ISITEP
D7.1.1 - DEMONSTRATOR PLAN AND REQUIREMENTS

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V1.0	31-08-2015	All	All	Comments from Christian Bjerrum-Niese implemented and document revised
V1.1	04-02-2016	All	All	Updated according to the remarks of the Commission after the 2nd Annual Review

Publishable extended abstract

This output deliverable documents the plan for the WP71 multi agency demonstration between Norway and Sweden to showcase the interconnection of the two live TETRA networks Nødnett and Rakel. This demonstration will be a full-scale cross-border exercise where the procedures for a joined operation between public safety agencies from the two countries will be played out. The document provides information on the demonstrator objectives, approach and means of evaluation based on KPI's. It also gives an overview of the trial environment, technologies involved as well as how the demonstrator will exploit results from the other ISITEP work packages.

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1. INTRODUCTION

This chapter provides a description of this deliverables place in the ISITEP work package structure and general scope of the work. This output deliverable D7.1.1 answers to the general objectives as described in the ISITEP DOW:

WP 7.1 aims to demonstrate the feasibility of a multiagency cooperation scenario using the ISITEP framework: bilateral agreement, cooperation procedures and migrating terminals functionality enabled by network interoperability. Specific objectives include:

- *Verification of ISITEP procedures and processes for cooperation and communication cross border*
- *Evaluation of cross border communication services available through TETRA interoperability (group calls, one to one calls, short data message communication) for all involved users.*
- *Detailed measurements of the traffic and services used during the demonstration*
- *Evaluation of all ISITEP developed items (procedures, processes and template agreement)*
- *Evaluation of the implemented TETRA ISI solution and the ISITEP Functional model with the fleet map configured in the networks*

Task 7.1.1 - Demonstrator plan and requirements:

- *Demonstrator concept and test plan*
- *Definition of key performance indicators*
- *Definition of target performances*
- *Definition of specific requirements*

The first section provides an overview of the demonstrator scenario and general objectives of the demonstrator. The trial is heavily based on end-user support in Norway and Sweden and the agencies involved are elaborated on in the next section. Technologies involved and ISITEP demonstrated gateways are explained in the following chapters. A three stage test strategy for WP71 has been defined and is described in this document. This test strategy will be more elaborated on in future deliverables. The section on demonstrator overview includes models illustrating the technologies used in this demonstrator networks and ISI gateway, transmission between gateways, radio terminals and air interface migration and static linked talk groups.

Finally, the WP7.1 multi-agency exercise will also demonstrate the usage of ISI compatible radio terminals with migration. The software development for terminals on the market is outside the scope of the ISITEP project, but is being developed with support from DNK since this is a necessary part of this end-to-end demonstrator.

This document also describes how we will evaluate the technical and procedural set-up after this demonstrator. These are defined as KPI's ranging from technology specific objectives to assessment of procedures and training program. Although this deliverable is providing a detailed view on the demonstrator plan, trial environment and KPI's changes may occur during the work towards the trial. Especially remaining work in SP3 will continue to improve the KPI's up until the demonstrator.

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Deviations or extra input to this plan will be documented in upcoming WP71 deliverables; D71.2 Demonstrator design, D71.3 Demonstrator test results first run, D71.4 Demonstrator test results final and D71.5 Demonstrator final report.

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2. DEMONSTRATOR PLAN

2.1. Demonstrator general objectives

The WP 7.1 aims to showcase the interconnection of the two live TETRA networks Nødnett (Norway) and Rakel (Sweden). The Norway-Sweden trial will be a full scale cross-border field exercise where the technology as well as procedures for a joint operation between public safety agencies from the two countries will be played out. Resources from police, fire/rescue, health/ambulance, supported by the control room operators will participate and receive assistance from resources from the neighbouring country. Thus the exercise is a realistic cross border scenario. More specifically, the scenario includes a bus accident on the Norwegian side of the border which requires nearby resources from Sweden. After some time, another crashed car is discovered on the Swedish side of the border where the passengers have fled the scene. This initiates a search and rescue mission which requires Norwegian agencies to cross the border. The scenario will imply TETRA (Norway) – TETRA (Sweden) communication over an ISI gateway which allows for interoperability and migration of terminals.

