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Extending an innovator's 'reach': The Grid and (one) international eSocial Science collaboration

Ashley D. Lloyd

'yes' OPTUS

E·S·R·C ECONOMIC & SOCIAL RESEARCH COUNCIL

Australian Government
Australian Research Council

Sun microsystems

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Extending an innovator's 'reach': The Grid and (one) international eSocial Science collaboration

Carley (1996):

ICT enables communication but does not guarantee diffusion - there is a difference between an innovator's potential and actual reach

As the network grows in size and ICT becomes ubiquitous, an innovator's potential increases … but their reach can actually reduce!

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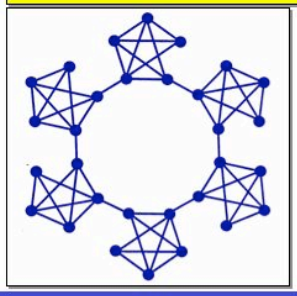
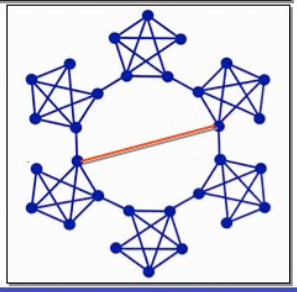
'It's a Small World'
Stanley Milgram (1967) *Psychology Today*
- six degrees of separation for everyone in the world!

'The Strength of Weak Ties'
Mark Granovetter (1973) *Am. J. Sociology*
- innovation depends on new information from (far) outside your circle.





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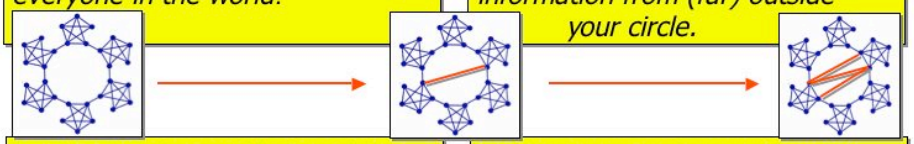

'Could it be a big world after all?'
Judith Kleinfeld (2002) *Society*
- is six an underestimate, but still a big number?

'Maybe its not such a small world'
Michael Macy (2006) Sociology, Cornell
- complex innovations diffuse where multiple weak ties (bridges) reinforce

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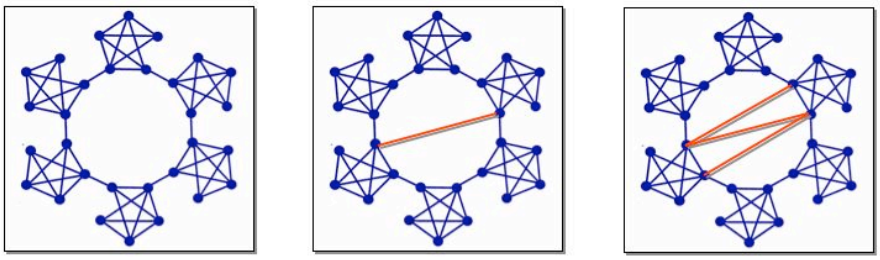

Networks of Innovation vs. Networks for Innovation?

"As the network grows in size and ICT becomes ubiquitous, an innovator's potential increases … but their reach can actually reduce!"

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Extending an innovator's 'reach': The Grid and (one) international eSocial Science collaboration

1. **Introduction to INWA**: Innovation Node - Western Australia
2. **From INWA to INCA**: integrating the Chinese Academy of Sciences [*sampling world's largest synchronous market*]
3. **eScience & Innovation**: 3G Grid Infrastructure & 3G Innovation Policy [*tighter coupling = higher volatility?*]
4. **The 4G Grid and eSocial Science:** *Is Utility Computing (4G Grid?) going to provide eSocial Scientists tomorrow with the benefits eScientists enjoy today?*

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Building global computing networks - out of NRENs & public domain Grid middleware

