



**Rikshospitalet**  
Universitetsklinikk

**Norsk Teknisk  
Audiologisk Forening**  
17.11.04

**Hørselsentralens  
Datannettverk**

Ralf Greisiger



Rikshospitalet  
Universitetsklinikk

# Why having a network?

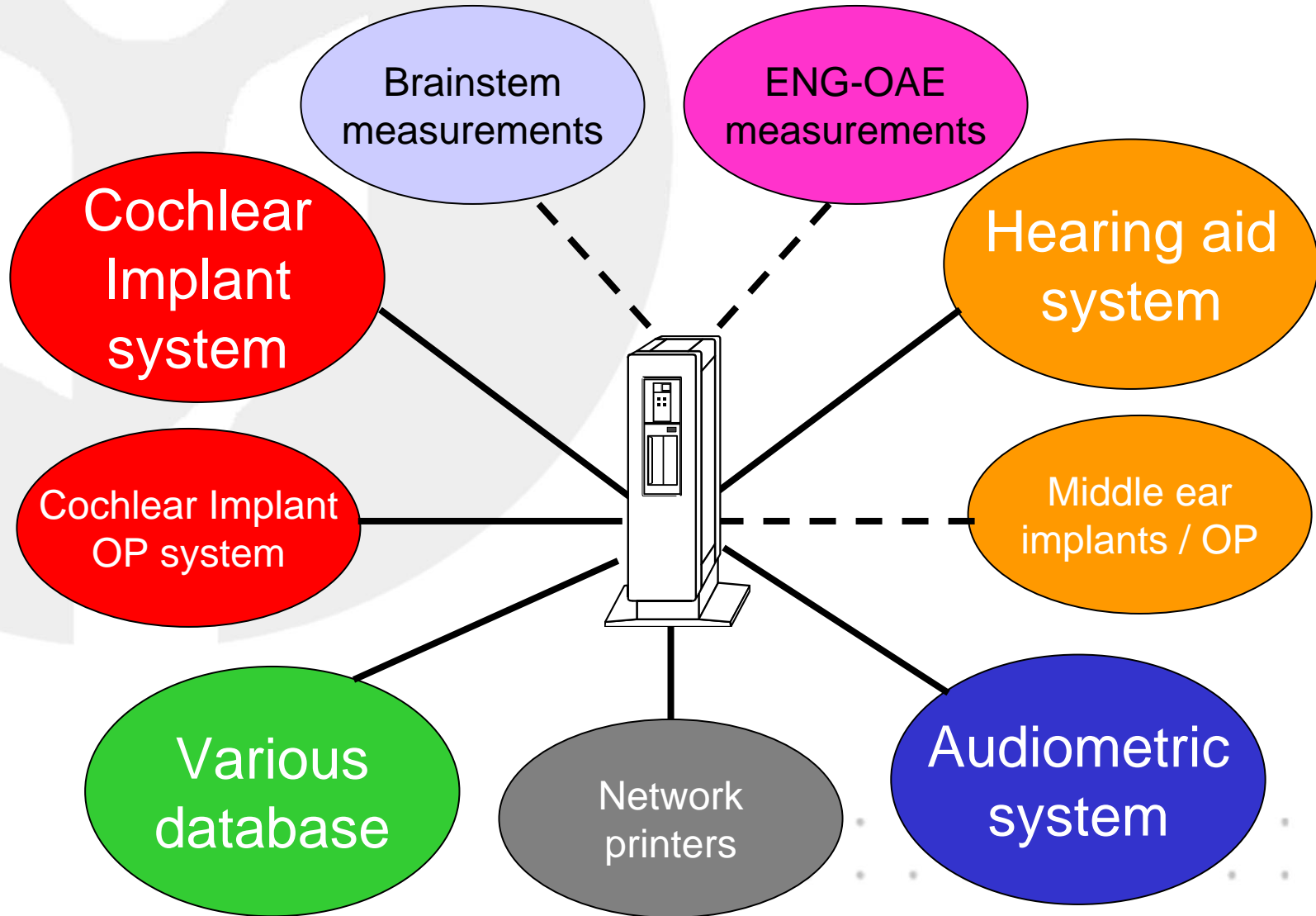


# Benefits

- share information
- share resources (printer, etc.)
- backup
- accessibility of patient data
- maintenance



# Hørselsentralen Network



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**Cochleaimplantater databasen**

*Skjemaer*

- Journal
- Implantatregister
- Cochlear Implantat Program

*Rapporter*

- Venteliste for utredning
- Planlagt utredning
- Ikke kandidater
- Hengere
- Venteliste for operasjon
- Planlagte operasjoner
- Cochlear Implantat Program

**Cochlear Program**

Id	Utdrings	Operasjon	allokasjon / Tid	Kontroll	Planstruktur	Operasjon
09.02.04	2110:06:18.26:01:12) Medel 110-126	0901 Sporborg 00:11:00		1104:04 Hilde 1104:04 1204:06 H4 H 6900		0901 12-13
10.02.04	2110:06:18.26:01:12) Medel 110-126	0901 Sporborg 00:11:00		1104:04 Hilde 1104:04 1204:06 H4 H 6900		0901 12-13
11.02.04	2110:06:18.26:01:12) Medel 110-126	0901 Sporborg 00:11:00		1104:04 Hilde 1104:04 1204:06 H4 H 6900		0901 12-13
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13.02.04	2110:06:18.26:01:12) Medel 110-126	0901 Sporborg 00:11:00		1104:04 Hilde 1104:04 1204:06 H4 H 6900		0901 12-13

Alle typer 2002

Medel 2002

Cochlear 2002

Alle typer 2003

Medel 2003

Cochlear 2003

**Cochleaimplantert-op**

CI barna nr: XXXXXXXX

Fornavn: Arne Vidar

Etternavn: XXXXXXXX

Fødselsdato: 09.05.1934

Mors: [Empty]

Adresse 1: XXXXXXXX

Adresse 2: [Empty]

Postnr Sted: 1540 VESTBY

Kommune: 0211 VESTBY

Fylke: 02

Telefonnummer: [Empty]

Fax: [Empty]

Mobil Tel: [Empty]

e-post: [Empty]

Ikke kandidat:

OP Rikshospitalet:

OP Huddinge:

Merknader: [Empty]

Utrednings detaljer		
Utred vent	Utred fase II	Utred ferdig
27.09.1999	27.09.1999	10.01.2000
27.09.1999	27.09.1999	10.01.2000

Post: 1 av 2

Operasjons detaljer					
OP klar	OP plan	OP dato	OP siden	OP lege	Implantat Index
11.01.2000		04.07.2001	hoyre		Medel C40+ 26537
11.01.2000	22.12.2003	22.12.2003	hoyre	Harris	Medel C40+ 69001



# CI database

- patient info (address, birthday, etc.)
- operation data (side, surgeon, date)
- system info (implant type, serial number)
- statistics (implants per year, age distribution, etc.)
- work scheduler, time table, room organisation
- test data (speech tests)
- medical data (etiology, gen info)
- technical data (speech processor)
- kommune, fylke, school, kindergarden
- Address labels, standard letters
- OP plan, OP waiting list, utredings waiting list, hengere,...

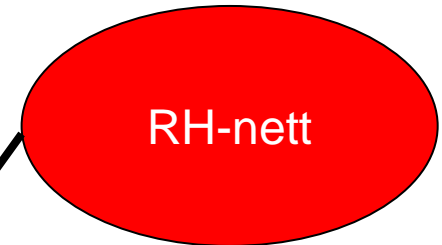
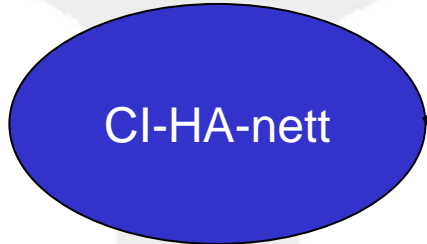




- 7x NOAH hearing aid fitting PCs (currently 5)
- 1x spare NOAH/Otologics middle ear implant fitting PC
- 4x CI-datamaskiner CI-fitting (currently 3)
- 1x CI-OP notebook
- 1x CI-OP spare / presentation notebook
- 6x Audiometry PCs (currently 4)
- 3x Visual Reinforcement Unit PCs (planned)
- 2x ASSR / ERA PC (currently 1)
- 1x Admin-Test-PC
- 1x Server
- 1x Spare Server / Test Server / Backup Server
- 2x OAE-PCs (not connected yet)
- 2x ENG-PCs (not connected yet)
- 4x Network Printer (3x colour / 1x black/white)

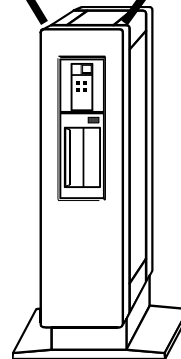
->**36** **Network elements**

# Accessibility



- CI-database
- Audiogram (audiografer)

- Administration
- Investigation (leger)



CI-HA Server:

- Dual processor
- SCSI
- RAID 1
- 1GB RAM

System	Software	Database
NOAH hearing aid	✓	✓
NOAH Audiometry	✓	✓
Cochlear R126 V2.1	✓	✓
Med-EI Studio+ 2.01	✓	✓
Cochlear NRT	✓	
Visual Reinforcement Unit	✓	
ASSR Audera	✓	✓
ENG system (balance)	✓	✓
OAE system (sceening)	✓	✓
CI database		✓
HA database		✓

