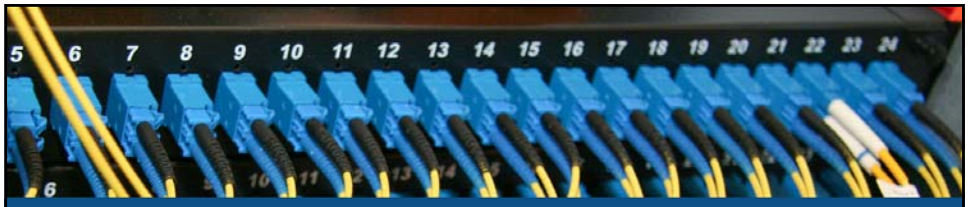

Dedicated virtual Network Infrastructures - for the Health Sector (and the rest of us)

- The next big wave?

QUESTnet 2011 Conference, Gold Coast, Queensland
Deputy Director Martin Bech, UNI•C / Forskningsnettet.dk
martin.bech@uni-c.dk

July 14th, 2011

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A few figures about Denmark

- **5,5 million inhabitants**
  – like Victoria
- **Area of 43,098 km²**
  – ⅔ of Tasmania
- **7,300 km coast line**
  – number 17 in the world
- **443 islands (76 inhabited)**
  – but that's no match for Australia

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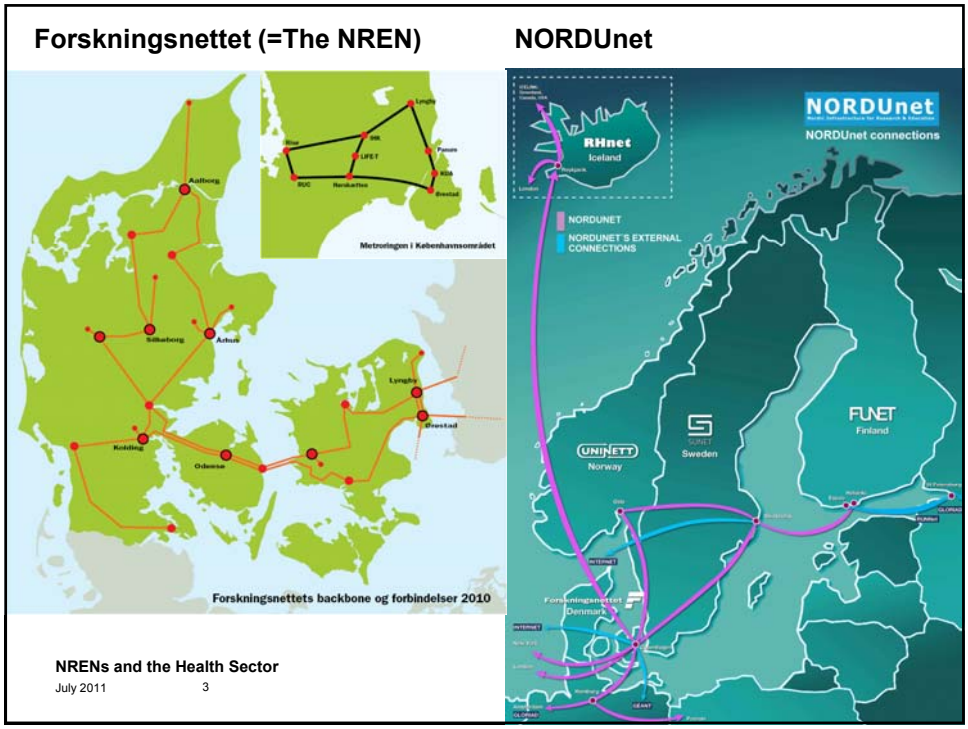
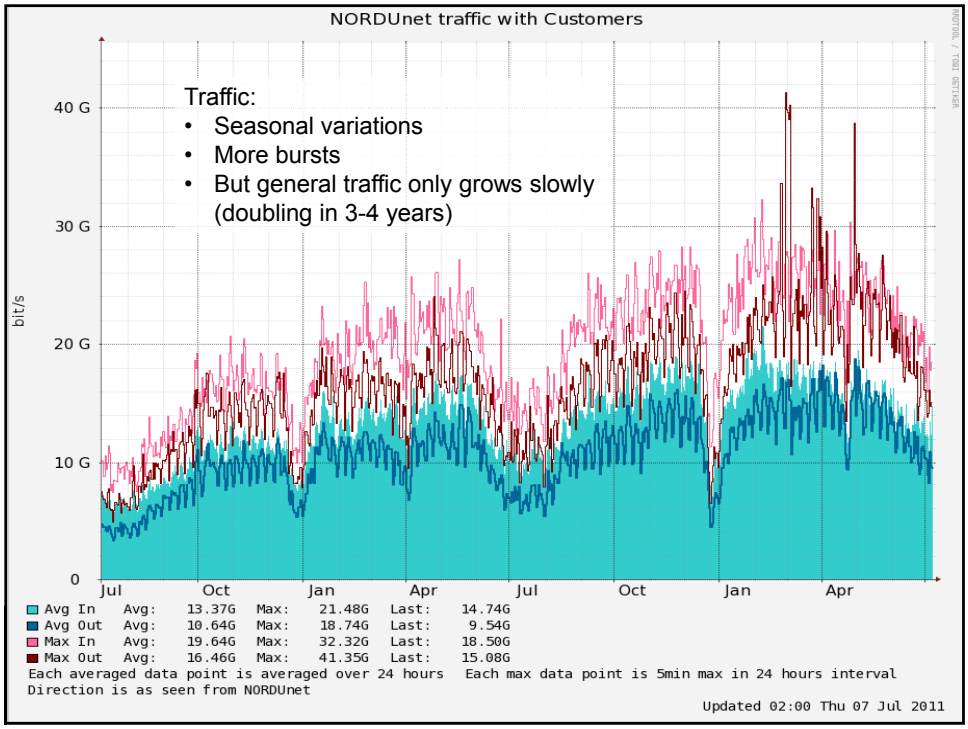
Titel på slide





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Why is our traffic not growing like the general Internet?

The growth is a result of two movements:

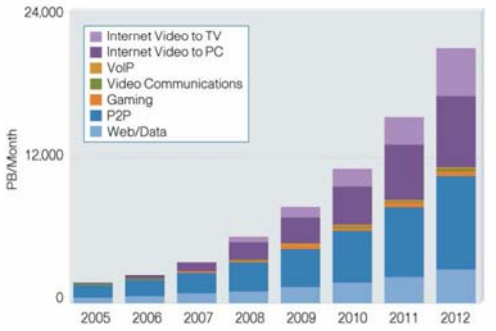
- Existing internet users use more bandwidth
- New users join or start using new applications

A plausible hypothesis:

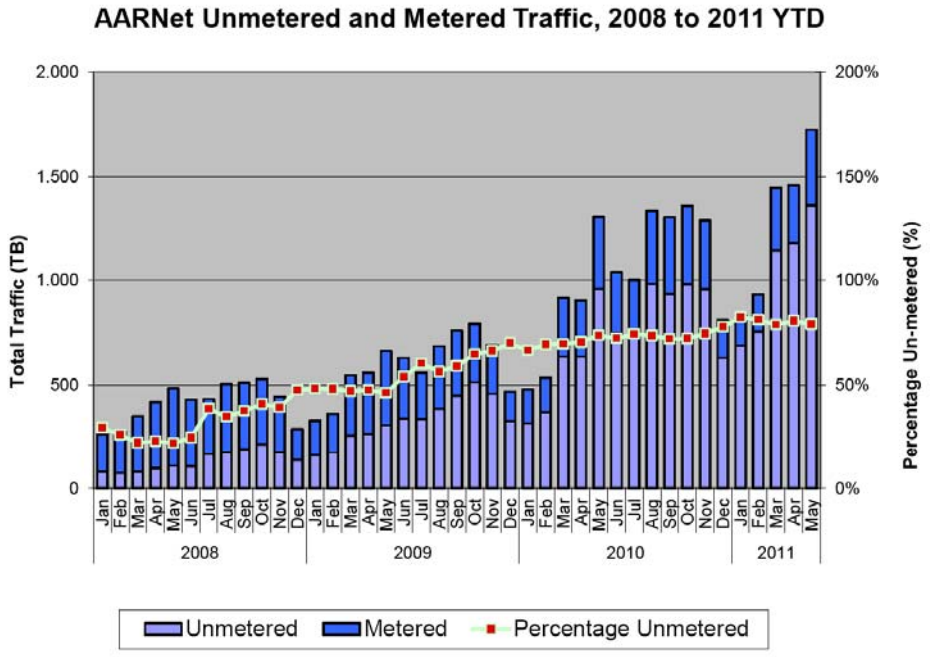
- In the NRENs, we have run out of new users

Figure 2 shows the components of consumer Internet traffic growth. Of the 20 exabytes per month of consumer Internet traffic that will be generated every month in 2012, nearly 50 percent is due to Internet video.

