3rd NG112 Emergency Services Plugtest; Sophia Antipolis, FR; 28 January - 1 February 2019

Keywords
Testing, Interoperability, NG112

ETSI

650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - NAF 742 C
Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° 7803/88

Contents

Intellectual Property Rights

IPRs essential or potentially essential to the present document may have been declared to ETSI. The information pertaining to these essential IPRs, if any, is publicly available for **ETSI members and non-members**, and can be found in ETSI SR 000 314: *"Intellectual Property Rights (IPRs); Essential, or potentially Essential, IPRs notified to ETSI in respect of ETSI standards"*, which is available from the ETSI Secretariat. Latest updates are available on the ETSI Web server (http://ipr.etsi.org).

Pursuant to the ETSI IPR Policy, no investigation, including IPR searches, has been carried out by ETSI. No guarantee can be given as to the existence of other IPRs not referenced in ETSI SR 000 314 (or the updates on the ETSI Web server) which are, or may be, or may become, essential to the present document.

1 Executive Summary

ETSI, in partnership with EENA (the European Emergency Number Association), has organized the third Next Generation (NG112) Emergency Communications Plugtests™ event. This event was hosted by ETSI, from 28 January to 1 February 2019 in Sophia Antipolis, France.

The aim of the event was to trial independently and jointly all components of the 112 communication chain based on Next Generation networks. Different topics were addressed, including Location Based Emergency Call Routing, Policy Based Emergency Call Routing, and Next Generation Media Types.

12 organizations from around the world, including Asia, Europe, and North America, had the opportunity to connect their equipment to the test infrastructure and validate the interoperability and conformity of their market solutions using different scenarios and test cases on-site from the ETSI headquarters in Sophia-Antipolis, France, as well as from their own labs. Remote-only testing sessions involving a US-based organization were carried out.

The scope of the event included content-rich emergency calling, such as video calling and TOTAL conversation. Participants put their products to the test, gaining valuable insights from experiencing a variety of scenarios. Tested technologies included Advanced Mobile Location (AML).

The event was used to validate the standard ‘Core elements for network independent access to emergency services, ETSI TS 103 479’. This standard will be published in June 2019. Additionally, in this third edition, conformance tests were performed and will provide a basis for future certifications.

The event also proved out the PEMEA (Pan-European Mobile Emergency Application) architecture framework, ETSI TS 103 478, basic core and advanced services. This standard was published in March of 2018. The results of the PEMEA tests show that all of the core services, including security across all nodes, were interoperable across all vendors. In addition to this, advanced video calling services using WebRTC had successful interoperable tests between three of the vendors.

The results of the tests show that the NG112 technology is mature and that a large number of vendors provide the various elements of the NG112 equipment chain and that those elements interoperate with each other. Thus providing a large choice of innovative products to build next generation emergency communication solutions. With the upcoming publication of ETSI TS 103 479 and its accompanying standards, the conditions for procurement and deployment are reached.

2 References

The following base specifications were validated in the Plugtest.

[i.1] Emergency Communications (EMTEL); Core elements for network independent access to emergency services, ETSI TS 103 479; to be published in June 2019

[i.2] Emergency Communications (EMTEL); Advanced Mobile Location for Emergency Calls, ETSI TS 103 625; to be published in June 2019

[i.3] Emergency Communications (EMTEL); Total Conversation Access to Emergency Services, ETSI TS 101 470, June 2012.
http://www.etsi.org/deliver/etsi_ts/101400_101499/101470/01.01.01_60/ts_101470v010101p.pdf

[i.4] Emergency Communications (EMTEL); Total Conversation for Emergency Communications, Implementation Guidelines, ETSI TR 103 201, March 2016.
http://www.etsi.org/deliver/etsi_tr/103200_103299/103201/01.01.01_60/tr_103201v010101p.pdf

[i.5] Emergency Communications (EMTEL); PEMEA architecture and functional entities, ETSI TS 103 478, March 2018
https://www.etsi.org/deliver/etsi_ts/103400_103499/103478/01.01.01_60/ts_103478v010101p.pdf

[i.6] 3GPP. TS 22.173: IP Multimedia Core Network Subsystem (IMS) Multimedia Telephony Service and Supplementary Services; Stage 1, Version 9.4.0, December 2009.