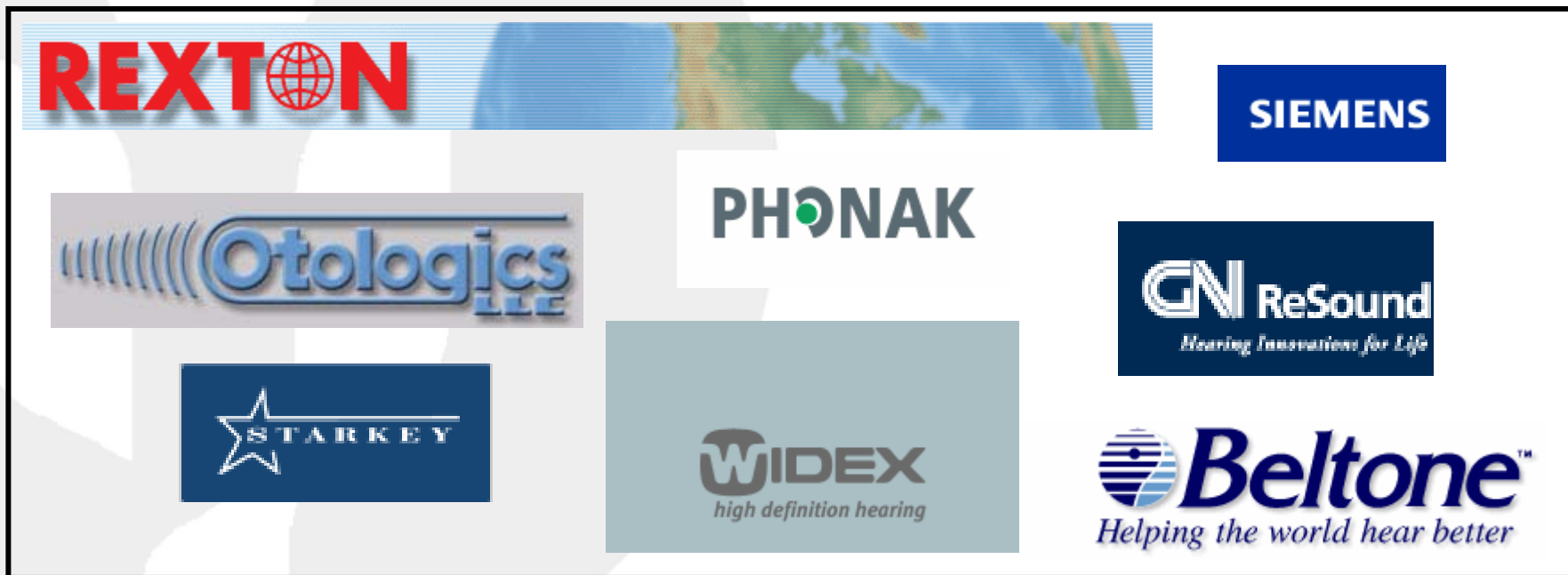
} soon one database



9

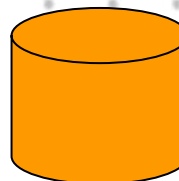
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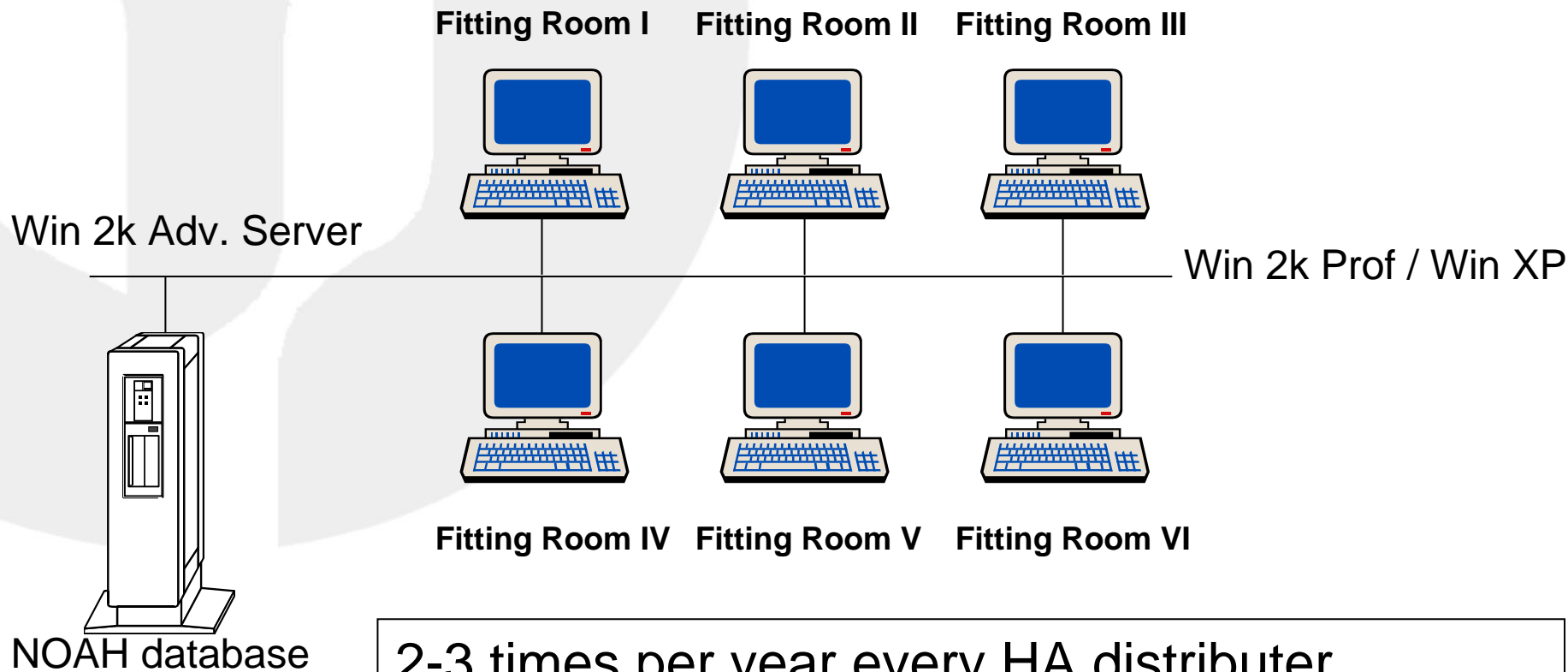


NOAH can handle  
the SW from 95  
hearing aid distributor

RH & UUS using  
about 15-20 different  
hearing aids



NOAH database



2-3 times per year every HA distributor  
is sending us new modules/fitting SW . . . . .

$15 \cdot 6 \cdot 2 = \underline{\underline{180 \text{ installations}}}$  per year (best case)

$20 \cdot 6 \cdot 3 = \underline{\underline{360 \text{ installations}}}$  per year (worst case)

## HIMSA's product manager, Søren Kristensen (November 2004):

*Is there a solution in development that the modules can be installed in a network setup just at the server and the clients receive the latest fitting module from the server?*

**No I'm sorry; this is a limitation to the current NOAH framework. We are taking this in consideration when discussing next generation of NOAH. There are no plans yet for this, so you should not expect a solution to this issue within the next year at least.**

*Why is the connection to the database much slower if I access the server database than to the local one?*

**During login the entire client list is retrieved from the database. The time will depend on the number of clients in the database, and the network is also a factor in this.**

**We are looking into changing the database and it will be to a database with same or better performance. We have not yet decided which Database to use.**



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# Maintenance Solution



# Support Levels

- **Third level support**

One of our audiografer can solve easy problems and can do basic installations

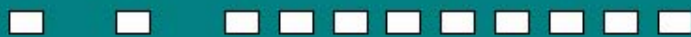
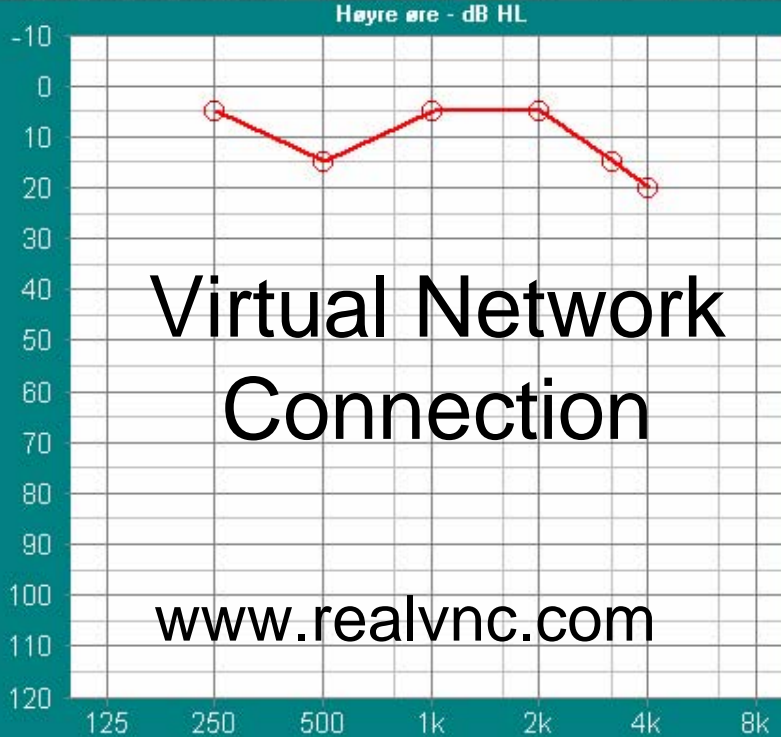
- **Second level support**

One of our audiofysiker (ikke Ole) takes care of problems that are more difficult, as well designs the infrastructure to the departments needs

