



GÉANT COMPENDIUM, AZ NREN-EK CSALÁDI FÉNYKÉPALBUMA

Bálint Lajos
balint.lajos@kifu.gov.hu

NETWORKSHOP 2018, Eger

- **Történeti háttér:** az e-Infrastruktúrák alakulása 30 éves történetük tükrében
- **A Compendium szerepe és célja:** **visszatekintés, áttekintés, összevetés**
 - **Európai körkép:** NREN-ek, infrastruktúrák, szolgáltatások, alkalmazók
 - **A hálózati infrastruktúra és a hálózati szolgáltatások**
 - **A felhasználói közösségek:** alkalmazási elvek és gyakorlat
 - **Az NREN-ek szervezeti-személyi és költségvetési jellemzői**
 - **Szolgáltatások:** szolgáltatási spektrum, portfólió-gondozás
- **Tanulságok és következtetések - fejlődési irányok és meghatározó folyamatok**
- **Előretekintés:** mi várható az elkövetkezőkben

1986: kutatói hálózatok csírái néhány európai országban*

2017: e-Infrastruktúra szerte a világon

(a kutatás, felsőoktatás és közgyűjtemények speciális hálózati infrastruktúrája és a ráépülő járulékos elektronikus infrastruktúra, valamint az infrastruktúrán kialakított szolgáltatások)

NREN: a "kutatói hálózatot" fejlesztő és működtető nemzeti szervezet

Európa ~40 államában (és a **világ** további ~70 országában) működik NREN

- Kommunikáció, erőforrás-hozzáférés, kooperáció, VRE / VRC ...
- Szoros együttműködés kontinensenként és globális szinten is.

2001-től : „TERENA Compendium”

2016-tól : „GÉANT Compendium”

<https://www.geant.org/Resources/Pages/Compendium.aspx>

Az NREN-ek kulcs-információinak közreadása

- az NREN fejlesztők és üzemeltetők
- a felhasználók
- a partnerek
- a finanszírozók

számára ... első NREN ismerkedés a fotóalbum lapozgatásával!

**Indulás a GÉANT indításával egyidőben ...
... kiadás mindig a tárgyévet követő évben.**

Az első tartalomjegyzék (2001):

1. Basic information (tagok és felhasználók adatai)
2. Network information (sebességek, méretek, technológiák, forgalmak)
3. Tasks, staffing, funding (szolgáltatások, létszámok, költségek, források, beruházások)
4. KF és szolgáltatási célok-tervek-eredmények

Tartalomjegyzék a 2016-os Compendiumban:

- 1 A Guide to the GÉANT Compendium of NRENs
- 2 About GÉANT
- 3 Defining Topics
- 4 Organisations and Users
- 5 Network
- 6 Security and Trust & Identity
- 7 Cloud and Collaboration Services
- 8 NRENs in other Regions and Continents

Összevetések (2001-es, 2010-es, 2016-os állapotok)*:

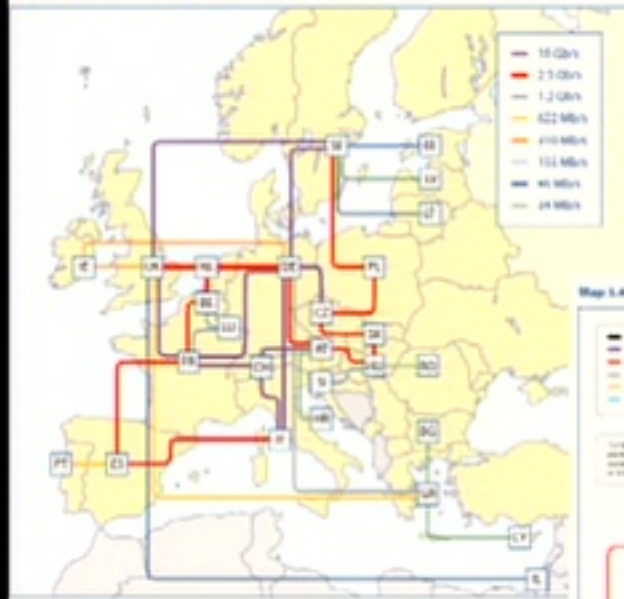
- a) **NREN-ek Európában és a világban** (szervezetek és közösségük)
- b) **NREN Felhasználók** (alkalmazói létszámok, kategóriák, AUP-k)
- c) **NREN Kapacitások** (sebességek, hálózatméretek, technológiák)
- d) **NREN Forgalmak** (külső, belső, fajlagos)
- e) **NREN Működtető létszámok** (összes, műszaki)
- f) **NREN Költségvetések** (források, költségek, fajlagos adatok)
- g) **e-RI Szolgáltatások** (kifutó, futó, felfutó, tervezett)

* The GÉANT Compendia are acknowledged as original sources of the following figures

Legend	
Red	1980 or earlier
Purple	Between 1981 and 1985
Green	Between 1986 and 1990
Blue	Between 1991 and 1995
Yellow	1996 and later



Map 3.A.1 - GEANT topology, 2001



Map 3.A.2 - GEANT topology, 2010

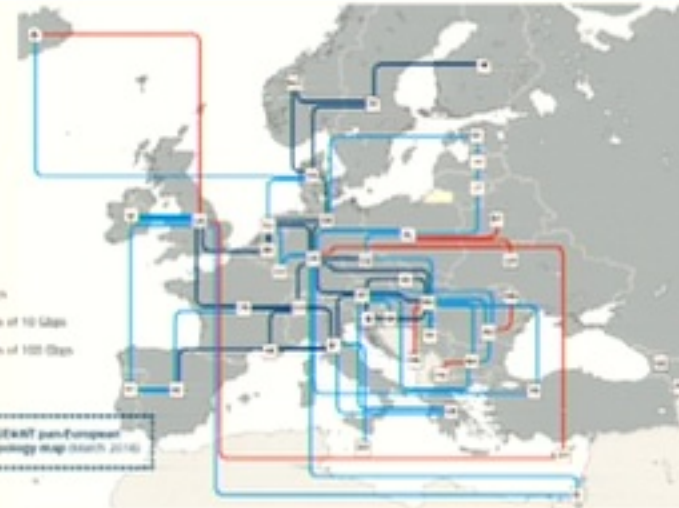
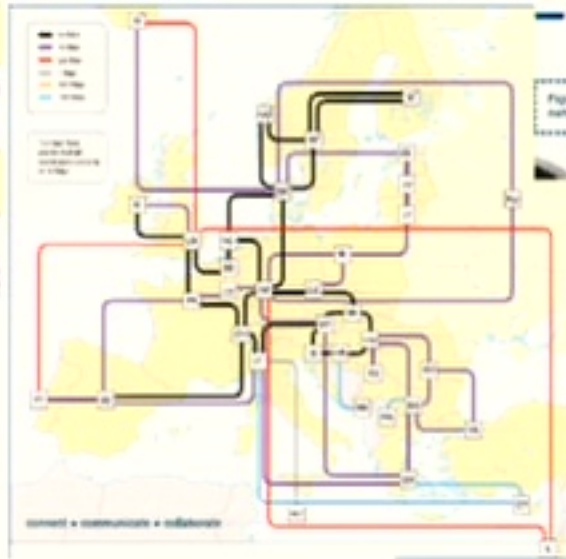
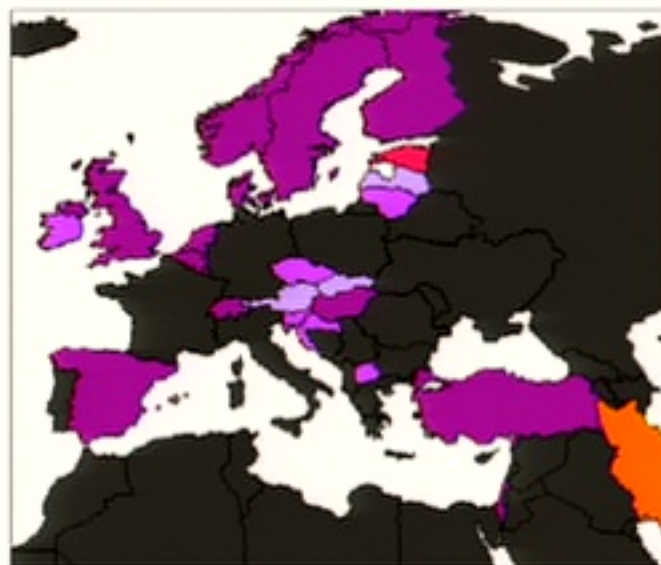


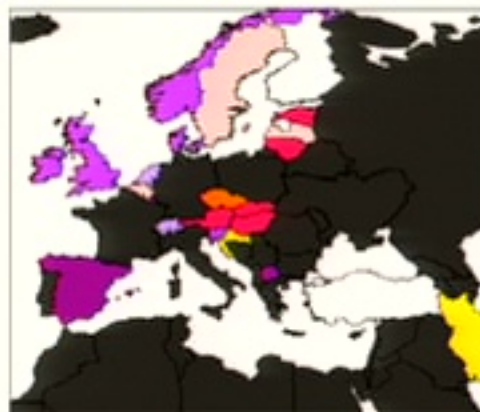
Figure 2.1 - GEANT pan-European network topology map (March 2016)

Legend			
Grey	No reply received	White	Zero
Dark Purple	100%	Purple	from 90 to 99%
Light Purple	from 70 to 89%	Pink	from 50 to 69%
Orange	from 30 to 49%	Salmon	from 10 to 29%
Yellow	from 6 to 9%	Light Yellow	from 1 to 5%

Percentage of University students that have Internet access through the NREN



Percentage of Higher/Further education students that have Internet access through the NREN



Percentage of Secondary education students that have Internet access through the NREN

