

« *networking the networkers* »



EUNIS, Dublin, Ireland
19 June 2011

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www.terena.org

The Evolution of Research and Education Networks

NRENs & the European Networking Ecosystem



TERENA

- › **Association of European NRENs (39)**
 - › **International & Associate Members (11)**

- › **Formed as RARE 13 June 1986 (25 years old this week)**

- › **Secretariat of <20, based in Amsterdam**

- › **Not-for-Profit, funded by memberships and projects**

- › **Objectives:**
 - › **Support R & E collaboration networking in Europe & beyond**

- › **Achieved through:**
 - › **Activity Programme;**
 - › **Task Forces; Workshops; conferences; Publications, Projects**

- › **TERENA is OPEN**
R&E INSTITUTIONS can participate in TERENA ACTIVITIES



TNC 2012, Reykjavik 21-24 May 2012

TERENA Membership in 2010
(as at 31 December)





1. Where R&E computer networks (NRENs) **started**
2. What NRENs have **been doing**
3. Where NRENs are **now**
4. Where NRENs might go in the **future**

My aim:

To encourage you to get the most from your NREN

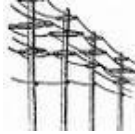


. . . . A few questions

- › **Do you know your NREN well?**
- › **Does the NREN satisfy your networking and service needs?**
- › **Can you get a better service at a more economic price from the market?**



A complete history of Telecommunications, Networks and NRENs



Liberalization of Telecommunications

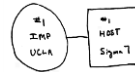
Commoditization of Services

1886

VOICE TELEPHONY

1980's

100 years of state monopoly for telephones



1969

1971

1990

2004

INFORMATION TRANSMISSION

30 years of R&E innovation

Birth and development of NRENs

INTEGRATION & SERVICES



Some Generalizations about NRENs

- › **NRENs provide network connectivity**
- › **NRENs provide Services**
 - › **Access to remote systems; email; data transfer**
 - › **Collaborative tools; VC; social media; wikis...**
- › **To the Research and Education Community** +
- › **An NREN is a not-for-profit organization**
 - › **Some funded 100% by user community**
 - › **Some largely funded directly by Governments**
 - › **Most in between the extremes**



The ZEN of an NREN

- › **Open, Independent & Knowledgeable**
 - › **non-proprietary standards**
 - › **Open access to a well bounded community**

- › **Serves researchers and educators:**
 - › **In all disciplines**
 - › **Not only Big Science or Computer Geeks**

 - › **Arts; Humanities; Social Science**

 - › **Broadening the community**
 - › **Primary; Secondary; Cultural; Health; E-Gov. . . .**

- › **one NREN per country**



Life History of a Real NREN

- › **1970's**
 - › **Local and research networks**
 - › **national computer facilities & Star Networks**
- › **1980's**
 - › **Interconnect by expansion of a single network**
- › **1983**
 - › **hosting \approx 50 sites at 9.6 kbps (backbone)**
- › **2006**
 - › **All: university; research institutes; further education; (schools and primary) 10 Gbps interconnects (10^6 times faster)**
- › **2011**
 - › **100 Gbps core (10^7 time faster)**
 - › **User base exceeding 18 million people (2010)**

<http://www.ja.net/documents/publications/janet-history/janet-the-first-25-years.pdf>