[i.7] 3GPP. TS 23.167: IP Multimedia Subsystem (IMS) Emergency Sessions, Version 9.3.0, December 2009.

[i.8] 3GPP. TS 24.229: IP Multimedia Call Control Protocol Based on Session Initiation Protocol (SIP) and Session Description Protocol (SDP), Stage 3, Release 11, Version 11.4.0, June 2012

[i.9] Emergency Communications (EMTEL); Conformance test specifications for NG112, ETSI TS 103 659; to be published in March 2019

[i.10] Emergency Communications (EMTEL); Interoperability testing of core elements for network independent access to emergency services, ETSI TS 103 480; to be published in March 2019

[i.11] PEMEA Interoperability Test Descriptions
https://portal.etsi.org/Portals/0/TBpages/CTI/Docs/NG112_Plugtest_PEMEA_TestPlan_v1.0.pdf

[i.12] Summary of all test resources at https://forge.etsi.org/gitlab/emergency-communications/NG112

3 Abbreviations

AML	Advanced Mobile Location
BCF	Border Control Function
ECRF	Emegency Call Routing Function
ESRP	Emergency Service Routing Proxy
GW	Gateway
HELD	HTTP-Enabled Location Delivery
IUT	Implementation Under Test
LIS	Location Information Server
LoST	A Location-to-Service Translation Protocol
MIME	Multipurpose Internet Mail Extensions
MNO	Mobile Network Operator
PEMEA	Pan-European Mobile Emergency Application (framework)
PSAP	Public Safety Answering Point
RFC	Request for comments
SDP	Session Description Language
SIP	Session Initiation Protocol
SIP UA	Session Initiation Protocol User Agent
Tel	Telephone
TS	Technical Specifications
URI	Uniform Resource Identifier
URN	Uniform Resource Name
WebRTC	Web Real-Time Communication

4 Participants

The vendors which executed tests during the Plugtest are listed in the table below.

Table 1: List of vendors

Vendors
Beta 80
Deveryware
Frequentis
GridGears
Huawei
Intersys
Omnitor
Oracle
RapidSOS
Smart 112
Unify
University of Ljubljana

5 Scope of the event

5.1 Objectives

The main objectives of this event were to:

- validate the interoperability of different solutions on the market on end to end emergency services communications utilizing NG112 core services and PEMEA service entities
- provide an opportunity for developers from different companies to get together to test their implementations and ensure interoperability between products
- to evaluate the level of conformance of several implementations to interface specifications (RFCs, TS, …)

5.2 Description

In this event three groups of tests considering different scenarios and test cases (examples: location based call routing, accessibility, different types of originating networks) were performed:

- NG112 core service conformance and interoperability tests
- PEMEA architecture
- PEMEA / NG112 interworking functions

5.3 NG112 Conformance Tests

5.3.1 General

Conformance tests for the LIS, ECRF, PSAP and ESRP NG112 elements were performed. Test components were deployed for the first time and will be available in the future for organisations willing to use them. This will foster standard-compliant solutions and hence help to increase the interoperability.

5.3.2 Location Information Service

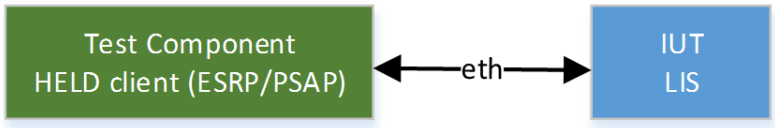
Location is fundamental to the operation of the emergency services, and the generic functional entity that provides location is a Location Information Server (LIS). The following table lists scenarios considered for conformance testing.

