# RESORT -
# Providing Remote Support and Service for PC based Rehabilitation Technology

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**Abstract.** This paper describes the experiences and results of the RESORT project which has developed a state of the art prototype system for remote service provision for rehabilitation technology (RT) products. RESORT stands for Remote Service of Rehabilitation Technology and is a European Union funded R&D project in the Disabled and Elderly sector of the TAP (Telematic Applications Programme, DE-4208). High-end environmental control systems, AAC devices and devices used for therapy and training are gaining an increasing importance in the daily life of disabled and older people and their carers. In these areas the crucial point for user satisfaction is not only the price of purchasing the equipment but also to an even greater extent the costs of personal adaptation and ongoing service and updating according to changing user needs. The RESORT prototype provides a multimedia and remote interaction link between the RT-user and a service provider. Updating the user software, carrying out adjustments, answering questions of the user and troubleshooting will now no longer require the personal presence of a specialist but will be carried out via telematics. Additionally, the RESORT protocol has been defined in order to allow other manufacturers to make their products RESORT compliant.

## 1.  Background of RESORT

An increasing number of disabled people are using RT systems that help them to live more independent and self-determined lives. Analysis of the provision process shows that buying and installing an up-to-date RT system is definitely not the end, but much more the starting point of a process of continuously tailoring the system to the ever changing needs of the individual user.

In many cases the carers (teachers, therapists, family members) are the key agents in this process. Often a lack of experience in using and configuring RT systems causes a resulting lack of adaptation and frequently the total abandonment of Rehabilitation Technology. Generally spoken, it is anticipated that the actual use of RT systems is much lower than the need. Currently support is a complicated and expensive procedure due to high travel efforts and to frequent hands-on involvement of professional support personnel.

A number of research and pilot projects have explored the potential for providing remote support for RT systems and the users. Examples include the work of Burns et al [11] and Cole et al [12], and the CATCHNET Project [2]. Support specifically for the rehabilitation professionals is being piloted by Nelms and Colven [13]. All these systems either provide communication tools, or freely available application sharing tools. The RESORT project recognised that these approaches did not adequately address the time critical aspects of the use of RT systems. For example, where scanning arrays are used in the user interface, re-

mote application sharing cannot provide the time critical synchronisation between actions taking place at each end of a remote link.

The RESORT project team therefore, developed a PC-based system, which provides online support for the carer and the handicapped person by establishing a videophone and synchronisation of the RT applications at both ends of the links. Whenever a problem arises the carer can establish such a multimedia link to a RESORT service centre (RSC) and ask questions, get oral explanation and support, can demonstrate what seems not to function correctly or can learn by watching the RSC operator solving problems on the remote PC via the multimedia link.
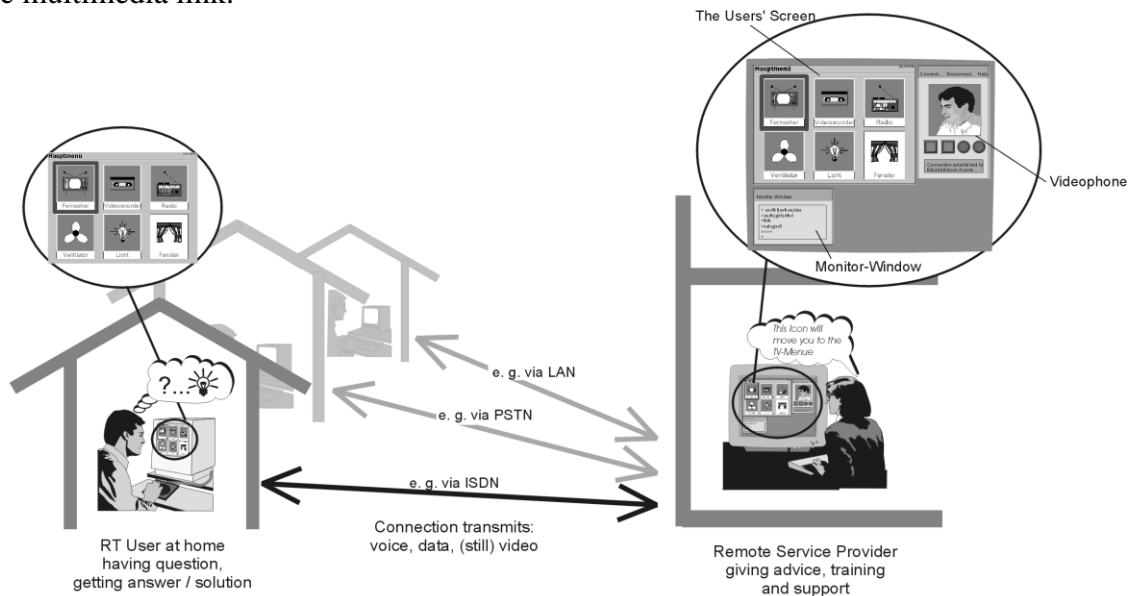


Fig. 1: Remote service provision for PC based RT systems designed by EU funded RESORT project.