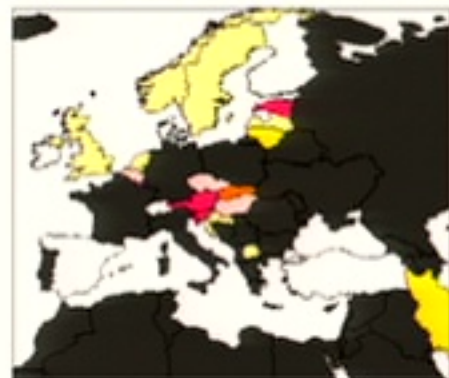


Table 2.3.1 - Approximate market shares

Country	NREN	Universities	Institutes of higher/further education	Research institutes	Secondary schools	Primary schools	Libraries, museums, national archives	Non university hospitals	Government departments
EU/EFTA countries									
Austria	ACOnet	52 (=100%)	1 (=100%)	27 (=50%)	+ (=100%)	+ (=50%)	10 (=50%)	4 (=50%)	30 (=50%)
Belgium	BELNET	67 (=100%)	5 (=0%)	42 (=100%)	6 (=0%)	+ (=0%)	13 (=0%)	13 (=0%)	53 (=50%)
Bulgaria	BREN	22	2	50	1,500	500	15	5	-
Cyprus	CYNET	7 (=100%)	10 (=50%)	3 (=50%)	1 (=0%)	-	-	-	-
Czech Republic	CESMET	26 (=100%)	11 (=50%)	22 (=50%)	120 (=50%)	20 (=0%)	52 (=0%)	55 (=50%)	40 (=50%)
Denmark	URUC	6 (=100%)	7 (=50%)	12 (=50%)	-	-	5 (=0%)	2 (=0%)	4 (=0%)
Estonia	EFNet	27 (=100%)	10 (=50%)	18 (=50%)	55 (=50%)	55 (=50%)	86 (=0%)	+ (=0%)	5 (=0%)
Finland	Funes	50 (=100%)	-	12 (=50%)	-	-	4 (=0%)	-	8 (=0%)
France	RENATER	436 (=100%)	525	555	115	-	10	5	28
Germany	DFN	+ (=100%)	+ (=100%)	+ (=50%)	+ (=0%)	+ (=0%)	+ (=0%)	+ (=0%)	+ (=0%)
Greece	GRNET	44 (=100%)	144 (=100%)	26 (=100%)	4,206 (=100%)	5,090 (=100%)	8 (=50%)	-	75.7 (=50%)
Hungary	NIF/HUNGARNET	26	31	73	29	-	235	58	9
Ireland	Bitnet	7 (=100%)	3 (=0%)	10 (=50%)	1 (=0%)	-	1 (=0%)	-	-
Ireland	HEAnet	8 (=100%)	30 (=100%)	12 (=50%)	800 (=100%)	5,200	+ (=0%)	-	9 (=0%)
Italy	GARR	145 (=100%)	0 (=0%)	157 (=100%)	10 (=0%)	1 (=0%)	26 (=50%)	49 (=50%)	5 (=0%)
Latvia	SigmaNet 3	18 (=50%)	60 (=0%)	14 (=50%)	3 (=0%)	-	6 (=0%)	-	-
Lithuania	LITNET	66 (=100%)	142 (=100%)	70 (=100%)	746 (=50%)	52 (=50%)	90 (=50%)	11 (=0%)	28 (=0%)
Luxembourg	REStENA	4 (=100%)	2 (=100%)	17 (=100%)	56 (=100%)	150 (=50%)	12 (=50%)	1 (=0%)	3 (=0%)
Malta	UkM/RekaNet	1 (=100%)	20 (=50%)	5 (=50%)	+ (=0%)	+ (=0%)	+ (=0%)	+ (=0%)	+ (=0%)
Netherlands	SURFnet	14 (=100%)	64 (=100%)	52 (=100%)	+ (=0%)	+ (=0%)	19 (=50%)	11 (=50%)	-
Norway	UNINETT	7 (=100%)	57 (=100%)	79 (=50%)	8 (=0%)	2 (=0%)	14 (=50%)	-	-
Poland	PONER	168 (=100%)	17 (=0%)	199 (=100%)	106 (=0%)	13 (=0%)	156 (=50%)	35 (=0%)	107 (=0%)
Portugal	FCCN	42 (=100%)	0 (=0%)	10 (=100%)	-	-	3 (=0%)	-	14
Romania	ReFcuNet	50 (=100%)	10 (=50%)	55 (=50%)	360 (=50%)	140 (=0%)	40 (=50%)	-	30 (=50%)
Slovakia	SANET	58 (=100%)	7 (=50%)	20 (=50%)	200 (=50%)	100 (=50%)	6 (=50%)	+ (=0%)	-
Slovenia	ARNES	4 (=100%)	20 (=100%)	58 (=100%)	100 (=100%)	521 (=100%)	204 (=100%)	-	12 (=0%)
Spain	RedIRIS	100 (=100%)	0 (=0%)	150 (=100%)	-	-	25 (=0%)	50 (=50%)	50 (=0%)
Sweden	SUNET	50 (=100%)	9 (=50%)	4 (=50%)	-	-	19 (=50%)	-	20 (=0%)

NREN	Univ	FE	Research Inst	Secondary School	Primary School	Library	Hosp	Gov	Int'l Res	For-Profit
ALOnet	80	0	0	90	90	20	60	60	0	0
AMRES	50	10	50	5	100	25	5	2	0	0
ANA	74	0	13	0	0	4	0	7	0	0
ASNET-AM	0	0	0	0	0	0	0	0	0	0
ARNES	0	90	90	90	90	80	0	10	0	0
BASNET	0	0	0	0	0	0	0	0	0	0
Bolnet	100	0	0	0	0	0	0	20	2	0
CARnet	99	0	100	95	90	1	30	5	0	1
CESNET	95	10	95	5	100	0	0	0	0	0
CYNET	100	80	70	0	0	0	0	0	0	0
DuIC	100	25	50	0	0	2	0	6	0	1
DFN	0	0	0	0	0	0	0	0	0	0
EENet	0	25	0	30	27	0	0	0	0	0
FCCN	0	0	0	0	0	0	0	0	0	0
FLJNET	0	0	0	0	0	0	0	0	0	0
GARR	100	0	80	5	80	20	25	0	20	0
GRENA	0	0	1	0	0	0	0	0	0	0
HEAnet	100	27	50	100	100	0	0	20	30	0
IMCS	0	0	0	0	0	0	0	0	0	0
IJCC	100	0	0	0	0	0	0	0	0	0
Jisc	0	1	0	0	0	0	0	0	0	0
LITNET	0	78	100	70	30	25	10	10	0	1
MAAnet	20	0	0	0	0	0	0	0	0	0
MREN	0	0	0	0	0	0	0	0	0	0
NIE (KIFU/HUNGARNET)	0	50	9	100	100	20	5	5	0	0
PIONER	0	0	0	0	0	0	0	0	0	0
RedIRIS	70	0	95	0	25	0	50	5	0	0
RENAM	0	11	88	0	0	0	7	5	0	0
RENATER	100	80	80	*	*	5	5	5	*	*
RESTENA	0	0	95	100	80	80	0	20	0	0
RHnet	90	50	70	100	0	0	0	0	0	0
RoEduNet	0	50	80	30	50	60	0	10	0	0
SANET	100	95	70	90	10	10	5	5	0	0
SUNET	100	100	90	0	0	0	0	0	0	0
SURFnet	100	90	0	8	8	5	6	0	20	1
SWITCH	0	0	0	0	0	0	0	0	0	0
ULAKRIM	100	50	80	0	0	0	0	7	0	0
LINNETT	100	100	90	0	0	10	0	0	0	0
URAN	0	10	0	100	0	5	5	5	10	1

* Market share unknown at time of survey; upcoming work

90-100%

80-89%

70-79%

60-69%

50-59%

40-49%

30-39%

20-29%

10-19%

0-9%

Graph 2.2.1 - Connection policies of EU/EFTA and other countries

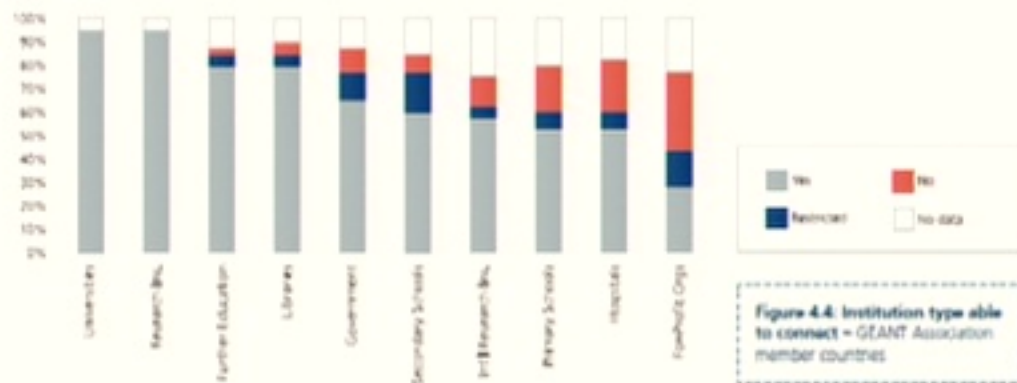
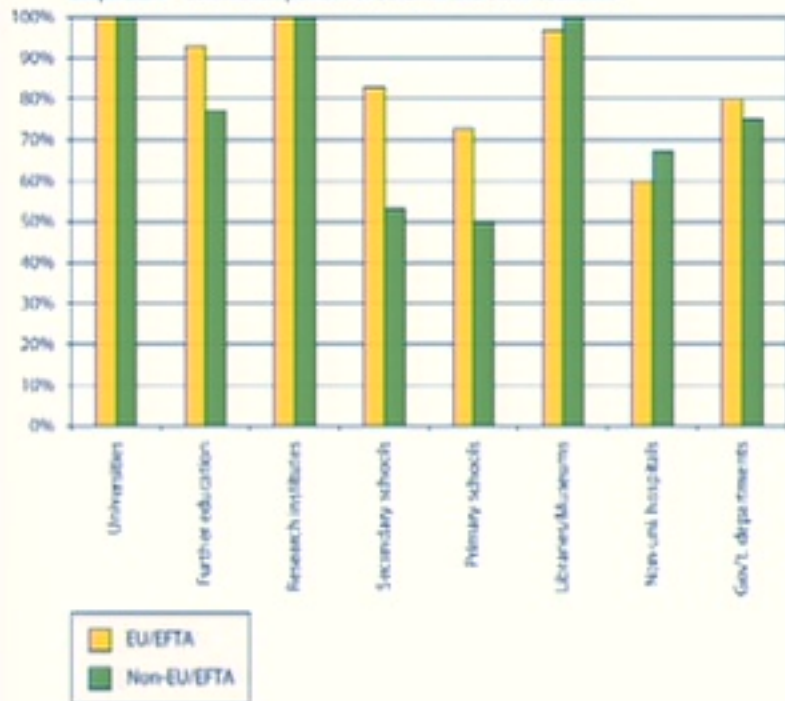
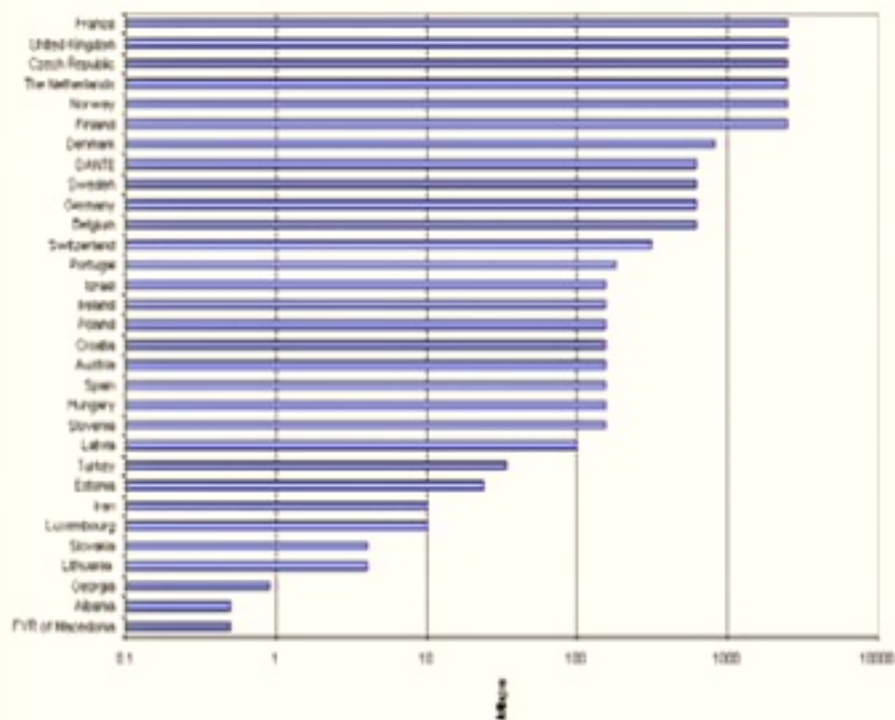
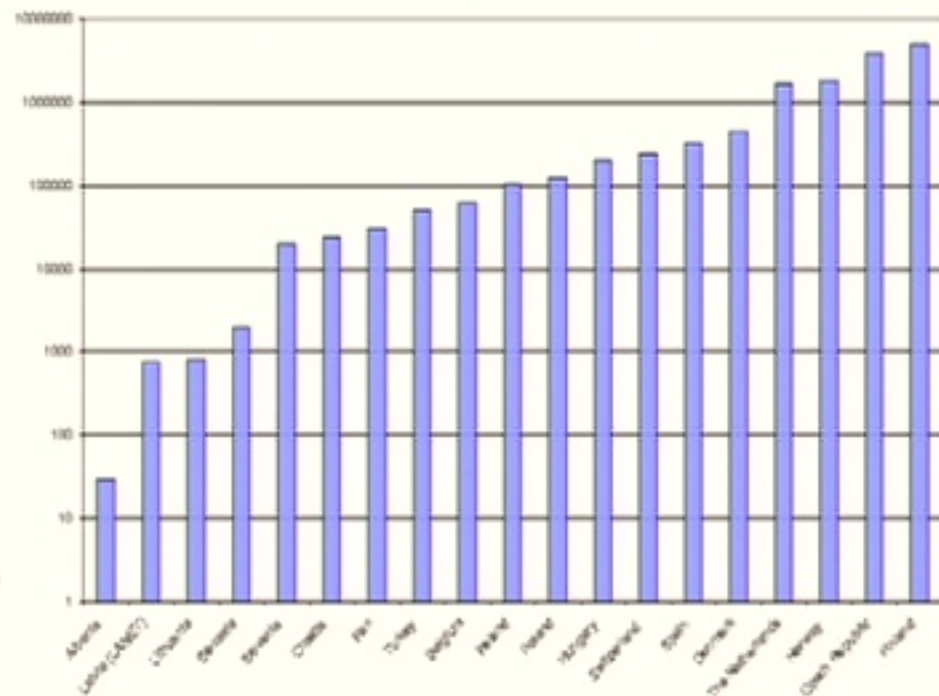