NREN and community achievements

- › **Open protocols based on TCP/IP**
 - › **Interworking between all systems**

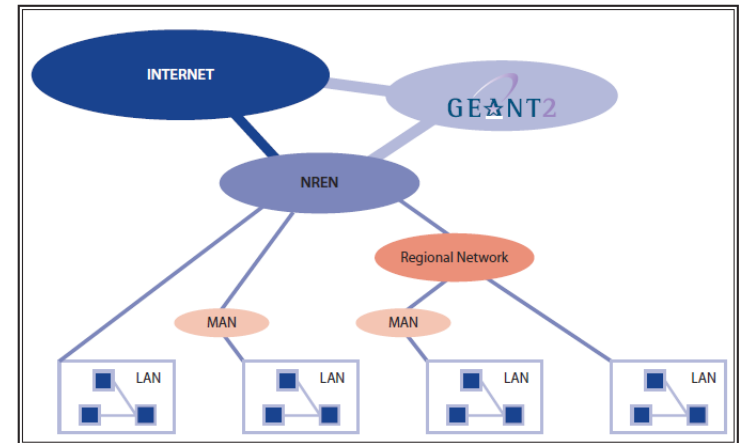
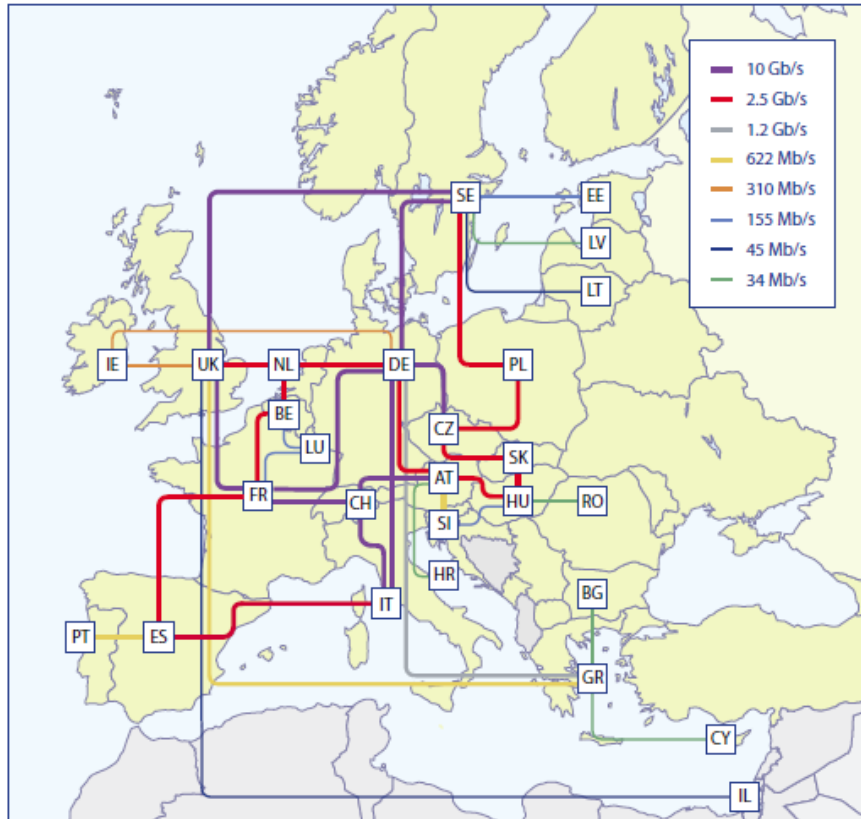
- › **Took products and adapted them to serve community needs**

- › **. . . and built some of our own:**
 - › **Grid Computing**
 - › **Distributed Communities (VO's)**
 - › **Multi-domain E2E services across the globe**
 - › **Federated Access**
 - › **Eduroam / edugain**



GÉANT (2001)