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NREN collaboration
The Global Lambda Integrated Facility

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2003: Distributing HPC@EPCC
The INWA Grid

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1. Introduction to INWA

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Focus on coupled systems and behavioural dynamics: Moving from INWA to INCA

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1. Introduction to INWA

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2005: Coupled nodes in 3 continents: The INWA + INCA Grid

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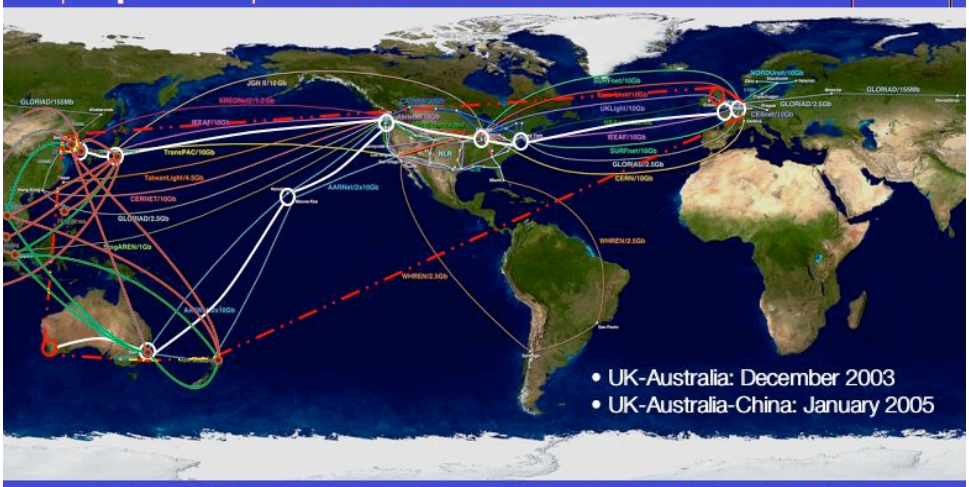

2. Moving from INWA to INCA: large scale observation & prediction of behavioural dynamics

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Universities, Business & Government: establishing common interests & collaboration

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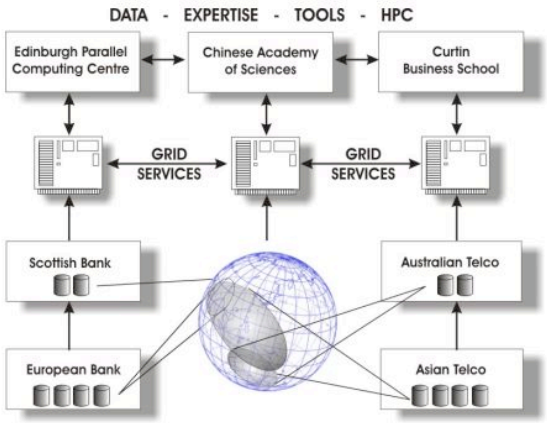

Why would Business and Government data holders collaborate, and give access to real data about real behaviour?

What gets more difficult as:
- *markets globalise*
- *social interactions 'atomise'*
- *scale efficiencies 'force' physical concentration*
- *fiscal policy is devolved (whilst monetary policy is centralised)?*

2. Moving from INWA to INCA: large scale observation & prediction of behavioural dynamics

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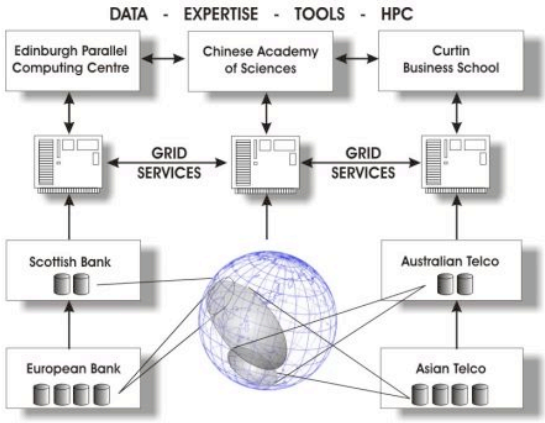

What gets more difficult (as these 'megatrends' evolve)?