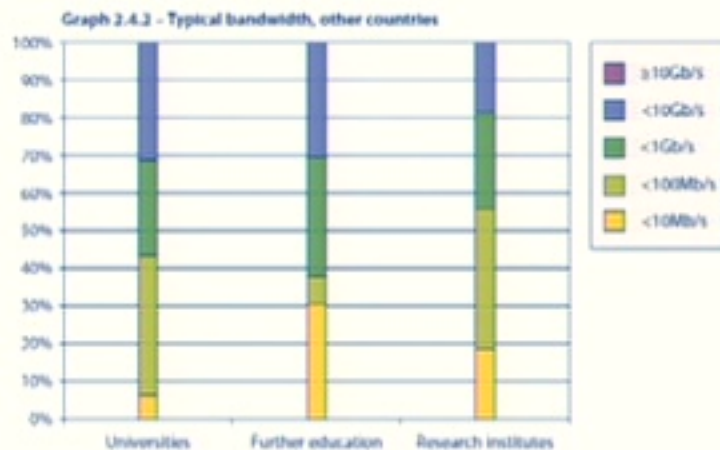
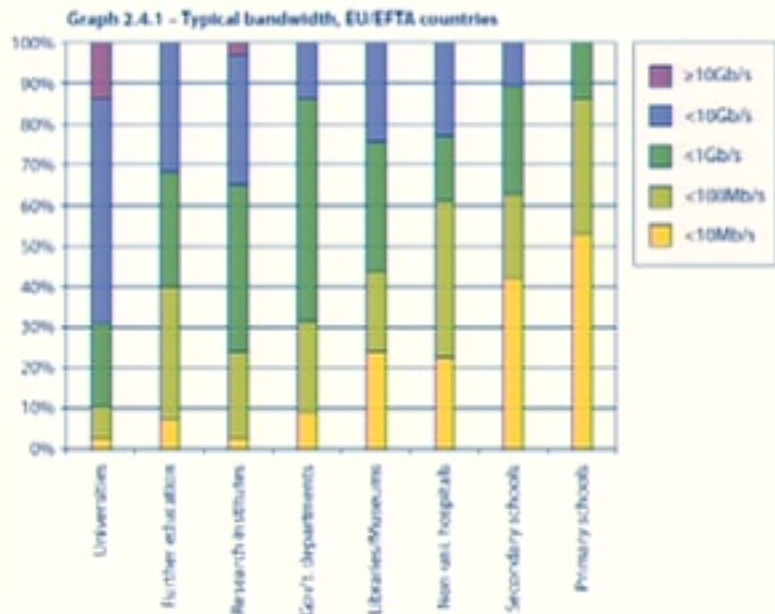
Figure 4.4: Institution type able to connect - GEANT Association member countries

Core capacities on NREN networks, 2001
page 24

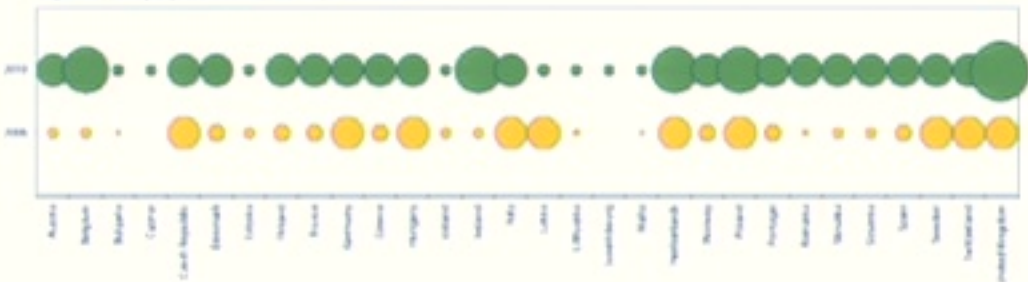


Absolute network size in Mbps x km
page 25





Graph 2.4.3 - Core capacity of the networks, 2006, 2010, EU/EFTA countries



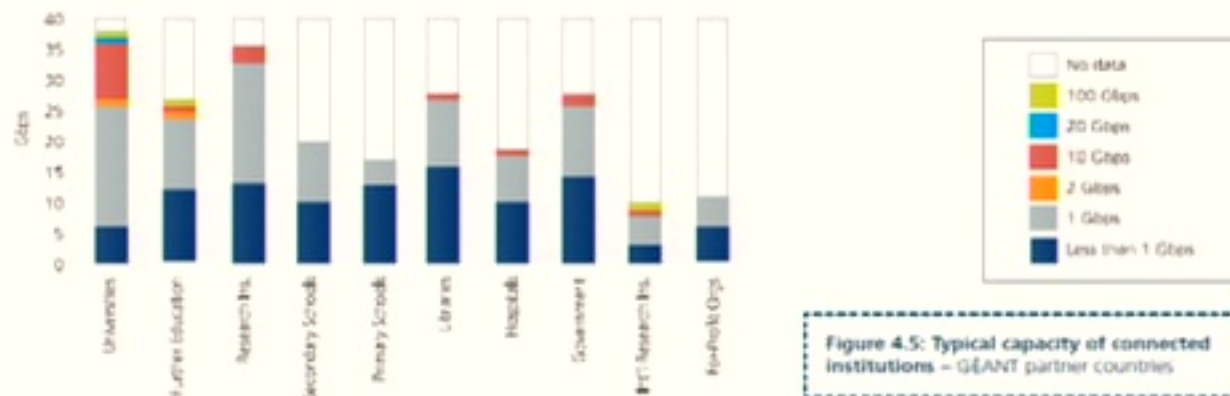


Figure 4.5: Typical capacity of connected institutions – GÉANT partner countries

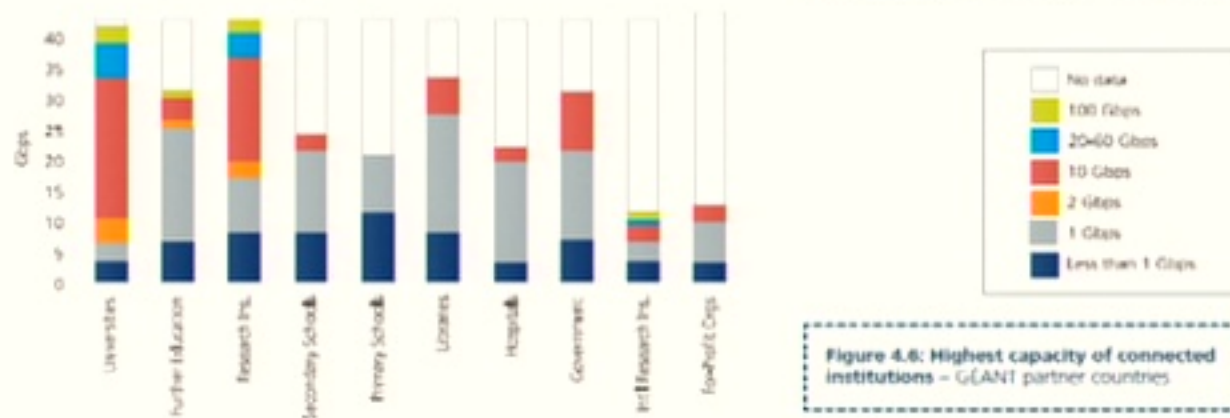
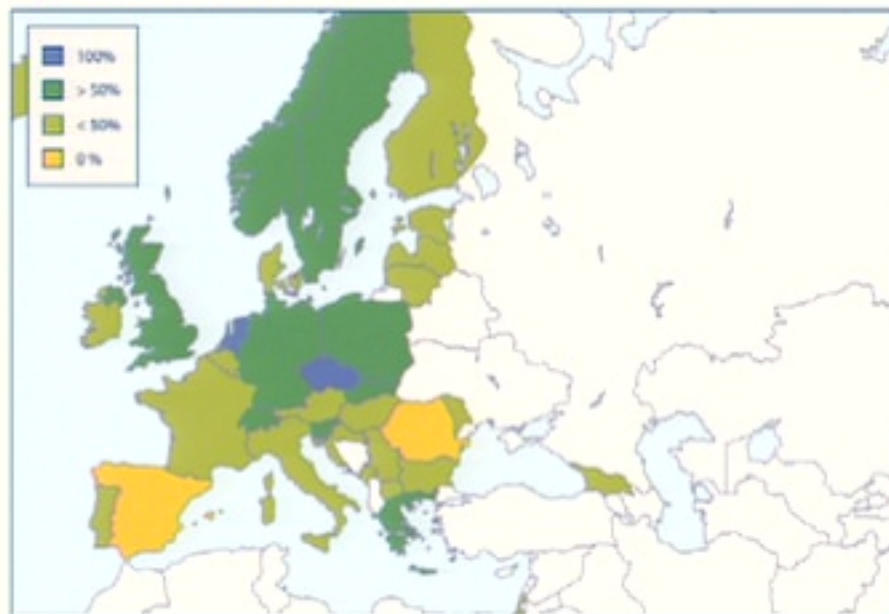


