STSM Scientific Report

June 2, 2009
Tbilisi

STSM Title:
"Mobile telemedicine for emergency care, tele-monitoring and tele-treatment - design for low bandwidth environments"

Applicant/Beneficiary:
Dr. Zviad Kirtava, Partners for Health / National Information Learning Centre, Tbilisi, (Georgia)

Host:
Mr. Hong Chen, Altran B.V., Amsterdam, (the Netherlands)

STSM dates:
06-12 May, 2009

STSM Place:
Altran B.V., Amsterdam, and MobiHealth B.V., Enschede (the Netherlands)

• **Purpose of the visit:**
1. to review current requirements and use of telecom services for telemedicine, especially possibilities for telemedicine in low bandwidth environments;
2. to learn more about mobile communication usage for telemedicine;
3. to analyze technical matters for low bandwidth environment – elaborating services currently adjustable for less advanced mobile networks and at lower ARPU states;
4. to develop scenario-based methodology for mobile telemedicine requirement analysis, with particular emphasis for low bandwidth environments;
5. to assess data transfer size for particular scenarios and appropriate it with current mobile networks in Georgia;
6. to plan possible cooperation between involved institutions;
7. to suggest new topic for COST 605 future meetings – mobile telemedicine prospective – technological, social and economical issues;
8. to plan chances for possible Research and Technology Development (RTD) project development.

• **Description of the work carried out during the visit**
      Dr. Kirtava had visited Altran BV (Amsterdam) on May 9-12 and MobiHealth BV (Enschede) on May 6-9. Mr. Chen had accompanied Dr. Kirtava in Enschede on May 8-9. All days, but Sunday (May 10), have been working days.

In Enschede Dr. Kirtava visited MobiHealth BV and Twente University. Mr. Richard G.A. Bults MSc, BSc, CTO MobiHealth and Ms. Katarzyna Wac PhD Candidate[1], University of Geneva and University of Twente, Computer Science Department, Remote Monitoring and Treatment Group participated in discussions, presentations, definition of future targets for joint research and scientific plans coordination – along with host partner, Mr. Hong Chen, who besides meetings at

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[1] - Ms. Wac and Mr. Bults participate in COST Action IC0703 titled "Data Traffic Monitoring and Analysis", where they investigate Quality of Service requirements and provisions for mobile services, mainly in the healthcare domain

Altran BV, Amsterdam, specially traveled to Enschede for 2 days and participated in joint meetings. It needs to be emphasized, that Ms. Wac primarily holds a position at University of Geneva and she also specially has traveled from Switzerland to Enschede for meetings her research colleagues – Mr. Chen and Mr. Bults, and ensure success of Z. Kirtava's STSM. I express cordial gratitude for all involved persons devoting such precious time (including weekend) for very fruitful discussions, which made short time used at its best.

Before the STSM Hong Chen and Katarzyna Wac have communicated by e-mail to Z. Kirtava and worked out the draft technology survey for Georgian mobile communication sector – GSM providers and regulatory bodies. Although applied parties have not yet submitted answers to the questionnaire, Z. Kirtava himself collected data about current state of art in mobile sector (it was part of the presentation of Z. Kirtava at Copenhagen COST 298 conference which took place immediately after STSM meeting on 13 May 2009). The data constituted overview presentation which Z. Kirtava made on May 7 in Enschede.

The explanatory presentations made by Ms. Wac and H. Chen about important technology issues covered Quality of Service (QoS), Quality of Experience (QoE), difference between modes of GSM communication for data transfer and their reflection on delays, loses, bandwidth and availability which is important in medical data transfer – over GSM, UMTS/CDMA, GPRS or HSDPA data communication networks. H. Chen also discussed with Dr. Kirtava the differences in the price plan structure in prepaid and postpaid services between Dutch and Georgia telecom operators.

- **Description of the main results obtained**
  - 2 Surveys – technology and medical personnel acceptance are drafted in collaboration with Ms. Wac. Technology survey will provide insight of readiness of telecom sector for mobile telemedicine as well as promote publicity for new niche for GSM operators. Medical Survey will evaluate medical personnel acceptance for mobile communication to be used for diagnostic, tele-monitoring and treatment options and reveal future partners for possible RTD project applications.

  - Different modes of mobile telemedicine services have been discussed for Tbilisi and similar, low-bandwidth environments, i.e. constantly interactive and occasionally interactive modes. The latter one provides limited interactivity, but it is a valuable option if critical medical data transfer is required in low-bandwidth situations.