Figure 2. Cisco's Global Consumer Internet Traffic Forecast



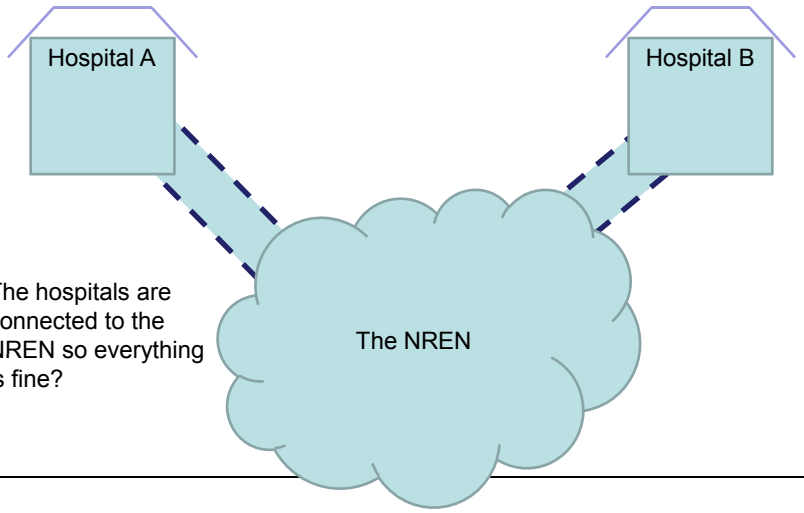
Source: Cisco, 2008



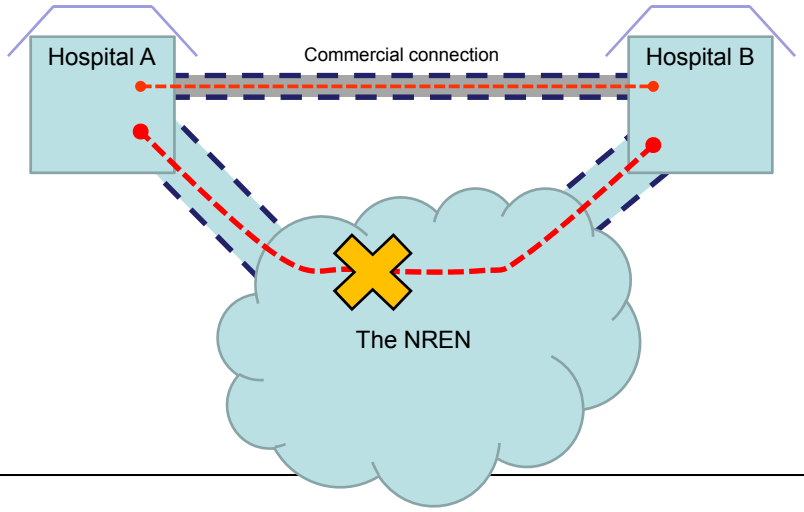
Users of the NREN

	Forskningsnettet (DK)	AARNet
Universities	Yes	Yes
State research institutions	Yes	Yes
Private research	Some	No
University Hospitals	Yes	1
Local hospitals	A few	Still none
Government administration	Scattered	Few
Student residences	Yes	Yes
Trade schools/ Vocational schools	Majority	Few
Schools	Yes – but separate network	Independent schools

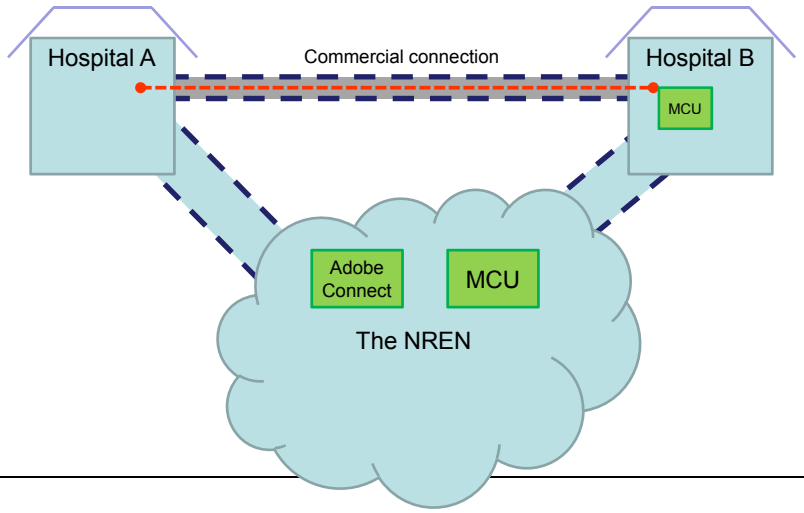
Hospitals and the NREN: Internet connection



Hospitals and the NREN: Data transfer



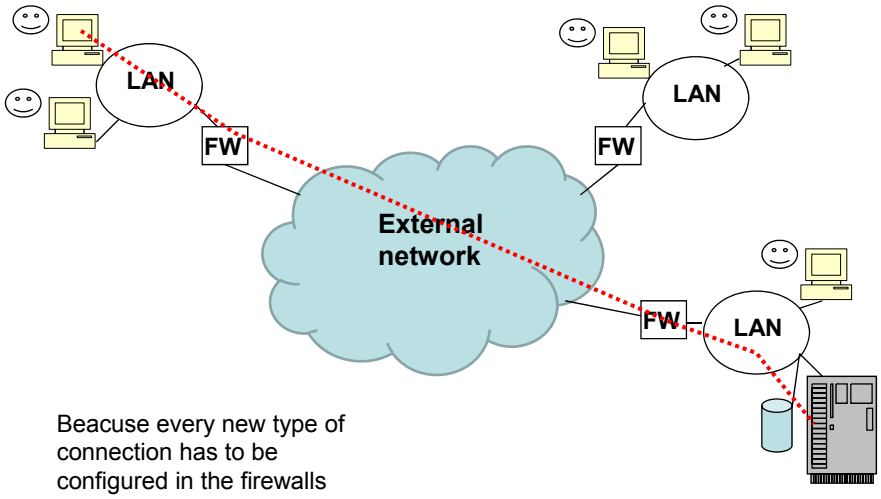
Hospitals and the NREN: Services



NRENs provide a lot of services…

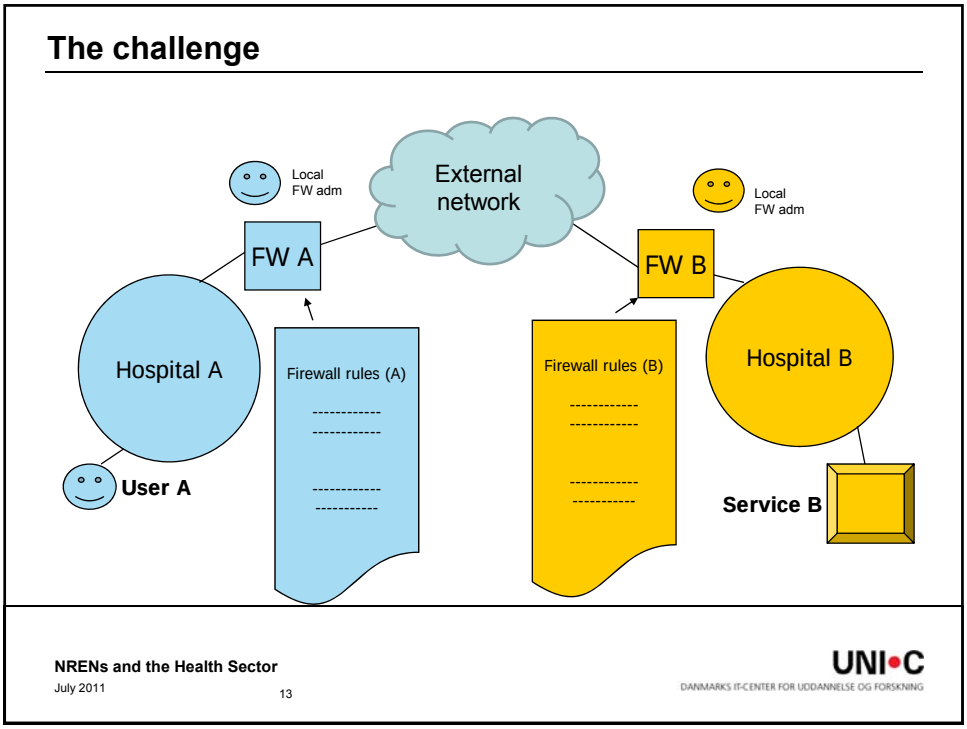
	Universities and research institutions	Hospitals
Basic Internet connectivity	Yes	Yes
Point-to-point connections	Yes	
Video conferencing	Yes	
Collaboration tools	Yes	
UCLP-type connections	Yes	
IPv6	Yes	
Roaming services	Yes	
CERT and security	Yes	
GRID and Scientific Computing	Yes	
Media Libraries	Yes	

Why are they not just using the NREN?