Figure 4.6: Highest capacity of connected institutions – GÉANT partner countries

Map 3.6.1 - Dark fibre on NREN backbones, 2006



Map 3.6.2 - Dark fibre on NREN backbones, 2010



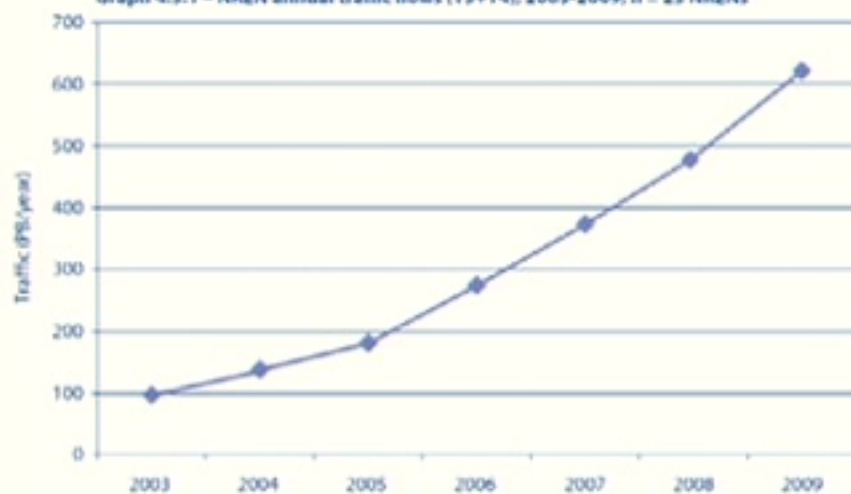
Map 3.2.2 - Cross border dark fibre



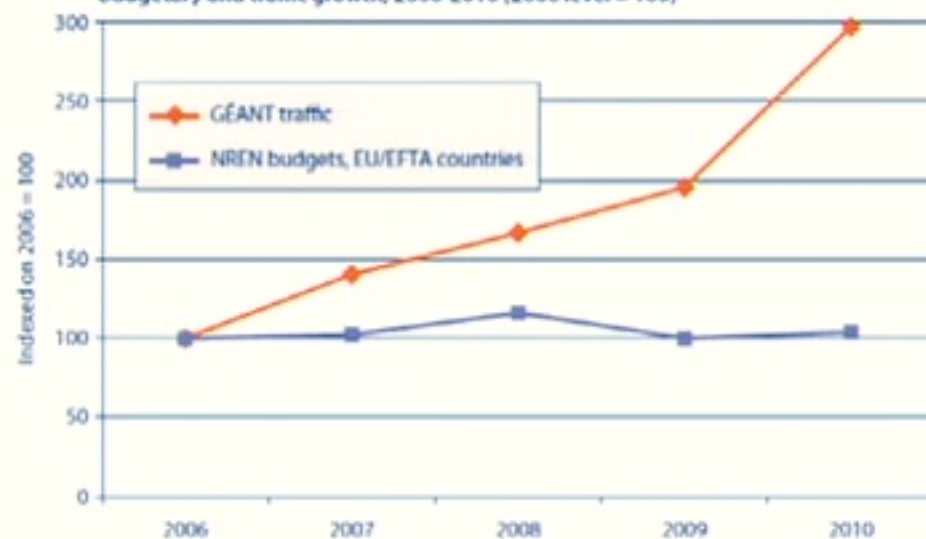




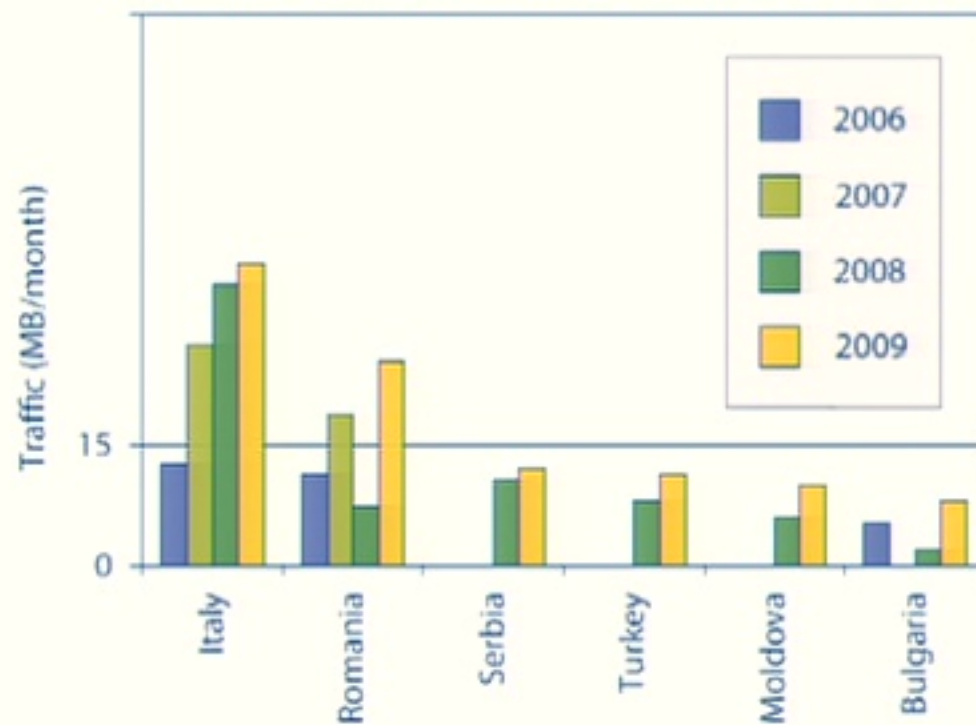
Graph 4.3.1 - NREN annual traffic flows (T3+T4), 2003-2009, n = 23 NRENs



Budgetary and traffic growth, 2006-2010 (2006 level = 100)



Graph 4.1.1 – Traffic per inhabitant and the digital divide



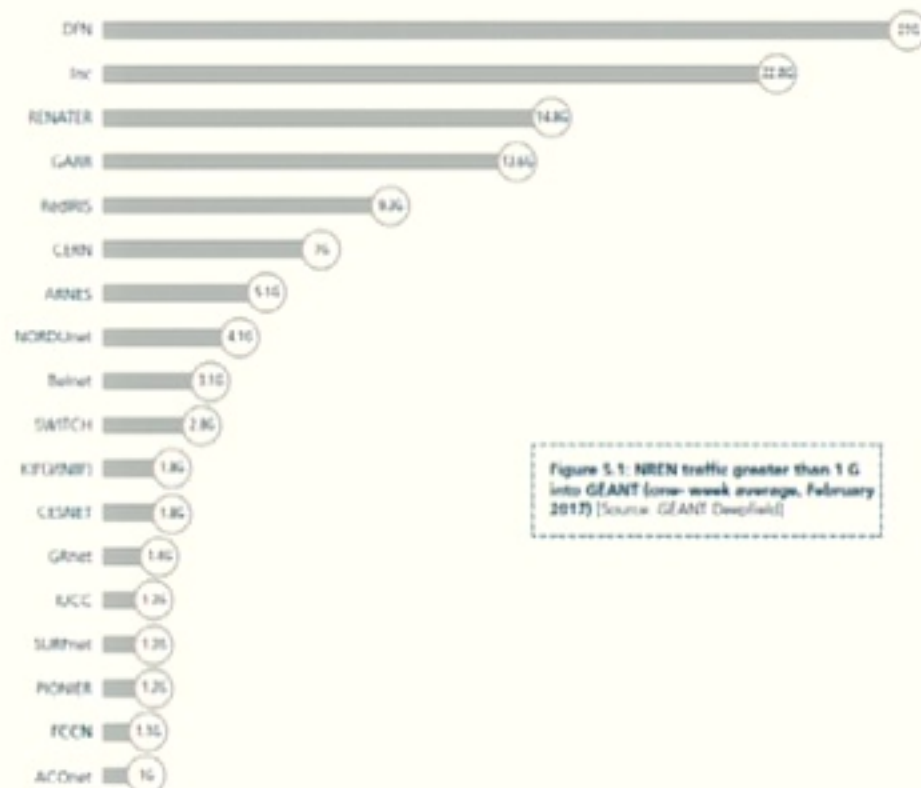
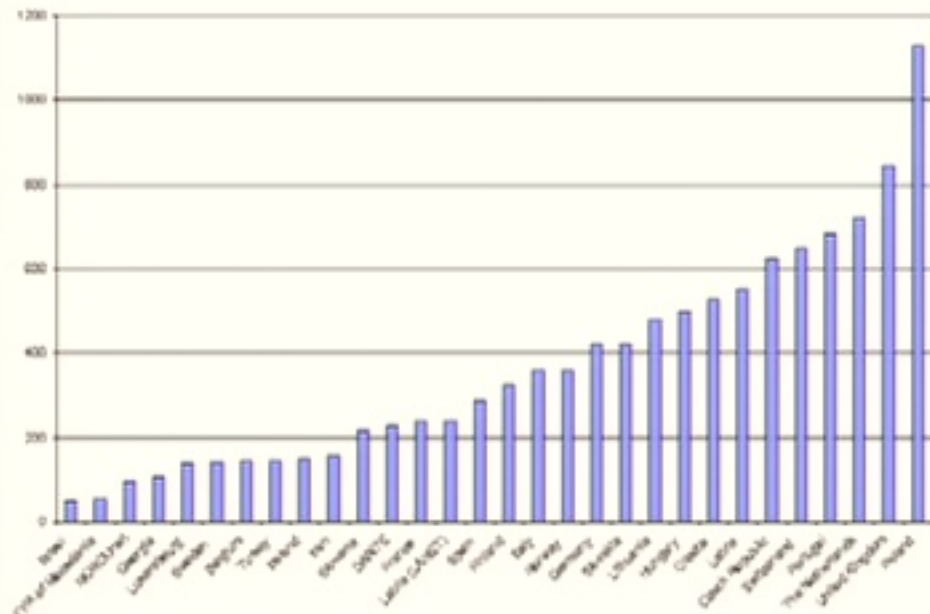
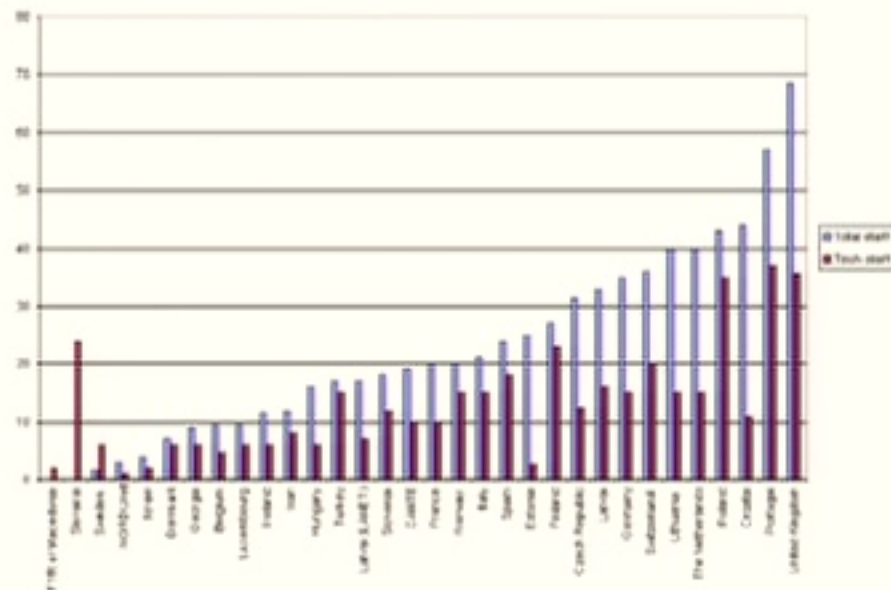


Figure 5.1: NREN traffic greater than 1 G into GEANT (one-week average, February 2017) [Source: GEANT Deepfield]

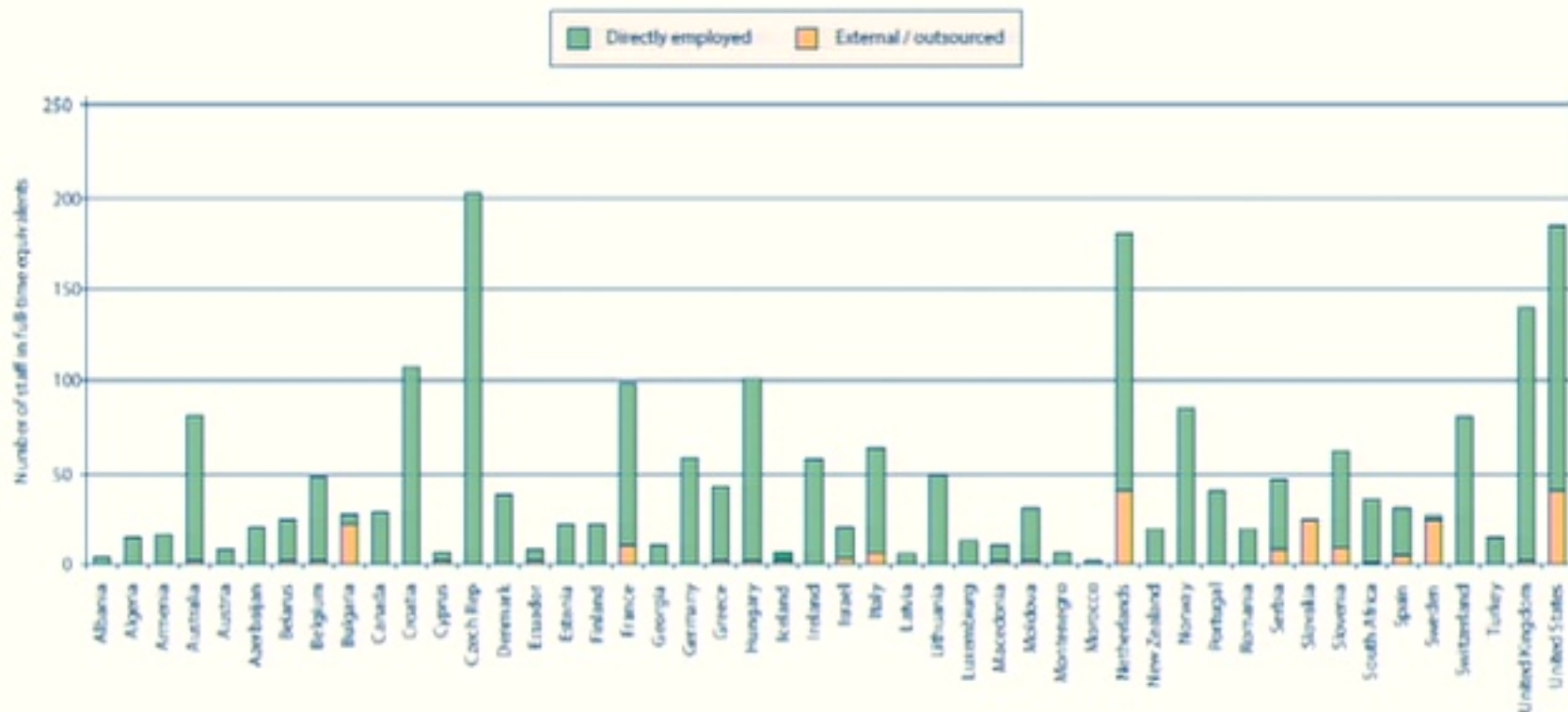
Total Amount of Effort available in person/months per year
page 101



