

## Perspectives on Telemedicine



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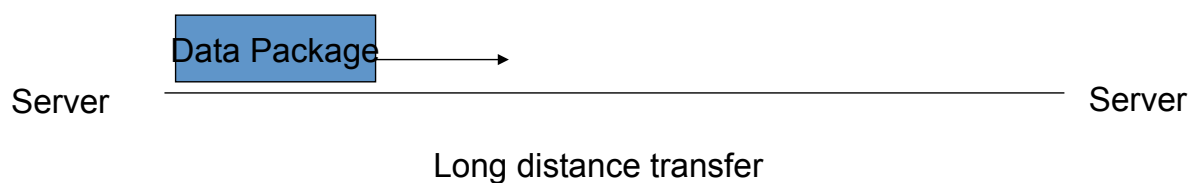
## Agenda

- History of telemedical applications
- Challenges of network architecture
- Examples for Teleneuroradiology
- Example for Telepathology
- Example for an integrated telemedical project
- Take Home

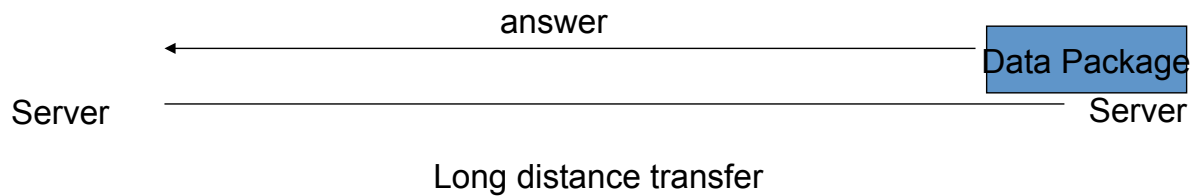
# History of telemedical applications

- DICOM (Digital Imaging and Communications in Medicine) Standard.
- Upcoming network solutions (Satellite, ISDN (Integrated Services Digital Network )).
- HR Monitor displays.

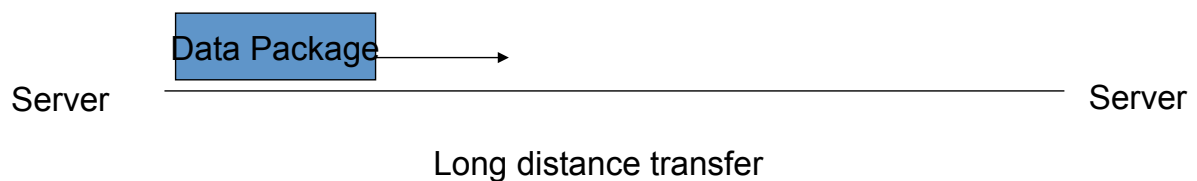
## Network architecture



# Network architecture

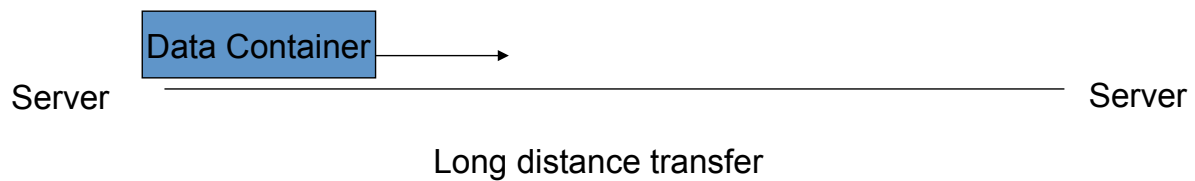


# Network architecture



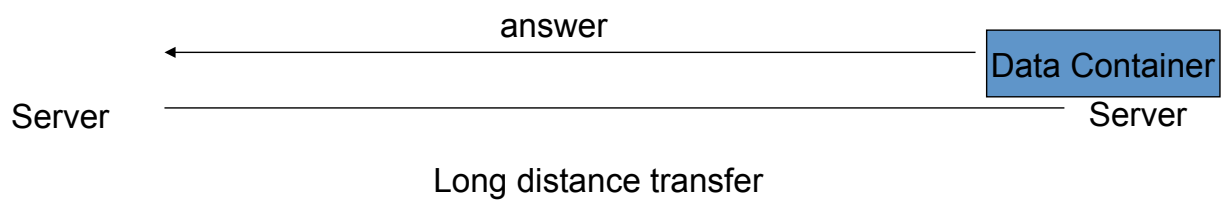
Process can take 250ms or more, so that 4 packages/sec can be transfered only

# Network architecture

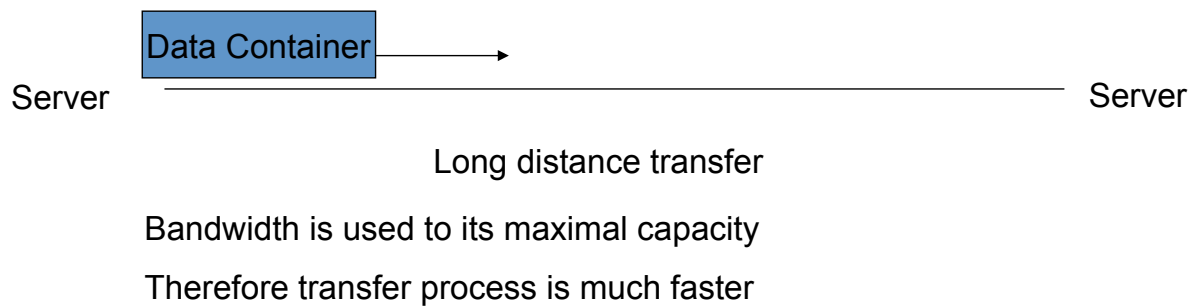


Data package can contain several images (data packages) (f.e.100)

# Network architecture



# Network architecture



# Network architecture

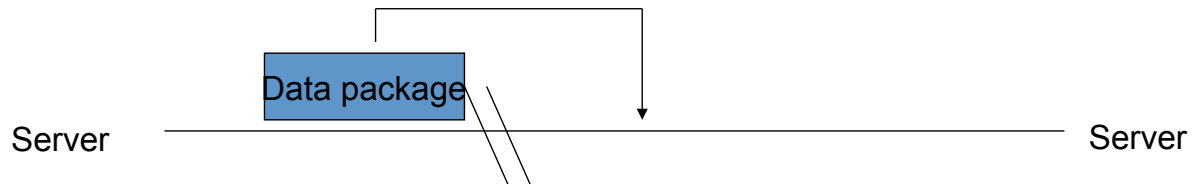
For video data it is useful to use dedicated lines



