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BSC

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Centro Nacional de Supercomputación

BSC Demos

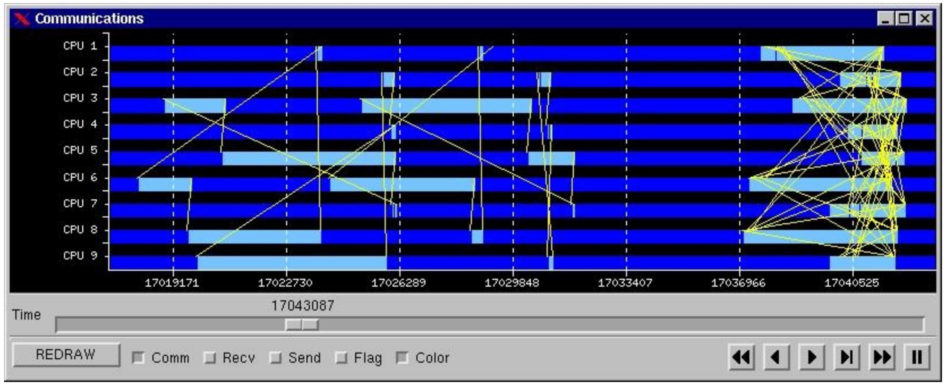
SC14

New Orleans, LA | hpc matters.

Interested in any of these topics?
Ask for a demo

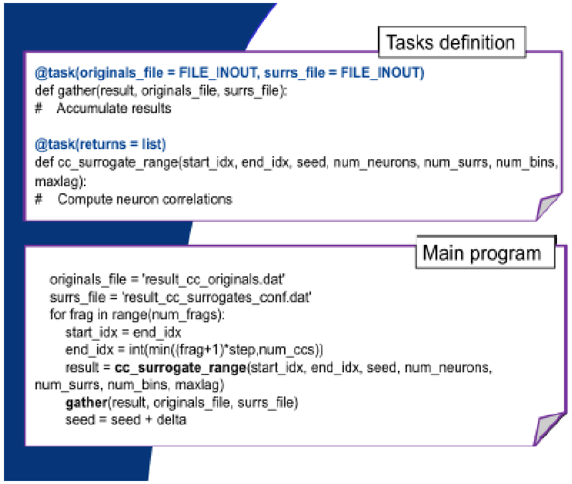
OmpSs Development Environment and Training Material

- OmpSs Examples:
- Debugging
- What to taskify?
- Paraver



Parallel Python at Heterogenous Architectures

- PyCOMPSs Automatic parallelization
- Xeon and Xeon Phi
- Neuroscience application



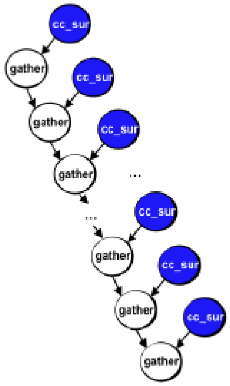
Tasks definition

```
@task(originals_file = FILE_INOUT, surrs_file = FILE_INOUT)
def gather(result, originals_file, surrs_file):
#    Accumulate results

@task(returns = list)
def cc_surrogate_range(start_idx, end_idx, seed, num_neurons, num_surrs, num_bins,
maxlag):
#    Compute neuron correlations
```

Main program

```
   originals_file = 'result_cc_originals.dat'
   surrs_file = 'result_cc_surrogates_conf.dat'
   for frag in range(num_frags):
      start_idx = end_idx
      end_idx = int(min((frag+1)*step,num_ccs))
      result = cc_surrogate_range(start_idx, end_idx, seed, num_neurons,
num_surrs, num_bins, maxlag)
      gather(result, originals_file, surrs_file)
      seed = seed + delta
```



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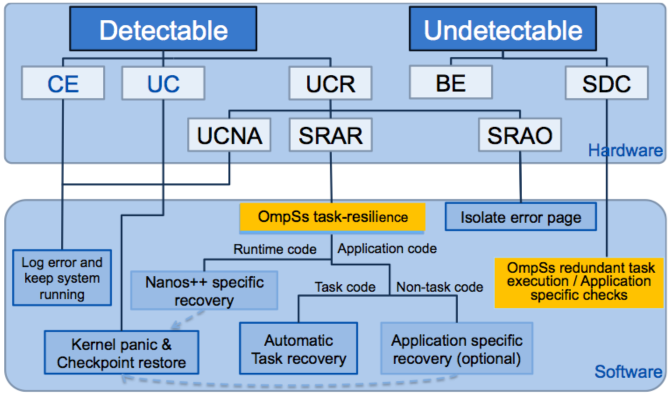
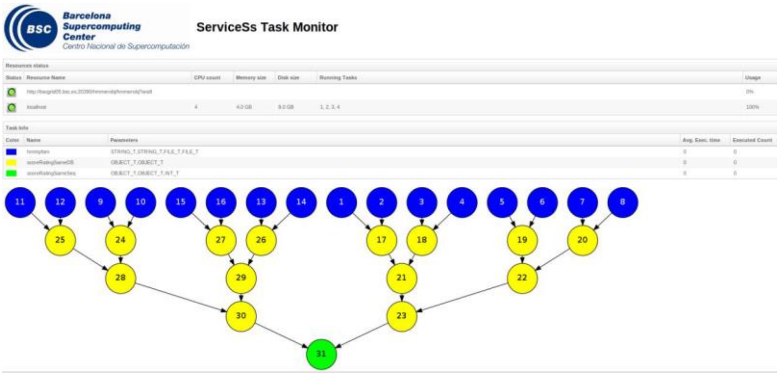
- Transparent resilience at OpenMP
  - NanoFT: Task based fault tolerance