Beacuse every new type of connection has to be configured in the firewalls

The challenge



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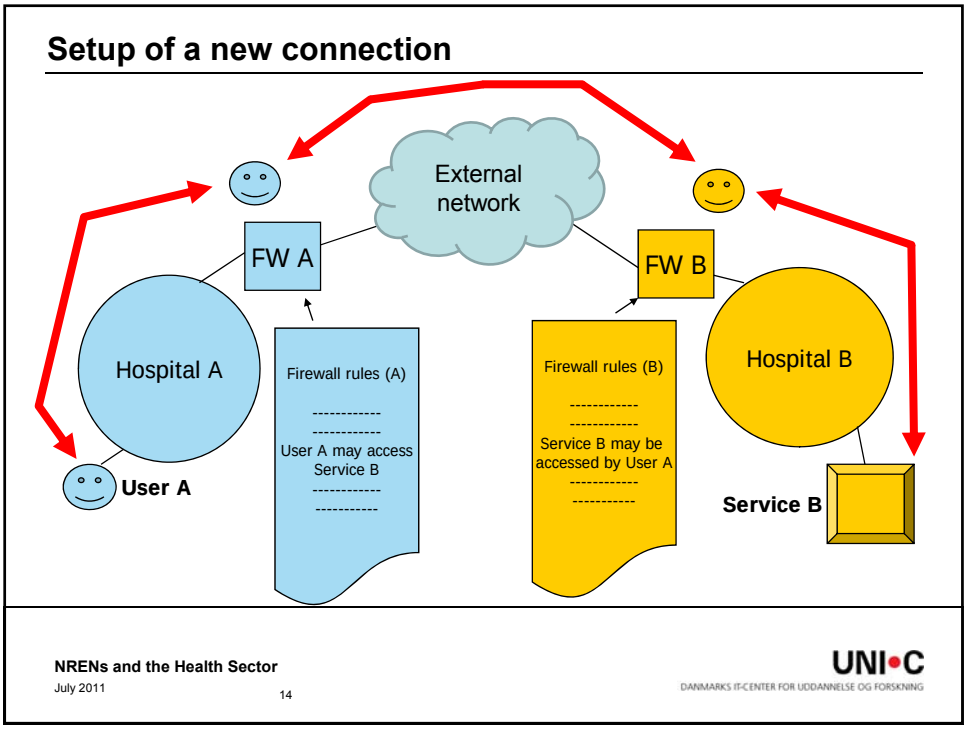
Setup of a new connection



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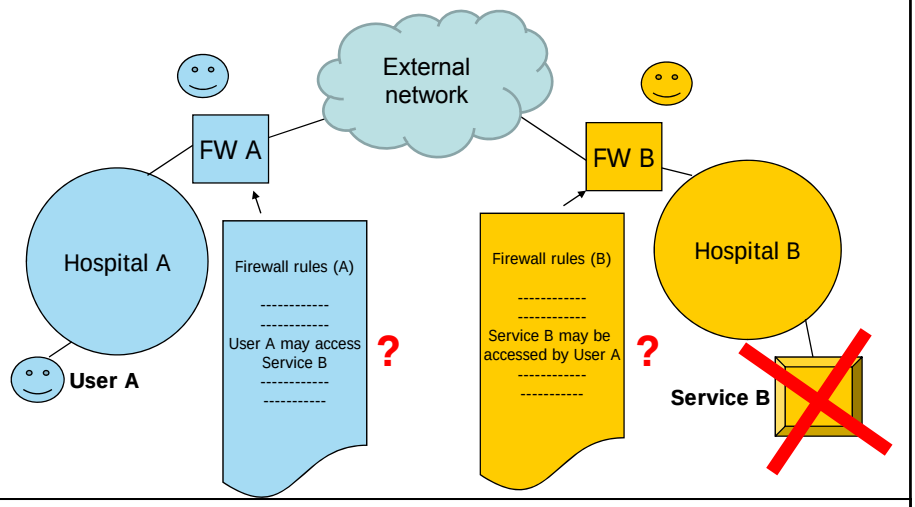
Expiry of a connection?



Manual administration

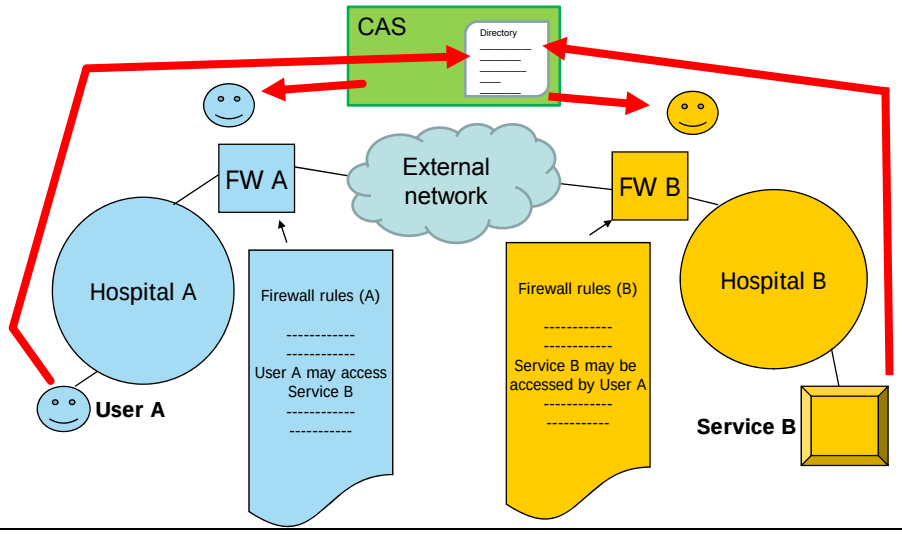
- No problem for a single example such as this
- But, if a national network contains 50 firewalls and just 10 common services are to be used across every unit, the total number of rules is 12.250
- Most firewall administrators can't say who is responsible for every rule

Therefore: We need a system to keep track of all these connections

The Connection Agreement System (CAS)

- All groups of users and all services are put into the system by the users
- User A finds Service B in a large directory
- User A enters a request for a connection to system B
- Both User A and the administrator of Service B accepts the connection in the system
- The system generates rules which the fírewall administrators put into their firewalls

The Connection Agreement System (CAS)