Table 2: Scope of LIS tests

Location Information Service (LIS)

Basic (B)

1. HELD: Geolocation by Value
   a. Location found POINT
   b. Location found CIRCLE
   c. Location not found
2. HELD: Geolocation by Reference
   a. Location reference
   b. Location derefenced
3. HELD: Civic by Value
   a. Location found
4. HELD: exact locationType
   a. Location type found
   b. Location type not found
5. HELD: unknown device



5.3.3 Emergency Call Routing Function

The functional element responsible for providing routing information to the various querying entities is the Emergency Call Routing Function (ECRF). The following table lists scenarios considered for conformance testing.

Table 3: Scope of ECRF tests

Emergency Call Routing Function (ECRF)

Basic (B)

1. FindService request geodetic-2d and one matching service boundary
   => findServiceResponse
   a. Request with Point in boundary
   b. Request with Circle in boundary
   c. Request with Circle intersecting boundary
2. FindService request geodetic-2d and multiple matching service boundaries
   => findServiceResponse
   a. Request with Point
      => return both services
   b. Request with Circle
      => return services with greatest overlap
3. FindService request with serviceBoundary attribute by value
4. FindService request resulting in errors response
   a. notFound
   b. serviceNotImplemented
   c. locationProfileUnrecognized
5. FindService with multiple matching service types
   => return correct service type only
6. ListServices
7. ListServicesByLocation

5.3.4 Public Safety Answering Point

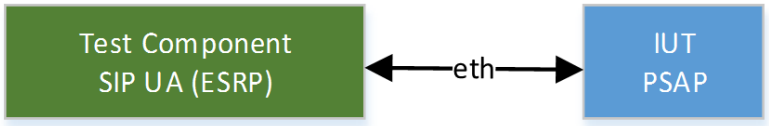
The PSAP deploys the SIP call interface including the multimedia capability, and the non-human-initiated call (emergency event) capability. The following table lists scenarios considered for conformance testing.

Table 4: Scope of PSAP tests

Public Safety Answering Point (PSAP)

Basic (B)

1. Incoming INVITE without service urn
2. Incoming INVITE with service urn
3. Incoming BYE
4. Incoming OPTIONS
5. Incoming MESSAGE
6. Media support
    a. audio
        i. mu-law
        ii. a-law
7. Multipart MIME support
   - SDP and location
8. Transports:
    a. TCP
    b. UDP



5.3.5 Emergency Service Routing Proxy

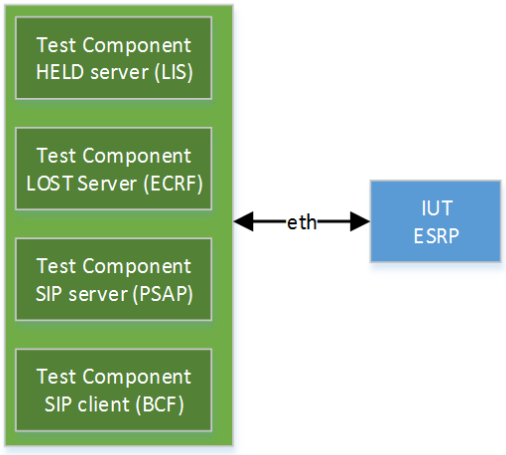
The Emergency Service Routing Proxy (ESRP) is the base routing function for emergency calls. It shares interfaces with a LIS, ECRF, PSAP and BCF. The following table lists scenarios considered for conformance testing.

Table 5: Scope of ESRP tests

Emergency Service Routing Proxy (ESRP)

Basic (B)

1. Incoming call with Location by value (multipart MIME: SDP and location)
   => Query ECRF for next hop
   => forward call to next hop (TCP)
    a. Upstream leg: UDP
    b. Upstream leg: TCP
2. Incoming call without Incident-ID and Call-ID
   => add INFO headers
3. Incoming call with Location by reference
   => Query LIS for location
   => Query ECRF for next hop
   => forward call to next hop
4. Incoming call without location
   => Query LIS for location
   => Query ECRF for next hop
   => forward call to next hop
5. Incoming call, no target reachable
   => respond BUSY
6. Handling OPTIONS requests
7. Incoming Message with Location by value
   => Query ECRF for next hop
   => forward call to next hop (TCP)



5.4 NG112 Interoperability Tests

5.4.1 General

As in the previous editions of the NG112 Communications Plugtest event, the NG112 components and their interfaces, as shown in Figure 1, of different vendors were tested working together. Scenarios and vendors combinations were planned and tests were executed.