Rerouting might be time consuming. It takes some weeks sometimes  
Therefore if availability is mandatory at least one backup line is a must

# Network architecture

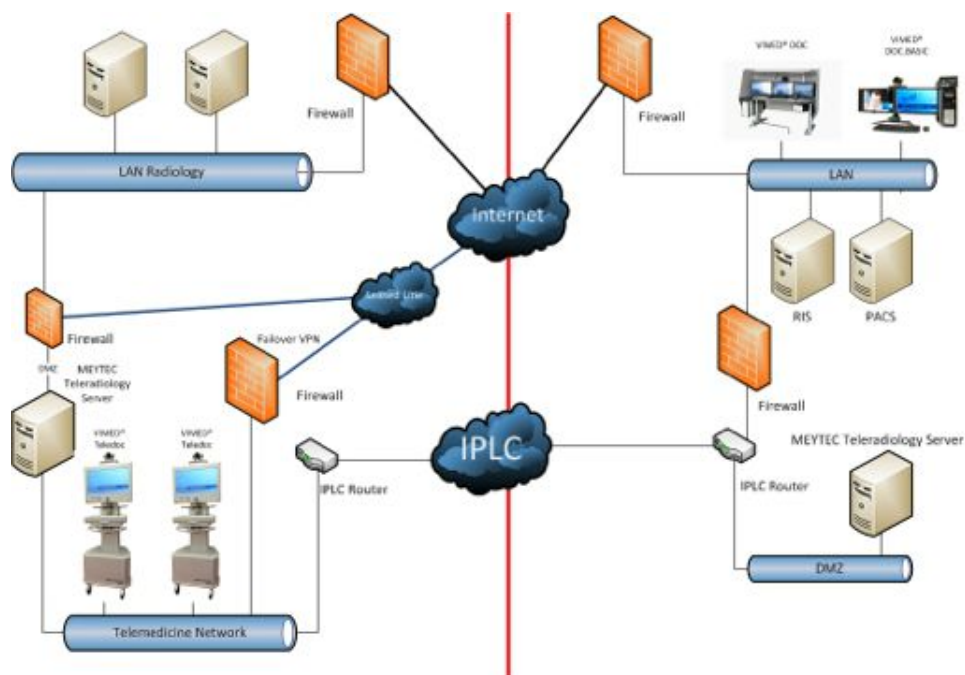
Normal internet can be used for backup



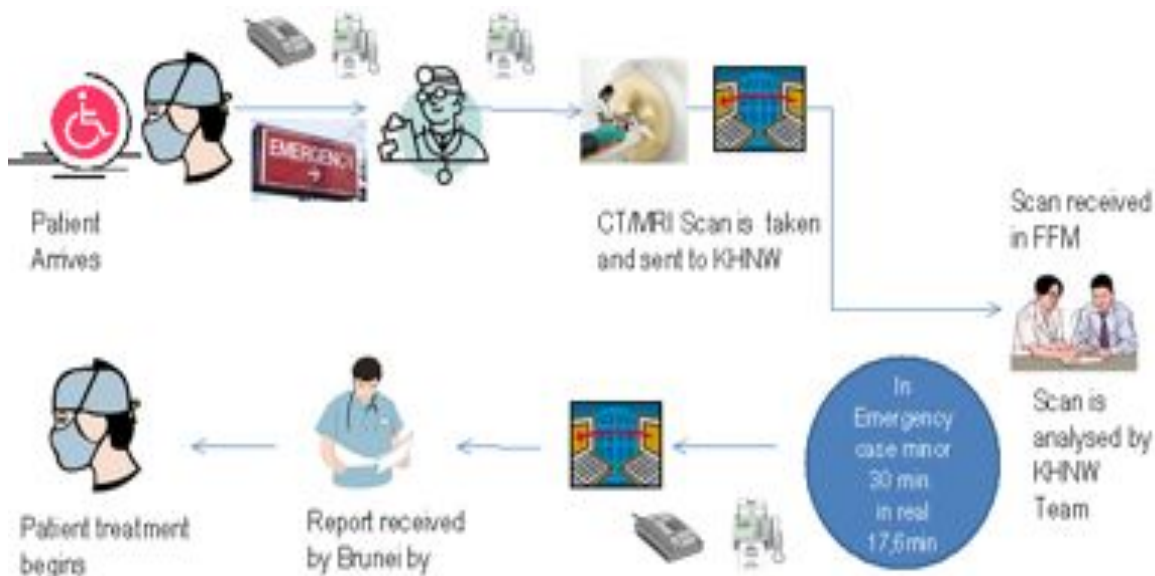
Capacity is less, but this is a backup only

Rerouting is done automatically in less then a second

## Network architecture: Example



# Key features of the establishment and operation Teleneuroradiology and Teleradiology concept



## Examples for Teleneuroradiology

Stroke Unit Krankenhaus Hofheim located 30km to Frankfurt  
Since 2007  
500 acute strokes a year  
24/7 service  
Reaction time less than 30 minutes by contract, 17 min in real  
Teleradiology including CT, CTA, MR  
720 reports 2011  
7% of patients in time window less than 1h  
Highest intravenous lysis rate in Hessen

## Examples for neuroradiological second opinion

### Makhota Hospital

Located in Melakha, 700.000 inhabitants, 150km to KL and 200 km to Singapore

Alle specialties including Neuro, Neurosurgery, ENT, OMF, Oncology, Radiation therapy

25.000 patients a year

28 outpatient office in Indonesia, Malaysia, and Vietnam

### Regency Hospital

Located in Joho, 1.000.000 inhabitants, near to Singapore

Alle specialities including Neurosurgery, OMF, Oncology

Both hospitals are depending to HMI listed at Singapore stock exchange

## Make it simple: Second opinion on demand

### Easy to establish:

Case based link sent by email makes it possible to upload images and clinical data

Case based:

URL: [https://chili.khnw.de/chili/uploadLink.cgi?](https://chili.khnw.de/chili/uploadLink.cgi?TICKET=52d8f8af.d2f00-42186433e2-60d5b527a157fc2-73011&uploadDestination=chili@localhost)

TICKET=52d8f8af.d2f00-42186433e2-60d5b527a157fc2-73011&uploadDestination=chili@localhost

