International Tele-Teaching — A Progress Report

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Abstract

In this paper we report on a successful tele-teaching project between the Computer Science Department of the Technische Universität Dresden (Germany) and of the Universidade Nova de Lisboa (Portugal).

1. Introduction

In the last years and decades the world grew together due to the rapid development of the Internet. Informations about various topics and from all over the world are easily available.

Tele-teaching or e-Learning is a way to utilise this concept explicitly for educational matters. A sophisticated integration will augment the syllabus of a school or university by providing courses given by international or national experts and at the same time avoid massive travel expenses for students as well as for lecturers. Studies will become more flexible considering location and time.

Tele-teaching is not a new invention and there are a lot of field reports. We can distinguish two major kinds of tele-teaching projects. Firstly, we have the distance learning universities, where material related to a specific study subject is provided as for example in the Fernuniversität in Hagen (Germany) [Fen05]. Secondly, there are networks of universities where tele-teaching is used to combine the different competencies in the same subject. Examples are VIROR [Vir05] or the Finnish Virtual University [Fin05]. In each network national universities are joined. International projects are rather unusual.

In this paper we report on a successful tele-teaching project belonging to the latter category. Between the Computer Science Department of the Technische Universität Dresden (TUD), Germany, and of the Universidade Nova de Lisboa (UNL), Portugal, a series of tele-teaching seminars was led to effect.

Both institutions have been cooperating partners for years, especially in the research field of Computational Logic. Firstly, there is a double master degree project between the UNL and the TUD. Secondly, among the universities of the Freie Universität Bozen/Bolzano (FUB), Italy, the Universidad Politécnica Madrid (UPM), Spain, and

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the Technische Universiät Wien (TUW), Austria, both departments are part of the International Master in Computational Logic. Last but not least, they work together with the University of Indonesia in Jakarta and the Hanoi University of Technology, Vietnam, within an Asia-Link project of the European Union. Thus, students as well as lecturers are spread all over Europe and can even be found in South-East Asia. To meet the demand for sophisticated teaching at international level and to be flexible in time and place, tele-teaching seems to be suitable for our approaches. The seminar was therefore a test to integrate e-Learning in the syllabus of Computational Logic.

In our case, we were just interested in synchronous scenarios like lectures given in parallel in Lisbon and Dresden. For every single appointment there were two lecturers, one in Lisbon and one in Dresden. Both gave a talk in succession to the distributed audience in both cities. After each presentation there was the opportunity for a discussion. The talks were divided into two parts running in parallel: the slide presentation and the video transmission.

According to Geyer et. al [Gey05], there are three areas which are important for tele-teaching events: didactics, organisation and technology (also known as the DOT-strategy). Therefore, this paper is organised as follows: Firstly, we report on our experiences in the didactic field. The question, how lecturers as well as the students cope with this extraordinary situation, is in the main focus. Because of the internationality of the project and the great distance between the partners, the organisation of an event was a bit more complicated than it would have been the case for a national project. The second part of the paper deals with this problem. The configuration of the technology turned out to be the major problem. Therefore, the last part contains the hardware and software requirements and a description of our main problems and their solutions.

2. Didactics

With new means of communication the way how someone communicates by using these tools also changes. In [Fri03] the video conference is seen as a self-contained form of communication affected by

- technical conditions,
- benefits and skills of the communicating partners,
- and the aim of the communication.

So, our tele-teaching scenario requires other didactic concepts due to modified means of communication. If we take a closer look at these three points, we can state that the aim of a tele-teaching lecture has not changed in comparison to a "classic" lecture. What we are going to analyse in the following is what the technically conditioned limitations of our software are and how the lecturers and students can cope with them. First, we will consider the slide presentation where we used *WebCall* from JaTeK as our slide presentation tool. After that we will dwell on the video conference where we used *VidConference* by VidSoft.

2.1 Slide Presentation

Presenting digital slides in lectures and talks has become as usual as using a microphone in big rooms with a large audience. Therefore, one might think that it should not make any difference if slides are not presented locally but remotely. Nevertheless, in practice, it turns out that slight differences had to be taken into consideration.