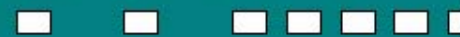
- **First level support**

IT-expert from RH IT department





PTA = 8 dB, HL = 1.4 %



PTA = 33 dB, HL = 21 %



Test

- Terskel
- MCL
- UCL

Frekvens

250 Hz

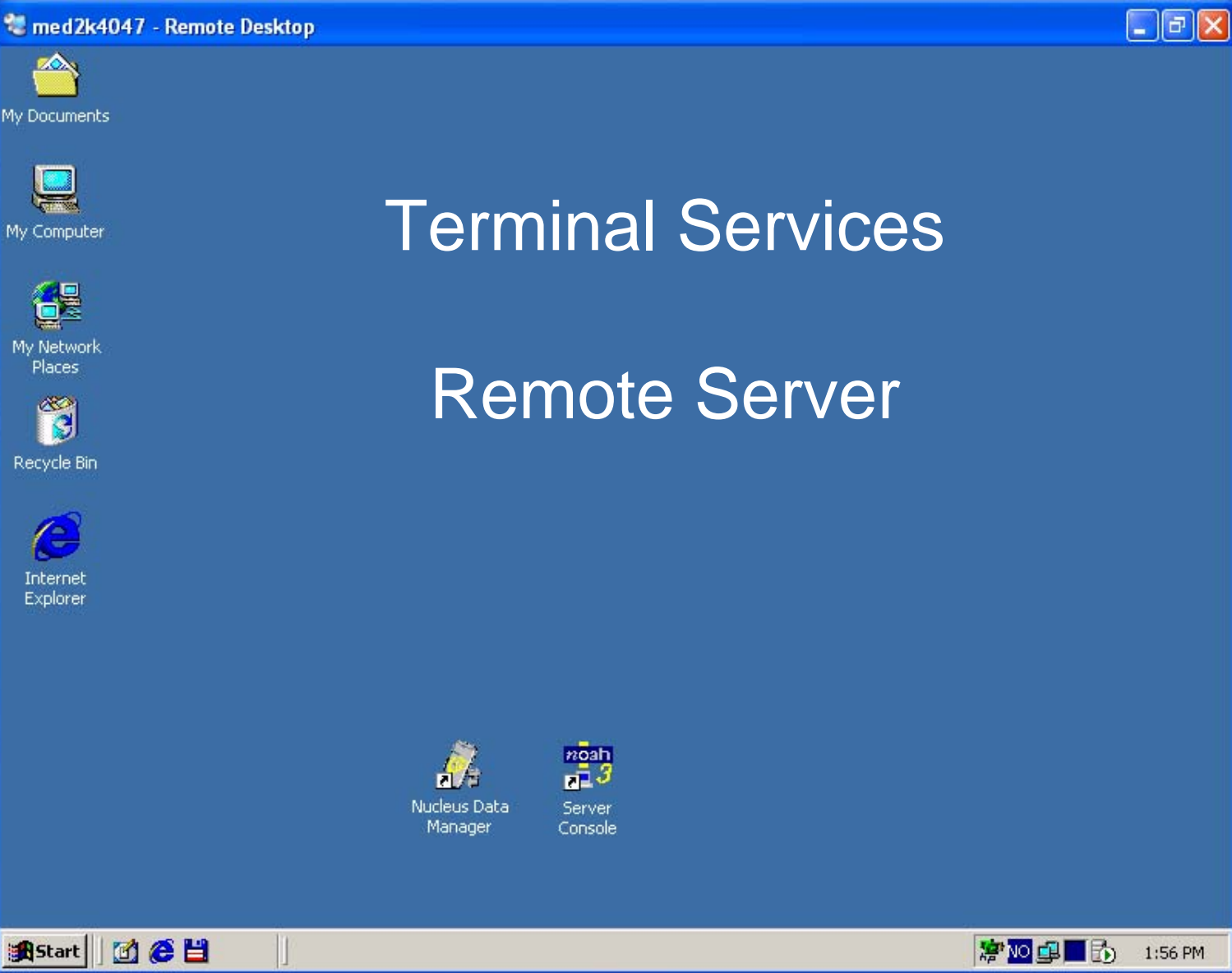
← →

Stimulus nivå

↑ 10 dB ↓

Masking

- Maskert Pg U
- Lås Pg D

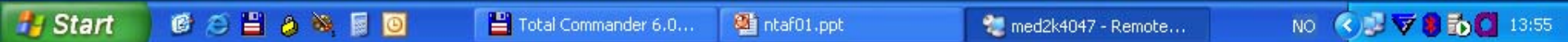


# Terminal Services

# Remote Server



# local PC





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# Security

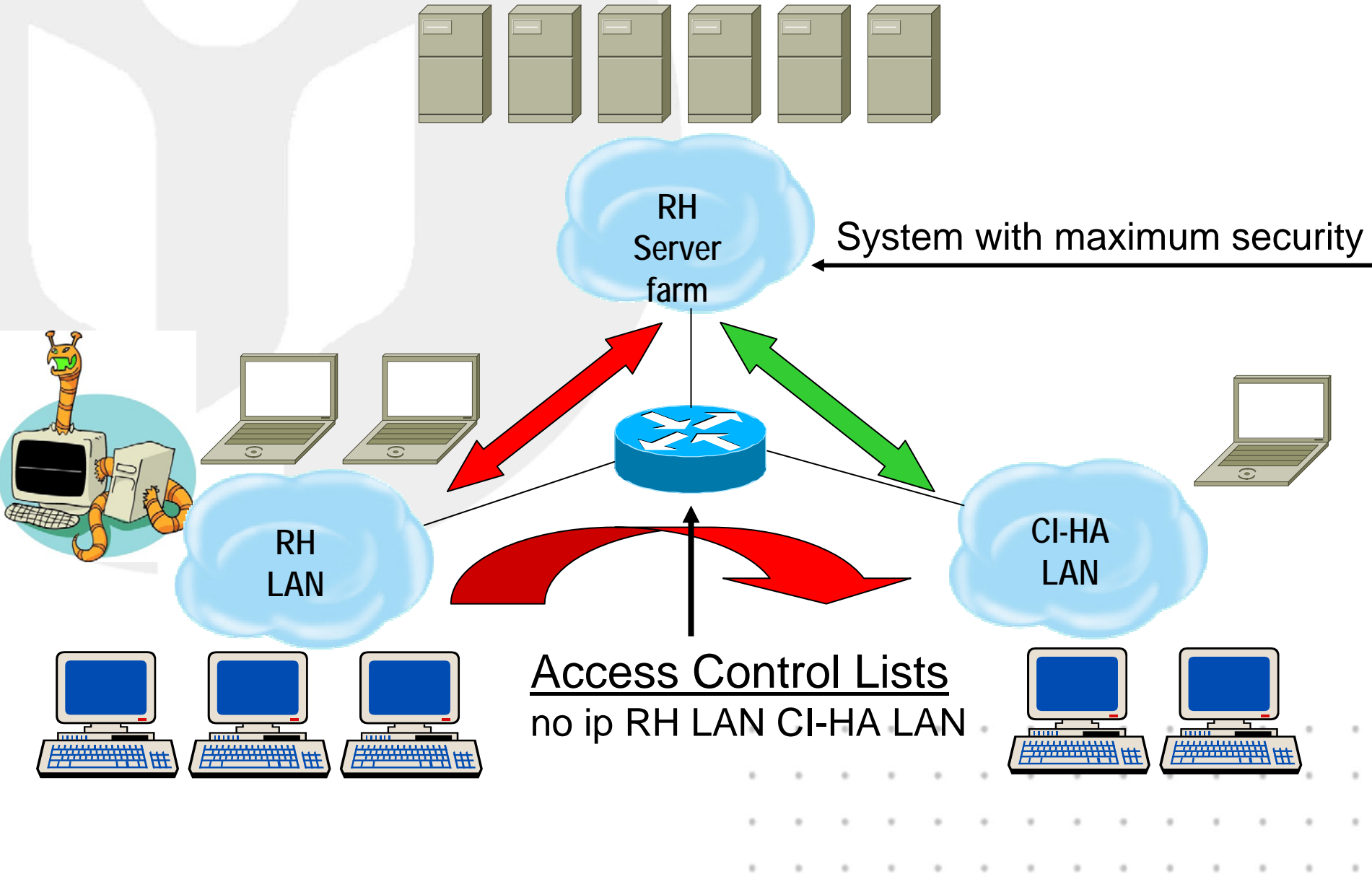


# The minimum!

- Virus protection
- patch installation
- Access control lists
- Firewalls?!
- Backups / safety copies



# Example: worms



# Stability

How to use the system?



# NOAH / Auricle usage

- save and close audiogram / HA fitting after you have finished the patient
- if NOAH is not used within a short time -> close it too!
- best close NOAH whenever you don't use it
- reboot the PC at least once per day (in the morning or before you go home)
- if you have any error messages during measurements or fitting - reboot PC and start with a clean system
- on Fridays or every evening you can shut down the PC
- make sure the Auricle interface is switched on before the PC starts up in case of doubt - restart PC again
- close the patient after you have saved an audiogram (don't open an audiogram after you have closed it - close -> open patient first)
- in case nothing works for the Auricle PC - un-plug power cable, put back in and start the PC (extrem emergency procedure!!!)

