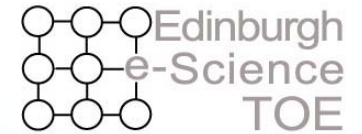


Enabling, facilitating and delivering quality training
in the UK and Internationally



Training Outreach and Education

Introduction to e-science concepts

Mike Mineter
Training Outreach and Education
National e-Science Centre

Mike.Mineter@ed.ac.uk



omii europe
open middleware infrastructure institute



Overview

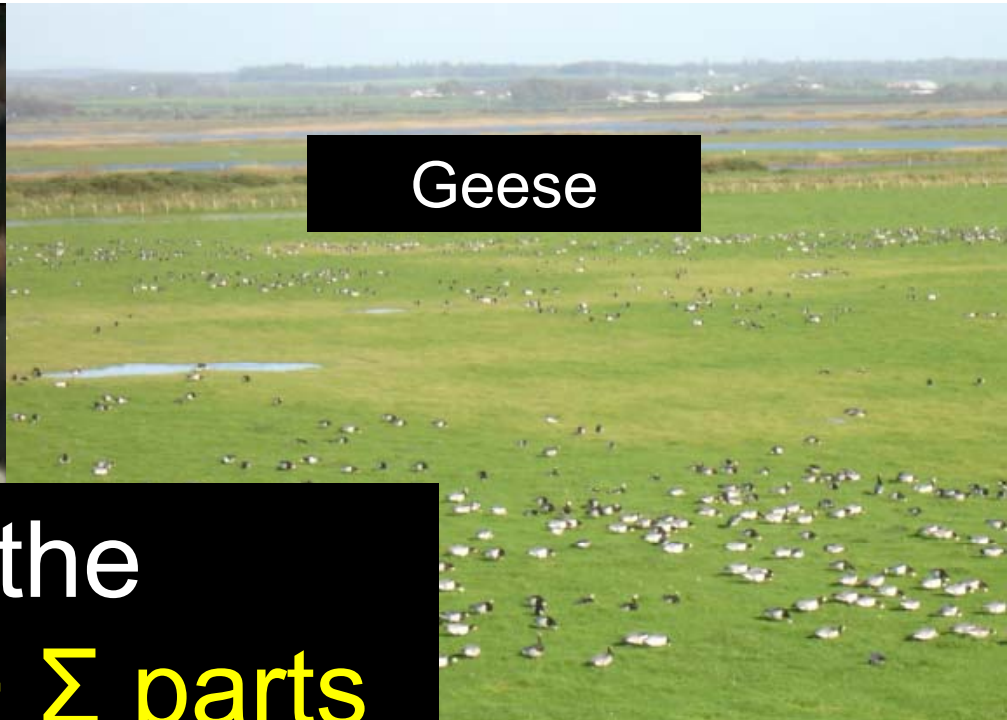
- The vision –what is e-science?!
- The pioneers
- Some aspects of e-science
- The week ahead

All slides will be uploaded to the [agendapage](#)



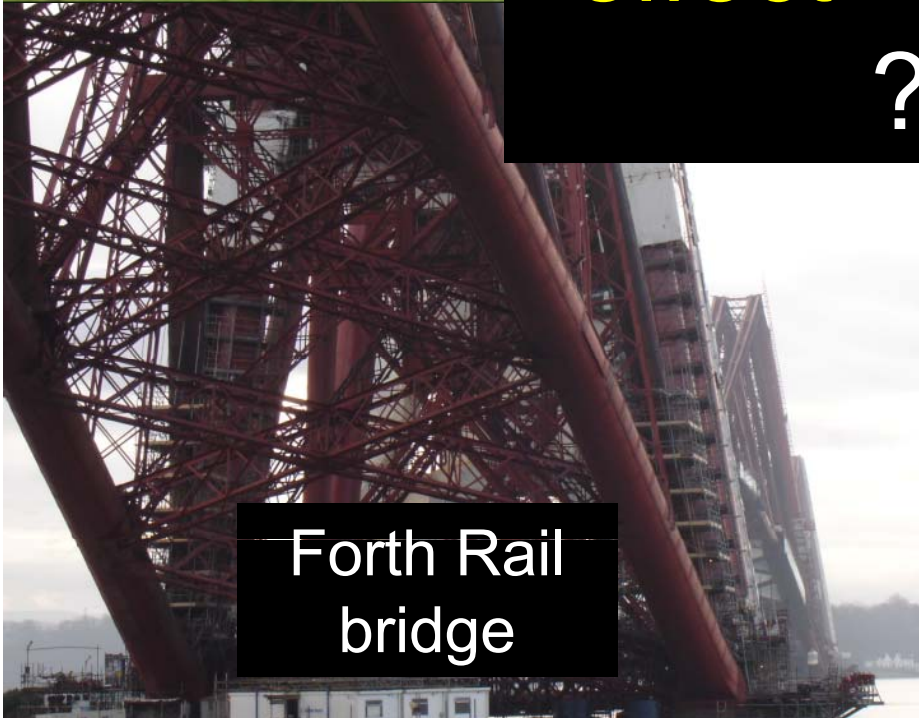


“Engerlund”



Geese

Is the
effect > Σ parts
??