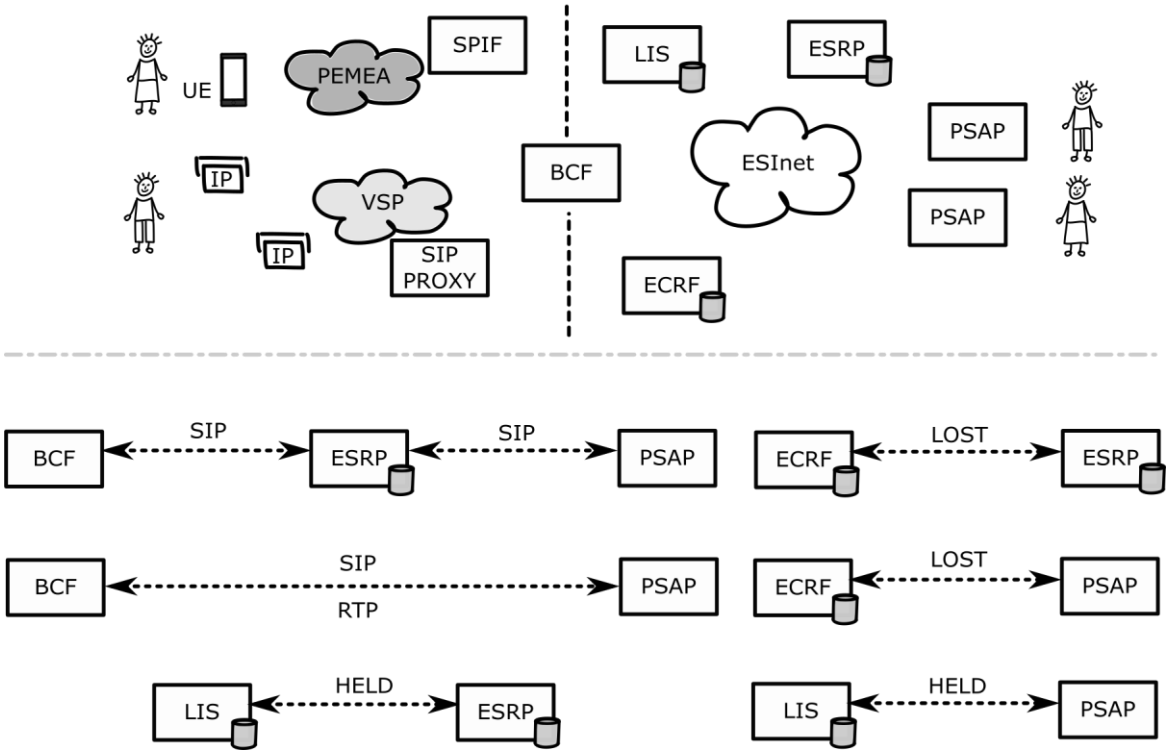


Figure 1: Functional elements and interfaces

The objectives of the tests were:

- **Connectivity**: Tests covered basic connectivity between functional elements at both, network and application layer
- **Routing**: Tests covered variants of location based emergency call routing. These included different methods how user location is assessed and how this information is delivered
- **Media**: Tests covered different media types in order to contact emergency services
- **Location**: Tests covered variants of location configuration and conveyance methods such as advanced mobile location (AML)

5.4.2 Test Data

Testing several scenarios required to define simple polygons that describe PSAP areas (or service boundaries) surrounding the ETSI building. Figure 2 shows nine polygons (rectangles) and predefined locations, three per each PSAP service boundary (2x point, 1x circle). ECRFs were configured with PSAP areas and SIP URIs that represent a PSAP vendor's call processing equipment. LISs were preconfigured with locations (pin icons in Figure 2), for instance, sip:alice-01@plugtets.net resolves to a location within the top-left PSAP area shown in Figure 2, and, therefore, calls originated by alice-01 shall be routed to the PSAP configured for that region.