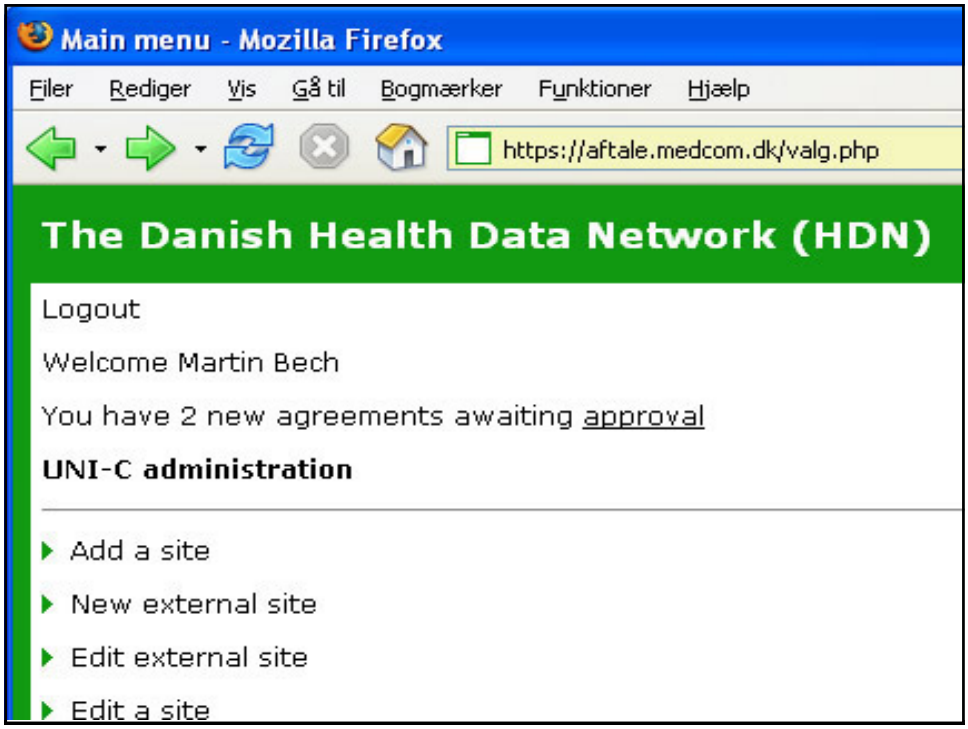
The connection agreement system

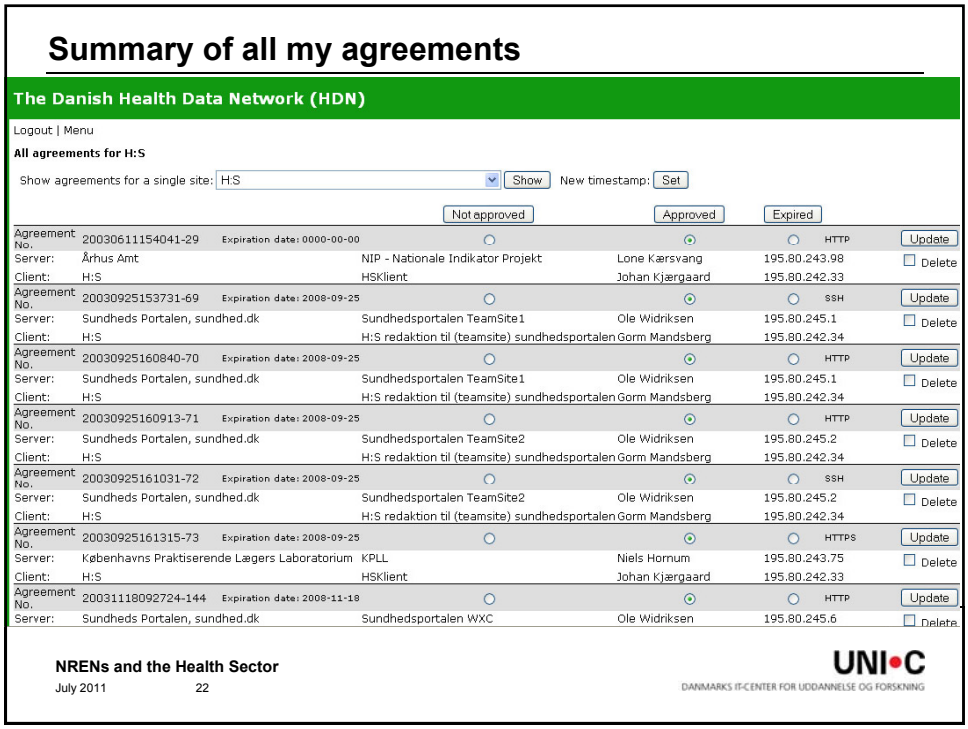
- Everybody can find the services they need – and each other
- Eliminates the need for administering a huge number of VPN tunnels
- Establishes documentation of who ordered what connection and how long it is supposed to exist
- Simplifies security administration
- A simple and inexpensive solution to a problem that is common to all nation-wide health care systems

The technology works: In production since 2003!

- The nation-wide Danish Health Data Network is based on the Connection Agreement System
- The idea has been adopted by a number of health networks, most prominently the Swedish health network, Sjunet and the Norwegian health network, but the actual system was replaced by other solutions
- Several other countries and regions are considering implementing the Connection Agreement System

Titel på slide





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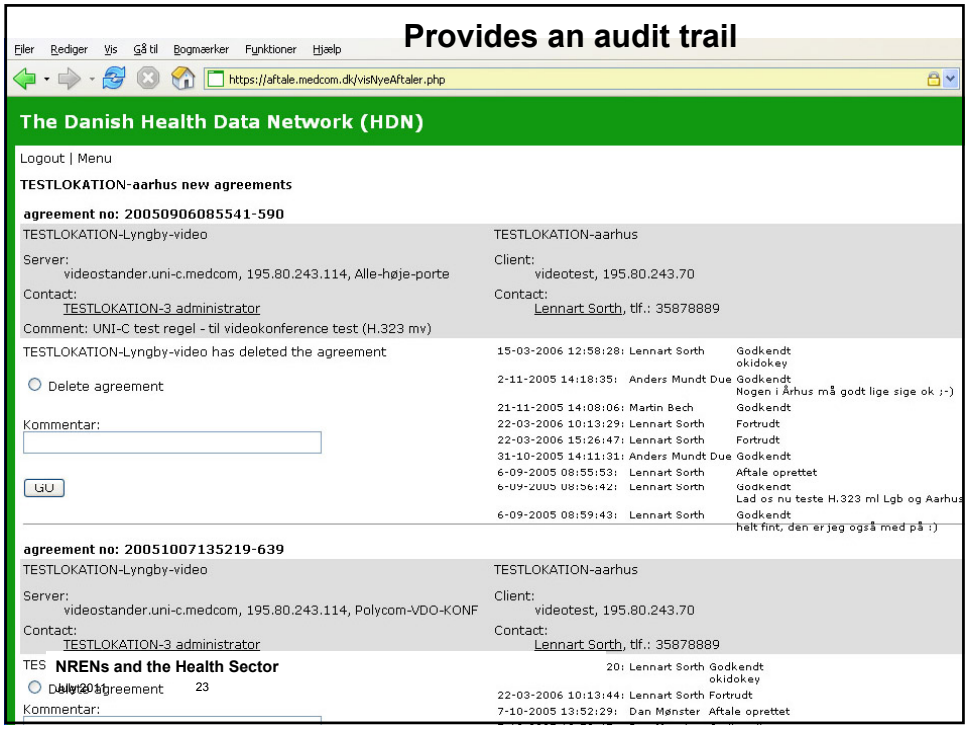
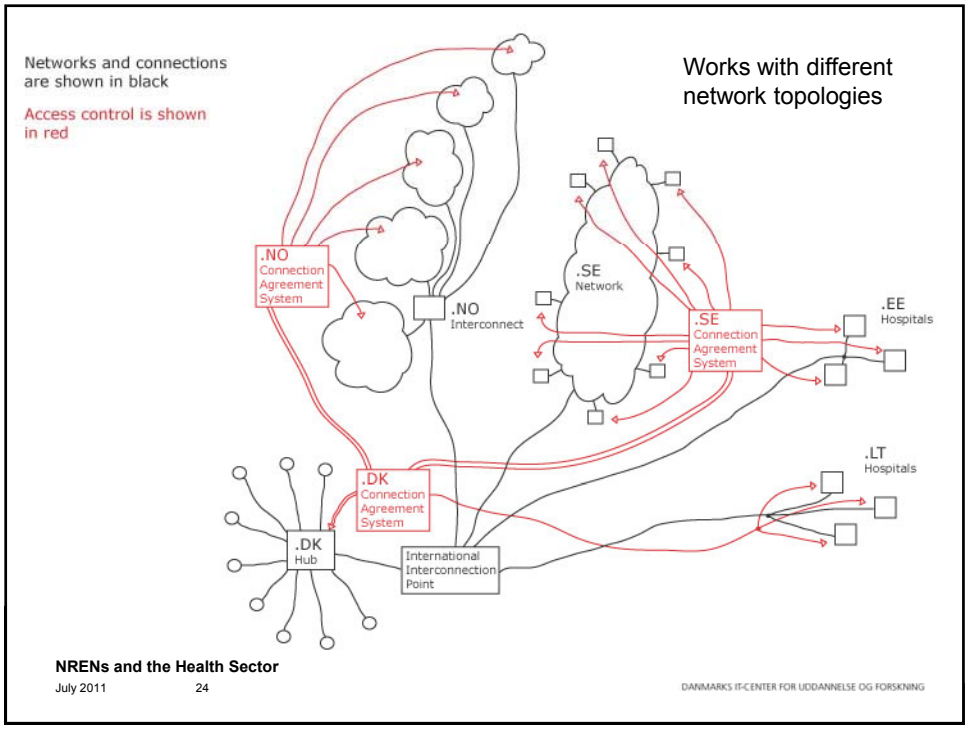
Titel på slide





