
Sustainability of e-Infrastructures

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Problem Description: Challenges ahead?

- As any other infrastructure, **e-infrastructures** is more than a set of **interconnected networks**
- History showed that, “a working **infrastructure** is more than just the **technical elements** (hardware and software); it’s a **socio-technical** arrangement involving complex relationships between stakeholders of various kinds of problem domain and wider socio-political context” (Voss et.al, 2007)

Problem Description: Challenges ahead?

- Current e-infrastructures are characterized by:
 - Limited group access
 - Publicly funded
- A **transition to a more open system** has to happen, in order to **ensure the sustainability** (the ability to keep a certain process or state at a certain rate) of e-infrastructure
- Preparing e-infrastructure transition to the next generation Internet requires the identification of the **current and future economic and management challenges** of e-infrastructures

Objective

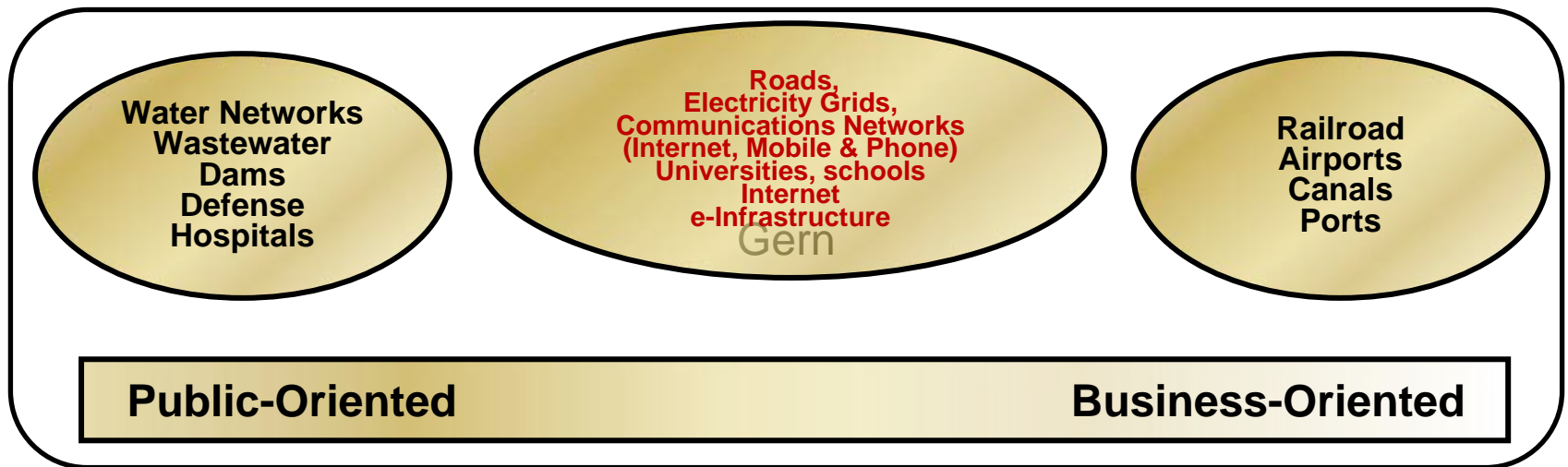
- To **identify the factors** that impact the development of e-infrastructures
- To model e-infrastructure funding and management, through which we can **identify main shortcoming that hinder sustainability** of e-infrastructure
- To offer policy makers a set of outlines and policy **recommendations that can help them accelerate the development of sustainable e-infrastructures.**