At first the presenter has to remember that after switching to the next slide there might be a short delay before it is visible for the remote audience. Our experiences show that the delay is between 1 and 3 seconds, while sound and picture are in real-time. However, this difference does not result in any problem, it should just be kept in mind of the presenter. *WebCall* eases this by marking the status of the visibility on the remote site. Before the lecturer goes on in the talk he should make sure that the appropriate slide is available for everybody.

The lecturer should also avoid quick movements with the mouse pointer on the slides because they will be transmitted as jumps and are hardly visible.

It is possible to write into the slides (e.g. by using a graphic tablet) but the quality is rather poor. So, it should be avoided. Instead, the lecturer has to take this into consideration when he is developing his or her slides. All important information should be written down because there is no possibility to add something during the talk.

However, it turned out that the video picture is good enough such that normal text on the blackboard is readable for the remote audience. Therefore, the lecturer has the possibility to make corrections or to give additions by using the blackboard rather than by changing the slides. Nevertheless, this option should be used rarely, because it is linked with motion, which might cannot be tracked by the slow camera.

You can find further discussion about this problem in the following section.

2.2 Video Transmission

As just mentioned, the video transmission can be used to show the blackboard of the lecturer to the remote audience. However, the main function of it is to show the lecturer in person. It turns out that to see the speaker is an essential prerequisite for the acceptance of tele-teaching by the remote audience. This requires more changes in the way the lecturer gives a presentation during the slide presentation.

Obviously, the space where he is visible for the remote audience is limited by the position, possible movements and velocity of the used controllable camera. The only thing one can influence is the camera's position.

The video device should be located far enough away from the lecturer to be able to also transmit gestures, but not too far away to make the observation of facial expressions possible.

Because the amount of the camera's possible movements and its velocity cannot be influenced, the lecturer has to adapt his movements to the abilities of the technology. In practice this means that to stay in one place is the best solution. This was actually the only significant difference compared with his usual way of giving lectures.

The presenter also has to remember that gestures, e.g. pointing to things outside of the scope of the camera, can have another or no meaning if they are not seen in relation to the room where the presenter is located. So they have to be considered more carefully.To avoid that the remote audience feels more like passive listeners

than active participants of the lecture, the lecturer should look into the camera as much as possible. However, there is obviously no possibility to eye participants in the remote audience. This remark leads directly to the next section where some suggestions are made on how to activate and include the remote audience.

2.3 Encourage Interaction

Due to the technical principles of tele-teaching in comparison to usual communication, it is difficult for the remote audience to feel as a part of the lecture. The usual attitude of most participants to a video picture is more bounded to passive entertainment.

At first, we try to activate the listeners by providing an extra wireless microphone for the audience. Making comments or asking was simplified.

Secondly, we announced explicit time for a discussion after each talk. This led to a lively interaction between both sides.

With respect to the general acceptance of tele-teaching by a remote audience we observed that, due to the visibility of the lecturer, the attention to follow the lectures comes close to a normal lecture. However, there are still three points which distinguish tele-teaching from them. First of all, an interruption of the lecturer often requires the intervention of a moderator who can use the microphone to attract the lecturer's attention to a question in the remote audience. Furthermore, the use of microphones might be unusual for people in the audience. It requires, in particular, an adaption of the voice which is unfamiliar. Finally, the camera transmitting the picture of the audience to the lecturer's room makes the people in the remote lecture room feeling being constantly watched. Therefore they might be less relaxed as in a normal lecture room.

3.Organisation

For the preparation of a tele-teaching seminar one has to take into account the content as well as the technical requirements. In this paper we focus on the latter issues. However, there are some words to say about the former ones.

Even if all technical facilities are working, the success of a tele-teaching seminar mainly depends on the interest of the participants. While the new technology might attract people for curiosity in the beginning, to keep them at it requires an elaborated and beneficial embedding of the event into the educational programme of the participating universities. In our case, this is guaranteed since the tele-teaching activities are embedded in a long standing cooperation between the TU Dresden and the UN Lisbon in the common field of Computational Logic. We mainly use tele-teaching for a joint seminar where recent research topics of both partners are discussed. In general, a common research field is suitable to attract researchers as well as students to attend the tele-teaching activities. In this case the profit of the collaboration is obvious. It multiplies the benefits of a normal research seminar, as given at any university, by joining more experts and students in the discussion.