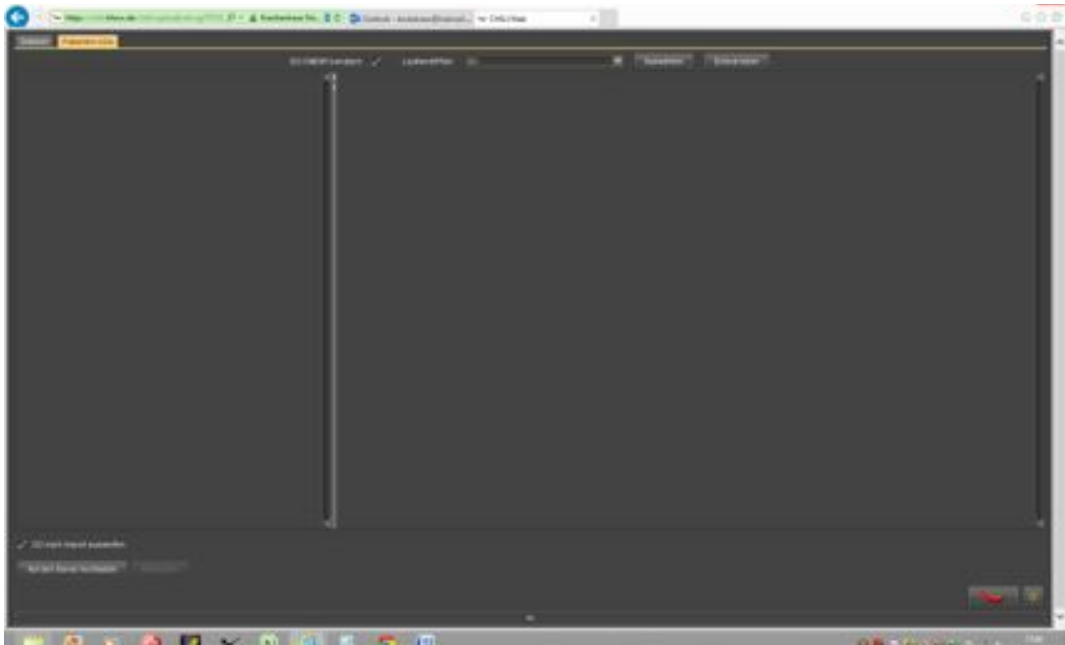
Ticket : 605-372-325-2

Valid to: 22.04.2014 10:32

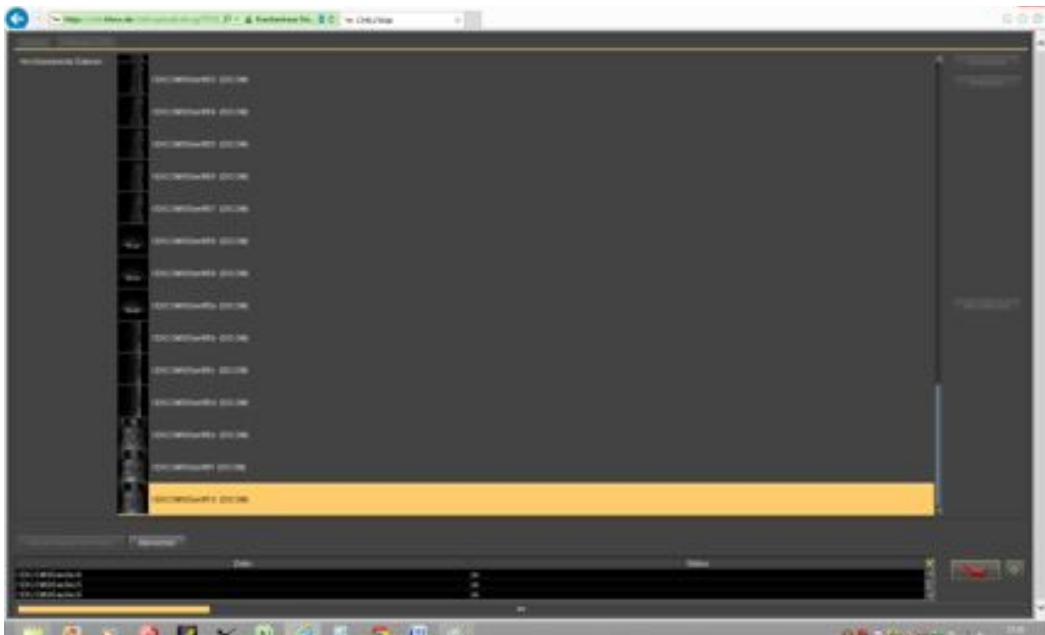
Encrypted connection → data security



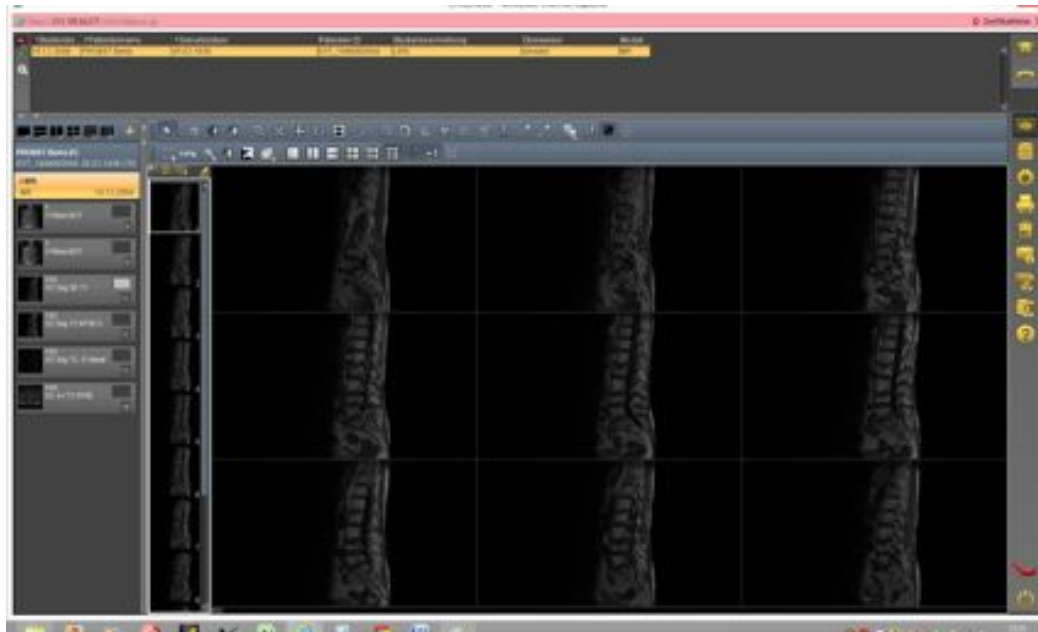
# Images Upload



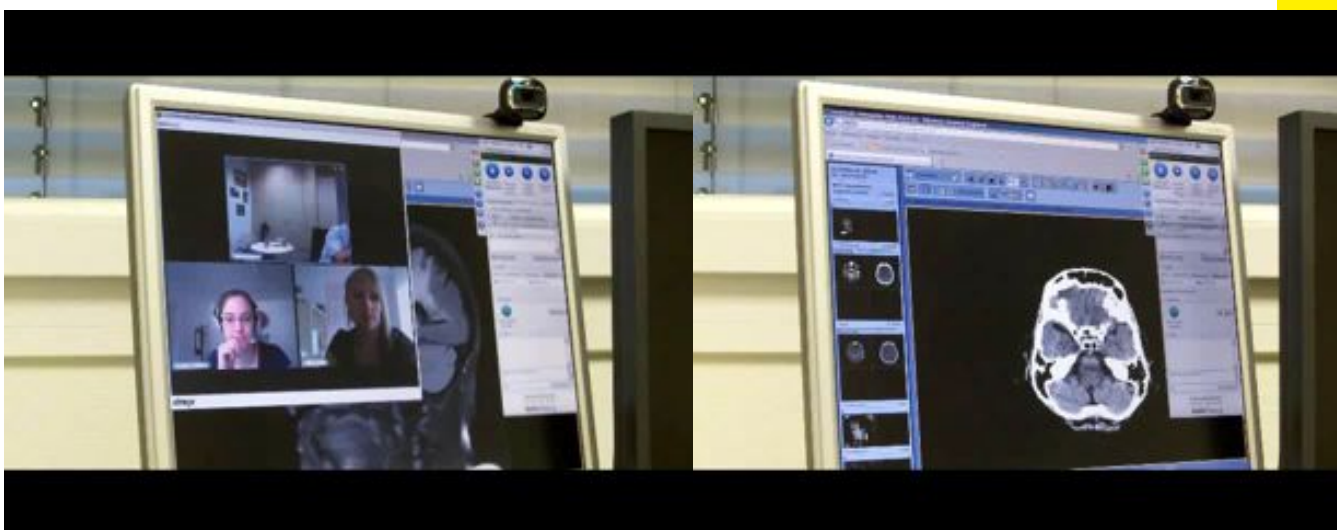
# Images Upload



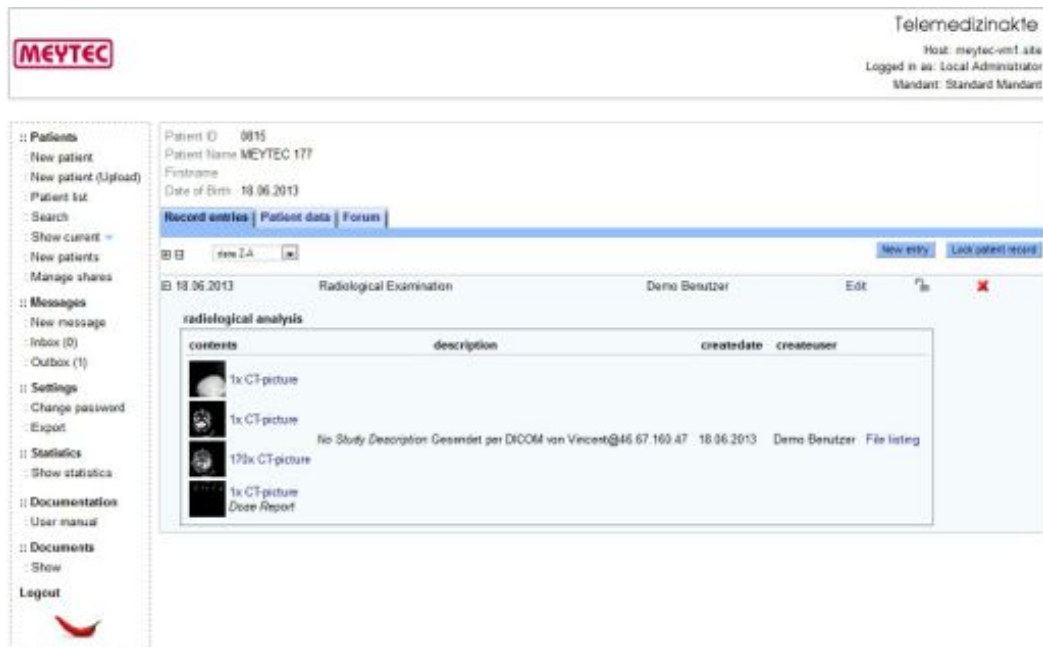
## Images Upload



## Interactive Teleteaching



# Telemedicine records



# Telepathology



Determined line



High data volume, therefore dedicated line mandatory

# Telepathology



## Setup of a Neuroscience, Stroke & Rehabilitation Center of Excellence

at  
  
*Jerudong Park Medical Center*  
Brunei, Darussalam

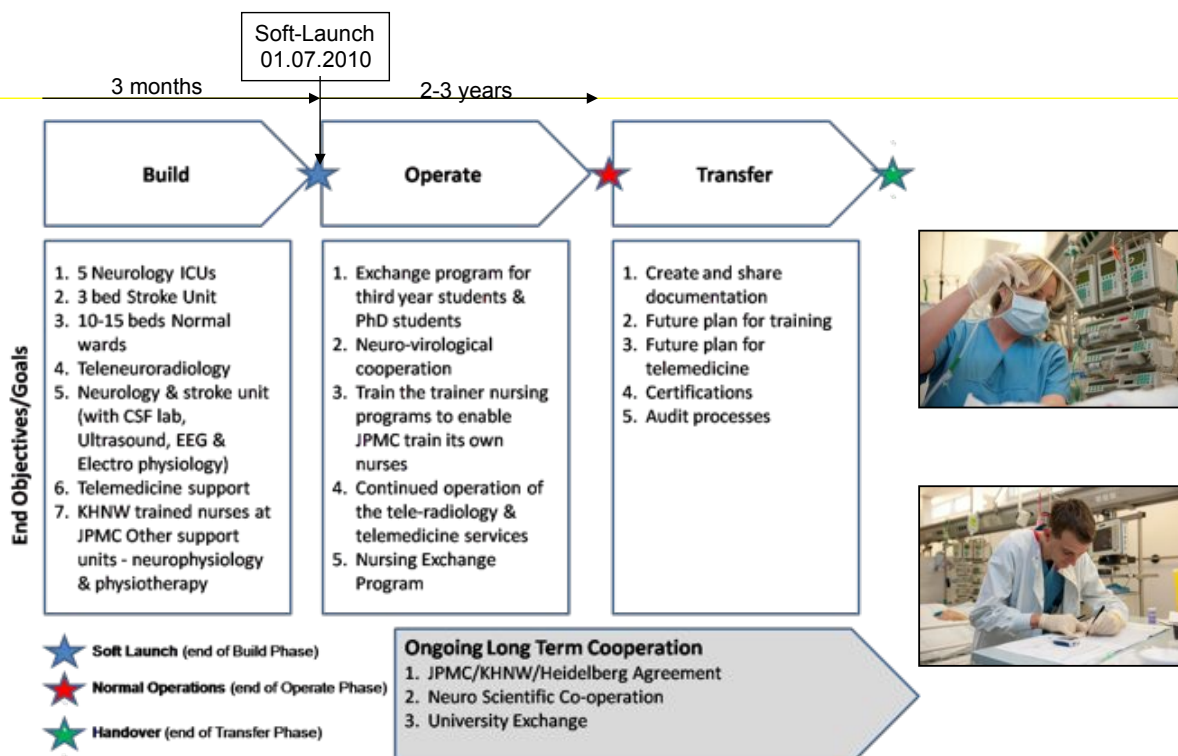


# Objectives of the partnership with Jerudong Park Medical Center (JPMC)

- Establish a basic **Neuroscience Center** at JPMC with the capability to receive and treat patients by July 2010.
