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European Commission

Pilot project on the design, implementation and execution of the transfer of GNSS data during an E112 call to the PSAP

Contract No 440/PP/GRO/PPA/15/8308

Deliverable D4.6 AT Pilot - Notruf Niederösterreich

René Kerschbaumer
July – 2017

Contract No 440/PP/GRO/PPA/15/8308

Deliverable D4.6 AT Pilot Notruf Niederösterreich

Pilot project on the design, implementation and execution of the transfer of GNSS data during an E112 call to the PSAP

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LIST OF ABBREVIATIONS

3GPP - 3rd Generation Partnership Project

A-GNSS - Assisted Global Navigation Satellite System

ACE - Accredited Center of Excellence

AEL – Android Emergency Location

AML - Advanced Mobile Location

API - Application Program Interface
AT – Austria

AVL – Automatic Vehicle Location

C&C - Command & Control

CAD - Computer-aided dispatch

EC - European Commission

EGNOS - European Geostationary Navigation Overlay Service

ETSI - European Telecommunications Standards Institute

EU - European Union

GIS – Geographic Information System (part of CAD software, maps with layers)

GNSS - Global Navigation Satellite System

GPS - Global Positioning System

GSM - Global System for Mobile Communications

IP - Internet Protocol

IPR - Intellectual Property Right

MNO - Mobile Network Operator

NG112 - Next Generation 112

NNOE – Notruf Niederösterreich (AT pilot site)

PCO - Project Control Office

PSAP - Public SAFETY Answering Point

SIM - Subscriber Identity Module

SLA - Service Level Agreement

SMS - Short Message Service

TOA - Time of Arrival

TKG – Austrian Law "Telekommunikationsgesetz"

WP - Work Package

WPL - Work Package Leader

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1 Introduction

1.1 Place of this document and objectives

This document describes the Austrian Pilot project on the design, implementation and execution of the transfer of GNSS data during an emergency call to the PSAP, identified as D4.6 in the list of project deliverables.

It is generated as part of the contract 440/PP/GRO/PPA/15/8308.

Advanced Mobile Location (AML) was introduced in Austria by Notruf Niederösterreich (PSAP for Lower Austria) on the 15.10.2016 after intensive work with EENA, Google, HELP112 Consortium, Austrian telecom regulatory board, and Austrian MNOs.

Google AEL technology was used from the beginning of the Austrian pilot project.

With beginning of November AEL position datasets are used "live" by our emergency dispatch staff and are integrated in our workflow.

1.2 Test surrounding / limitations

Notruf Niederösterreich is currently testing different handsets and is planning additional tests in remote areas and urban areas to gather more understanding and knowledge respectively compare our experiences with the other pilot sites.

Data comparison at the moment is only possible between the verbally/manually inquired address and the AEL position. Systematic requests for a "network based location" (cell-id / focus position finding) is not possible for us out of local legal reasons. All Cell-ID location requests have to be requested formally at the related MNO, and as a basic reason there has to be an emergency respectively "imminent danger / life threat" according to Austrian TKG.

NNOE is no 112 PSAP.

Notruf Niederösterreich is responsible for Work Package D4.6 of the Help 112 Project involving feasibility study and pilot to look at:

1. Testing AEL with SMS transport of the location over a range of handsets for Austrian callers in Austria
2. Using mobile data (HTTPS) instead of SMS to transport handset locations for Austrian callers – using Google's https format

1.3 Foreword

Locating emergency callers is the most important process for PSAPs, emergency callers and emergency responders. The fast increase on emergency calls originating from mobile phones has put PSAP staff under additional pressure to figure out the accurate position of the emergency (with emergency calls from fixed lines PSAP staff normally had accurate and immediate address details).

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Accurate position information delivered technically additional to the verbal inquired location details helps in all cases, and can be lifesaving in some cases, which we typically see in traffic accidents when emergency callers are not familiar with their whereabouts or incidents in rural or alpine areas. Reliable and timely technical support at locating callers will save lives, save precious time and can be the last resort for callers who cannot talk (any more). Not having it will mean negative outcomes for our citizens.

Until now we had to rely on Cell-ID, which is very unreliable (besides the inaccuracy we are still facing problems with our MNOs and the daily changing number of MVNOs to timely provide us with position information). The AEL way to deliver GNSS or WIFI position datasets to the PSAP is revolutionary. Personal note: Working inside the emergency branch for 25 years the AML idea is one of if not the best developments in the PSAP world.

Thanks to the EC, Google, the HELP112 consortium and EENA that we received the possibility to be a part of this very effective ongoing development.

1.4 Austrian PSAP Landscape / Emergency Numbers besides 112

Austria's nine federal states are each responsible for "non-police" emergency preparedness and response.

Besides 112:

The historic / traditional emergency numbers (besides 112) still play a big role in Austria: http://www.fmk.at/mobilfunktechnik/notruf/notrufstatistik/

A list of all formal emergency call numbers is published by the Austrian Telecom Regulatory Board: https://www.rtr.at/en/tk/TKKS_Notrufe

112: Police is overriding all nine states at the federal ministry of interior level. 112 calls are routed to the nearest district police dispatch office. Within Police PSAPs only one of the nine federal states uses a computer aided dispatch system to dispatch police resources. A tender to completely restructure police dispatch is on its way.

Non-police PSAPs are organized on each state level, and sometimes separated into different PSAPs for "one" emergency service / emergency service "branch". Area coverage / responsibility is ranging from one district to state wide coverage.

NOTRUF Niederösterreich (NNOE) is no 112 PSAP. Simless Calls can only be received by 112 PSAPs in Austria. NNOE currently operates the following emergency call numbers: 122,140,141,144

1.5 Applicable Documents

AD	Title of the document & reference

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AD 1	Contract 440/PP/GRO/PPA/15/8308
AD2	Help112 Consortium Agreement

Table 1 – Applicable documents

1.6 Reference Documents

RD	Title of the document & reference
RD 1	Help112 Technical, Management & Financial Proposal TPZF/SSA-T2015-PP-0451 is1.0 31/07/2015
RD2	Help112 Requirements Document D1.1

