

# BOINC as a platform for building the Wikipedia of weather forecasting

# Weather forecasting - the DIY way

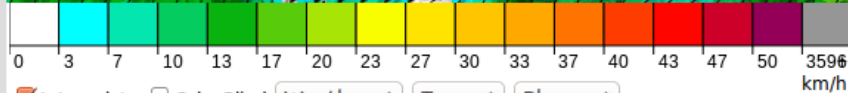
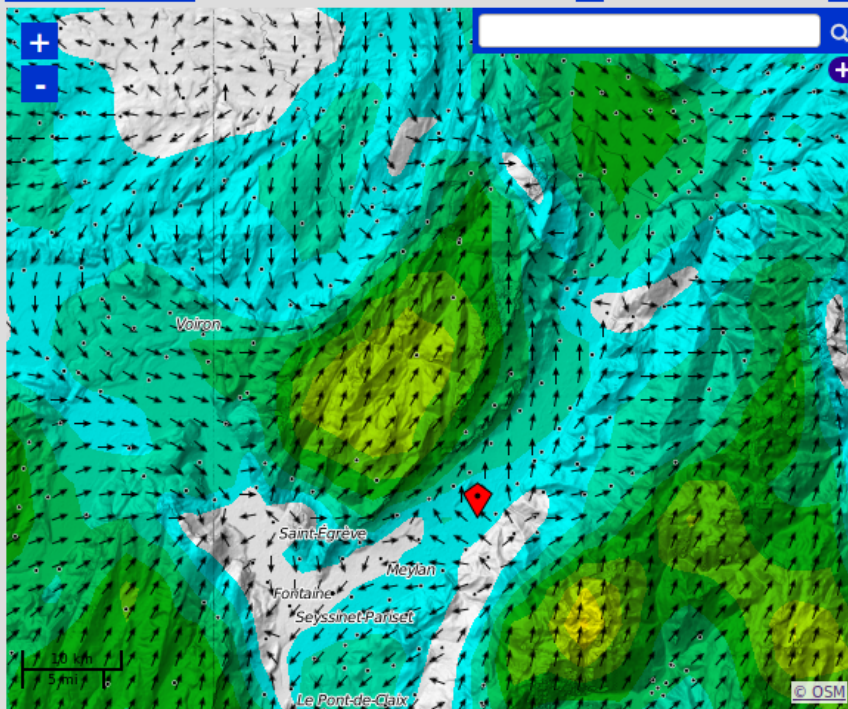
BOINC as a platform for building the  
Wikipedia of weather forecasting



**WARNING !**  
**Geek Porn**  
**inside**

# Background





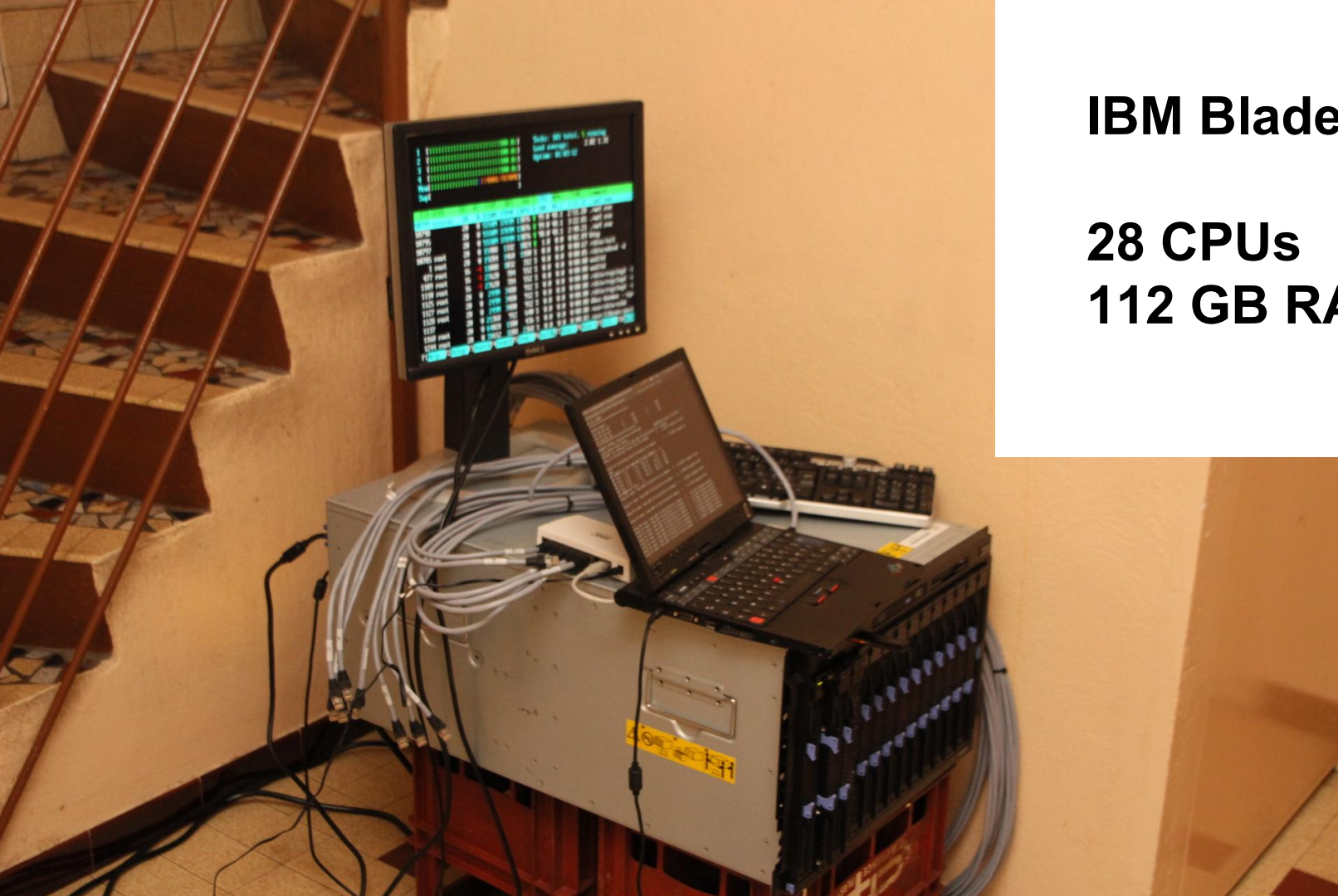
45.23°N, 5.87°E - 20140929 - km/h - UTC+2