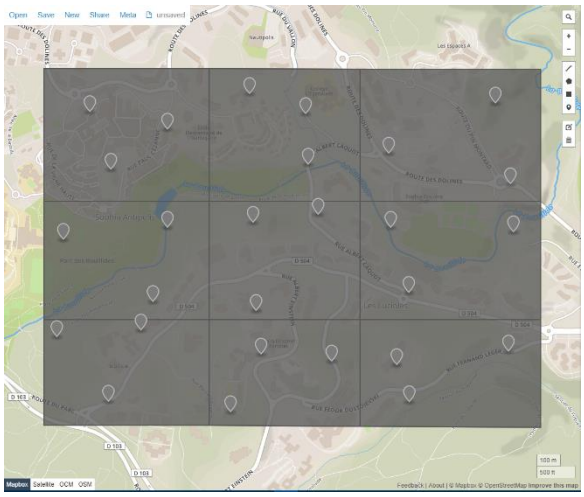


Figure 2: PSAP regions and manually configured locations (source: geojson.io)

5.4.3 Configuration

Different test configurations were used to test interoperability among different service instances from different vendors. The basic configuration, as schematically shown in Figure 3 below, supports Next Generation Core Service (NGCS) testing scenarios, including scenarios with different service urns (URN), multimedia communication (audio, video and text) and location delivery using identities (sip and tel URIs). Most test calls were placed from local user equipment (UE) configured to register one of the predefined identities with a SIP proxy. Depending on the emergency numbers dialled, the SIP proxy forwarded calls to the border control function (BCF) inserting corresponding service urns, listed as follows:

- 112 (urn:service:sos), or 911 (urn:service:sos)
- 15 (urn:service:sos.ambulance)
- 17 (urn:service:sos.police)
- 18 (urn:service:sos.fire)

BCFs used static routing to forward calls to the ESRP used in specific scenarios or combinations. To route to the correct PSAP based on the location received or requested at the LIS via HELD, the ESRP was requesting routing information at the configured ECRF, and finally forwarding the emergency call to the PSAP serving the location at which the caller is located.

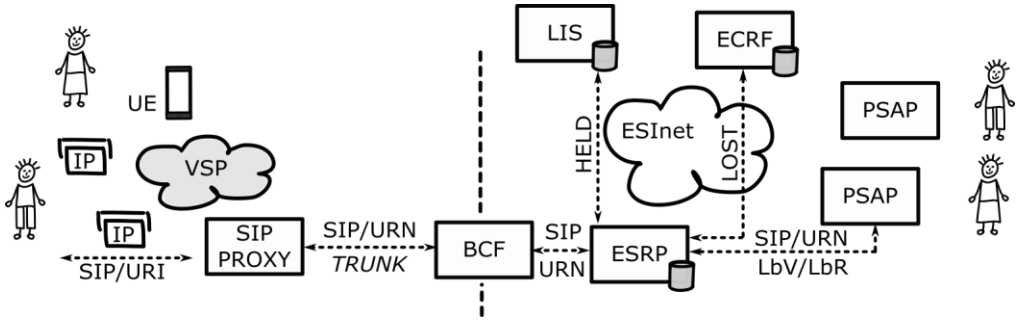


Figure 3: General NGCS Configuration

Testing AML required to interface with a local mobile network operator (4G) using a location independent phone number, VoIP gateway (GW) services of a public VoIP service provider and a termination point within the lab, refer to Figure 4 below.