Table 2 – Reference documents

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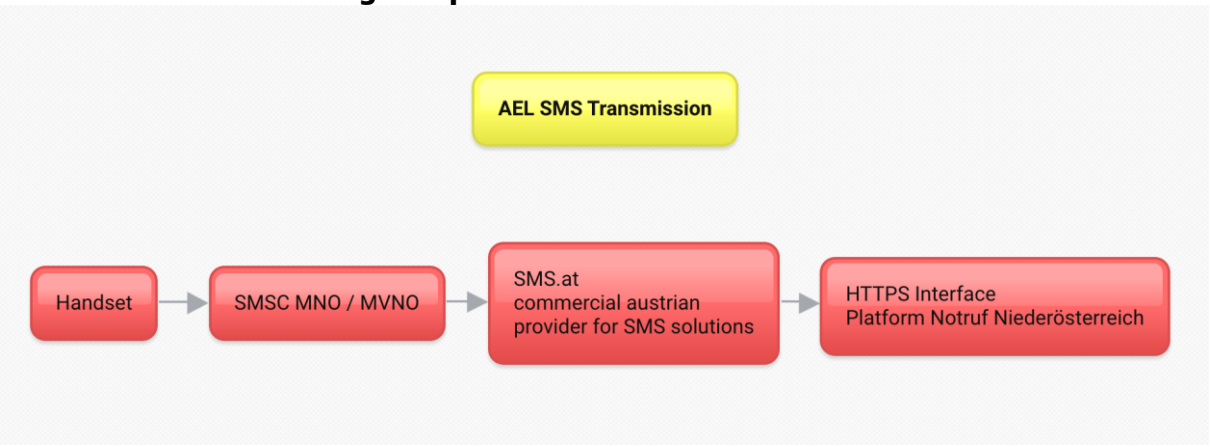
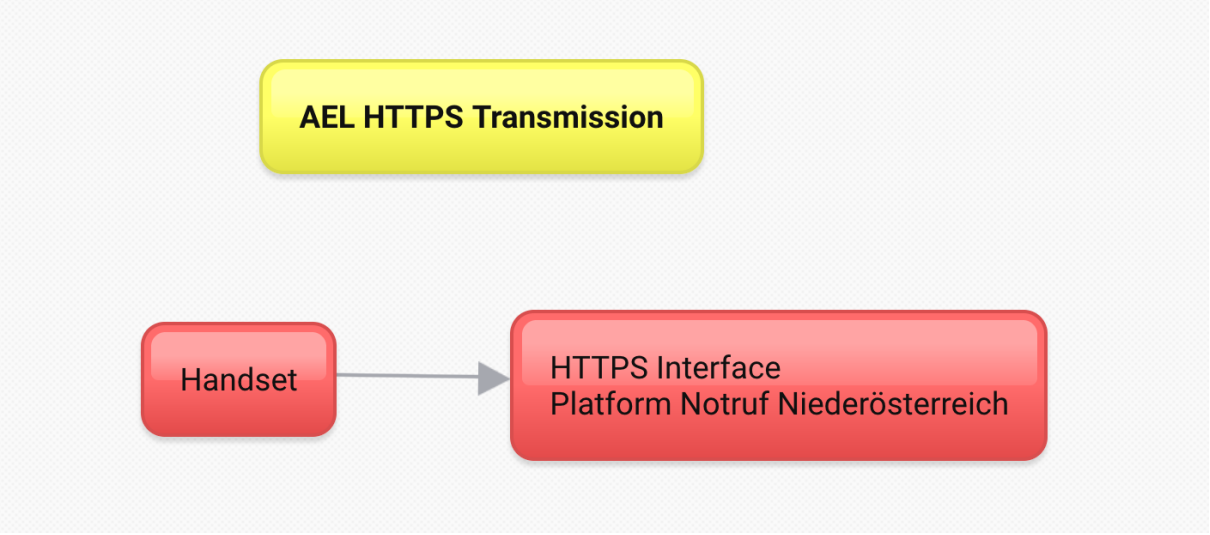
2 Technical Architecture in Austria

Architecture for receiving AEL position datasets:



At the moment we use a long SMS number provided by a commercial SMS solutions company to receive the short messages. Other possibilities are considered / tested at the moment. Costs play a role in this decision (most ways also charge money for each SMS that is received additional to implementation and monthly fees).



Architecture for distributing AEL position datasets to the regional PSAP:
After the first tests showed the fast, reliable and accurate results it became clear that all Austrian PSAPs (covering other austrian areas) should be able to benefit from the AEL location information also. Google AEL works on national level. By setting up the infrastructure for AEL NNOE became the first Austrian federal state to receive AEL information. As a resulting but separate project NNOE built a platform to be able to distribute the AEL location datasets in a secure way.

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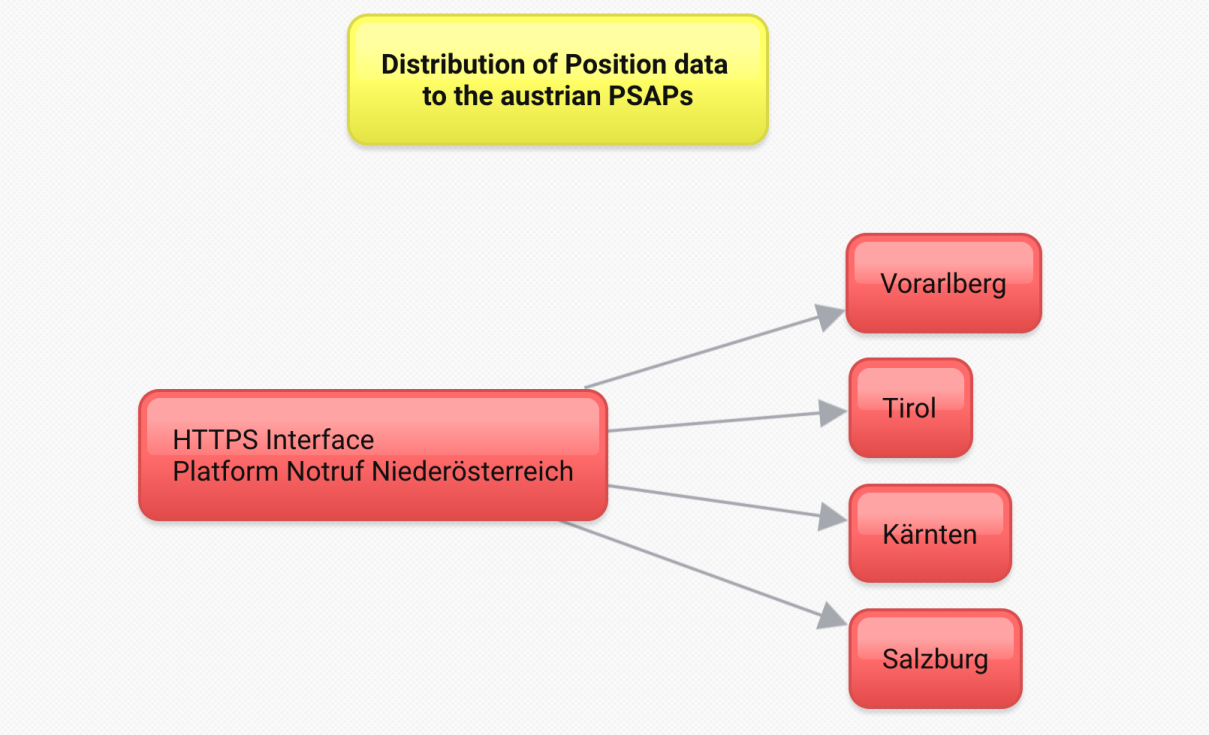

Including the federal state "Lower Austria" = Niederösterreich five of nine federal states already use AEL position data in their PSAP workflow. This linking process is encrypted and ongoing, hopefully all states and PSAPs will use this technology soon.

