



THE PERSPECTIVE OF RADIO BROADCASTING

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Abstract:

Radio broadcasting today has many different types and ways for the end-user. The beginning of digital radio in Serbia was in 2018. Pandemic Covid, slow development DAB+, the rapid development of hybrid radio, further use of FM analogue radio resources and popular streaming radio – they give us one very complicated situation of radio broadcasting. In this paper, we would like to present additional features of any radio. Traffic announcement -TA, traffic and travel information- TTI, virtual voice assistant – we describe what potential solution we expect. Method of realization TA, TTI, comparison of solution. We analyse technologies and the results that drive the radio through the coming years.

Keywords:

DAB+, FM, Hybrid radio, TA, TTI, virtual voice assistant.

INTRODUCTION

Analogue radio together with additional software tool RDS -Radio Data System is to provide the radio listener with useful information, such as traffic reports, program information, the radio re-tune to the nearest transmitter (when the radio goes out of range of a transmitter). The features TA – Traffic Announcement System allows the listener to stay connected only to those radio broadcast information about traffic in the surrounding area[1]. PJ ETV from Belgrade made his system via analogue Radio Belgrade 202. It is dealing with ETV, the Road of Serbia and Traffic Police of Serbia to avoid accidents or at least to avoid even more serious consequences of the road. The radio receiver in the car will be able to have option TA, and this option must be enabled. The idea is to use traditional broadcasting and insert metadata of interest. Today, the radio signal is not enough to satisfy the needs of the user. Many companies invent, develops, and delivers technologies extraordinary experiences, and in this way they improve radio broadcasters hearing. With functionality and features AF- Alternative frequencies, PS – program service name, RT – radio text etc. We will explain in detail how the whole TA features in the project were done and compare it with TTI digital radio solution.

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Radio Data System enabled more attractive analogue radio programs. Digital Radio has a lot of TTI features: Traffic events and news, traffic weather, driver assistance, local hazard warnings, traffic flow and prediction, parking information etc. At this moment Serbia has not implemented yet TTI, but it is a matter of time. Belgrade and the other town in Serbia have very had traffic, make us very nervous and take us very much time. TTI help us to save time and we know exactly which streets with little traffic, which nearest garage is available and has free spaces, where we can find a map of scheduled roadworks, road closures and diversion. The broadcasting system based TTI service architecture seems relatively effective to this kind of one-to-many data delivery job [2]. In this paper, we analyzed which model of TTI requirement is the best choice for us and what we can gain by improving our existing system. We will review the existing TTI system and analysts which one is best for us. The second section described RDS technology analogue radio broadcasting with features TA. Prospective service architecture and the current application are explained in section three. Hybrid radio we analyzed in chapter four. In section five we compare digital and analogue broadcasting features traffic information. Finally, section five give a conclusion, and what is the perspective of further development.



Figure 1 – PI structure

2. FEATURES OF ANALOG RADIO

Traditional analogue FM Radio offers us continued enjoyment of sound. RDS services of Analog radio give us metadata. RDS data is broadcast along with the main signal from the transmitters, and inside every RDS equipped head unit, is a small chip that decodes that information and that is then shown on the display in the car. A lot of kinds of metadata in the RDS service. We will mention some of them and the way in which TA has been implemented in Serbia. The alternative frequencies -AF is a feature that automatically retunes the receiver to another frequency in the network which is broadcasting a stronger signal where there are problems with the reception of the currently tuned station. In the other case, better reception is possible on a different frequency.

This option allows us the highest quality broadcast signal in coverage areas where possible. Programme identification -PI is the most important RDS parameter and represent the unique character hexadecimal code that identifies the station. Figure 1 is showing the structure of PI [3].