- Establish a **Telemedicine process** in place in order to treat patients (and teach doctors) through a larger team in Frankfurt am Main, Germany
- **Expand and grow** the facilities (infrastructure, staff) after July 2010 to accommodate increase in patients and to carry out more **complex treatments**
- Establish a **Resident Exchange and Training Program** to facilitate the education and training of medical personnel from Brunei
- Create a **Long Term Scientific Cooperation Program** together with JPMC and University of Brunei Darusalaam.



## Project Phases





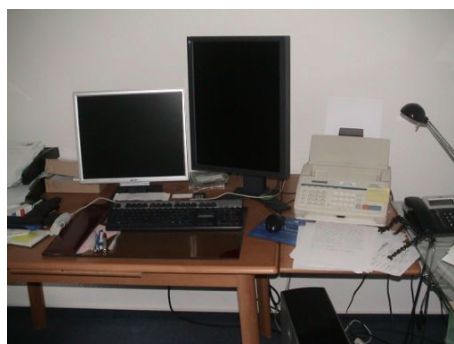
# Key features of the Neuroscience and Rehabilitation Centre

- Dedicated Comprehensive Stroke Unit
- Neurological Intensive Care Unit
- General Neurology in-patient ward
- Neurological Rehabilitation Centre
- Telemedicine (Neurology) 24/7 from Germany
- Electrophysiology and Neurosonology laboratories
