Moving towards Next Generation Emergency Services

Architectures for Next Generation Emergency Services (NG112 and NG911) suitable to support Digital Transformation in Public Safety

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Strategic approach and architectural outlines

This document has been created specifically to reflect the current state and the future vision for 112 and 911 emergency services. The content has been created in cooperation between Avaya and Avaya's Technology Partner

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1 Introduction and Strategic Approach

When it comes to **emergency situations**, citizens have been used over the past decades to dial the emergency number from their phone, getting connected to a call taker to make sense of the situation, and if necessary to dispatch emergency response personal to resolve it. Whilst in principle this approach is still valid and very effective, communication habits have been changing widely over the past decades. Starting with the introduction of widely available GSM mobile phone services to the public in the 1990s, mobility of the caller has become the biggest change in how phone services have been used.

Beyond that, 3G mobile internet services have been introduced in the early 2000s, but only after the advent of the smartphone as a mass device in 2007 we were able to recognize an ever-growing adoption of text-based communication and a decline of voice calls, especially visible with citizens belonging to the group of "digital natives".

These two major paradigm shifts and their mass adoption amongst citizens led to a changing landscape of requirements for emergency communications, and some major challenges became visible and have to be solved:

1. Multi-Channel citizen access to emergency services
2. Precise information on caller and incident location
3. Interworking of Public Safety Answering Points (PSAP)
4. Multi-agency and cross-border response

In parallel, the conversation of "Digital Transformation" and "Industry 4.0", mainly discussing automation of processes through all areas inside an organization as well as transactions and interactions between organisations became very active, fully building on the ubiquity of the internet and network services.

Many emergency services globally, have operated under the assumption of a telephone-only access for citizens in the past. Considering the changes in communication habits, citizen's expectations as well as the technological development towards location-based services, a future strategy shall established in order to be able to cope with current limitations, as well as being open and flexible to keep track with upcoming progress and changes from all angles, legislation, technology, behaviours and expectations.

1.1 Multi-Channel citizen access to emergency services

The phone combined with a voice communication service being the single way of gaining access to emergency services probably isn't the best suited way for citizen communication, considering a massive shift in preference towards **text based** and **video-enabled** communication has happened already especially amongst the generation of "Digital Natives". Also, voice only is bearing its limitations in a multi-cultural society, where not every citizen has the same level of understanding a language to clearly describe the emergency situation, or to understand the ask from the call takers in order to support the situation in the best possible way. This also applies to the community of persons who are deaf, deaf-blind, and hard of hearing as well as individuals with speech disabilities, where in many cases their workaround for gaining access to emergency services is by sending faxes, another technology of the 1970 that could be questioned to be appropriate for 2017 and beyond.

Opening the communication to **visual-oriented channels**, including **text** and **video**, allows for far better communication and also adding a much faster access to situational context or delivering evidence, so call takers are like to make better and faster decision on how to respond to the situation.

Also, **video communication** can be a true enabler in for digital transformation when established between the ambulance car and the hospital, to support challenging situations for the ambulance crews by giving access to medical experts over video.

And last but not least, video as an element of telemedicine between the caller and the call taker can help to prevent sending an ambulance to an incident when it's not really needed but would have been sent because of the unclear situation.

1.2 Precise information on caller and incident location

To be able to send responders to solve a situation, the information of the location where to send help needs to be as precise as possible. With the ever-growing amount of mobility in all kinds of communication and probably 70%

or more of all emergency calls being originated by mobile phones today, determining the “dispatchable address” can be time consuming. Especially considering the degree of confusion and anxiety on the callers’ side this task can take several minutes before progressing to the next step in the process.

Whilst the introduction of **Advanced Mobile Location (AML)** as feature available on mobile phones with Google Android first, followed by Apple iOS in spring 2018, as well as its adoption as a standard published by ETSI is already a big step forward, the overall approach to mobile phone-supported transmission of location data with satellite precision should be based on multiple methods available (e. g. **HTML5** internet connection through a web browser, usage of location services from **smartphone apps**) in order to provide the largest possible coverage for as many mobile phone types as possible.

1.3 Interworking of Public Safety Answering Points (PSAP)

Many existing Emergency Response Organisations with their respective PSAPs have grown historically, resulting in a constellation of multiple small locations with a few call takers (typically 2-6). In former times with lower call volumes this was appropriate, but nowadays most individuals carry a mobile phone, the amount of emergency calls per incident has been significantly raised. Up to the early 1990s people witnessing a traffic accident had to ring on someone’s door and ask for calling the emergency number.

Many countries follow a 2-stage approach for emergency response: 1st level PSAPs to answer the emergency call, qualifying and categorizing it, and then handing over to 2nd level PSAPs or dispatching centres to take care of the incident response.

In some countries 112/911 centres as 1st level PSAPs have already been enabled to manage high call volumes by establishing overflow mechanisms in the past and sharing information as well. Beyond this, handing over the case from the 1st level organization to the 2nd level dispatching centres needs to be optimized in terms of **collaboration capabilities** as well as **data and information sharing**.

1.4 Multi-agency and cross-border response

Effective collaboration between different emergency response organisations becomes even more challenging if they belong to different agencies and/or cross-border response is required. In that case, the daily practice is to exchange information by phone calls, faxes, and manual re-typing of incident data into independent case management and CAD systems. Not only that this way of working is time consuming, it also is very error prone due to the human factor acting under stress.

People that do work as responders in one of the agencies and that have been involved in cases with multi-agency will agree that not having the same information when on scene can be very challenging for a coordinated joint response.

To add onto that, **cross-border response** obviously happens at national borders between countries, but even more often **at the border of smaller areas of responsibility**, regional or even municipal borders. This is where collaboration becomes limited to phone calls, written notes and faxes, rather than structured exchange of data enhanced by appropriate means of modern real time communication.

1.5 Conclusion defining future strategies

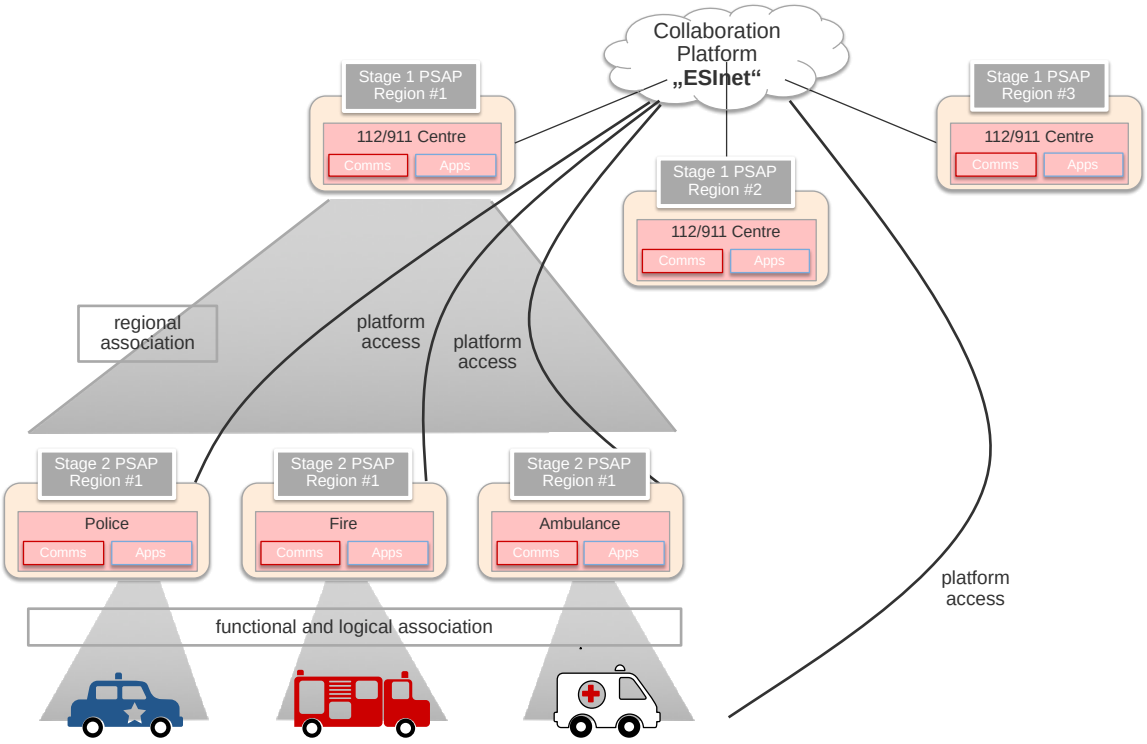
Understanding these areas of challenge, the principles of **digital transformation** with a focus on **processes inside and between organisations** have a strong potential of leading to resolving many of the current limitations in 112/911 emergency services and their associated response organisations.