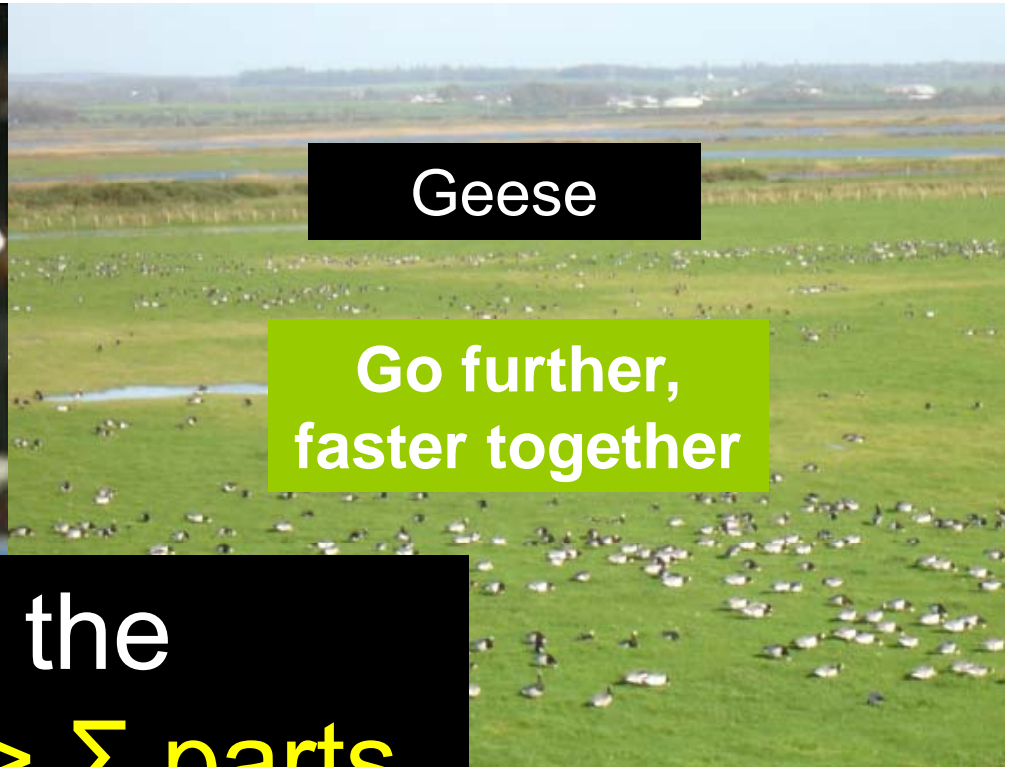
Forth Rail
bridge



Orchestra



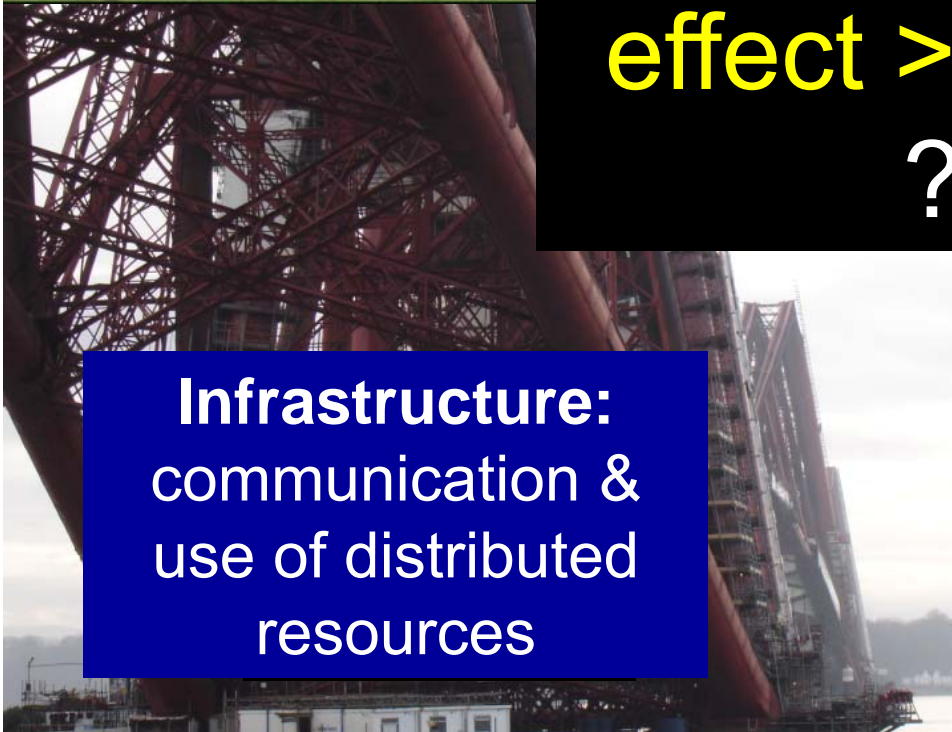
“Engerlund”



Geese

Go further,
faster together

Is the
effect > Σ parts
??



Infrastructure:
communication &
use of distributed
resources



Coordinated use
of resources

Orchestra

**Go further,
faster together**

**Coordinated use
of resources**

**Infrastructure:
communication &
use of distributed
resources**

Enhancing science

**Go further,
faster together**

Researchers

**Enabled
by**

**Coordinated use
of resources**

Technologies and services

**Permitting access
to**

**Infrastructure
Internet**

**Resources (Data, Storage,
Computers, Instruments,...)
connected by the Internet**

Enhanced (e-) science is....

‘...about global collaboration in key areas of science, and the next generation of infrastructure that will enable it.’

John Taylor

Director General of Research Councils

Office of Science and Technology

2001

- Many vital challenges require **community effort**

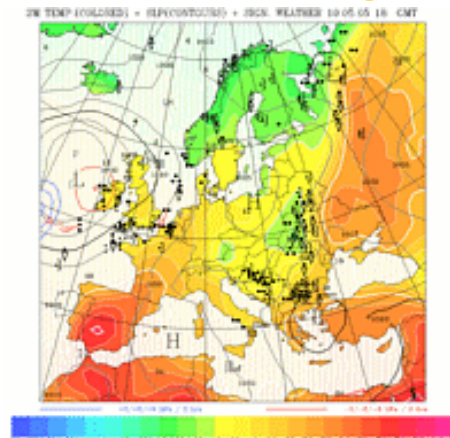
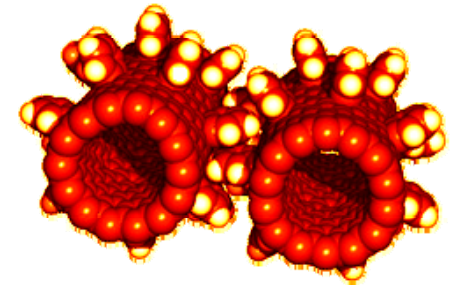
- Fundamental properties of matter
- Genomics
- Climate change
- Medical diagnostics

- Research is increasingly digital, with **increasing amounts of data**

- **Computation** ever more demanding

e.g.: experimental science uses ever more sophisticated sensors

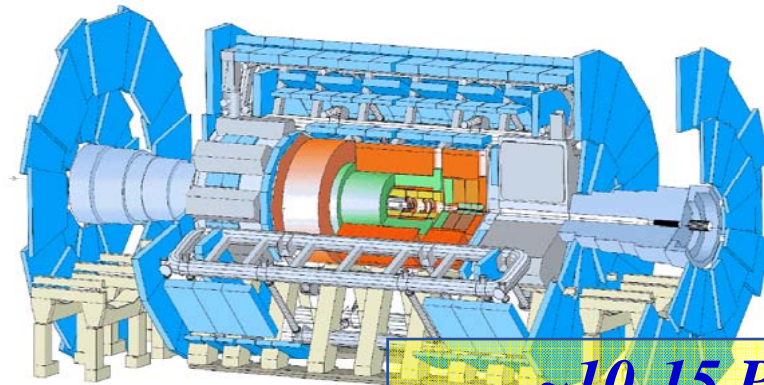
- Huge amounts of data
- Serves user communities around the world
- International collaborations