Socio-economic behaviour becomes more complex, more volatile, and the data trace is more widely distributed!

'In 25 years forecasting techniques have got better, but this has been balanced by reducing data quality' [Clive Granger, ISF 2004]

Fiscal & Business Policy both require an understanding of this behaviour!

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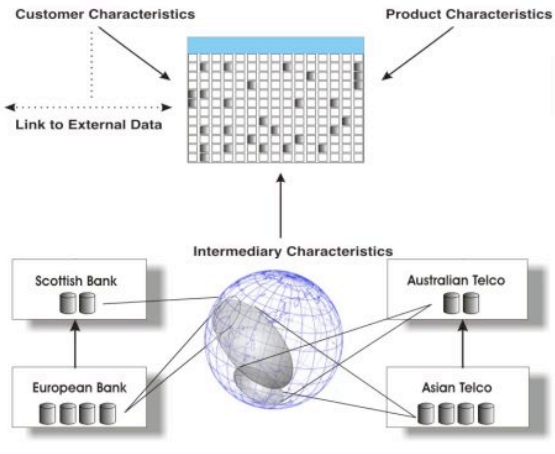

Hence:
- re-aggregate globally distributed market data
- combine with Govt. data
- observe region-specific current & historical behaviour
- model & predict future behaviour
- feed into business innovation process

Deconvolution requires:
HPComp (size / complexity)
+ HPComms (federated combination / expertise)
= Global Grid

2. Moving from INWA to INCA: large scale observation & prediction of behavioural dynamics

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epcc | Predicting Behaviour & Promoting Innovation: from mathematical models to visualisation

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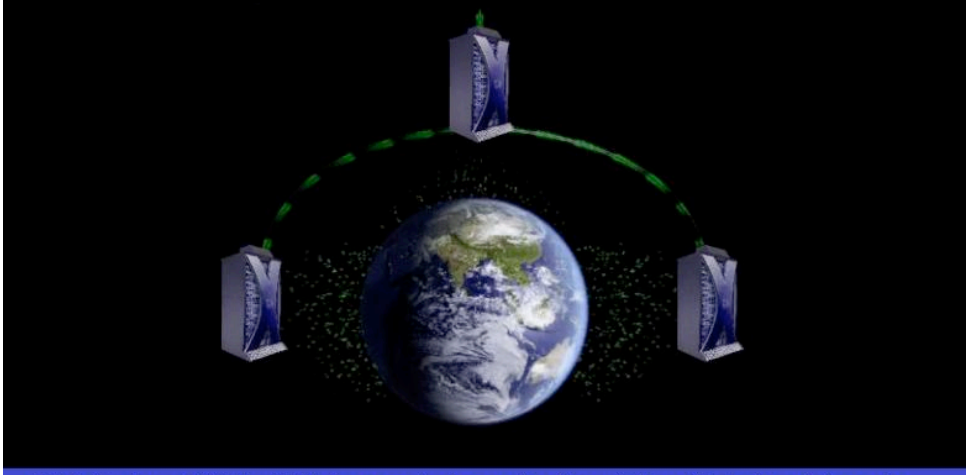