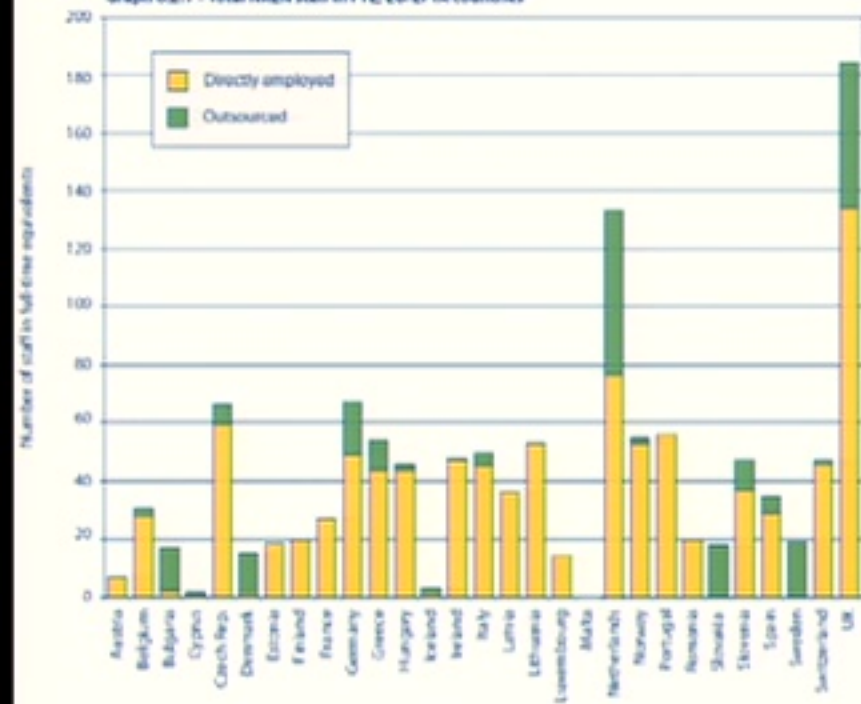
Total staff size and total technical staff size in FTEs
page 102



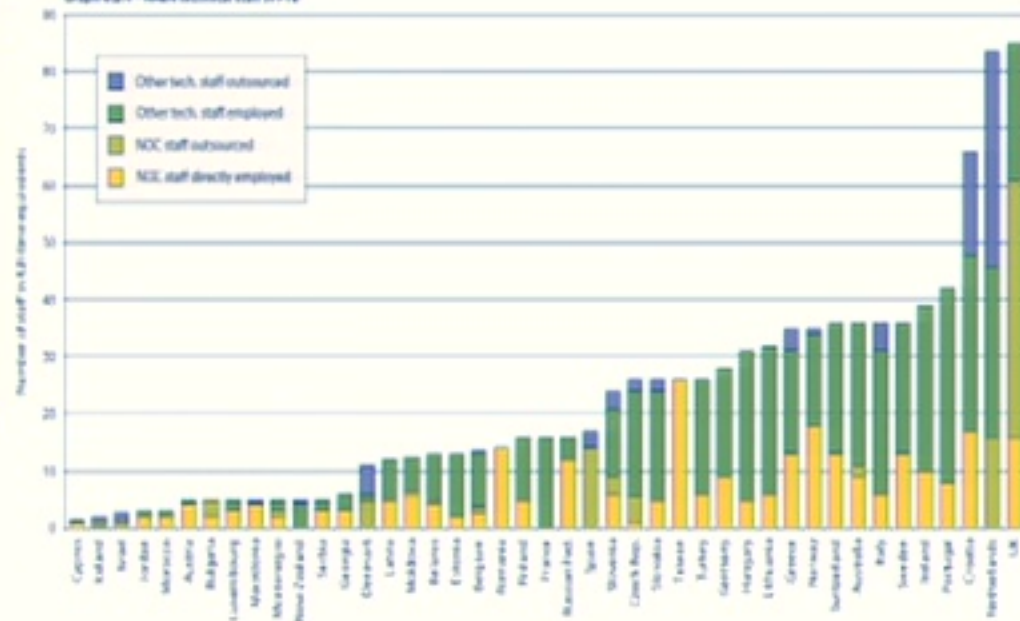
Graph 7.1.1 – Total NREN staff in FTE



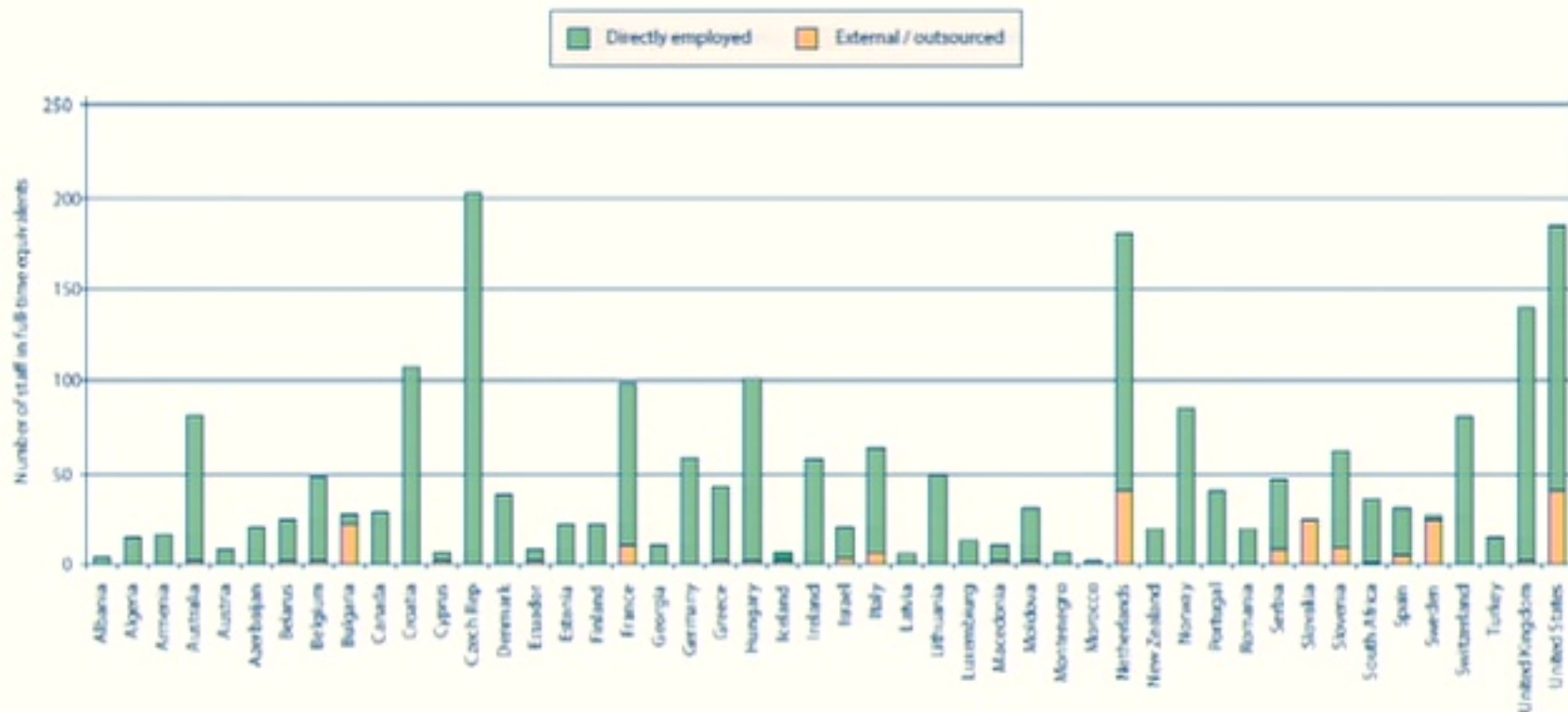
Graph 4.2.1 - Total NREN staff in FTE, EU/EFTA countries