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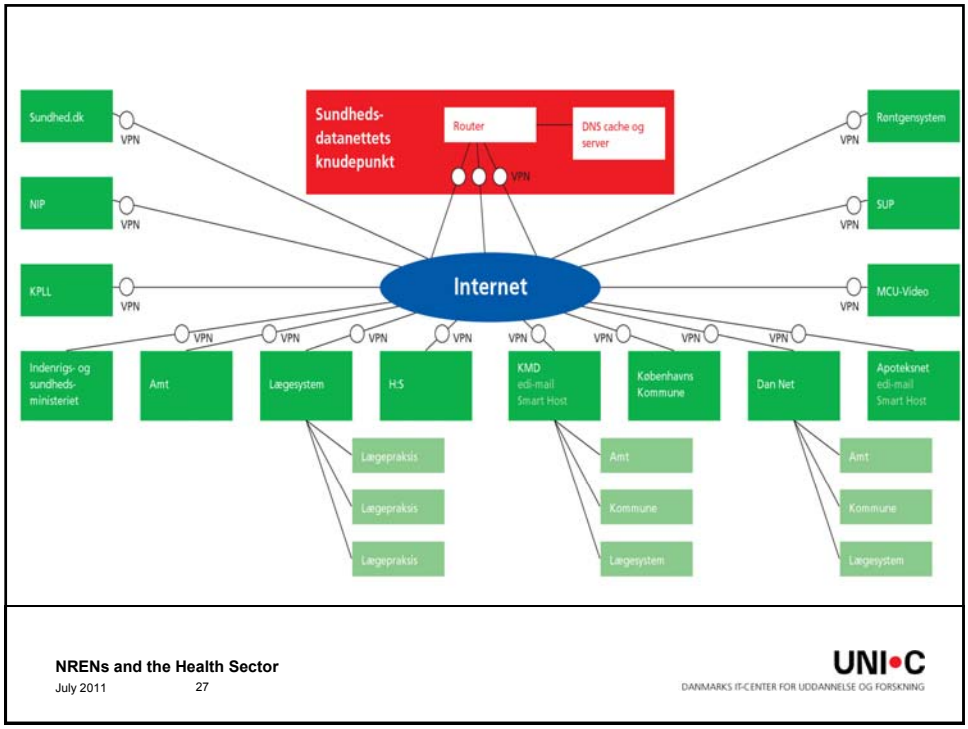
What does the health sector use the Health network for?

- All sorts of research projects
- Overseas connections
- Video conferences
- Service providers
- External labs
- Equipment service partners
- And indeed for health care, too…

MedCom
Center for Sundheds-telematik

Internet project: Services

- Web accesss
- Teleconsultation
- Videoconference
- Collaboration Platform
- National Health Portal


Sundhed.dk
NIP
KPLL
Sundheds-datanettets knudepunkt
Router
DNS cache og server
VPN
Internet
Røntgensystem
SUP
MCU-Video
Indenrigs- og sundheds-ministeriet
Amt
Lægesystem
H:S
KMD edi-mail Smart Host
Københavns Kommune
Dan Net
Apoteksnet edi-mail Smart Host
Lægepraksis
Lægepraksis
Lægepraksis
Amt
Kommune
Lægesystem
Amt
Kommune
Lægesystem
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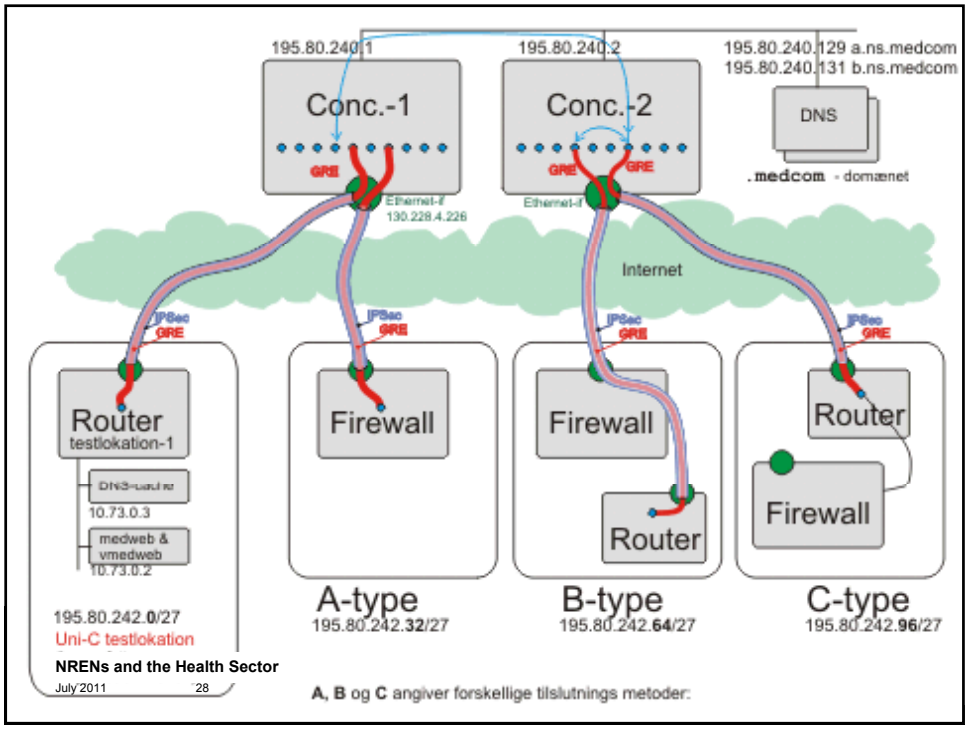
195.80.240.1
195.80.240.2
195.80.240.129 a.ns.medcom
195.80.240.131 b.ns.medcom
Conc.-1
Conc.-2
DNS
.medcom - domænet
GRE
Ethernet-if
130.228.4.226
Internet
IPSec
GRE
Router
testlokation-1
10.73.0.3
medweb & vmedweb
10.73.0.2
Firewall
Router
195.80.242.0/27
Uni-C testlokation
A-type
195.80.242.32/27
B-type
195.80.242.64/27
C-type
195.80.242.96/27
A, B og C angiver forskellige tilslutnings metoder:
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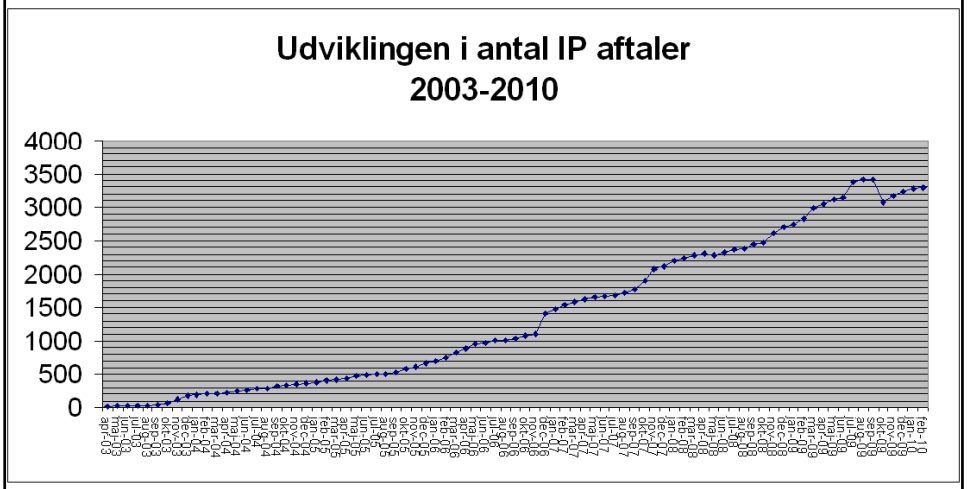
The connection agreements



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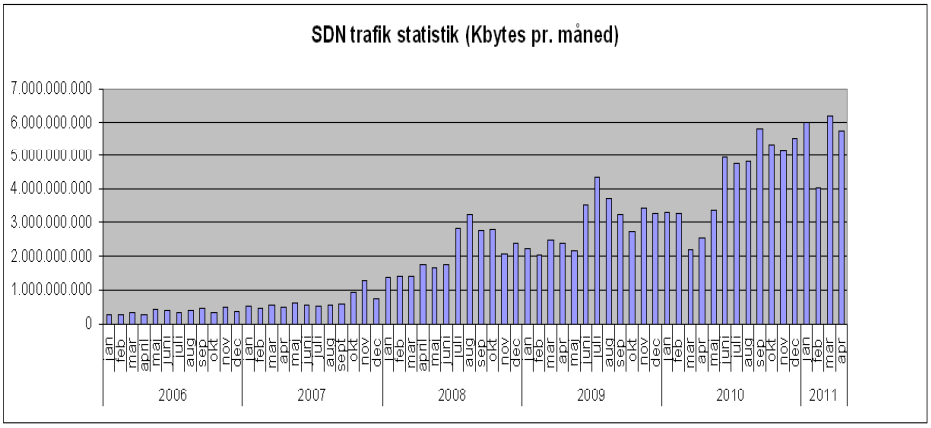
Traffic volumes