Detectable
Undetectable
CE
UC
UCR
BE
SDC
UCNA
SRAR
SRAO
Hardware
OmpSs task-resilience
Isolate error page
Runtime code
Application code
Log error and keep system running
Nanos++ specific recovery
Task code
Non-task code
OmpSs redundant task execution / Application specific checks
Kernel panic & Checkpoint restore
Automatic Task recovery
Application specific recovery (optional)
Software

- Workflow development environment
  - COMPSs workflow in Java
  - IDE for development and deployment



ServiceSs Task Monitor

Resources status

Status	Resource Name	CPU count	Memory size	Disk size	Running Tasks	Usage
●	http://bscgrid05.bsc.es:20390/hmmerobj/hmmerobj?wsdl					0%
●	localhost	4	4.0 GB	8.0 GB	1, 2, 3, 4	100%

Task Info

Color	Name	Parameters	Avg. Exec. time	Executed Count
🟦	hmmpfam	STRING_T,STRING_T,FILE_T,FILE_T	0	0
🟨	scoreRatingSameDB	OBJECT_T,OBJECT_T	0	0
🟩	scoreRatingSameSeq	OBJECT_T,OBJECT_T,INT_T	0	0

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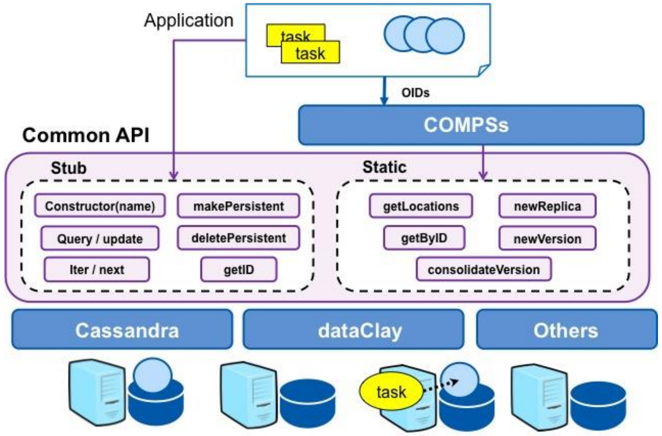
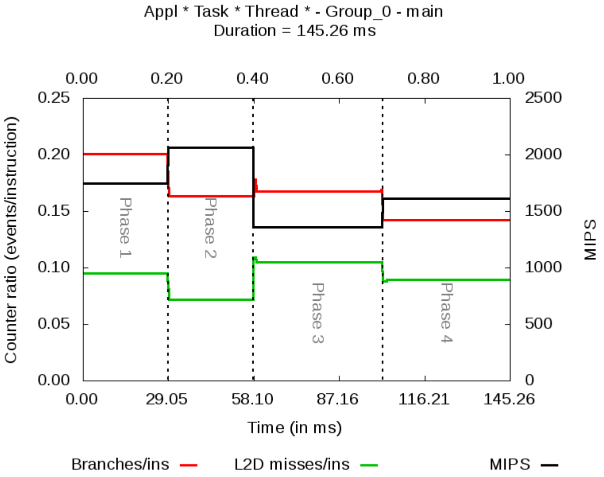
Integration of workflow and Data Infraestructures

- Persistent objects in Parallel Python
  - Cassandra and data clay



Instantaneous performance metrics

- With no noticeable overhead
- Example uses
  - Improving production codes
  - Analysing impact of multicore sharing



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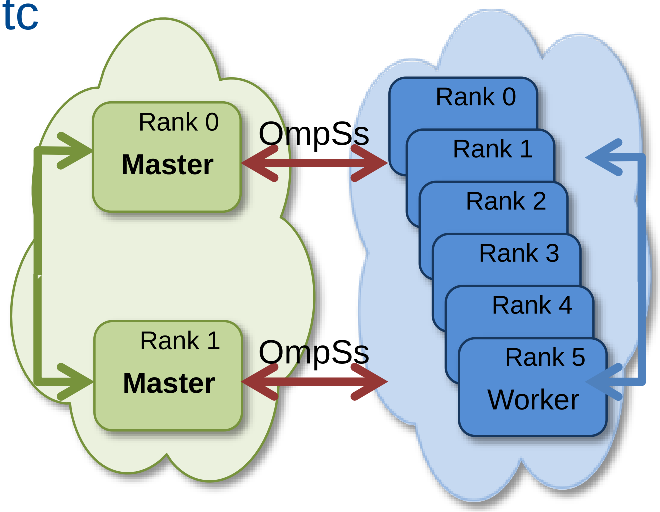
- Multilevel architectural simulation
  - Integration Tasksim and Dimemas
  - Trace-driven simulation of communications between nodes
  - Execution driven simulation of node level runtime
  - Trace driven simulation of core