e-Infrastructure Case Studies with Respect to Funding and Management

Project	Funding Source	Management		
		Composition	Organization (Committees)	Member Access
DEISA (1&2)	EC	Compromise of 6 National Research Networks (NERNs)	1- Consortium 2-National evaluation committee	1- Validation by national evaluation committees. 2- Technical validation by DEISA technical teams. 3- DEISA Executive Committee. 4-The Consortium set priorities
GÉANT (1&2)	EC (shared between NRENs and EU)	30 National Research and Education Networks (NRENs) representing 34 countries	- Executive Committee - Policy Committee - Project Coordinator - Technical Management Committee	-verification the eligibility of proposal. -Access to GÉANT2 is only possible through a connecting NREN - contact GÉANT consortium
DFN	Federal Ministry of Education and Research along with a differentiated membership fee	400 members including: universities, technical colleges, research labs from industry, government agencies	- executive office that control its operation - All organization, planning, supervision, consultancy, projects finance, administration, and international contacts are managed by main office in Berlin	
TeraGrid	Funded by National Science Foundation	Nine Supercomputing <i>Resource Provider</i> partner	- The System Management Group - Grid Infrastructure Group (GIG) - Cyberinfrastructure User Advisory Committee (CUAC)	- Academic researchers have to provide an abstract describing the work to be done, - More extensive allocations involve a proposal that is reviewed during a quarterly peer-review process , - All allocation proposals are handled through principal investigator (PI) whom must be a researcher or educator at a U.S.-based institution, including federal research labs or commercial organizations
NAREGI	The Ministry of Education, Culture, Sports, Science and Technology (MEXT)	9 universities and more than 10s of Institutions/Centers	- Operated by the center for Grid research and development (national institute of informatics)	Through a Certificate of usage for 1) joint research organizations 2) Participating institution and organizations
K*Grid	MIC (Ministry of Information and Communication,).	50 organizations including 20+ universities, research institutes, companies, etc.	K*Grid Testbed team KISTI	Users must belong to one of the member organizations of K*Grid or PRAGMA- Users should create and account and give the Purpose for using KISTI then request are reviewed and approved
CANARIE	Membership fees, and majorly by Government of Canada through Industry	85 organizations (22 of them are universities; others include industry and research centers).	As a company with a board of directors (from industry, education and research communities)	- Apply for Connection should go through regional Network GigaPoPs. (can be paid) - Should be approved by CANARIE in consultation with the CANARIE Network Policy Committee
EGEE	Mainly Funded by EU with significant contribution by partners	140 institutions with approximately 300 sites in 52 countries	6 main management groups covers: Administrative Federation Committee , Activity Management Board , collaboration board, External Advisory Committee , Project Management Board , Technical Management Board.	- Join as member of VO - obtain a appropriate certificate of usage.

e-Infrastructures: How do They Compare to Classical Infrastructures?

- Infrastructure can be analyzed according to different criteria:
 - Funding schemes (tax, per-use, special tax)
 - Network/System types
 - Competition vs. Monopoly
 - Technology level
 - Development phases
 - Infrastructures for the public vs. business



Comparison to Classical Infrastructures: Summary

Aspect \ Infrastructure	Traditional General-Purpose Infrastructure	Internet	e-infrastructure
Funding	Public → Public-Private Sustainable	Public → Private - Sustainable	Public
Access to the infrastructure	Open	Exclusive → Open	Exclusive
Technology offered	Low	High	Very high
Competition in technology market	Low	Low → High	High
Network structure	System → Multiple → Interconnected	Multiple → interconnected → Inter-domain	Multiple → Inter-domain → interconnected

Discussion:

How Complicated is Adding “e” to the Infrastructure

- The following issues have to be resolved in order to make the transition to the next-generation Internet:
 - **Stakeholders inclusion** and **openness of** the e-infrastructure for industry and businesses
 - Lack of international (or least national), inter-sectoral (private and public), and inter-disciplinary **cooperation, standardization, and collaboration** between all stakeholders
 - **Incentives and policies for resource sharing**
 - Privatizations of the e-infrastructure while protecting the **network neutrality** and public interest

In fact, economics of e-infrastructure are more complicated than that of any classical infrastructures.

- **Competition between network / technology providers and publicly funded technology innovators.** (i.e. the cutting-edge resource offered by e-infrastructure that exceeds any technology frontier available in the market)
- **Revenue sharing** and distribution between local network service providers in the e-infrastructure.
- **Continuous Transition models**

Conclusion: The way Forward

- In fact, there is an urgent need to deeply study and research:
 1. The **economics of infrastructure operations, management, maintenance, and development** .
 2. Possible **transition models for the e-infrastructure** from an exclusive limited access e-infrastructure to the next generation Internet
 3. The **pros and cons of including the private sector** in the development of the e-infrastructure, and if such inclusion will open the boundaries of the research community, it will enable new business models around the e-infrastructure, financing the upgrade of existing technology
 4. **Techniques and policies that secure public universal access** to e-infrastructures and ensure access by a growing number of the population in an easy and cost efficient ways.

- Therefore, a **task force for the economics and policy issues of e-infrastructures Task Force** that carries out economics and policy research for e-infrastructures would be valuable

Thank You

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Biography

Jörn Altmann is Associate Professor for Technology Management, Economics, and Policy at the School of Engineering, Seoul National University. Prior to this, he taught computer networks at UC Berkeley, worked as a Senior Scientist at Hewlett-Packard Labs, and has been a postdoc at EECS and ICSI of UC Berkeley. Dr. Altmann received his B.Sc. degree, his M.Sc. degree, and his Ph.D. from the University of Erlangen-Nuremberg. Dr. Altmann's current research centres on Internet economics, with focus on economics of Internet services and on integrating economic models into Internet infrastructures. On these topics, he has major publications, served on editorial bodies of journals and on program committees, chaired international workshops, reviewed research proposal, and has given several invited talks.