Bits 12 to 15 represent country code, Program in terms of area coverage 8 to 11 and finally, 0 to 7 bits is program reference number. PS – Programme Service identifies the name of the tuned service. The PS name is an eight-character alphanumeric transmitted by the broadcaster, and the complete PS name requires a minimum of four groups, which at the recommended rate takes just one second to be transmitted [4]. The default function CT – clock time and date, should also be mentioned. PTY – Programme type has 31 coded different type RDS program (4- Sport, 8-Science...). REG- Regional is a very interesting option – lock-down the set to their current region or let the radio tune into another region-specific programming as they move into the other region. RT -radio text function allows a radio station to broadcast text messages. Figure 2 represent the structure of the radio text segment -type 2A group [4].

Rt+, radio text plus broadcast additionally some other data: Artist, Title etc. EON – Enhanced other network-connected different radio stations using flags like the TA flag. TMC – traffic message channel, the radio station broadcast digitally-encoded traffic information and for a client need an appropriate decoder. FM Translator Announcements has introduced one type of metadata – identification code for US FM translator. TA IN Serbia was realised with several economic entities. 2019 because of fog on the road, there was a big accident on the highway. Other participants in the traffic did not know that and there was even more confusion and danger for the drivers arriving on the part of the road. That all traffic participants have timely information about unforeseen traffic circumstances and avoid those sections of the highway, public enterprises met Serbian roads, Traffic police, ETV, RTS and REM- Media Service Providers Register. The concept of TA implementation was made through a series of meetings of the mentioned stakeholders. The functioning of the whole new system and project is achieved according to Figure 3. The most important creation of traffic information is between the traffic police and the roads of Serbia. The situation on the road is permanently monitored and when the weather conditions change, the information is sent to special part Radio Belgrade in charge of receiving traffic information.

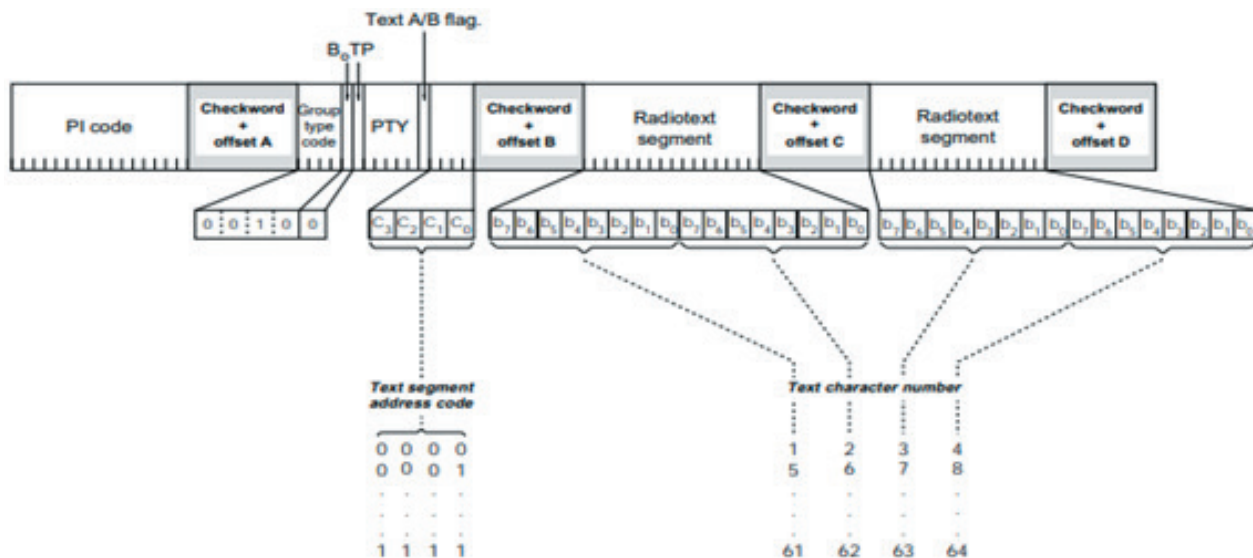


Figure 2 – Radio text format 2A group

Also, Roads of Serbia get information from a possible accident on roads from Traffic Policies, that are provided also Radio Belgrade. Media Service Providers Register regulates the legal framework in which only Radio Belgrade 202 has the exclusive right to activate the TA option. No other radio station may have a TA option for the entire system to function.