Processes and procedures driven by events, enhanced with the capabilities of fast and structured exchange of context and situational data, as well as enriched by real time communication through all available channels, audio, visual and text-oriented, become an integral part of next generation emergency communication. This is going to help organisations collaborating in emergency response and healthcare. Beyond that, citizens are going to see that a **more intensified engagement** whilst in an emergency situation is going to **deliver response faster** and of **higher quality** compared to the limitations of current phone-based emergency calling.

2 The Journey Next Generation Emergency Services – Project Phases

A potential future platform for 112/911 emergency services on a national or regional level (depending on size and population of a country) can be built on a single platform, integrating all required functions for communication as well as application and information services.

Best practices go towards centralized platforms at a national level, ready to serve and to be distributed across the different regions, providing Public Safety Answering Points (PSAP) as a stage 1 function.



According to the administrative and organizational setup in the specific country or region, the future platform could

- connect the regional 112/911 centres acting as PSAPs at stage 1 to each other
- connect the regional 112/911 centres to the dispatch centres acting as PSAP at stage 2 at district and regional level
- connect the mobile response units to the 112/911 and dispatch centres

In a future environment building on the principles of NG112/NG911, including aspects of the “Emergency Services IP Network” **ESInet**, there is room for a more centralized approach of emergency communication, overcoming regional borders and constraints, but without neglecting regional structures and organizations and their need to communicate according to those structures. Also, the **delocalization** of services allows a **consolidation process**, in other words this framework approach opens the door for having **less contact centres than before, saving money and resources**.

The move from current 112/911 deployments to a future Next Generation service can become a complex task, considering the multitude of aspects to be inspected. As every journey starts with a first step, this first step will have to consider the assurance of the service as it currently stands, and then leading into enhancing this service with innovation, as well as adding new services and also additional (external) partners to the future emergency services landscape. This is best possible to be achieved in splitting the overall journey into multiple stages, establishing a phased approach:

- Phase 1: Assuring current operations
- Phase 2: Adding new services to the core of 112/911 Emergency Services organisations
- Phase 3: Providing access to external non-emergency service organisations

Especially phase 2 and 3 may of course be overlapping and mixed, as services and service delivery are somewhat dependant from each other.

A national procurement concerning these aspects is to be **planned in a long term scenario**: 3-4 months for tender preparation; with the participation of several stakeholders, 2-3 months for assignment and other 1-2 months for a potential appeal. After this 6-9 months period of procurement assignment, the delivery phase will start. Considering a national unified multichannel communication platform and management software as the scope of the procurement, this might take 12-18 months to deliver (to be added on top of the procurement phase), depending on the complexity of the scenario, the amount of new technologies to be delivered and those who will be kept in use. A possible complete infrastructure might be **operational 18-30 months after the planning process has been started**.

2.1 Phase 1: Extension to added value services

If possible, the 112/911 agency should ask for a contract extension, to start delivering added value features that cover some of the most important issues currently discussed Europe-wide. Once again, this step does not require specifically a national tender unless national rules says otherwise. We are talking about improvements of the existing 112/911 system beyond its current features. These improvements may include:

- **Caller location techniques** that can be provided seamlessly in addition to existing call services without affecting their operation (AML, smartphone apps, HTML5-based services)
- **WebRTC-based added value services** (point-to-point video over the top of existing voice calls)
- **Social Media** networking first steps (creation of 112/911 social media profiles, creation and use of contents to be shared with the citizens)

2.2 Phase 2: Adding new services to the core of 112/911 Emergency Services organisations

We suggest that innovative services that currently are not standard in most countries (**Total Conversation** with Voice, Video and Text), as well as full use of Social Media in emergency communication should be introduced as additions in a new project phase of the new platform after the delivery and full implementation has been achieved in phase 1.

The rationale here is to allow all 112-associated organizations to learn, get trained and gain experience in effective operations.

Adding new services will have an influence on every role involved in emergency case management, therefore they should regain the same level of confidence in managing the procedures with the new platform before extending the scope of emergency services.

2.3 Phase 3: Providing access to external non-emergency service organisations

Currently the benefit of opening emergency communications and procedural workflows for third party non-emergency organisations like Traffic Management Agencies and Third Party eCall Providers are widely discussed because of the potential in moving into the area of Digital Transformation, helping to solves cases faster by collecting all information available and automating workflows and procedures.

Also, Machine-to-Machine communication, embracing the world of the Internet of Things comes with a lot of promises and interesting use cases.

Recent European projects demonstrated how the interaction between Emergency Services and other entities increase the level of service provided: associations helping Children with case history of critical situations, Private insurance companies providing TPS eCalls, Transport/logistic companies sharing their cargo data. All these many other cases were addressed as example of interoperability and synergic cooperation.

Beta 80 and Avaya experimented successful interoperability and data sharing with open-source protocols, widely used in the emergency environment, such as CAP: the protocol is adaptable and follows a standard given by a community of experts, that can be joined by every Emergency Management force or agent. CAP has been used also for M2M communications, becoming a well-rounded element for implementation (e.g. Firefighter sirens can be alerted through CAP protocol for a given type of alarm created by a 112 PSAP).

Both, the addition of Thirds Parties as well as embracing the Internet of Things should follow a well conducted approach and flow with some high-level points such as:

- Discovery of relevant new use cases
- Definition of workflows and procedures associated with the new use cases
- Definition of data structures, interfaces and integrations required to support new use cases
- Definition of certification criteria for external services to pass with a certification authority
- Pilot projects involving key stakeholders from all organisations involved in emergency services and selected external organisations

