



...a quick recap

- The BIG question
 - What actually happened at the Big Bang?
- Other questions
 - How does gravity work?
 - How do particles have mass?
 - Where is the rest of the universe?

UNIVERSITY OF BIRMINGHAM 101001010001001000100001000010 To help answer these questions, the LHC experiments have built truly massive machines that will create about 15PB (petabytes) of data every year! 15PB (2010) 15PB (20





The Solution What do we need?

GridPP

The solution must be:

- able to handle massive amounts of data,
- able to process large computing jobs,
- relatively inexpensive,
- simple to use,
- accessible 24/7, and



- easily upgraded.



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What about **Super Computers**?

e.g. Blue Gene/L, Red Storm, BGW, ASC Purple, MareNostrum, etc.

So, can't we just keep building them bigger and more powerful?





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The Solution Current Tools on the Internet

• Worldwide Web

World Wide Web

👗 GridPP

- File Sharing networks
- BOINC e.g. SETI@home, LHC@home





The Web specifically designed by scientists at CERN to help with their work.



The Solution A New Tool for the Internet

GridPP

- Building a new tool
 - Computers in the various institutions are already connected
 - They already share files





How about sharing everything?



Distributed computing has been around for some time but:

- the use of different sites has to be negotiated by individual scientists,
- separate access accounts are needed for each system, and
- jobs have to be submitted and results retrieved by hand from individual signals



A little history...

Distributed computing requires a significant amount of co-ordination work before any useful work can be done.



The Electric Grid





- Always on
- Use as much (or as little) on demand
- You do not need to know about the source
- Just plug in and go

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Today...

Grid Middleware lets you submit jobs to the Grid without having to know where the data is located or where your jobs will run. No



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Now, you can just submit a job and pick the results up all from one place!





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GridPP is a collaboration of *Particle Physicists* and *Computing Scientists* from 20 UK universities and CERN building the UK arm of the Grid.



- 100+ Individuals
- Hardware computing power equivalent of 6,420 desktop computers (reaching 10,000 later this year)
- 280TB of storage

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We are members of two Grid projects







Beyond Particle Physics

- WISDOM Challenges:
 - Avian Flu
 - 100 years work done in 4 weeks
 - Malaria
 - 50% of computing power provided by GridPP

- Inferno Grid
 - Humanities Project in Montclair University New Jersey
 - Current texts available on the system include Aristotle, Galen, Plato, Marcus Aurelius, and Commentaries.



Conclusion

- Large physics problems ---> Large detector machines ---> Phenomenal data and computing requirements
- The worldwide Grid is needed to meet these new challenges.
- UK GridPP is heavily involved in providing the manpower and hardware to make this all possible.
- *Grid Computing* is heavily used by HEP. Many other disciplines recognise its potential and benefits as well.





http://www.gridpp.ac.uk