Until now, there are no implementations or configurations on austrian MNO network level. To reach improvements in reliability, some MNO level configurations would be necessary. Discussions with Austrian MNOs are ongoing but difficult.

2.1 Implementation, Tests and start of "live operations"

2.1.1 Implementation experience

As we started exploring possible ways we contacted all relevant stakeholders (MNOs, Austrian regulatory board, PSAPs…) and EENA supplied information to all of them. When Google started their new AEL solution directly planted into all android smartphones it immediately became clear that no other solution makes more sense.
After looking into the possible transmission ways, we designed our own platform to receive AML SMS and HTTPS transmissions (with commercial carriers). With the support from Google and EENA, we were able to start very quickly. The actual system design will be improved in the next months, but it was comparatively cheap and it was mostly done by our IT department "in house".

2.1.2 Implementation costs – HELP 112 / AEL infrastructure

HELP 112 Costs NNÖ until 01.02.2017

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Pos. 1	Travel Costs	6.500,00 €
Pos. 2	Human Resources NNÖ/...	30.250,00 €
Pos. 3	IT-Costs (one time)	4.859,49 €
Pos. 4	IT-Fees (recurring costs)	6.000,00 €
	TOTAL	**47.609,49 €**

ad 1)	Flight tickets, Meetings, Hotels, Daily Allowances, Shuttle,...
ad 2)	39 technical men days, 21,5 project coordination men days a 500 €
ad 3)	SMS Interface, Test Handsets including fees
ad 4)	monthly fees for SMS Interface (from octobre until today) 1500 €/month

Above table shows the HELP 112 (AEL implementation for NNOE) costs until now. This included some "pioneer efforts", possibly following projects should be less demanding.

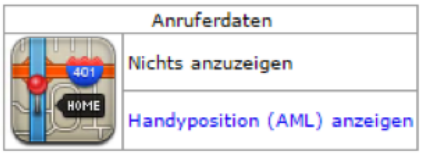
In a resulting project (see above Chapter 2, paragraph 2) we built a secure platform to distribute the datasets on the austrian national level. Technical implementation and operation costs of this additional platform (separate project) are shared between the receiving Austrian PSAPs.

2.1.3 Test runs

Tests are continuing and using the "live" AEL solution and also the test application provided by Google.
Systematic Tests comparing AEL positions with "Cell ID / network based locations" are legally not possible in our state.
First tests with assigned test handsets before going live with the pilot project set up impressed with never before seen accurate and fast position information.

2.1.4 Start of "live operations"

With November 2016 we started to use the position datasets in our PSAP workflow.



Emergency calltakers get a notification as soon as AEL information is available.
Very soon first cases came up where the AEL information was vital in speeding up the location inquiring process or reduced the (normally large) search area to a small radius.

2.1.5 Real life emergencies – improvements by never before seen accuracy

Very soon after the start of live operations we were impressed by the fast and accurate location datasets. Most notably in off road or outdoor incidents we now get immediate knowledge about the location of the emergency (where no street names and house numbers exist and callers usually struggle to verbally describe their location).

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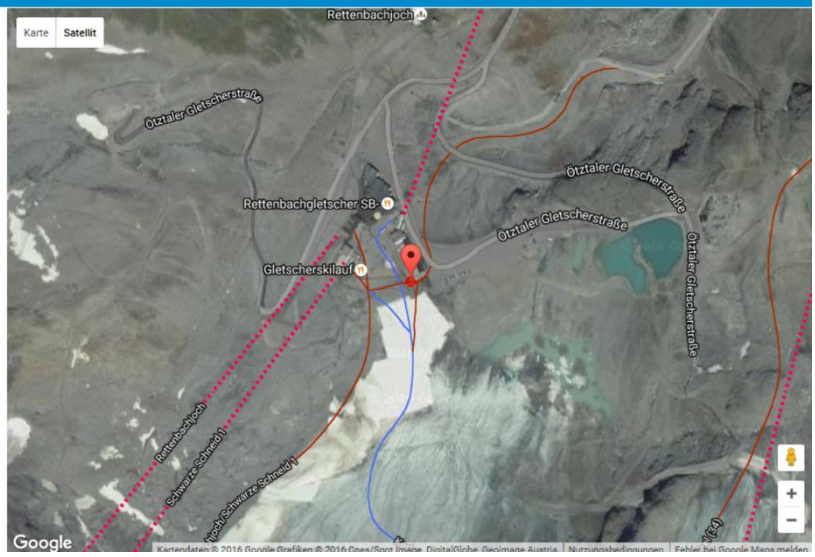
example: alpine emergency call (140), skiing area, caller position on a slope

AML - Advanced Mobile Location Ergebnisübersicht

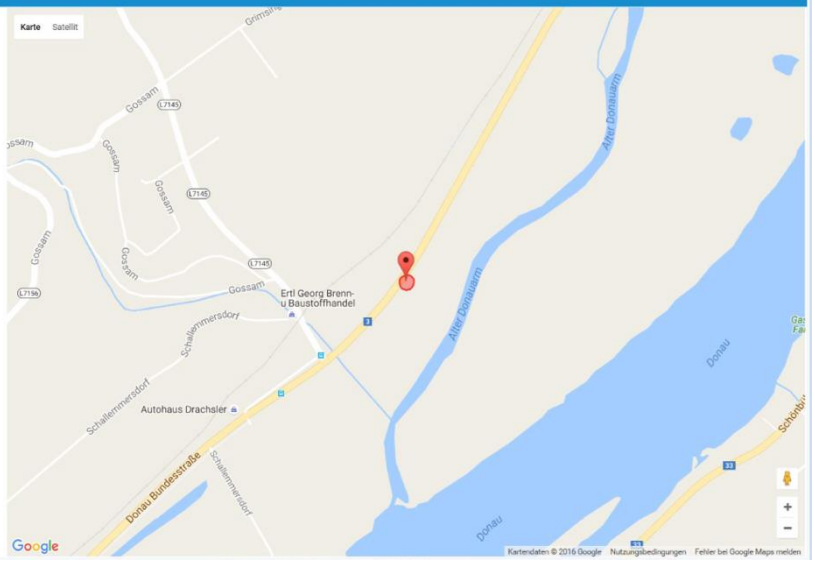
Beschreibung	Information
Latitude	46.9407014
Longitude	10.9329984
Radius	8 Meter
Lokations-Methode	gps
Notruf-Nummer	140
Bundesland	T
Handy	samsung SM-A310F
Rufnummer	+4[redacted]
Home-Netz	A1
Zellen-Netz	A1



Example: serious traffic accident, caller was not familiar with the area > thanks AML/Google !