3 Next Generation Emergency Services Solution Approach

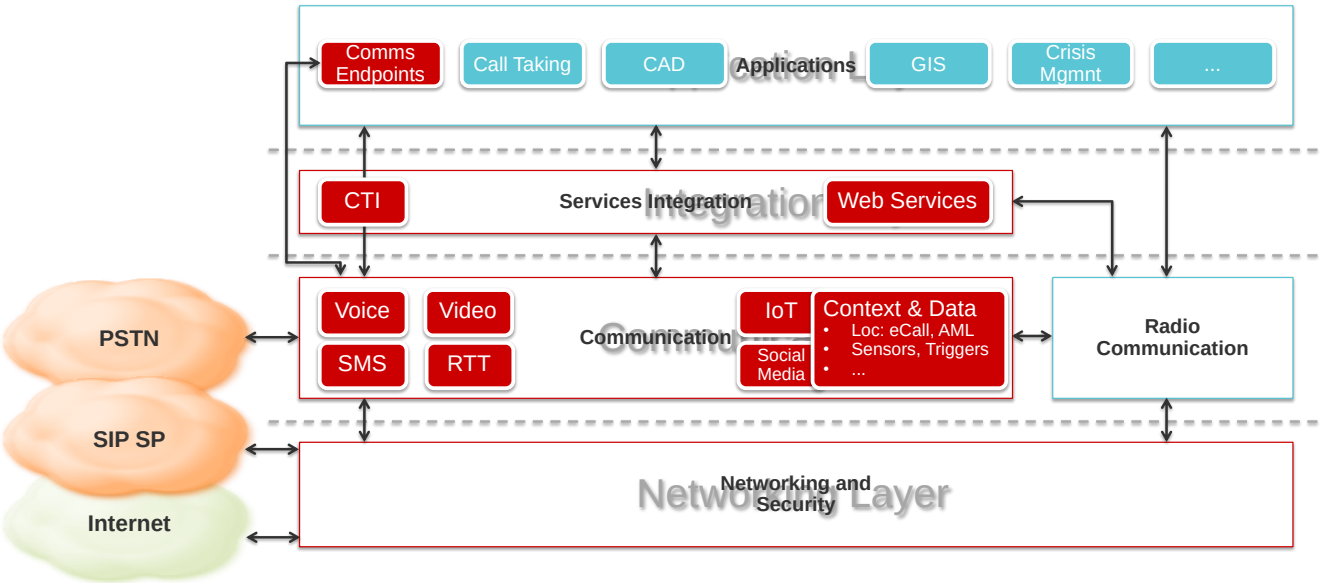
3.1 Centralized Architecture Characteristics

A centralized architecture serving organizations on national and regional levels, as well as connecting organizations with different operational focus (call taking, dispatching, external support organizations), has to follow a few general, but yet key criteria in order to assure future extensibility:

- Highest level of availability: 99,999% or higher
- High scalability with centralized platform management:
  - 1.000 locations or more
  - 1.000 concurrent active call takers or more, configured in a contact center environment
  - 100.000 concurrent users (communication endpoints) or more
  - 200.000 Busy Hour Call Completions (BHCC) or more
- Relying on IP-based communication services for voice, video and data communication, with SIP as the main protocol for real time services like voice and video
- Standards-based and open: access to a wide range of functions through well documented Application Programming Interfaces (APIs)

The platform is organized in well-defined layers in order to support extensibility, continuous development and evolution to keep track with future developments:

- **Application Layer**: providing all functions for case and process management (Computer Aided Dispatching CAD, Geographic Information Systems GIS, Crisis Management)
- **Communication Layer**: providing access to all real time and near-real time communication services (voice, video, text, sensors)
- **Services Integration Layer**: providing open interfaces, preferably web services, allowing access to the APIs associated with the application layer and the communication layer. A workflow engine, Software Development Kits (SDK) and APIs shall ensure a high level of customization especially in terms of user frontends and newly developed features and functions.



The platform's core functions are available as software only to benefit from future developments, rather than being hardware-centric and less agile. Special hardware may be acceptable to provide functions or interfaces not available in software (e.g. access to specific communication interfaces like ISDN or analog ports, special communication endpoints like wearables/body worn devices).

3.2 Application Layer

The application layer is expected to be a universal layer for collecting all possible information and coordinating procedures in the most effective way to allow efficient and high quality response to incidents. However, as a single source of information, it has to be able to support multiple tenants from all agencies involved, Police, Fire Brigades and Medical Emergency Services, fully reflecting their individual needs to access specific information according to their roles and tasks, which on the other hand must be restricted for use from the other agencies.

Also, in terms of case and incident management, all of the involved agencies will have the same goal to solve an incident in the best possible way, but on the other hand will need to follow different procedures and workflows that have to be reflected in the layout of screens as well as the procedural flows.

3.2.1 Computer Aided Dispatching

Computer Aided Dispatching (CAD) has to be the core of public safety solution suite, which besides CAD also includes Mapping, Mobile Collaborative Tools and Emergency App. Any information generated or managed in one application seamlessly has to flow through the entire suite of applications through a single information platform, leading to improved real-time information access across all PSAP operations. The platform is designed to simplify complex operations, increase operational efficiency and improve unit arrival time on scene.

The call handling process is managed through a Call Taking Module, which already supports Next Generation architectures and automatically includes all versions of Automatic Line Identification (ALI) call information from all known sources, through a direct integration. It always collects Automatic Number Identification (ANI) information (i.e. the Calling Line Identification) from the PBX via its CTI integration, allowing Call Takers to pick up calls directly from the CAD. This module also supports to geographically pinpoint the caller position and to create a new incident. The Call Processing software stores ANI/ALI data for integration with the CAD event and incident comments or separate fields within event or incident records. It supports new ways of conveying distress calls, such as automatic vehicle collision systems (Pan-European eCall or private Third Party eCall services), SMS, AML (Automatic Mobile Location for Android and Apple phones), Emergency Apps for the citizens, as well as data retrieval from other localization services (e.g. HTML5).

The CAD's dispatch algorithms are customizable by the agency following the responses that reflect the department's procedures and operations. In doing so, the CAD shall automatically recommend Fire/EMS and Law Enforcement units based on pre-planned run cards or post assignments. It supports the agency in reducing response time by dispatching the closest available resources with the right equipment. Unit recommendations shall be based on customizable criteria, such as: personnel and unit capabilities, split vehicle attendance, routing-based recommendations, alarm level, response plans based on time of day or day of week, and many other criteria.

Beta 80 integrates the most sophisticated tools for triaging a citizen in need, such as the platform provided by Priority Dispatch - ProQA Paramount.

The most important advantage is the platform openness to import and use a PSAP's own triage procedure: thanks to the configurability of the CAD, every PSAP can import a triage procedure created by their own experts, to define results, protocols and decisions to be taken as a result of an emergency call.

The CAD application is fully and tightly integrated with the Mapping application, providing PSAPs with a variety of static and dynamic real time map layers, localization services and rich data from innovative sources. The dispatcher can move on the map, perform zoom operations, measurements, etc. with a simple click of the mouse. It automatically imports entities and objects created within the CAD system (i.e. incidents, emergency vehicles, substations, factories/plants, etc.). The Mapping application allows the import of a specific point's coordinates into the CAD, which is particularly helpful whenever the caller cannot tell where they are and can only describe what they are seeing around them (i.e. businesses, parks, landmarks).

3.2.2 Caller Location Identification

Besides eCall which is already introduced to the European market, a couple of other caller device-based technologies to support resolving the precise location of the emergency caller or the incident are already technologically available. As currently no single technology can solve the location determination on its own, it is highly recommended to implement all available technologies and automatically guide the call takers when to use what technology:

- **Advanced Mobile Location (AML)**: ETSI TR 103 393[1], currently natively supported by Google Android as well as Apple iOS (from iOS 11.3 onward)
- **HTML5 Geolocation**[2]: SMS- and browser based, cross-mobile OS service, invoked by the call taker after successful call setup, no smartphone app needed, procedurally controlled by the PSAP, with the potential to deliver additional information (photos, videos, realtime media) in parallel to the existing 112 call
- Emergency Apps: Smartphone App-based emergency communication, with the potential to deliver additional information (caller personal and medical data, pictures, video) through the **PEMEA**[3] (Pan-European Mobile Emergency Application) network.

Beta 80 computer aided dispatch platform is currently including all existing geolocalization methods through standardized interfaces, making it the most efficacious tool for Call Takers to locate citizens.