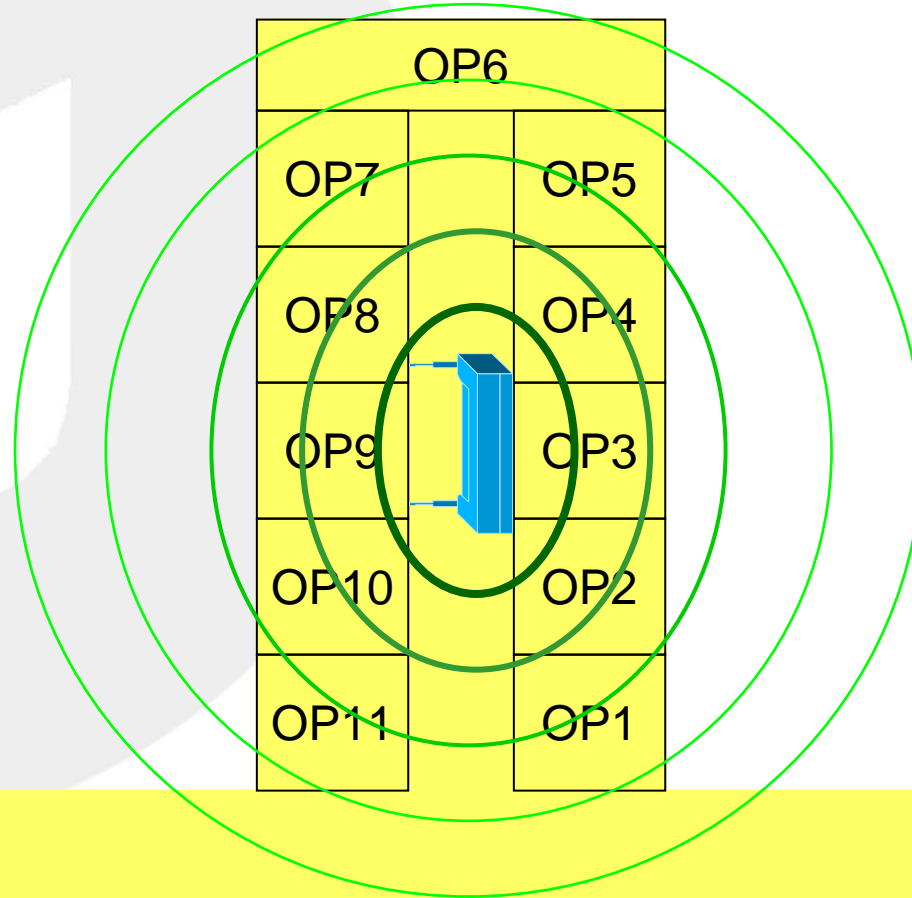
# Mobility

Wireless?

Incompatibility with other medical  
devices?