- Training and exchange program for Residents and Nurses
- Audits & Certifications
- Scientific studies in Stroke Care (epidemiological, acute care, secondary prevention and more)
- Technical consulting & advice
- Implementation of SOPs, protocols and workflows



# Key features of Neuroradiology (incl. teleneuroradiology)

- Physical presence in Brunei by certified neuroradiologists implementing protocols and workflow and training of radiological technicians.
- Provide a 24 hours service via Teleneuroradiology/or in Brunei with reaction time from emergency CT/MR examination to neuroradiological qualified English written report within 30 minutes.
- Clinical imaging demonstration sessions offered twice a week by video conference.



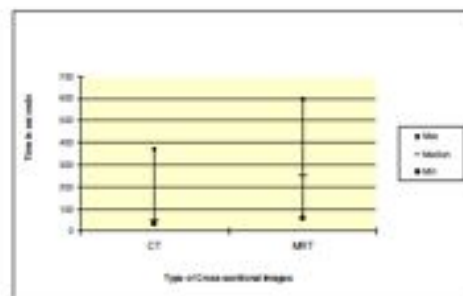
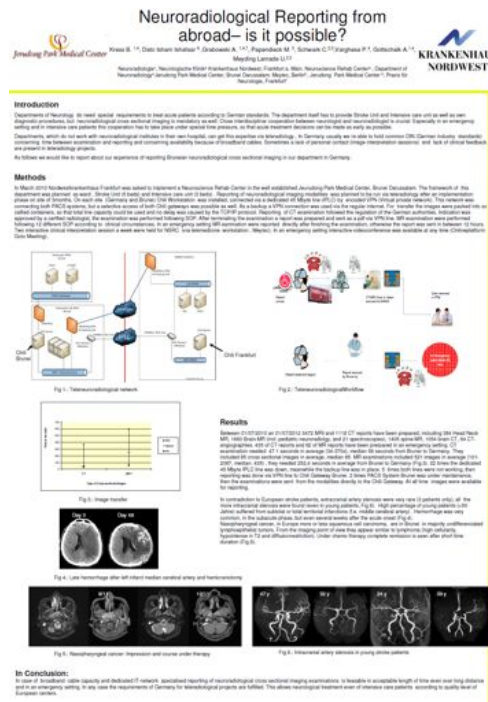
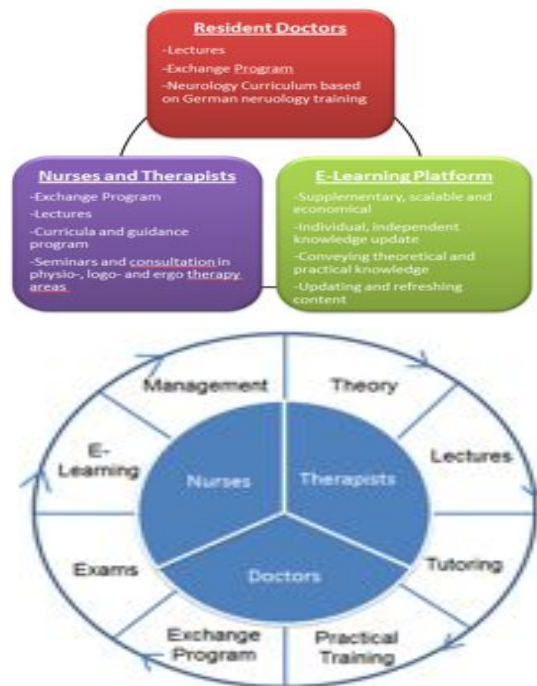