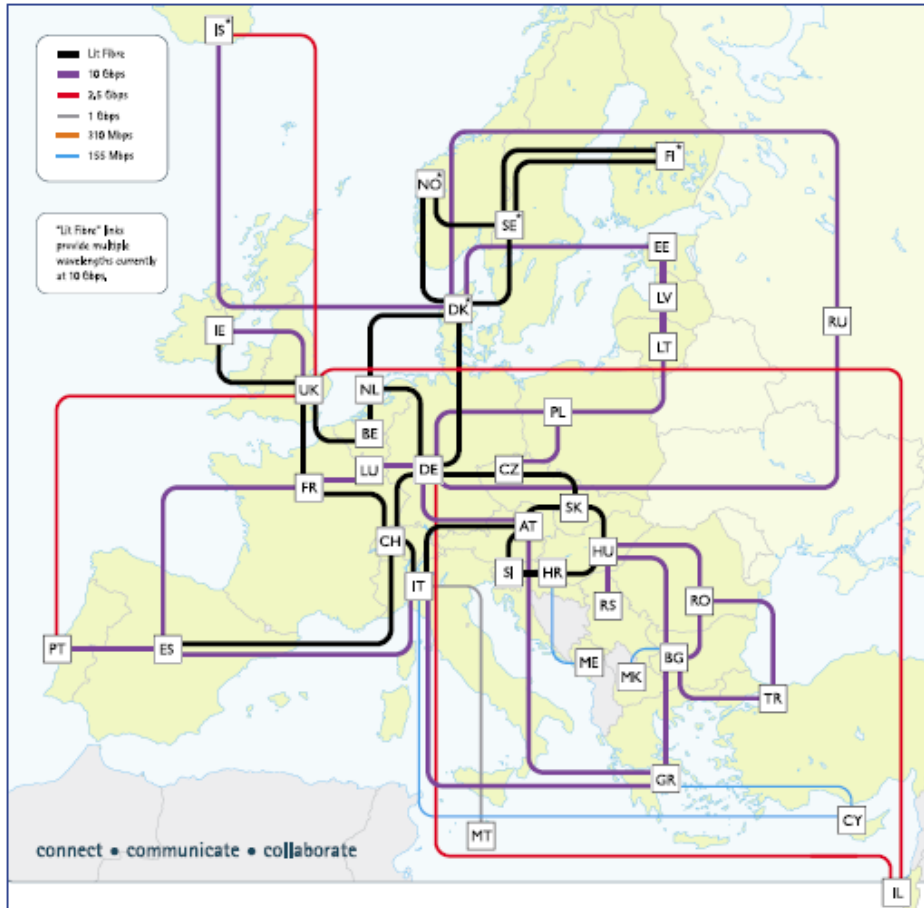
The EU NREN interconnectivity model



is managed and operated by DANTE



GÉANT (2010) plus NREN Dark Fibers

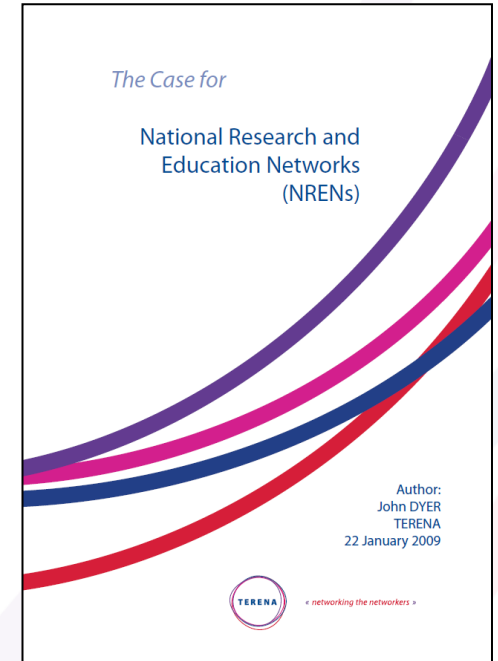


Estimated: 50,000,000+ users



A view of NRENs in 2009

- › **Unique symbiotic relationship NREN & users**
- › **NRENS complementary to the commercial ISPs**
- › **Serve Closed user group - non-public networks**
- › **Source of much Internet innovation**
- › **NRENs are a national asset**
- › **Benefits flow from NREN to society generally**



2009

<http://www.terena.org/publications/files/20090127-case-for-nrens.pdf>

The World is changing very fast

POLITICAL IMPERATIVE

ERA to be world leader
ERA to be inclusive

ENVIRONMENTAL

Reduce Impact
Hardware manufacture
Power consumption
Need to Travel

SOCIETAL

Inclusiveness
Equality of Opportunity
Cohesion

ECONOMIC

Budgetary Reductions
Best Value for Money

TECHNOLOGICAL

Evolution v Revolution
Virtualization

LEGAL

Security
Privacy
Trust

We must adapt !

But how ...



The world in becoming increasingly Cloudy

Microsoft Live@edu

United Kingdom - Change | IT Admin, already enrolled? | Sign In

Home
Services
Primary + Secondary
Enrol & Deploy
Support
Partners
Case Studies
Promote on Campus
FAQs
Learn about Office 365

Preparing Students for the Future

Microsoft understands your need to provide students with great communication and collaboration experiences while saving time and money. Live@edu delivers all of this and more, while students on the same software on which employers depend.

Products - Software Solutions - The Co... | Spamina - The

Provide a co...

SPAMINA
The Email Security Company

Google Apps for Education - Free Hos...

More than 10 million students use Google Apps.

Free email and collaboration tools.

Google Apps

How Schools Benefit | Trust & Security | Learning | Support | English (US)

Gmail, Calendar, Docs and more

Google Apps for Education offers a free (and ad-free) set of customizable tools that enable faculty, staff and students to work together and learn more effectively.

