



SERENATE

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 (\$ 1M)**
- **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 eEurope**
- **“Research networking in Europe – Striving for global leadership”**
- **2000: Europe to become the leading economic region in the world thanks to ICT: Action Plan eEurope 2002**
- **2002: Action Plan eEurope 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



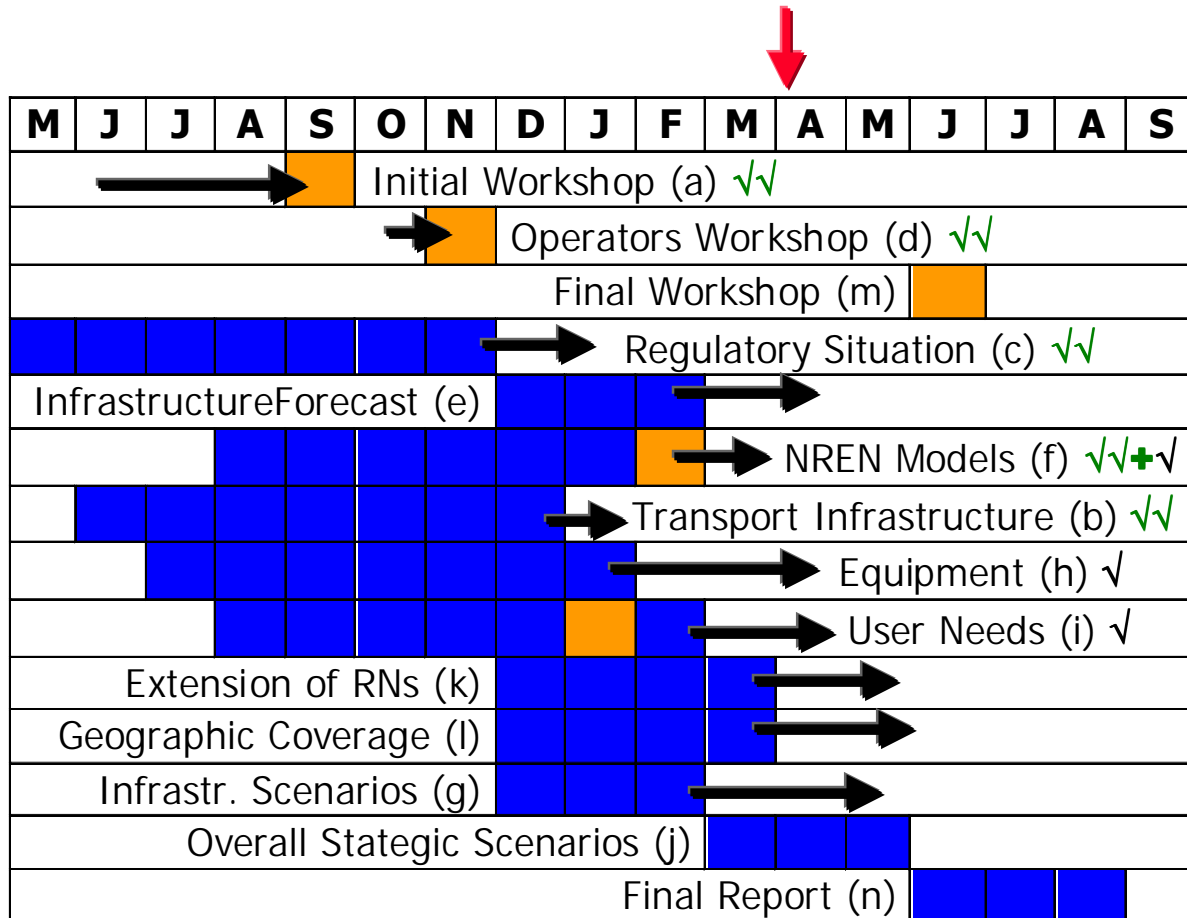
The current situation

- **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

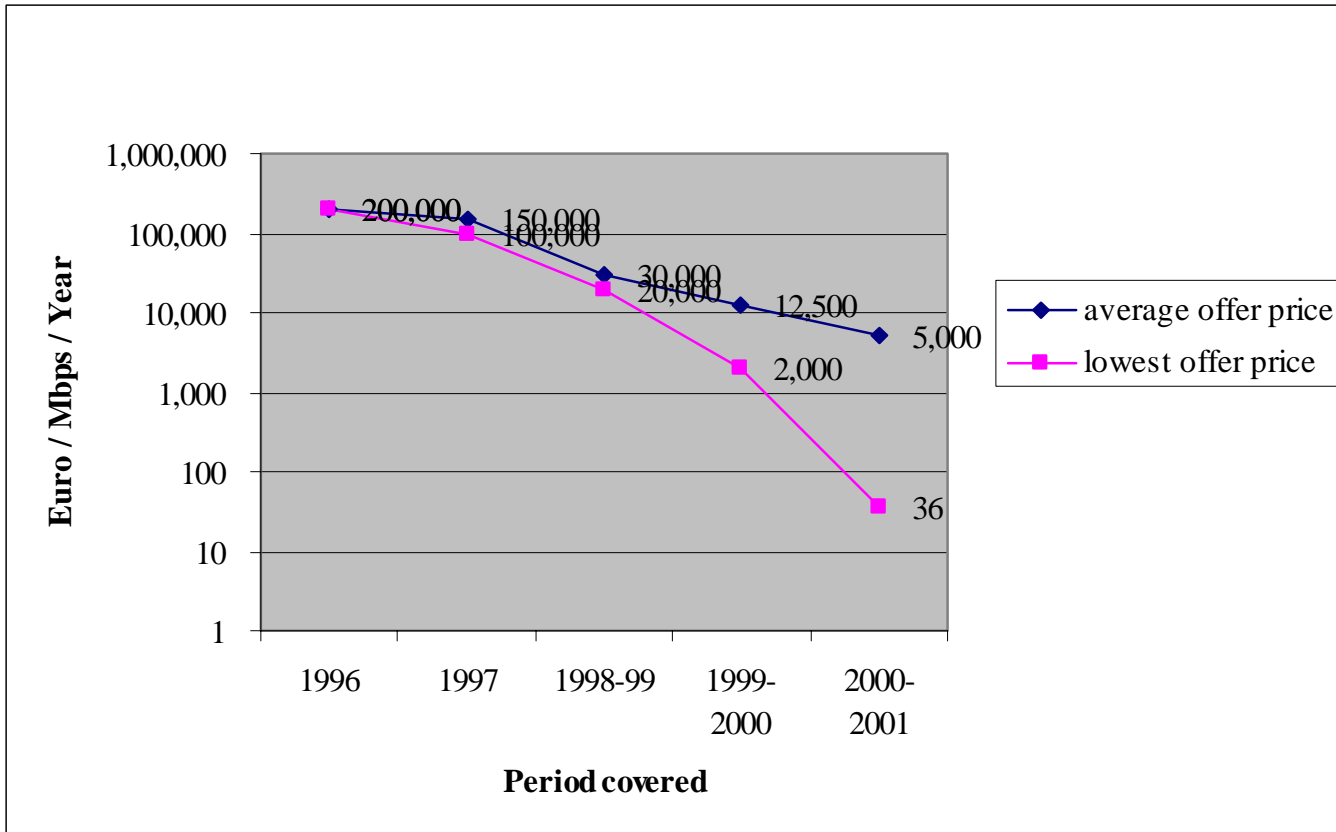
Market segment	Number of Countries	Cost Range
Liberal Market with transparent pricing	8	1-1.4
Liberal Market with less transparent pricing structure	7	1.8-3.3
Emerging Market without transparent pricing	3	7.5-7.8
Traditional Monopolist market	9	18-39





Transport infrastructure (2)