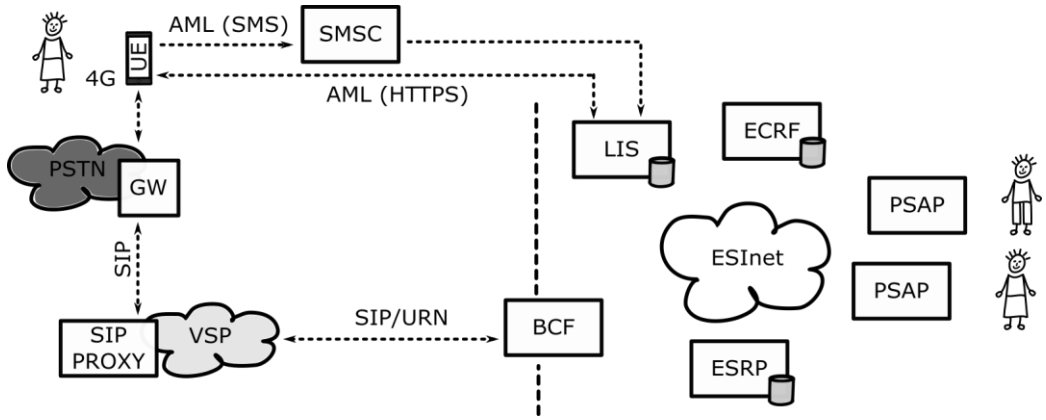


Figure 4: AML Test Configuration

Minor changes to the basic configuration were needed to support location by reference (LbR) testing. In that scenario, the *public* SIP proxy requested location information at the LIS using the identity (tel or sip uri) received with the emergency call as depicted in Figure 5. The response in a LbR scenario is an URL to be inserted in the SIP request as Geolocation header value. The next downstream element that requires location information uses the URL to dereference location information via HTTP(S).

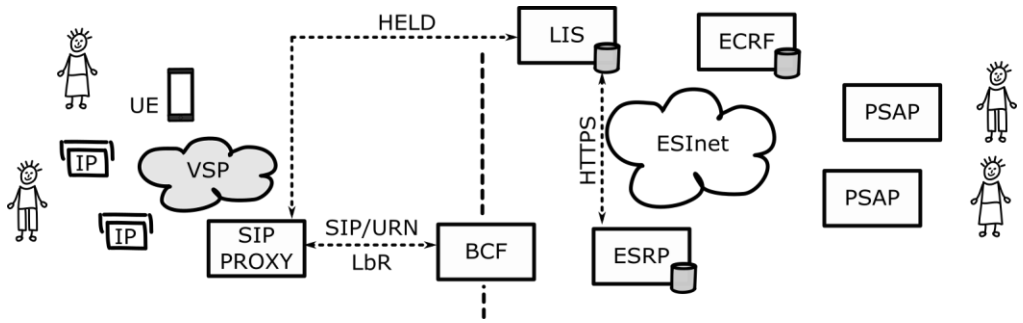


Figure 5: Location by Reference (LbR) Test Configuration

To test location by value, the *public* SIP proxy only forwarded calls by inserting a service urn, and the ESRP requested location information at the LIS using the identity (tel or sip uri) received with the emergency call as depicted in Figure 6. In addition, the ESRP inserted location information as value (PIDF-LO) into the SIP message as part of a multipart MIME body. The next downstream element that requires location information (e.g. PSAP) uses the location received in the message.

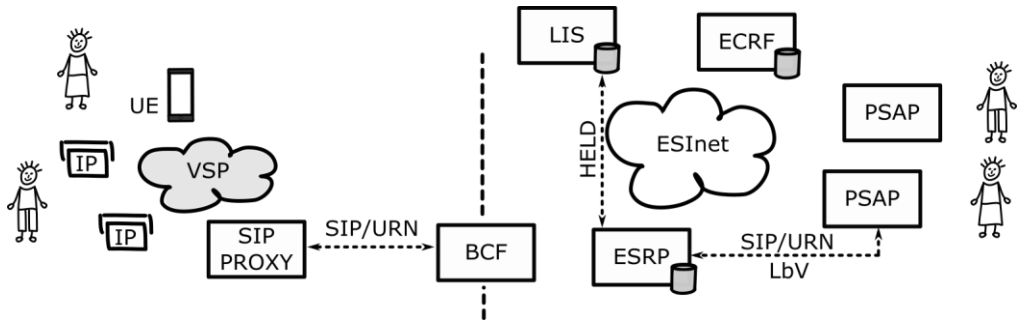


Figure 6: Location by Value (LbV) Test Configuration

Basic steps to test calls were: registering an UE using a specific identity (to get a location), dialling an emergency number, and setting up audio, or multimedia calls.