AML - Advanced Mobile Location Ergebnisübersicht

Beschreibung	Information
Latitude	48.25476
Longitude	15.35763
Radius	16 Meter
Lokations-Methode	gps
Notruf-Nummer	
Bundesland	NÖ
Handy	
Rufnummer	+436[redacted]
Home-Netz	-
Zellen-Netz	A1



The first caller reported this accident with a wrong location 14 km northeast of the correct location.

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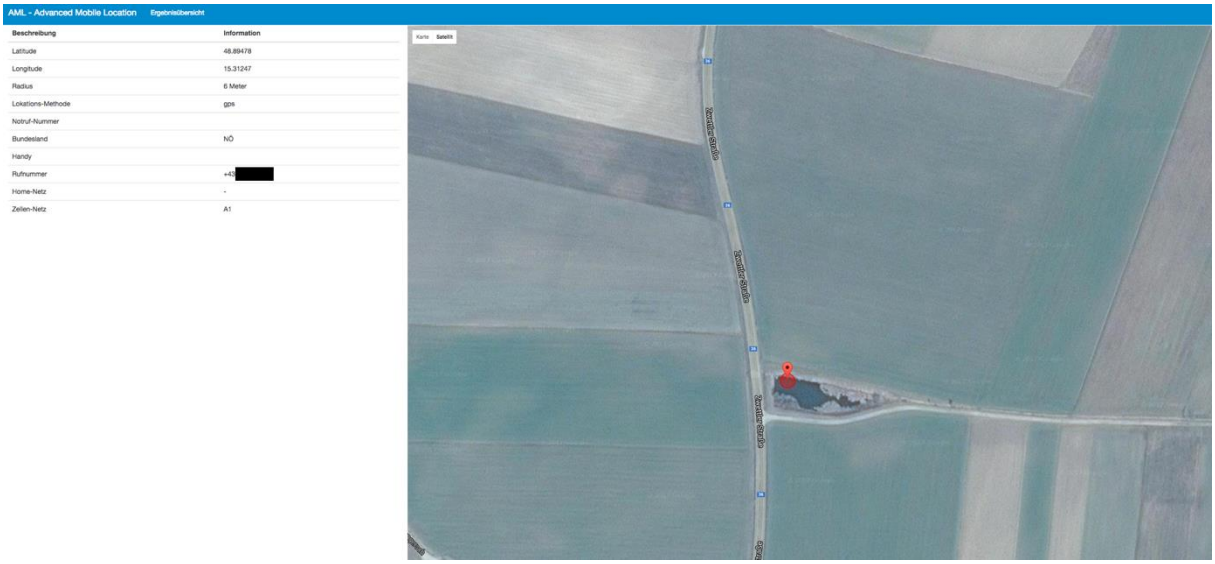
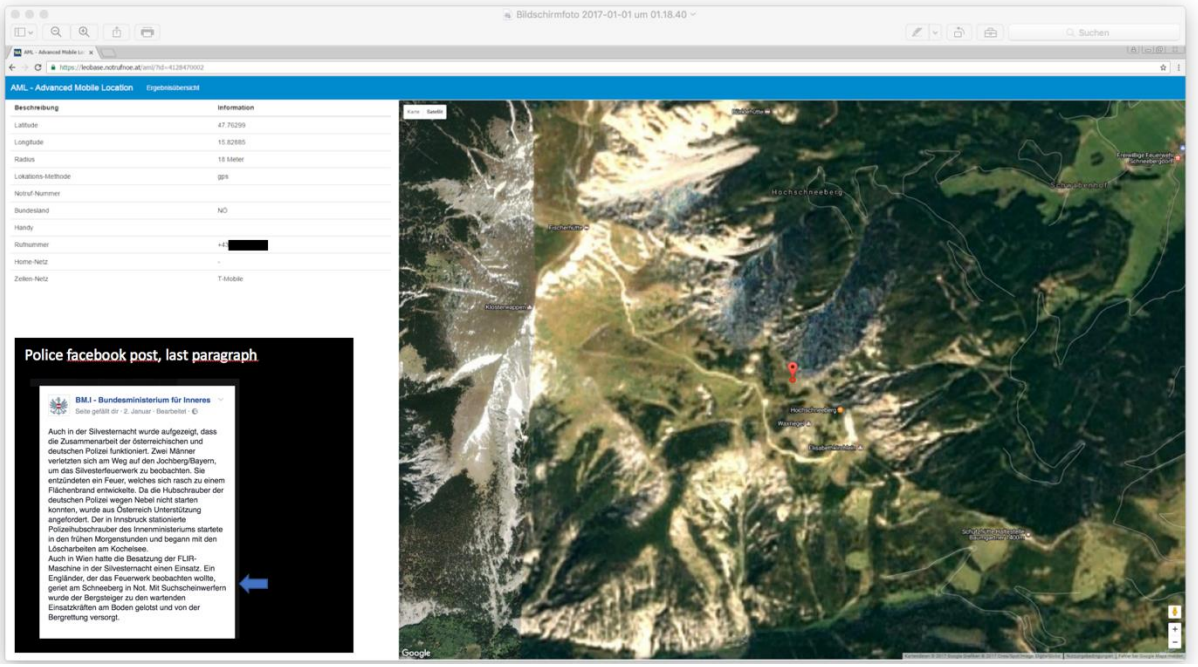


Ice skating accident on a natural pond, caller used a traditional local name to describe the location which until this incident was not in the CAD Database. Thanks to AML – no problem.

