



Total Conversation & 112 for all



REACH112

REsponding to All Citizens Needing Help

A White Paper on the implementation of Total Conversation systems across Europe

Total Conversation is an extension of the voice telephony concept by adding the video and real-time text media, still maintaining the bearing ambition of standardized implementation to accomplish an opportunity of global interoperability between implementations of different manufacturers and service providers.

The extended conversational service concept is intended to suit a wide range of situations in conversational settings over distance, and especially situations that appear when one or both communicating parties has a communication related disability causing a need to communicate in other modalities than speech, or complementing speech with other modalities.

The REACH112 project established a model for implementation of conversational services focusing on Total Conversation access to emergency services as well as person-to-person communication in modalities that suit persons with varying capabilities and preferences. Relay services, providing translation between modalities in communication form also important parts of the services. The project aimed at contributing to making the 112 number accessible for all across Europe, encouraging replication as well as ensuring interoperability and assessing cost effectiveness and user acceptance.

Even if the concept has general applicability to improve communication for all, the project focused on serving deaf, hard-of-hearing and deafblind persons.

This white paper is intended to give an overview on the achievements and findings of REACH112 and to serve as a quick reference guide for those who are considering the implementation of Total Conversation Services in their Region.

Reference is sometimes made to public deliverables of the project, where supporting data and details can be found. The are all available on the project website www.reach112.eu



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1 The REACH112 project

REACH112 was a joint undertaking by 22 organisations across Europe, each of them contributing with their expertise, skills, aspirations and needs to achieving the project objectives defined in the previous section.

The project was part of the Competitiveness and Innovation Framework Program CIP, and its Policy Support Program PSP, aiming at support to deployment of services of potential importance of policy reasons.

As a response on observations of fragmented communication services with low functionality and inferior support of emergency calls for people with communications related disabilities, REACH112 was set up as a pilot project in five countries: France, The Netherlands, Spain, Sweden and the UK. Its primary aim was to implement interacting telecommunications infrastructure across these countries using the same standard of Total Conversation (TC) – allowing video, real-time text and voice simultaneously in the call for emergency service access as well as everyday communication. REACH112 was organised in three components:

1. Deployment of infrastructure and user terminals to allow person to person calling in Total Conversation to reach other users and terminals in each country.
2. Implementation of and/or integration with relay services, which support Total Conversation functionality in order that disabled users can get support for conversion of communication modality when contacting and being contacted by the community at large.
3. Installation of Total Conversation in emergency service centres and cooperation with such centres in regard to accepting Total Conversation-enabled calls to 112.

The overall result of the project were targeted in being the implementation and evaluation of a pilot service offering Total Conversation with Real Time text as an extended and accessible telephony service for people who use voice, sign language, text and other visual expressions in person to person communication.

The Total Conversation service had to be validated for access to emergency services (making the 112 number accessible for all across the pilot sites). Services had to be replicable in other settings and other countries. However, the key targets were interoperability and assessment of cost effectiveness and user acceptance of the provided services.



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2 The REACH112 Ten Commandments

- 1. All shall be able to call all.** All users of each REACH112 pilot SHALL be able to call all other users of all REACH112 pilots.
- 2. Call by SIP address and number.** Calling users of other REACH112 pilots MUST be made possible by using phone numbers (through public or private ENUM lookup) and SHOULD be possible by using sip address on the form user@domain.
- 3. Use common media.** It SHALL be possible to use the media that are in common between two terminals in a call.
- 4. Total conversation or subset including Real-Time Text.** In calls between REACH112 pilots, it SHALL be possible to use the protocols and media of Total Conversation as specified in IETF RFC 5194 or a subset thereof including Real Time Text.
- 5. Call destination and include relay service.** In pilots including relay services, calling SHALL be possible by providing the number or address of the call destination, and get an appropriate relay service invoked in the call. This SHALL be possible both for voice users and relay service users.
- 6. Call 112 for all.** All users SHALL have the opportunity to call 112 and be served by the emergency service in the media and modes that suit the users, and are supported by the communication service provider including Real-Time Text. External relay services MAY be invoked to meet this need.
- 7. Call back from Emergency Services.** The 112 emergency services SHALL have a possibility to call back to the calling user and use the same set of media, modes and relay services as in the original call.
- 8. Provide Location in emergency calls.** Pilots are STRONGLY ENCOURAGED to provide location in emergency calls according to draft-ietf-ecrit-phonebcp.
- 9. Record emergency calls.** Pilots MUST follow national requirements for recording of emergency call information and media.
- 10. Use CAP for data transmission on emergency cases.**
Pilots are RECOMMENDED to implement data transmission between PSAPs according to CAP for conveying information of emergency cases.



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3 Project organization and activities

In REACH112, the work has progressed along two converging directions:

1. The identification of a Total Conversation system (i) interoperable across different Regions, (ii) independent from vendors and providers, (iii) ready to be integrated by Emergency Services in day-by-day operations and (iv) responding to the needs of the Deaf and Hard-of-Hearing in they every day's life.
2. The adaptation of services already existing in 5 Regions across Europe that became a 12-month pilot of the REACH112 Total Conversation system.