| Alti (m) | 6h | 7h | 8h | 9h | 10h | 11h | 12h | 13h | 14h | 15h | 16h | 17h | 18h | 19h | 20h | 21h | 22h | 23h |
|----------|----|----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 3500     | 33 | 41 | 53 | 53 | 48  | 41  | 31  | 25  | 22  | 37  | 34  | 34  | 38  | 32  | 25  | 27  | 28  | 26  |
| 3000     | 29 | 34 | 44 | 49 | 41  | 33  | 29  | 23  | 23  | 32  | 34  | 31  | 37  | 33  | 20  | 19  | 21  | 19  |
| 2500     | 26 | 31 | 40 | 46 | 41  | 33  | 31  | 26  | 27  | 32  | 35  | 32  | 38  | 33  | 19  | 17  | 18  | 15  |
| 2000     | 28 | 36 | 43 | 41 | 32  | 32  | 28  | 28  | 32  | 34  | 36  | 33  | 39  | 34  | 20  | 16  | 14  | 12  |
| 1500     | 24 | 28 | 34 | 43 | 42  | 35  | 34  | 32  | 36  | 36  | 37  | 35  | 39  | 36  | 24  | 14  | 12  | 9   |
| 1000     | 22 | 28 | 33 | 39 | 41  | 39  | 38  | 39  | 40  | 38  | 38  | 37  | 38  | 39  | 30  | 15  | 11  | 9   |
| 500      | 20 | 28 | 33 | 38 | 40  | 44  | 44  | 44  | 43  | 41  | 38  | 37  | 37  | 40  | 36  | 16  | 12  | 11  |
| 0        | 19 | 28 | 34 | 38 | 39  | 45  | 48  | 46  | 44  | 42  | 38  | 38  | 37  | 39  | 40  | 20  | 13  | 14  |
|          | 17 | 29 | 34 | 38 | 38  | 45  | 48  | 45  | 43  | 40  | 38  | 38  | 37  | 38  | 42  | 26  | 15  | 18  |
|          | 16 | 28 | 35 | 37 | 38  | 43  | 47  | 44  | 41  | 39  | 38  | 38  | 35  | 37  | 44  | 34  | 19  | 21  |
|          | 14 | 27 | 35 | 37 | 38  | 42  | 46  | 43  | 40  | 38  | 37  | 38  | 33  | 34  | 43  | 42  | 27  | 28  |
|          | 13 | 25 | 34 | 36 | 37  | 41  | 45  | 42  | 38  | 36  | 36  | 38  | 31  | 32  | 43  | 44  | 34  | 33  |
|          | 11 | 22 | 33 | 35 | 35  | 38  | 43  | 41  | 36  | 33  | 35  | 38  | 29  | 28  | 41  | 42  | 38  | 33  |
|          | 10 | 20 | 31 | 33 | 32  | 34  | 41  | 40  | 34  | 31  | 34  | 37  | 29  | 25  | 38  | 39  | 38  | 32  |
|          | 9  | 18 | 29 | 29 | 28  | 29  | 38  | 39  | 31  | 28  | 33  | 36  | 28  | 21  | 34  | 36  | 31  | 28  |
|          | 8  | 16 | 26 | 25 | 23  | 24  | 34  | 36  | 28  | 26  | 32  | 34  | 25  | 19  | 31  | 32  | 23  | 21  |
|          | 7  | 14 | 21 | 20 | 18  | 18  | 29  | 32  | 25  | 24  | 30  | 30  | 22  | 16  | 26  | 26  | 17  | 14  |
|          | 6  | 12 | 15 | 13 | 14  | 14  | 24  | 27  | 22  | 23  | 26  | 25  | 18  | 15  | 21  | 20  | 12  | 7   |
|          | 5  | 10 | 11 | 10 | 11  | 10  | 18  | 20  | 20  | 22  | 21  | 20  | 16  | 16  | 18  | 14  | 11  | 5   |
|          | 4  | 8  | 8  | 6  | 7   | 7   | 13  | 15  | 17  | 18  | 18  | 16  | 16  | 16  | 16  | 12  | 8   | 3   |
|          | 3  | 6  | 4  | 2  | 1   | 1   | 10  | 10  | 10  | 10  | 10  | 10  | 10  | 10  | 10  | 10  | 10  | 5   |
|          | 2  | 4  | 2  | 1  | 1   | 1   | 7   | 7   | 7   | 7   | 7   | 7   | 7   | 7   | 7   | 7   | 7   | 5   |
|          | 1  | 3  | 2  | 1  | 2   | 3   | 5   | 5   | 5   | 5   | 5   | 5   | 5   | 5   | 5   | 5   | 5   | 8   |
|          | 0  | 2  | 1  | 0  | 1   | 2   | 3   | 3   | 3   | 3   | 3   | 3   | 3   | 3   | 3   | 3   | 3   | 8   |
|          | 0  | 1  | 0  | 0  | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 15  |
|          | 0  | 0  | 0  | 0  | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 8   |
|          | 0  | 0  | 0  | 0  | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 5   |