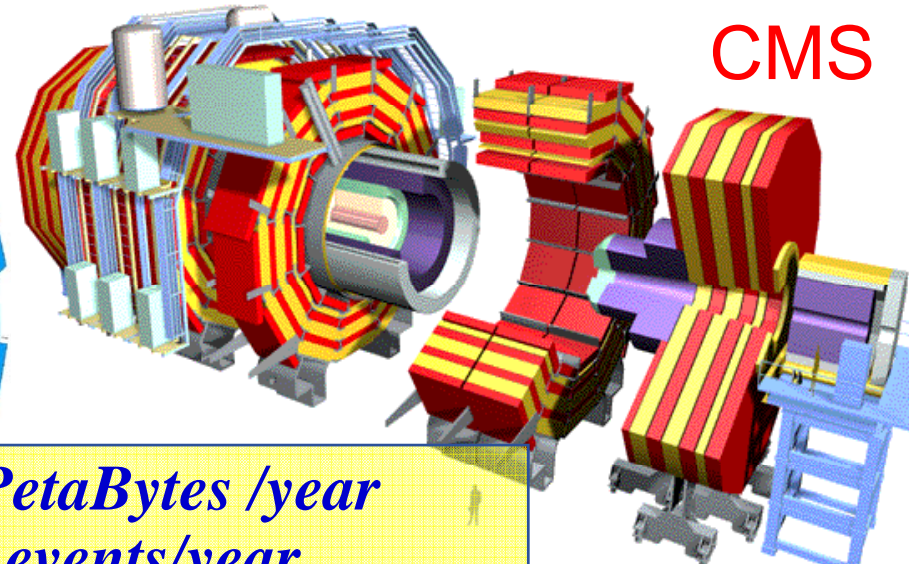
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- The week ahead

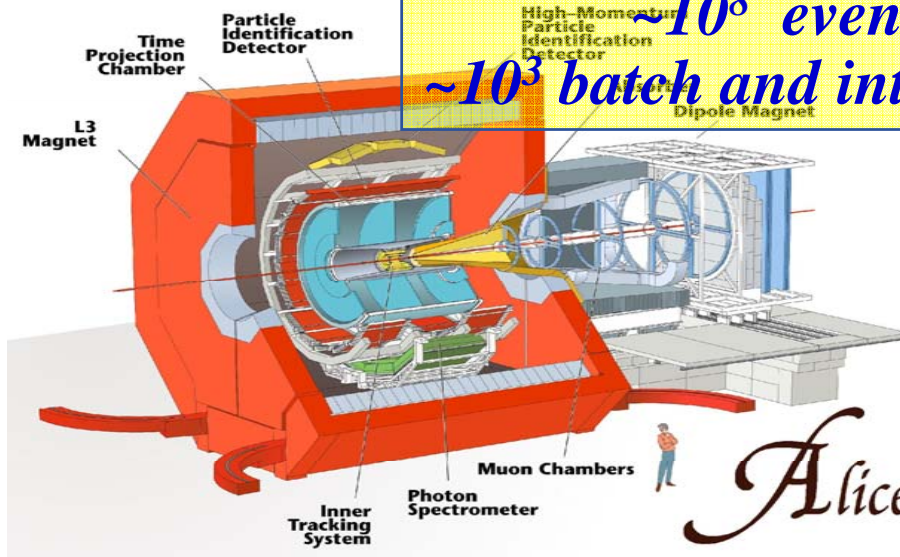
ATLAS



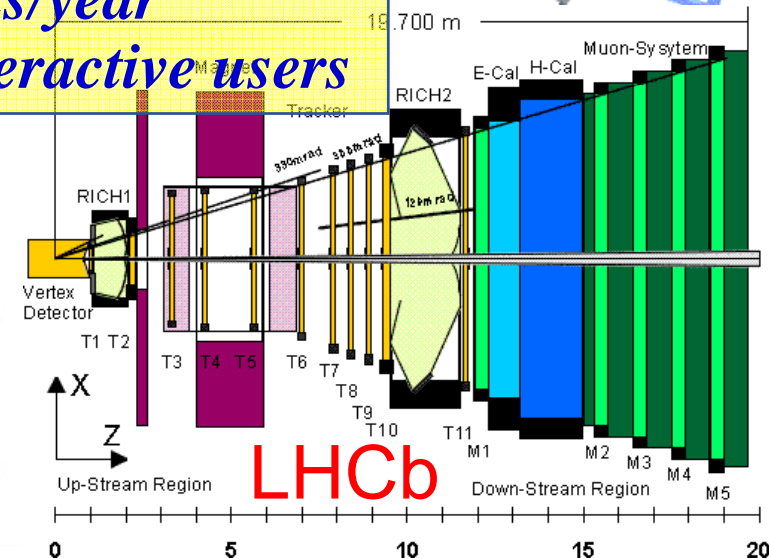
CMS



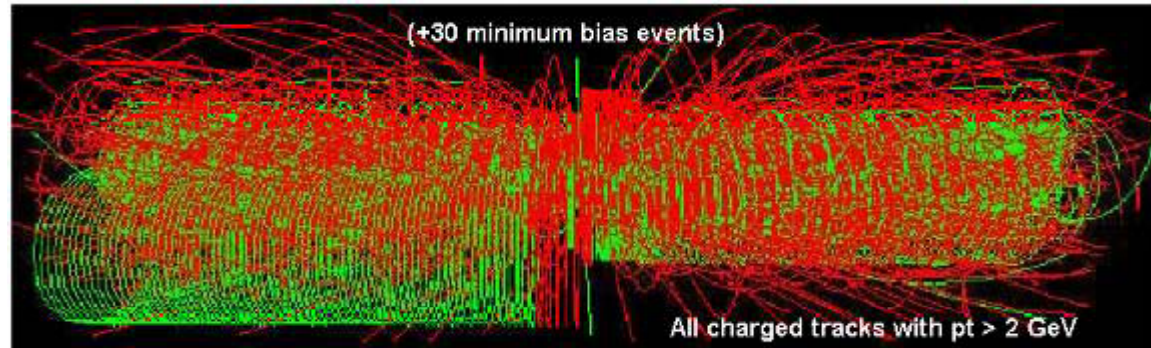
~10-15 PetaBytes /year
~10⁸ events/year
~10³ batch and interactive users



