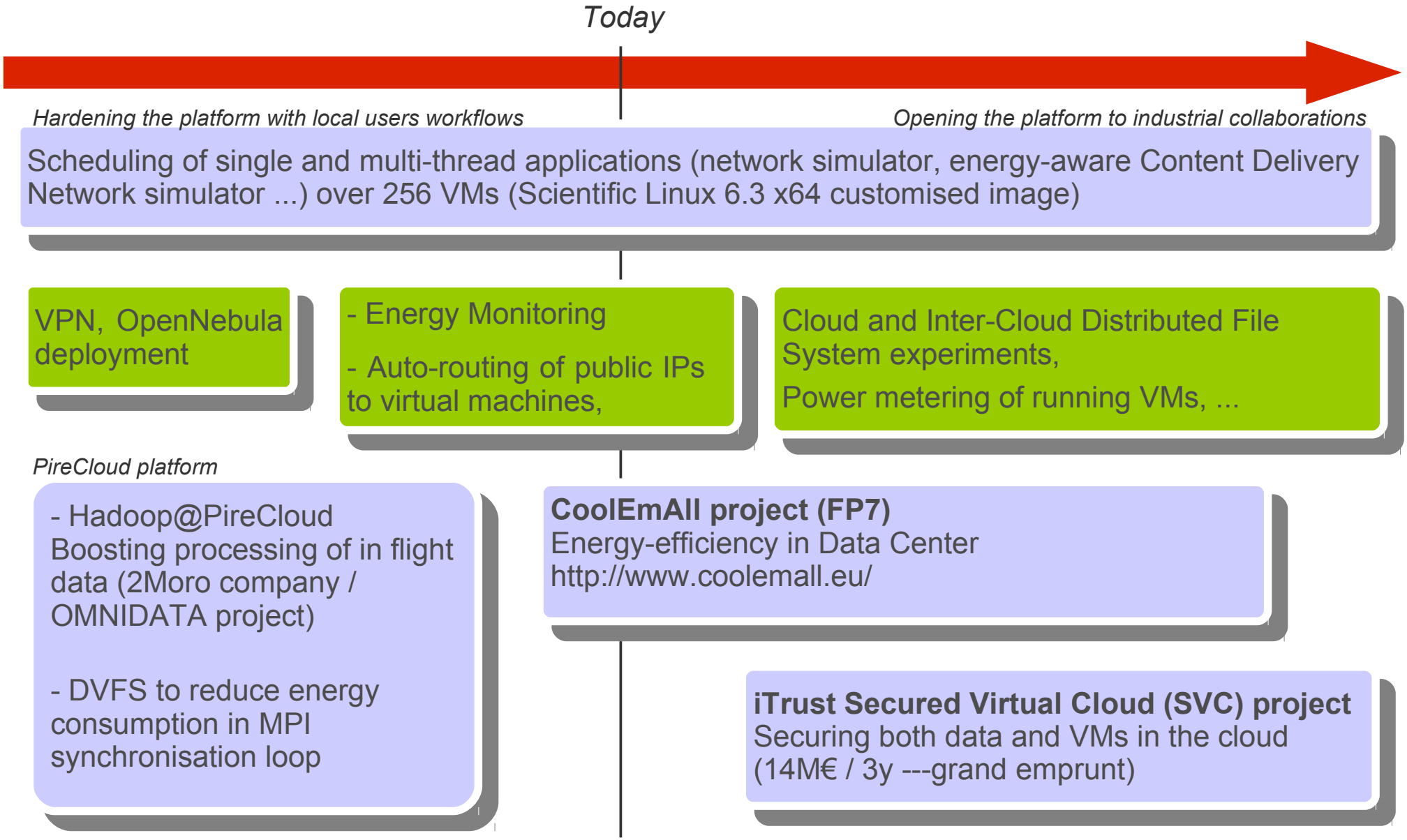


The SVC project focuses on the following points :

- Securing VMs ⇨ development of iKare v2 software,
- Secure distributed filesystem,
- Energy efficiency.

*http://www.itrust.fr **{mzoughi,jorda}@irit.fr

Experiments timespan



Future work

Near future ...

- Deployment of an object oriented distributed file system whose storage will be based on nodes' unused storage space,
- Much more fine-grained power consumption monitoring : a per-core approach,
- Deployment of the per-process power consumption accounting (Leandro's work),
- VMDirac plug-ins integration to OpenNebula,
- Enabling the PireCloud site from Pau as a CloudMIP clone,
- ...

... a bit further

- PireCloud  CloudMIP tighter integration : span of the distributed FS across both sites, proxying Zabbix monitoring to CloudMIP,
- RECS2 and RECS3 integrated made available for energy efficiencies researches,
- Inter-Cloud VM migration scheduler according to pluggable policies,
- ...

Questions ?