# IBM Bladecenter

28 CPUs

112 GB RAM



4 kW =



# HPC in da bedroom



**Is that all we can do ?**

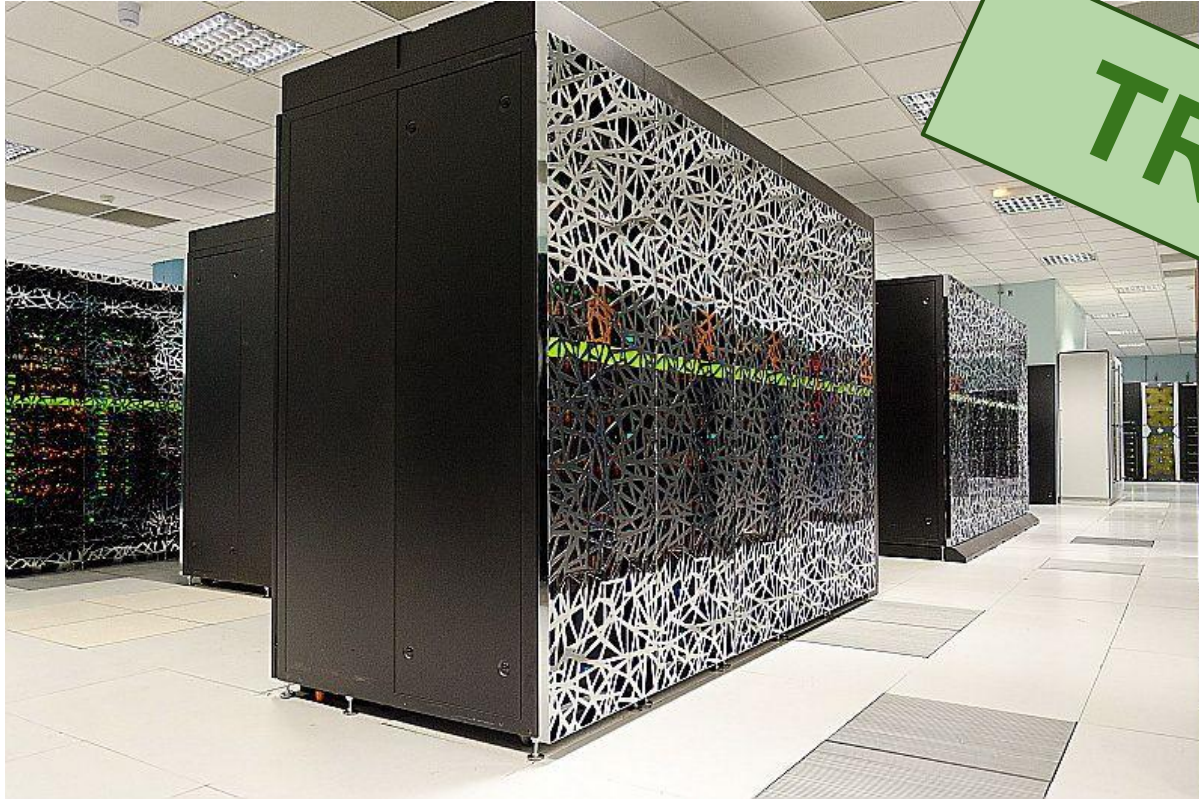


# 4 days forecasts for the world

|        |             |
|--------|-------------|
| 11 km  | 18 CPUs     |
| 2,5 km | 1 600 CPUs  |
| 1 km   | 21 000 CPUs |

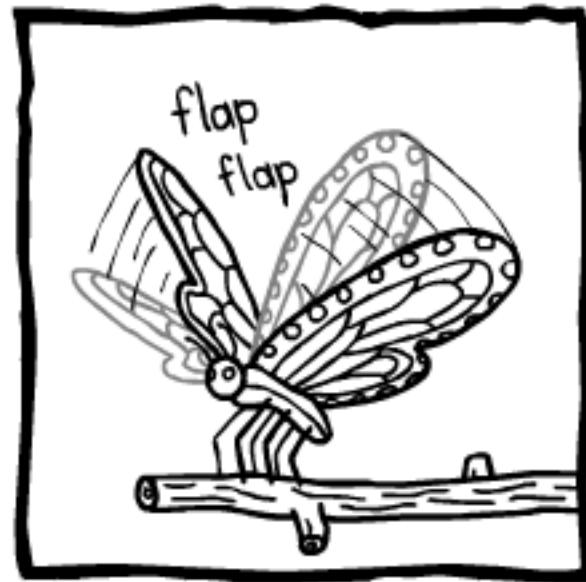
**I will need a bigger bedroom !**

# Weather forecasting needs HPC



**TRUE**

# The Butterfly Effect.



by  
J.L. Westover

[www.mrlovenstein.com](http://www.mrlovenstein.com)