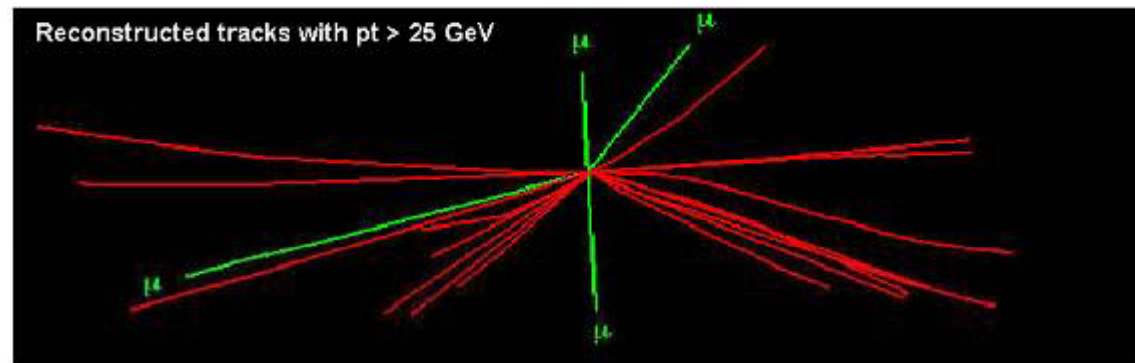
Alice



Starting from
this event



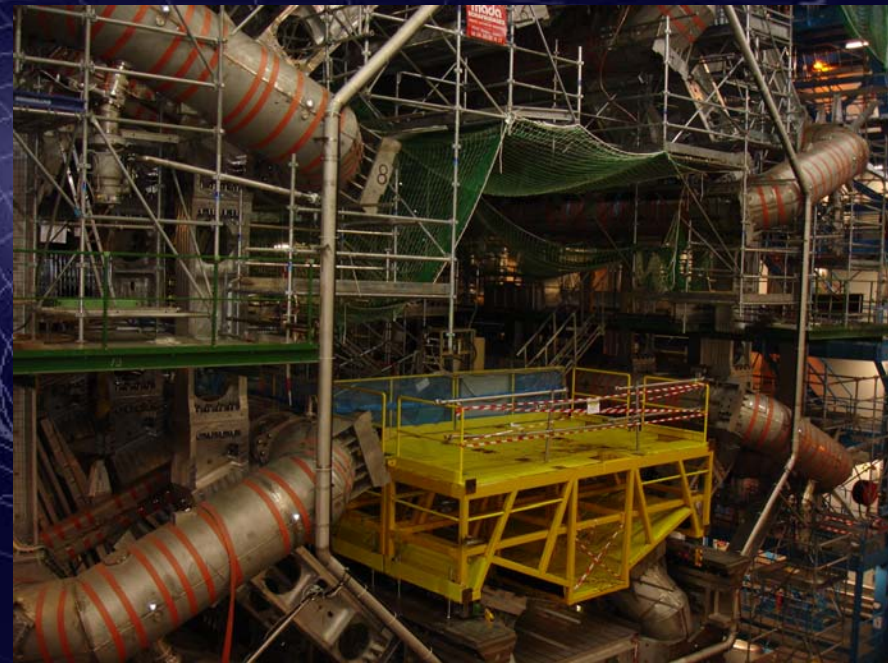
Looking for
this “signature”



→ **Selectivity: 1 in 10^{13}**

(Like looking for a needle in 20 million haystacks)

UK Grid for Particle Physics

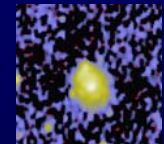
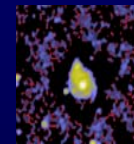
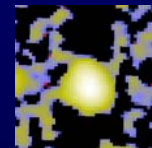
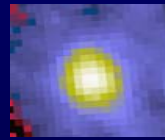
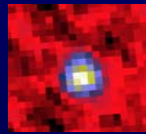
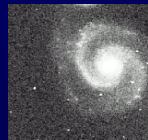
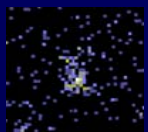
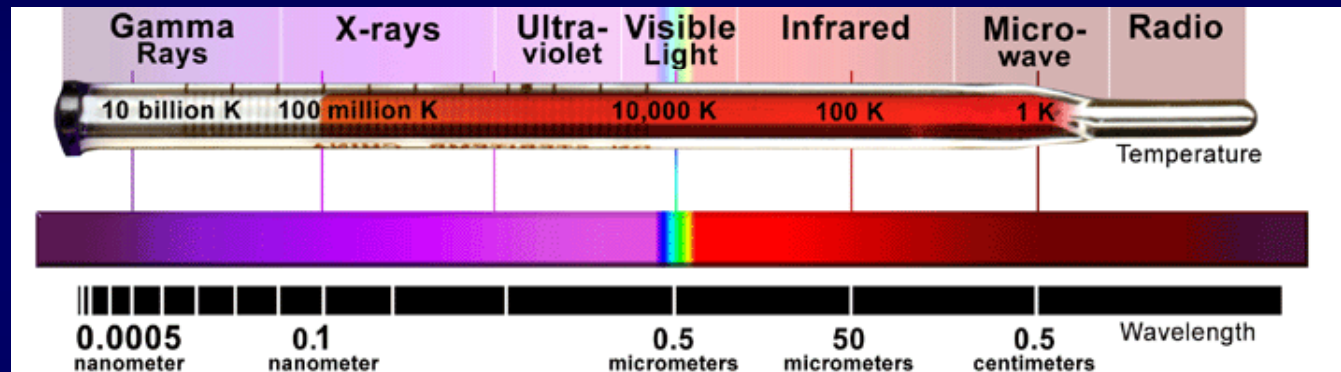


GridPP www.gridpp.ac.uk

ATLAS detectors, 2/3/06

Virtual Observatories

Observations made across entire electromagnetic spectrum



ROSAT ~keV DSS Optical 2MASS 2 μ IRAS 25 μ IRAS 100 μ GB 6cm NVSS 20cm WENSS 92cm

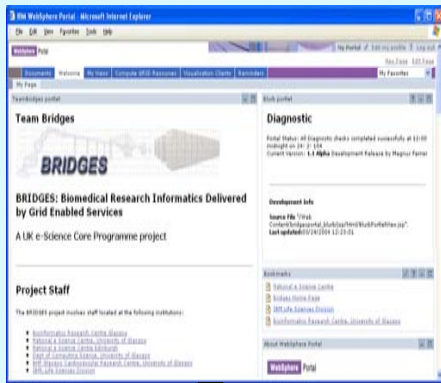
⇒ e.g. different views of a local galaxy