3.2.3 Geographic Information System

The Geographic Information System (mapping application) provides all kinds of geo-referenced maps with a high-performance visualization including the display of Open Street Maps, Google Maps and Google Street View, where applicable. It also allows for superimposition of different customized layers of information (typically consisting of Points of Interest (POI) maps or orthophotos of the covered territory). Layers can be added or turned off by PSAP dispatchers according to what they have to display during the emergency management (e.g. turn on the utilities layer). This feature helps dispatchers to pinpoint the caller's location on maps and to speed up the identification of the most appropriate resources on the ground. The Mapping application allows customized colors for each element represented: trees, rivers, parks, industrial areas, wetlands, etc.;

The Mapping application is designed according to the international standards defined by the Open Geospatial Consortium (OGC), including Web Map Services (WMS) and Web Feature Service (WFS). The adherence to these standards gives full interoperability with other mapping systems. The visualization component enables the user to quickly and simply focus the map on the portion of interest. The navigation features of the map are presented through simple and intuitive toolbars. The dispatcher is able to move on the map, perform zoom operations, measurement, etc. with a simple click of the mouse.

The most important element of a GIS platform is the reliability of data and the capability of being fast.

The experience of using “heavyweight” GIS platforms often becomes a burden for PSAP operators, who need to locate fast a resource or a call, often in dire situation where the only parameter they have a voice at the phone trying to explain its position.

Beta 80 chose to develop a geolocation platform delivering exactly what a PSAP is expecting: fast geolocation on every possible geolayer.

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[1] ETSI Technical Report TR 1013 393: http://www.etsi.org/deliver/etsi_tr/103300_103399/103393/01.01.01_60/tr_103393v010101p.pdf
[2] EENA White Paper “HTML5 Geolocation”: http://www.eena.org/download.asp?item_id=237
[3] EENA White Papers “Pan-European Mobile Emergency Application (PEMEA) Requirements and Functional Architecture”: http://www.eena.org/download.asp?item_id=158 and “Pan-European Mobile Emergency Application (PEMEA) Protocol and Procedures Specification” http://www.eena.org/download.asp?item_id=175

The platform is based on the most advanced **open-source components** such as:

- **PostGIS** extensions to the Postgres database
- **Openlayers** libraries for high performance mapping requirements
- **SOLR search platform**, to replicatethe quality of Google search engines, based on open-source code
- **OSRM pathfinder algorithm** to determine the best route when dispatching emergency units.

Compatibility with the most popular formats is supported as well as integration with real-time services such as **Waze** traffic data and incident reporting, or **live CCTV** streaming from different source.

Some of the formats supported include (but are not limited to):

- ArcGISCache
- ArcGIS93Rest
- ArcIMS
- Bing
- Boxes
- EventPane
- FixedZoomLevels
- GeoRSS
- Google
- Google.v3
- Grid
- HTTPRequest
- Image
- KaMap
- KaMapCache
- MapGuide
- MapServer
- Markers
- OSM
- PointGrid
- PointTrack
- SphericalMercator
- … and much more

3.3 Communication Layer

Today the vast majority of organisations are looking for a solid approach to renew current infrastructures or establish new systems to effectively manage incoming emergency calls into a national system providing the primary and secondary PSAP capability.

In the modern call handler and dispatching centre many technologies are being used to facilitate the response to the incident, it is no longer just about voice but now also includes all aspects of **visual-centric communications**: **text, social media and video**. The true value of the solution is in its ability to bring all of these components together in a simple harmonious way. Ensuring that the system has the highest availability, security, and call processing capability. To achieve the required availability targets for this type of centre other areas have to be brought into the equation such as the network infrastructure which does have a huge impact.

The communication layer also has the capability to expand to include new ways of connecting to external devices and services. These include text, social media, telemetry, and web video interactions – all handled from the same core solution. They are expandable further by incorporating location aware services from smartphones, cars and potentially other devices grouped under the 'Internet of Things'.

The following paragraph describes an open architecture that supports the various type of communication end points and applications as described previously in the section "Applications Layer".

3.3.1 Architecture

The solution architecture builds on a platform founded on the Session Initiation Protocol (SIP) as the established standard for next-generation communication networks (NGN). It is highly reliable and extendible, typically set up in two or more data centres, and distributed to the edge locations to serve 112/911 centres, dispatch centres on all regional levels, as well as directly reaching into the response units.

The communication platform appears as a single system, operated from a central management platform.

Each Data Centre site is equipped with a full stack of functional elements, with a few options depending on the detailed project requirements which will still have to be determined as part of the progress throughout the journey to NG112/NG911:

- **SIP Server**

  The SIP Server manages the overall SIP Session of each contact and shall act as a SIP proxy for SIP phone extensions. A high availability setup is mandatory.

- **Management Server**

  The Management Server is the administration tool platform to manage the full communication stack. A high availability setup for Management Server in order provide geographic redundancy for administration access is required. Access to the Management Server is role based.

- **Telephony Feature Server**

  The telephony feature server provides a comprehensive feature set of modern and up-to-date enterprise telephony services, including voice contact centre services, to the SIP server. It also provides all functions to non-SIP communication entities like IP phones and trunks working on H.323, TDM digital, ISDN and analog protocols.

- **Telephony Gateway**

  Hardware Telephony Gateways deliver the Telephony Server's features and functions to all physically connected telephone sets (digital, analog, ISDN) as well as trunks (ISDN E1 and QSIG, analog) through the respective line cards that will be placed in the gateways. It shall also hold the necessary DSP resources in order to provide signal processing like mixing channels for conferencing and playing announcements and tones.

Depending on the per-site requirements, potentially two gateways types will be needed: a more lightweight gateway as well as a heavy duty high capacity gateways with redundancy options to increase availability.

- **Media Server**

  The Media Servers provide the functions of Telephony Hardware Gateways in software. This approach is applicable when no specific hardware-centric interfaces such as ISDN or analog ports are required, e.g. in a full SIP deployment.

- **Session Border Controller**

  Session Border Controller is the element connecting the Bulgarian 112/911 platform to external networks, e.g. SIP trunks to SIP Service Providers, or the Internet. In case of soft phone SIP clients being deployed in response units, Session Border Controllers secures the connections to these clients operated outside of the secured national communication network.

- **OPTIONAL: Multimedia Contact Centre and Work Assignment**

  Multimedia Contact Centre provides advanced services for multichannel citizen access to 112/911 emergency services. In future multichannel scenarios, the Multimedia Contact Centre has to be able to assign incoming contacts across all channels to the most appropriate call taker based on situational data (e.g. time of day, traffic load, weather and KPIs and other events), citizen data (e.g. personal data, location, preferences and behaviours) and call taker data (e.g. skills, experience, knowledge of location)

- **OPTIONAL: CTI Server**

  Depending on the project's requirement for data integration, there may be a requirement to provide traditional CTI servers.

The **Avaya Aura** communication and collaboration framework is leveraging this modular architecture to enable open, scalable and versatile applications fit for purpose in emergency communication

All elements of the above architecture can be delivered as VMware images to be deployed in a VMware ESXi infrastructure, or alternatively as appliances on dedicated servers, hardware telephony gateways excluded.

3.3.2 Communication Endpoints

All channels of communication are managed through adequate communication endpoints. Whilst Moving from the current operational model for voice services to the future multimedia platform, the initial first step will be covered with traditional IP Phones built in hardware or software, standalone or integrated into the call taker's desktop.

In the future, software clients will have to become more relevant, as new services like video or text require a more flexible visual-centric communication user interface.

3.3.2.1 IP Hardware Clients

Standard IP Hardphones are available in multiple sizes, extensible with additional key modules or software defined docking modules. They are capable of being fully powered over the Local Area Network Power over Ethernet (PoE) infrastructure. **Avaya's J100 series** of IP hardphones is the latest incarnation of modern hardphones to accommodate different user roles, modernizing the desktop experience, offering Ethernet, Bluetooth and Wi-Fi connectivity.

