



**EUROPEAN TRANSPORT INFRASTRUCTURE EDUCATION ON  
INTELLIGENT TECHNOLOGIES FOR REMOTE INFORMATION  
AND COMMUNICATION PLATFORM.**

**Zdravko Rusev**

*Technical University of Ostrava, Faculty of Civil Engineering,  
CZECH REPUBLIC*

PART I.

***Key words:** internet, televideo information and communication, distance study.*

***Abstract:** One of the directions of the future of European university education will be based on digital I-televideo information and communication technologies development. This paper presents the advantages of such education and is a part of the author's Theory of DIVIEDUR (2001 – 2007 research).*

## **1. Introduction**

European area development directly depends on cultural development. In the beginning of the 21 century (2007), the European Union is formed of 27 countries, that is, half of the European countries have been united, creating the conditions for common development.

This inevitably reflects their common multicultural development. A driving force for cultural development is education, especially university education. European Commission Education and Culture significantly support the cooperation between university research and development institutions. Mobility support and harmonization of educational criteria appear among the trends in European area development. ECTS (the European Credit Transfer System) is being created, as well as the conditions for awarding double and multi-degree diplomas.

**One of the directions of the future of European university education will be based on digital I-televideo information and communication technologies development.**

This research has several goals:

- to study existing technologies in different places in Europe,
- to analyze existing infrastructure and scientific possibilities,
- to define methodical steps for New European Form of Higher Education on HD video platform for remote communication,

- to found European Network on Video Education – ENOVE,
- to prepare some details as real application of this kind of Education on 21<sup>st</sup> Century.

## 2. Existing situation

### Main changes

In the beginning of the 21 century, Information and Communication Technology development undergoes rapid technological changes characterized by the following fields of interest:

- realization and functioning of hi-tech computer centers,
- implementation of high-speed Internet,
- development of SW and HW support for video data transfer and processing on mega, giga and terra level availability for common users.

### Conclusion

**Fast internet technology development contributes to European Higher Educational Systems?**

### E-learning

E-learning can be understood as a multimedia **educational support using** modern information and communication technologies for the improvement of education. This state-of-the-art methodology is useful mainly in distance education, but can also work towards an effective extension of full time studies. The students are offered study and information resources through the computer network, using it for communication with the educational institution, teachers and co-students.

LLL (Life Long Learning): another term relating to **E-learning** is part of the life long learning. Its essential feature is the use of e-learning platform for a certain life long learning segments. E-learning in existing Higher education is education support for the same students' which used classical forms of study process.

### Conclusion

**E learning is not effectiveness of multimedia support to university education. It is good support of the other standard system of education?**

## EXISTING HIGHER EDUCATION MODEL

### Full Time Study

At the moment, it deals with the preparation of the specialists at **Bachelor, Master and Doctoral** courses, standard form of teaching, such as lectures, seminars etc. (at the school, or outside).

The link between students and teachers **is very close**, such as in full-time study. Third year of the study program<sup>1</sup> Technology of Transport Management contains 24 hours of

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<sup>1</sup>University of Pardubice 2005/2006

28 weeks in total per 12 hours each, 336 hours of tuition present lectures in one year and 14 weeks per 12 hours make 168 hours of seminars in winter term, 14 weeks per 16 hours 224 hours of seminars in summer term make 392 hours in total for one study year. In total: 336 + 392 = 728 hours.

tuition per a week in winter term (6 subjects) and 28 hours (8 subjects) in summer term. In total it represents 60 credits in 14 subjects. 12 hours lectures a week (winter and summer term) and 12 hours of seminars (winter term) – 16 hours (summer term).

We expect that the direct tuition makes another 728 hours, i.e. an average student should spend around 1456 hours on his/her study preparation.

### Distance Study

Third year, branch Technology of Transport Management contains 106 hours of tuition in winter term(6 subjects) and 96 hours (8 subjects (summer term). 60 credits in 14 subjects. Consultations 212 hours in total.