Alpine area, 00:50 am new years morning, red pinpoint: caller, orange dot: Peak Hochschneeberg, other dots: alpine shelters



AML rescues UK tourist in new year night:

A tourist from the UK fortunately using an austrian smartphone + MNO wanted to watch some of the fireworks from a lower Austrian mountain. Shortly past midnight (new year) he reported that he got lost in difficult terrain (after trying to reach/find the shelter “Fischerhütte” for a longer time, and is suffering from hypothermia). Thanks to the AML dataset his position was immediately clear (normally it takes a lot of time to narrow the callers position down in this surroundings). A responding police FLIR helicopter could guide the tourist to a responding squad of the mountain rescue service using its nightsun searchlight. The mountain rescue service squad

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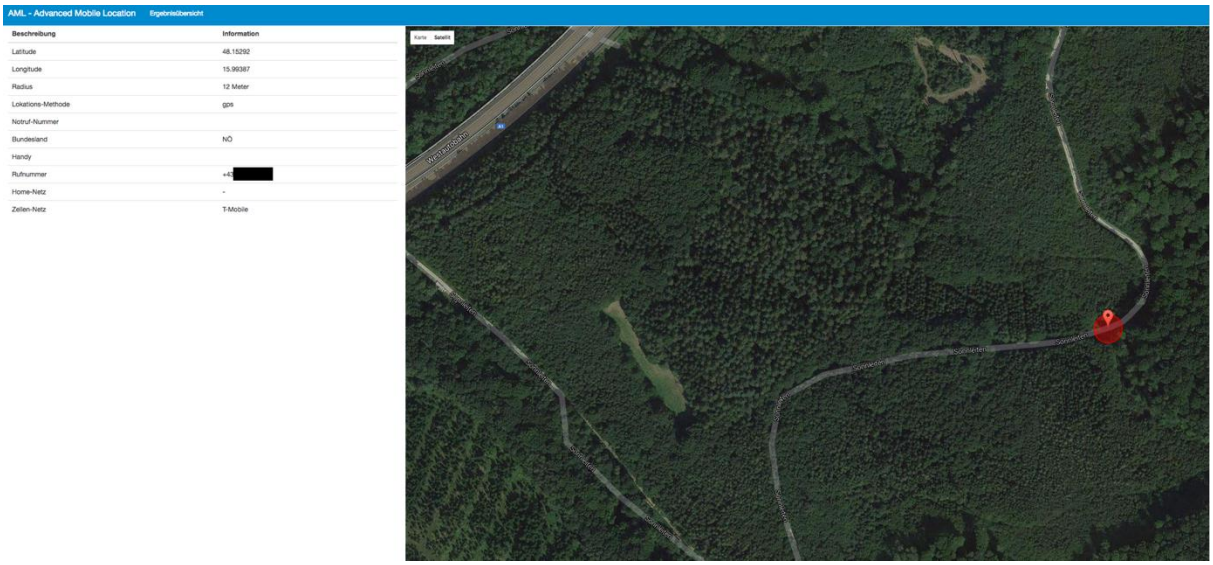
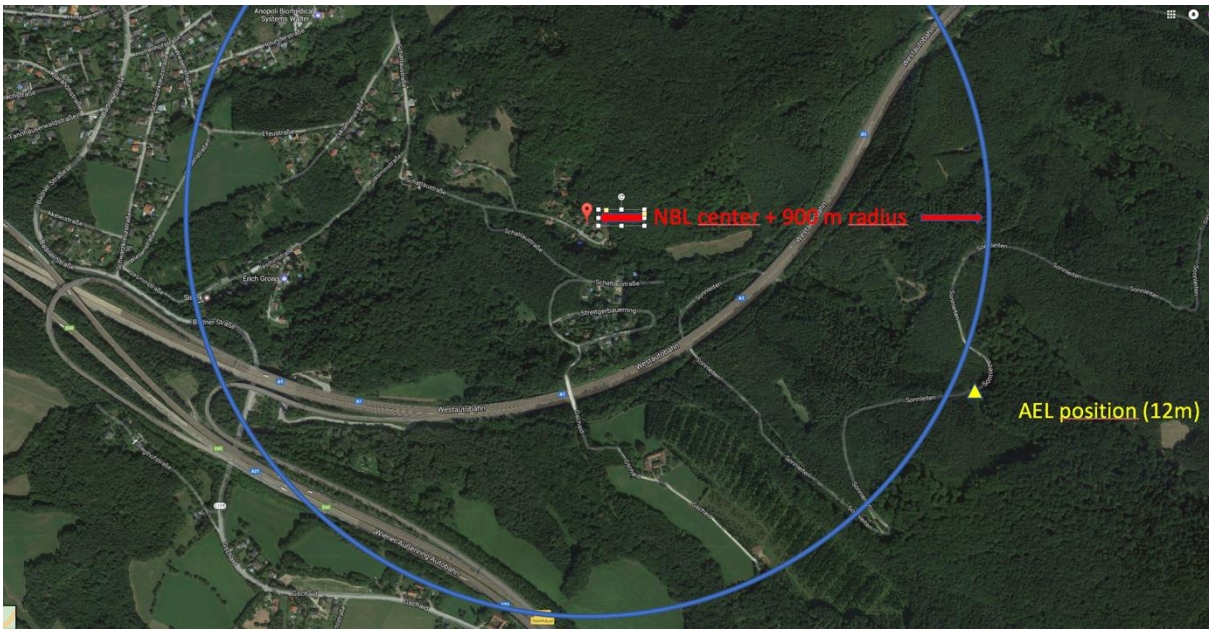
provided first aid and brought the mountaineer to another shelter in the vicinity where they spent the (short) rest of the night. http://www.bergrettung-puchberg.at/index.php/einsaetze/einsatzbericht/174

Mountain Bike accident - Comparison NETWORK BASED LOCATION vs. AML:
In this single case we requested a network based location from the MNO additionally to the received AML dataset.
Picture 1 – AEL Location:



Accident site in densely wooded area. Please take notice, that the center dot of the location is exactly on the way.
Picture 2 – AEL vs. Network Based Location of the MNO:



Center point and radius of NBL (red dot, blue radius) aside the correct location (yellow dot).

General experiences:

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General subjective comparison experience is, that NBL + radius is very often inaccurate / aside actual location.
The location is normally available within 20 seconds of the start of the call. Since our average time for taking the call is eight seconds and the call used some seconds in the GSM/LTE environment before coming through, on average 8 seconds after starting the verbal inquiry AEL position data is available.
Usability for the PSAP dispatch staff can and will be improved by better integration inside of the location inquirement process inside of the computer aided dispatch system.
Verification of all technically supplied location information is still requested from PSAP staff in all cases - to be safe. However, our dispatchers already love it.

2.1.6 Live Data

167962 received position data sets (15.10. - 31.12.2016) were analyzed from the NNOE "live" AEL system.

