Multimedia Conferencing in Healthcare: QoS requirements and QoE expectations

Katarzyna Wac, Muhammad Ullah, Markus Fiedler, Richard Bults

QoE/QoS ETSI meeting France, 21-22 Sept 2010
• specifics of healthcare domain
• multimedia conference for healthcare
• lacks of standards
• fragmentation of QoS requirements and QoE expectations
• conclusive remarks

Katarzyna Wac, Carnegie Mellon University
Katarzyna Wac, Carnegie Mellon University

- **applications**
  - consultation
  - diagnosis
  - treatment

- **stakeholders**
  - patients
  - insurance companies
  - healthcare professionals/organizations

- **healthcare**
  - disease/epidemic outbreak tracking
  - treatment monitoring
  - prevention of illness
  - application/technology providers
  - regulatory/governments

- **compliance**
- **education/promotion**
- **monitoring**

→ different requirements for emergency/non-emergency case
healthcare domain trends

episodic cure

- older society
- unhealthy lifestyle
- chronic diseases
- high cost
- centralized

self-management

continuous care

- patient empowerment
- & continuous efficient effective healthcare

(distributed) healthIT/eHealth

affordable health for everyone

multimedia conference tools

Katarzyna Wac, Carnegie Mellon University
multimedia conference scenarios

- Timely diagnosis from remote specialist
  - Under-staffed providers to patients residing in rural areas, Tribal lands, and health professional shortage areas
  - Real-time treatment e.g. decision to deliver the life-saving, clot-busting drug known as tPA within 3 hours of stroke onset [Knox, 2009]

- Pandemic situations – assist more patients, avoid them to use public areas

Katarzyna Wac, Carnegie Mellon University
lack of standards & ETSI timeplan

2 years
- healthcare services classification
- interoperability, also with legacy devices
- patients safety
- radio interfaces and RF inference
- security and privacy, role-based authentication and authorization

5 years
- asymmetry of links
- dependability
- standards and protocols for sharing administrative, research and clinical data

10 years
- context-awareness

heterogeneity of requirements...

Katarzyna Wac, Carnegie Mellon University
healthcare data file sizes

- Text of single clinical document (HL7 CDA format): 0.025 MB
- Text of single clinical doc (PDF format): 0.050 MB
- Ultrasound: 0.200 MB
- Standard chart (healthy patient): 5 MB
- X-ray: 10 MB
- Chest radiograph: 16 MB
- MRI: 45 MB
- PET scan: 100 MB
- Mammography study (4 images): 160 MB
- 64-slice CT scan: 3,000 MB
- Human genome (sequence data only): 3,000 MB
- Cellular pathology study (6 slides): 25,000 MB

Katarzyna Wac, Carnegie Mellon University
required broadband connectivity

- Single Physician Practice: 4 Mbps
- Small Primary Care Practice (2-4 physicians): 10 Mbps
- Nursing Home: 10 Mbps
- Rural Health Center (-5 physicians): 10 Mbps
- Clinic/Large Physician Practice (5-25 physicians): 25 Mbps
- Hospital: 100 Mbps
- Academic/Large Medical Center: 1,000 Mbps

Katarzyna Wac, Carnegie Mellon University
<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>tele-monitoring</strong></td>
<td>ECG, X-rays, video and high</td>
<td>e2eD: ECG 12 ms, X-ray 60s, image 5s</td>
<td></td>
</tr>
<tr>
<td></td>
<td>resolution still images [Qiao]</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>AV, ECG, HR, BP, SpO2, images, EHR [Martinez]</td>
<td>e2eD: audio 150 ms loss 10%, video 250 ms, 12%</td>
<td></td>
</tr>
<tr>
<td><strong>remote hospital</strong></td>
<td>WWW, EHR, image, VoIP, vital sign, video, equipments control [Soomoro]</td>
<td>e2eD: vital signs 300ms, video 10-250 ms, control 3-5 s</td>
<td></td>
</tr>
<tr>
<td><strong>tele-ultrasonography</strong></td>
<td>ultrasound, robotic arm control data [Grawi]</td>
<td>e2eD 325 ± 297 ms, loss &lt; 0.5 %; 5 fps</td>
<td></td>
</tr>
<tr>
<td><strong>tele-surgery</strong></td>
<td>AV, robotic arm control data [Marescaux]</td>
<td>‘safe’ e2eD 330 ms</td>
<td></td>
</tr>
<tr>
<td><strong>tele-trauma</strong></td>
<td>images, video, ECG [Chu]</td>
<td>low delays, no loss for ECG, frame resolution: 320x240</td>
<td></td>
</tr>
<tr>
<td></td>
<td>AV, medical data [Navarro]</td>
<td>video H.263 5-10 fps, audio AMR 4.47-12.2 kbps, data 5-10 kbps</td>
<td></td>
</tr>
<tr>
<td></td>
<td>voice, AV, ECG, images [Gallego]</td>
<td>e2eD: AV 150-400 ms, ECG 1ms</td>
<td></td>
</tr>
</tbody>
</table>
conclusive remarks

- specificity of health care domain
- potential of multimedia conference tools
- no standards
- fragmented QoS/QoE requirements space
- need for reimbursement schemas, change in clinical processes
- lack of close collaboration with healthcare practitioners: user acceptance is a critical factor
  - instate standards during the infancy and development of solutions, before problems arise
  - listen rather than impose

Five Rights of Medication Safety
- right patient
- right drug
- right dose
- right time
- right route

Five Rights of healthIT
- right device
- right interface
- right distribution
- right content
- right intelligence

Katarzyna Wac, Carnegie Mellon University
Thank You!
Katarzyna Wac
University of Geneva & Carnegie Mellon University
Katarzyna.Wac@unige.ch
www.cui.unige.ch/~wac
### Explanation of Referenced Terms

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health IT</td>
<td>Information-driven health practices and the technologies that enable them. Includes billing and scheduling systems, e-care, EHRs, telehealth and mobile health.</td>
</tr>
<tr>
<td>E-Care</td>
<td>The electronic exchange of information—data, images and video—to aid in the practice of medicine and advanced analytics. Encompasses technologies that enable video consultation, remote monitoring and image transmission (&quot;store-and-forward&quot;) over fixed or mobile networks.</td>
</tr>
<tr>
<td>EHR</td>
<td>An electronic health record is a digital record of patient health information generated by one or more encounters in any care delivery setting. Included in this information are patient demographics, progress notes, diagnoses, medications, vital signs, medical history, immunizations, laboratory data and radiology reports.</td>
</tr>
<tr>
<td>Telehealth</td>
<td>Often used as a synonym for e-care, but includes non-clinical practices such as continuing medical education and nursing call centers.</td>
</tr>
<tr>
<td>Mobile Health</td>
<td>The use of mobile networks and devices in supporting e-care. Emphasizes leveraging health-focused applications on general-purpose tools such as smartphones and Short Message Service (SMS) messaging to drive active health participation by consumers and clinicians.</td>
</tr>
</tbody>
</table>