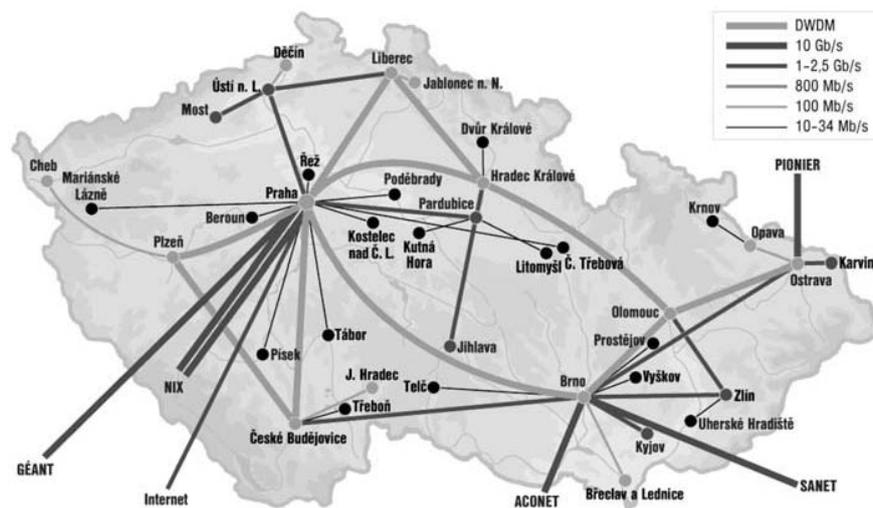
Another 1224 hours of individual preparation are expected to achieve approximately the same results.

It is obvious that the conditions in full-time and distance study are far from being equal, there are reasonable reserves, but the graduates are awarded the same diploma upon completion the whole course.

**Conclusion Is it essential to harmonize the quality of full-time and distance studies? Then we can talk about the same diploma for a different purpose?**

## TECHNICAL INFRASTRUCTURE IN CZECH REPUBLIC

### CESNET2



Source: CESNET2 www

Source: CESNET2 www

CESNET2 is Czech high speed internet network for scientific, research, development and education. The capacity in 2007 show us that between Prague, Plzeň, Hradec Králove, Ostrava, Brno, Olomouc, České Budějovice and Liberec we have level DWDM<sup>2</sup> (theoretically single fiber have been able to transmit data at speed up to 400 Gb/s.). The other parts 1 Gb/s.. Link to outside are GÉANT, Internet, AGONET, SANET and PIONIER<sup>3</sup> (up to 1 Gb/s.), from them GÉANT, AGONET, SANET and PIONIER until 10 Gb/s..

<sup>2</sup>DWDM -Dense Wavelength Division Multiplexing

<sup>3</sup> Source: [www.cesnet.cz](http://www.cesnet.cz), 2007

## **IN EUROPE**

### **DANTE**

Delivery of Advanced Network Technology to Europe plans builds and operates pan-European research networks. Owned by European National Research and Education Networks (NRENs), it works in partnership with them in co-operation with the European Commission. DANTE provides the data communications infrastructure for the global research community.

Although based in the UK, DANTE is a truly European company. It has a diverse, multi-lingual staff representing many different nationalities and operates throughout Europe. The company has had a conscious policy of recruiting from across Europe throughout its eleven-year history.

### **Some History<sup>4</sup>**

Although research networking in Europe first started in the late 1970s, it was mainly confined to developments of National Research Networks. The first serious pan-European co-operation started with the establishment of the RARE (Réseaux Associés pour la Recherche Européenne/European Association of Research Networks) organization in 1986. The first real attempt to define a longer term set of objectives and goals for European research networking was the COSINE project. COSINE (Co-operation for Open Systems Interconnection in Europe) had the aims of improving co-operation among research networks in Europe whilst at the same time promoting the development of OSI. It, therefore, had too many different targets to represent a strategic direction for European Research Networking. A more focused approach was required.

The National Research Networking organizations, although grouped together within RARE, still needed an efficient and cost-effective vehicle to co-ordinate pan-European research networking on their behalf, and to ensure that project results were delivered on time, within budget and with high levels of reliability. The answer: DANTE.