The specific WP objectives will include:

- Demonstration of ISI gateway functionalities
- Demonstration of migration capabilities of terminals
- Verification of the ISITEP procedures
- Demonstration of cross border collaboration guidelines, including fleet map, in action
- Demonstrate “added value” by enabling cross border communication between emergency agencies.
- Final assessment on procedures, technology and tools, and performance evaluation
- The exercise will also be a showcase to facilitate use of ISI in other Swedish/Norwegian regions than the demonstration area.

The WP activity is supported by the local authorities and end-user organizations (public safety agencies) in the demonstration region (Trøndelag/Jämtland). This region is a rural area, where available emergency resources can be far away and there is already an existing collaboration between the local Swedish and Norwegian emergency services. So the exercise aims to demonstrate how technology can enhance collaboration and efficient use of the emergency services resources across borders. A close collaboration between Norwegian and Swedish public safety agencies is expected to improve response time and efficient use of resources. The local end-users are responsible for the exercise and will plan this event with input from the ISITEP working group (MSB/DNK). MSB, DNK, Motorola and Airbus are responsible for testing and preparations.

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2.2. Number of agencies involved

Main agencies involved in the WP7.1 demonstration are the Swedish police, health, fire and rescue services, customs as well as the associated control room operators (including SOS Alarm). From Norway representatives from police, health, fire and rescue, and customs will participate. In addition will volunteer organizations and helicopter rescue service (which is important contributors in the Norwegian rescue service) participate in the exercise. From Sweden the same type of resources will participate, and in addition the County Administrative Board. The number of participants is still to be decided by local end users and the group planning the exercise scenario.

2.3. Technologies involved

This demonstration is ambitious and will involve two live TETRA networks. The live networks of Nødnett and Rakel will be interconnected by sTESTA (IP) or commercial E1 lines to their ISI gateways (WP 42) delivered by Motorola and Airbus, respectively. The demonstrator will also showcase over the air migration of radio terminals, use of cross-border talk groups and patching of local talk groups to the cross–border talk groups in the involved control rooms. Thus, the demonstrator will focus on end-to-end interoperability between agencies working on TETRA networks.

These supported voice and data functionality for migrated radio terminals (MS) from Norway and/or Sweden will be tested and demonstrated:

- Group call capability using intersystem group- linking
- Make/receive individual call across both networks
- Outgoing PSTN / PABX call via visiting network
- Phone calls routed from home network when migrated
- Emergency call processed over ISI to home network
- Group SDS from any visiting terminal to permanent TG’s covering both countries
- Individual SDS from a visiting terminal to any individual destination
- Group Status message from any visiting terminal to permanent TG’s covering both countries
- AVLS updates to home network
- E2EE updates on migrated MS

2.4. Number of networks interconnected

The trial will show the interconnection of 2 live networks with different suppliers in order to support interoperability between agencies: 1 TETRA network (Motorola) and 1 TETRA network (Airbus).

2.5. ISITEP demonstrated gateways and innovation

WP7.1 demonstrator is focused on TETRA-TETRA IOP use case. So, WP7.1 demonstrator plans to demonstrate the TETRA-TETRA (ISI) gateway (see WP42 E1 ISI Tetra gateway), new ISI radio terminal software, control rooms and end-user functional model and procedures.

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2.6. Radio terminals and migration

New ISI software in ordinary radio terminals and in control rooms will be demonstrated in WP 7.1. This is outside the scope of ISITEP, but is vital for ISI to function and for the success of this end-to-end demonstrator. ISI software is developed for end-users in Norway and Sweden to enable use of the ISI functionality. DNK and MSB are working with suppliers outside the ISITEP project to make ISI ready terminals available for the WP7.1 demonstrator. Descriptions of the radio terminal ISI software will be part of descriptions in SP3.

The expected number of radio terminals in Norway and in Sweden is estimated to about 40 radio terminals on both sides, a maximum of 80 radio terminals. A total of 2-4 control rooms will be involved.

2.7 Test strategy

The test strategy for WP 71 has three stages:

1. Supplier testing of ISI gateways

Supplier testing of ISI gateways is described in D 4.7.1 Gateways integration and testing plan.