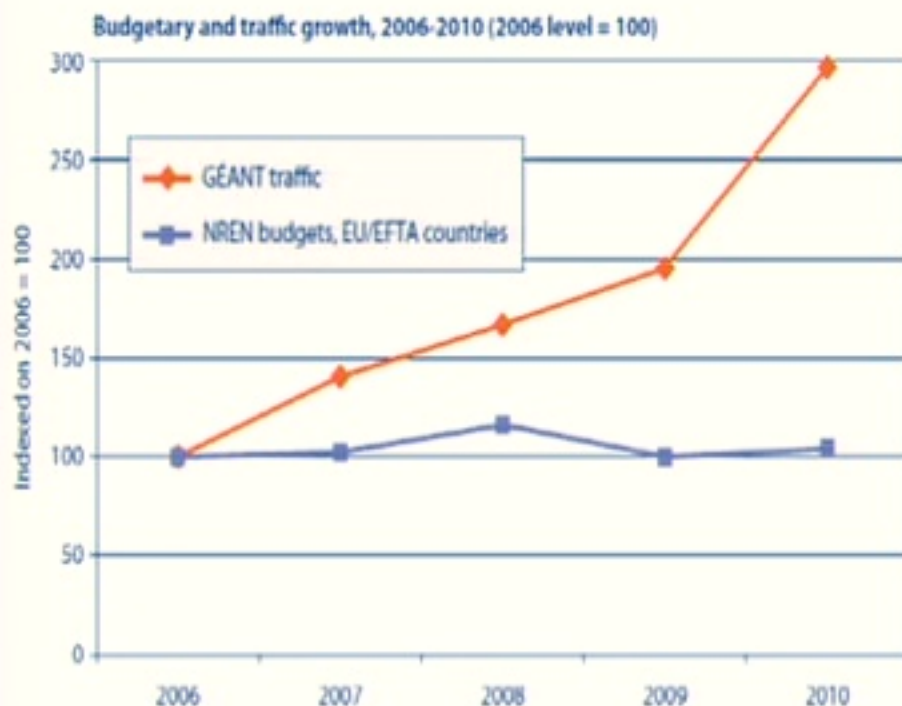


Graph 4.2.4 - NREN technical staff in FTE

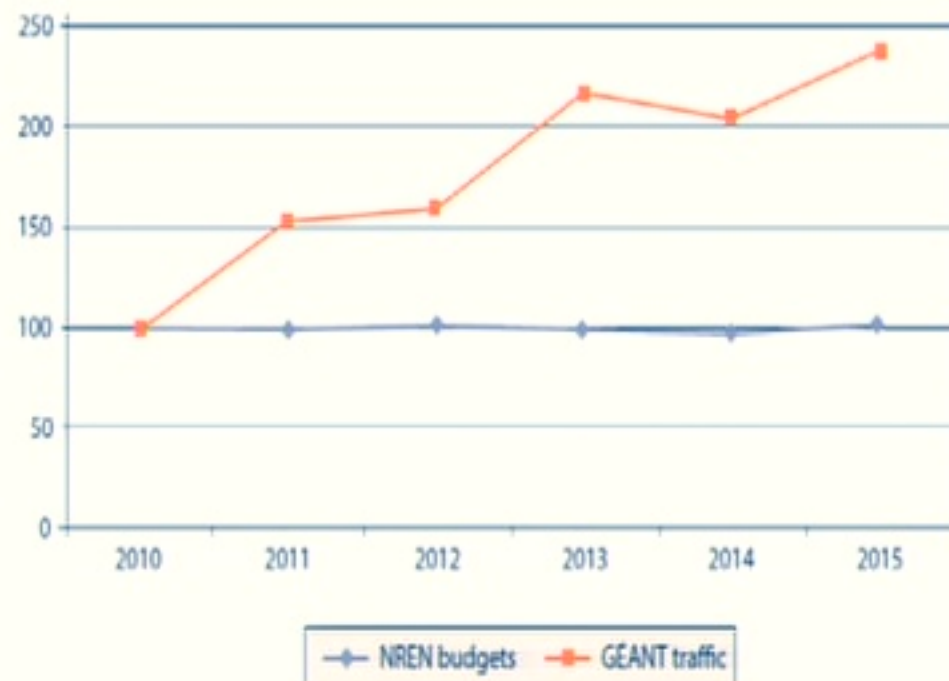


Graph 7.1.1 – Total NREN staff in FTE

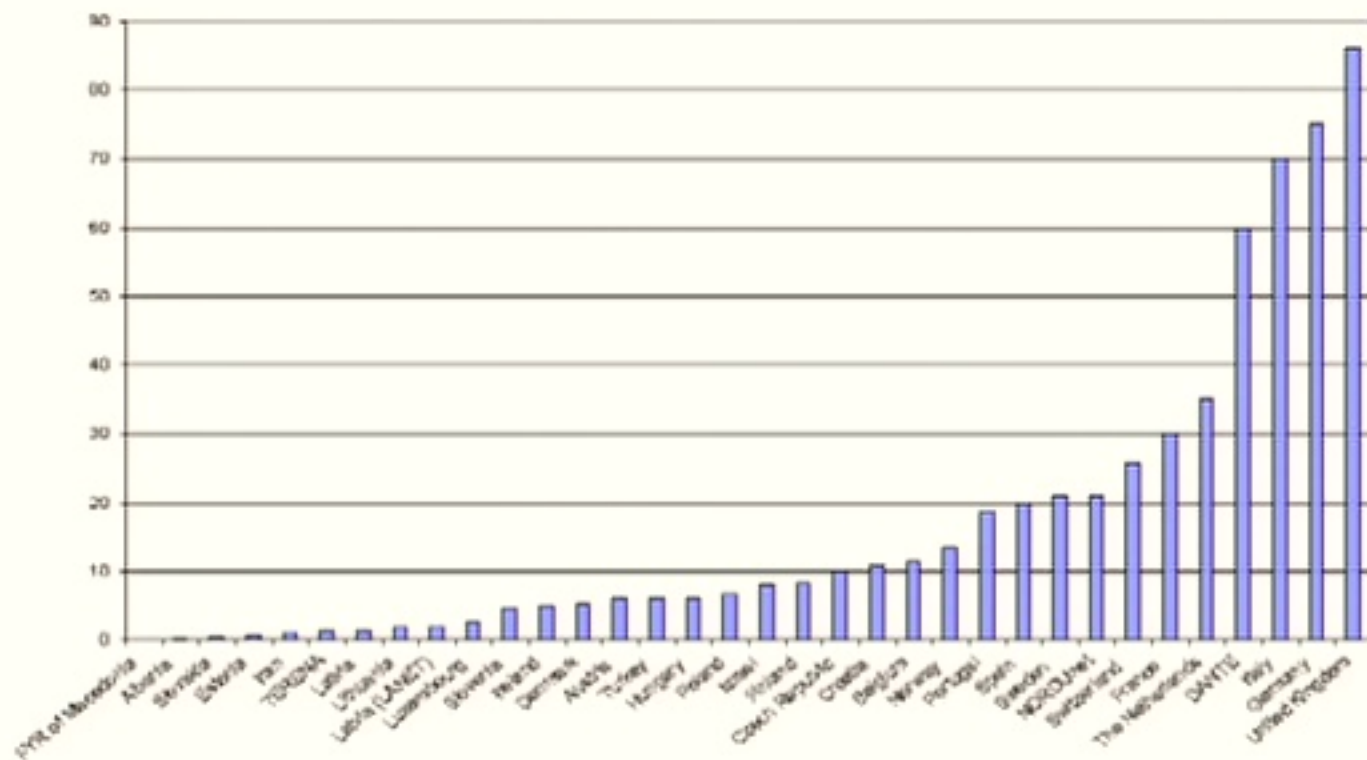


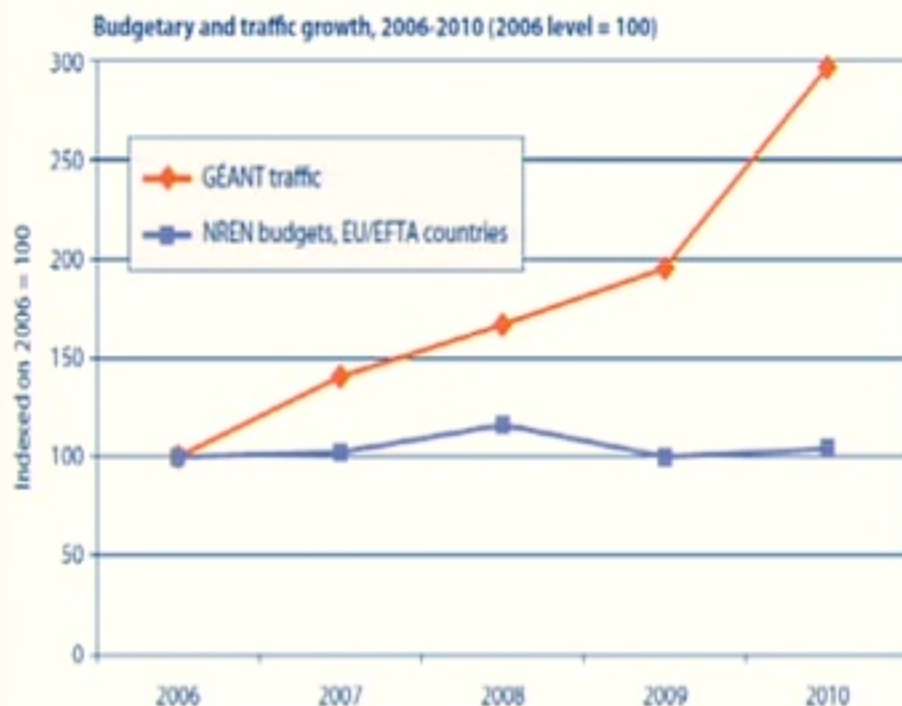


Graph 7.2.4 - Total NREN budgets and traffic, 2010-2015, GÉANT partner countries (indexed on 2010 = 100)

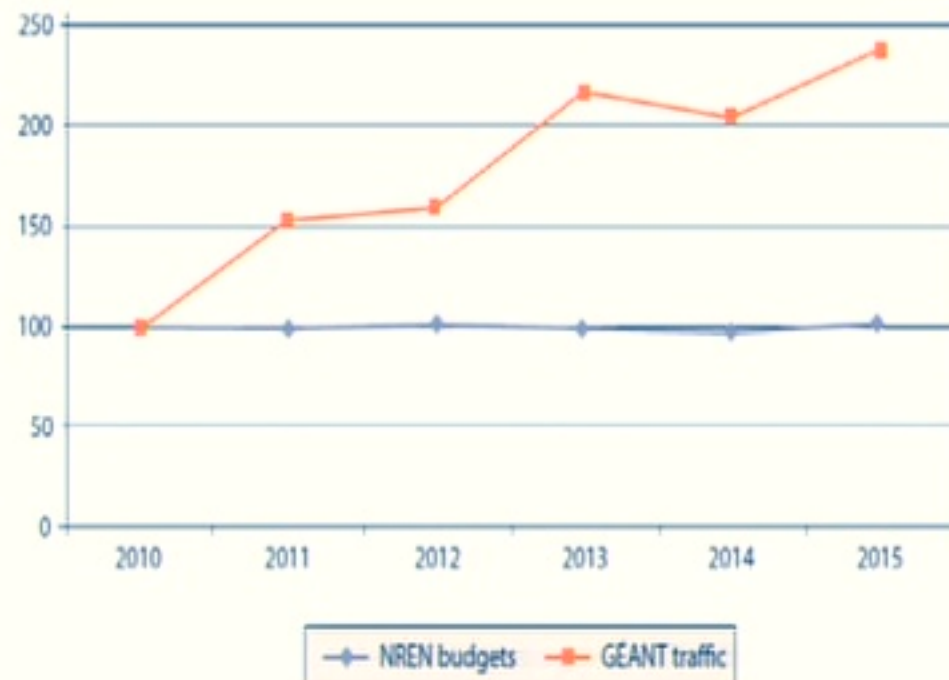


Total NREN budgets in MEUR
graph 30

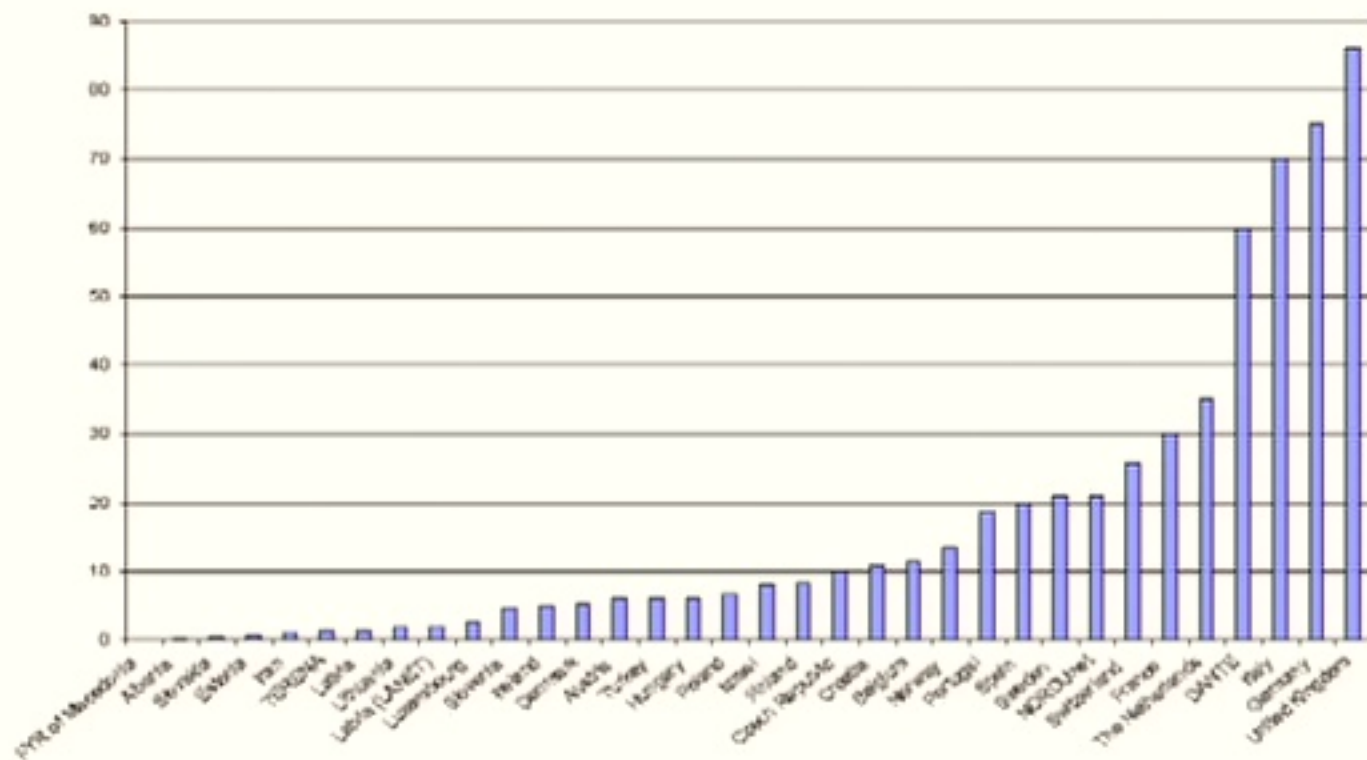




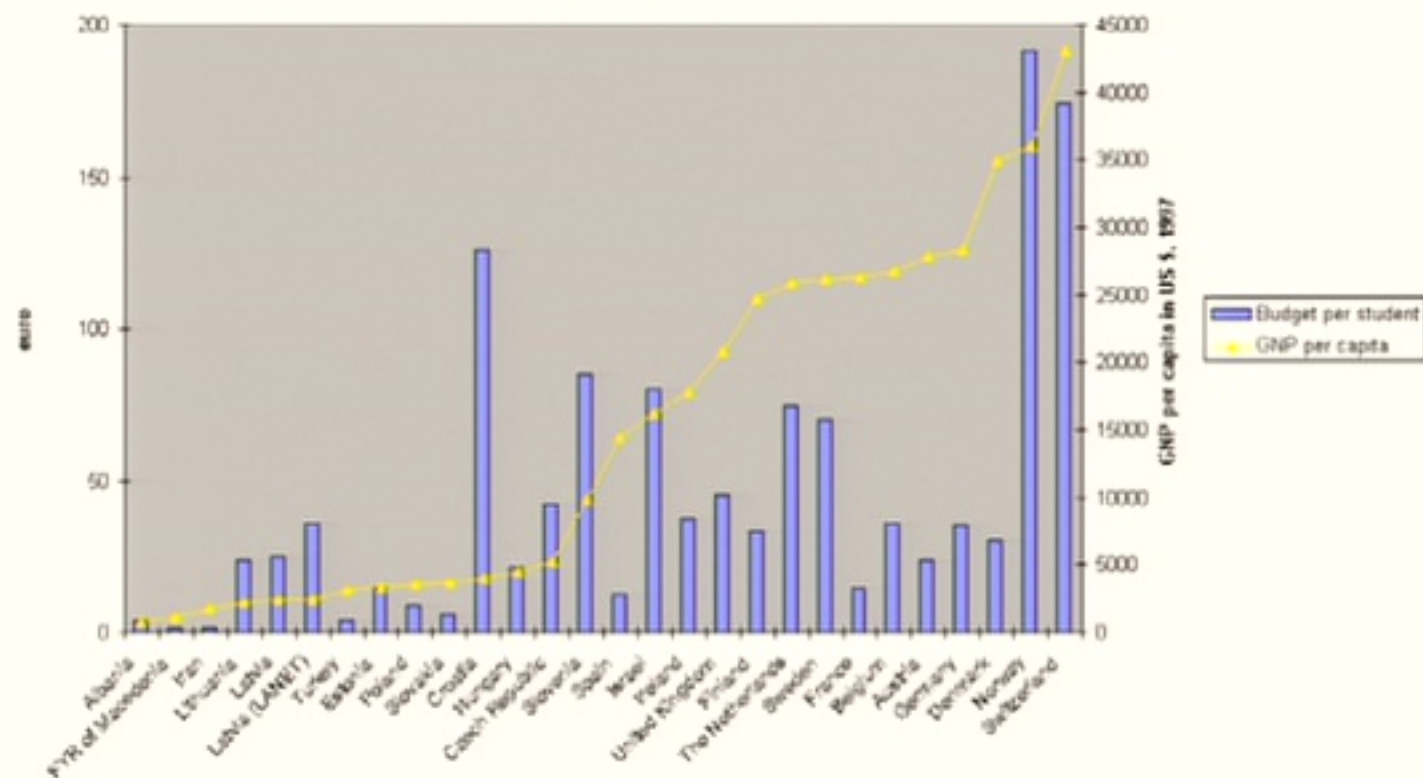
Graph 7.2.4 - Total NREN budgets and traffic, 2010-2015, GÉANT partner countries (indexed on 2010 = 100)