Descending by the results of these two main lines of work, two fundamental tasks were carried out:

- Assessment of the impact of project on the society and the intended user (Deaf, Hard-of-Hearing, Hearing people, Emergency Services, the Society as a whole)
- Identifications of the conditions for the sustainability of Total Conversation services; this includes the relevance of legal frameworks, technical standards and business conditions.

The project was organised in different tasks, each of them focusing on parts of the described direction of work.

Users & Services

This task aimed at determining and specifying the Current Service Status in Europe, the User experience and aspirations, the legal requirements and a description of the situation at Emergency Services. The conclusions of the activity are reported in the public deliverable D2.1 "Current status and availability of Total Conversation systems, aspirations of users; Legal requirements and structures of emergency services in each Participant country".

Total Conversation Platform

This activity had to goal of specifying and providing the Total Conversation Platform for development and pilot in each participant country. The conclusions of this work package are reported in the public deliverable D3.2 "Final Specification of the functioning Total Conversation Platform", where functionalities, components and standards to be adopted are documented.

Total Conversation Service specifications; Person to Person trials

This activity targeted the specification of devices and connectivity needs for users, along with the execution of trials of person-to-person calls; additionally, trans-national interoperability was trialed. The conclusions of this work package are reported in the



public deliverable D4.2 "Report on Person-to-person trials", however important conclusions were reported in deliverable, D4.1 "Description of users, their characteristics and their position in terms of marketing", whose conclusion have an important role in defining the user base for Total Conversation services.

Emergency Services' Trials and adaptations

This activity aimed at installing the Total Conversation Clients in PSAPs (Public Safety Answering Points, where emergency calls are taken and managed) and Relay Services. It was also focused on specifying devices and connectivity needs for operators of PSAPs and on carrying out initial trials with users and relay services. The conclusions of this work package are reported in the public deliverable D5.1 "Report on Emergency Services' trials", however important conclusions were reported in a deliverable, D5.2 "Pilot Phase Specification", whose conclusion had a strong relevance for identifying the conditions for the next generation of 112 services compatible with the Total conversation principles.

Service Deployment and Pilots

During 12 months towards the end of the project, service operation has been running making it possible for the users to call each other and the emergency services in ways accessible for persons with disabilities. The performance was monitored, and the activities reported in two reports: In D6.1 ("Pilot report 1") after 6 months, and in D6.2 ("Pilot report 2") after 12 months. An extra deliverable was also linked to this work package, reporting on European and national best practices in the area of accessible communications services with special focus on relay services. It is called D6.0 "Overview of best practices in accessible communication services".

Monitoring, Evaluation and Reporting

Experience and statistics were collected from the pilot period. Specific focus groups and other activities were also organized to collect views of users and other stakeholders. Analysis of this data was made and documented in D7.1 "Report on performance of all elements in the value chain".

Sustainability

The actions for creation of the exploitation and business plan looked at possible ways to make the deployed services sustainable, and reported different approaches for different countries.

Summary and conclusion of the project have been reported in the document in D8.5 "Final report on REACH112".



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4 A kit for deployment of Total Conversation Services.

A common question from parties interested in deploying Total Conversation services is of course: What needs to be done, what is available, how do we hook in to the growing Total Conversation network?

This section provides some answers on these questions while more information is found in other deliverables, the referenced standards and from the web-site <http://www.reach112.eu> .

4.1 Technical service establishment

Establishing Total conversation services technically is described mainly in deliverable D3.2 "Platform Specification".

The main principle is that for communication with other service providers, SIP shall be used for call control and a specific set of media codecs shall be used for media coding and transport in video, audio and real-time text. This is described in chapter 4 of D3.2.

Central to the technical service implementation are servers for authenticating subscribers, and for routing of calls and setting up calls with agreed media streams. User terminals verified to work with the implemented system are also important parts of the implementation.

Equipment and functionality for interoperation with other providers of both the same technology and also with other new and legacy systems, relay services and emergency services are also important components in a complete Total Conversation system.

The factors that need to be agreed with the other Total Conversation providers are described in D3.2 chapter 8. That is protocol details in the interoperability interfaces between services, addresses used by the servers where calls are routed between the providers, so that protection against harmful network traffic can be established. It is also information about other service providers' numbering and addressing systems, so that call by number can be used between users of different providers.

The design of a Total Conversation service provider environment follows mainstream habits in SIP based communication service establishment.

The description is valid for implementation in native SIP. It is possible to implement it in IMS and other call control environments. Then, translation to native SIP must be provided for interworking with services based on native SIP. The standards used for the IMS case are briefly introduced in D3.2.



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The technical providers of REACH112 can on request provide products suitable for building the production environments for new Total Conversation services. On all topics below, D3.2 gives further guidance.

4.1.1 Addressing and numbers

It is recommended to allow both phone number addressing and sip-URI addressing. For conversion from phone number to SIP URI, ENUM conversion is used, with corporate roots. The search path for each provider's ENUM resolution therefore needs to be agreed between any new provider and the current providers. A more universal number resolution system is desirable but was not available when REACH112 was established.