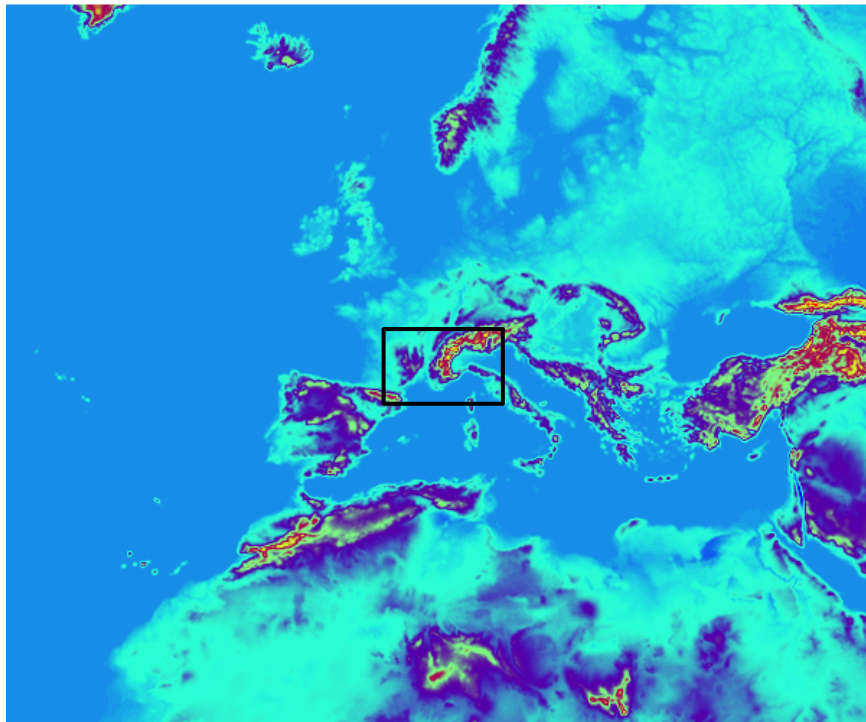
~~A single computer can not do good job~~

**We are no longer in 2010 !**

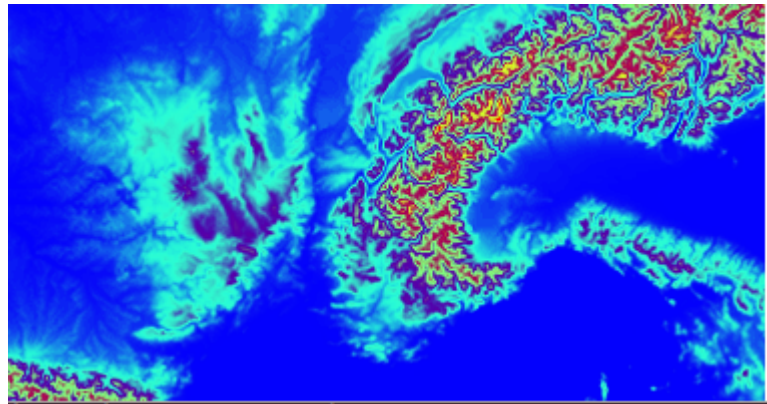
**A single computer can now do good job**