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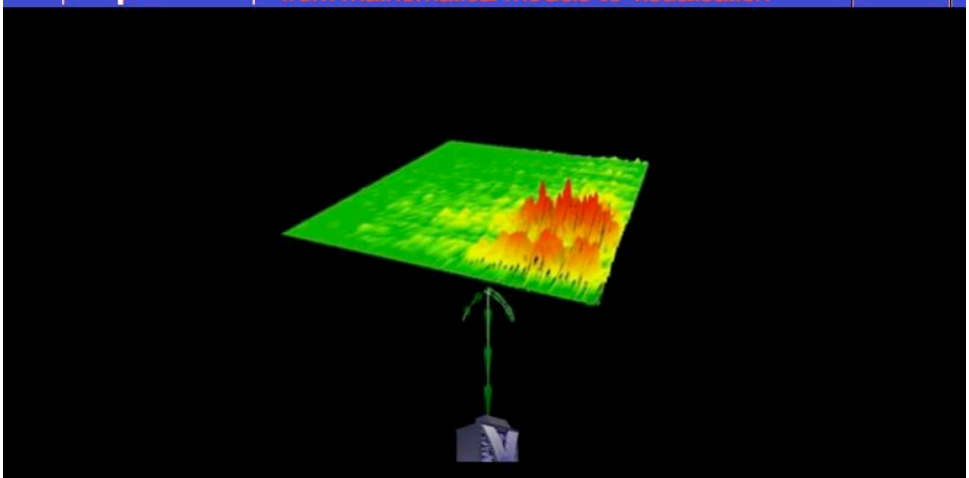

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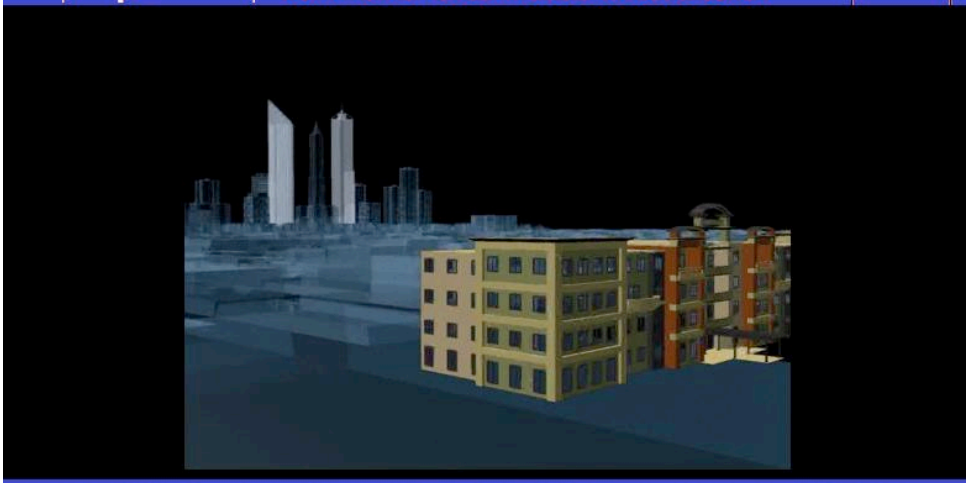

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epcc | Sampling Behaviour: in the world's largest synchronous market

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East Asia has a single time-zone with:

- ✓ 2 Billion people
- ✓ 2/3 Global economic growth
- ✓ a limited ICT legacy problem
- ✓ high rates of technology adoption
- ✓the biggest regional economy in the world by 2050?

= the most volatile growth pattern?

2. Moving from INWA to INCA: large scale observation & prediction of behavioural dynamics

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"the successful exploitation of new ideas"
UK Economic & Social Research Council

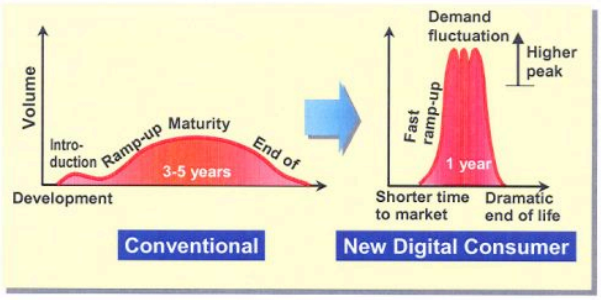
Innovation is as much as about creating new meanings as it is creating new artefacts, e.g. Apple iPod