Concerning the technical realisation, the time constraints require small adaption of the time slots. A thoughtful choice is needed because there is one hour time shift between Germany and Portugal. Since the preparation of the technical equipment might require consultation of the technical stuff outside the department, their working

hours have to be respected and taken into consideration.

Due to the large distance between Lisbon and Dresden the organisation of this series was not that easy but feasible. Long e-mails were written and uncountable dates of test sessions had to be arranged.

In [Boh04] exists a list of preparation steps which somehow reflect an ideal organisation of a tele-teaching event. It assumes that a date and time for the event is already fixed and a presenter or presenters are also committed to give a talk.

As early as possible, one should already clarify all local administrative necessities on both sides, like booking rooms, ensuring the accessibility (keys, Internet) and the announcement of the event. A date for a rehearsal, which is essential before *every* real tele-teaching seminar whenever there is a minimal change in the technical specification (like change of computers, use of another room, etc.), has to be set up.

Both sides have to agree on technical requirements and the arrangement of the hardware. All computer data (hardware specification, but also IP addresses, login information, etc.) has to be gathered. This also includes additional data for backup configurations. Existing firewalls have to be configured appropriately.

Due to the technical specification of the software we use for the slide presentation, the slides of the presenter have to be converted to JPEG or GIF files. These files have to be uploaded onto the slide server in advance.

Whenever the configuration has changed, one should use every possibility to check out the connection, even before a rehearsal. During the rehearsal it is obviously advantageous if the lecturer takes part to introduce him to the equipment. If this is not possible, he should be instructed at another occasion which simulates the event, and indicates possible problems which can occur during the transmission.

To relieve a lecturer who is unexperienced in the field of tele-teaching, a moderator should manage the seminar. He or she is responsible to introduce the presenter or presenters and the topic of the talk. Afterwards, this moderator should lead the discussion.

At least half an hour before the tele-teaching event starts, everything has to be configured in the appropriate room.

The possibility of problems during tests as well as during the tele-teaching event makes it necessary that there is at least one independent communication channel. Since lecture rooms are often not equipped with telephones or international calls are not enabled, separate computers with e-mail and/or messenger software can help.

If a connection between both cities is established via the video conference software One should be aware of the fact that, due to unpredictable circumstances (first of all, a failure of the network connection), it might be cancelled on short notice.

4.Technology

4.1 Resources

The set up of the necessary equipment for the tele-teaching seminars, requires some special hardware and software to be acquired and configured. We now turn to describe the main issues concerning this.

4.1.1 Hardware

Apart from a high-end PC, tele-teaching specific hardware including a frame grabber

(a TV signal converter (camera-to-PC) special device), a camera, two wireless (lapel and hand) microphones with respective receivers and a pair of loudspeakers were bought and properly connected to the PC.

The camera or cameras are used to film and transmit the lecturer during the talk, or the audience when appropriate, usually after the talk, during the discussion period. Typically, the lecturer is wearing the wireless lapel microphone to leave his/her hands free. The hand microphone is used for the audience to pose questions to the lecturer.

It is recommended to have backup devices for all necessary components. In fact, they should be exactly the same as the first choice devices such that replacements do not require any kind of reconfiguration.

Illustration 1 Steffen Hölldobler, giving a talk for Lisbon and Dresden. (20.01.04)

In Illustration 1 you can see Steffen Hölldobler giving a talk by using the tele-teaching equipment. He is wearing a wireless lapel microphone as already mentioned before. In front of him, there is the laptop running the slide presentation. He is controlling it by himself. Right behind Steffen Hölldobler, the slides are projected on the wall to be visible for the local audience.

Furthermore, there is a display next to him, showing the picture of the video conference. The computer running the according software is controlled by an administrative person. The video conference is projected left behind the presenter.

Additionally, there is a second camera to record the local audience. This setting might be clarified by Illustration 2 which depicts a view onto the scene.