# Single Xeon E5-1650 (Q1 2012, \$580)

~6 hours computation, 4 days forecasts



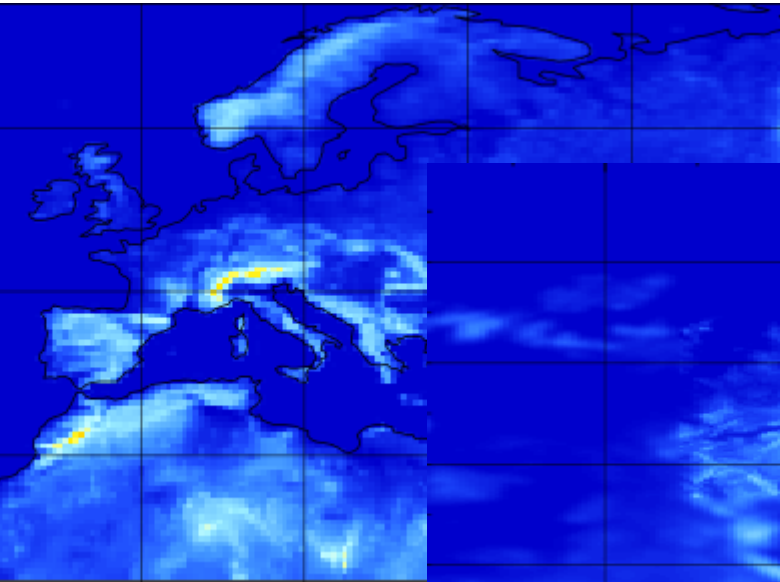
11 km



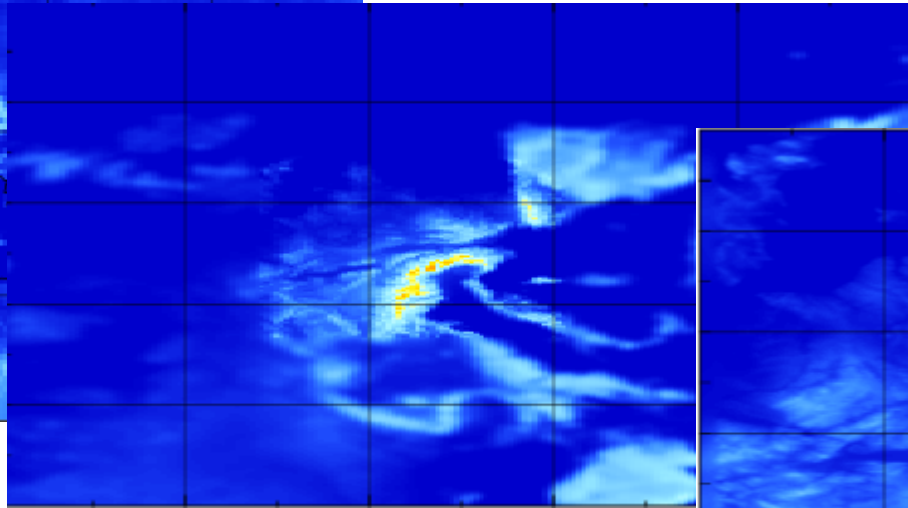
2.5km



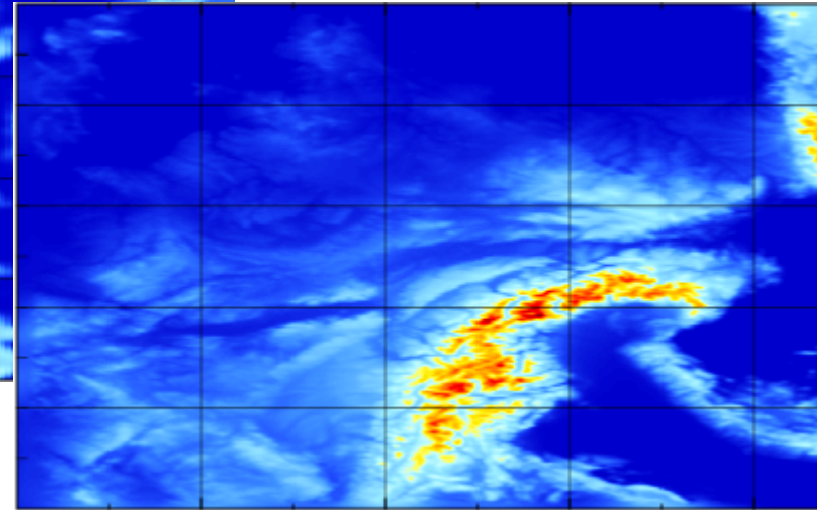