After two years of preparations, DANTE was launched on 6 July 1993 at St John's College in Cambridge in the UK. Its mandate was "...to rationalize the management of otherwise fragmented, uncoordinated, expensive and inefficient transnational services and operational facilities."

During the first year of DANTE's existence, RARE was the legal owner and only shareholder. Then on 25 March 1994, the ownership of the company was formally transferred to 11 national research networking organizations. There have been some small changes, and four additions, to the shareholders' list over the years. More information about DANTE's shareholders is available from the link alongside.

Following on from the IXI (International X.25 Interchange) initiative which was part of the COSINE project, DANTE managed the EuropaNET project. EuropaNET was the first generation of pan-European research networks to be managed by DANTE, and the company has gone from strength to strength since then.

Since its creation in 1993, DANTE has played a pivotal role in the creation and management of four consecutive generations of pan-European research network: EuropaNET, TEN-34, TEN-155 and now GÉANT. All these networks have been established and supported in the context of European Union programmes, such as the

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<sup>4</sup> Source: DANTE www

Fourth and Fifth Framework Programme and eEurope. In addition, DANTE has managed or been a partner in numerous other research networking projects. Further details of all of these projects are available by selecting the Projects link at the side of this page.

- From 1993 to 1997, EuropaNET was developed. It connected 18 countries at speeds of 2 Mbps and used IP technology.
- From 1997 to 1998, TEN-34 was developed, again connecting 18 countries, but now at speeds of 34Mbps and using both IP and ATM technology.
- From 1998 to 2001, TEN-155 was developed, connecting 19 countries at speeds of between 155 and 622 Mbps, again using IP and ATM technologies.
- From 2001 until 2004, the GÉANT network connects 32 countries at speeds of between 2.5 and 10Gbps. It uses DWDM technology and offers both IPv4 and IPv6 native services in dual-stack mode.

The development of each generation of network has typically been undertaken as a project involving a consortium of National Research and Education Networks (NRENs) with DANTE acting as a managing or coordinating partner.

As well as steadily improving pan-European research network connectivity, these networks have been used to conduct a number of test programmes, focusing primarily on ATM and quality of service (QoS). These have been carried out by Task Forces, such as Task Force TEN (TF-TEN), TF-TANT (Testing of Advanced Networking Technologies) and TF-NGN (New Generation Networks).

### **The GÉANT2 Network**

GÉANT2 is a multi-gigabit research and education network, pan-European in scale and reach. It provides the European research and education community with a state-of-the-art data communications backbone network. The network provides the most advanced services and widest geographical reach of any network of its kind in the world, boasting leading-edge standards of reliability and innovation.

GÉANT2 connects 30 European national research and education networks (NRENs) which serve 34 countries. The NRENs connect research and educational institutions within their respective countries (though the exact structure for doing so varies between nations). More than 30 million research and education end users in over 3,500 institutions across Europe are connected to GÉANT2.

The initial topology of the new network was announced at the project's official launch on 14-15 June 2005. The first links of the network came into service in Q4 2005. The network will operate until September 2008.

Research networks have become an essential part of many research and education activities. The networks provide the data communications connectivity needed to allow researchers and academics to collaborate together in their work.

The pan-European backbone approach has been definitively proven by GÉANT2's predecessor networks, and can offer, amongst other benefits:

- Maximum efficiency in the centralization of network management.

- A high concentration of networking expertise in support of European research and education.
- Easy access for users in other regions and countries around the world to resources and equipment which would otherwise be out of reach.

Research and education networking in Europe is organized in a hierarchical fashion. GÉANT2 provides the pan-European backbone to interconnect Europe's national research and education networks. Together, GÉANT2 and the NRENs provide advanced communications services to Europe's research and education community.

The network architecture is evolving to a more flexible structure based on a combination of routed IP and switched components. The objective is to create a hybrid infrastructure that meets the needs of different types of user with the most appropriate technology.