Need all of them to understand physics fully

Databases are located throughout the world

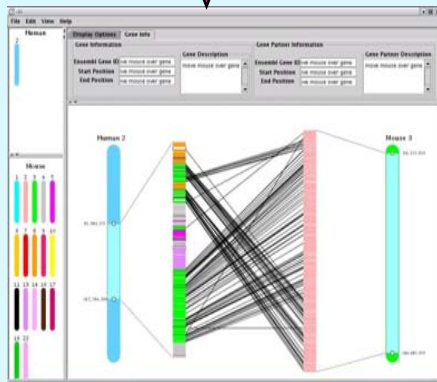
Biomedical Research Informatics Delivered by Grid Enabled Services

VO Authorisation

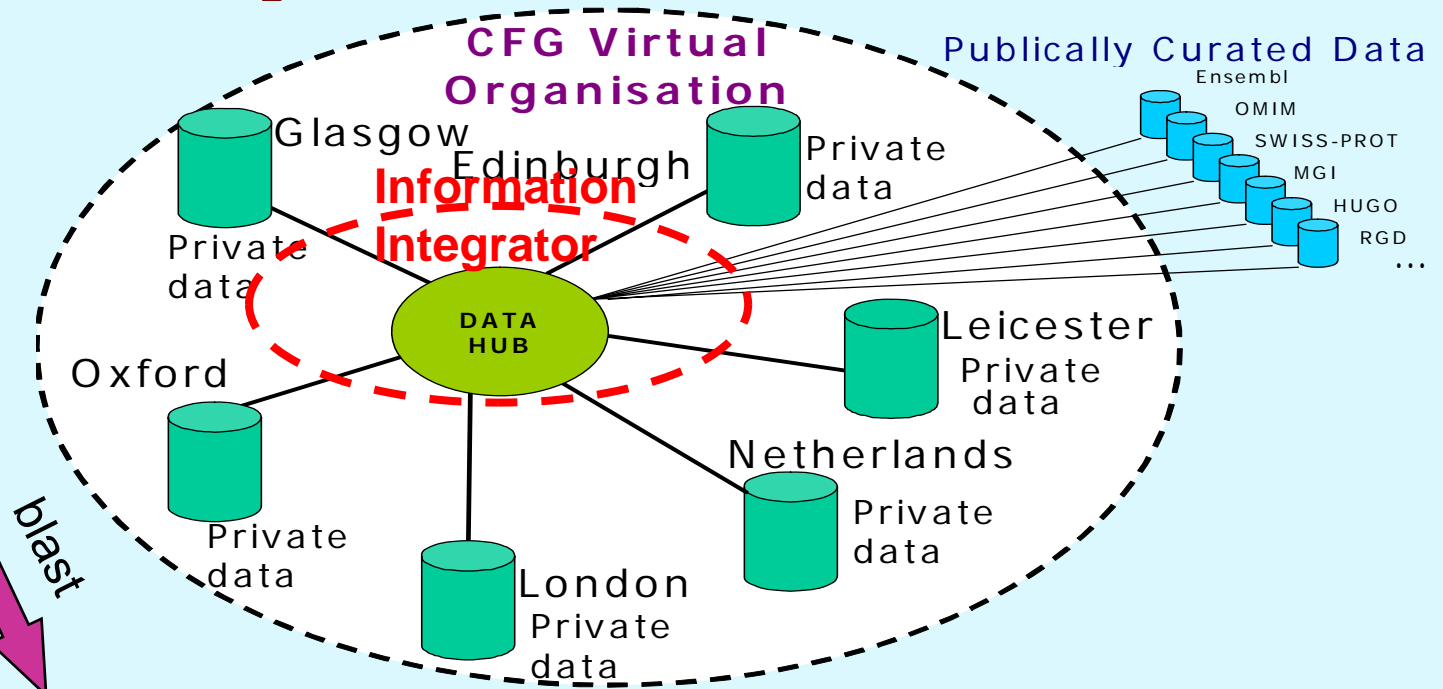


Synteny
Grid
Service

blast



+



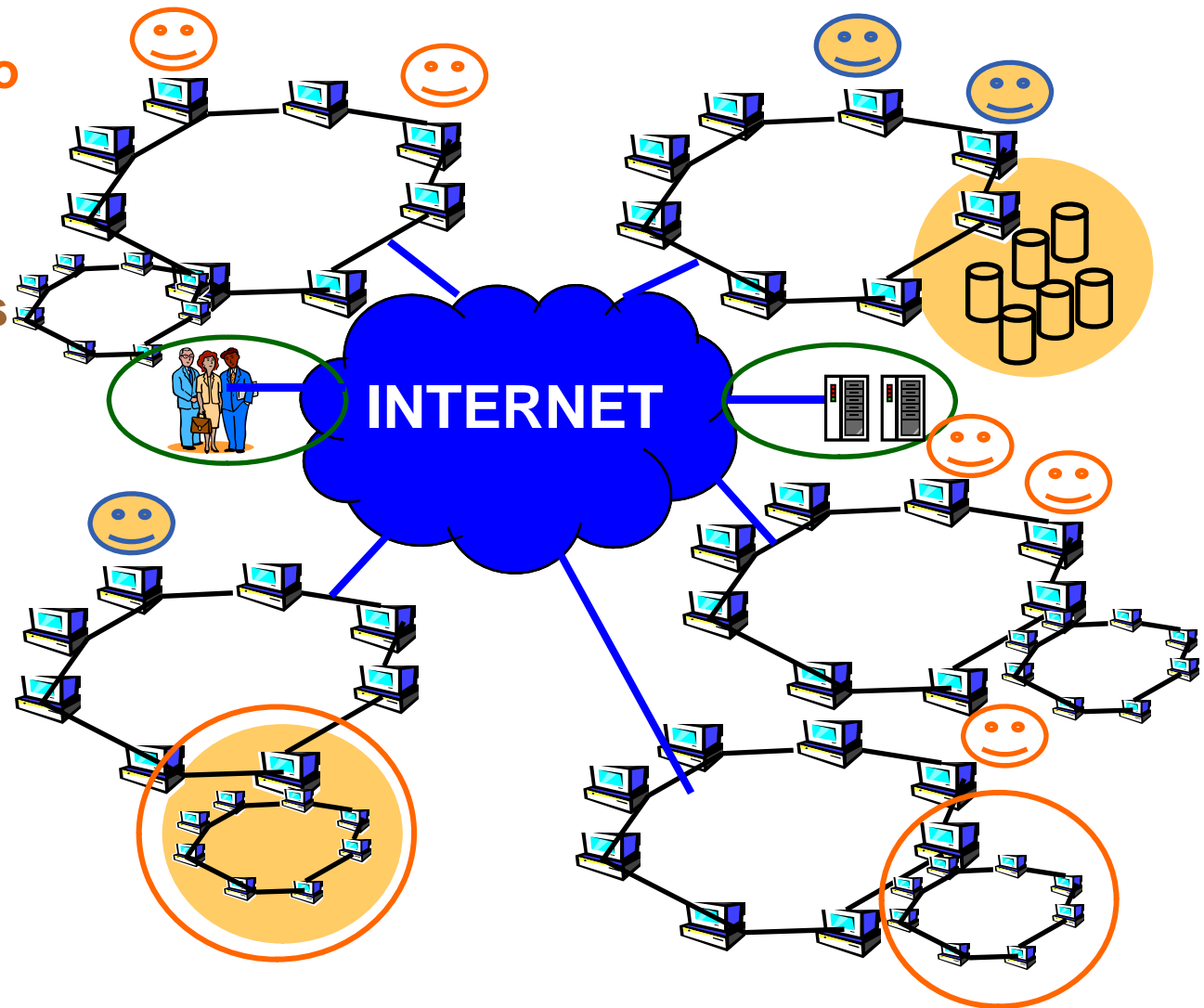
Overview

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What is fundamental to e-Science?

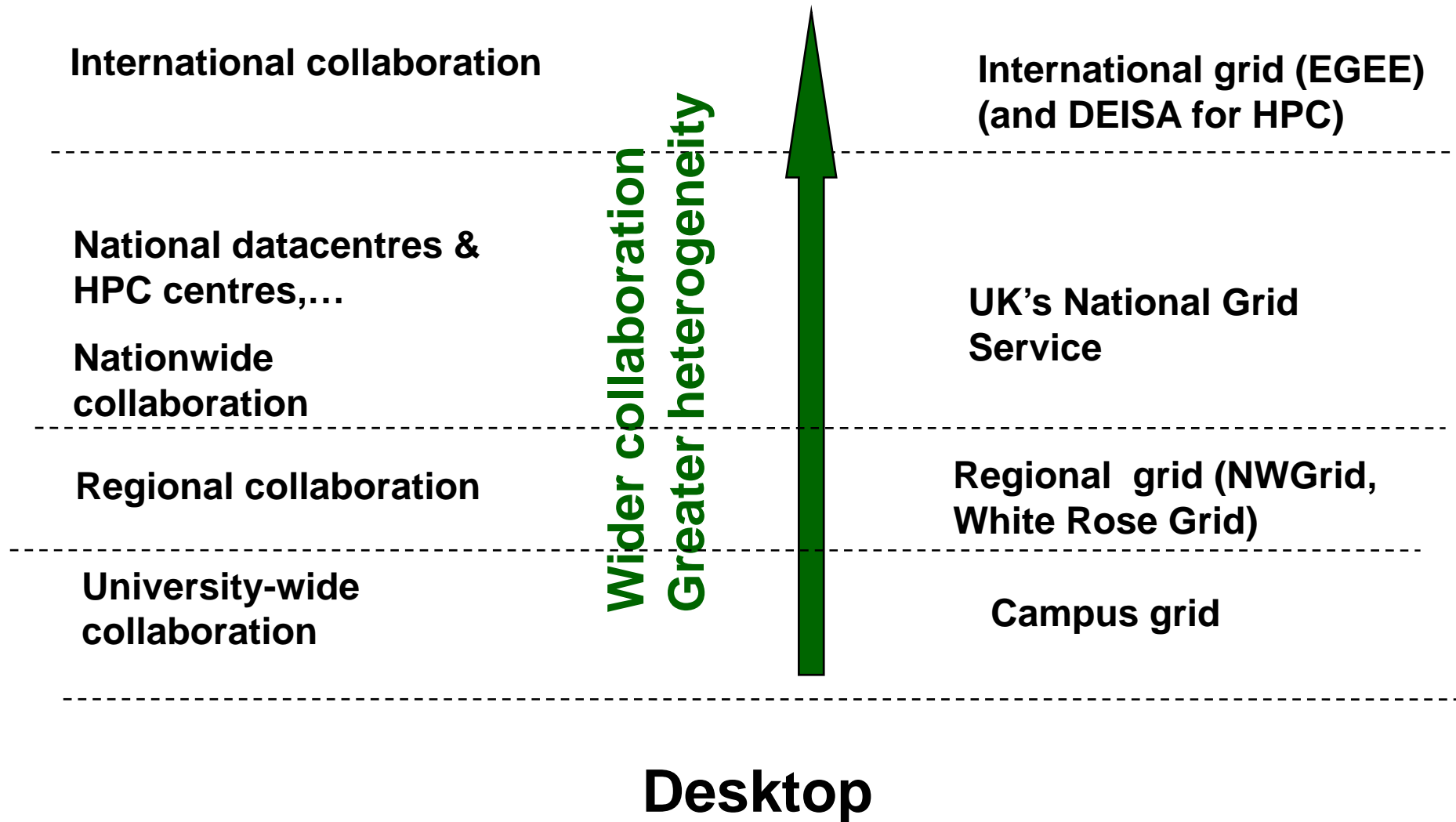
- 3 most evident aspects
 - Data, Computation, Collaboration
- Underpinned by mechanisms for crossing administrative domains with security
 - Communicating identity – of resources as well as users
 - Communicating role and membership in collaborations – basis of authorisation
 - Single sign-on
 - Encryption / integrity-checking
- Virtual computing across administrative domains...
“grid computing” for short.

- **User communities negotiate with sites to agree access to resources**
- **Grid middleware runs on each shared resource to provide**
 - Data services
 - Computation services
 - Single sign-on
- **Distributed services (both people and middleware) enable the grid**