# Downscaling



**55 km**

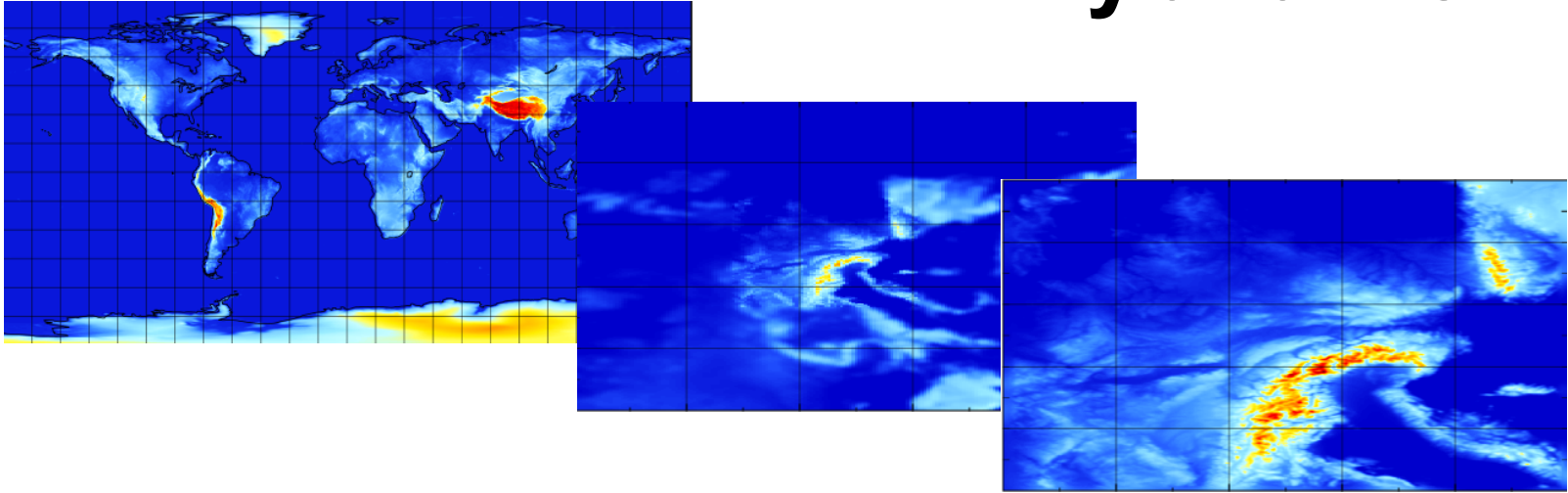


**16 km**



**2.5 km**

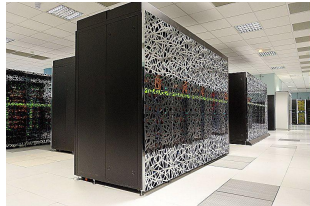
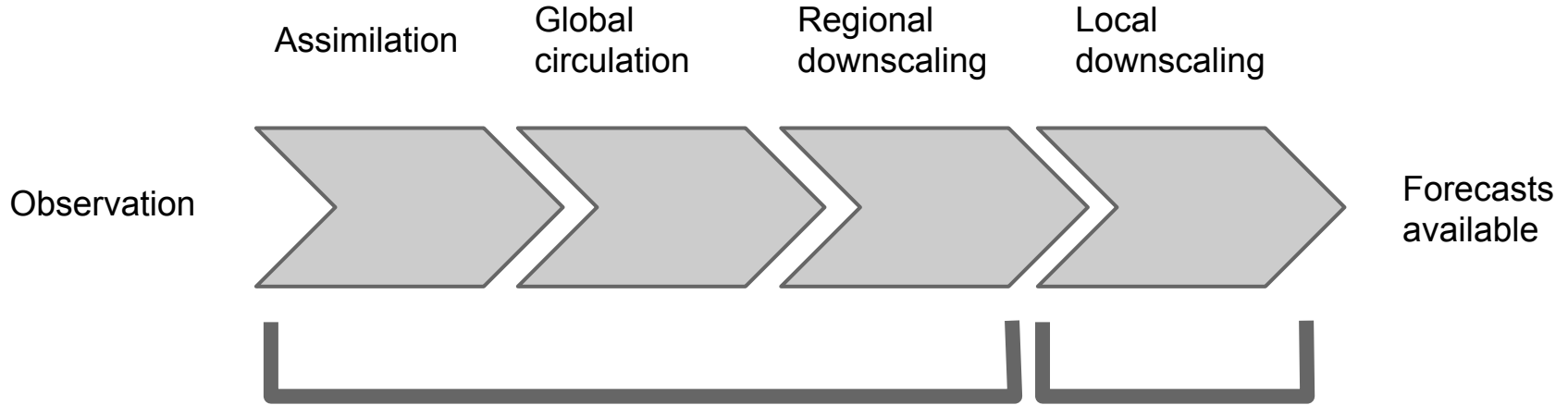
# Hybrid workflow