This section of the website provides information on the technological approach of the GÉANT2 network, including:

- A summary of general principles that have been employed in planning the topology, including downloadable maps of the current GÉANT2 topology.
- An outline of the commercial aspects of network procurement.
- Principles that have guided the migration from GÉANT to GÉANT2 and topology design for the new network
- A summary of the approach to implementing international connectivity.
- Network services to be provided across the core network, including the classes of service that will initially be available on GÉANT2.
- An overview of network operations.

### **GÉANT2 partners**

The GÉANT2 project is collaboration between 30 European national research and education networks (NRENs), DANTE and TERENA.

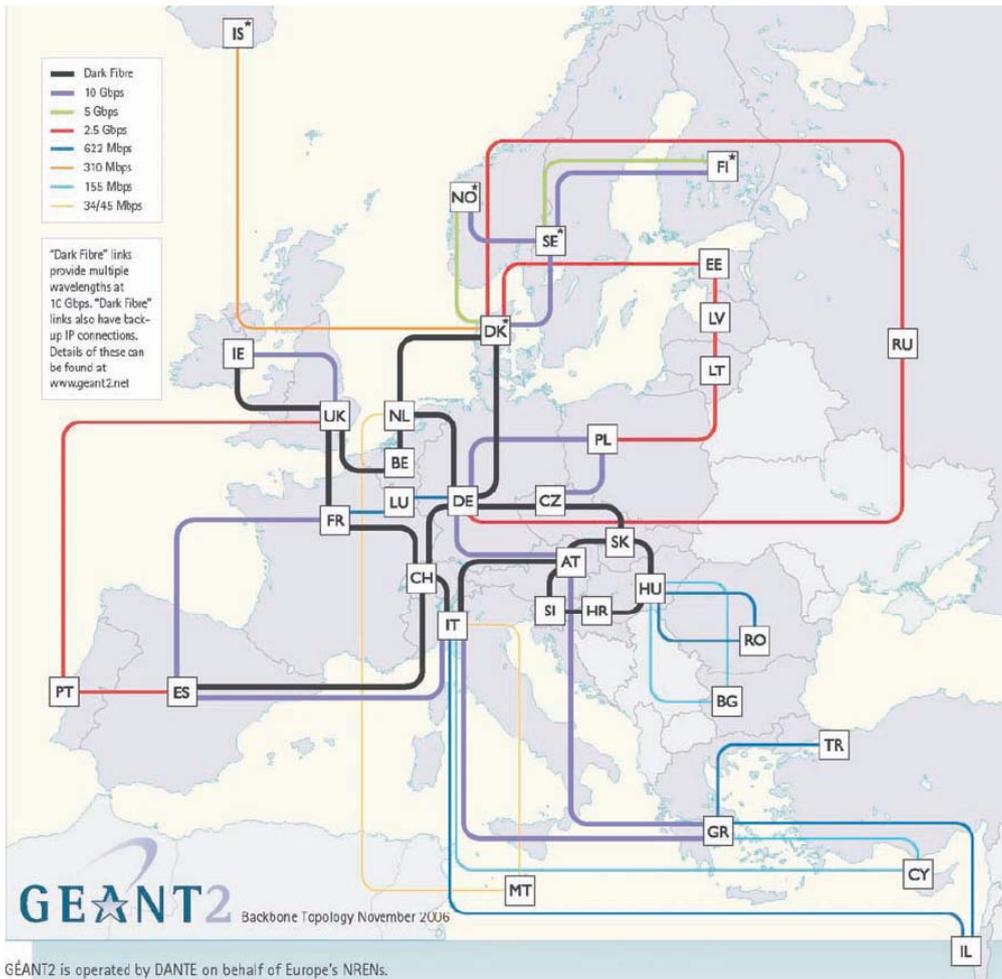
The managing partner and project co-coordinator is DANTE. DANTE's purpose is to plan, build and operate pan-European research networks. It was set up, and is owned, by a group of NRENs. It was established in 1993, and has since played a pivotal role in five consecutive generations of pan-European research network: EuropaNET, TEN-34, TEN-155, GÉANT and now GÉANT2.

