The SERENATE project

Strategic studies into the Future of Research and Education Networking in Europe

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What is SERENATE?

- study project: May 2002 – September 2003
- budget € 960k
- funded by European Union
- SERENATE will formulate recommendations for decision makers (governments/funding bodies, research networks, universities etc.) for the development of research networking in 5-10 years' timeframe (at ≥100 Gb/s)
- SERENATE looks into:
  - user needs
  - technology
  - market conditions , regulation
  - organisation and finance

The background

- **SERENATE = Study into European Research and Education Networking As Targeted by *e*Europe**

- **2000: Europe to become the leading economic region in the world thanks to ICT: Action Plan *e*Europe 2002**
- **2002: Action Plan *e*Europe 2005**

The history

- **history of European research networking is characterised by trying to keep up with developments in North America**

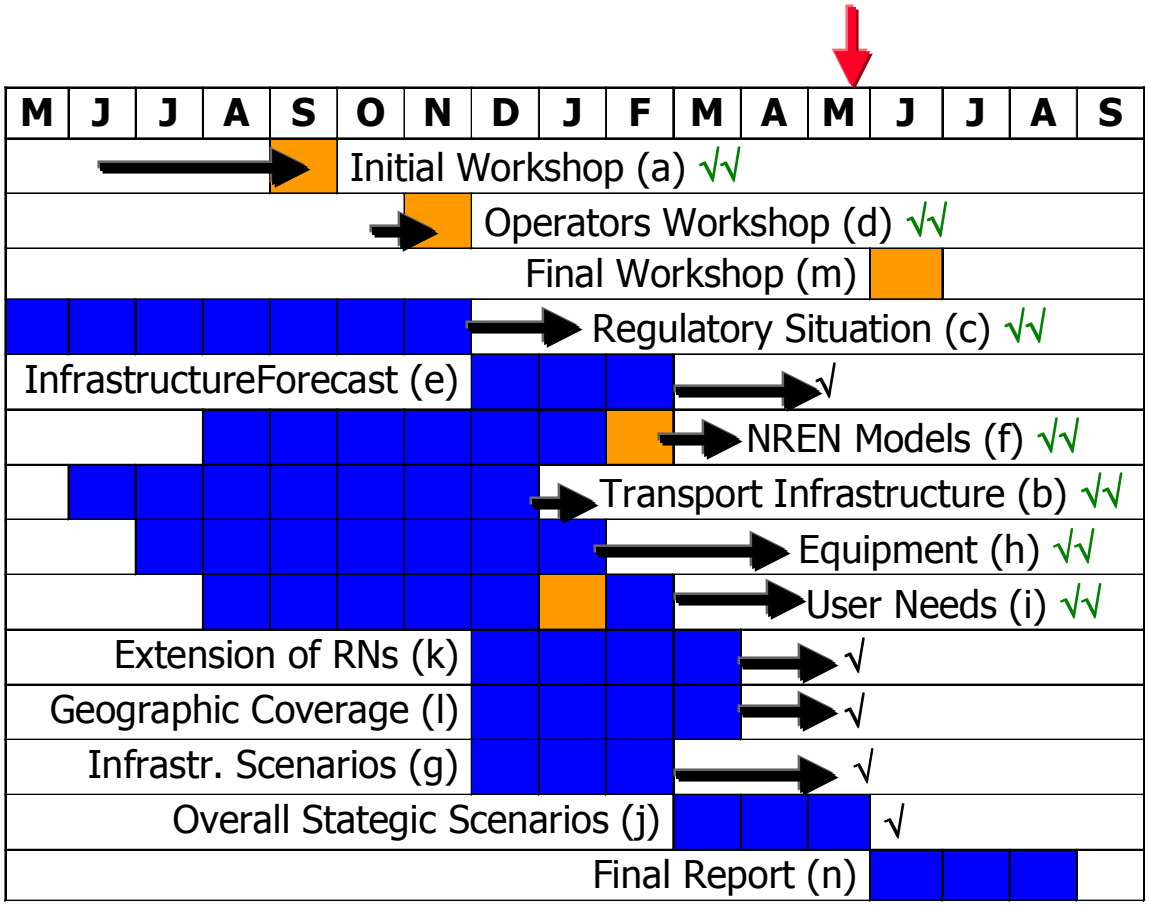
- **e.g., continental backbone:**

Period	Most performant Data Link technology available	Technology available in pan-European network	Technology available in United States network
1991 - 1995	34/45 Mbps PDH	2 Mbps PDH	45 Mbps PDH
1996 - 1997	155 Mbps SDH	45 Mbps PDH	155 Mbps SDH
1997 - 2000	622 Mbps SDH	155 Mbps SDH	622 Mbps SDH
2000 +	10 Gbps DWDM	10 Gbps DWDM	2.5 Gbps DWDM