What is not given in this diagram, are the possibilities to handle fast switching between the audience, probably posing a question, and the lecturer answering it. A switch mixer for commuting between the signals from both microphones (hand and

lapel) is convenient to facilitate the transmission of the signal. Furthermore, we used a change-over gate between the two cameras to change the transmitted picture by avoiding a very slow camera panning.
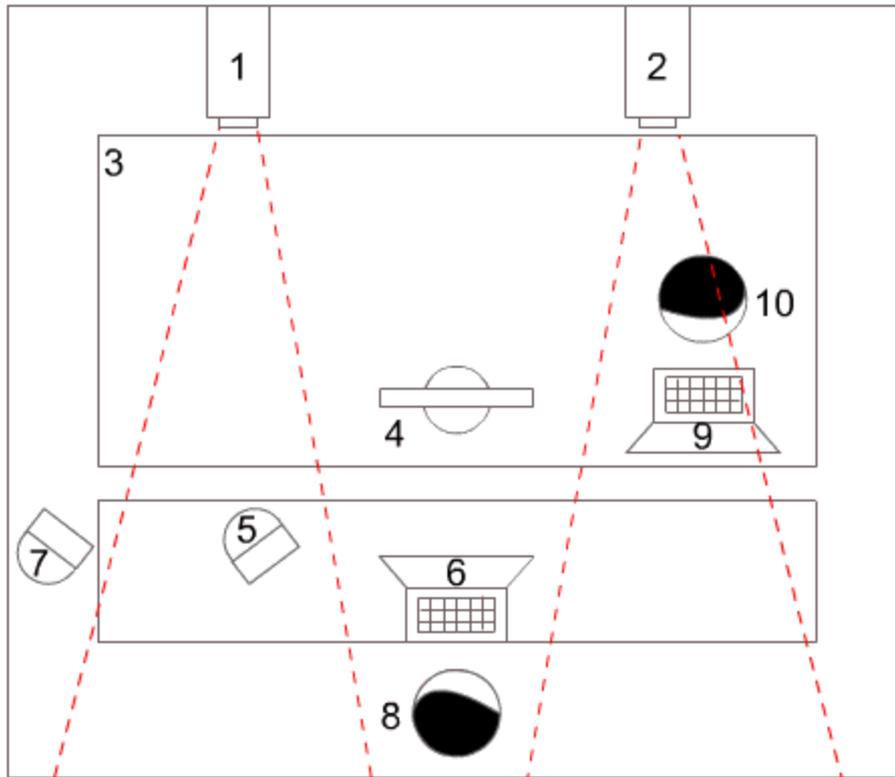

Illustration 2 The Setting of a Tele-Teaching Event.