SDN-trafikstatistik_0411

Tilbage

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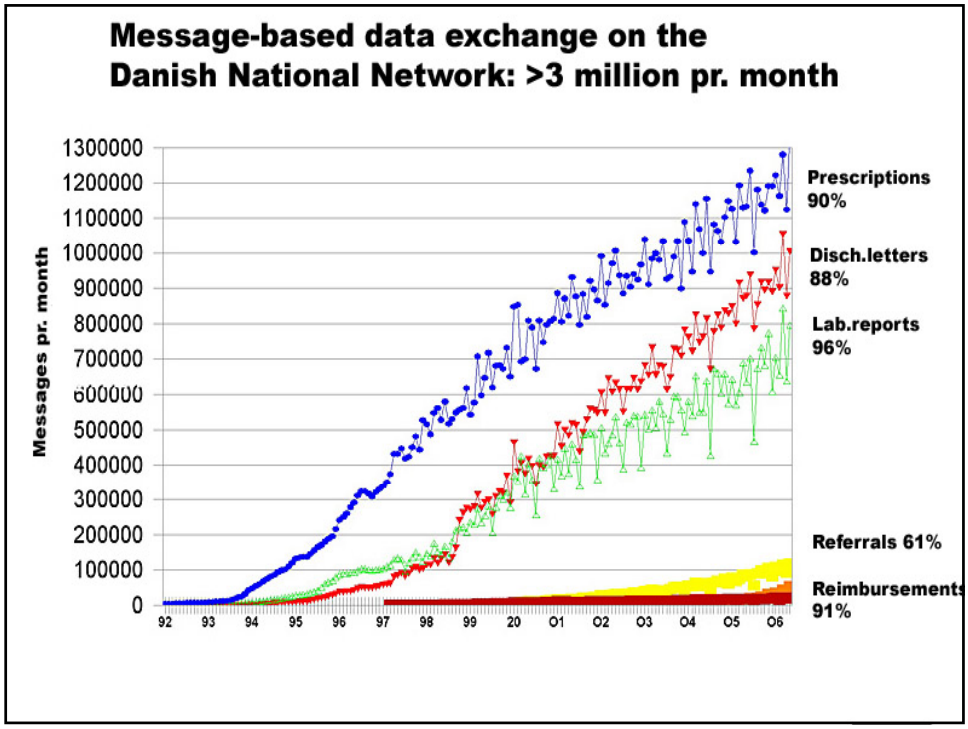


Direct benefits for the health sector

- Access to a network infrastructure far superior to what they used to have
- A lot of the barriers inhibiting collaboration are gone
- Sharing any ressource is now only a question of authorization – not a technical problem
- Cheaper, safer, more secure and better documented network usage
- A more efficient market for service providers
- The network compensates for shortage of specialists

NRENs provide a lot of services…

	Universities and research institutions	Hospitals
Basic Internet connectivity	Yes	Yes
Point-to-point connections	Yes	
Video conferencing	Yes	
Collaboration tools	Yes	
UCLP-type connections	Yes	
IPv6	Yes	
Roaming services	Yes	
CERT and security	Yes	
GRID and Scientific Computing	Yes	
Media Libraries	Yes	

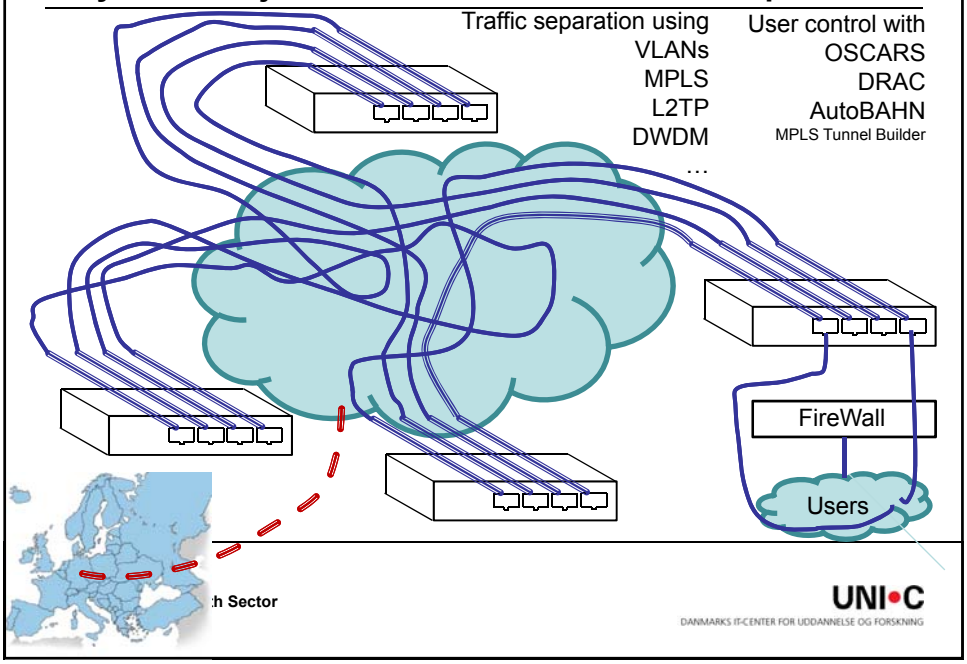
The Health Data Network provides:

	Hospitals
Basic Internet connectivity	No
Video conferencing	Yes
Collaboration tools	Yes
Lambda networking	Not yet
IPv6	If needed
Roaming services	Yes
CERT and security	Yes
GRID and Scientific Computing	Yes
Media Libraries	Yes

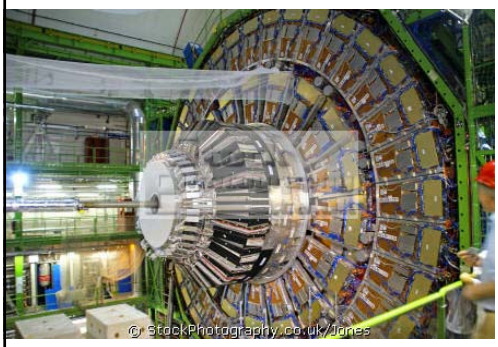
Why separate traffic using CAS when we have layer 1,2,…?

- What about suppying each connection in a port on the CPE switch/router and the use whatever technology you have available to separate the traffic in the backbone infrastructure?
- Then you would also need something provide a user interface to control the connections: DRAC (like in Canarie and SURFnet), OSCARS (like in the USA), Cisco and other MPLS vendors supply software to control MPLS installations, AutoBAHN (like in GN3)

Why don't we just use the network for traffic separation?



Can we generalize this approach?



Mega-science has it all:

- **Separate λ-connections**
- **Dedicated GRID-clusters**
- **Services hardened to tolerating being directly on the internet**

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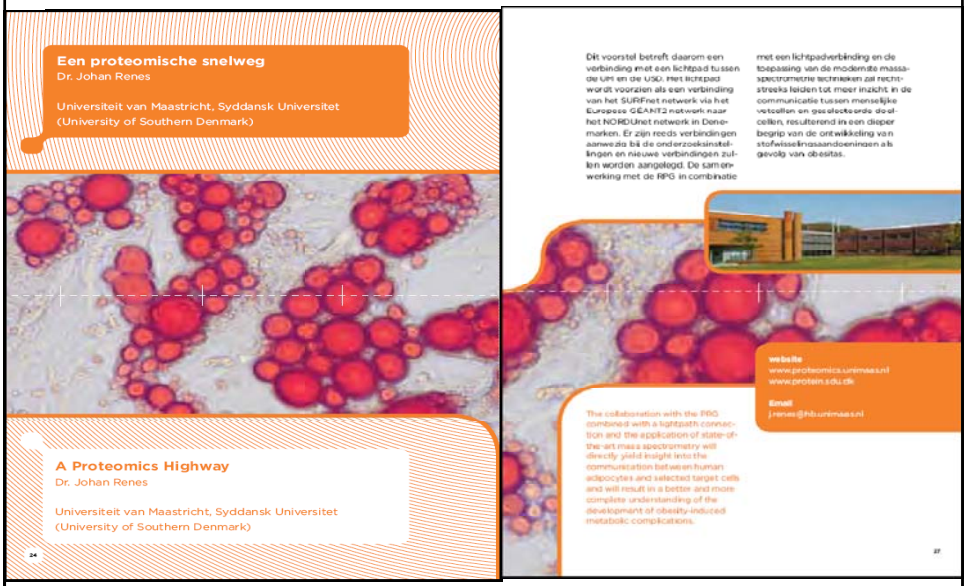
What do researchers with more modest budgets do?