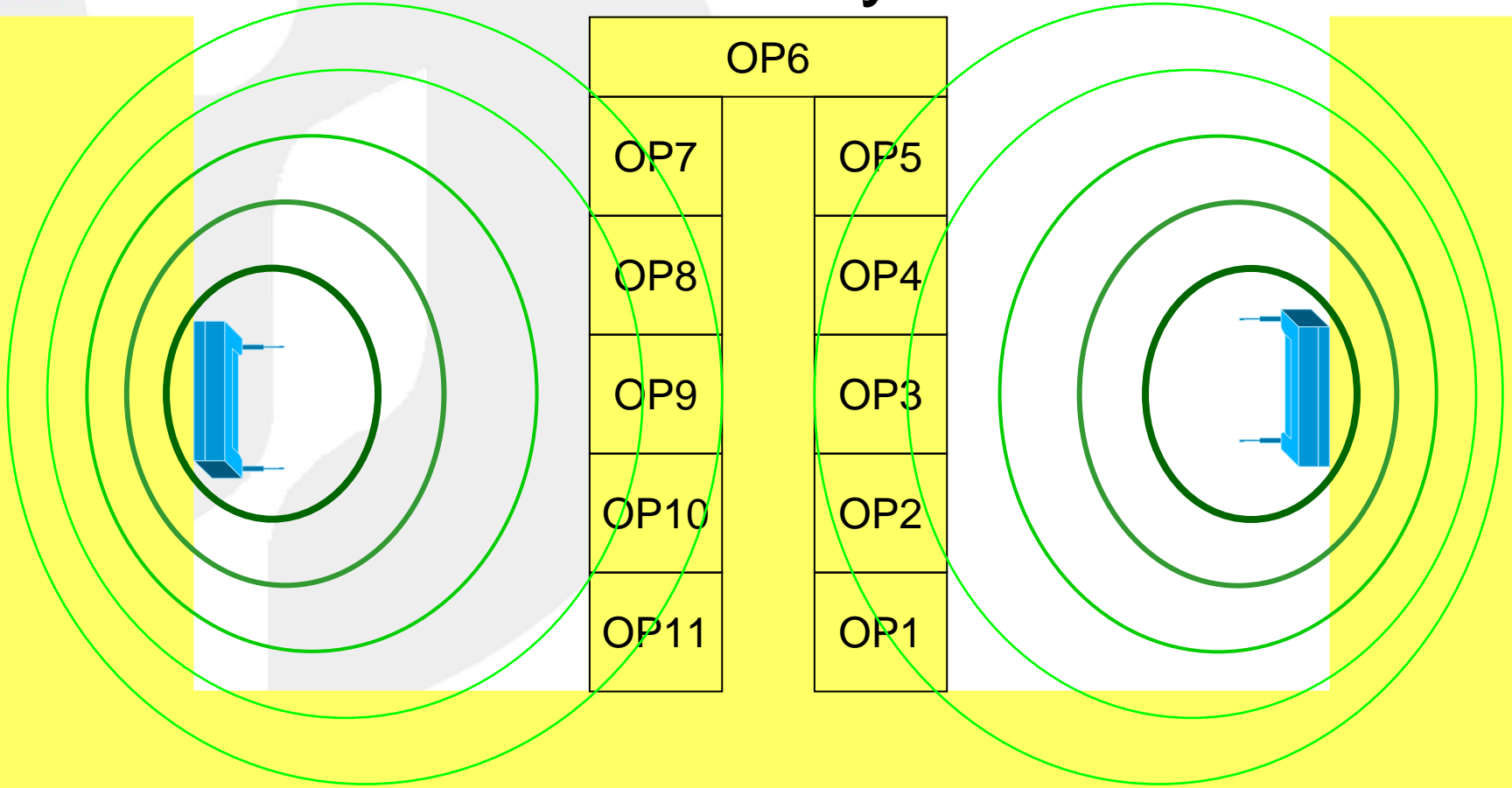


# Do we have a signal?





# Maybe now?

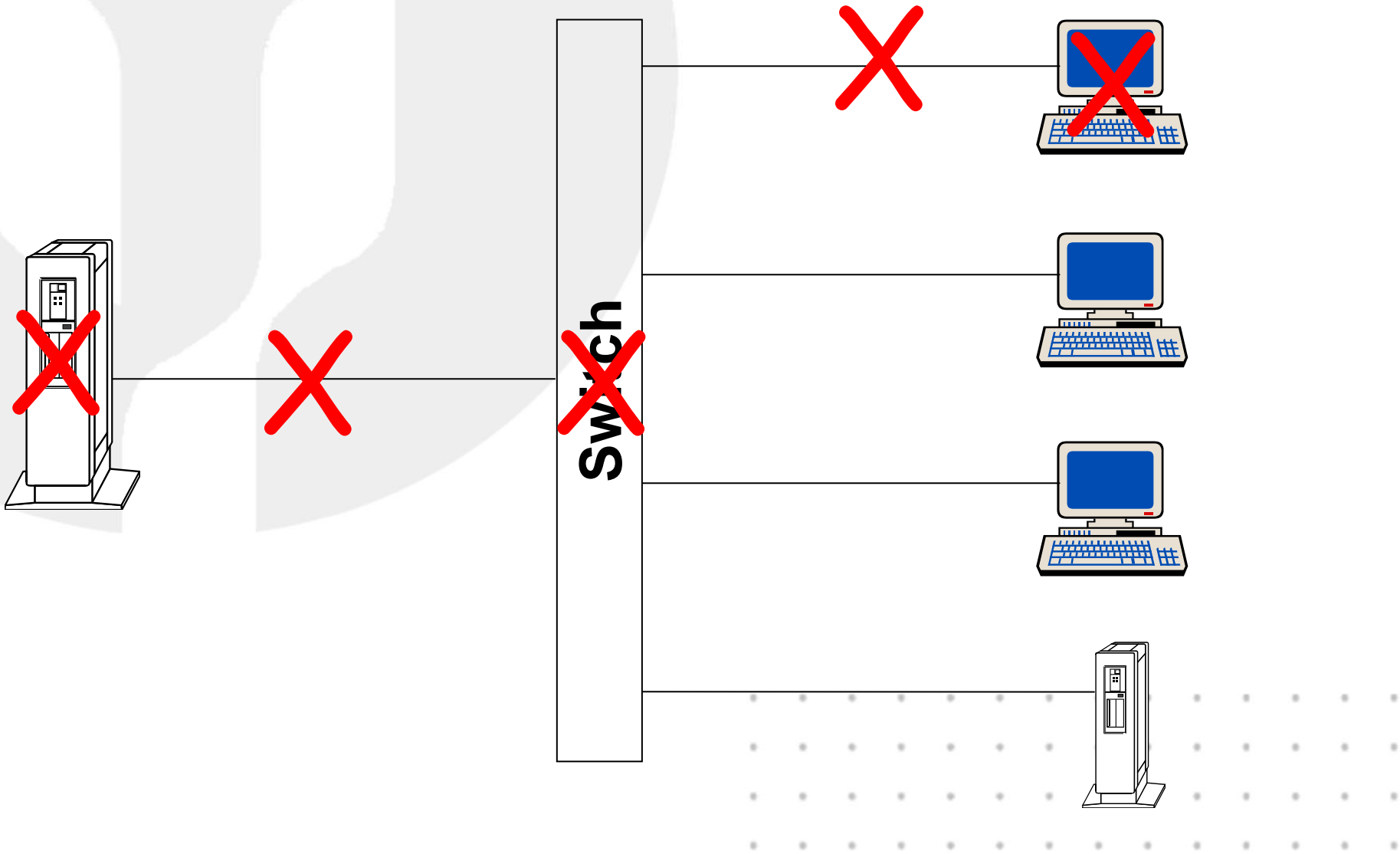


# Worst case

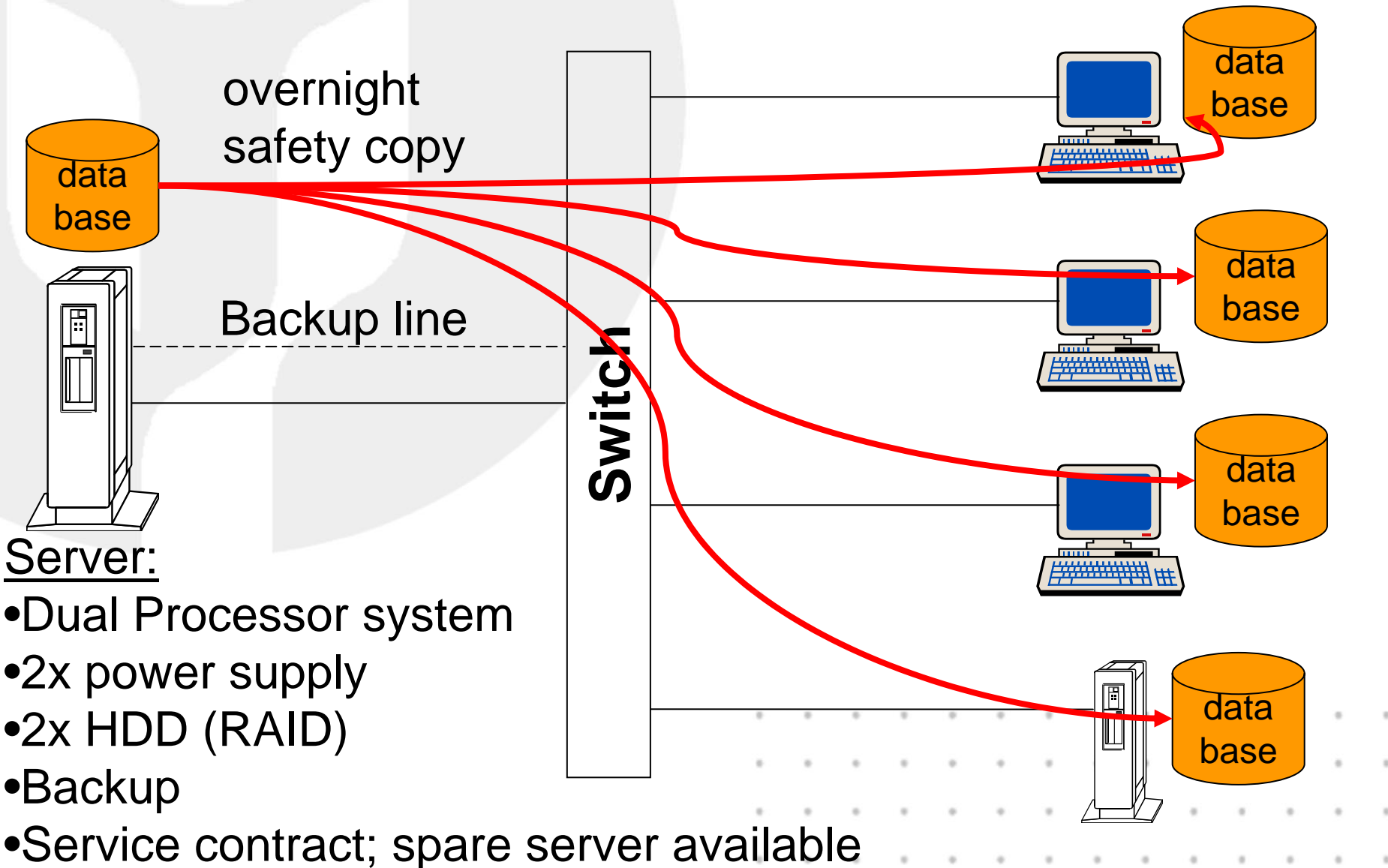
What to do if the server or network  
is down?



# Single Point of failure



# Redundancy



# Redundancy

- copy the database e.g. weekly onto each local workstation
- use the standalone version if network is down
- import created data back onto the server
- use scripts, batch files and task manager for copying files
- SQL is having open files
- mdb no probs, but user limited



Min datamaskin

Fil Rediger Vis Fa

Tilbake

Adresse Min datamas

Systemoppgaver

Vis systeminform

### Alternativer


Generell Database-profiler

Profilnavn	Databasebane
Auricle-Server	N:\noah.mdb
NOAH Database I...	C:\Programfiler\HIMSA\NOAH System\Database\noah.mdb
NOAH Server	X:\ha\noah\Database\noah.mdb

Ny Rediger Slett

OK Avbryt Bruk

## NOAH Login



Brukernavn: ABC

Passord:

Velg database: Auricle-Server

- Auricle-Server
- NOAH Database lokalt !!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
- NOAH Server

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OK Avbryt

er

Audio CD (D:)

Noah\_db på Auricle-server (N:)

Utvexling på med2k4047 (X:)

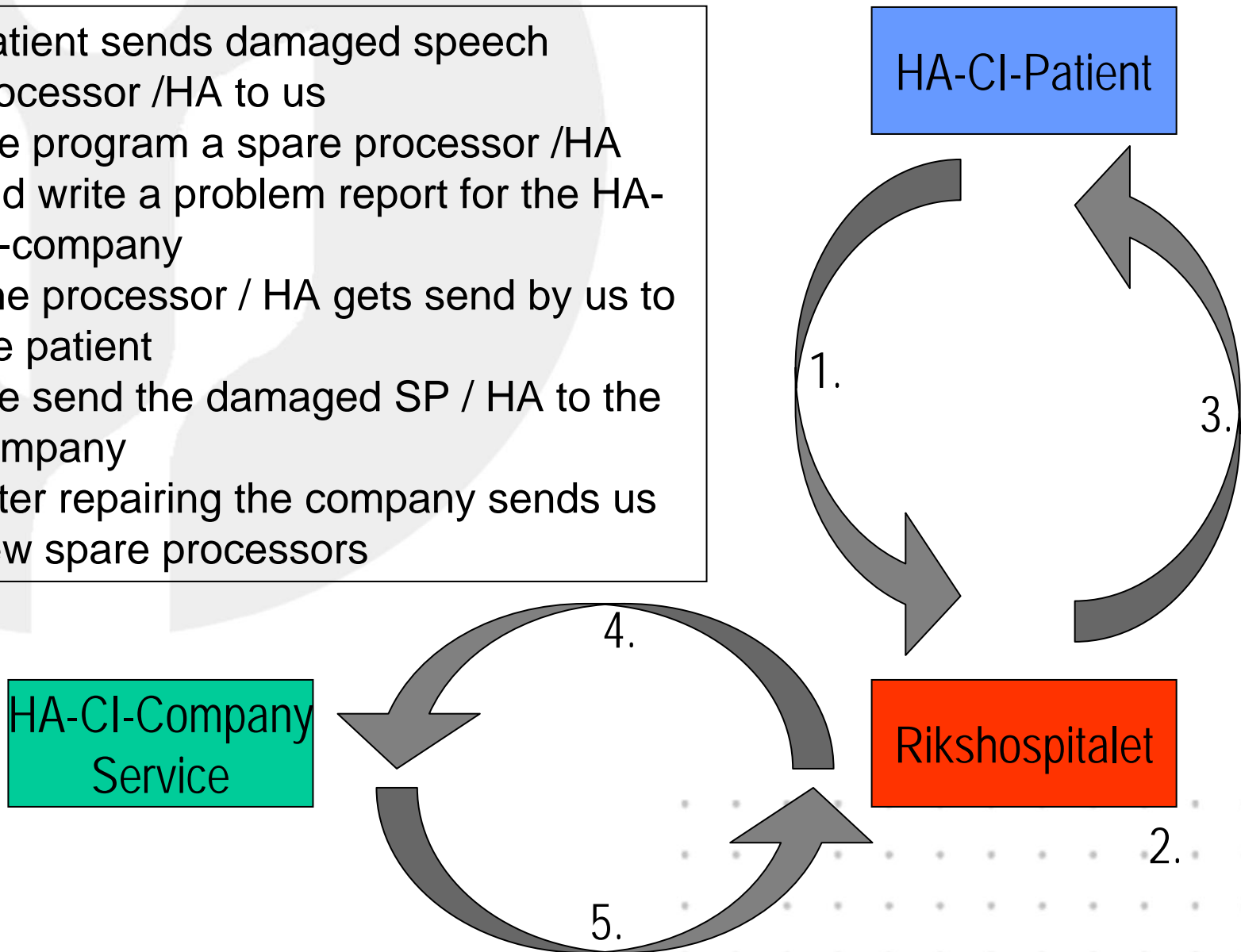
# Outsourcing services

Clinicians should concentrate on clinical work and should not be occupied with spare part and repair services!