1. Data Projector, Projecting the Slides on the Wall left behind the Presenter.

2. Data Projector, Projecting the Video Conference on the Wall right behind the Presenter.

3. Auditorium.

4. Display, Presenting the Video Conference to the Presenter.

5. Camera, Recording the Presenter.

6. Notebook, Running the Slide Presentation.

7. Camera, Recording the Audience.

8. Presenter.

9. Notebook, Running the Video Conference.

10. Administrative Person, Controlling the Video Conference.

4.1.2 Software

As already said above, we chose *WebCall* for the slide presentation. This is a java based tool which is very easy to handle. It is divided into a part for the lecturer, the *WebCall* Agent, and a part for the audience, the *WebCall* Client. Illustration 3 shows a screenshot of the *WebCall* Agent.
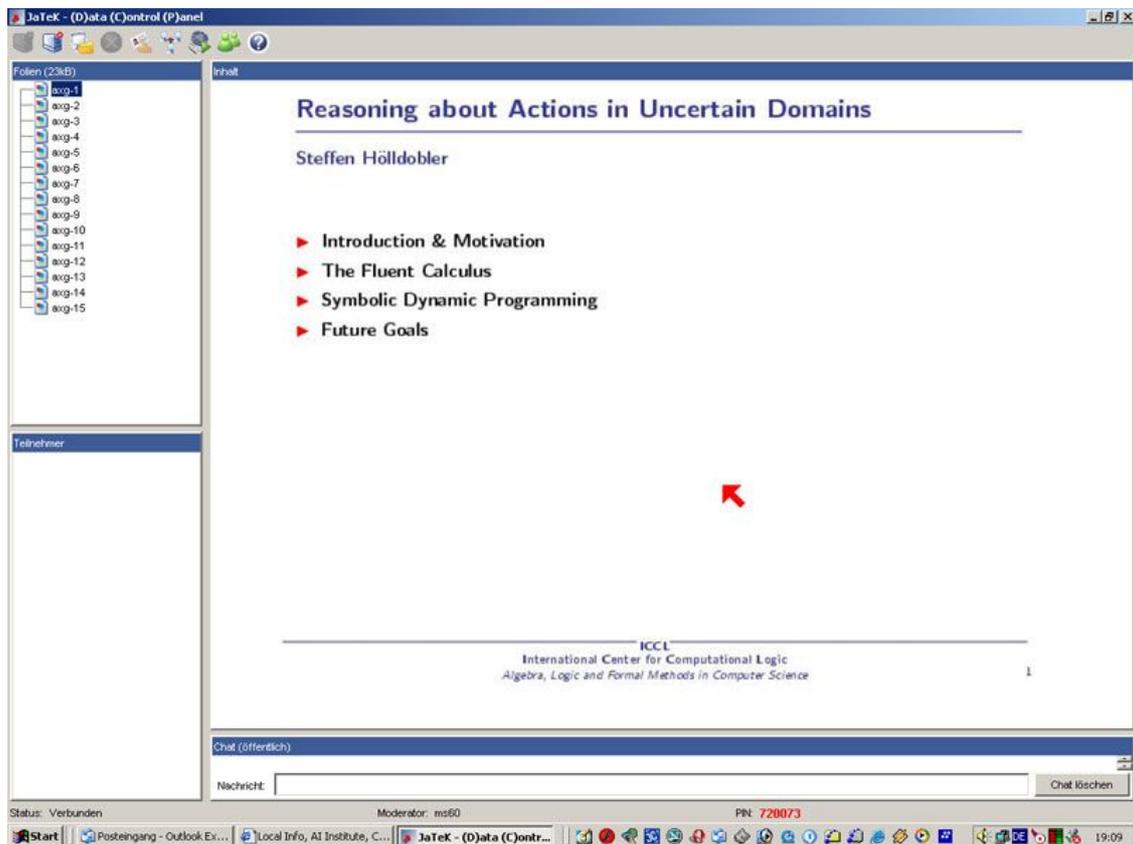
Illustration 3 A Screenshot of the Slide Presentation Software.

The lecturer uses the Agent to present his slides. As mentioned above, the slides have to be uploaded onto a server in advance. During the presentation the lecturer just has to flip through the pages. On the remote side, just a browser is needed, since the client runs as a Java plugin. Up to 250 Clients can watch a presentation simultaneously.

We never had problems concerning bandwidth or quality using this tool.

For the video transmission several existing applications were tested. However, the easy available standard video conference systems (running under Microsoft Windows), like *Netmeeting* or *MSN Messenger* could not fulfill the quality needs for a successful tele-teaching presentation.

Finally, *VidConference* was chosen as the software for the video transmission[4].

VidConference revealed itself as the application with the highest data compression rate between peers of a video conference session. It is a client/server application first establishing a session handshake via a *VidConference* server and then letting the clients exchange audio and video data in a peer-to-peer fashion.

VidConference and likewise most video conference software use a specific port for the transfer of audio/video data. This requires a special attention to the configuration of the firewalls.

In principle, a video conference would already work with a normal ISDN connection, however, to guarantee a high picture and audio quality favorably for tele-teaching, a broadband connection is required. Usually, every university provides the appropriate

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4   Since the software was

developed at the TU Dresden, we also profit from a direct support by the developers.