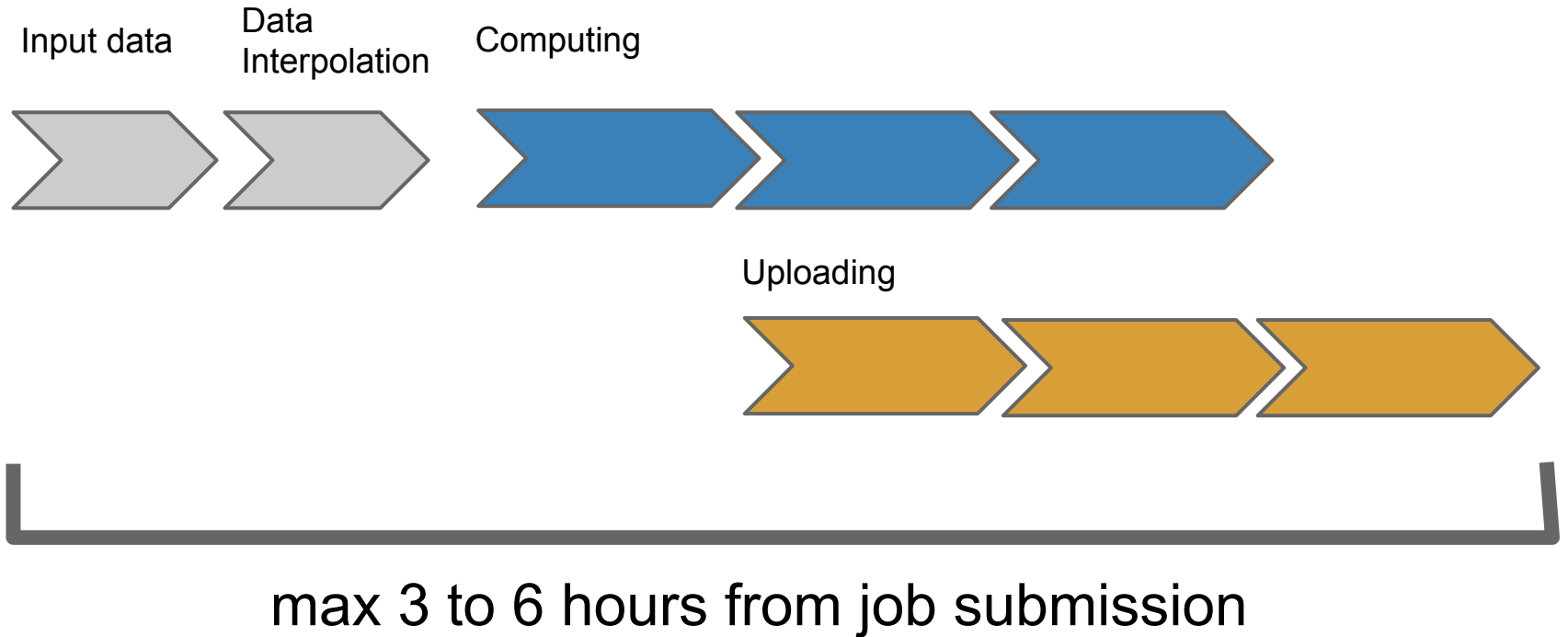


# **BOINC Implementation**

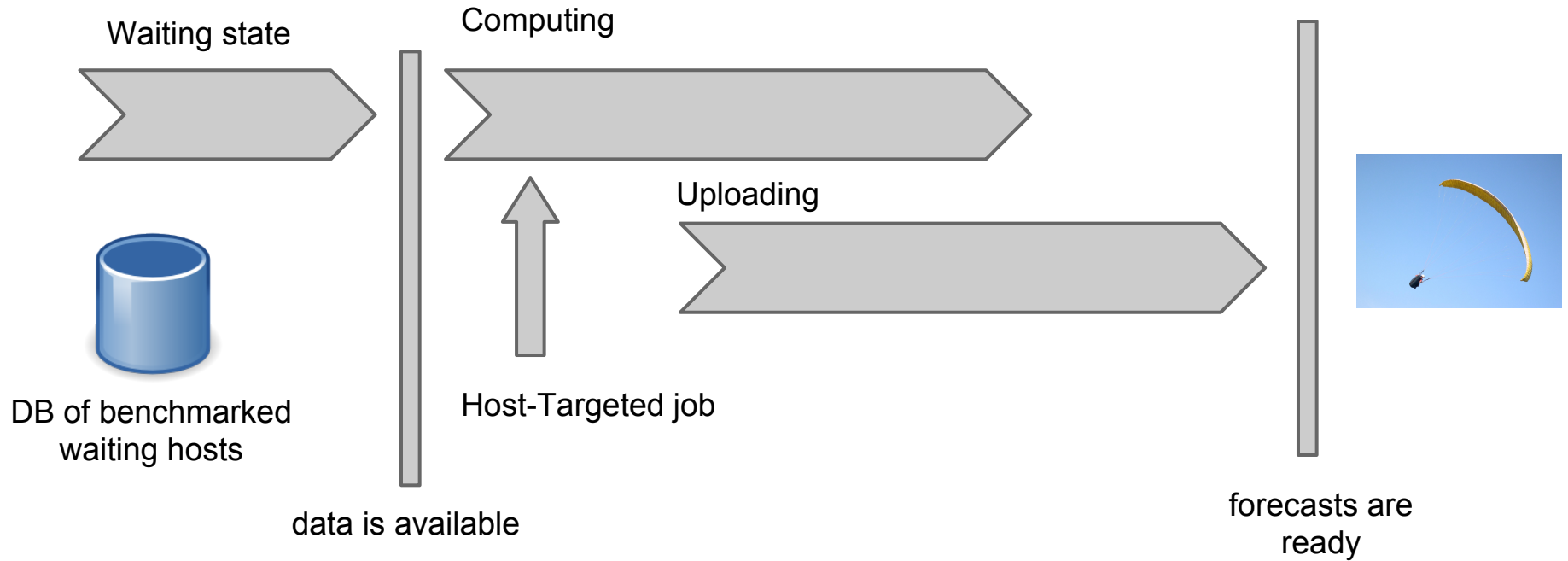
# Real-time challenge



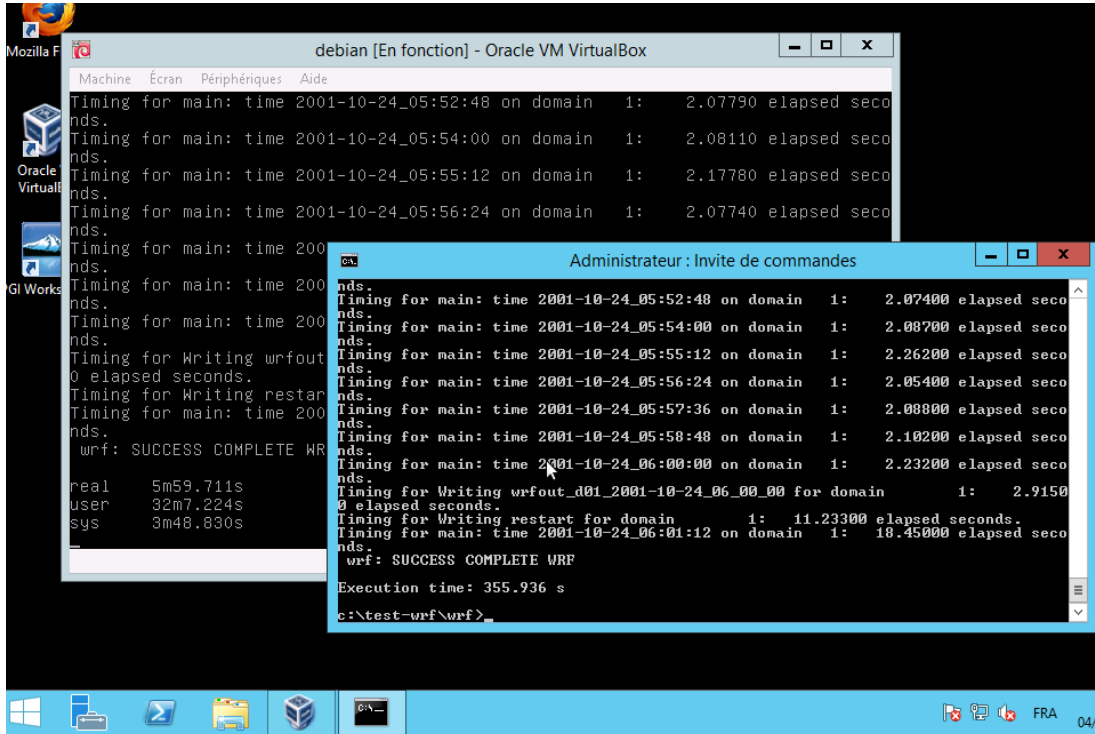
# Home computing workflow



# BOINC workflow



# Virtualbox

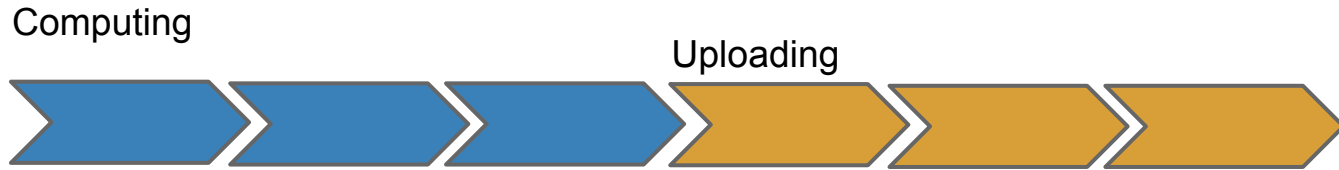


Win64 native :  
**354s**

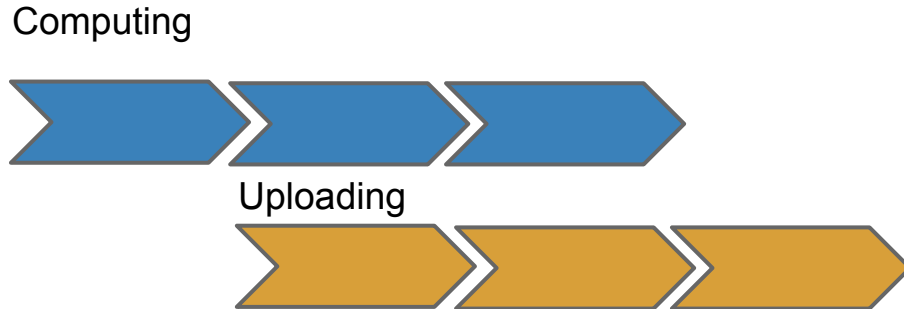
Linux in VBox :  
**360s**

# Need to adapt the VBOX wrapper

From :



To :



**Community**

**40 000 paraglider pilots now using  
meteo-parapente.com**





**« Help me make  
you better  
forecasts,  
so you will not die  
going flying »**



« compute it by yourself »

FEATURED APP



# Pilots are not geeks

**BOINC Manager**

**Choisissez un projet**

Pour choisir un projet, cliquez sur son nom ou tapez son URL ci-dessous.

Catégories: Tous

Projets: Yoyo@home, ABC@home, Asteroids@home, CAS@home, Climateprediction.net, Collatz Conjecture, Constellation