Logic for number and address evaluation and resolution needs to be implemented in both user terminals and the Total Conversation service.

The first step in the evaluation is to decide if the call is an emergency call and in that case apply the specific handling of emergency calls that should contain location provision routing, relay service invocation considerations and security.

Further steps are to verify if the called address is internal to the provider or to a user of another provider, if a relay service is desired to be included in the call, and to resolve a called number to a suitable network addresses, and then act on the routing information appearing from these steps.

4.1.2 User terminal communication

Communication protocols with user terminals for each service provider are in principle at each service provider's decision. However use of the same protocols as for the inter-service communication is strongly recommended, because then the same terminal types may be used with more service providers. The signaling of all calls are routed through servers in the own network, so that translation of call setup procedures can be provided if the external contacts require.

Terminals for Total Conversation based on the native SIP protocols are available from the technical providers in the REACH112 consortium as well as from other technology manufacturers, both in specific hardware form and as softphone applications in smartphones, pads and personal computers suitable for different operation situations.

It is important to consider the accessibility features of terminals when deciding on terminals to be supported in a Total Conversation service. That is quality of moving image from the camera in all light conditions, usability of the screen in all light conditions where it shall be operational, alerting mechanisms, convenience of the keyboard for the text part of calls, sufficient processing power for good video



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transmission quality and the ability of calling so that an appropriate relay service is invoked when wanted.

General factors to consider are possibility for location provision for the emergency calling, and compliance to the communication standards to be used in the Total Conversation service.

4.1.3 Emergency service communication

For communication with emergency services the guidance of ETSI TR 103 170 Total Conversation Access to Emergency Services can be used. Also D3.2 chapter 6 gives guidance on this topic as well as EENA NG 112 Long Term Definition.

For full integration in Emergency Services, the emergency service need to have IP based access.

A higher integration level in the PSAP technology than what was done in most REACH112 pilots is highly desirable. It is important to give the Total Conversation calls same treatment as other calls in emergency handling queue systems, call recording systems and ability to transfer calls and make multi-party calls with them. Still it is possible to start with different kinds of semi-integrations as was done in the REACH112 pilots.

Verification if any relevant standard for this purpose is registered in the Official Journal of the EU according to article 17 in directive 21/2002/EC should be done before deciding on how to do the implementation. New standards compared to what REACH112 used may be registered there as required by Article 26.4 in directive 22/2002/EC.

4.1.4 Relay service communication

Relay services are specialized call centres aimed at modality translation.

Calling by destination number and getting relay services invoked should be applied both for calls from relay service users and from voice users. Methods for such invocation are described in deliverable D3.2. Both discrete user indication of a wanted relay service type, a fixed profile connected to the service subscription and more dynamic user profile definitions and evaluations can be used for invocation of a relay service in the call. The invocation is part of the number and address resolution in the Total Conversation Service.

Invocation of relay services in relation to emergency services is also described in the ETSI document TR 103 170 Total Conversation Access to Emergency Services. A general description is found in D3.2 chapter 5.



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The established relay services should follow ETSI ES 202 975 Harmonized Relay Services.

4.1.5 Legacy textphone communication

Legacy text telephony interworking should be considered in countries where the text telephones still prevail. Such interworking is briefly described in deliverable D3.2 and IETF RFC 5194 and thoroughly described in ETSI EG 202 320 Duplex Universal Speech and Text.

The calls with legacy textphones are enabled by setting up gateway functionality between the networks. Conversion is made between the modem tone based transmission of text in the legacy telephone network and the real-time text standard in the Total Conversation calls. The legacy text telephony protocols have functional limitations in simultaneity, character sets etc, that need to be considered when designing the conversion procedures.

The technical providers in REACH112 can provide gateways and information on them.

4.2 Verification

Verifying the technical systems should be done using the test specification in deliverable D4.2 Test Plan for Intra Service.

For further detailed verification of 112 calls, the use cases listed in deliverable D5.1 could be performed.

A set of test call cases are defined, for a large variety of normal calls and error situations, and test according to these test cases are performed and outcome compared to expectations.

4.3 Service establishment

The services can be established in at least three parts: The user communication service, the relay services and the access to emergency service.

Financial considerations for establishing these services have been studied with the REACH112 pilot countries as examples. Some findings are reported in deliverable D7.1 "Project evaluation".

Other considerations for setting up the services are found in D8.3 "Final plan for Disseminating the Foreground".



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4.3.1 User communication services

A service provider intending to set up Total Conversation services for user communication will, beyond the technology aspects described above, need to provide:

- Logistics for provision of terminals or terminal software.
- Support and user education.
- Production of the communication service.
- Follow up on service provision and improvements of the service.

For services provided to sign language users, the support and information about the services should be provided in the sign language of the users.

In order to meet national, regional and international policy goals, society support should be sought, so that the communication services can be provided with comparable affordability and user experience for people with disabilities as voice calls for the general population. Such aspects are described in this report in sections about sustainability.

The reports from the REACH112 pilots in deliverables D6.1 and D6.2 can provide insights in a lot of topics that may appear for a service provider of Total Conversation services.