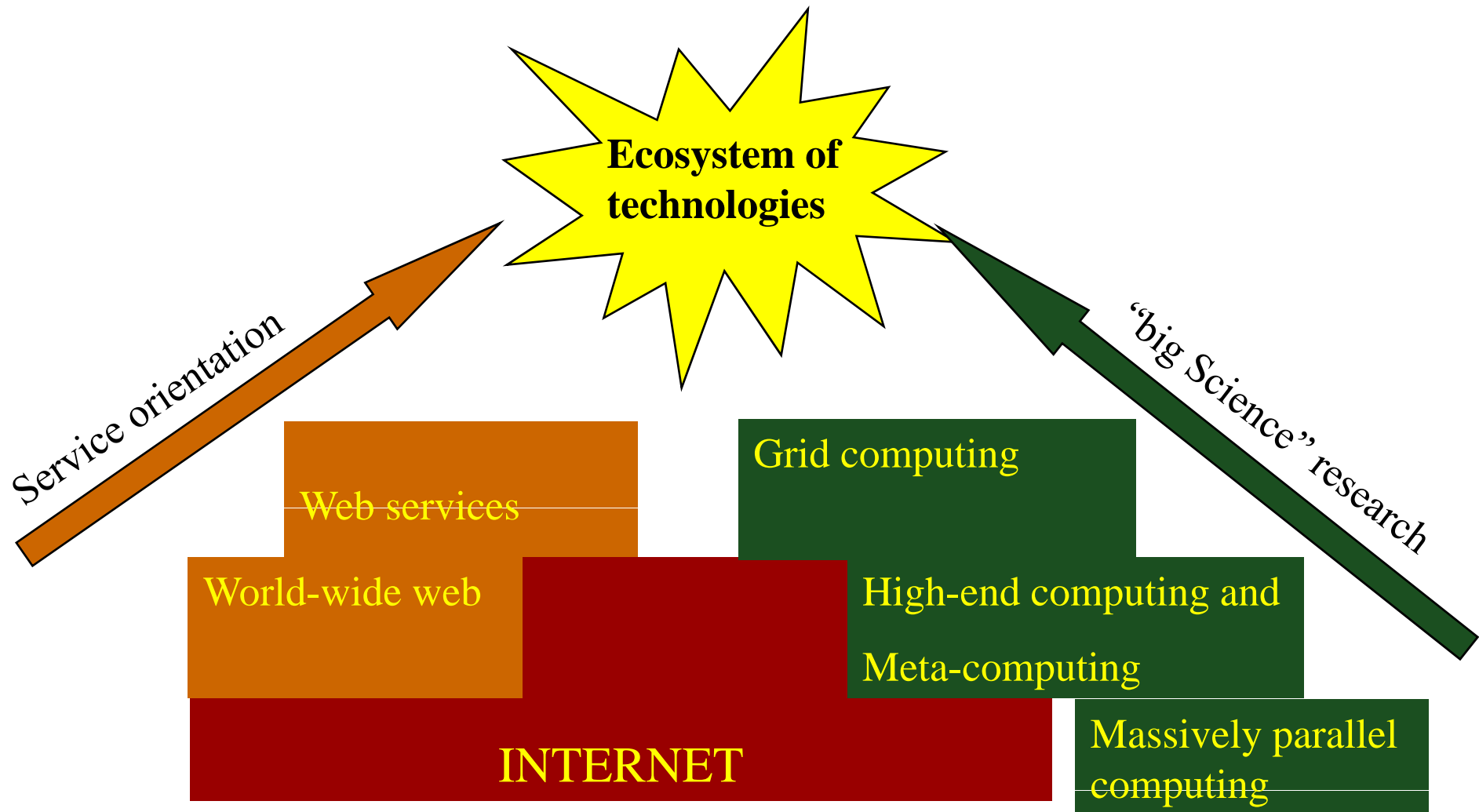


- **When using a PC or workstation you**
 - Login with a username and password (“Authentication”)
 - Use rights given to you (“Authorisation”)
 - Run jobs
 - Manage files: create them, read/write, list directories
- **Components are linked by a bus**
- **Operating system**
- **One admin. domain**
- **When using a Grid you**
 - Login with digital credentials – single sign-on (“Authentication”)
 - Use rights given you (“Authorisation”)
 - Run jobs
 - Manage files: create them, read/write, list directories
- **Services are linked by the Internet**
- **Middleware**
- **Many admin. domains**

Scales of grids



One story of e-science evolution



Empowering collaboration – Route 1

“Service-oriented
research”

Sharing and orchestrating
components

Collaborative
“virtual computing”

Accessing data, computers across
administrative domainsEnabled
by Grids

Improvised cooperation

Email
File exchange
ssh access to run programs
Enabled by networks:
national, regional and
International: GEANT

People with shared goals

Empowering collaboration – Route 2

Community that already shares and orchestrates components / services



Add grid-enabled services and components

Effect – expand horizons of collaboration and richness of resources accessible

Services seen
by researcher

Workflow, Portals....

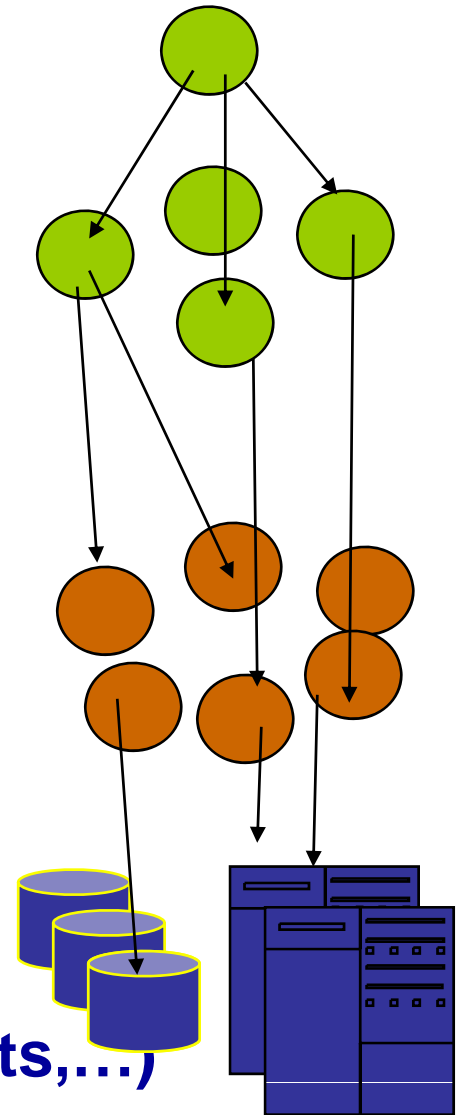
Applications,
data ...

Ecosystem of
e-science
technologies

e-Infrastructure
services

Networks

Resources
(Storage,
Computers, Instruments,...)



Roles

researcher

Workflow, Portals....