2. Customer testing

A customer test strategy for the Norway-Sweden ISI is developed and approved by MSB, DNK, Motorola and Airbus to be ready in time for the exercise. Details are to be worked out but overall the strategic test strategy has four phases:

- Phase 1: The ISI gateway in the infrastructure/test system - Q4 2015
- Phase 2: The radio terminals using Air interface migration with full ITSI and service provided by visiting SwMI - Q2/Q3 2016
- Phase 3: Control rooms connected to the network - Q2 2016
- Phase 4: End-to-end service testing Nødnett-Rakel cross border communication - Q2/Q3 2016

Results from the test phases will be input to ISITEP Deliveries D71.2 Demonstrator design and D71.3 Demonstrator implementation and first run test.

3. End-user testing, education and training

The period of August-October 2016 will be used for end-user education, programming of radio terminals, end-user testing, training and trials on the use of international talk groups and migration of radios by police, ambulances, fire/rescue teams on both sides of the border.

2.8. Trial environment

The full scale exercise will be executed near the E14 border crossing between Norway and Sweden. E14 is the main road connecting the two countries in the Trøndelag/Jämtland area and there will be two incident areas on this road; one on the Norwegian side of the border, and one on the Swedish side. Formal validation from the local authorities and end user organizations is ensured and the trial will be part of the regions annual field exercise.

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2.9. Relationship with other work packages

Being a full scale exercise utilizing an end-to-end ISI solution, this demonstrator will draw on work from several work packages within ISITEP. The ISI gateway with E1 IP over the sTESTA network (WP 4.2) will be demonstrated. Since the demonstrator involves two live PPDR networks a legal agreement between Norway-Sweden (D31.2) is necessary. The talk groups and configuration used in the exercise is based on the functional model developed in the project (WP 32). This functional model is developed by the project group and end users but also draw on insight from the WP2 deliverables. Also other user implementation activities documented in the standard framework model (WP 32) will be important for the exercise. The cross border guidelines between Norway and Sweden documented in the handbook on PPDR procedures (WP 33) will also be used during this exercise.

2.10. Approach

The ISITEP demonstrator will be part of a full scale field exercise. This implies that personnel from both countries participate in a realistic scenario for cross border collaboration in this region. The local end-user organizations will plan the scenario and playbook in detail, but the main framework is already decided. The scenario will mainly consist of two incidents along the E14 at Meråker in Norway and across the border in Sweden;

- A bus with many passengers has been pushed off the road and overturned on the Norwegian side of the border.
- It is later discovered a car which has overturned on the Swedish side of the border where the drivers have escaped from the scene – initiating a search and rescue mission.

The incident involves the Swedish resources coming into Norway and that Norwegian resources going to Sweden. Swedish resources are asked to respond across the border to assist in the rescue of passengers, traffic control and to limit material damage. Both Norwegian and Swedish resources are called to participate in the search and rescue mission. Various teams are assigned international agency specific and/or international multi-agency talk groups. Specific locations of the incidents are not yet decided, but E14 is the only border crossing that will be used. Number of participating resources from police, fire/rescue and health/ambulance services is to be decided.

The scenario in planning will be designed to provide a realistic example of cross border collaboration. The demonstrations will be conducted following a detailed playbook and end-users will follow the cross-border procedures supported by radio terminals and known common cross-border functionalities in the networks (WP 32 and 33). The details, milestones and “playbook” will be planned and developed by the local end user organizations. Representatives from the local end users in Trøndelag/Jämtland have been involved in the SP3 and WP7.1 activities to ensure synergy between ISITEP goals and end user goals for the exercise.

The date for the field exercise is set to November 16, 2016. The demonstrations are not to challenge the procedures or the technology, but to demonstrate the possibilities and support for cross-border collaboration. The field exercise shall demonstrate cross-border procedures between agencies and the use of the technology to support the procedures.

2.11. Comparison to other ISITEP scenarios

WP7.1 is an ambitious demonstration involving ISI gateways in two live TETRA networks and newly developed software in radio terminals and control rooms. The scenario to be played is a typical traffic incident use case involving many passengers on a bus, as well as a search and rescue use case. The

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scenario builds on existing collaboration procedures in the region but will demonstrate how interoperable radio communication can support this.