Communication - Enhance your community's dialogue with hosted email, shared calendars and integrated video chat.

Collaboration - Google Docs and Google Sites enable students and teachers to share documents online, at any time and from any location.

Customization - Easily integrate your existing IT systems with Google Apps while keeping your school's domain safe and secure.

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Leading colleges and universities use Google Apps to deliver the advanced technology students need. [Learn more >](#)

Apps for K-12 schools
Build a 21st century school by bringing Apps into the classroom. [See how >](#)

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WORLD-WIDE PRESENCE

Read www.spamina.net

MAP | Funding

The Wellcome Trust is the largest charity in the UK. It funds innovative biomedical research, in the UK and internationally, spending over £600 million each year to support the brightest scientists with the best ideas. The Wellcome Trust supports public debate about biomedical research and its impact on health and wellbeing. It provides significant resources to the Malaria Atlas Project through Fellowship support to many of the senior scientists.

The Malaria Atlas Project is funded by The Wellcome Trust (UK) to assemble medical intelligence and survey data to provide evidence-based maps on the distribution of malaria risk, human population, disease burdens, mosquito vectors, inherited blood disorders and malaria financing and control worldwide. The maps generated are the results of a collaboration between malaria scientists in UK, Kenya, Vietnam, Indonesia, Ecuador and the USA.

Other Funding

Canada Foundation for Innovation. MAP has received support for research infrastructure (scanner donated) in Kenya from the Canada Foundation for Innovation, awarded to the Faculties of Medicine and Law, University of Ottawa, Canada (GRF number 202381).

MAP receives generous support from Amazon Web Services, who have provided us with a grant enabling use of their Elastic Compute Cloud and Simple Storage Service for running high-end statistical modelling and mapping computations.

welcometrust

map

amazon web services

malaria atlas project



Cloud Services

› **Where is your data?**



“In the cloud”

Ireland? Europe? United States of America?

**What legislative jurisdiction does it fall under?
Is that acceptable to you?**

Migration Costs? Sanitization after deletion?

Ease of Access – Federated login? (SURFnet)

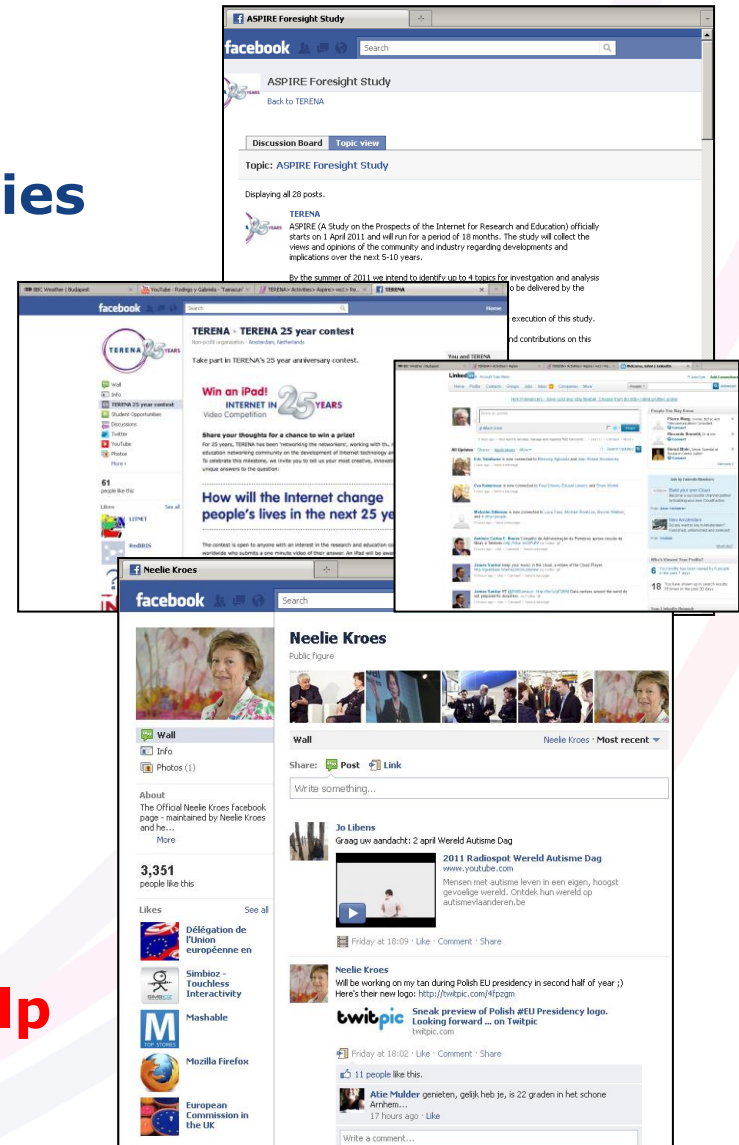
Use your NREN to aggregate your demand nationally