  - MobiHealth projects and achievements have been presented by Richard Bults and Katarzyna Wac through extensive presentation and demonstrations on May 7-8. Cardiac monitoring, *Awareness* (Epilepsy), *Myotel* (muscle rigidity measurement) projects, different settings of equipment has been demonstrated and discussed.

  - Vital signs and measurements for telemetric assessment have been discussed. The document was primarily developed by Ms Wac and some updates have been made by Z. Kirtava.

  - Different competitive schemes for duplication of service streams and more secure communication have been thought by Hong Chen and Katarzyna Wac to insure guaranteed data transfer if one of the systems would fail. Technologies discussed covered CDMA – GSM – Cable/Wi-Fi Internet data communication networks and VoIP service example of Skype application.

  - Comparison of different transport protocols for medical data exchange purposes was discussed (Katarzyna Wac) – TCP/IP – lossless and in order data delivery but possible data delays, versus UDP/IP e.g. used by Skype – less delay but more chances of loss and

reordering of data. MobiHealth application protocol is based on TCP/IP protocol stack. Suitability of SMS was also discussed for delivering healthcare services in low bandwidth environments. It was decided to work out recommendations when and why some telemedicine scenarios might have practical preferences for particular transport protocols.

- Several issues have been pointed for future elaboration (by surveys and personal discussions with local stakeholders)

   o Elaborate most economic modes (i.e. in terms of lowest monetary costs) for data transfer considering minimum data volume, as well as potential for compression/decompression

   o Elaborate GPRS classes available in Georgia and what bandwidth they can provide per slot and in total for both data upload (crucial in medical applications) and download. Elaborate options of UMTS in that regard.

   o Measure (during a possible visit of Dutch partners i.e. MobiHealth staff in Georgia) some of important parameters of mobile communication in Tbilisi city and around it – signal strength/availability, delay of data, coverage area for GPRS and HSDPA data communication networks.

- Scenarios for mobile telemedicine have been discussed – both from prospective of EU focus and Georgia needs. Cardiology (Arrhythmia, Myocardial Infarction), Neurology (Epilepsy, Sleep Disorders) and Rheumatology (Ankylosing Spondilitis, Rheumatoid Arthritis) has been discussed. It was decided that Z. Kirtava will coordinate discussions on necessity of these scenarios with Georgian healthcare institutions and after some selection of major 2-5 scenarios, all the stakeholders will elaborate technical details for these scenarios, i.e. detailed functional and nonfunctional QoS requirements including data volume, service modes,. These scenarios will be a base for future collaborative project design between Dutch partners and Georgian ones.

- Special attention was paid for scenarios, appropriate for emergency–ambulance service coordination, hard-to-reach situation (snowy mountain, islands) teleconsultations, as well as low bandwidth situations – SMS messaging, call, alarm-tone.

- Scenario assessment was considered to be carried out using a special chart designed by Z. Kirtava. This chart is dividing scenarios by hospital vs. GP/Primary Health Care settings, ER vs. outpatient care approach, and high vs. low bandwidth environment. This chart will be summarized throughout June.

- Hong Chen suggested discussing with local mobile operators and/or regulators possibility of special rates for telemedicine applications used in certain areas, and in certain times, e.g. night time and holidays. Also state might dedicate some support for mobile tariffs reduction. It was also suggested that rate of 1 MB data transfer could be lower with summary traffic increase. e.g. price of 1 MB to be X, Price for 1 MB if data volume is 10 MB - 0.5X, and if exceeding 100 MB – 0,25X.

 • **Future collaboration with host institution**

Visit of a Dutch researcher (Hong Chen or Katarzyna Wac) is planned for summer to provide independent feedback on network measurements for Tbilisi and suburban area Georgian mobile communication – QoS, drive tests etc.

2 Surveys – technology and medical personnel acceptance are planned to be carry out in Georgia in period of June –September.

Possible preparation for EU RTD project. Already in Tbilisi several meetings were held by Dr.

Z. Kirtava with Epilepsy and Neuropsychology Center, with Central University Hospital, Ambulance service CardioExpress, etc. The discussions with Dutch partners are undergoing.

• Projected publications/articles resulting or to result from the STSM

"Mobile telecommunication for Telemedicine applications in Georgia – technology and medical aspects based on survey (in preparation)".

• Confirmation by the host institute of the successful execution of the mission; (attached signed PDF)

The host acknowledges that this was a successful STSM. Key issues were worked on during meetings, which were facilitated in the form of presentations and intensive discussions even during weekend. The outcomes are concrete and promising. We will continue to collaborate on the issue in the future.
The host institution letter was submitted to the COST office by Hong Chen.

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