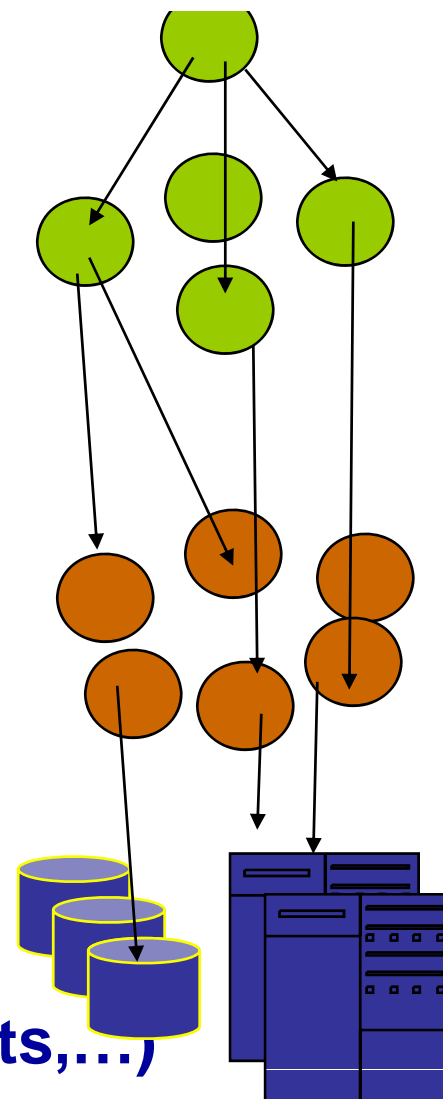
Applications,
data ...

Service provider

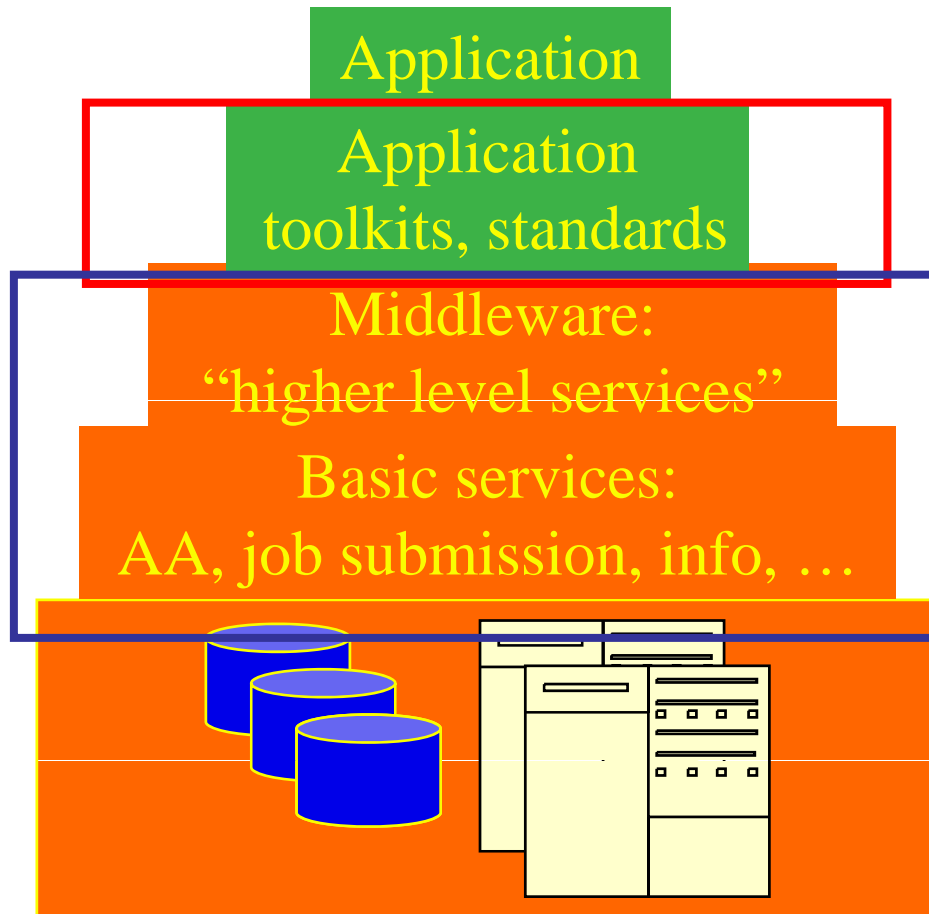
e-Infrastructure
services

Networks
Resource provider

Resources
(Storage,
Computers, Instruments,...)



The challenge for informaticians



Where computer science meets the application communities
Building upon middleware

Grids provide these services.

(AA: authorisation, authentication)

e-Science

- science that is made possible by the sharing across the Internet of resources (data, instruments, computation, people's expertise...)
 - Resources within a collaboration
 - Resources shared between collaborations
- Enabled by “e-infrastructures” at campus, UK, international scales
- Effect: “better, bigger, faster” research
 - Faster from concept to doing research
 - Scale and heterogeneity of computers, data,....
 - Foundation for orchestration of service-oriented research
 - Distinct roles: researcher can do research, not also managing resources..., infrastructure provider, resource provider
 - Informaticians are the vital link

This week

Taverna,
MyGrid
P-Grade

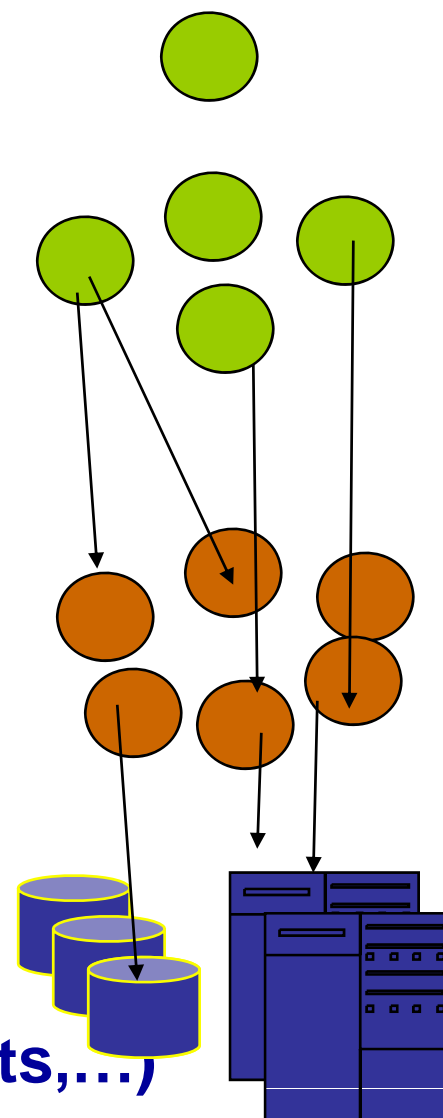
Workflow, Portals....

UK's National
Grid Service

e-Infrastructure
Services

International
grids

Resources
(Storage,
Computers, Instruments,...)



This week

**Taverna,
MyGrid
P-Grade**

Monday: Taverna workflow

Tuesday: advanced Taverna, web services, MyGrid

**UK's National
Grid Service**

**Wed./ Thursday: National Grid
Service
(with P-Grade)**

**International
grids**

**Friday: New NGS technologies,
International grids**



Agendapage – go via
<http://www.nesc.ac.uk/training>