Within the RESORT project two already existing RT systems have been used to verify and demonstrate the benefits of the RESORT idea. One of these RESORT compliant systems is Mr. STEP [5], a PC-based learning system for motor or learning disabled children, the other one is a combined environment control and AAC system for severely disabled persons, called AUTONOMY [1, 4, 8].

## 2. User Needs Analysis

Having analysed the responses of several series of interviews and questionnaires, the consortium drew the following conclusions:

- There is a distinction in the life of disabled people between primary and secondary carers. The "primary carers" have intensive interactions with and/or responsibilities for an individual and a small caseload. The "secondary carers" have a more specific input into the lives of a wider caseload.
- The RESORT system, therefore, focuses on assisting primary carers in the process of providing RT, including access to information and the management of cases and case conferences. A key element of the RESORT provision should be an improvement of ongoing after-care for RT users.

The consortium constructed a model that shows the actual interactions of professionals involved in the life of a disabled person. In many cases, whilst these professionals interact with the disabled person directly, their involvement is filtered, controlled or monitored by a primary carer. This primary carer is often either a professional or a member of the disabled person's family.

In addition to the professionals with a responsibility for general areas in the life of an impaired person, another group of professionals has responsibility for dealing with the disabilities that arise from the individual's impairment. These disabilities affect a range of activities and may require assistance from a specialist with a very focused set of skills. Again, the involvement of these professionals may be filtered, controlled or monitored by a primary carer. The RESORT concept was developed acknowledging this significant roles of primary and secondary carers.

## 3. The Concept and Functionality of RESORT

The overall system structure (see Fig 1) contains a Resort Service Centre (RSC) which can connect to RT users at home or in institutions via different types of networks: ISDN, cable, LAN, wireless LAN, xDSL, etc. The RESORT system provides the following functionality:

- RCI (Remote Control Interface) for "real time synchronisation" of RT systems
- easy-to-use scaleable User Interface
- real time communication and interaction (audio & video, H.323 compliant)
- application sharing (T.120)
- database access
- file transfer
- synchronisation of file systems
- text communication
- platform in-dependency
- security

and offers three different modes of operation:

- In the *telephone mode* RESORT provides hands free communication between user and service provider. If the bandwidth is large enough a video link can be established, too.
- In the *student-teacher mode* an additional data-link is established. The service provider will load exactly the same RT application as the user is running. The two applications - at the user's site and at the provider's site - will be synchronised via the data link.
- In *tele-service-mode* the service provider has the possibility to down- and upload files from and to the user's PC, modify configurations and test the changes he/she has made.

## 4. Implementation of Prototype System

The core of RESORT has been implemented in Sun Java 1.3 with a native interface to RT applications. The system exploits existing technologies for tasks like video / audio transmission according to the H.323 standard and desktop/application sharing according to the T.120 standard. Specific new features, however, such as the RCI technology which allows real-time synchronisation between local and remote RT systems (even when using automatic scanning) had to be developed from scratch.

The user interface of the RESORT controller can be tailored according to the needs of the users. Although the full functionality is always available, the degree of complexity of functions and information shown to the individual user can be varied within a wide range.

RCI implements a link between the RT system and the so-called RESORT controller (RC). The RCI and the RESORT protocol allow synchronisation in real-time. This is possible as only small data messages are transferred instead of changed screen contents. This method dramatically reduces the required bandwidth [2] and enables the RESORT system to provide real-time monitoring of single switch users. The RESORT controller module (RC) is linked to (a) communication modules for video, audio and chat, (b) to the database, (c) to the RT system and (d) via network interface to the remote RC.