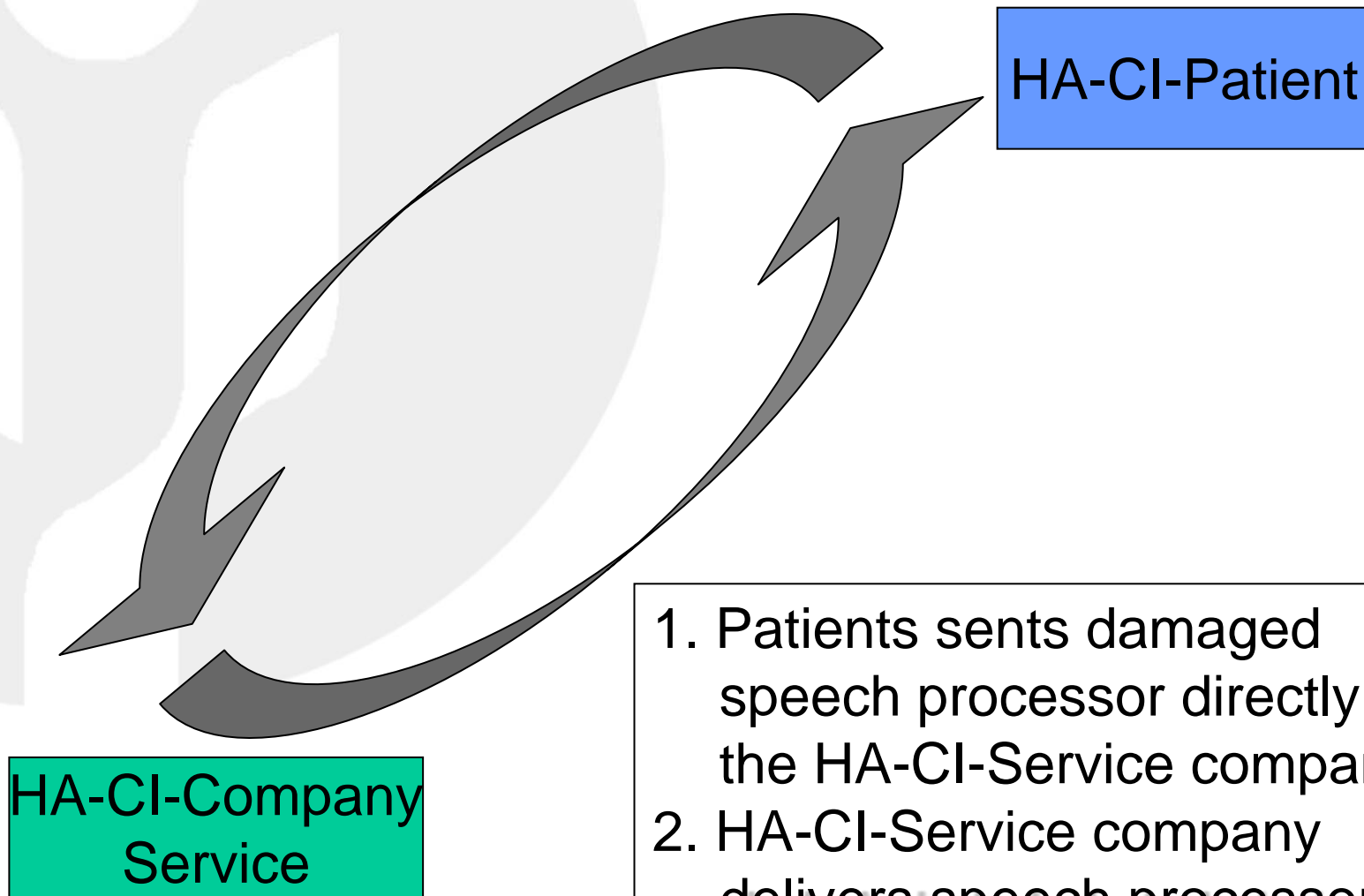


# Situation now

1. Patient sends damaged speech processor /HA to us
2. We program a spare processor /HA and write a problem report for the HA-CI-company
3. The processor / HA gets send by us to the patient
4. We send the damaged SP / HA to the company
5. After repairing the company sends us new spare processors



# Situation desired



1. Patients sends damaged speech processor directly to the HA-CI-Service company
2. HA-CI-Service company delivers speech processor / HA to the patient

# Economical/service advantage

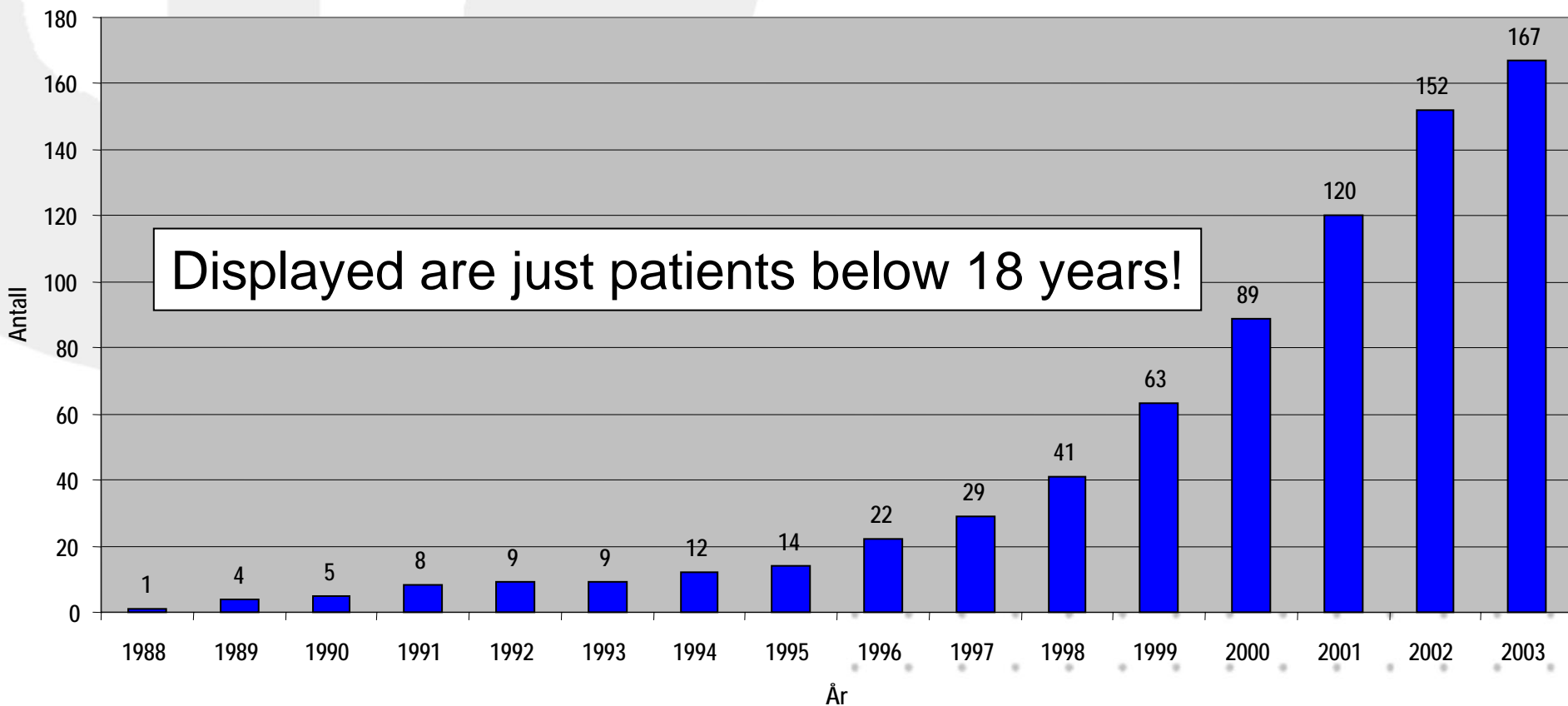
- No additional spare processor / HA programming time (and searching for the failure problem) is needed
- No cost for sending parcels
- No delivery insurance is needed (SP costs about NOK 70.000.-)
- No problems running out of spare processors in stock
- No additional staff required for service tasks - focusing on actual medical treatment





# Increase of patient number

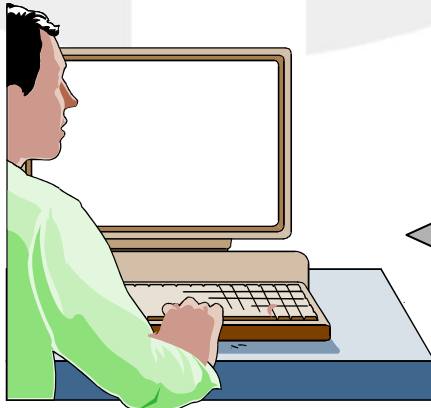
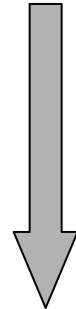
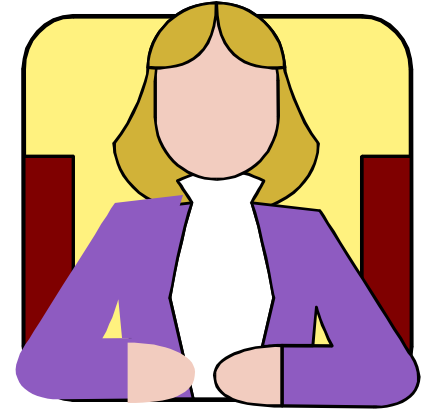
We have an **exponential** grow of patients with Cochlear Implant!  
Soon we are no more able to give required support and service to our patients!