4.3.2 Relay services

Relay services are needed for both everyday communication needs and for emergency service needs in calls where the communication modalities of the parties do not match.

A service provider intending to set up and run Total Conversation relay services will need to consider a range of topics beyond the technical considerations described above. Many of these are described in ETSI ES 102 975 "Harmonized Relay Services", in a form that can be used as a requirement specification on the service level or as an internal or external service description and code of practice for the provider.

Further material for establishing codes of practice is found in deliverable D6.0 "Guidelines for Total Conversation Codes of Practice".

The technical means for invoking a relay service in calls, and the provision of user-to-user communication services should be kept separate from the call centre and operational service aspects, so that new communication service providers and service providers who use other than the standard Total Conversation protocols internally, can provide interfaces to the relay services according to the relay service interface specifications and have calls for their users relayed.



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In order to meet national, regional and international policy goals, society support is clearly needed for running relay services, so that the relay services can be provided with comparable affordability and user experience for people with disabilities as for voice calls for the general population. The economic benefits of relay services are usually only visible on the national economy level, where the gain in better efficiency at work, and less cost for care and loss of life and property outperforms the cost for personnel and technology for relay services.

4.3.3 Access to emergency services

Setting up the service conditions around handling of Total Conversation emergency calls contain other tasks than the pure technical establishment.

Operational aspects such as concentrating the total conversation calls to a limited number of PSAP workstations may be considered.

The collaboration with relay services needs to be established and personnel educated.

Advices on operational aspects are provided in ETSI TR 103 170 "Total Conversation Access to Emergency Services", as well as in the deliverables from the pilot year of REACH112, D6.1 and D6.2 and operational documents from EENA.

In order to meet national, regional and international policy goals, society support is clearly needed for running total conversation emergency services, so that the emergency services can be provided with comparable user experience for people with disabilities as for voice emergency calls for the general population.

4.4 Conclusion

New Total Conversation services with all required components can be set up by advice from this chapter and use of the REACH112 deliverable documents and contacts with organizations within the REACH112 consortium.



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5 Standards relevant to Total Conversation

Based on D6.2 "Second Pilot Report", this section lists standards used fully or partially in the REACH112 project for Total Conversation user communication and emergency service access. Following standards is an important mean to achieve interoperability and good functionality.

5.1 Overviews, articles, regulations, policy statements

Document	Full name	Explanation	Use in REACH112
COCOM 04-08	INCOM Report	Report on eAccessibility to EU regulatory group COCOM The initial report about the bad situation in Europe for emergency service access and personal communication for people with disabilities.	Requirements for accessible communication implemented in REACH112 Total Conversation.
EENA Accessible 112	EENA Operations Document 112 Accessibility for People with Disabilities		Chapter 7 Total Conversation partially implemented

Table 1 - Overviews, articles, regulations, policy statements

5.2 Standards and specifications

Standard	Full Name of Standard	Explanation	Type	Use in REACH112
EENA NG112 LTD	EENA NG112 Long Term Definition.	IP based access to emergency services in Europe	Technical broad interface specification	Implementation in line with this specification, but not covering all aspects.

Table 2 - EENA specifications

Standard	Full Name	Explanation	Type	Use in REACH112
OASIS CAP 1.2	Common Alerting Protocol		Coding of emergency information	Tested in French pilot

Table 3 - OASIS document

Standard	Full Name of Standard	Explanation	Type	Use in REACH112
IETF RFC 4103	RTP Payload for Text Conversation.	RTP Payload for T.140 text conversation. MIME Registered as "text/t140", used in H.323 and SIP and 3GPP	Transport	Implemented
IETF RFC 5194	Framework of requirements for real-time text conversation using SIP	Requirements and implementation guidelines for real-time text in the SIP environment	Requirements	Implemented

Table 4 – IETF accessibility specific documents



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Specification	Title	Explanation	Type	Use in REACH112
IETF RFC 3261	Session Initiation Protocol	The base for VoIP, IP Multimedia and Total Conversation in IP environment	Call control	Implemented
IETF RFC 4566	Session Description Protocol	Contains "text" as an allowable media type in multimedia calls.	Call control	Implemented
IETF RFC 2198	Redundancy for RTP payloads	Used in RFC4103 for reliability of text traffic	Transport	Implemented
IETF RFC 4733	Definition of events for telephony tones	Text transport in RFC 4103 mentioned	Transport	Implemented
IETF RFC 4504	SIP Telephony Device Requirements and Configuration	Text requirements included, referring to RFC 4103	Device requirements	Partially implemented
IETF RFC 5012	Requirements for Emergency Context Resolution with Internet Technologies	Requirements for emergency services in IP, including real time text, referencing RFC 4103.	Service requirements	Partially implemented, mainly media requirements.
draft-ietf-ecrit-phonebcap (approved but not yet published)	Best Current Practices for Communications Services in support of Emergency Calling	Refers to real-time text for emergency calls. Refers to RFC 4103	Service and terminal requirements	Media chapter implemented. Partially the location information provision.
IETF RFC 3984	RTP Payload format for H.264 video	Standard for packetization of video coding.	Technical coding	Implemented
IETF RFC 4629	RTP Payload format for ITU-T REC. H.263 video	Standard for packetization of video coding.	Technical coding	Implemented
IETF RFC 6442	Location Conveyance for the Session Initiation Protocol	Standard for placement of location information in the call establishment information	Technical	Implemented in one user terminal and one PSAP. Not used because the terminal did not get popular and network issues blocks location info.
IETF RFC 6443	Framework for Emergency Calling in Internet Multimedia	Structure for emergency services in IP. Refers to RFC 4103 for text	Service requirements	The media chapter implemented and partially the location information provision

