Country Wide Central Medical Image Archive: Estonian example

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OUTLINE OF TALK

• Foundation of Estonian PACS
• Organization
• Technology
• Data (types, amount)
• Data usage
• Possible future applications: Science and Research
ARCHIVING OF DIGITAL IMAGES IN ESTONIA

• **2001**: Swedish government financed **BITNET project**: AGFA Impax 3.5 PACS installed in **Tartu University Hospital** (TUH). **Free of charge** DICOM archive and WEB Viewer for Estonian medical institutions

• **2004**: TUH upgraded PACS system hardware and software. Fee for archiving: 1€/study

• **2005**: Hospitals in Tallinn formed consortium for purchasing new powerful PACS as alternative of TUH PACS

• **2005**: State founded National E-Health organization

• **2006**: TUH and North Estonia Medical Centre (NEMC) established Foundation of Estonian PACS (Pildipank)
FOUNDATION OF ESTONIAN PACS (PILDIPANK)

- **Purpose**: to develop and manage the one common environment for transmission, archiving and usage of medical images for all Estonian healthcare institutions in equal conditions
- Integrating technologies, images, clients, knowledge, experienced people and resources into one organization
- Organization: small, effective, specialists from hospitals: <10 persons
- **2014**: Government authorized Foundation of Estonian PACS to act as a Central Medical Image archive
  - Law requires to store all DICOM images in central archive from 01.09.2014.
  - Reimbursement problem: state covers 25%, 75% is covered by medical institutions.
- **2016**: State finance is stopped. Pildipank subsidized archiving with 25% of price
- **2017**: Estonian Health Insurance Fund starts to finance archiving of images
TECHNOLOGY: ARCHIVE

Central PACS (Cloud Distributed Resources)
Databases, File-, Application-, Communication-, Audit Trail Servers

Long Term DICOM Archive (VNA)
Primary Archive Location 1
Primary Archive Location 2

WEB clients
Web Viewer
GP portal

PACS clients
WEB clients

DICOM
HL7
URL integration
Vendor specific protocol
Direct Connection to VNA
TECHNOLOGY: NETWORK

- Data communication between modalities and Central Archive is done using encrypted network channels (VPN)
- Encryption is done with:
  - Special hardware devices (VPN router)
  - Special software solutions
  - Mobile Telecommunication System Operator solutions
- Web based image distribution is based on secure SSL protocol
COLLECTED DATA TYPES

- Central Archive has capability to receive DICOM images from most of modern imaging modalities (CR, CT, MR, US, ES, NM, etc.)
- Old images digitized from old plain X-Ray film
- Images of patient done by photo camera or operation theatre devices
- Radiology reports
- ECG in numeric format
### CURRENT ARCHIVE SIZE

<table>
<thead>
<tr>
<th>Modality</th>
<th>Number of Studies</th>
</tr>
</thead>
<tbody>
<tr>
<td>PET</td>
<td>9,474</td>
</tr>
<tr>
<td>Nuclear Medicine</td>
<td>36,177</td>
</tr>
<tr>
<td>Dental Intra Oral</td>
<td>37,742</td>
</tr>
<tr>
<td>Other</td>
<td>62,952</td>
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<tr>
<td>Dental Panoramic</td>
<td>81,521</td>
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<tr>
<td>Angiography</td>
<td>122,979</td>
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<tr>
<td>Endoscopy</td>
<td>207,972</td>
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<tr>
<td>Mammography</td>
<td>341,485</td>
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<tr>
<td>Magnetic Resonance</td>
<td>488,082</td>
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<tr>
<td>ECG</td>
<td>501,885</td>
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<tr>
<td>Ultrasound</td>
<td>1,336,403</td>
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<tr>
<td>Computed Tomography</td>
<td>1,389,434</td>
</tr>
<tr>
<td>X-ray</td>
<td>7,445,306</td>
</tr>
</tbody>
</table>

**Total number of studies:**
> 12 millions

**Archive size:**
non compressed 820 TB
ACCESS TO THE DATA IN CENTRAL ARCHIVE

- All Estonian Hospital’s Information Systems are integrated with Pildipank
- All General Practitioners have Access to Pildipank
- Data access is granted to Healthcare Service Providers based on standard contract
- Data is allowed to use only for patient diagnostic and treatment purposes

- Via Pildipank PACS client (Agfa Impax)
- Via Pildipank image portal
- Via WebViewer
- Via integrated healthcare providers information systems
- Via DICOM protocol for hospital’s
  - PACS systems
  - DICOM workstation
POSSIBLE FUTURE APPLICATIONS: SCIENCE AND RESEARCH.

PREREQUISITES

• Legal rights to share anonymous patient data
  – Patient rights to collected data
  – Medical institution rights to collected data

• Recourses
  – Separated hardware and software components for live and research system
    • Not influencing the performance of live systems and daily workflow
    • For anonymization and data sharing
    • For fulfilling the ISKE (IT Baseline Protection Manual), GDPR and other additional regulations from state
  – Human resources for setting up and supporting the service

• Finances
CONCLUSIONS:

• Images of Estonian people are archived centrally and are accessible by personal ID for medical purposes
• For sharing the data for science and research the Foundation of Estonian PACS has: data, knowledge, people
• Currently there is missing
  – Proper legislation
  – Financial recourses
• Data sharing service can not be free of charge
• Pildipank can offer extra value for science and research by connecting the anonymized data with single person
• Pildipank project success: co-operation with healthcare providers and initiatives from down to up
THANK YOU

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