- ICT convergence promotes 'recombination' innovation
- These new meanings can redefine competitiveness
- ICT convergence means that this can happen faster

epcc | Science & Innovation Investment Framework: 2004 - 2014 | The University of Edinburgh Management School

dti UK Department of Trade & Industry — Innovation

Dramatic Change in Life Cycle



Source: Dr Tsugio Makimoto - Hitachi/Sony

3. eScience and Innovation: 3G Infrastructure and 3G Innovation Policy
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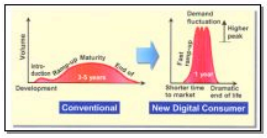
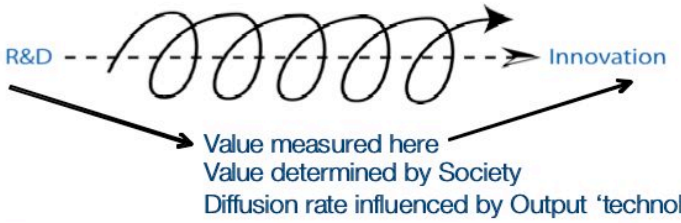


Innovation in this context is further complicated as the process, solution and problem are coupled (a 'wicked' problem').



Globalisation increases coupling, makes the process faster, and more complex ==> Innovation Policy <> R&D Policy

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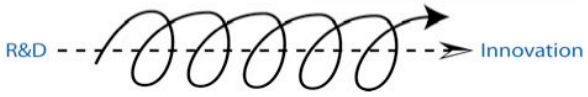

However, International Innovation Systems increase cost & complexity and may threaten local R&D intensity, on which reciprocal trade in IPR depends (homophily in networks?). Hence the move to a 3rd generation 'nonlinear' model may well be slow!

3. eScience and Innovation: 3G Infrastructure and 3G Innovation Policy
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The Grid and eSocial Science: New research communities and networks

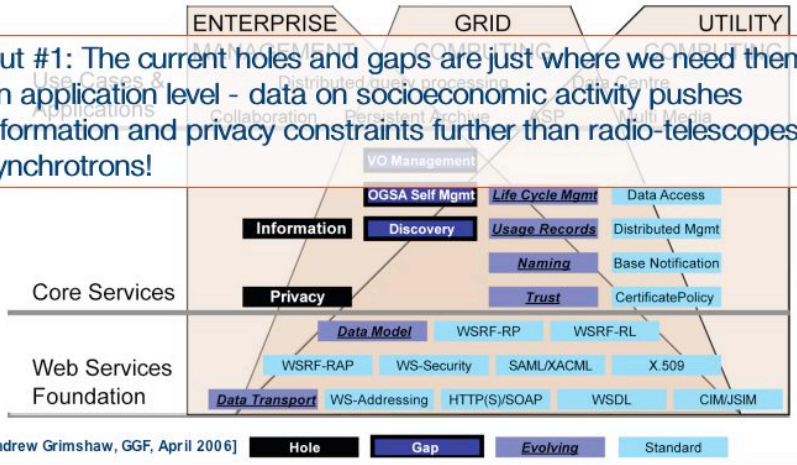
3rd Generation Innovation Policy assumes [the ability] to release the potential for innovation that is embedded in other sectors or policy domains [i.e.] that coherence may be achieved by ensuring cross-sectoral optimisation [..] through co-ordination and integration [OECD, 2005]

3rd Generation Grids will seek standardisation to establish markets for multi-vendor interoperable technology that moves innovation to the application (user) layer, whilst encouraging the competition required to bring technology costs down and make Foster et al.'s vision of more pervasive access a reality.

Good news for Social Scientists when *"…most social science research is done within national and local boundaries, and, most often by individual scholars"*? [Forbes, I. and Abrams, D., 2004]

The Grid and eSocial Science: Standards

But #1: The current holes and gaps are just where we need them at an application level - data on socioeconomic activity pushes information and privacy constraints further than radio-telescopes or synchrotrons!