The current situation

- in general, Europe is not behind developments in other continents
- in some areas Europe is at the forefront of developments, e.g.:
  - continental backbone
  - IPv6
  - AAA / PKI
  - Grids
- need for strategic planning (hence SERENATE), because:
  1. no reason for being complacent
  2. simple copying no longer sufficient

Where is SERENATE now?



Some of the SERENATE findings thus far…

Regulatory situation

- telecom market fully liberalised in the 15 EU member states since 1998-99 (Portugal: 2000, Greece: 2001)
- in the 12 EU accession states: 2001-2004
- new regulatory package to be introduced in July 2003
- regulatory regime will mainly help NRENs:
  1. direct effects: supportive of NRENs using new ownership models and getting necessary elements from incumbents
  2. indirect effects: more competition leading to lower prices etc.
- could lead to questions about NRENs' status and fair competition

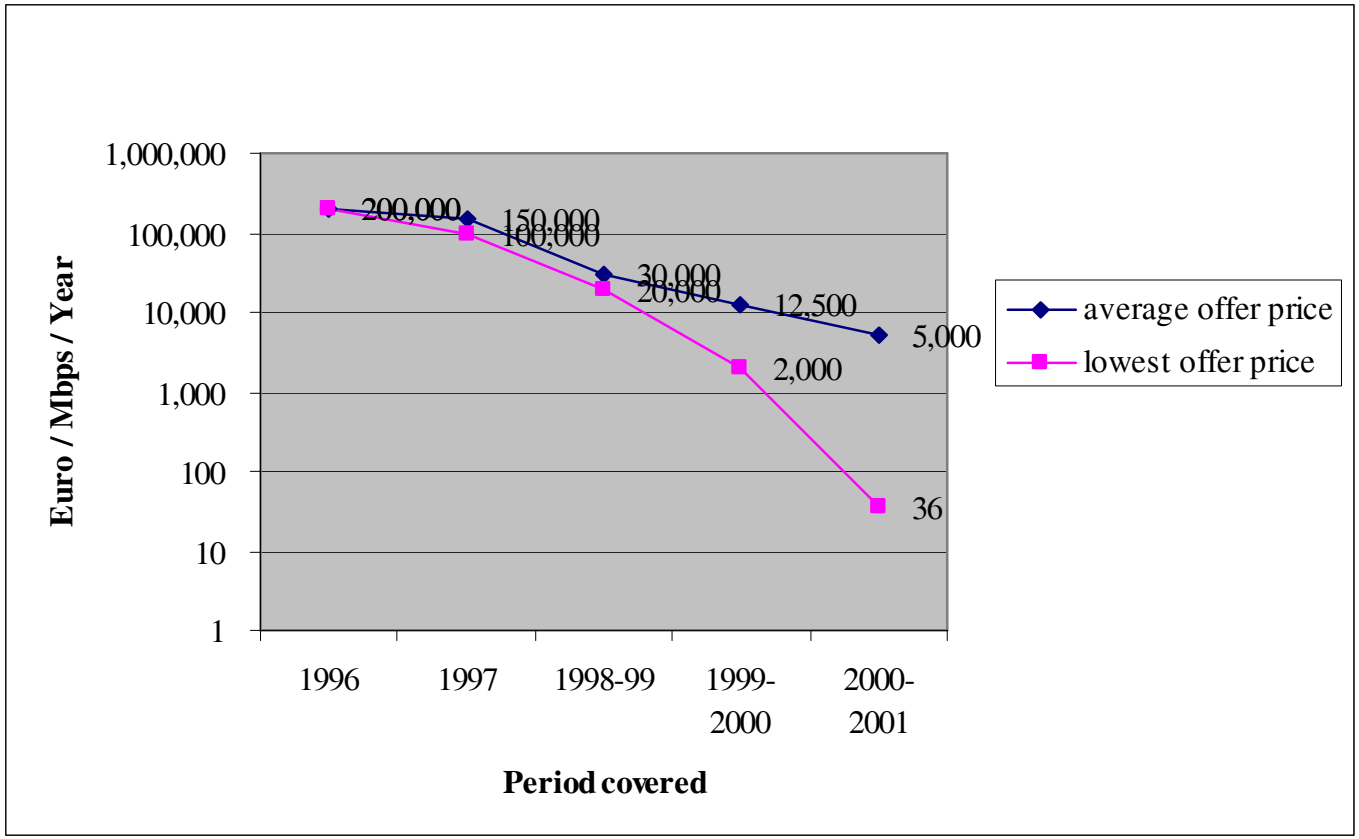
Transport infrastructure (1)