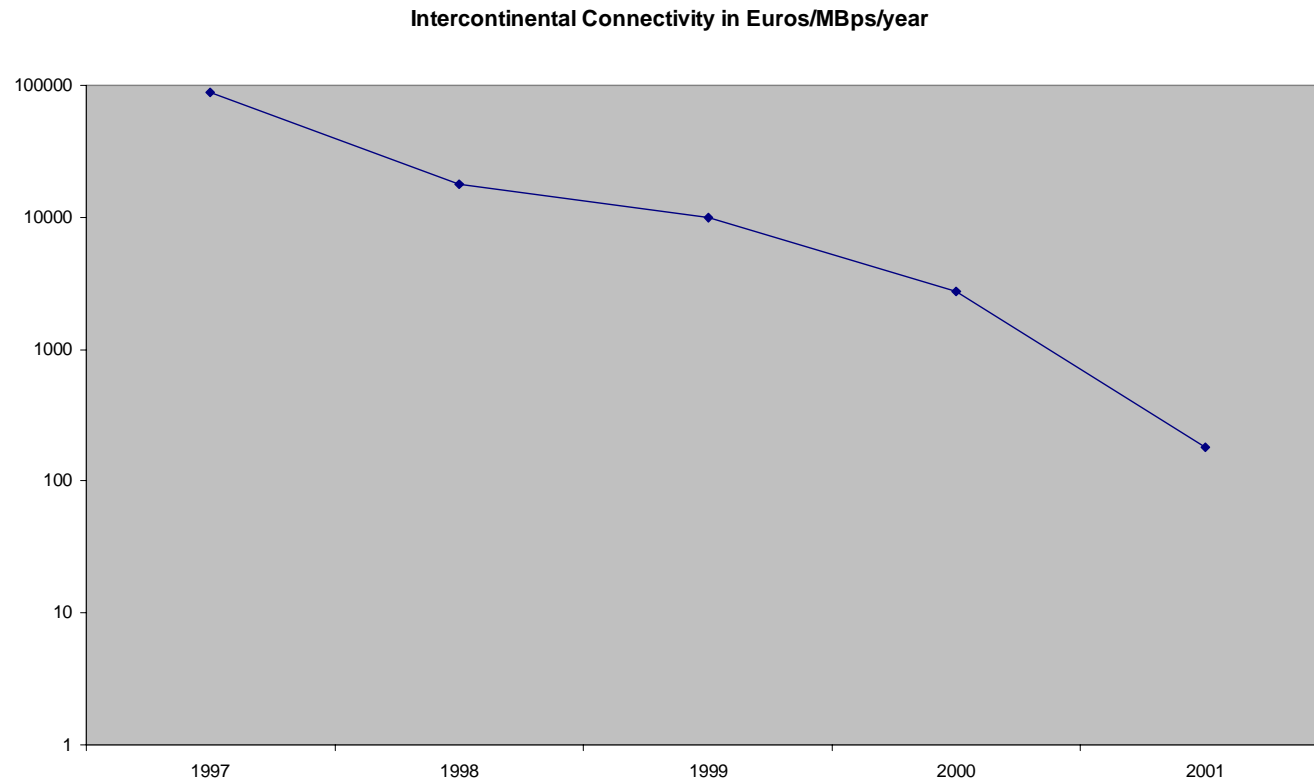
Evolution of Market Competitiveness : International Intra-European Connectivity





Transport infrastructure (3)

Intercontinental Connectivity Price Evolution Europe-USA Route



Transport infrastructure (4)

- **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 (5)

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



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 - **The Bad:**
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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

- **next work items:**
 - **infrastructure scenarios**
 - **research networking infrastructure forecast**
 - **users outside research and higher education**
 - **Digital Divide issues**
 - **research networking scenarios**
 - **Final Workshop: 16-17 June 2003, Bad Nauheim**
 - **Final Report (Sept-Oct 2003)**
- **I hope to be back at the Internet2 Fall Member meeting to present to you the final results, conclusions and recommendations**





SERENATE

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

www.serenate.org