2.12. Demonstrator overview

Norway-Sweden ISI essentials

- Pragmatic ISI approach – most important functionality
- Based on standards
- Commercial agreements. Norway-Sweden Steering Committee with four parties.
- Heavy user involvement, establishing common rules & routines for cooperation between emergency agencies on both side of the border
- ISI to be used operationally in live networks from 2016
- Includes Motorola infrastructure in Norway (2100 BS) and Airbus infrastructure in Sweden (1800 BS)
- ISI support in terminals and control rooms from several vendors

The following models illustrates the technical concept and interoperability of the Norway-Sweden ISI solution.

2.12.1 Networks and ISI gateways

The figure shows the overall concept of the ISI functionality between Norway-Sweden:

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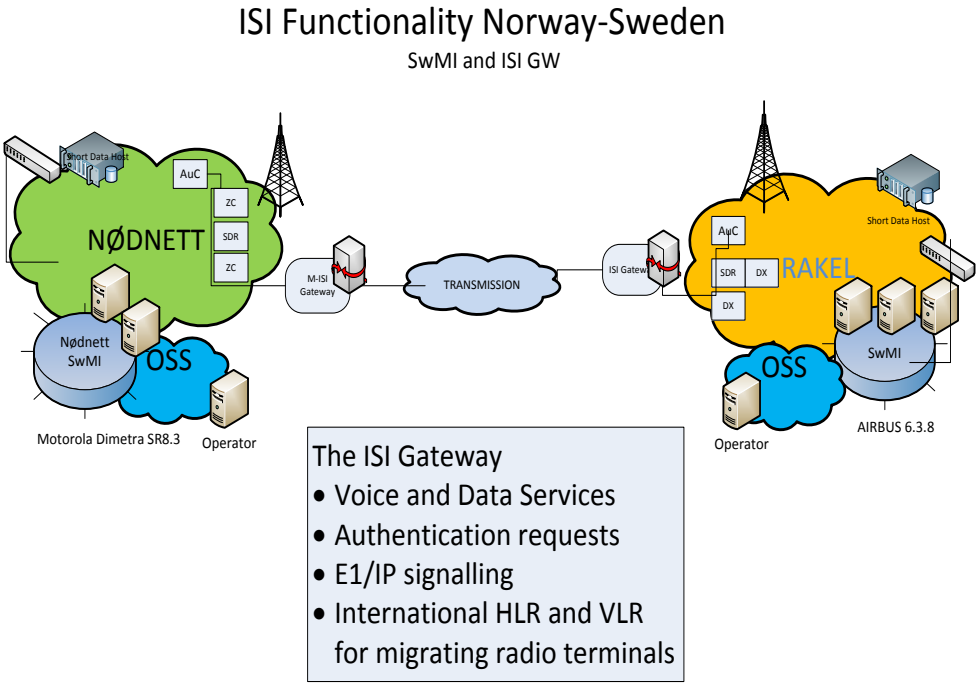
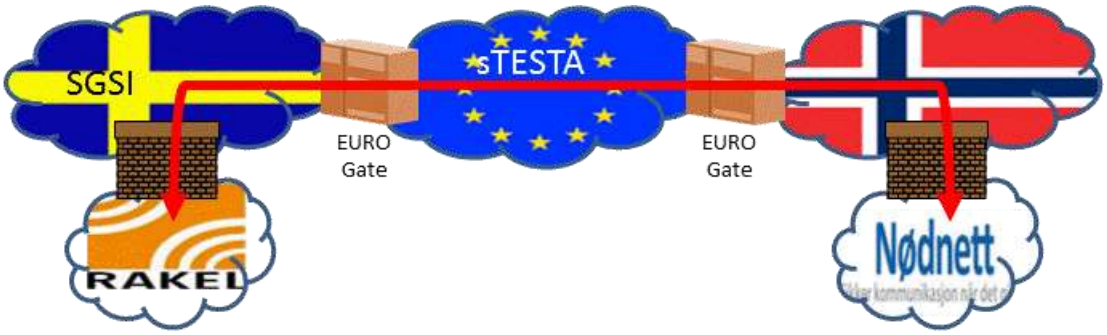


2.12.2 Transmission between ISI gateways

Transmission between ISI gateways in Norway and Sweden has been ordered. The figure illustrates how the transmission will function over the sTESTA network:



2.11.3 Static Linked Talk Groups

Cross border communication is based on static linked international Talk Groups (TG) providing group call capability using multiple permanent TG's covering both countries.