Location method	Accuracy (meters)
GNSS (min/max/avg)	3m/16897m/35m
Cell (min/max/avg)	100m/5000m/1791m
Wifi (min/max/avg)	10m/86022m/29m
No Method Information (min/max/avg)	4m/3100m/96m

Table: Location accuracy based on different methods

Location method	Received data sets (percentage)
GNSS	40356 (24%)
Cell	5820 (3,4%)
Wifi	118504 (70%)
No Method Information	3282 (1,9%)

Table: AEL location method statistics

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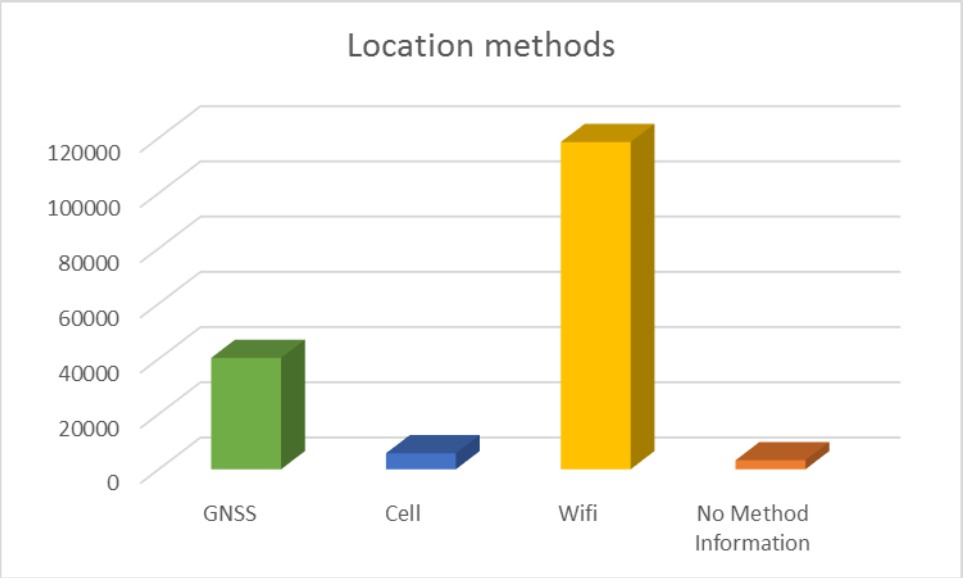

Chart: AEL location method statistics

AEL transmission method	Received data sets (percentage)
http + sms	126842 (75%)
sms only	25799 (15%)
https only	15321 (9,1%)

Table: AEL transmission statistics

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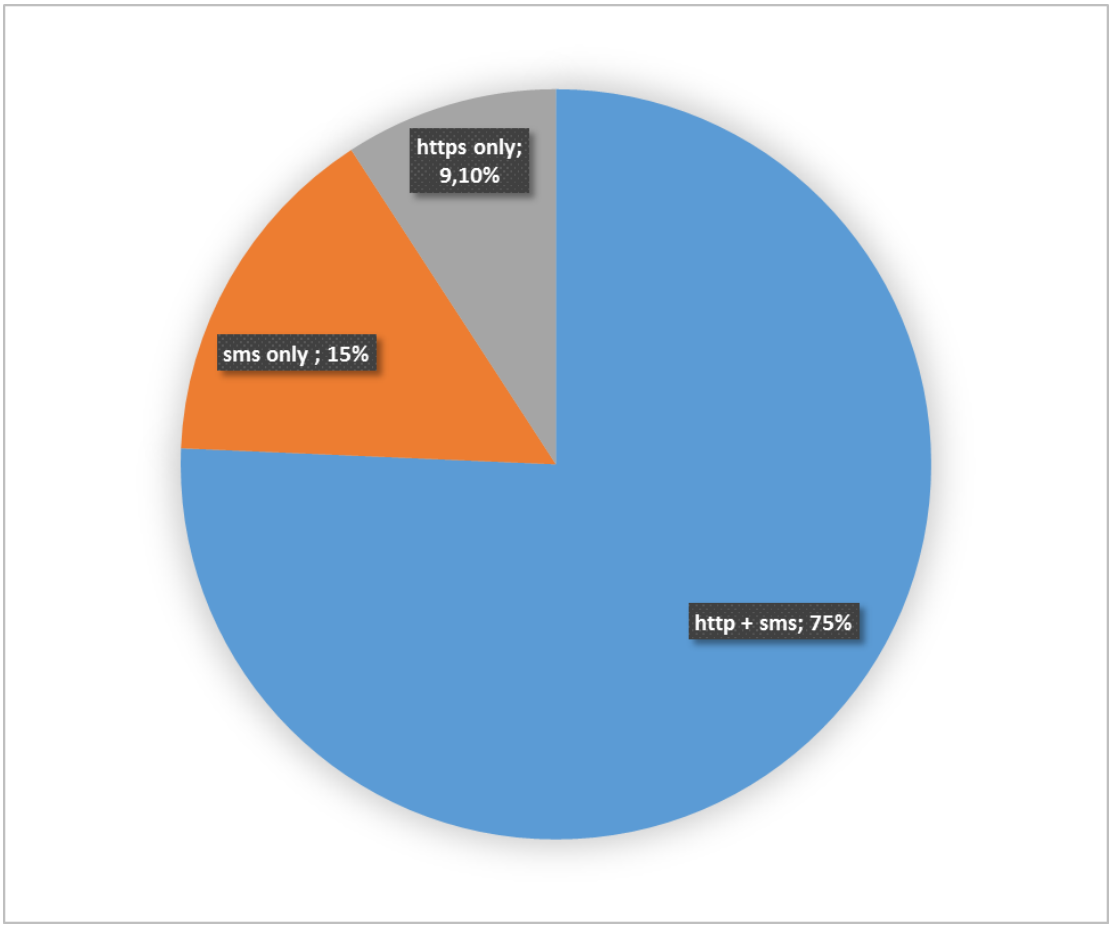

Chart: AEL transmission statistics

Emergency number	Received data sets (percentage)
144 AMBULANCE	67644 (40%)
141 Doctors Service	72272 (43%)
140 Alpine Emergency	1274 (0,75%)
128 Gas Leak/Electricity	705 (0,42%)
122 FIRE RESCUE	10565 (6,3%)
datasets received per SMS only cannot be assigned to the number (by design)	15502 (9,24%)