[Andrew Grimshaw, GGF, April 2006] Hole Gap Evolving Standard

1st Generation	2nd Generation	3rd Generation
Distributed computing systems Metacenters explore inter-organizational integration *Totally custom-made, top-to-bottom: proofs of concept*	Utilize software services and communications protocols developed by grid projects: Condor, Globus, UNICORE, Legion, etc. *Need significant customization to deliver complete solution* *Interoperability is still very difficult!*	Common interface specifications support interoperability of discrete, independently developed services *Competition and interoperability among applications, toolkits, and implementations of key services* ***Standardization is key for third-generation grids!***

But #2: At the end of the 2nd Generation there was "little or no interoperability .. I think no is a better phrase"! (Grimshaw, April 2006)

[Andrew Grimshaw, GGF, April 2006]

National Scope eScience Research Infrastructure

Map of TeraGrid Sites

"Continental Scope" eScience Research Infrastructure

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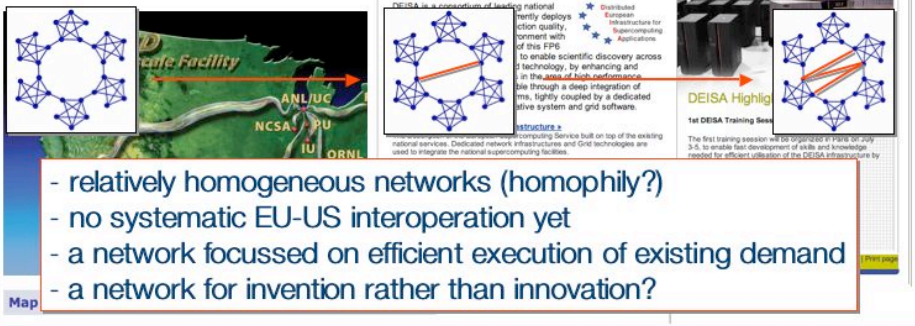
But #3: Interoperability is being driven by efficiency gains through scheduling … to allow existing users to do more or new users to access cycles at low marginal cost?



- relatively homogeneous networks (homophily?)
- no systematic EU-US interoperation yet
- a network focussed on efficient execution of existing demand
- a network for invention rather than innovation?