# Possible Solution

Patients coming to Rikshospitalet

- Patients are regularly coming to RH for fitting adjustments of their speech processors / HA
- All fitting data is stored on our server
- In case of programming a spare processor/HA, the HA-CI-Service company is having access to the latest fitting data



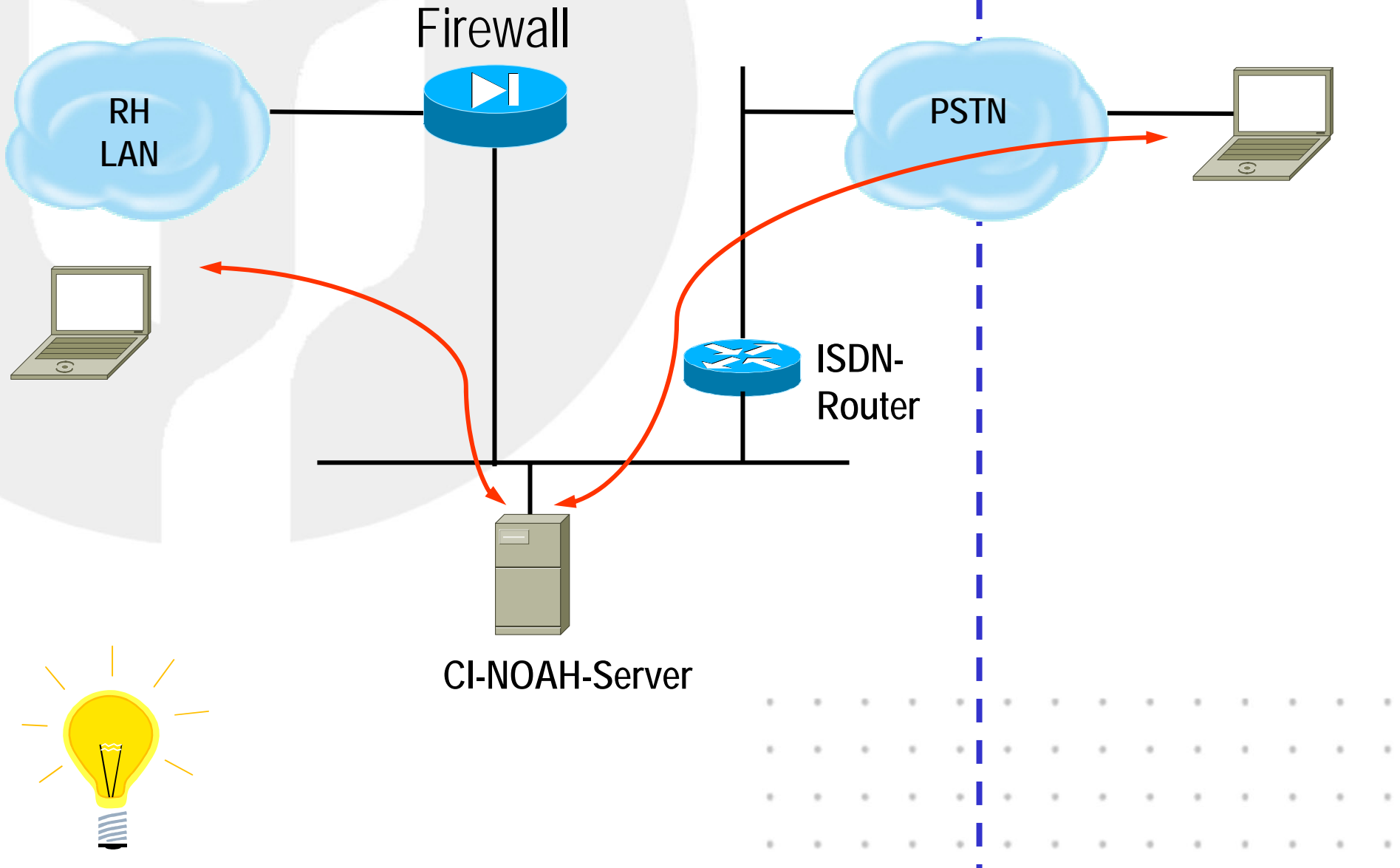
RH Server

HA-CI-Service Company

CI-HA Fitting at Rikshospitalet

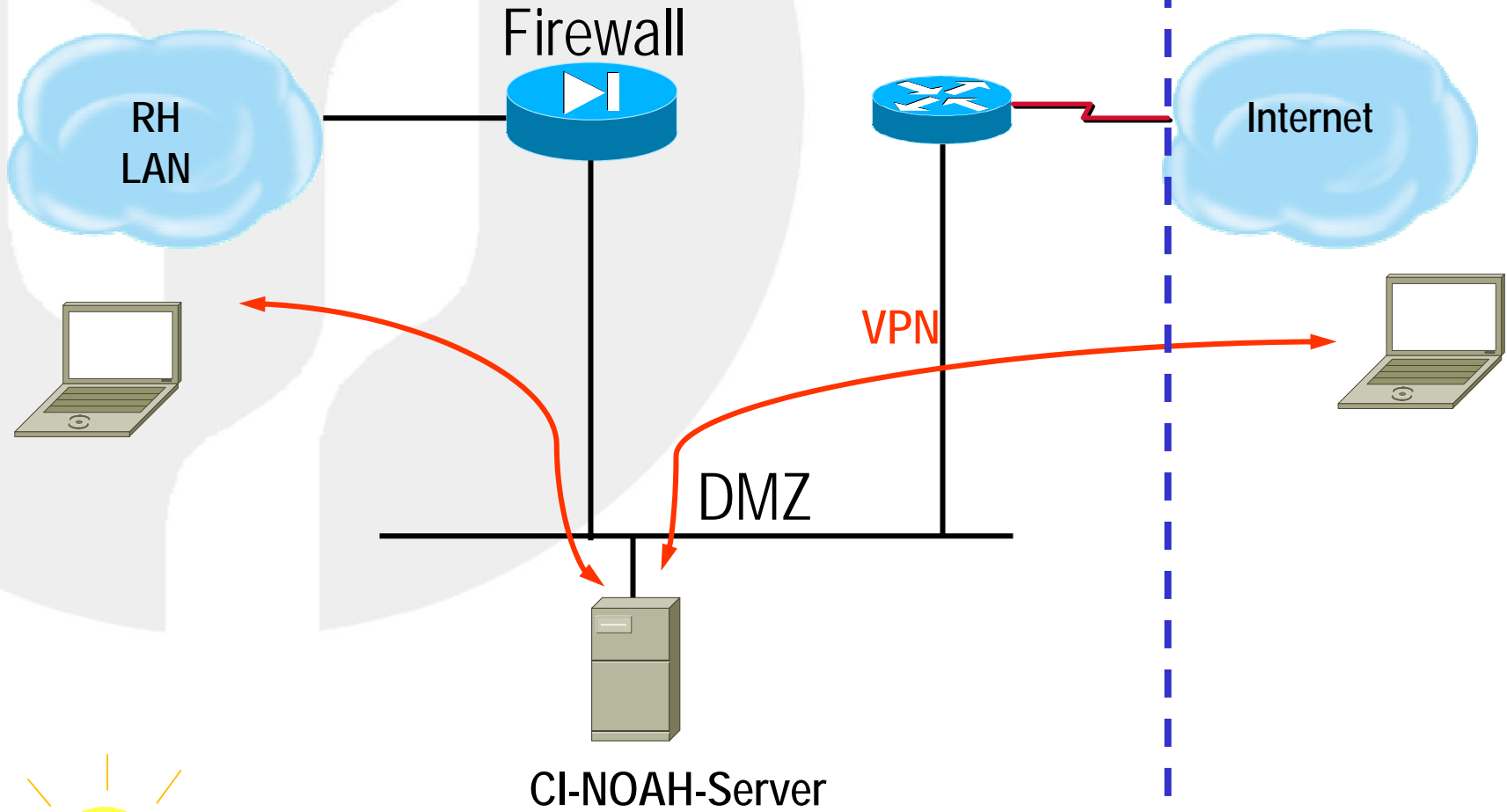
# Solution I

RH-net | Outside

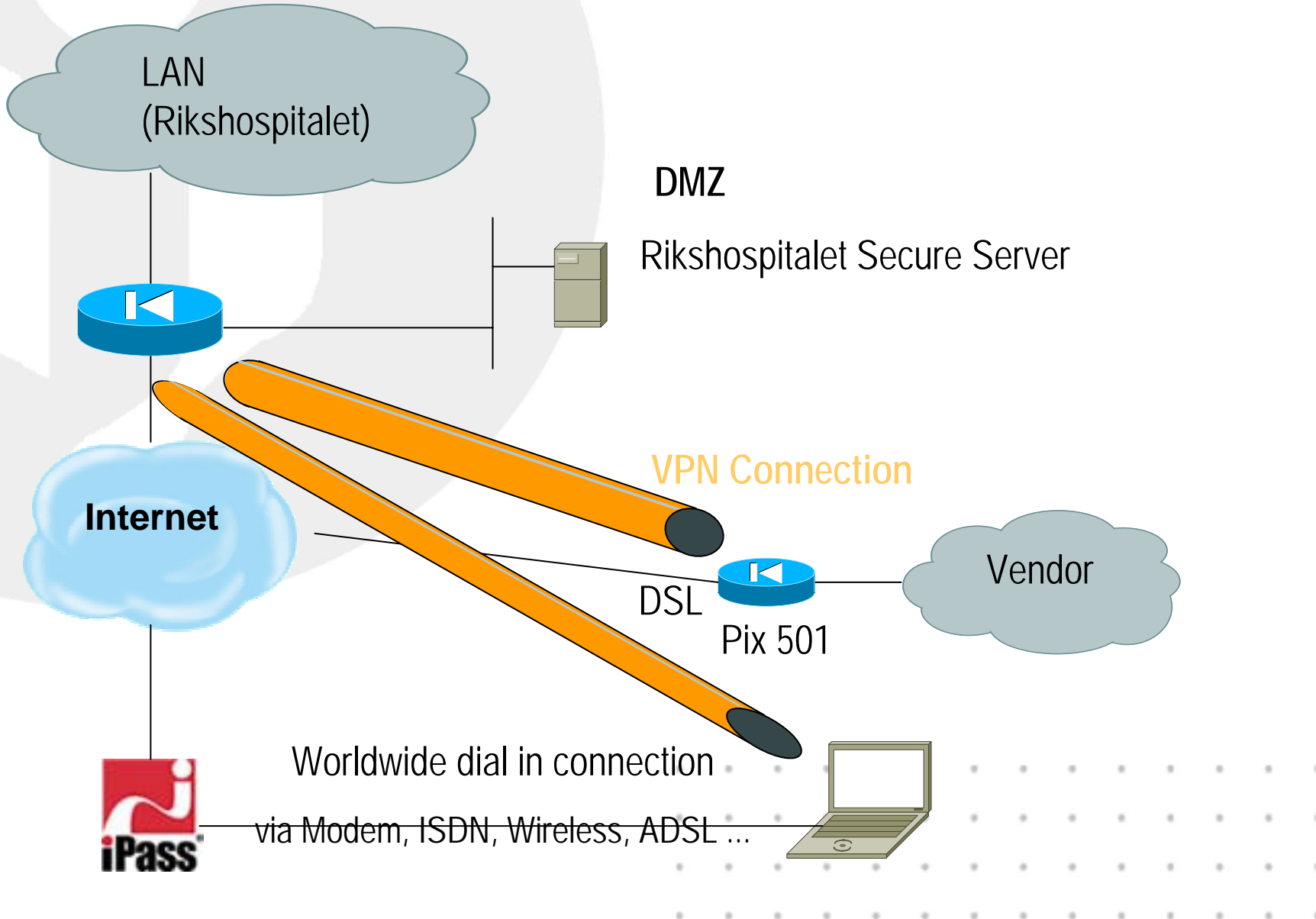


# Solution II

RH-net | Outside



# VPN Connection

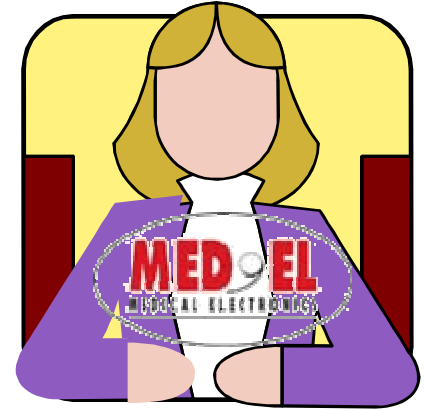


# Logistics

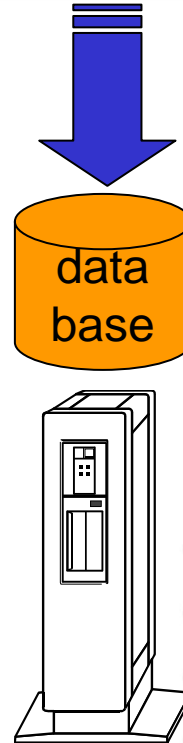
Who has ordered what?



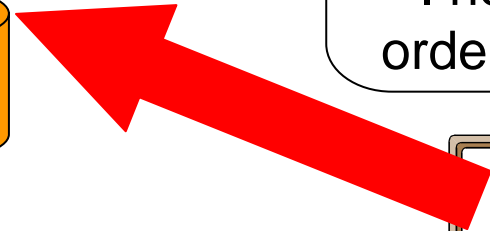
# Order database



Need some cables.  
Great Arne has ordered some



We are out of spare cables.  
I need to order some.



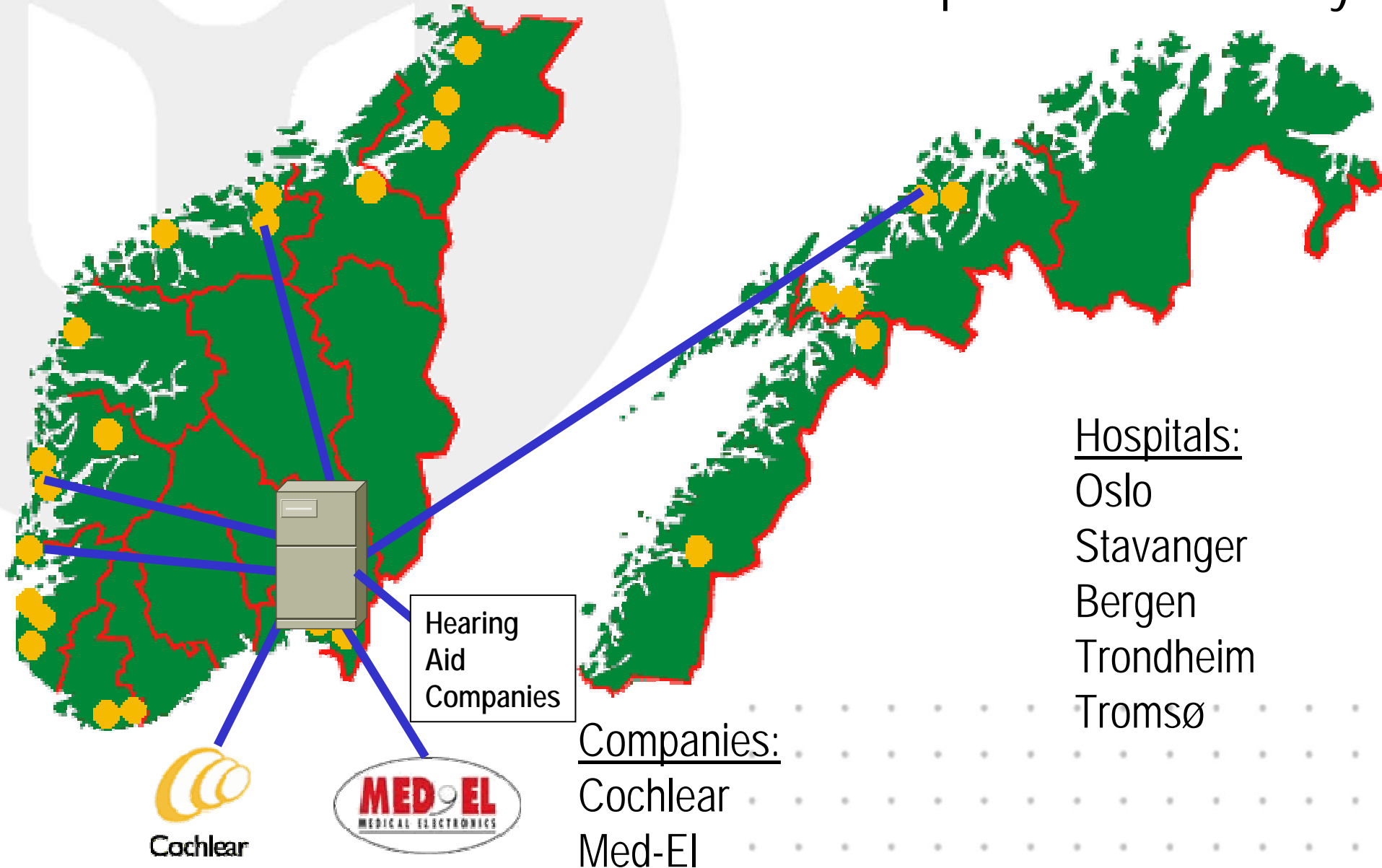


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# Future visions