5.5 PEMEA Interoperability Tests

Interoperability testing for the PEMEA entities was covered in a comprehensive test plan that provided detailed tests for each of the major core services in PEMEA:

- Security and connectivity
- Routing and errors
- Termination and capability exchange
- Capability invocation

The test plan details the configurations required to test each of the test cases, the pre-conditions, steps, and expected outcomes. While no tests were automated at the event, the test cases provide enough content to ensure conformance and compatibility between various PEMEA nodes if executed correctly.

5.6 NG112 and PEMEA Interoperability Tests

TS 103 478 defines a means to provide interoperability between PEMEA and NG112, where the address of the gateway into the local ESInet can be determined. This solution uses a SIP-PEMEA Interworking Function (SPIF) to provide a gateway between the SIP-network and the PEMEA-network so that data provided by and application to the PEMEA network can be used by the PSAP and other nodes inside the ESInet.

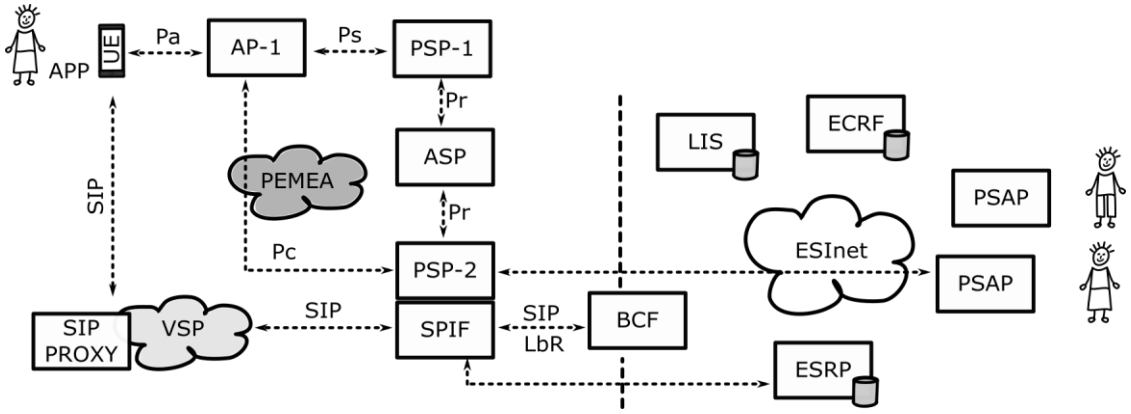


Figure 7: PEMEA Interoperability Testing

6 Achieved Results

6.1 NG112 Conformance Testing Results

6.1.1 General Observations

- Conformance test successfully used
- LIS and ECRF conformance tests validated against multiple vendor implementations
- Issues identified of vendor implementations
- Quick verification of vendor fixes
- Cloud based conformance test solution used
- Conformance tests to be released for 24/7 self service
- Conformance tests are a good tool to qualify for future interoperability testing

6.2 NG112 Interoperability Testing Results

6.2.1 General Observations

- PSAPs and ESRPs handled well Location by reference and by value including audio, video calls
- BCFs performed successful interoperability with all originating and terminating networks, including audio, video calls
- All location boundaries were respected by the ECRFs and routed correctly by the ESRPs to the appropriate PSAPs
- Location provided by the LIS or by the end devices via AML was used successfully
    - Calls via a public operator using AML were successful (SMS)
- Emergency calls were successfully originated from Public VoIP network.
- Signalling and media interoperability with ESInet functional elements achieved
- Service urns sos, sos.fire, sos.ambulance, sos.police successfully tested
    - Routing to different PSAP areas and agencies according to the service urns
- Successful NG112 emergency calls with an emergency app was placed
    - SIP-based video and audio calls connected with all PSAPs
- Still lack of vendor support of TOTAL conversation (RTT)

6.2.2 Statistics

Overall results considering scenarios as introduced in 5.4.2

Table 6: Overall Results

Interoperability		Not Executed		Totals	
OK	NO	NA	OT	Run	Results
61 (81.3%)	14 (18.7%)	10 (11.8%)	(0.0%)	75 (88.2%)	85

Group results considering individual scenarios as introduced in 5.4.2, with NGCS representing emergency call routing based on location considering all core service interfaces (BCF, LIS, ECRF, ESRP and PSAP).