Internet connection needed for such a transmission. However, since the traffic on the university line is shared with all users on a campus, a prioritisation might be necessary. With the appropriate configuration the software provides a picture which is very satisfactory, even in the case of movements (the screen shot in Illustration 4 can of course only illustrate a frozen image).
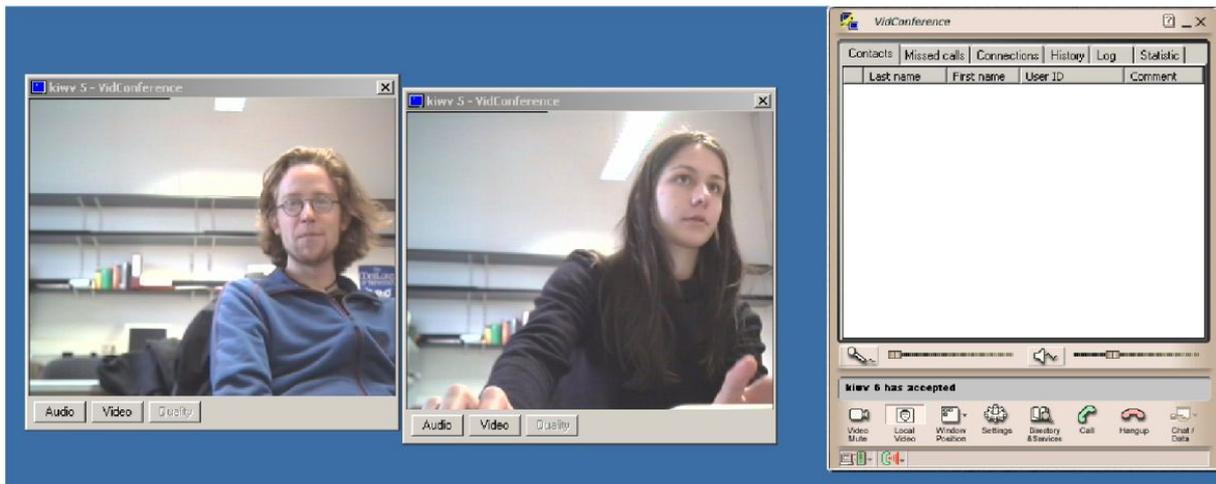

Illustration 4 A Screenshot of the Windows Screen with two parallel Pictures of the Video Transmission Software and its Control Interface.

4.2 Problems and Solutions

International tele-teaching sessions occur on top of several layers of software and hardware components. Therefore, it is hardly possible for us to control every part of the system and to avoid errors.

First of all, we mainly had to cope with several network problems during tests and also during live sessions. They led to poor audio and video quality due to a high packet loss and sometimes to connection breakdowns when the quality dropped drastically. Of course, the network conditions between two international peers are totally out of control for both partners and they may occasionally degrade audio/video transmission. So, our troubleshooting was focussed on the local network.

In an academic environment, the traffic of a tele-teaching session will flow in parallel with the remaining traffic of hundreds of students, teachers, researchers and all other staff. In order to guarantee a high-quality audio/video transmission a prioritisation of the traffic may be necessary.

Traffic Shapers are special hardware devices designed to control, monitor, and prioritise traffic. The correct configuration is not trivial and requires special attention. Several tests should be led to effect to make sure the correct prioritisation policy is being used. Also routers and other complex network devices may require some fine-tuning in their configuration.

The main causes of the problems we found were related to the configuration of routers and traffic shapers. The detection and resolution of network related problems, such as an inappropriate network device configuration, requires, in most cases, the collaboration of other people, namely Systems Administrators. Sometimes the collaboration of people from outside the universities, such as national organisations for Internet traffic routing, is also essential. These factors must be

considered as they may impose time constraints in the resolution of problems: the work schedule of these persons must be respected.

For facilitating the detection and solution of problems an independent communication channel, such as e-mail or chat, is highly recommended.

The second type of problems was linked to the local hard- and software. For several times *VidConference* itself crashed leaving us no alternative but to restart the application and establish a new connection. This might be caused by a compatibility problem between hard- and software. Nevertheless, this was solved by constantly updating drivers and *VidConference*.

The most important thing for a tele-teaching event is the sound. There is no advantage to the audience if they can see a perfect picture of the lecturer but do not get anything of what he is talking about. Therefore, one should take enough time for tuning the audio equipment. The experiences required for this task can be gained by several tests. A high number of spare batteries are needed, specially for the wireless microphones.

Also the lightning conditions have to be checked. The transmitted picture will be of poor quality if there is for example just one source of light in the considered room and the camera points directly in this direction. We achieved the best results when we just used artificial light and covered the windows with curtains.

5. Conclusion

Our experiences showed that a successful use of tele-teaching in an international cooperation is possible. First of all, the basis for this is a common scientific
research field of the participating institutions. Under this premise, tele-teaching can enrich the educational programme in Computer Science in a significant way. The technical effort to perform a tele-teaching seminar is not negligible but feasible. It requires a time-consuming preparation of the configuration, in cooperation with complaisant support from the computing services of the institutions. However, this is a valuable investment to compete for an innovative improvement of Computer Science Education.

Acknowledgement

indispensable for the success of the transmissions.

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