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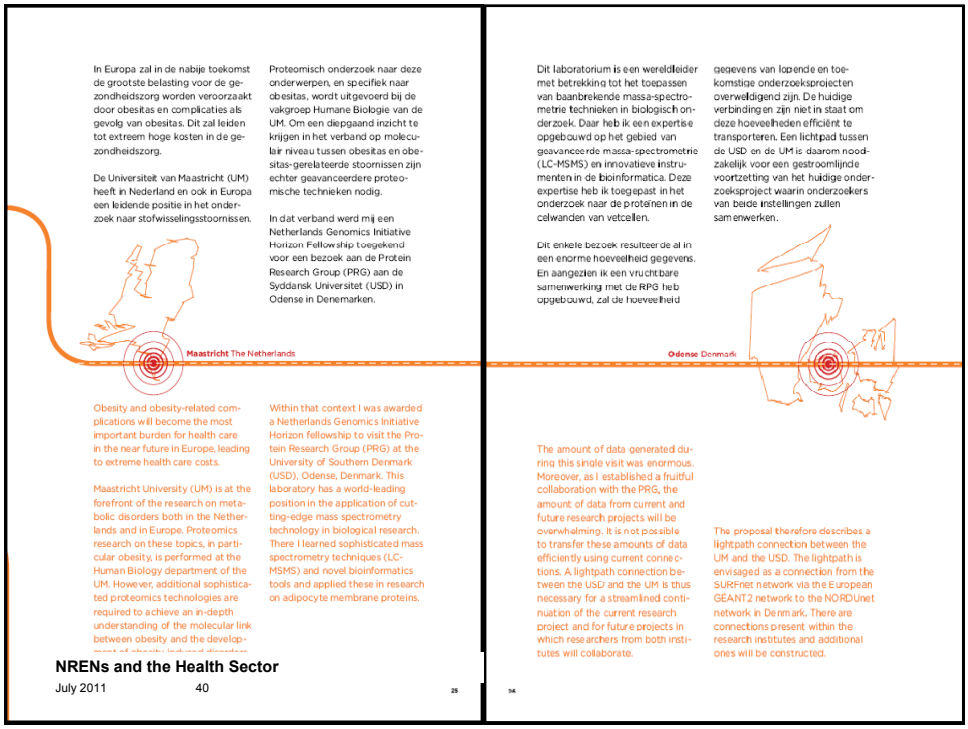

In Europa zal in de nabije toekomst de grootste belasting voor de gezondheidszorg worden veroorzaakt door obesitas en complicaties als gevolg van obesitas. Dit zal leiden tot extreem hoge kosten in de gezondheidszorg.

De Universiteit van Maastricht (UM) heeft in Nederland en ook in Europa een leidende positie in het onderzoek naar stofwisselingsstoornissen.

Proteomisch onderzoek naar deze onderwerpen, en specifiek naar obesitas, wordt uitgevoerd bij de vakgroep Humane Biologie van de UM. Om een diepgaand inzicht te krijgen in het verband op molecuulair niveau tussen obesitas en obesitas-gerelateerde stoornissen zijn echter geavanceerdere proteomische technieken nodig.

In dat verband werd mij een Netherlands Genomics Initiative Horizon Fellowship toegekend voor een bezoek aan de Protein Research Group (PRG) aan de Syddansk Universitet (USD) in Odense in Denemarken.

Maastricht The Netherlands

Obesity and obesity-related complications will become the most important burden for health care in the near future in Europe, leading to extreme health care costs.

Maastricht University (UM) is at the forefront of the research on metabolic disorders both in the Netherlands and in Europe. Proteomics research on these topics, in particular obesity, is performed at the Human Biology department of the UM. However, additional sophisticated proteomics technologies are required to achieve an in-depth understanding of the molecular link between obesity and the develop-

Within that context I was awarded a Netherlands Genomics Initiative Horizon fellowship to visit the Protein Research Group (PRG) at the University of Southern Denmark (USD), Odense, Denmark. This laboratory has a world-leading position in the application of cutting-edge mass spectrometry technology in biological research. There I learned sophisticated mass spectrometry techniques (LC-MSMS) and novel bioinformatics tools and applied these in research on adipocyte membrane proteins.

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Dit laboratorium is een wereldleider met betrekking tot het toepassen van baanbrekende massa-spectrometrie technieken in biologisch onderzoek. Daar heb ik een expertise opgebouwd op het gebied van geavanceerde massa-spectrometrie (LC-MSMS) en innovatieve instrumenten in de bioinformatica. Deze expertise heb ik toegepast in het onderzoek naar de proteïnen in de celwanden van vetcellen.

Dit enkele bezoek resulteerde al in een enorme hoeveelheid gegevens. En aangezien ik een vruchtbare samenwerking met de RPG heb opgebouwd, zal de hoeveelheid gegevens van lopende en toekomstige onderzoeksprojecten overweldigend zijn. De huidige verbinding en zijn niet in staat om deze hoeveelheden efficiënt te transporteren. Een lichtpad tussen de USD en de UM is daarom noodzakelijk voor een gestroomlijnde voortzetting van het huidige onderzoeksproject waarin onderzoekers van beide instellingen zullen samenwerken.

Odense Denmark

The amount of data generated during this single visit was enormous. Moreover, as I established a fruitful collaboration with the PRG, the amount of data from current and future research projects will be overwhelming. It is not possible to transfer these amounts of data efficiently using current connections. A lightpath connection between the USD and the UM is thus necessary for a streamlined continuation of the current research project and for future projects in which researchers from both institutes will collaborate.

The proposal therefore describes a lightpath connection between the UM and the USD. The lightpath is envisaged as a connection from the SURFnet network via the European GEANT2 network to the NORDUnet network in Denmark. There are connections present within the research institutes and additional ones will be constructed.