# Future plans - one database for all CI patients in Norway

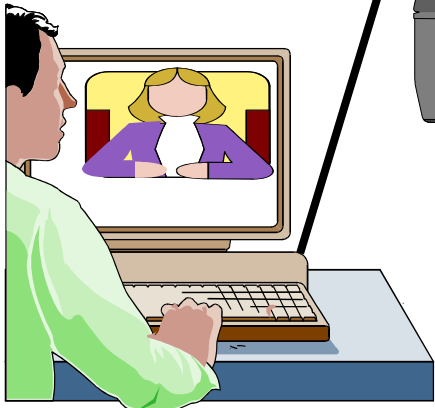
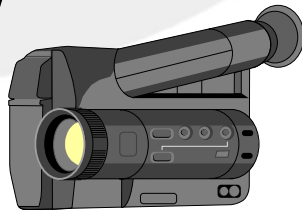
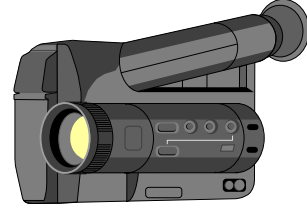
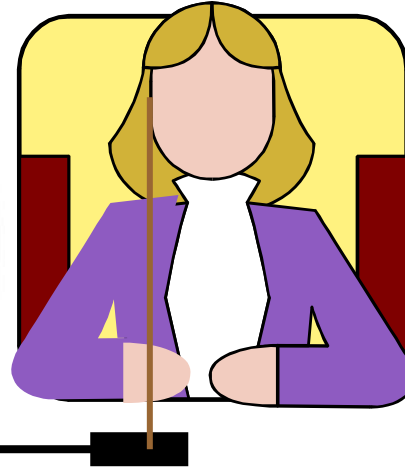


# Future plans

- Operation and first fitting at Rikshospitalet
- Control and standard fittings at remote centers
- Problem cases at Rikshospital
- Information exchange by regularly visits and/or video conferences



# Fjerntilpassing



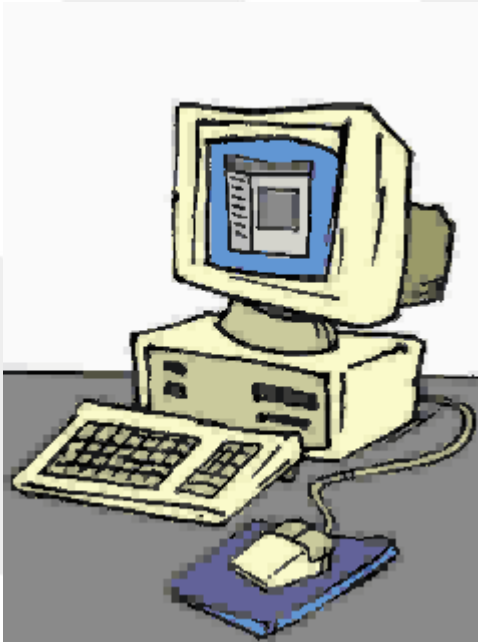
maybe in future the patient connects its device via USB or Bluetooth to the PC and gets reprogrammed over the internet

- fast
- cheaper
- maybe personal contact is required?





## Contact Information



Rikshospitalet  
Universitetsklinikk  
Øre-, nese- og halsavdelingen  
Hørselssentralen  
Ralf Greisiger  
N-0027 Oslo  
Norge  
Dir. linje: +47-230-71692  
Telefaks: +47-230-71637  
E-post: [ralf.greisiger@rikshospitalet.no](mailto:ralf.greisiger@rikshospitalet.no)