Table 5 - IETF General documents of specific interest for accessibility

Document	Title	Explanation	Type	Use in REACH112
ITU-T Rec. V.18	Operational and Interworking Requirements for DCE:s Operating in the Text Telephone Mode	Includes automatic interworking with most legacy text telephones.	Modem transport	Relevant national annexes are implemented for legacy text communication
ITU-T Rec. F.703	Multimedia conversational services	Defines Text Telephony and Total Conversation services	Service description	Fulfilled requirements
ITU-T Rec. T.140	Protocol for multimedia application text conversation.	Text conversation protocol for multimedia application. With amendment 1 (2000).	Presentation level	Implemented
ITU-T Rec.T.140 - Addendum	Marking of missing characters	Replacement for characters missing after transmission	Presentation	Implemented
ITU-T H Series	Video Quality for sign	Quality characteristics of	Requirement	Fulfilled requirements



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Document	Title	Explanation	Type	Use in REACH112
Supplement 1	language and lip reading	video transmission of importance for sign language and lip-reading use.		
ITU-T FSTP.TACL	Technical paper: Accessibility checklist	General accessibility checklist for standardizers.	Guideline	Valid checklist
ITU-T F.790	Telecommunications Accessibility Guidelines for Older Persons and Persons with Disabilities	General accessibility guidelines	Guideline	Valid guidelines

Table 6 - ITU Accessibility specific documents

Standard	Full Name of Standard	Explanation	Type	Use in REACH112
ITU-T Rec. F.700	Framework Recommendation for multimedia services, Annex A.3.	Multimedia Framework, including real time text	Service description	Fulfilled requirements
ITU-T Rec.H.324	Terminal for low bit-rate multimedia communication	Addition of data channel for T.140 text	Multimedia system	Used in French pilot for some video calls.
ITU-T H.263	Low bitrate video codec	Good compression video coding standard	Media coding	Implemented
ITU-T H.264	Advanced Video Coding	High compression video coding standard	Media Coding	Implemented
ITU-T G.711	Audio coding		Media Coding	Implemented
ITU-T G.722	Wide band audio coding		Media Coding	Implemented

Table 7 - ITU general documents of accessibility interest

Standard	Full Name	Explanation	Type	Use in REACH112
ETSI EG 202 320	Duplex Universal Speech and Text Communication	Guide for text as a mainstream call component	Requirements and implementation framework	Implemented the SIP and PSTN parts
ETSI ES 202 975	Harmonized Relay Services	Service description for relay services	Service definition	Used the sign relay part
ETSI TR 103 170	Total Conversation access to emergency services	Specifies how total conversation shall be used in emergency calls	Technical report, close to specification	Partly

Table 8 - ETSI and 3GPP Accessibility specific documents

5.3 Used/missing standards in the REACH112 components

There is work underway in ETSI EMTEL group for standardisation of Total Conversation access to emergency services. It has also involved groups in 3GPP for specification on how to include relay services automatically in calls. The first part of the work in ETSI EMTEL is published. It is the technical report TR 103 170 Total Conversation Access to Emergency Services. It provides both requirements, a bit of background, and technical indications on functions and solutions to use. It can be used as a base for implementation, even if next planned output from REACH112 in the ETSI EMTEL standardisation is intended to be a more strict technical specification.



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It is not possible to time the work in standards groups with the timing of projects. Therefore, TS 101 470 Total Conversation Access to Emergency Services is planned to be completed during the first half of 2013, and is still an output from REACH112. There is clear benefit of performing this kind of specification work in the wider context of the ETSI EMTEL standardization group with the wider experience and established authorization this group represents.

5.4 Key Performance Indicators

The consortium has defined Key Performance Indicators to be used with regards to emergency calls in REACH112. It should be noted that currently no EU performance indicators are in place for 112 calls thus the creation of such indicators was challenging. The process of establishing performance indicators in REACH112 had to consider cultural, geographical, organization and legal requirements in each of the 5 pilots before agreeing on list of KPIs.