Total NREN budgets in MEUR
graph 10



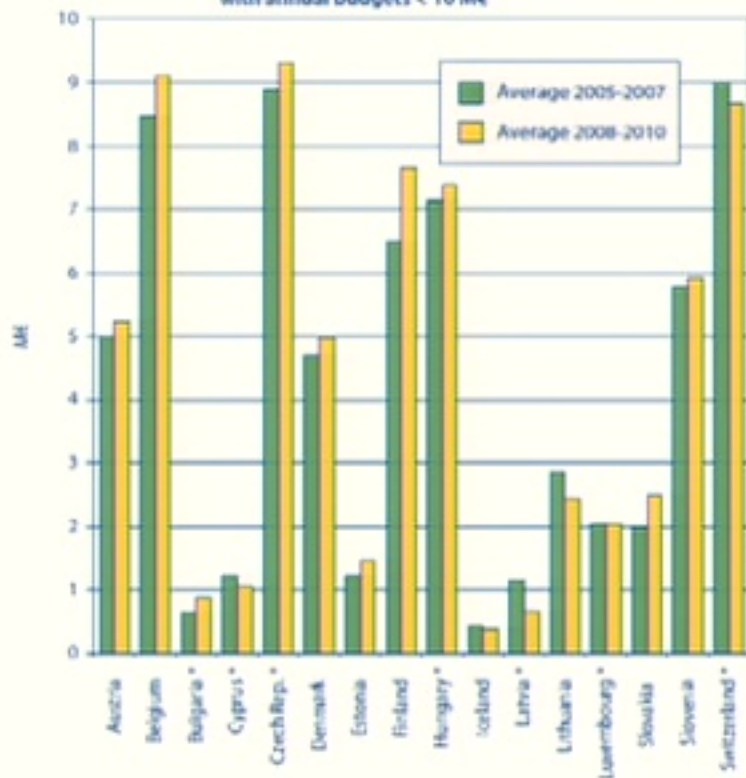
NREN budget per student



Country	Proportion of total budget available for investment	Applications budget	Development budget	Network equipment budget	Other investments budget	Transmission budget
Albania	<25%	<10%	<10%	<10%	<10%	
Austria	<25%			11-25%		>75%
Belgium	<25%			>75%		
Croatia	11-75%	<10%	11-25%	25 - 50%		11-75%
Czech Republic	<25%	<10%	11-75%	<10%	<10%	25 - 50%
Denmark	<25%	<10%	<10%	25 - 50%	<10%	25 - 50%
Estonia	<25%			>75%		
Finland	<25%	11-25%	11-25%	11-75%	<10%	
France	<25%			<10%		>75%
Hungary	<25%	11-25%	11-25%	11-75%	<10%	<10%
Iran	11-75%	<10%	<10%	11-25%		11-75%
Israel	25 - 50%	<10%	<10%	25 - 50%	<10%	11-75%
Israel	<25%	<10%	<10%	11-25%		11-75%
Italy	<25%					
Latvia	25 - 50%			11-25%		
Lithuania	<25%	<10%	<10%	11-25%		11-75%
Luxembourg	<25%	<10%	<10%	<10%	<10%	>75%
PYR of Macedonia	<25%	<10%	<10%	<10%	<10%	>75%
The Netherlands	<25%	11-25%		>75%		
Norway	<25%		11-25%	11-25%		25 - 50%
Poland	25 - 50%	11-25%	11-25%	11-25%	11-25%	11-75%
Portugal			11-25%	>75%		
Slovakia	<25%			<10%		>75%
Romania	<25%					
Spain	<25%	11-25%	<10%	<10%	11-25%	11-75%
Sweden	<25%	<10%	<10%	11-25%	<10%	11-75%
Switzerland	>25%	11-25%	>10%	11-25%	>10%	11-75%
Turkey	>25%	>10%	>10%	>10%	25 - 50%	25 - 50%
United Kingdom		>10%	>10%			11-75%
DANTE	>25%	>10%	>10%	11-25%	>10%	>75%
EUROD/Net	<25%			>75%		

Country	Proportion of total budget that is for recurrent expenditure	From the Government	From the EU	From users	From companies / the commercial sector	From (foreign) foundations or charitable bodies	From other sources
Albania	<2%	>7%					<2%
Austria	>7%	>7%		<2%			
Belgium	>7%	>7%		<2%			
Croatia	27 - 30%	>7%					
Czech Republic	>7%	21-7%	<2%	<2%	<2%	<2%	<2%
CYPRUS	>7%	<2%	27 - 30%		<2%	<2%	<2%
Denmark	>7%	27 - 30%	<2%	21-7%	<2%		<2%
Estonia	>7%	>7%				<2%	
Finland	>7%	21-7%		27 - 30%			
France	>7%		<2%	>7%			
Germany	>7%	<2%		21-7%			<2%
Hungary	>7%	>7%	<2%	<2%	<2%		
Iran	27 - 30%	<2%		>7%			
Ireland	27 - 30%	<2%	<2%	>7%			
Israel	>7%	27 - 30%	<2%	27 - 30%			
Italy	>7%	27 - 30%	<2%	21 - 7%			
Latvia	<2%						
Latvia (LAURE)	11-7%	>7%		<2%			
Lithuania	>7%	>7%		<2%			
Luxembourg	>7%		>7%				
FXR of Mauritius	>7%		>7%				
The Netherlands	>7%	27 - 30%		21-7%			
NEWZEAL	>7%	>7%	<2%				
Norway	>7%	21-7%		27 - 30%			
Poland	21-7%	>7%		<2%	<2%		
Portugal	>7%	>7%			<2%		<2%
Romania	>7%	>7%	<2%	<2%			
Spain	>7%	>7%	<2%				
Sweden	>7%	21-7%	<2%	27 - 30%	<2%	<2%	<2%
Switzerland	>7%	<2%	<2%	<2%	21-7%	<2%	<2%
TAIWAN			<2%	>7%	<2%		<2%
Turkey	>7%	>7%	<2%	<2%	<2%	<2%	<2%
United Kingdom	>7%	>7%		<2%	<2%		

Graph 6.3.2 – Total budgets, 2005-2010 averages, EU/EFTA countries with annual budgets < 10 M€

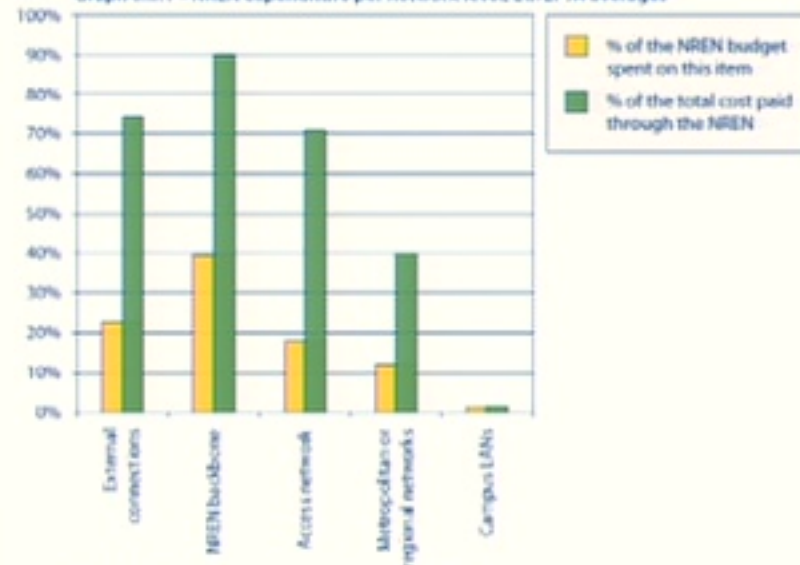


Graph 6.3.1 – Total budgets, 2005-2010 averages, EU/EFTA countries with annual budgets > 10 M€

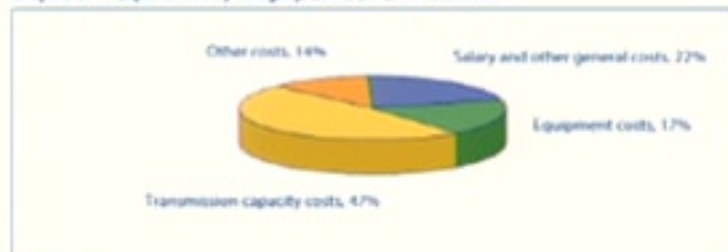


* Budget includes GÉANT subsidy.

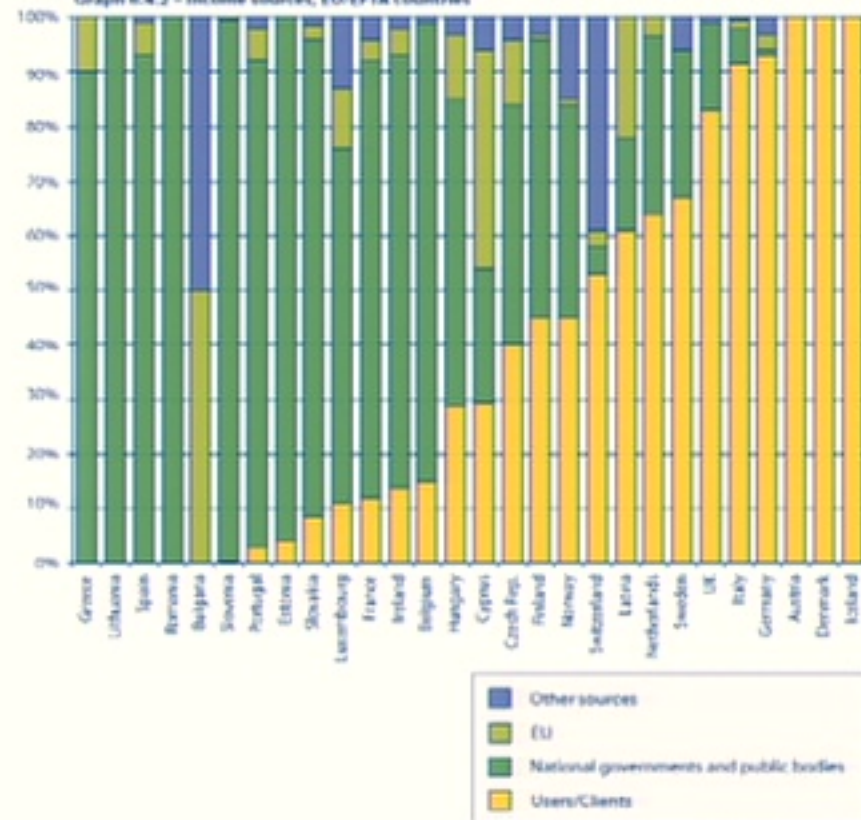
Graph 6.4.1 - NREN expenditure per network level, EU/EFTA averages