TERENA, the European association of research and education networking organizations, also has significant responsibilities within the project. It handles a number of the outreach activities, and supports the co-ordination of the research and development effort among project partners. In particular, it encourages the common exploration of new technologies between project partners and other groups that are active in technical development of particular relevance to research and education networking, through the continued operation of TERENA task forces.

Besides these two organisations, 30 NRENs participate in the project, and are directly connected to the network. One of the 30 NRENs is NORDUnet, the Nordic regional NREN, which connects Denmark, Finland, Iceland, Norway and Sweden. The list below contains links to the websites of these NRENs.

[off-site] AConet Website of AConet - Austrian NREN  
[off-site] JSCC Website of JSCC - Russian NREN  
[off-site] ARNES Website of ARNES - Slovenian NREN  
[off-site] LATNET Website of LATNET - Latvian NREN  
[off-site] BELNET Website of BELNET - Belgian NREN  
[off-site] LITNET Website of LITNET - Lithuanian NREN  
[off-site] CARNet Website of CARNet - Croatian NREN  
[off-site] NIIF Website of NIIF - Hungarian NREN  
justright [off-site] CESNET Website of CESNET - Czech NREN  
[off-site] NORDUnet Website of NORDUnet - Nordic NREN  
[off-site] CYNET Website of CYNET - Cypriot NREN  
[off-site] PSNC Website of PSNC - Polish NREN  
[off-site] DFN Website of DFN - German NREN  
[off-site] RedIRIS Website of RedIRIS - Spanish NREN  
[off-site] EENet Website of EENET - Estonian NREN  
[off-site] RENATER Website of RENATER - French NREN  
ault [off-site] FCCNWebsite of FCCN -Portuguese NREN  
[off-site] GARRWebsite of GARR -Italian NREN  
[off-site] GRNETWebsite of GRNET - Greek NREN  
[off-site] HEAnetWebsite of HEAnet - Irish NREN  
[off-site] ISTFWebsite of ISTF - Bulgarian NREN  
[off-site] IUCCWebsite of IUCC - Israeli NREN  
[off-site] JANET(UK)Website of JANET(UK) - United Kingdom NREN  
[off-site] RESTENA Website of RESTENA - The Luxembourg NREN  
[off-site] RoEduNet Website of RoEduNet - Romanian NREN  
[off-site] SANET Website of SANET - Slovakian NREN  
[off-site] SURFnet Website of SURFnet - NREN in the Netherlands  
[off-site] SWITCH Website of SWITCH - Swiss NREN  
[off-site] ULAKBIM Website of ULAKBIM - Turkish NREN  
[off-site] University of Malta Website of the University of Malta - NREN in Malta

Source: DANTE www



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**University of Zilina**



Videoconference studio – Zilina University – 2005. Ing. Daniel Milucky (left) and Dr. Zdravko Rusev Polycom 9000 is the basic videoconferencing platform of the University of Zilina.

## CZECH REPUBLIC

### University of Pardubice



Video studio A8 University of Pardubice during the videotransmission test on Polycom platform (2006)(left).

Video studio A8 University of Pardubice during the videotransmission test on Tandberg platform (2006)

### Conclusion - part I

All this show us that the technical solution is no problem to put European Education and Research on New Platform - on the wings of DIVIEDUR. The main goals are:

- World-class education and research infrastructures;
- Excellent research institutions;
- Effective knowledge-sharing.

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## ОБРАЗОВАНИЕ ЗА ЕВРОПЕЙСКА ТРАНСПОРТНА СИСТЕМА НА ОСНОВАТА НА ПЛАТФОРМА ЗА ИНТЕЛИГЕНТНИ ТЕХНОЛОГИИ ЗА ДИСТАНЦИОННА ИНФОРМАЦИЯ И КОМУНИКАЦИИ

Здравко Русев

ЧАСТ I.

*Ключови думи:* интернет, теле-видео информация и комуникация, дистанционно обучение.

*Резюме:* Едно от направленията в бъдещото европейско университетско образование ще бъде на основата на развитието на технологиите за дигитална интернет теле-видео информация и комуникация. Този доклад представя неговите предимства и е част от авторската теория за DIVIEDUR (изследване 2001 – 2007).