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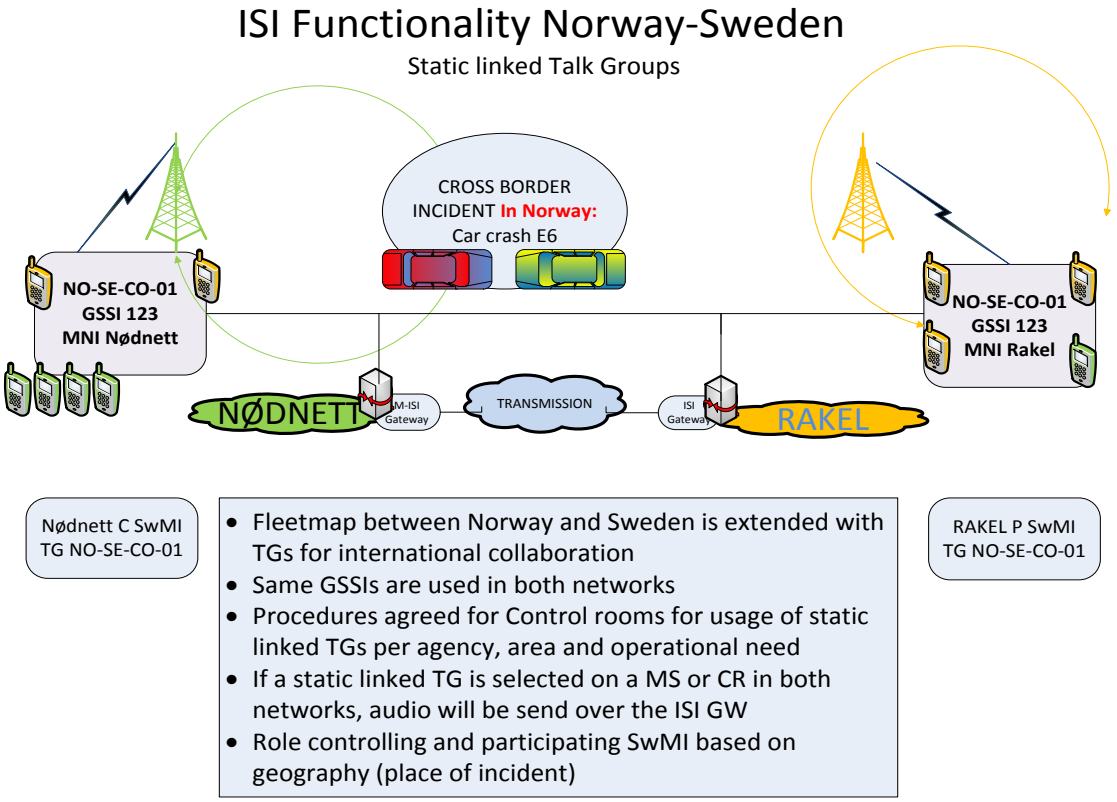

2.12.4 Norway-Sweden talk group structure

The following talk group structure is developed to be used over the ISI gateway:

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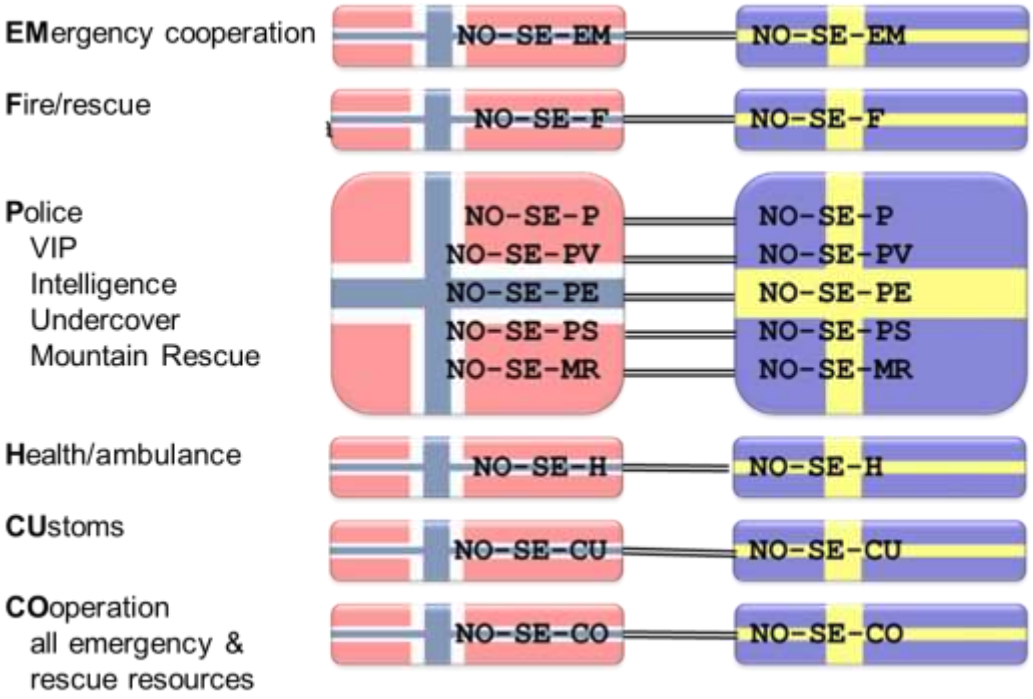