Fig 3.: Image transfer

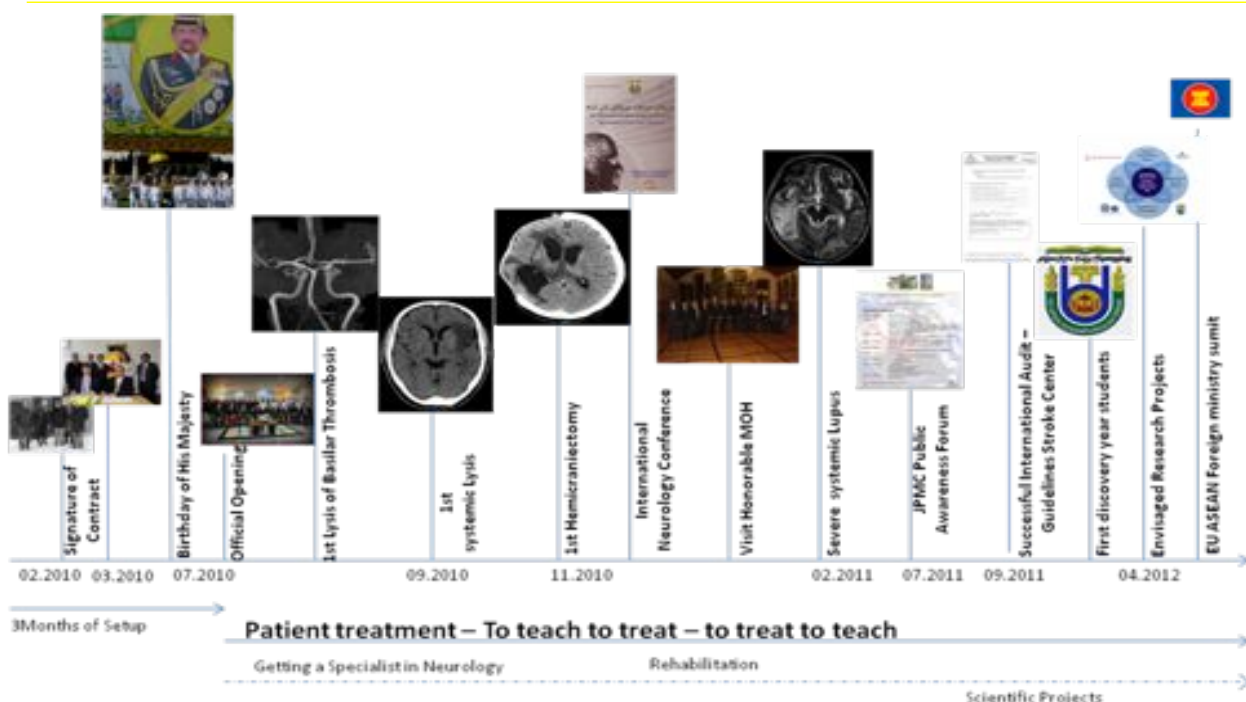
- Between 2010 and 2012 3472 MR and 1118 CT examinations have been reported
- Transfer of CT examination needed 47sec and of MR examinations 252sec
- Access to images was always possible, while dedicated line was 22 times not available.

# Key Features of Nursing and Therapists Program - „To care to teach, to teach to care“

- Creation of handbook “Specialized Neurological Nursing and Create E-Learning-Platform
- Provide facilities and lectures for 2-3 batches, with 8-10 qualified nurses each, in neurology, intensive care unit, the Stroke unit and normal ward station.
- Creation of a specific practical guidance program and supplementary seminars
- Provide certification together with the Association of Neurology of Germany.
- Resident and exchange program (Experiential learning - Small group learning opportunities - One-to-one teaching/ Tutor-System - Personal study - Audit and guidelines)
- Physio-, Logo and Ergo- therapists are trained in FFM, dispatched by KHNW to Brunei.
- Additional consultation in the specific nursing and therapy areas via the Telemedicine portal by qualified staff in nursing, Physio-, Logo and Ergo- therapy areas.