Item	Indicator
% calls answered (picked-up) within 15 seconds (stage 1 PSAP)	min. 80%
% calls answered (picked-up) within 30 seconds (stage 1 PSAP)	min. 99%
% calls answered (picked-up) within 15 seconds (relay service, where available)	min. 80%
% calls answered (picked-up) within 30 seconds (relay service, where available)	min. 99%
Average conversation time with Total Conversation vs. voice 112 calls in %	max. 200%
Average conversation time with Total Conversation vs. SMS 112 calls (where available) in %	max. 70%
% of calls recorded with all media	min. 99,9%
% of calls for which caller-location could not be determined (automatically or during the conversation)	max. 3%

Table 9 – Key Performance Indicators



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6 A technical reference to interoperability in REACH112

The technical base and architecture for the services implemented in REACH112 is fully described in deliverable D3.2 ("Platform specification"). The pilots are interconnected through the Internet, using specified state of the art standards for interoperability. These main standards for this purpose are:

- IETF RFC 3261 Session Initiation Protocol (SIP) for call control
- IETF RFC 6116 ENUM for finding SIP addresses from numbers
- ITU-T H.264 video codec with IETF RFC 3984 RTP packetization
- ITU-T H.263 video codec with IETF RFC 4629 RTP packetization
- ITU-T T.140 real-time text codec with IETF RFC 4103 RTP packetization
- ITU-T G.711 audio codec with IETF RFC 3551 RTP packetization

These standards are the same as once recommended by INCOM, TCAM eWGD and DigitalEurope and procured in Sweden, and form a good base for trans-European interoperability. The details of usage are described in Deliverable D3.2.

Each pilot had its own technology service providers. Within one service provider's network, it is possible to use other standards for the same purpose. However, there are benefits in using the same standards for creating a common market for Total Conversation system components. In the REACH112 project, all pilots except the Dutch pilot used the same standards internally.

When the project started, there were no published standard for how to access the Public Service Answering Points (PSAP) in the emergency services in the multimedia Internet environment. But there were mature drafts that got published as standards later during the project. The umbrella for these standards is IETF RFC 6443 Framework for Emergency Calling Using Internet Multimedia pointing at the required technical standards. The same standards for call control and media communication are specified in this standard, so the project could implement the same standards in the connection to the emergency services as for the interoperability communication.

Same with relay services, they are connected with the same communication protocols.

In this way, the REACH112 concept forms a consistent framework for interoperability and growth. New service providers can join by using the same protocols for interoperability, and decide for themselves if the same are used internally or if there is any reason to use other protocols internally.



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7 Results and discussions with stakeholders

In REACH112, case studies were originally expected to describe how the individuals who have come in contact with Total Conversation reacted to its use. Case studies are meant to describe the challenges faced as well as the successes and to offer a process view of the initiative. Typically we would expect to see a timeline showing movement towards a goal and a discussion of the factors which impede or support the progress. In the event most of the cases supplied were narrower in focus concerning individuals or incidents and offering mostly positive outcomes and praise for the services which were being developed.

Samples of the cases are provided in Appendix 8 of D7.1 and can be subjected to further analysis.

However, the report so far has a huge amount of rich content, designed to supplement and support the quantitative reporting of traffic and objectives. We will not therefore at this stage provide another chapter of quotations and comment. Rather what follows is a short reflection on the cases and their significance to the exploitation of Total Conversation.

7.1.1 Starting Off

It should be relatively clear by this stage that there is an enormous demand from the Deaf community to provide a solution for distance communication. The fact that the technology has advanced to allow mobile devices to communicate in video brings the whole development tantalisingly close. However, the Deaf community in many countries have already discovered opportunities with video applications which are freely available on the Internet and in many cases are already using them.

This creates two difficulties – the first is that the users are already creating their own micro-networks and are interacting with them with greater or lesser degrees of satisfaction. Beginning a new programme has to be able to displace the existing pattern of interaction.

The second is that by part solving this communication issue with incomplete tools and non-services, the Deaf community takes away the responsibility from the hearing community to offer and to support a solution which has a "design for all" label.

We see this tension most clearly in the cases supplied by Action on Hearing Loss where the members of staff have already part solved their communication issues and a new entrant – i.e. Total Conversation is not necessarily embraced fully.



7.1.2 Hard of hearing

One aspect which REACH112 has found difficult is how to implement Total Conversation for hard of hearing users. On the one hand, the commitment is to any combination of video, voice and text but the reality has tended to be a focus on either video or text. The case notes from Action on Hearing Loss, highlight the difficulties faced by hard of hearing users, trying to determine the advantage of being able to see the other person in the call.

It may seem obvious that being able to see and read the emotions on the other person's face is an advantage, yet with highly literate people, the use of text has become the most important aspect of communication. The cases presented seem to indicate a reluctance to alter behaviour and a common response is to displace the focus of the Total Conversation product to the more likely group of sign language users.

There are many reasons why REACH112 needs to examine very carefully the needs of this group. While the pilots in Spain and the Netherlands focused solely on text, various circumstances prevented the analysis of these counterbalancing cases.

Since hard of hearing people form a much larger group and would be the stronger case for change in central government funding then it is essential to examine in more detail the experiences of this group when visual communication is offered.

7.1.3 Person to Person

There is no doubt that there was great success for the Total Conversation concept among Deaf people. They have campaigned for a long time to have their needs met and the cases offered show clearly that the impact can be enormous. Cases tell of the liberation felt by the discovery of distance communication and interestingly also show us how service provision and contact with support professionals can be achieved.