IP is used as network protocol, TCP/IP for control messages, UDP mainly for audio and video. In order to test and demonstrate the benefits of the system 2 existing RT systems [4,5] have been equipped with a RESORT interface.
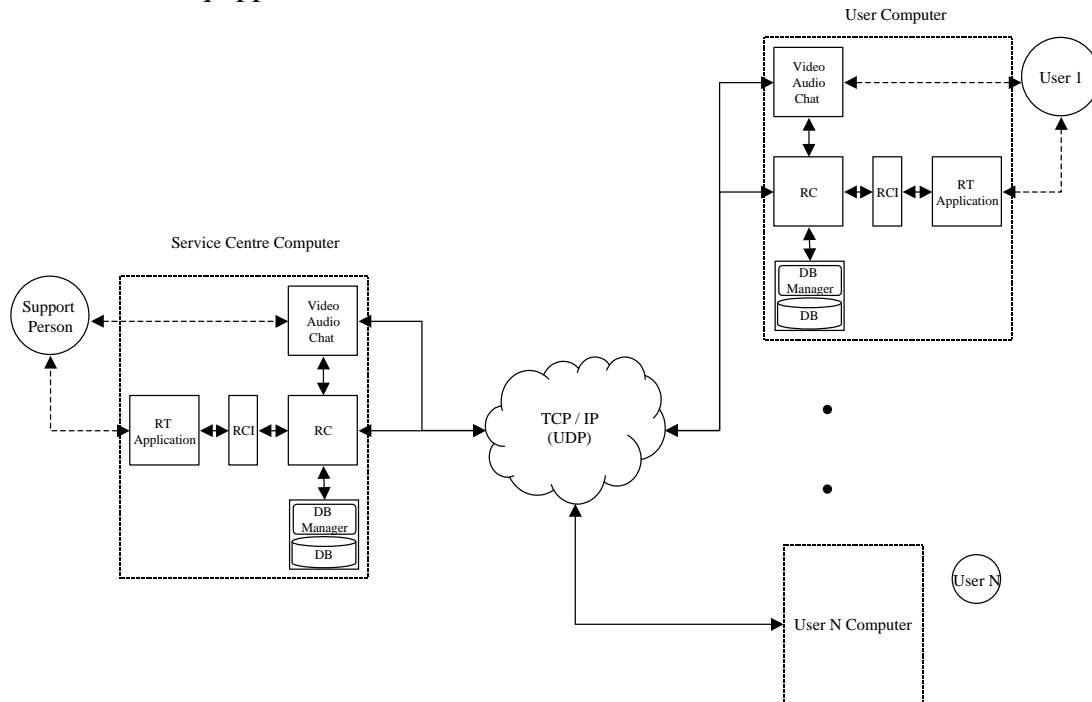


Fig. 2: RESORT system structure: On the left hand side the RESORT Service Centre, on the right hand the RESORT Client PCs (at special schools, at residential areas, private home). In between the Network.

In order to ensure a high level of flexibility several internal interfaces were introduced. The outcome is a highly modular system [3,6] which allows to exchange specific parts without the need of adapting other parts. This increases the independence from 3rd party products for audio, video, application sharing and desktop sharing.

## 5. Results and Achievements

The advanced prototype system was demonstrated to more than 200 professionals and disabled users in 15 workshops organised for care persons, disabled users, manufacturers and service providers in Austria, Germany, the Netherlands and Scotland. Overall, the users' response was very positive. Additionally, real life tests have been carried out. For the real life tests different network settings were used: (a) Dial up link via a 64 kbps ISDN link from the client to the backbone of the university network, (b) cable network from client to university network, (c) LAN, (d) wireless LAN in Scotland including ISDN bridging between the validation site and the university.

The results from the real life tests showed that the system was usable by disabled people and their primary carer. Furthermore, both primary and secondary carers consider the system a viable tool for the delivery of support for users of RT systems.

Additionally to the RESORT prototype software, the RESORT protocol has been developed and documented. This allows other manufacturers of assistive technology systems to adopt the RESORT protocol for their products in order to strengthen their position in the RT market. The RESORT Software Development Kit (SDK) provides material needed by a 3rd party manufacturer of RT applications in order to make their own RT systems RESORT compliant. This kit currently consists of a documentation of current RCI specification

v3.21, a manual explaining how to develop a RESORT compliant RT application out of a conventional one, the API, and sample software including source code [3].

## 6. Outlook - RESORT Interest Group (RIG)

RESORT not only aims at technical service delivery but also at pedagogic and therapeutic support via the telematic channel. In order to ensure ongoing research and development the RESORT Interest Group (RIG) has been set up in early 2001. The RIG is providing a framework for disabled users, care persons, manufacturers, service providers, and researchers to continue the engagement in the area of remote service provision. Interested parties are invited to watch and to join the activities of RIG by visiting the RESORT home page [3]. Currently, pilot service centres are being established and new RESORT applications are being developed taking into account also non PC based RT as robots, prostheses [9,10] and wheelchairs.

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