3.3.2.2 IP Software Clients

As more and more purpose-built hardware devices (PCs, laptops, phones) are going to be replaced by standard or ruggedized smartphones or tablets, also the real time communication functions will need to move to these

devices. IP Software clients are capable of providing access to voice, video and secure enterprise texting and chat services, allowing to also exchange pictures and documents from the incident scene.

Avaya Equinox is the standard softphone client to be deployed on PC's, tablets and smartphones, offering Voice, Video and secured Enterprise Instant Messaging capabilities.

3.3.2.3 OPTIONAL: Hybrid Clients

Hybrid clients are IP Software Clients rolled out on a purpose-built but yet open hardware platform, to be easily used and integrated in an enterprise IT environment. Such clients, preferably built on tablet operating systems shall contain a camera, corded and cord-free handsets, Bluetooth and WiFi, and shall be powered via PoE and traditional power supplies.

Avaya Vantage is the all-new dedicated desktop device that provides simple, instant, seamless and natural Engagement. Users can fire up voice, chat, collaboration instantly through one touch connections with no unnatural breaks or pauses – eliminating the need to manage multiple devices in order to engage.

Vantage is the industry's only customizable desktop device that gives you the advantages of a deskphone and the flexibility of an application platform. It is modern, connected, and personalized.

3.3.2.4 Client SDK and open APIs

As requirements and technologies are going to evolve, a future workspace in emergency services will need to be open, extensible and adaptable to these requirements. Beyond standard hardware and software clients, a full-featured Software Development Kit (SDK) for real time communications supporting purpose-built clients such as PC touchscreens in all sizes or fully integrated functions into the CAD applications will become very valuable.

Avaya Breeze Client SDK provides a common, developer-friendly set of tools that allow customers and developers to build innovative user experiences based on the full reach of Avaya Unified Communications, Collaboration and Multi-touch capabilities. Any and all functionality Avaya uses in its own clients and applications is available to developers through the SDK. Developers can now mix and match functionality that has previously been siloed in the Unified Communications or Contact Center spaces.

3.3.3 Duplication, High Availability and Scalability

The communication platform is proven for use in both public safety as well as high performance/high volume customer service centers in other industries (e.g. finance, insurance, trade, wholesale) with maximum resiliency and availability of 99,999% or higher.

Key principles for raising resiliency to maximum levels are

- **Geographic redundancy** at data centre level
- **On-site duplication of servers** and gateways
- Active-active deployments and clustering

VMware-based redundancy concepts including V-Motion are supported for the deployment of servers.

Avaya Aura offers multiple levels of resiliency and redundancy built in by design, and enhanced by the capabilities of modern virtualized software deployments in data centres.

3.3.4 Radio Communication

Integrating response units to the communication and information platform will be key in the future. Existing TETRA networks as well as future radio networks must become an integral part of new communication platform. Representing the radio subsystem on the call taker's and dispatcher's desktops has to be a function of the software applications.

Beta 80 has been working on radio integration for many years, understanding the importance of giving dispatchers a unified interface to manage radio communications and incident data. Thanks to its native radio server, **Beta 80 integrates GPS positioning from radios, as well as short data messages that can be displayed directly on radio devices, sent directly from the CAD**, seamlessly. But the most powerful logic behind this concept is the multi-channel, multi-radio approach: virtually every radio can be connected to the same radio server, making the experience to the dispatcher totally transparent, allowing also multi-frequency communications.

3.4 Services Integration Layer

The Services Integration Layer provides the capability for a structured approach of adding new services to an existing operational environment, fitting logically between the Communication Layer and the Application Layer, without disrupting operations, and managing data flows between the communication layer and the application layer.

The integration layer will become more relevant in the future as more and more new services will have to be added to the basic phone-based emergency services.

The integration layer is built on open standards and allows the adoption to future developments by using a flexible middleware layer, driving and optimizing cross-architectural workflows, data exchange and to allow flexible soft clients to be operated as standalone applications or to be fully embedded into the applications for case management associated with the applications layer.

The integration layer provides a variety of capabilities and functions that are connecting SIP Server, Telephony Feature Server, Media Server and Session Border Controller to current and future applications. In order to adopt to future standards and developments that are beneficial to modern emergency services, it will need to have the capability to

- access the SIP protocol in depth
- read and write into SIP protocol elements
- create, manipulate or delete SIP protocol data

As an open software framework, the integration layer further on provides the capabilities to interact and exchange data between real time communication services like voice and video calls, non-real-time services like text (SMS, Chat, Real Time Text, Social Media), and other applications by simple Java and JavaScript programming.

These capabilities are delivered as independent and re-usable software modules, so-called Snap-Ins, built for a specific purpose and arranged to realize the required call and workflows. These modules are generated in a visual process-oriented development environment.

At the time of establishing the future 112/911 platform, there are already a couple of new services that are mandatorily to be embedded from day 1 (e.g. eCall in the European Union, Text to 911 in the US). Others technically available, but not yet mandated (e.g. "Total Conversation" in the European Union), and still other are currently just appearing on scene, or will be inspected for intermediate and long-term deployment.

The **Avaya Breeze** platform has been developed and designed to create a single integrated application platform that works in conjunction with any device or system, enabling enterprises and developers to build and deploy collaboration and customer engagement applications in days without prior communication development skills.

Most importantly, the Avaya Breeze platform is a single integrated environment providing capabilities that extend across both the **Unified Communications** space and the **Contact Center** space to allow applications to be built in a way that reflects real business processes and customer requirements, not technology silos.

As an integrated environment, the Avaya Breeze platform will provide a suite of developer enablement capabilities, exposing all the powerful enterprise collaboration capabilities of the Avaya Aura Platform in a single developer experience. Over time, this will benefit our developer community as Avaya transitions from multiple, overlapping

platforms and software development kits (SDKs), with platform-specific functionality, to a single, simplified environment with both legacy and advanced new capabilities needed to keep pace with the exploding demand for mobile, social and cloud-based communications applications and integrations.

3.4.1 EU eCall

EU eCall is mandated to be operationally ready for EU member states PSAPs since 1st October 2017.

However, the future eCall solution inside a new 112 platform adheres to the following characteristics

- **Single software-based eCall platform**
- Distributed across two date centres to provide geographic redundancy
- **Future-readiness to support new eCall services (TPS eCall, HGV eCall, NG eCall)**
- Scalability based on licences and software, without the addition of any special eCall hardware

Avaya have gained the experience of deploying national centralized eCall platforms in several European countries, tightly integrated into workflows, procedures and applications. Although eCall requirements are the same for all EU member states, Avaya have found that individual deployments are widely differing from country to country, depending on the operational model the country has decided to implement in order to answer and process 112 eCalls.

3.4.2 Total Conversation

Total Conversation[4] is a concept to allow citizens with hearing and speaking disabilities accessing emergency services through visual oriented hardware devices, PC-based applications or smartphone- and tablet-centric apps.

Total conversation embraces video as the core service to allow citizens with disabilities to use sign language for communication. Besides video, also audio is transported to give call takers access to surrounding and background noises, as well as Real Time Text (RTT), a special type of text-based communications[5].

In SIP-centric environments, Total Conversation as an internet based service has to be integrated technically and operationally. In this context the openness of the Integration Layer is highly valued.