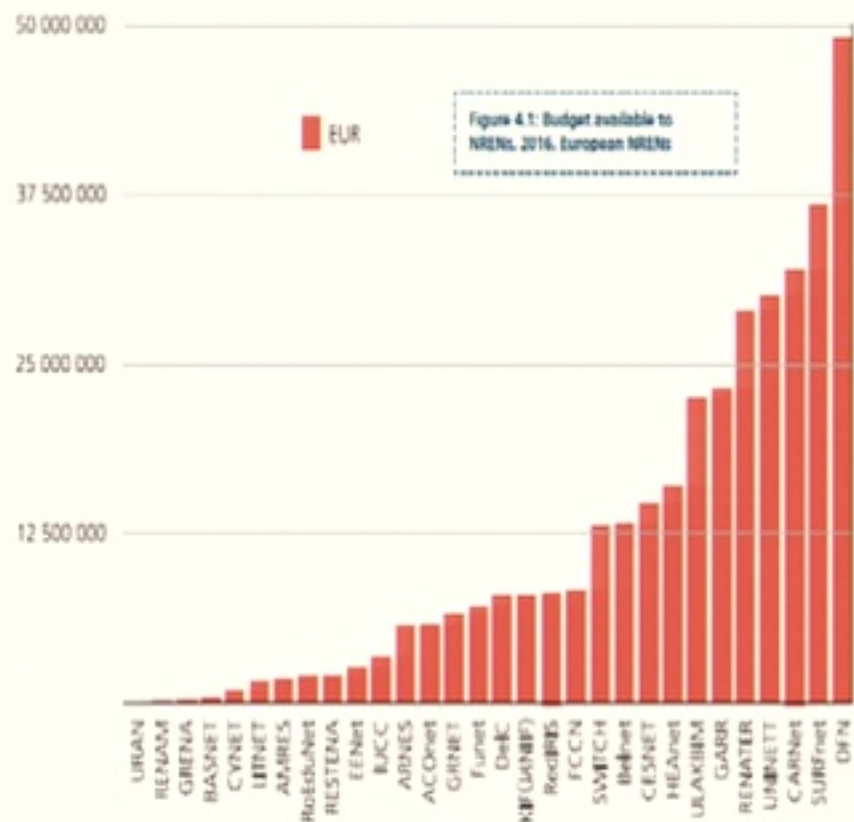


Graph 6.5.1 - Expenditure by category, 2010, EU/EFTA countries



Graph 6.4.2 - Income sources, EU/EFTA countries





	COMMERCIAL	CLIENT INSTITUTION	GOV/PUBLIC BODIES	OTHER EU	OTHER
ACONet		█			
AMRES		█			
AMRES	█		█	█	
AzSciencenet			█		
BASNET		█	█		█
Belnet	█	█	█		
CAINet	█	█		█	█
CEINet		█	█		█
CYNET		█		█	
DeIC		█			█
DFN		█			
EENet		█	█	█	█
FCCN		█			
Furiet		█	█		
GARR		█	█	█	█
GRENA	█	█			█
GRNET		█	█	█	
HLAnet	█	█	█		
ICC		█			█
LITNET		█	█	█	
MBN		█	█		
KIP(GA)IBP		█	█	█	
RedIRIS		█	█		█
RENAM		█	█	█	
RENATER		█	█	█	
RESTENA	█	█	█		
RoEduNet		█	█		
SAINet	█	█	█		
SURFnet		█	█		
SWITCH	█	█	█		
ULAKBIM			█		█
UNINETT		█	█		
URIAN		█			█



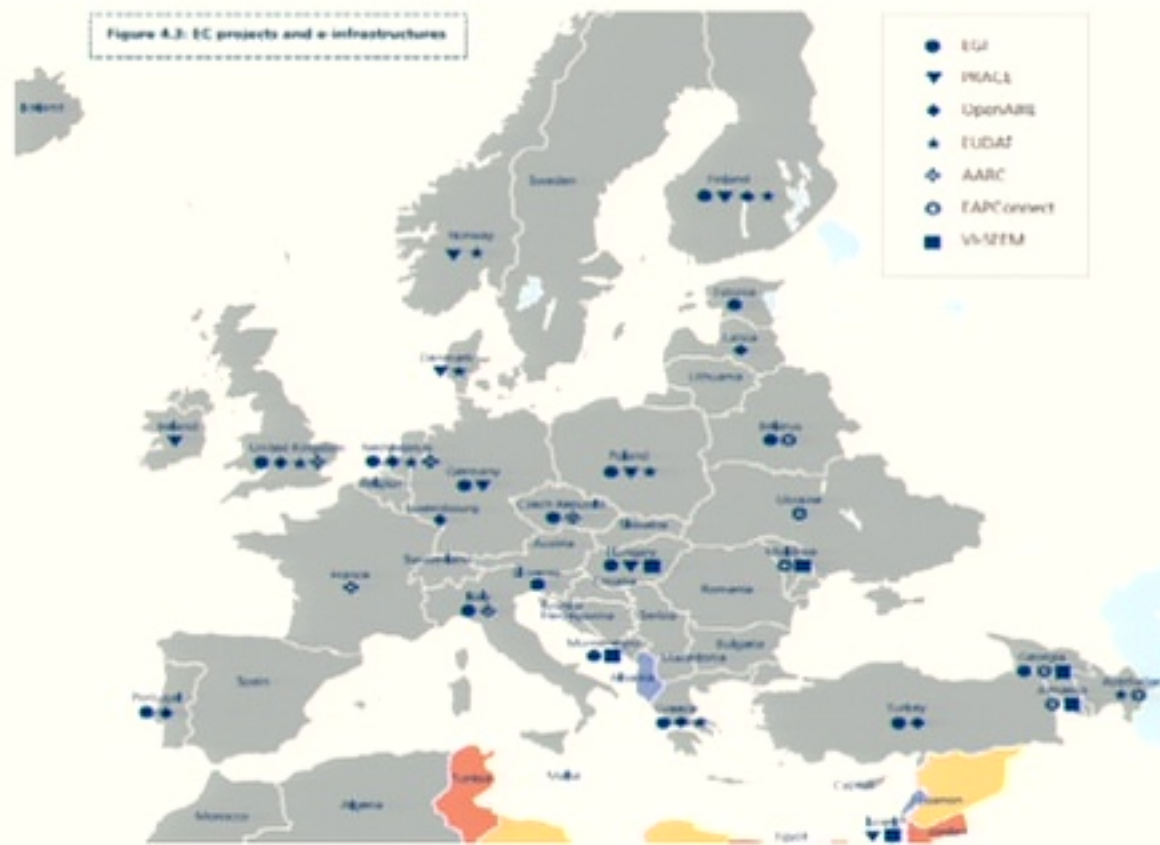
NREN fejlesztési tervek - 2001

Country codes are the ISO codes: AL - Albania, BE - Belgium, HR - Croatia, CZ - Czech Republic, DK - Denmark, EE - Estonia, FI - Finland, FR - France, DE - Germany, HU - Hungary, IR - Iran, IE - Ireland, IL - Israel, LV - Latvia, LT - Lithuania, LU - Luxembourg, MK - FYROMacedonia, NL - Netherlands, PL - Poland, SK - Slovakia, SI - Slovenia, ES - Spain, SE - Sweden, CH - Switzerland, TR - Turkey, GB - United Kingdom.

	Current	Essential future	Potential future development	Will follow other NRENs	No interest
Infrastructure	FR, DE, ES	DE	IL, LT		
SDH	BE, CZ, DK, FR, HU, IE, LV, NL, SI, ES, SE	AL, BE, MK, ES	HR, TR	FI, LV, PL	EE, IR, IL, CH, GB
SDM	CZ, DK, FI, FR, DE, NL, PL, SE, CH, GB	BE, HR, FR, DE, HU, IE, LT, PL, ES, SE, SI	TR	AL, EE, IR, MK	IL
Optic Ethernet	BE, CZ, DK, FI, FR, IR, IE, LV, NL, PL, SI	AL, HR, EE, FR, HU, LV, LT, PL, ES, SE	LT	MK	IL, CH, TR
Optical Terrestrial access	FI, FR, DE, NL, PL, GB	BE, HR, CZ, EE, DE, HU, LV, PL, ES, SE	DK, IR, IE	AL, MK, CH	IL, TR
Wireless LAN	AL, HR, CZ, DK, EE, LV, NL, SI, SE	FI, DE, LT, SE, CH	BE, FR, HU, IR, IE, MK, PL, ES, GB		IL
DiffServ/QoS	CZ, DK, FR, DE, HU, IE, IL, NL, PL, SI, ES, CH, GB	BE, EE, FI, FR, DE, IL, LT, MK, PL	IR, IE, LV, SE, TR	AL, HR, MK	
IPv6 Development	FI, FR, DE, HU, IR, LV, NL, PL, SI, ES, GB	FR, DE, LV, PL, SE	AL, CZ, DK, EE, IE, SK, CH, TR	HR, IL, MK	BE
IPv6 Service Implementation	AL, BE, CZ, FR, DE, LV, NL, PL	AL, BE, FR, DE, HU, IR, LT, PL, SK, ES	DK, EE, FI, IE, LV, SE, CH, TR	HR, IL, MK, GB	
Middleware		FR, DE	FR		
User authentication	CZ, FI, FR, HU, LV, NL, PL, SI, ES, SE, CH	FR, DE, IR, IL, LV, LT, MK, PL, SE	HR, DK, FR, IL, GB	AL, EE	BE, TR
Directory Services	BE, CZ, DE, HU, LV, LU, NL, PL, SI, ES, CH, TR	HR, FI, DE, MK, PL, SK	AL, DK, EE, IR, LT, GB	FR	IE, IL
Caching/Loadbalancing/Mirroring	AL, BE, HR, CZ, EE, HU, IR, IE, IL, LV, NL, PL, SK, SI, ES, CH, TR	AL, LT, MK, PL	DK, FR, SE	FI	GB
Multicast	BE, HR, CZ, DK, FR, DE, HU, IE, IL, LV, NL, PL, SI, ES, SE, CH	AL, EE, DE, LT, MK, PL, SE, GB	TR	FI, IR	
Mobile Access (persistent presence)	LV, NL	HR, FI, PL, CH, GB	AL, BE, CZ, DK, EE, FR, HU, IE, ES, IR, MK		IL, TR
Security	FR, DE	FR, DE	FR		
CERT services	AL, HR, DK, EE, FI, FR, DE, HU, IR, IE, IL, LV, LU, NL, PL, SI, ES, CH, GB	CZ, DE, MK, PL	LT, SK	IE	BE, TR
CERT incident coordination	AL, BE, HR, DK, EE, FI, FR, DE, IL, LV, NL, PL, SI, ES, CH, GB	CZ, DE, HU, LT, MK, PL	IR, IE, SK	FR	TR
Application level			FR		
Teaching and learning methods	AL, HR, CZ, DE, HU, LV, LU, NL, PL, ES, SE	EE, DE, IR, IL, LT, MK, PL, SK	FR, IL, LT, SE, GB	FI	BE, DK, CH, TR
Video Conferencing	BE, HR, CZ, DK, FI, FR, DE, HU, IE, NL, PL, SI, ES, SE, CH, TR, GB	AL, DE, IL, LV, LT, PL, SE	EE, IR, LT, MK, SK		
Streaming Media	BE, HR, CZ, DK, FI, DE, IE, LV, LU, NL, PL, SI, ES, SE, CH, TR, GB	DE, HU, IL, LT, MK, PL, SE	AL, EE, FR, LT	IR	
Management	FR, DE	DE			
Capacity planning / statistics	HR, CZ, DK, EE, FI, DE, HU, IR, IE, IL, LV, LU, NL, PL, SK, SI, ES, SE, CH, TR, GB	AL, DE, LT, MK, PL, SE	FR		
Web Server management	AL, EE, HU, IR, IL, LV, NL, PL, SK, ES, TR, GB	CZ, IL, LT, MK, PL	DK	HR	FI, FR, SE, CH
Web Server usage analysis	AL, DK, EE, HU, IR, IR, LV, NL, PL, ES, TR, GB	CZ, IL, MK, PL		HR	FI, FR, SE, CH
Information Center management	EE, FR, LV, PL, ES, TR, GB	AL, HU, IR, IL, LV, MK, NL, PL	IE, SK, SE, CH	HR	BE, DK, FI
Others	CZ, VIP	PL: High performance routing; Optical switching using MPLS and/or optical BGP			



Figure 4.3: EC projects and e-infrastructures



Tanulságok, következtetések, jövőkép:

- Izgalmas, tanulságos, bizonyító erejű történet
 - Építkezés alulról
 - Felkészültség
 - Kapcsolatrendszer
 - Tapasztalatok
 - Szolgáltatási spektrum
 - Rugalmasság
- Európai és nemzeti felelősség és szerep mindenhol



Köszönöm a figyelmet ...

**... és kívánok minden résztvevőnek
kellemes és tanulságos lapozgatást
az NREN-ek családi fotóalbumában!**

www.geant.org/Resources/Pages/Compendium.aspx

Bálint Lajos
KIFÜ
balint.lajos@kifu.gov.hu
www.kifu.gov.hu