Paired NO-SE talk groups residing in Nødnett and Rakel will have the same GSSI. Each of these talk group pairs will have a number of groups available and are named NO-SE-P-N, where N is a number and the regular police talk groups have up to 8 groups available. All NO-SE talk groups will all have national coverage in both networks.

Assignment of talk groups will be made by the Swedish national point of contact, but can be requested and reserved by Swedish and Norwegian national and local control rooms through a common website. Deliverables in WP32 will elaborate on the functional model for Norway-Sweden as well as the website solution in more detail.

2.12.5 Radio terminals and Air Interface Migration

Cross border mobility is based on Air Interface Migration for the Mobile station (MS) with full ITSI (TCCA TIP TTR 001-06). Some additional terminal functionality defined in the radio procurement document[1].

Authentication is done in the Home network for the MS after request from the Visiting network; when approved for migration the visiting network assigns an (V)ASSI to the foreign ITSI

[1] http://www.dinkom.no/Global/Dokumenter/Radio%20Terminal%20Requirements%20for%20ISI.pdf

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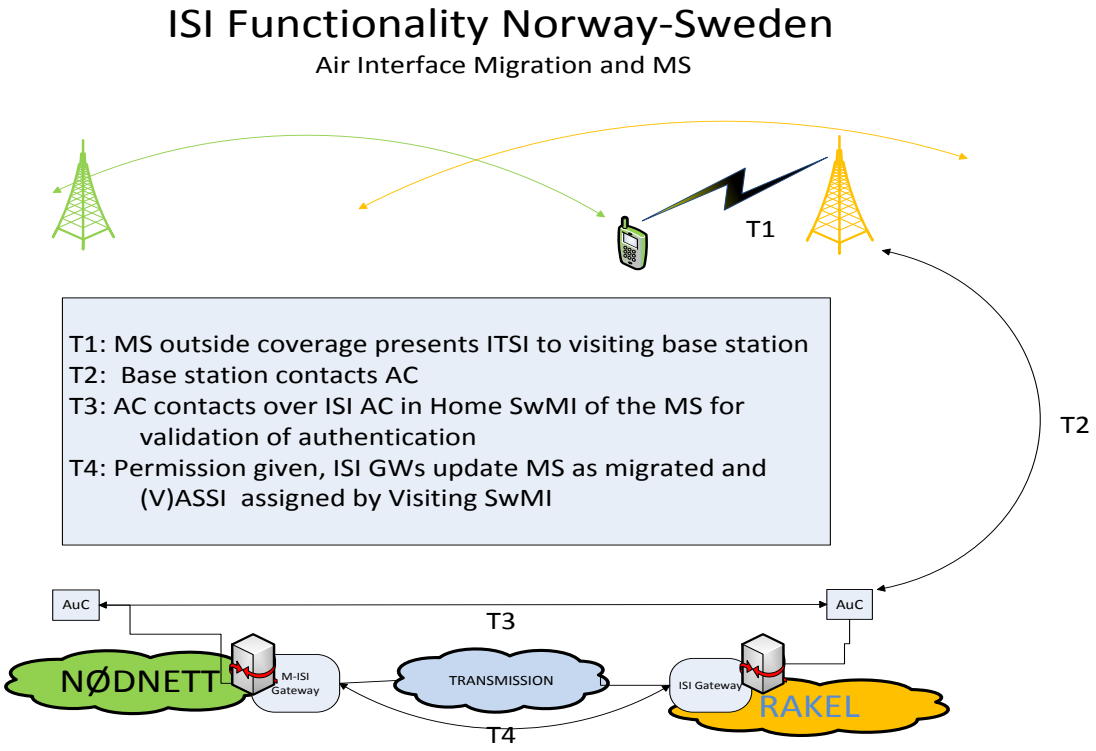