Very often there are multiple options to create and rolling out new services. In the case of total conversations we see mainly two approaches, leading to the desired result of adding text and video communications to the existing voice communication:

- **Standards-centric** Total Conversation fully based on SIP, with ITU-T T.140 **Real Time Text (RTT)** defining a representation of text suitable for transmission over IP networks and IETF RFC 4103 **RTP Payload for Text Conversation**
- Adding typical enterprise **video collaboration** capabilities to the emergency contact center, allowing deaf or hard of hearing citizens to utilize real time video and text chat capabilities as known from other **commercial products**.

Both approaches have their pro's and con's, and both are suitable to achieve the result of giving users more than voice access from their PCs, Android or iOS devices with the use of browser- or app-based communication.

Avaya do have the experience of both approaches being implemented in Europe inside the Avaya Aura platform.

[4] Reach 112: http://www.reach112.eu/view/en/project/tc.html
[5] RealTimeText.org: http://www.realtimetext.org/rtt_in_detail/standards/ietf

3.4.3 Internet-based access to 112/911

Currently, and historically, access to 112/911 emergency services is granted from telephone devices only (with the main exception of fax and TTY services for the community of deaf citizens).

Whilst internet based communication through different access channels (PC browsers, smartphone browsers, chat apps) is increasingly be use for all kind of communications and transactions, emergency services is still excluded from this trend, due to a couple of reasons.

With the advent of (satellite) location services, as well as real time communications from within web browsers via **WebRTC**, the previous restrictions to extend access to emergency services via the Internet are continuously disappearing, so there is an expectation that there will be a multichannel communication capability with naturally integrating voice, video and text through browsers or apps.

3.4.4 Social Media

Social media is a “special” form of Internet-based access to communication: its nature of communication many-to-many or many-to-one, especially for emergency services, is under development and there is no specific standard, like it happens with eCall, CAP protocol for data exchange, SIP protocol for VoIP communications, etc.

Beta 80 has been researching ways of integrating social media in the Public Safety environment, considering **two main rules**:

- The use of social media is not mandatory by any law, so it has to assume a role of “useful tool”. The integration with social media should upgrade the Public Safety service quality, but the lack of integration must not make it worse.
- Social media identities are still uncontrolled, making it a less reliable way for raising an emergency. On the other hand, social media have the power of numbers: multiple alerts sent on social media can define a situation with quite some precision in a precise area.

From these two rules, research defined the following approaches to Social media in the form of best practice:

- **Integration with Waze services**:
  - Beta 80 PSAPs can now access to Waze data, allowing the dispatchers to see in real time traffic situation, roadblocks and other potential critical situations that may become critical during a dispatching operation.
  - At the same time, the PSAPs can alert Waze users who are driving, of emergency situations created in the PSAP because of en emergency call. This data become automatically visible to the Waze community and are the very first example of direct interaction between the PSAP and the citizens.
- **Integration with Twitter, Facebook and similar social media**
  - When any social identiy is public (not restricted by the owner’s decision) the PSAP can “tap” into the stream of data created by users, to detect relevant activities in the surroundings of an emergency call: whenever a call is localized, the CAD sends out a search with specific coordinates and hashtags to determine if there is particular activity in the same area. People may be posting on social media about an emergency, using their smartphone’s camera, etc. This is all relevant data for a PSAP who must dispatch resources.
  - At the same time, like the Waze example, a PSAP may create proper Social identities to communicate seamlessly with the citizens. The CAD is designed to issue specific communications or messages to the population whenever an event happens.

3.4.5 Internet of Things (IoT)

Adding the world of **IoT** to emergency services very often will require **fundamental changes on the routing and call taking for emergency services**[6], as it will be addressing previously unknown services to become part of the emergency communication and processing universe. Whilst sensors detecting environmental conditions and threshold (e.g. temperature, fire, smoke, gas, water) have the capability to significantly add information to deliver a precise operational picture, they can also become very overwhelming in terms of mass alarms.

Therefore, the use cases for IoT have to be thoroughly discovered, evaluated and established in Proof of concepts.

Besides the technical connectivity of sensors in the field, the processing on an organisational and procedural has to be clearly described, and the impact on tools and staffing have to be identified.

With opening any future 112/911 platform to IoT, there has to be a clear concept of adding external 3rd parties to the concept, including a wholistic approach of setting up the required interfaces in terms of communication entry points through realtime media and near-realtime web services, making use of existing or evolving standards. Beyond that, any external application or service to be attached to a new 112/911 platform will need to pass through a well determined process of certification, led by the appropriate national or regional authorities.

Also here, the **Avaya Breeze** platform is best possibly suited to connect to IoT devices, to consolidate access, as well as to manage IoT-originated data to drive routing and contact management decisions.

3.4.6 Public Warning and ‘Reverse 112/911’

National and regional approaches to public warning tend to be very different from country to country, state to state, region to region.

In Europe, as part of the EECC telecom legislation package, the European Parliament has voted the establishment of a compulsory public warning system in each of the EU countries[7].

Therefore, interacting with Public Warning systems shall become an extension to the future emergency services platform.

There are multiple approaches to Public Warning, which can be used in isolation or in combination with each other, aiming to reach a high share of the population in a timely manner, and at the same time being contextually relevant in terms of location and content presented through these channels.

Subscribing to services with Mobile Network Operators for reaching the population with traditional platforms such as SMS is a straight forward approach to enhance Public Warning. Beyond that emergency services can also become more independent by choosing to become active users of social media channels. Allowing the Contact Center to automatically disclose with all subscribed citizens, information about major accidents through Telegram, Facebook, Twitter, etc. can be spread very fast.

Public Warning and 112/911 on their own are typical “one-way services” outside-in or inside-out. In a networked and digitally educated society there should be a perspective of combining both services under a strong “brand” of well-known 112 and 911 services, establishing what is known as a ‘Reverse 112’ and ‘Reverse 911’ approach.

Beta 80 with their focus in emergency case management and Avaya with their experience in MultiChannel communication in Citizen and Customer Service can provide solutions that can combine inbound with outbound communication, seamlessly interact with Social Media, and allowing the publishing of selected information from the PSAP to the citizens.

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[6] EENA White Paper „The Internet of Things (IoT) and Emergency Services“: http://www.eena.org/download.asp?item_id=170

[7] EENA News, 4th Sept 2017 http://eena.org/news/breaking-vote-in-support-of-establishing-a-public-warning-system#.WjE1dbYly8W

4 Next Generation 112/911 (NG112/911)

The concepts of Next Generation 112/911 (NG112/NG911) address three major objectives in emergency communication:

- Communication between citizens and emergency services
- Interoperability between emergency services
- Open Standards approach

NG112/911 itself is a fully SIP-centric, future oriented approach to overcome the current limitations of 112/911 emergency communication. In principle, it is changing the paradigm of 112/911 calling by adding and embedding location information **'PIDF-LO'**[8] directly into the SIP invite message at the origination of the emergency call.

Beyond that, it introduces the capability for Video and Real Time Text in emergency calling. On the PSAP side, it allows for situation- and policy-based dynamic call routing, understanding the current condition at a specific PSAP and taking this as well as the caller location information into account when choosing the most appropriate PSAP to answer the emergency call.

NG119 as well as NG112 are close-to-standard frameworks, specified and developed by the National Emergency Number Association (NENA) under "i3 Solution – Stage 3" in the US, adopted under the aspects of European requirement by the European Emergency Number Association (EENA) under "Next Generation 112 – Long Term Definition).

NG911 and NG112 are currently regarded as a desired end-state for the digital transformation of emergency services.

There are two important statements that have to be understood and taken into consideration:

- Next Generation Emergency Services can be created without the need to implement strictly according to NG911/NG112 standards.
- Next Generation Emergency Services are going to become a reality first, and are probably going to lead to the implementation of NG911/NG112 standards.