- Homogenizing heterogeneity
  - Intra-node heterogenity
    - OpenCL, CUDA, OpenMP 4.0, FPGAs, etc
  - Cluster heterogeneity
    - OmpSs @ Cluster
    - OmpSs MPI offload



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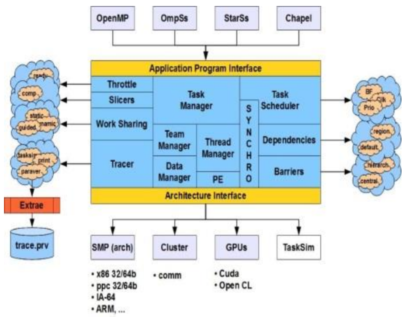
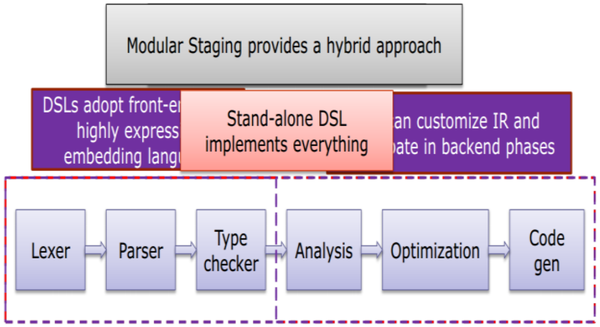
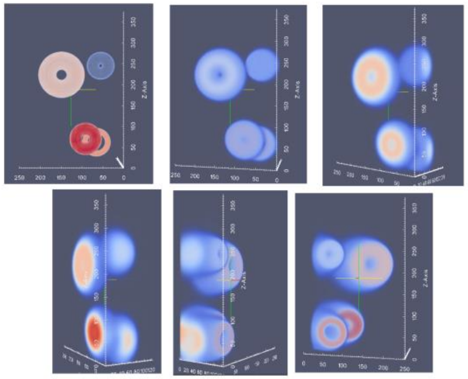
Generic DSL infrastructure

- Common framework to speedup development of HPC DSLs
  - OmpSs + Lightweight Modular Staging (LMS) + OpenCL
- Uses case: Saiph: A DSL for solving Partial Differential Equations







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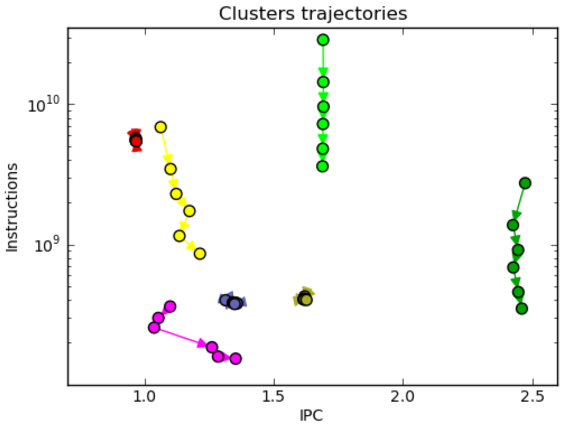
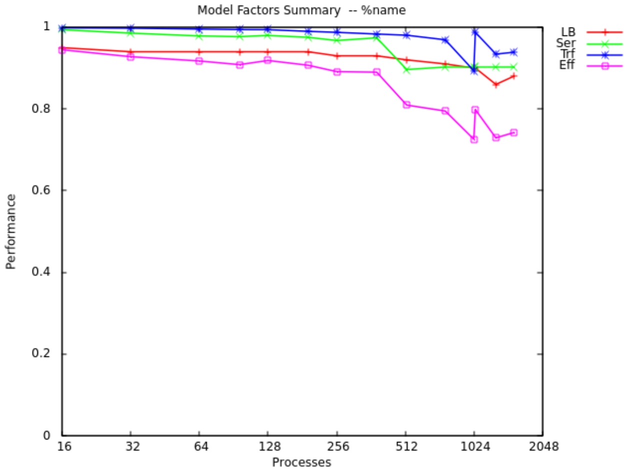
Tracking the performance of computation regions

- Changing core count …
- … problem size …
- … processes per node



Performance models

- Characterizing fundamental efficiency factors
- Scalability prediction for production codes


Model Factors Summary -- %name
Performance
Processes
LB
Ser
Trf
Eff