Table: Emergency number statistics

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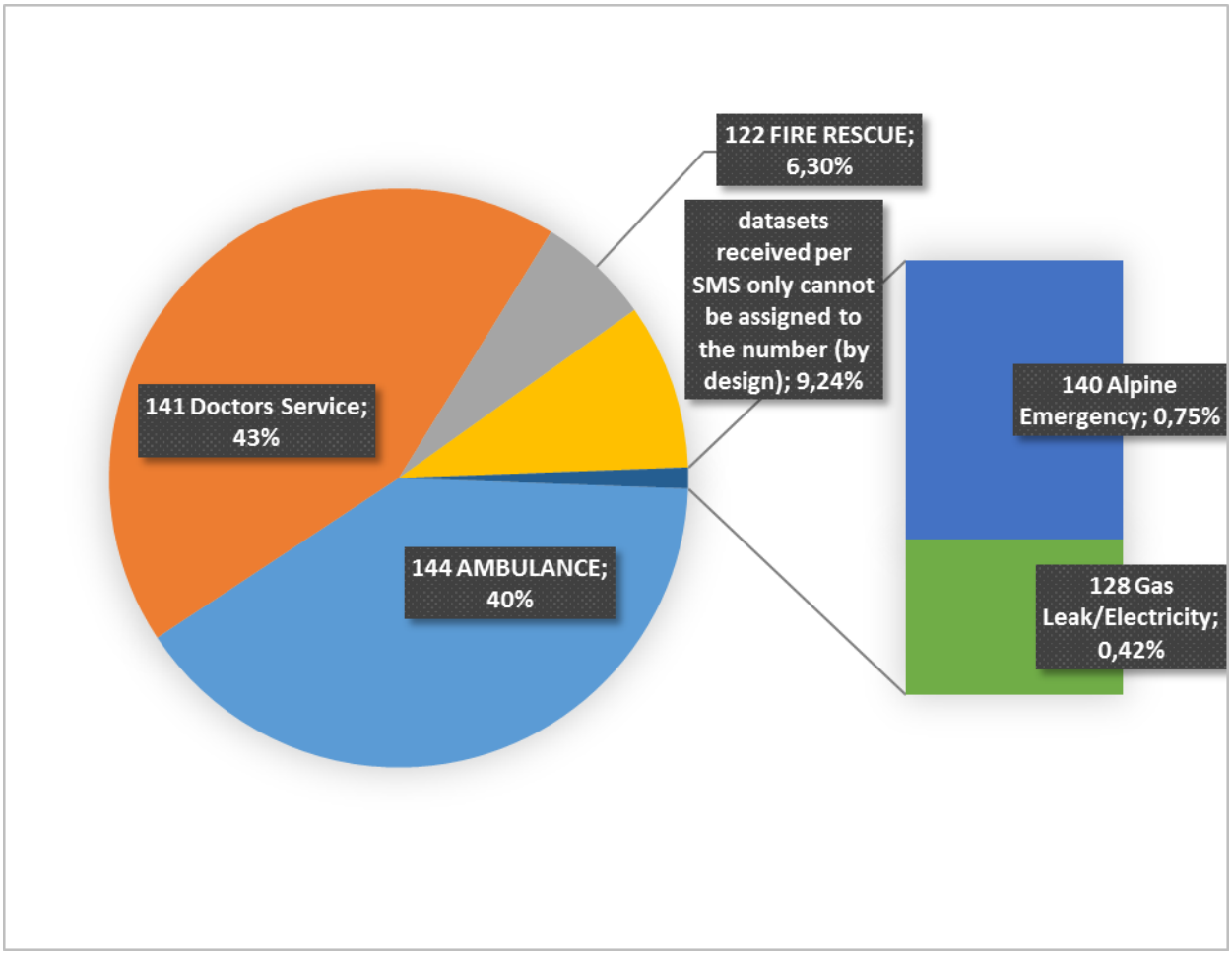

Chart: Emergency number statistics

Manufacturer	Received data sets (percentage)
samsung	104108 (67,1%)
huawei	14647 (9,4%)
sony	11705 (7,5%)
lge	8975 (5,8%)
htc	3483 (2,2%)
motorola	1589 (1,0%)
tcl	1118 (0,7%)
oneplus	914 (0,6%)
lenovo	852 (0,5%)
zte	784 (0,5%)
wiko	653 (0,4%)
others	3789 (2,4%)

Table: Manufacturer statistics (data sets with no information omitted)

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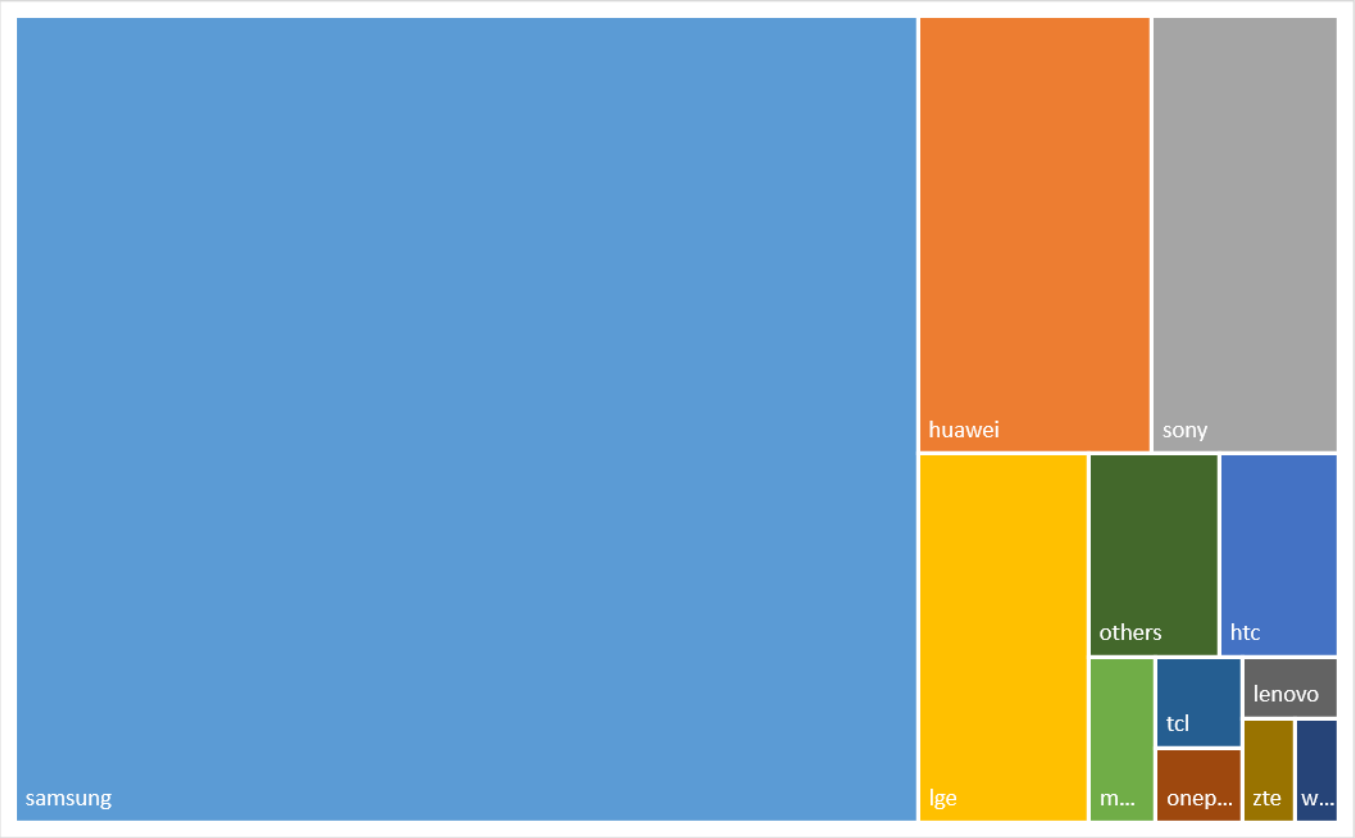

Chart: Handset Manufacturer statistics (data sets with no information omitted)

Actual Live Data with 30.1.2017: 248716 datasets received (data not processed yet).