Détails du projet: Yoyo@home... adapter between BOINC and several existing volunteer computing projects: ECM, Muon, Evolution@home, and distributed.net

Domaine de recherche: Mathematics, physics, evolu...  
Organisation: Private  
Site Web: <http://www.rechenkraft.net/yoyo/>  
Systèmes compatibles:

URL du projet:

< Retour Suivant > Annuler

**BOINC Manager**

**Identifiez votre compte**

Participez-vous déjà à ce projet ?

Non, nouvel utilisateur  Oui, utilisateur existant

Adresse email:

Choisissez un mot de passe:

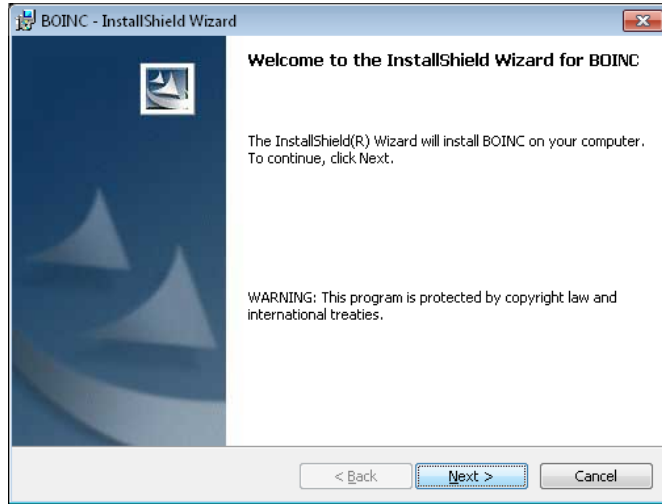
Confirmez le mot de passe:

longueur minimum: 6 caractères

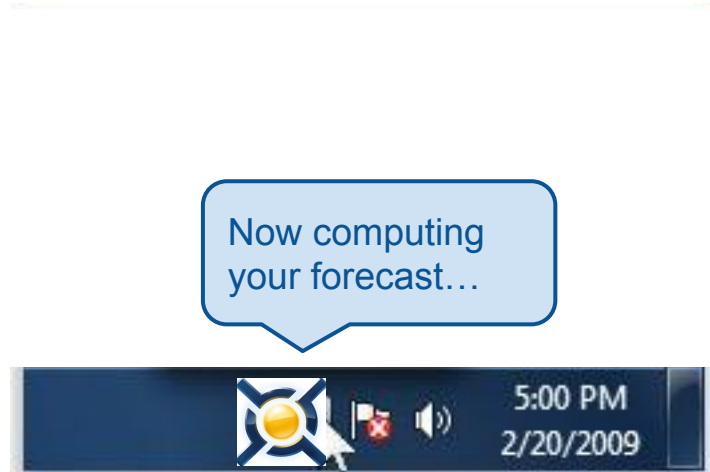
[Mot de passe oublié?](#)

< Retour Suivant > Annuler

# Extremely simplified BOINC client



**Step 1**



**Step 2**

# I need help :)

- Setting up the BOINC server, scheduler...
- Adapting the vbox wrapper
- Making a simple client
- Work distribution algorithm

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