4.1 ESInet Architecture

In order to approach NG911/NG112, the central concept of the "Emergency Services IP Network (ESInet)" will become a central element.

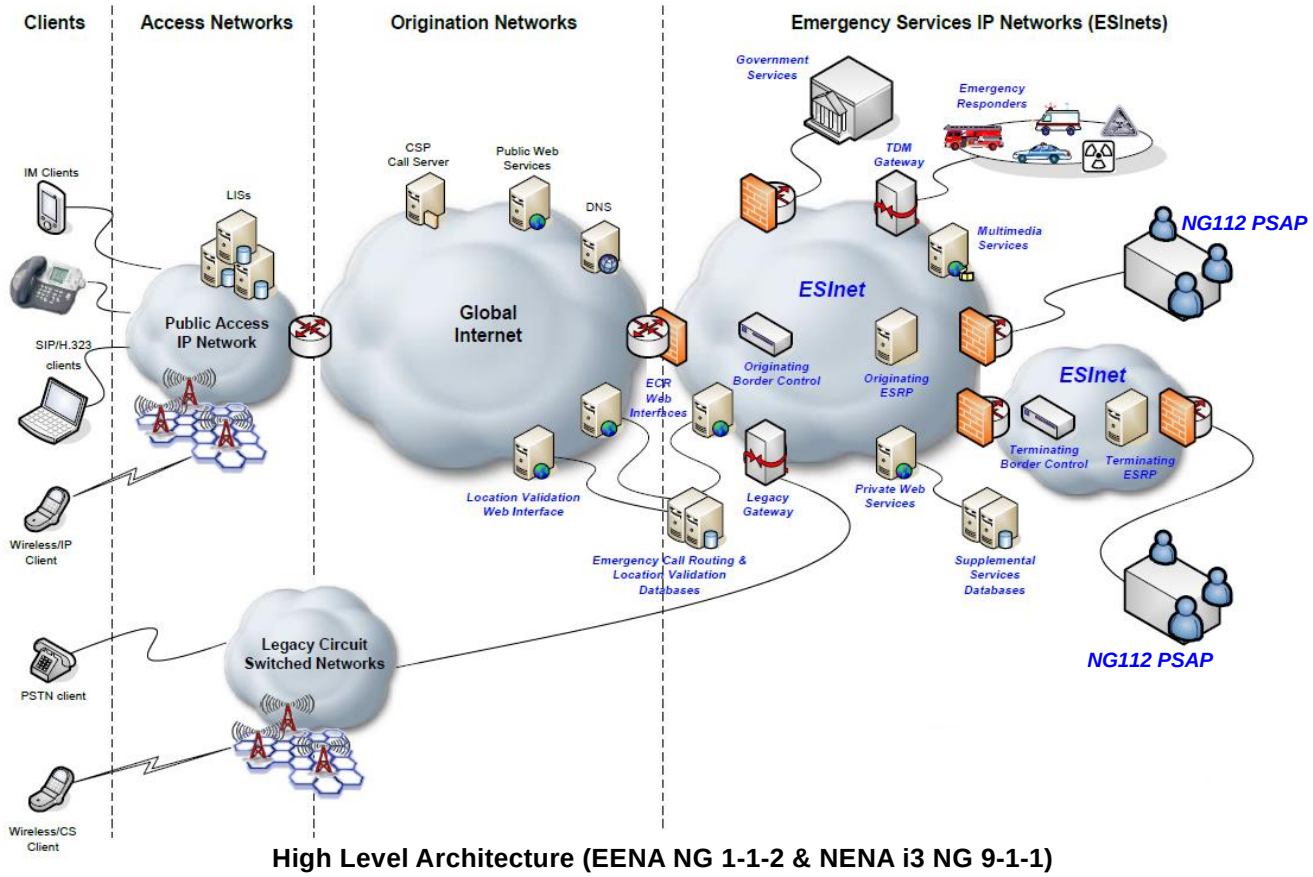
An ESInet is a private, managed, and routed IP network, serving a set of PSAPs, a region, a state, or a set of states. ESInets are interconnected to neighboring ESInets, and they are locical and functional constructs that typically are provided by Service Providers.

Although the ESInet is a private and managed IP network, it is not a walled garden:

- The ESInet is connected to the Internet
- The term ESInet refers to the network (routers and links) but not to the services that run on it
- The key to reliability is redundancy and security protection

[8] PIDF-LO, Presence Information Data Format-Location Object: XML data scheme specified in a number of IETF RFCs (RFC 4119, RFC 5491, RFC 5139, and others)

The following graphic showing the high level architecture is taken from NENA and EENA documents[9]:



High Level Architecture (EENA NG 1-1-2 & NENA i3 NG 9-1-1)

The following paragraphs are giving a deeper insight into the most relevant functional nd architectural elements of the ESInet.

4.1.1 Border Control Function (BCF)

The Border Control Function (BCF) is the external security border for the ESInet to any other connected services and networks. In this function, it also serves as the internal isolation border for any directly connected PSAPs.

Functionally, the BCF contains both capabilities of Firewall and Session Border Controller. Applying these capabilities, the BCF can block sources of specific call and other contacts if they match criteria to be seen as suspicious.

4.1.2 Emergency Services Routing Proxy (ESRP)

The Emergency Services Routing Proxy (ESRP) is the functional core for any call or session routing:

- The ESRP contains a SIP-based session routing engine
- It does use an external function “ECRF” to determine and choose the nominal next hop inside the ESInet
- It applies route policys of the nominal next hop to determine the actual next hop
- Route policies may take into account the status of a PSAP, time of day, actual load, available capacity to take calls, …

[9] Source: http://www.eena.org/uploads/gallery/files/pdf/eena_ng112_longtermdefinition.pdf

- A route decision can be either a next ESRP inside or outside of the current ESInet, or a PSAP with call takers available to take the call.

In essence, the ESRP is a SIP Telephone System with no users or phone extensions, but only trunks.

4.1.3 Emergency Call Routing Function (ECRF)

The Emergency Call Routing Function (ECRF) is the “external intelligence” to an ESRP, allowing to make routing decisions based on the built-in database. It is used to route to the correct service, Police, Fire, Medical Emergncy Services, based on the context of ‘location’, and its understanding of the status of any receiving PSAP stored in its database.

The ECRF is queried by the ESRP applying the IETF LoST (Location to Service Translation) protocol. The ESRP sends the PIDF-LO location information attached to SIP Invite message plus a denominator for the requested service (‘service urn‘) to the ECRF, and get a URI of where to send the call or session to in response.

4.1.4 Location Information Service (LIS)

The Location Information Service (LIS) is a controller of locations, usually positioned outside an ESInet. Its scope is to gather location information from the available sources (embedded in SIP messages, through AML, etc.), be able to verify the correctness of the data acquired and provide the information to ECRF when the destination URN is being generated, by a comparison between source location and destination PSAP.

The LIS also uses PIDF-LO protocol and supports HELD (Http Enabled Location Delivery) to provide geolocation by reference (address where to fetch coordinates) or by value (direct geographic position).

4.1.5 Public Safety Answering Point (PSAP), Customer Premises Equipment (CPE)

In NG112/NG911 the Public Safety Answering Point (PSAP) sometimes is referred to as CPE (Customer Premises Equipment), underlining that this is the functional element being built on-site in a building, with call taking and dispatching staff as users of that functional element that are able to take emergency calls and dispatch the emergency response teams.