Social Media adoption and use in the R&E Community

- › **Build and maintain communities**
 - › **Ground up**
 - › **Users - need driven**
 - › **Democratic**
- › **Popular in R&E community**
- › **Global Reach**
 - › **Pool Innovation**
 - › **Expertise & Best Practice**
 - › **Your NREN may be able to help**

Slide 17





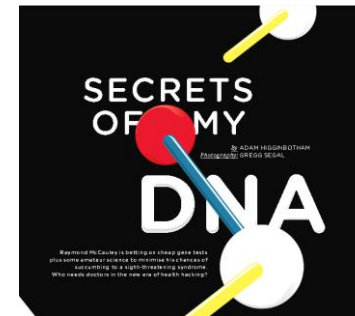
Security; Privacy; Trust; Legal Issues

- › **Authorization and Authentication of Identity**
- › **Cloud services the situation is complex**
 - › **divisions of responsibility: provider and user**
 - › **hybrid clouds - more complex**
- › **FEDERATED access provides a solution**
 - › **One set of credentials administered locally**
 - › **Accepted world wide**
 - › **Your NREN probably runs a federation!**

Content and Access

The Data Deluge

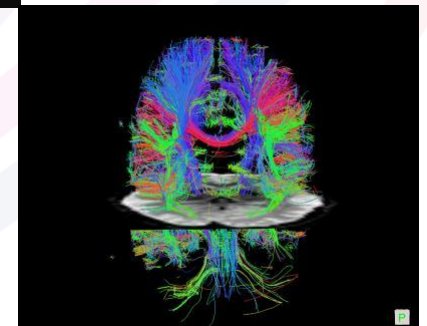
- › Adequate, authentication and authorization
- › Inherent value of community datasets
 - › Largely Funded by Public Purse
 - › Common Good
- › Access
- › Data provenance
- › Sustainability



Citizen Science
Looking for
Genetic markers
of disease.

Human Connectome Project datasets
likely to dwarf LHC datasets
Single Human Brain:
 10^{11} Neurons 10^{14} synapses

New Scientist 5 Feb 2011





Change is happening



CSC – IT Center for Science

- › **Target near zero carbon footprint**
- › **The Kajaani Data Center, Northern Finland**
- › **Hydropower station on site**
- › **Low energy transfer loss in supply chain**
- › **Raw water from the river is used for cooling**
- › **NRENs could jointly host a “community cloud”**