2.13 Key performance indicators and target performance

The demonstration will measure the performance on several key performance indicators in the live networks. TETRA-TETRA connection between two live networks is a completely new feature in regards to gateway, radio terminals and control rooms, and it is a strong requirement for end-users to collaborate with their counterparts in the neighboring country. The basic KPIs that will be measured are:

- End-users from Norway and Sweden within the same agency can communicate in an agency specific ISI talk group. This communication must work:
  - When end-users are in two different countries (and different networks)
  - When end-users are in the same country (same network)
- End-users from Norway and Sweden from different agencies can communicate in a multi-agency talk group
  - When end-users are in two different countries (and different networks)
  - When end-users are in the same country (same network)
- Swedish end-users can migrate with their Rakel-radio terminals to Nødnett (both by automatic and manual migration)

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- Norwegian end-users can migrate with their Nødnett-radio terminals to Rakel (both by automatic and manual migration
- User which have migrated to the other country can communicate back to their home control room dispatcher.
- Norwegian control room dispatcher can group-combine/patch national talk group with the ISI talk group
- Swedish control room dispatcher can group-combine/patch national talk group with the ISI talk group

Suggested high level indicators are identified for the several aspects of this demonstrator, being the the procedures of operation:

- Time from the report of an incident is reported until the international cooperation is up and running.
- Qualitative measurement of operational use when people from different countries - speaking several different languages - can migrate into an area.
- Verify the operational benefit of the ISITEP procedures to support the end-users in the emergency operation
- Correct methodology (ISITEP procedures) for using ISI is applied by end-users (to evaluate training program)
- Talk group structure fits the purpose of connecting necessary emergency agencies
- Qualitative assessment of use of collaboration guidelines (i.e. terminology) and situational awareness on the talk groups.

More detailed operational procedures will be created and refined with input from D32.1 (Functional model) and D33.1 (Handbook of PPDR procedures). The methodology to measure these KPIs will make use of both quantitative and qualitative data. Quantitative traffic data will be used in the evaluation of the trial. Also qualitative observation of the conversations in the talk groups and use of collaboration guidelines will be used. An evaluation design combining traffic data with qualitative observations have already been developed and tested by DNK during a field exercise in 2015.

2.13.1. Technical target performance indicators

Target performance for TETRA-TETRA ISI gateway, control rooms and terminals[2]: The following technical measurements will be performed:

- Time of automatic and manual migration of radio terminals between the two networks
    - First time migration of a radio terminal from home network to visiting network
    - Second time migration of a radio terminal from home network to visiting network

[2] Performance indicators are drawn from the document D2.1 End-user Requirements Specification from the MACICO project

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    - The initial migration registration procedure (including authentication) to a foreign network should not take more than a few seconds longer than the first registration (including authentication) on the home network of a radio
- For group calls the call setup delay will be measured and compared to national use
- The end-to-end audio delay experienced by the users for calls over the ISI will be measured and compared to national use
    - In Nødnett
    - In Rakel
- Voice quality over the ISI gateway should equal compared to national use

2.13.1. Definition of specific requirements

TETRA-TETRA migration of radio terminals between two networks is of strong interest to end-user requirements. The end-users have specific requirements to be able to bring their own operative radio terminal to the other country during large-scale incidents or when resources in a neighboring country are closer to the incident area than national resources.

The specific end-user requirement is to enable cross-border communication between all emergency agencies from when an incident is reported and resources are allocated to the incident to enable a shared situational awareness:

- Communication and coordination between units from both countries on the way to the incident in common talk groups.
- First unit at the scene reports to the other emergency units still on the way
- Coordination of all units at the incident area

The key performance indicators and target performance in the precious chapter is constructed to meet these end-user requirements.

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