The cases also indicate as have the focus groups and other feedback particularly in France and the UK, that the awareness of the value of Total Conversation does not by itself translate into action on the part of potential users. It requires a good deal of support and instruction, workshops and clinics, peer support and ultimately requires critical mass in producing a sustainable call network. The comments that 'I tried to call people but no one answered' and that 'I never receive any calls or people do not call back' are common in the mass of feedback data. This is partly social in that the community of users have not yet developed etiquette in regard to call behaviour and partly technical in that end points are often not connected to the network – mainly because the user switches them off. The advent of Smartphone applications could make an enormous difference to this situation.



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7.1.4 Person to Relay

What is most welcome in all the accounts is the possibility to have an on-demand relay service. It is this component more than any which leads to the comments of feeling equal. Cases indicate that being able to manage problems, make arrangements and have a readily available interface to society as a whole is perhaps the single most important factor in enabling the Deaf community. In pilots, this has typically been set up as a sign language relay service as in many places there is already 24/7 text relay. The value of this service is set out very clearly.

The possibility however, to have this combined with speech and text is also very important. Cases also refer to the use of text for particular purposes and in one case, the user makes connection and announces that she does not use sign language and demands lip-speaking from the relay agent (which in that case, is successful). Agents in Total conversation relay may need to move towards agent plus status where they are able to manage all three of the options of text relay, sign language relay and speech relay.

Feedback from relay agents who began to work on this as a result of REACH112 most of the time express their enthusiasm for this service as they perceive the obvious advantage of being able to support many more users in a shorter space of time than they can with on-site interpreting.

7.1.5 Person to Emergency Services

The case study in the Appendix of D7.1 which presents an account of an emergency call and provides some context to it, illustrates the conduct of the call and the users' perceptions (both end user as caller and emergency call taker) which catches the theme of surprise that this interaction should work. There is a simple conclusion here that this will save lives. To do so effectively, it will need to be embedded in the mainstream telephony system and become part of the "normal" call patterns. End users, as indicated in the analysis for cost benefit, are still likely to reach for a hearing person in case of problem.

The value of REACH112 is in identifying the longer term issues for adequate mainstream technology, for end user support and training. It also indicates the challenge in regard to visual contact with the incidents for both the relay agent and the call taker. In nearly all the feedback from end users, the ability to be able to call for emergency help is the true aspiration which provides equality.

7.1.6 Creating a service

However, as can be gleaned from the component case studies, the creation of a new means of communicating within a community is not always easy. Even if the



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technology is proven without establishing the community engagement and influence on the project from the outset the achievements will be reduced. The very extensive qualitative data from the French pilot points to the enthusiasm of users when they feel they are contributing to the design of the service.

The other aspect which has provoked considerable discussion is the nature of a pilot which is not linked in at the other end to social policy – although in this particular situation, the overall economic climate in Europe works against any social policy initiatives which require an outlay to begin and a commitment to support into the future.

The cases and the feedback say clearly that the smart and evolving technology has to be supported at both ends by the community of users and by the decision-makers and policy-makers.

7.1.7 Exploiting the service

In the end, it is this part which worried most users – what happens at the end of the project?

Six months after the project ended, it is obvious that the parts of the services that by tradition require society funding are not continued directly. That was the message that needed to be distributed to end users, relay agents and call takers. The knowledge about this and the impossibility to influence authorities to rapidly fund continuations appear as a pressure on the partnership knowing that important parts of the service is withdrawn

The project addressed this aspect of exploitation and sustainability but the case studies make it a real personal and social issue. European policy states clearly that services with functional equivalence shall be provided, but in reality this happened only during the short time period of the pilot performance. After the end of the project, limitations or gaps in service provision appeared in all pilot countries.

7.1.8 In summary

Case study data presents in some detail the users' enthusiasm for the service development and validates the approach. The analysis also teaches us about the process of implementation and the training and support needed for such a marginalised community. It also moves the agenda to the questions of sustainability and drives the debate forward into public planning and social policy.



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8 Considerations on Ethics

Findings and recommendations can be found in D6.0 "Code of practice", that represent the contribution of REACH112 to the understanding of the Ethical aspects of implementing Total Conversation with Relay Services. Moreover, it aimed at shedding some light to the implications of Emergency Calls placed via Total Conversation with Emergency Service Call-takers challenged by new technologies and new situations.

For this purpose, it is important to understand the whole chain of use of the Total Conversation service. In essence this is a complete overlay of the existing voice telecommunications; in fact, this may be a complete replacement for the PSTN system. Users engage with the Total Conversation network in order to interact with other Total Conversation Users, to talk to mainstream users of voice telephones and also to make contact with emergency services (or other public/commercial services e.g. banks, employment agencies and so on). Features such as leaving and retrieving messages that are handled in the voice telephone system exist also in Total Conversation Services but are handled in all three media.

To the extent that these agencies or operations impact on the users' rights and conditions of service, we will comment where appropriate.

There are many service documents available and many laws which apply to the service provision in regard to telecoms. Relevant aspects of these are set out in Deliverable D4.0 "Ethical Guidance" (section 3.4 and Appendices A to G).