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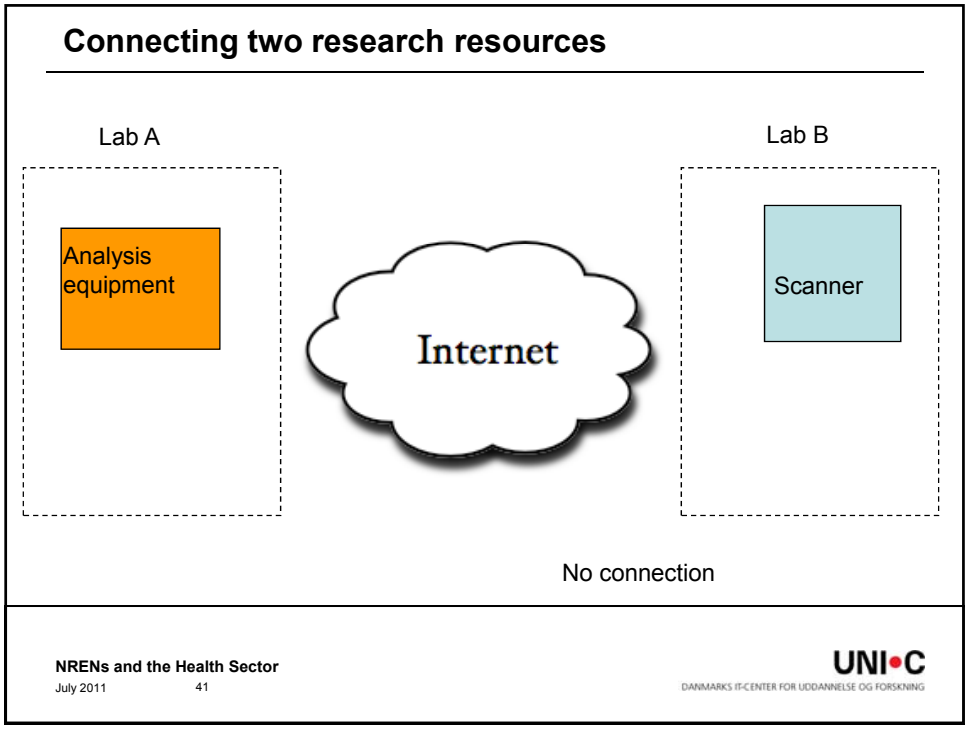
Connecting two research resources
Lab A
Lab B
Analysis equipment
Internet
Scanner
No connection
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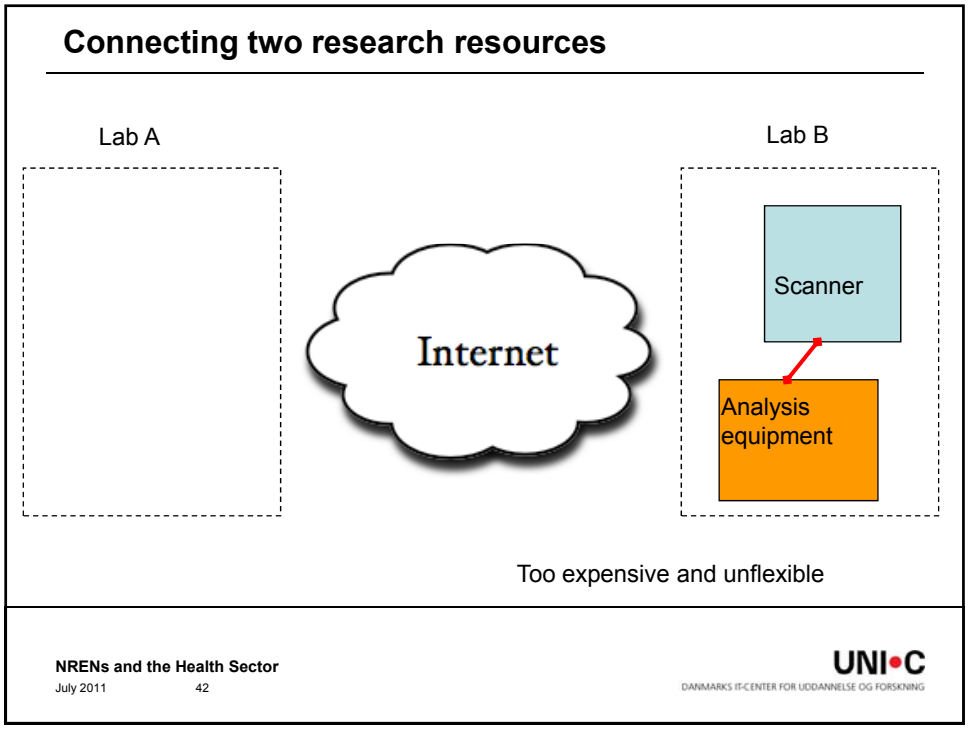
Connecting two research resources
Lab A
Lab B
Internet
Scanner
Analysis equipment
Too expensive and unflexible
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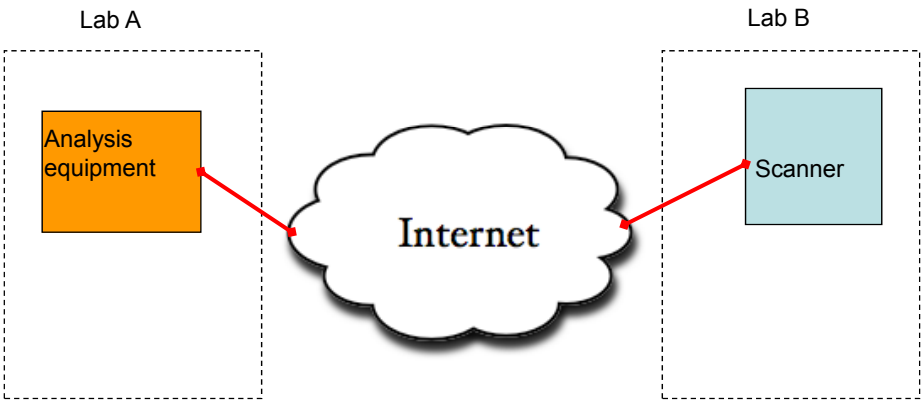
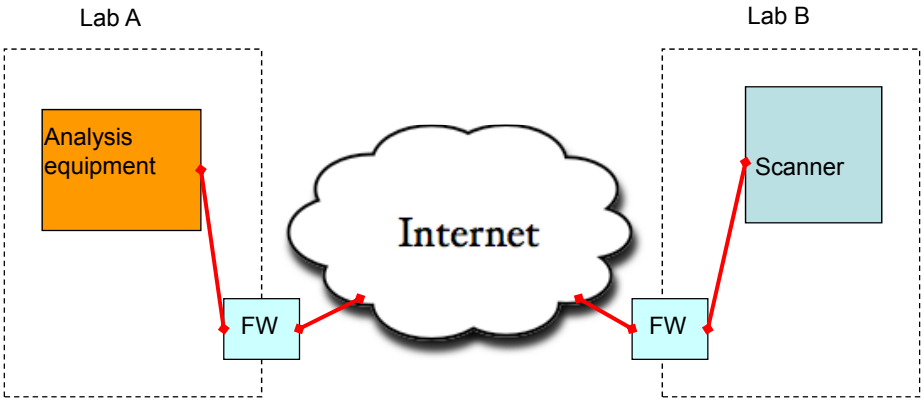
Connecting two research resources



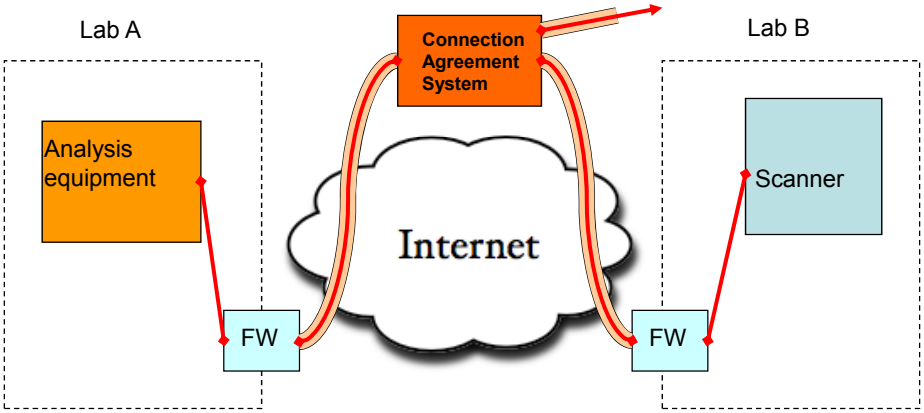
Not safe: Equipment will be hacked and connection is not secure

Connecting two research resources



Using firewalls:
Works, but unflexible and time-consuming to set up each time

Connecting two research resources



Using the Connection Agreement System:
Flexibility by user configuration

Have we now solved all problems?

YES – Once connected, new connections are operational almost immediately

YES – We can now manage the increased complexity of the explosion of many types of connections between organizations

YES – A light-weight alternative to dedicated lambda connections (no cost, immediate set-up)

YES – Local security administrators can let their users do the administration and documentation of their security components

NO – Network interoperability does not guarantee working interoperability of services

NO – The present system does not offer any means for identity management of users (yet…)

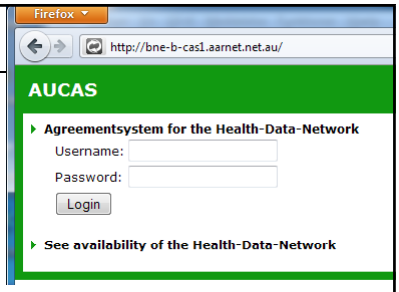
Lightweight version of dedicated circuits

- Easy to set up
- Easy to convince the users to try out
- Traffic statistics will show whether they actually need dedicated bandwidth, or just the security of a closed connection
- Not a competitor to dedicated circuits,
- but rather a lightweight testbed
- and even a marketing tool for dedicated circuits

Direct benefits for the NREN and its users

- The same network infrastructure can be used by more users
- Also more users to share the costs
- Lightweight way to service users in need of dedicated connections
- Help demonstrate the need for dedicated connections
- The services on top of the basic network may in some instances be re-used for the health sector

AARNet pilot test of CAS



- Never mind the actual system – it is the idea that matters
- I hope this inexpensive piece of infrastructure will help you bring more value to more user groups
- I have ”sold” the concept to the AARNet people – why waste your time now?
- Only if you participate in the pilot with your firewalls and propose use cases will this project move forward and get a fair evaluation
- Talk to your local freindly AARNet people – especially Mike Rebbecchi

The rest is up to you: Go connect!