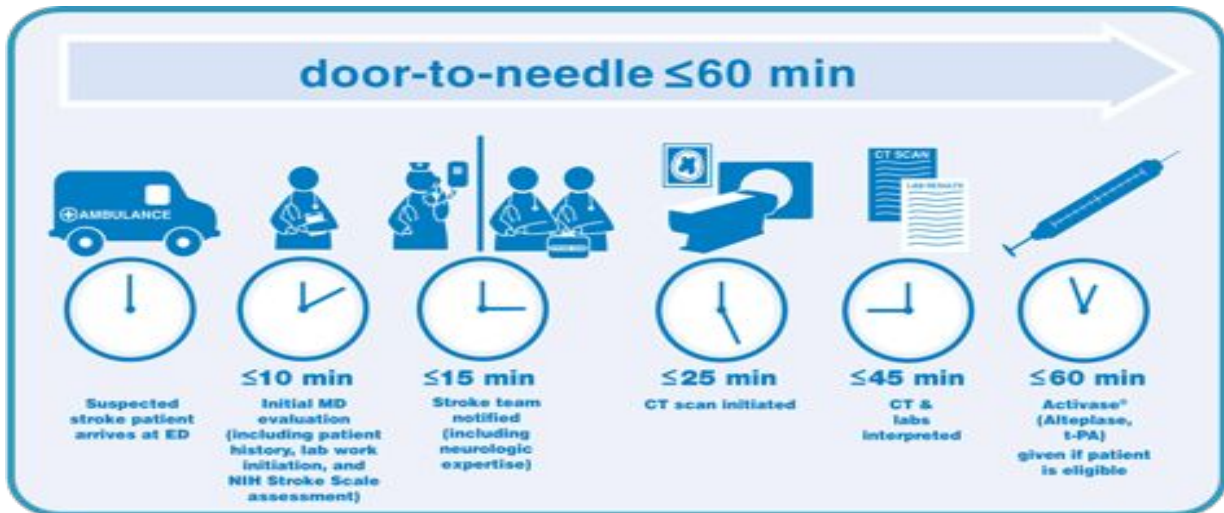
## Achieved Milestones





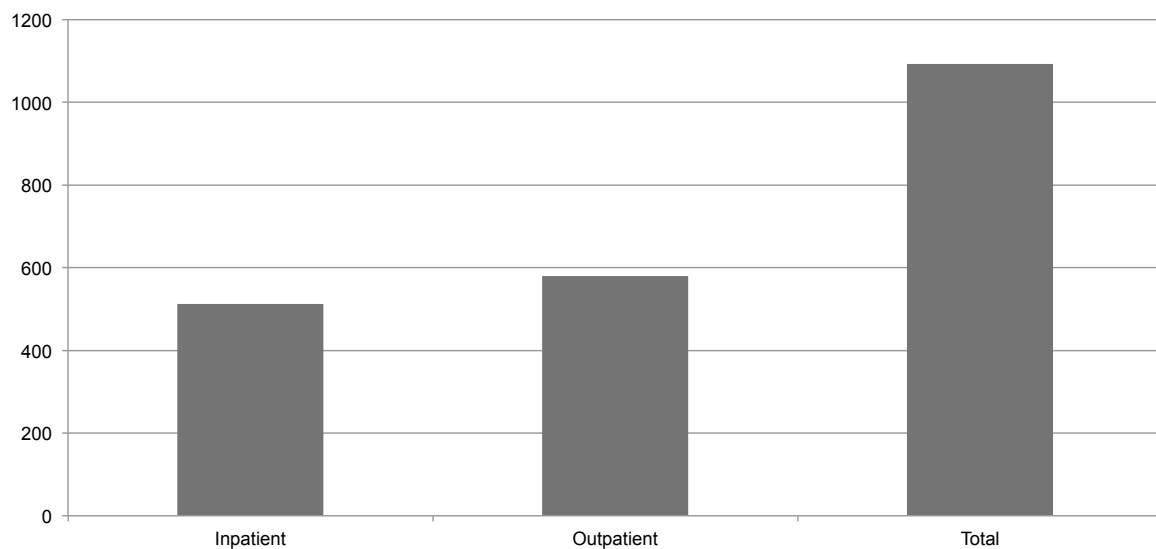
# Spreading Stroke Awareness

## Importance of awareness and cross-linkage between the hospitals and local doctors in Brunei

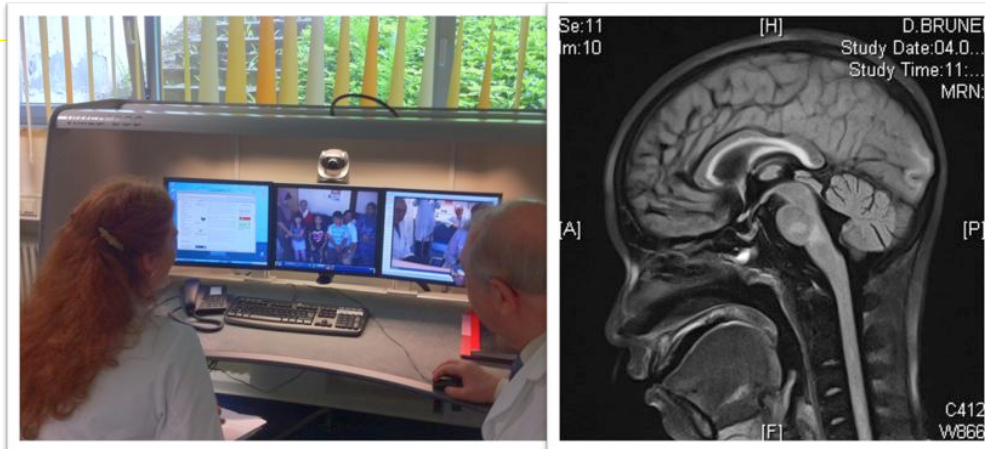


## Achievements in numbers (as of April 2012)

### Patients treated so far at NSRC

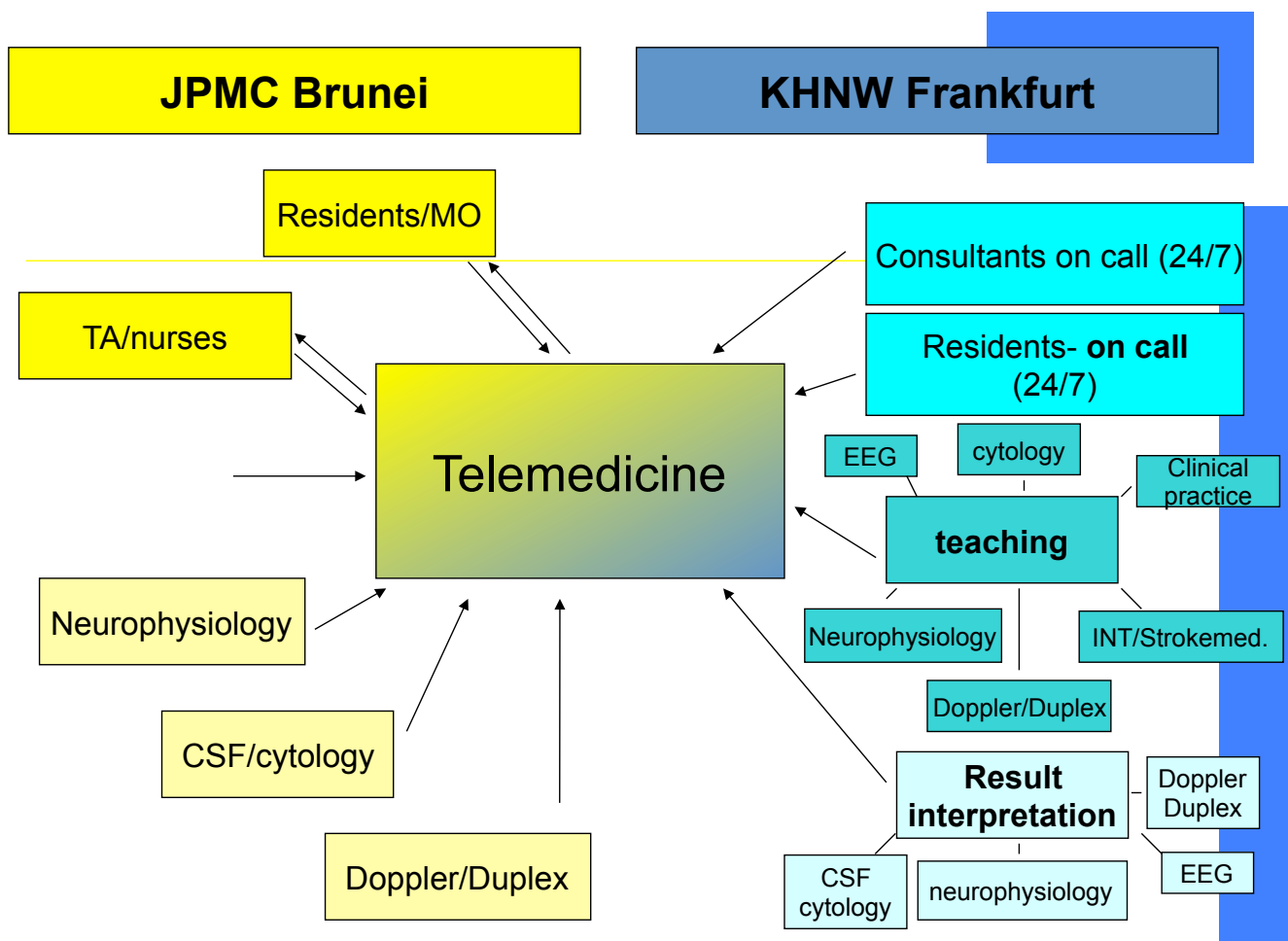


# Examples for telemedicine



13-year old patient  
Admission with seizures and fever  
On examination: mild leftsided hemiparesis  
DD: Herpesencephalitis, media infarction, ADEM, MS

35



Krankenhaus Nordwest (KHNW) is a leading German hospital based in Frankfurt am Main



- Treating 50.000 patients p.a.
- Approx. 1000 employees
- 10 medical specialties, 3 research institutes
- Renowned for its Neurology, Radiology, Oncology, and Laboratory Departments
- Academic teaching hospital of Goethe University, Frankfurt am Main.
- Medical and nursing care education in conjunction with Frankfurt University of Applied Sciences
- Leader in dispensing medical advice and opinion to remote locations via telemedicine wherein patients' conditions can be analyzed and treated from Germany by German experts using the latest technologies
- International experience in using German technology to build, operate and transfer specialist hospitals and / or departments

Krankenhaus Nordwest (KHNW) is especially renowned for its...



### Clinic for Neurology

- Nationally certified Stroke Unit with treatment of about 1,000 patients/year.
- Professor Meyding-Lamadé is one of the leading experts in neurology in Germany.
- Training center accredited by the German Society for Clinical Neurophysiology
- Certified as a multiple sclerosis center
- Involvement in national and international clinical trials (stroke, multiple sclerosis)

### Central Institute Radiology & Neuroradiology

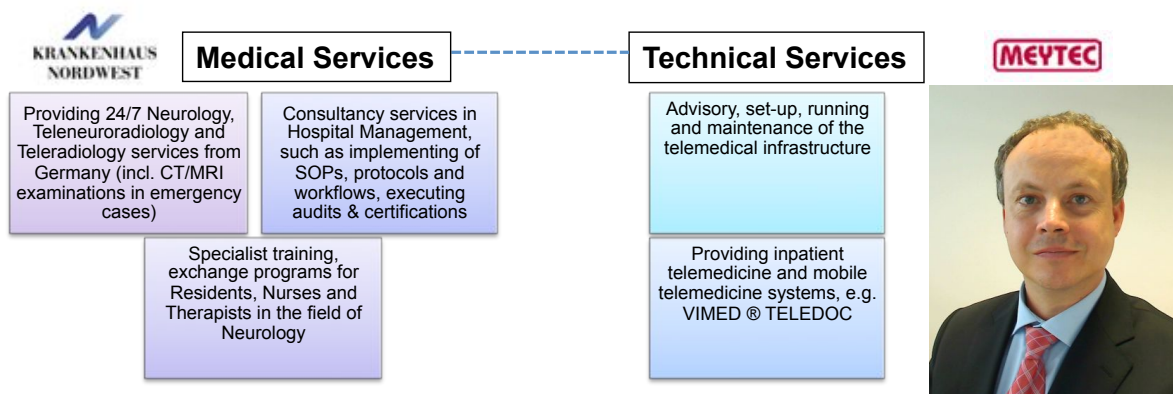
- Cross-sectional imaging for stroke diagnosis
- Diagnosis of inflammatory and malignant CNS diseases