International Connectivity Costs in the Differing Market Segments

Market segment	Number of Countries	Cost Range
Liberal Market with transparent pricing	8	1-1.4
Liberal Market with less transparent pricing structure	7	1.8-3.3
Emerging Market without transparent pricing	3	7.5-7.8
Traditional Monopolist market	9	18-39

Transport infrastructure (2)

Evolution of Market Competitiveness :
International Intra-European Connectivity



Transport infrastructure (3)

- **State of the market:**
  - **where are KPN/Qwest, Teleglobe, Carrier1?**
  - **prices are stagnant**
  - **no one is making money**

- **Conclusions:**
  - **liberalisation has made a difference**
  - **there is a significant Digital Divide**
  - **the European Union's view is complacent**
  - **the market is not yet stable**

Transport infrastructure (4)

- **Scenarios:**
  - **The Good:**
    - **cost-effective connectivity for all**
    - **equality of access for all**
    - **probability <10% - needs political/direct action**

Transport infrastructure (4)

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    - **current market structure is maintained**
    - **limited increase in competition**
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    - **inequality of access a factor**
  - **The Ugly:**
    - **more corporate failures**
    - **return of the old monopoly model**
    - **fragmentation of the market**
    - **equality of access denied**

Discussion with operators

- **hybrid architecture needed:**
  - **classic approach for any-to-any connectivity**
  - **switched approach when needing high-speed between limited set of sites ("The Return of the Circuit Switch")**
- **little operator interest in >10 Gb/s**
- **differing approaches to dark fibre**
- **expectation that increasing liberalisation in Eastern Europe will bring down costs**
- **further strong consolidation of the industry anticipated**

Equipment (1)

- **Extensive discussions with vendors:**
  - **routing:**
    - **Alcatel, Cisco, Juniper, Marconi**
  - **switching:**
    - **Alcatel, Calient, Ciena, Cisco, Corvis, Lucent, Marconi, Nortel, Tellium, Wavium**
  - **transmission:**
    - **Alcatel, Ciena, Corvis, Lucent, Marconi, Nortel, Photonex, Tellium, Wavium**

Equipment (2)

- 40 Gb/s
  - now only available as 4x10 Gb/s
  - will it appear first in LH or in metro area?
  - some say it will still cost more than 4x10 Gb/s
- 80 Gb/s, 160 Gb/s technically possible, but in labs (600 Gb/s has been demonstrated)
- routers and OXC ready for operation in next few years, on track with NREN needs
  - routers are interoperable, OXCs not
- PXCs very immature at the moment
  - not interoperable
- developments in transmission technology enable DIY approach to NRENs, in some cases

The users

- good progress during the past 5 years
- the bottleneck is now in the campus network!
- all disciplines in all countries feel they need dramatic growth of network facilities over next 5-10 years
- use of high bandwidth in many disciplines
  - physics, neuroscience, chemistry, human biology, linguistics, forest ecology, computer-aided surgery, ….
- Gigabit networks make completely new applications possible
  - Grids, real-time VLBI, solar alerts, earthquake prediction, ecosystem, fishery management, …

The next steps

- **current work items:**
  - **infrastructure scenarios**
  - **research networking infrastructure forecast**
  - **users outside research and higher education**
  - **Digital Divide issues**
  - **research networking scenarios**

- **next work items:**
  - **Final Workshop: 16-17 June 2003, Bad Nauheim**
  - **Final Report (Sept-Oct 2003)**

SERENATE

More information, including all reports, is available from the SERENATE website at

www.serenate.org