How is the world changing

› Many Services becoming commodity

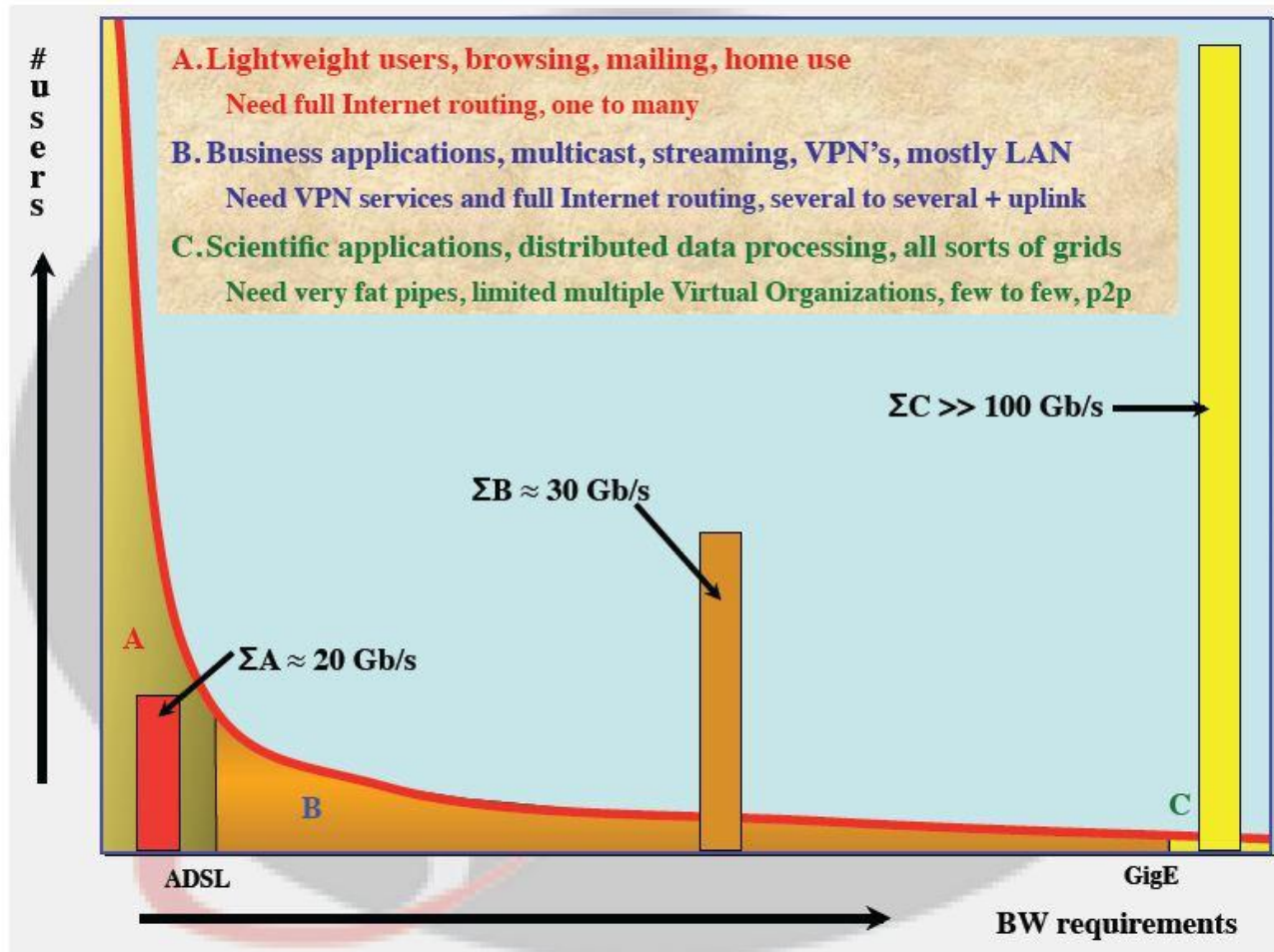
- › **Email**
- › **Collaborative working / documents**
- › **Calendars**
- › **.....**

› Bandwidth is becoming increasingly available

- › **ADSL => 1Gb connectivity – no problem**
- › **10 Gbps**
- › **100 Gbps ?**
- › **End to End multi-domain SLA guarantees** **X**



How to serve the Class C users



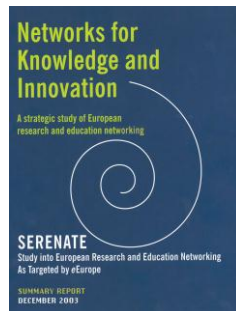


The ASPIRE PROJECT



A Study on the Prospects of the Internet for Research & Education

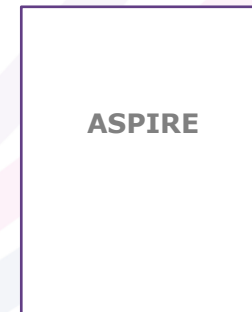
- › **Foresight study with 5 -10 year horizon**
- › **Explore and Recommend Actions**
- › **Policy input to European Commission on FP8**
- › **European R&E networking global forefront**



2002-2003



2006-2008



2011-2012



Let's Work together to deliver better R&E Services

› **NRENs**

- › **high end infrastructures for Class C users**
- › **Multi-Domain End-to-End Services**
- › **Integration of Commodity Services**
- › **Niche services: eduroam; Community Cloud?**

› **Commodity Suppliers**

Commodity services

› **Work together on Middleware**

- › **Federations**
- › **Confederations**
- › **Discipline Specific for data deluge**



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