- Intensive interdisciplinary cooperation with the Neurological Clinic and the Clinic for Vascular and Thoracic Surgery of the hospital
- MR spectroscopy
- MR perfusion
- CT angiography
- Stent implantation
- Thrombectomy
- Cross-sectional Imaging in Oncology
- Interventional Tumor Therapy e.g TACE, Microwave Ablation
- All Interventional Recanalisation Procedures in General Radiology
- General Radiology is Key Member of all Tumor Boards and annually certified Tumor and Vascular Centres

### Clinic for Oncology and Hematology

- Interdisciplinary tumor center, part of the UCT, an academic center of excellence in tumor therapy in the Rhein-Main area.
- Certified as a Leading Center for Oncology by German Cancer Aid.
- Professor Elke Jäger, head of the department, is one of only four German members of the Academy of Tumor Immunology, New York.
- Supported by the department of Radiation Oncology with state of the art treatment.

## Offering integrated medical and technical services in one package...

- Krankenhaus Northwest (KHNW) and **MEYTEC**, a leading manufacturer and service provider of telemedicine devices, have entered into a cooperation under the name of **TELEHOSPITALPARTNER**, offering a holistic service package of combined tele-medical and technical services. The rationale of such a cooperation is the attractiveness of delivering systemic and integrated medical and technical services in one package.
- The combined offering includes:



## Take home

- Telemedicine is feasible now, even over long distance
- Proper network architecture is mandatory including backups
- Teleneuroradiology causes no delay even in emergency cases and should include regular demonstration sessions.
- Telemedicine has an impact in neuroradiology, neurology, oncology, radiooncology and pathology
- Especially integrated services containing onsite and telemedicine can achieve highest quality



# Thank You!

**Prof. Dr. Bodo Kress, Krankenhaus Northwest**

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