Table 7: Group Results

	Interoperability		Not Executed		Totals	
	OK	NO	NA	OT	Run	Results
NGCS	32 (76.2%)	10 (23.8%)	10 (19.2%)	0 (0.0%)	42 (80.8%)	52
Service_URN	18 (100.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	18 (100.0%)	18
Tel_URI	8 (66.7%)	4 (33.3%)	0 (0.0%)	0 (0.0%)	12 (100.0%)	12
AML	3 (100.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	3 (100.0%)	3

Test results considering individual scenarios as introduced in 5.4.2, with MM/VID representing audio and video emergency calls, MM/RTT representing audio, video and real-time text ermegency calls, and location by value (RT/LBV) as well as location by reference (RT/LBR) call routing.

Table 8: Test Results

	Interoperability		Not Executed		Totals	
	OK	NO	NA	OT	Run	Results
MM/VID/01	8 (61.5%)	5 (38.5%)	0 (0.0%)	0 (0.0%)	13 (100.0%)	13
MM/RTT/01	1 (33.3%)	2 (66.7%)	10 (76.9%)	0 (0.0%)	3 (23.1%)	13
RT/LBV/01	23 (82.1%)	5 (17.9%)	0 (0.0%)	0 (0.0%)	28 (100.0%)	28
RT/LBR/01	29 (93.5%)	2 (6.5%)	0 (0.0%)	0 (0.0%)	31 (100.0%)	31

6.3 PEMEA Interoperability Testing Results

6.3.1 General Observations

- Basic connectivity and security between three of the AP vendors and one of the PSP vendors was successful
- Basic connectivity, security and routing between the two ASP vendors was successful
- Circular routing and other routing error conditions were not tested between vendors
- Call termination, capability exchange and core function invocation with full security interoperability were successfully tested between onsite vendors (there were tunnelling issues with offsite vendors to one of the PSAP/PSP vendors).
- Advanced service invocation for the PEMEA Audio_Video capability using WebRTC between three of the App/AP vendors and one of the vendor PSP/PSAPs performed correctly with an audio-video session between the application and PSAP being established.
- The conformance tests performed where largely successful. Connectivity between offsite and some onsite vendors was an issue prohibiting some of the interoperability and connection tests. Further better data

preparation ahead of time would have led to some of the more complex routing and error scenarios being executed between ASP and PSP vendors.

6.4 PEMEA and NG112 Integration Testing Results

6.4.1 General Observations

- Interworking between PEMEA and ESInet according to ETSI TS 103 478 was tested. The emergency App was used to demonstrate the novel interworking
- AP and PSAP communication (location, subscriber's data, security)
- Emergency calls routed through BCF with location and user's URL rewritten by SPIF component, and delivered to ESRP
- Destination PSAP received subscriber's data URL
- SIP PEMEA Application successfully obtained SPIF address from the PEMEA network
- SIP INVITE successfully received by SPIF
- SPIF successfully identified calling entity and provided:
    - Location URI (Geolocation header field)
    - SubscriberInfo URI (Call-info header field)
    - BCF address (Route header field)
- Issues with ECRP dereferencing location URI, resolutions are ongoing. A content negotiation issue between the ESRP and the SPIF is suspected.
- Destination PSAP did receive SubscriberInfo URI in INVITE, but location URI appeared to be missing. Testing with the SPIF into the ESInet components is ongoing.

History

Document history		
V0.1	05.02.2019	First draft
V0.2	07.02.2019	Second draft
V0.3	14.02.2019	Third draft
V1.0	25.02.2019	Final draft