2.2 Observations

There are a lot of conditions and complications that we do not yet understand or just begin to get closer. Some of them might be brought under control, however some factors might reside outside of the area of influence of this consortium. Just to name a few of them: different accuracy from different handsets, transmission of MSISDN with all HTTPS transmissions, callers without prepaid credit, handsets which seem not to transmit during an ongoing call, …

2.2.1 Proposal for discussion

If there is a solution or improvement for the problem with the missing MSISDN phone numbers inside the HTTPS transmission, we would prefer HTTPS transmission before SMS transmission. A new AEL algorithm could help preferring HTTPS transmission:

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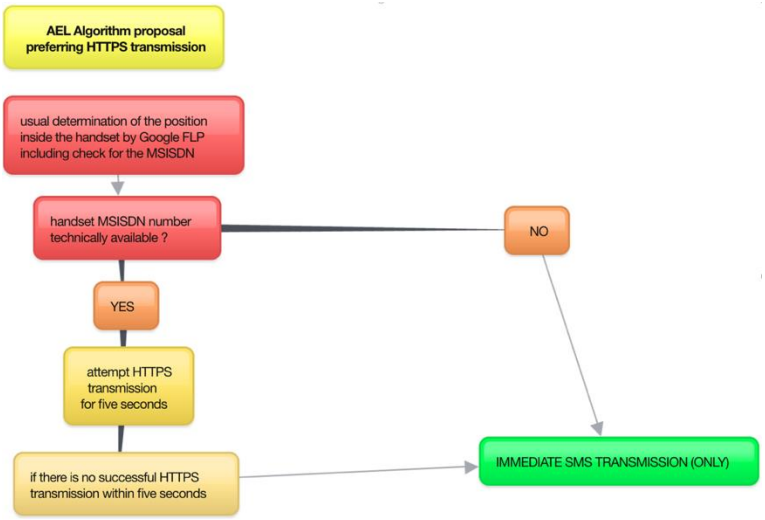

This also includes a cost discussion, since receiving SMS also costs money in our current setup.

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3 Overall Conclusions

Using handset location information (AEL) has already made and will make tremendous future improvements to the PSAP workflow and emergency response process:

- Daily incident cases during live use already show the benefits of the AEL information: AEL location datasets are now used as an additional location verification information (additional to the verbal inquired information). In some cases (caller not familiar with the area when confronted with an emergency) it has already been used as the primary source of location information.
- Irrespective of the area our Emergency Calltakers are often confronted with people having difficulties to describe their actual location. Under normal circumstances (non-problematic known address in populated area) we need 42 seconds on average to verbally inquire and verify an address (including verbal, CAD and GIS verification). When the caller is unsure about his location or unable to communicate, then the necessary time for verbal inquirement escalates quickly. We experienced this on road (people who travel are not always aware of street names, highway exits, directions,…), off road (caller trapped in car after crash not able to tell a detailed location), outdoor (alpine emergencies with no landmarks or civilization in the vicinity, spare time activity related emergencies: hiking, skiing, climbing,…) and indoor (callers suffering from a stroke unable to communicate clearly or callers with language barriers). Cell-ID Location requests are often not helpful because of the lack of accuracy (and reliability).
- Because of language barriers, mistakes or communication mishaps PSAPs have sometimes captured and dispatched wrong locations resulting in response delays. Thanks to the accuracy of AEL we can now identify the location better and we can design an automatic warning for the dispatcher, if the inquired location does not match with the AEL location (new additional technical system to reduce human errors).
- Future further development through automated integration in the CAD processes could systematically and dramatically reduce emergency response times by early "automated dispatch" in the direction of the pinpointed location: Nearly all emergency service vehicles (also first responders with handheld radios) are nowadays permanently tracked via AVL or other systems. By embedding the AEL location into the CAD System it is theoretically possible to direct/dispatch emergency service resources to the location/in the direction of the emergency location just seconds after the receivement of the AEL dataset. In the process steps of an emergency response (from the beginning of the emergency call to resource arrival on location) this could systematically reduce the overall duration (depending on circumstances about around 2-3 minutes on average at "routine location cases", more on incidents with "problematic" locations). Since none of the other process steps can likely be improved in the next years (already using top notch CAD system,

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up to date alerting technology, fast cars, powerful lights and sirens,…) such an improvement would be relevant.

A lot of work and potential for additional new ideas lays ahead.

Besides all the great results of this new location technique it should be noted, that also Network Based Location gathering technology should still be improved (regulation, PSAP access, speed, accuracy, …) and will also stay a relevant technique since emergency PSAPs sometimes need to locate people who did not call an emergency number directly (for example suicide threatening person messaged the threat to a friend, and now the PSAP needs to locate the suicidal person and not the reporting friend…).

AML Wish list:
The most important wish / need would be that other handset firmware / operating systems deliver the same / similar position datasets (besides Google/Android) when an emergency call is started.

Additional wishes:

- Standardisation on many levels might help to further improve reliability and accuracy:
  - Handset Manufacturer: all handsets should be required to be "AML fit"
  - MNO: dataset transmission "free of charge", prioritization of AML location transmissions
  - Nation: integration of AML requirements into national telecommunication law
  - EU: roaming specification for AML, requirements for handset manufacturers and MNOs to only use AML fit handsets, …
- repeated AEL location transmits: for situations with "mobile emergencies" (on a train, vessel or other moving incident locations) – after the first transmission – new dataset transmission every 60 seconds (for example as long as the call is active)

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4 References

1. Contract No 440/PP/GRO/PPA/15/8308
   Deliverable D4.1-D4.2 Tests specification
   Date: 28 July 2016

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5 Document Control

5.1 Document Owner

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5.2 Document Approvers

Only those named individuals below have authority to approve this document, and thereafter approve any changes to the document.

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Christof Chwojka	NNÖ CEO	chwojka@144.at

5.3 Change Control

Issue	Date	Author	Change
V1	**06/12/16**	**Kerschbaumer**	**-**
V2	**07/12/16**	**Kerschbaumer**	corrections
V3	**10/01/16**	**Kerschbaumer**	Additions: Implementation experience, latest statistics, Conclusions
V4	**01/02/17**	**Kerschbaumer**	Addendums & Corrections after EC Review
V5	**27/02/17**	**Kerschbaumer**	Addendums & Corrections after EC Review meeting in Brussels

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