4. The 4G Grid and eSocial Science: Convergence or Divergence?

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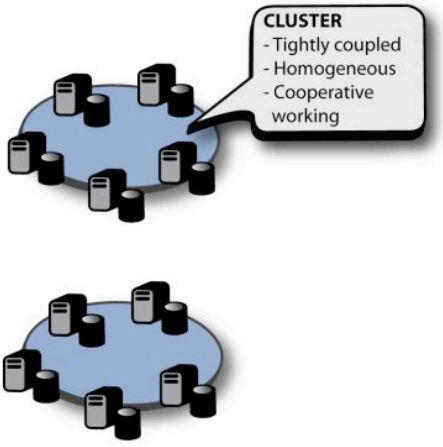
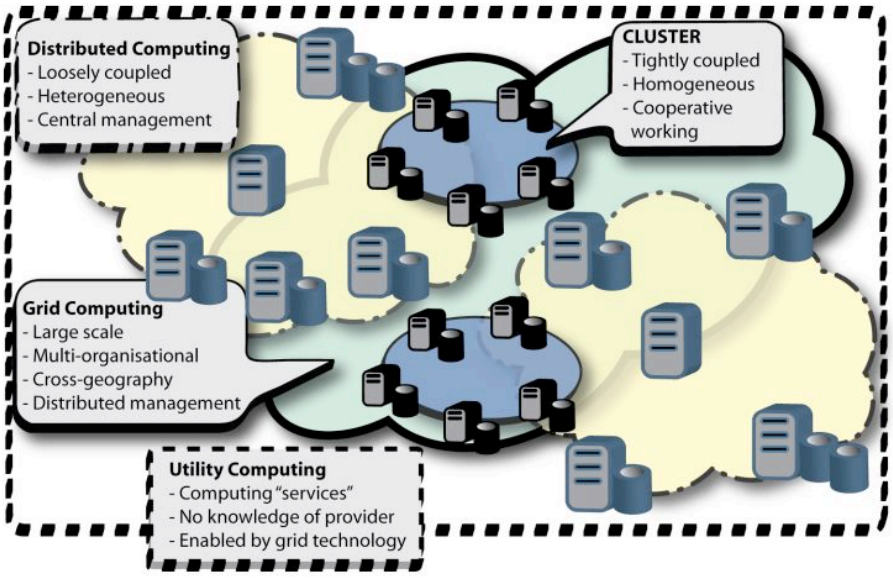
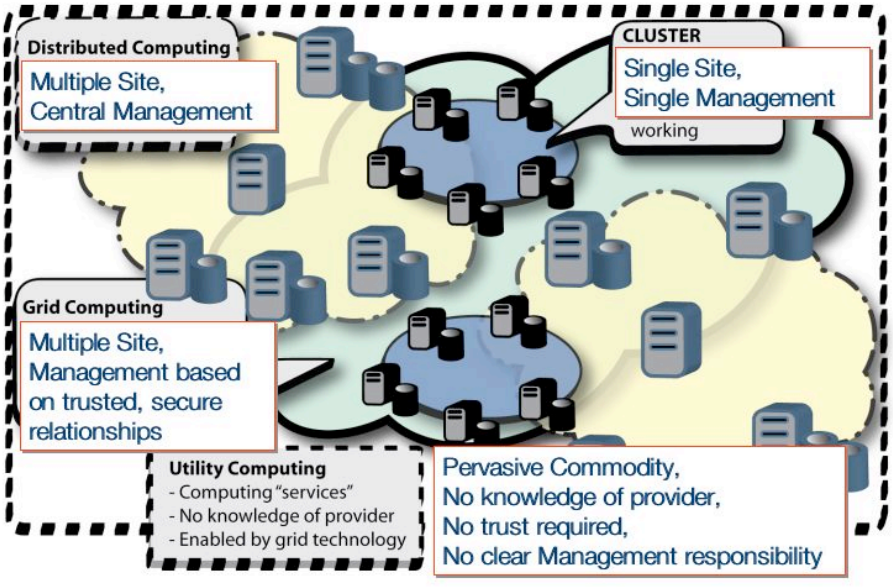
But #4: Is a 'Grid' architecture compatible with eSocial Science?