Guidance for REACH112 can be obtained from a study of these statutory documents for each of the pilot countries. Often these are technical and not user-facing. An analysis of these has been provided in D4.0 "Ethical Guidance" and all partners have subscribed to the actions, which are set out there.



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9 Sustainability

Sustainability of the provided accessible services are depending on society support. That conclusion is also clearly visible in the European directives on electronic communication where society support for the provided services is enforced. Changing society support is a long process. REACH112 has influenced that process towards solutions for persons in need of Total Conversation services, but the process is now at varying stages and in some cases not yet sufficient for continued services.

A Total Conversation service can be built around a multi-actor value chain including operators, relay services, PSAPs and technology vendors. Because it is currently mainly used to provide an accessible telecommunication service for people who are deaf and hard of hearing, the current potential user base is relatively limited. The funding of social services and inclusion policy implementation is under pressure. Building and maintaining a technology for only one relatively small segment of a population is costly and the target users may not be able to pay the full price for the service that they need, especially the interpretation costs. The EU directives for electronic communication recognise this fact, and various measures for funding such services are described. Anyway, cost can be reduced and benefit increased if the technology was to be used by larger parts of the population.

There are topics of interest for the general population in this concept: the migration of emergency calling to IP protocol (also called next generation 112), the migration of national operators to IP technology, and the availability of interconnection in audio, video and text in personal communication. These are important windows of opportunity for implementing total conversation and obtaining economy of scale.

The rationale behind total conversation is the same as that made for the delivery remote controls for TV screens. TV remote controls were once a device for disabled people with mobility problems, while now everyone uses them. In the same manner, rather than imposing total conversation as a technical add-on to provide accessible communication, one should consider the idea of embedding accessibility inside the mainstream telephony services. Sustainability of total conversation depends on how much this is understood and supported by policy, standardisation and businesses.

From a policy perspective:

- All communication providers (incumbent operators, VoIP operators but also well-known communication service providers such as Google, Apple, and Microsoft) should interconnect to enable video text and voice calling using Total Conversation. Citizens should be able to call each other regardless of their service subscription.



- In order to bring fair competition, the interconnection rules should be uniform and regulated by relevant telecom authorities. European policy should aim to reduce the gap between universal service obligation imposed upon incumbent operators and big communication providers at European level or recommend other schemes to achieve the same goals.
- Relay services should be recognised as a crucial piece for inclusion and national authorities should ensure a stable funding mechanism and quality standards while fostering R&D on automation of the translation processes between speech, sign and text. Such automation are long-term goals, with automatic translation between speech and text being closer to realization than between sign and speech. Disabled people should pay the same price for network access and communication services as others, and should be granted free use or at least a rich monthly allowance of minutes of relay service usage.

From a standard perspective:

- Procurement for relay services and all call centres with accessibility should mandate interoperability and reference Total Conversation protocols while allowing other standard to be supported.
- Push for continued inclusion of Total Conversation in all mainstream real-time communication standards.
- The foreseeable migration of national interconnection between telecommunication operators to IP technology must be examined at European level to harmonise the standards and rules. It is crucially important that future IP based interconnections support Total Conversation. Simpler interconnections for communication service providers should be established to foster competition.
- Next generation emergency services (NG 112) efforts should be pursued to prepare the migration of emergency calls to IP technology and by that enable handling of multiple media and mobility. All communication providers should have obligations imposed upon them to provide location and 112 call routing for total conversation calls as well as voice calls.

From a business perspective:

- We consider that fiscal policies should be adjusted to encourage large companies and call centres serving the public to provide accessible communications.
- Initiatives should be taken to encourage actors in the video communication and VoIP business field to provide the accessible solutions, and promote them to provide interconnection and interoperability.



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From the business models identified and the overall investigation realised, we have defined a number of different lessons learnt and recommendations to implement a REACH112 business in a new pilot country. In particular from the definition of the mixed model with total conversation interconnected. The main insights we have learnt are that the services should be provided as follows:

- Communication service providers should be mandated to be interconnected using SIP protocol according to Total Conversation standards. Everybody can call everybody regardless of the provider they are subscribed to.
- Communication service providers may keep their own access protocol but are encouraged to provide a standardized Total Conversation interface for terminals.
- Relay services can collect calls directly from service providers using Total Conversation. Relay invocation mechanisms are supported by both types of service providers.
- Emergency service calls are sent in Total Conversation to Emergency Service PSAP according to the standards for IP based emergency calling and Total Conversation Access to Emergency Services. All service providers are mandated to send emergency calls to Emergency Service PSAP.

In addition, the discussion within the consortium has led to the identification of a number of issues and barriers that should be overtaken for a full implementation of the REACH112 business:

- Support by national authorities in defining obligations to provide access to relay for all telecommunications providers, or public procurement of such services.
- A basic level of relay services should be provided by the telecommunications providers or publicly procured.
- Telco providers or the government should be providing the relay services (there may be a limitation to a certain amount of minutes per month per user).
- The users should pay a small charge per minute, in the same range as regular call charging for voice calls (apart from the sustainability issues, this will also avoid the misuse of the services)
- There should be a high level "cost sharing" to be defined by the regulator (e.g. U.S. and Sweden models, social taxes, etc.)