“On site” and “premises” of course is referring to the place where people work. Historically seen, staff and technology enabling communications and use of applications have always been co-located in that place. With the availability of cloud services, this co-location no longer is a necessity, although currently[10] most emergency services would probably prefer to work with on-premise deployments of all necessary technology. As more and more businesses and verticals are actively evaluating cloud-based services to support their operations, there is an expectation that also emergency will evaluate this at a later time when feasible.

Cloud-based virtual PSAPs are a clear option for NG112/NG911, so services may reside in a data centre or at the PSAP site.

Functionally, the PSAP receives all calls with embedded location information (PIDF-LO) via the ESInet. It can use ECRF and ESRP policies to route them to queues of call takers. The PSAP in NG112/NG911 will have multimedia capabilities to support voice, video, real-time text, and messaging.

[10] “currently” = 2018

4.1.6 Legacy Gateways

Legacy Gateways are used to support the transition from legacy 112/911 to NG112/NG911 over time. They connect the SIP world of packet switching and IP traffic to the ISDN world of TDM[11]. There are two type of Legacy Gateways

- Legacy Network Gateway (LNG)
- Legacy PSAP Gateway (LPG)

4.1.6.1 Legacy Network Gateway (LNG)

The Legacy Network Gateway (LNG) interconnects the ESInet to the legacy origination (ISDN-)networks, bridging calls between the still existing and operational origination network and the ESInet world. The KNG supports interworking of location capabilities from originating networks (e.g. Mobile Operators originating cell information) towards the ESInet, creating the required PIDF-LO container for SIP-embedded location. The LNG forwards calls to ESRP to be treated in the ESInet.

4.1.6.2 Legacy PSAP Gateway (LPG)

The Legacy PSAP Gateway (LPG) interconnects legacy TDM PSAP (based on ISDN Telephoen Systems) to the ESInet, so it's somewhat a reverse function to the Legacy Network Gateway (LNG).

Depending on the legacy PSAP's capabilities, the LPG supports interworking of location and status capabilities, allowing to represent PIDF-LO location in the PSAPs CAD and GIS system, as well as mirroring the PSAPs status in terms of availability and call taking capacity to the ESInet.

4.2 Transition to NG112/911

NG112 and NG911 are concepts that have matured over time. Especially NG911 was designed to suit the functional and organisational requirements in North America, USA and Canada, allowing a transition into IP-based communications with a high level of innovation in terms of geolocation and multimedia support.

Whilst USA and Canada are large territories with quite a homogeneous approach to 911 services, Europe is much more fragmented.

For Europe, there is an expectation of being able to alter and accommodate NG112 concepts depending on individual requirements, country by country, region by region. In essence this could be seen in an approach of providing the NG112 capabilities from a functional perspective, without a 1:1 adoption of each and every functional element described in the previous chapter, but embedding the core functions that are relevant to the country based on its interpretation of the NG112 LTD.

There also is an expectation of a long-term parallel existence of traditional 112/911 and NG112/911 due to economical master conditions with the responsible emergency response organisation, but also with the long-term investments with Service Providers and Network Operators. This will be considered and supported by the interoperability provided with LNGs and LPGs, assuring co-existence and service continuation.

Avaya and Beta80 jointly are capable to provide complete solutions for transforming emergency services to the level of Next Generation capabilities, starting in a today's environment and leading to a full deployment of NG112/NG911.

[11] TDM: Time Devision Multiplexing, core technology in ISDN telecommunications

5 About Avaya and Beta80

5.1 About Avaya

Avaya is a global leader in enterprise communications systems.

We have a long tradition in providing solutions for emergency services around the world. A large number of governments, public authorities and agencies trust Avaya solutions to receive 112, 999 and 911 emergency calls.

Avaya and our partners are crafting comprehensive solutions to meet the increasingly complex multi-channel communications and network requirements that are critical for successful Next Generation Emergency Services implementations.

Avaya's core contributions to Next Generation Emergency Services are centred around our core competencies in:

- **Contact routing and treatment** covering all media channels, e.g. Voice, SMS, Real-time Text & IM, Video and Social Media
- **Intelligent contact filtering and prioritization** to avoid resource overload and to enable adequate and efficient incident treatment
- **Multichannel Outbound Communication and Mass Notification** to enable case sensitive and location oriented communications to selected target groups and citizens
- **Application Integration into Command and Control Room** applications to provide feature-rich interactions between media streams and incident management application logic
- **Virtual Network and Cloud Infrastructures**, prepared for high volume real-time traffic (CCTV, voice, video), supporting distributed, consolidated and integrated Emergency Services and Public Safety environments

Our customers have trusted Avaya's technology, services and business partners with delivering into this type of environment based upon our proven track record in the following areas:

- High availability system resiliency and reliability, with an Active/Active architecture
- Ability from small and midsize environments up to large scale, to even handle extreme contact volume growth in emergencies
- Secure Software Defined infrastructure solutions to support dynamic, agile, 'web-scale' deployments.
- Experience with the 112 and 911 industry requirements, regulations and trends
- Open interfaces to enable integration with other technologies and other communication systems allowing for shared communications (such as Radio), task automation, and information sharing.

As Governments and Public Safety Institutions build the network required for Next Generation Emergency Services, Avaya is ready to provide solutions today, across all required communication channels. Government Institutions of all sizes can continue to depend on Avaya for state-of-the-art communications that improve efficiency, collaboration, and services to citizens.

5.2 About Beta80

Beta 80 Group is a provider of high quality software for public safety. We currently serve over 64 PSAP covering 38 million citizens. Our solutions are known for their reliability, **in over 25 years we have never lost a customer**.

We offer top quality CAD systems with flexible features and integrations:

- Mobile patient records
- Reporting and datawarehouse
- GIS platform
- Geolocalization platforms, AML, smartphone apps and other instruments for caller location
- Radio platfrom integrated components

Beta 80 participated in the most relevant EU funded projects for research and development in the field of emergency management and Public Safety. In particular, we have been pioneers in eCall platform, starting our work in 2011.

5.3 Avaya's and Beta80's Activities in Organizations and Forums

Beta 80 is a Selected Avaya Partner for delivering turn-key PSAP projects and solutions.

An important part in the changing world of Emergency Communications is the role that a company has helping to shape those new architectures. Avaya's and Beta80's solutions adhere to existing standards and are ready to adapt to evolving standards like NG112 LTD worked on by EENA in Europe, and the i3 architecture by NENA in North America. Both companies' experts are actively contributing to workgroups in both NENA and EENA and are thus shaping how next generation emergency services will be positioned to serve and protect citizens in member states of the European Union and in North America in the next years to come.

Avaya and Beta 80 are both in the EENA Advisory board and the authors of this document belong to the Tech & Ops committee.

5.4 Ready for Next Generation 112 Services

Already today, Avaya's solutions for Enterprise Customers, for Network Service Providers and for Public Organizations and Agencies running Public Safety Answering Points (PSAPs) are capable to add on new services like

- eCall data messages and voice communication initiated by cars in emergency situations (mandatory to support from 2017/2018 in the EU)
- caller location awareness in mobile and enterprise networks
- video and text communication to support citizens with disabilities
- social media-integration for crisis awareness and communication to the public
- call-back (reverse 112) into the enterprises from the PSAP

All of these services are ready now to be integrated immediately as modules and point enhancements to the existing voice channel, based on both traditional PSTN access and real time internet services. Once NG112 will be deployed in its entirety in a full end-to-end IP network architecture, including ESInet based on the SIP protocol, these elements will immediately be joint together to form a full flavour NG112-solution instantly.

Avaya and Beta 80 have successfully tested their respective platforms *Avaya Aura™* and *Breeze™* and Beta 80's smartphone app for caller location *Where Are U* , together with LIS components, in a real Next Generation 112 environment during ETSI NG112 Plugtests 2016 and 2017.