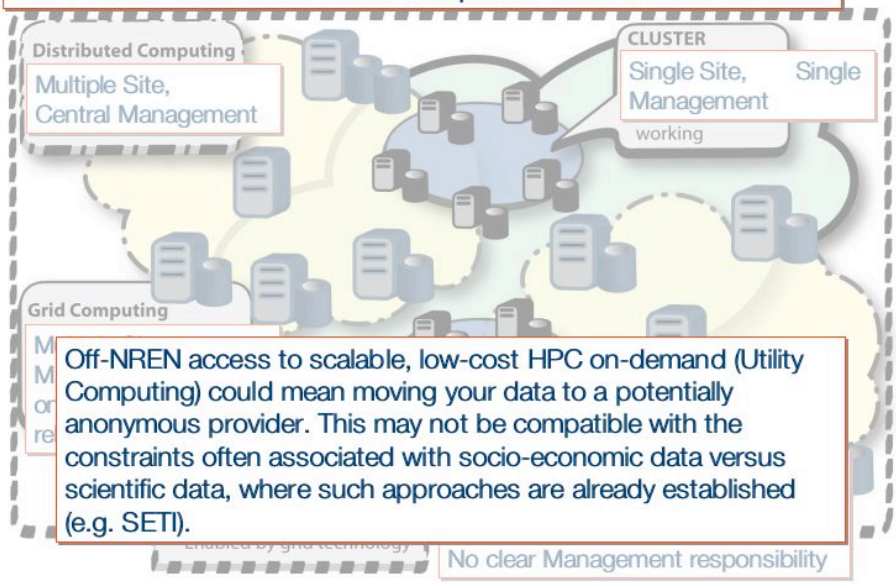


Adapted from Grimshaw, April 2006


Distributed Computing
- Loosely coupled
- Heterogeneous
- Central management
CLUSTER
- Tightly coupled
- Homogeneous
- Cooperative working
Grid Computing
- Large scale
- Multi-organisational
- Cross-geography
- Distributed management
Utility Computing
- Computing "services"
- No knowledge of provider
- Enabled by grid technology


Distributed Computing
Multiple Site,
Central Management
CLUSTER
Single Site,
Single Management
working
Grid Computing
Multiple Site,
Management based
on trusted, secure
relationships
Utility Computing
- Computing "services"
- No knowledge of provider
- Enabled by grid technology
Pervasive Commodity,
No knowledge of provider,
No trust required,
No clear Management responsibility

But #4: Is a 'Grid' architecture compatible with eSocial Science?



3G Innovation Policies and 3G Grid roadmaps appear to converge. This should offer a mix of NREN & (cheap) commercial infrastructure for eSocial Science, … but:

#1: Standards do not exist in some key areas for Social Science

#2: Standardisation processes that would allow *'the integration of innovation processes supported by interoperation of pervasive technologies'* have yet to be firmly established (EGA+GGF=OGF!)

#3: Immediate benefits arise from scheduling amongst homogeneous (eScience) peers, but this does not automatically lead to wider adoption.

#4: eSocial Scientists will require secure off-NREN 'Utility' peers, but may not get this with a Utility Computing architecture.

3G Innovation Policies and 3G Grid roadmaps appear to converge. This should offer a mix of NREN & (cheap) com… for eSocial Science, … but:

#1: S…

#2: S… innova… techno…

#3: Imr… (eScien… …us …wider adoption.

#4: eSo… …secure off-NREN 'Utility' peers, but may not get t… with a Utility Computing architecture.

Is Utility Computing (4G Grid?) going to provide eSocial Scientists tomorrow with the benefits eScientists enjoy today?

Not tomorrow! Solutions are possible (Mark Johnson, MCNC), but cost and timing are key.

COMMENTS & QUESTIONS

1. Interoperation is still hard, but collaborations based on exchange of socio-economic data across multiple legal jurisdictions poses 'wicked' problems!
2. The focus of existing developments certainly reflects requirements of expert users for whom faster and cheaper have demonstrable (incremental) benefits. Those for whom these technologies might represent a 'discontinuity' [Phil Edholm] are harder to identify (cost of access is important but learning curve barriers should be addressed)
3. Though '80% of innovation is external' eResearch still requires having something to share [Paul Davis]. Careful balance is required to make sure that this figure doesn't grow!
4. and finally, do we really know what the 'eResearch customer' looks like?

COMMENTS & QUESTIONS

1. Interoperation is still hard, but collab… …ge of socio-economic d… …'wicked' prol…
2. The … …nts of expe… (incre… repres… …st of acces… …sed)
3. Thoug… …ving someth… …ake sure th…
4. and fina… …what the 'eResearch customer' looks like?

Carlson, Nafus & Anderson
(2nd Int. eSocial Science Conference, 2006)

Scientists are 'like Paparazzi who would like a better view. if you have an interest, you apply for instrument time and you don't want somebody to pick it up from repositories.'

[eSocial Scientists?] 'are solitary hunters; they don't hunt as a pack. Alliances will form and break-up. They won't even leave trails of what they're researching: they will go somewhere and then somewhere else just to erase the track (…) they don't want an audit trail until they publish'.

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Thank you for listening.

Questions?

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