iCeBOUND : Cloud Based Design Support System for Urban Numeric Data

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iCeBOUND, a CTI project

- Arx-IT - Industrial partner
- HES-SO, hepia - Academic partner
- SIG (Services industriels de Genève)
- OCEN (Office cantonal de l'énergie)
- SGOI (Service de géomatique et de l’organisation de l’information)
- SEMO (Service de la mensuration officielle)
- CERN (Centre européen de recherche atomique)
Post CTI project -
Continued interest
Lack of computing resources
Team on different project

eSCT provides a channel to continue
Framework for new support with low barrier to entry
Access to new expertise
Access to infrastructures
Bring in new partners
Goal and use case

Surface de base (monocristallin):
Irr. moy.: 1110 [kWh/m2/an]
Pente moy.: 94 [°]
Orient. moy.: 3.5 [°]
Surf. toiture: 394 [m2]
Surf. capteur: 315 [m2]
Prod. janv: 1.4 [MWh/janv]
Prod. juil.: 8.4 [MWh/juil]
...
Prod. an: 56 [MWh/an]
Sum_Puis: 63 [kW]
CO2_econom: ~0 [t/an]
Solar radiation calculation

• Residential zone of Meyrin, 2015
Input data

• Sun positions
• 3D digital urban datas
Shading calculation

• Result of a shadow process at 8am and 2pm on July
Solar radiation components

• Direct (depends on the sun visibility) radiation

• Diffuse (depends on the sky visibility ratio) radiation

• Reflected radiation
Sky view factor (SVF)

- Determines the ratio of visible sky from a point
- Input data: Sky model composed of 400 suns
- Output data: the ratio of visible sun from each point of the urban model
- Highly parallelizable
SVF parallelization: challenges

- Reducing the time taken from an execution on a real urban area (3.4 * 3.4 [km]) compared with the original software
- Optimization in term of execution cost
- Integrating the distributed computation system into the current decision support system
SVF sun parallelization: principle

- Sky model
- Part 1
- Part N
- urban model
- sun 1
- sun 2
- sun 399
- sun 400
- N equal parts of the sky model
- Computation of shadow processing on N Virtual Machines
- merge
- SVF file
Am I shaded by another point?
iCeBound: eSCT extension

• eSCT project support extension of iCeBOUND to:
  • Cluster Framework : HTCondor
    ❏ With home made python orchestration library
  • MR Framework : Hadoop
  • Two targeted providers : AWS & SWITCHengines
  • Multicloud library : Apache libcloud
SVF parallelization : conclusions

• eSCT allows us to continue the research on iCeBOUND

• Decreasing the computation time from 2 days to 2 hours with condor

• MapReduce version is ready to be tested
Questions ?