REM also reacts if someone does not respect the agreement and sanctions any non-compliance with the rules. The regulatory body has enabled the legal system to function the entire system. Radio Belgrade has a special role in the whole project.

The telecommunication line with roads of Serbia and Police is always on stand by. The special department of Radio Belgrade 202 is in charge of receiving and forwarding information on traffic, accidents and weather conditions on dangerous sections of roads. The speaker in the radio centre must be ready at all times and turn on the option TA if necessary. When important information about the situation on the road section is received, ie when a speaker from the relevant institutions, the radio broadcasting is interrupted and an official statement is sent on a certain section of the road.

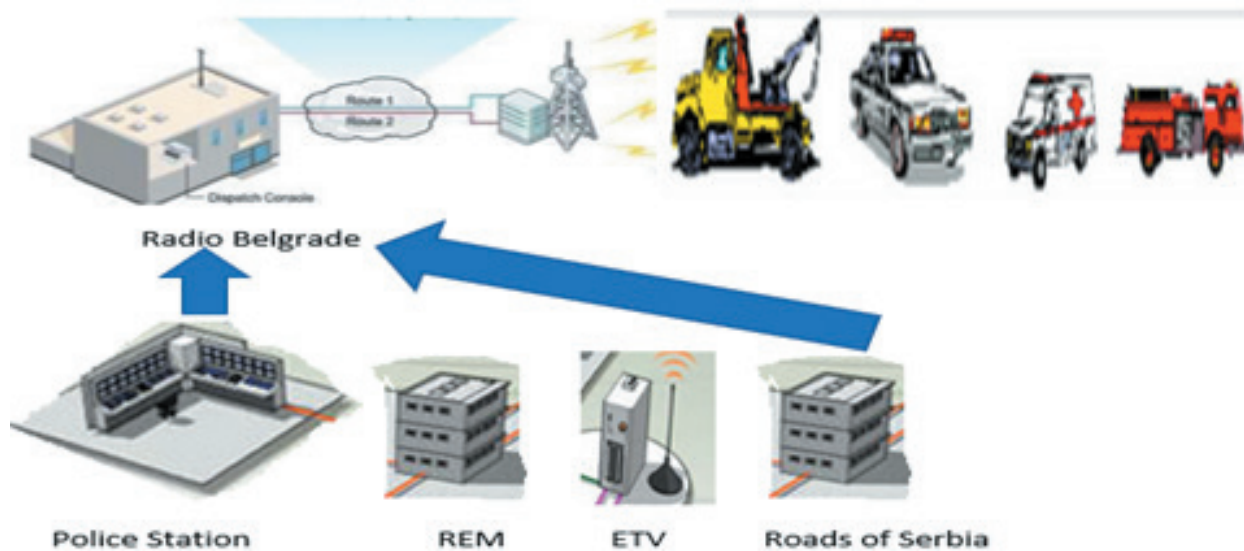


Figure 3 – Concept of TA

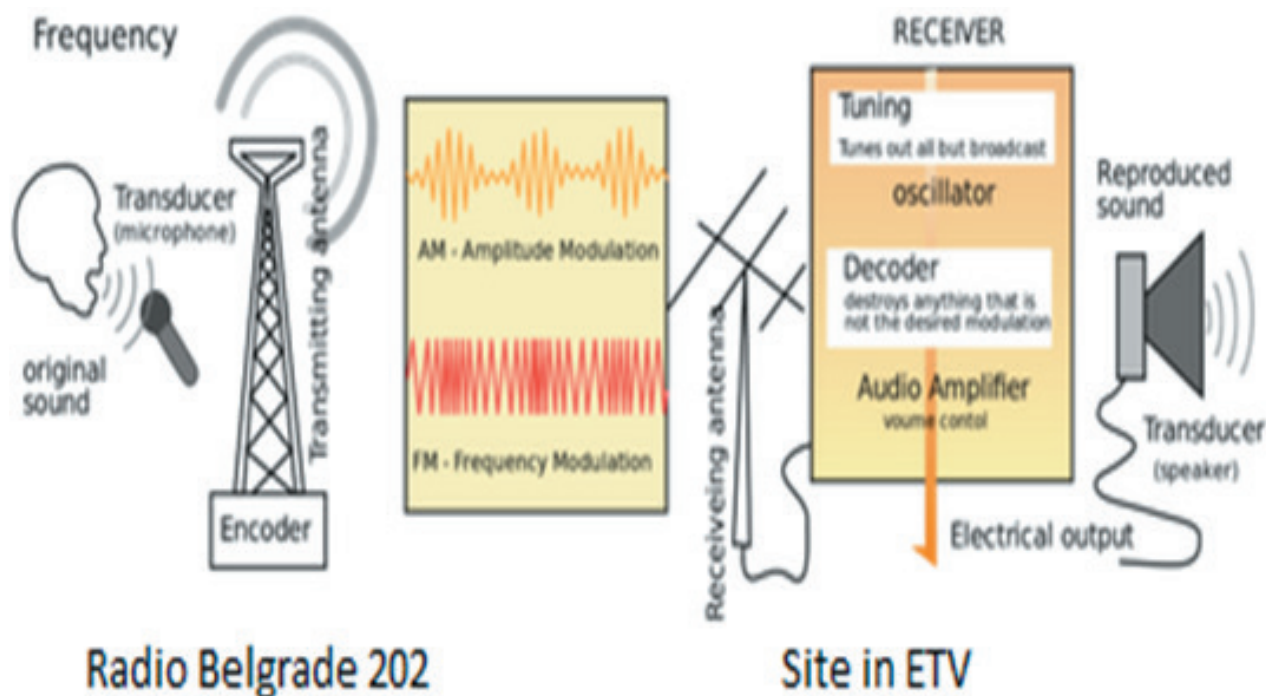


Figure 4 – The principle of forwarding TA metadata

On the way, all cars that have been activated TA option, any radio program to listen – will be interrupted. Receivers automatically switched to the frequency of Radio Belgrade 202. All drivers will hear important traffic information and will be warned in time to be careful of road conditions in that section. If there is a car accident then it should be avoided.

Metadata are inserted via an encoder in-studio Radio Belgrade 202. A certain number of etv locations adjacent to the main highways and highways are received by Radio Belgrade 202 together with TA metadata. On the receiving side must have an encoder and a transmitter that will broadcast the content to the listener. All listeners who have this option in the receiver allow the listener's metadata.

In this way, analogue radio provides its maximum in terms of additional data to the radio signal. Analogue radio gives limited possibilities to send additional data that is used to the maximum.

3. METADATA IN DIGITAL RADIO

In this chapter, we will mention only TPEG – traffic protocol expert group and EWF -Emergency Warning Functionality. Transport meanings as in the context of traffic and travel, and also meaning in the context of moving information from a service provider to an end-user. The content has to be collected and edited according to rigorous standards to ensure it is timely and accurate [5]. At any point in time, only some of the end-user would wish to receive particular information. Any end-user would be deluge with too many messages. Tpeg technology has various filter mechanisms to avoid mentioned situation (accident too far for us, traffic jams in a city where we are not...). So we do not need all the information but only the traffic information that helps us in a particular case. TPEG Technology consists of two main segments: the content segment and the delivery segment[6].

Traffic information and their technology have two demands to satisfy: mobility of access and language independence. The first demand is a complex client device containing a location database. The device must be maintained by the service provider and all client devices. The language independence demand satisfies using table code values.

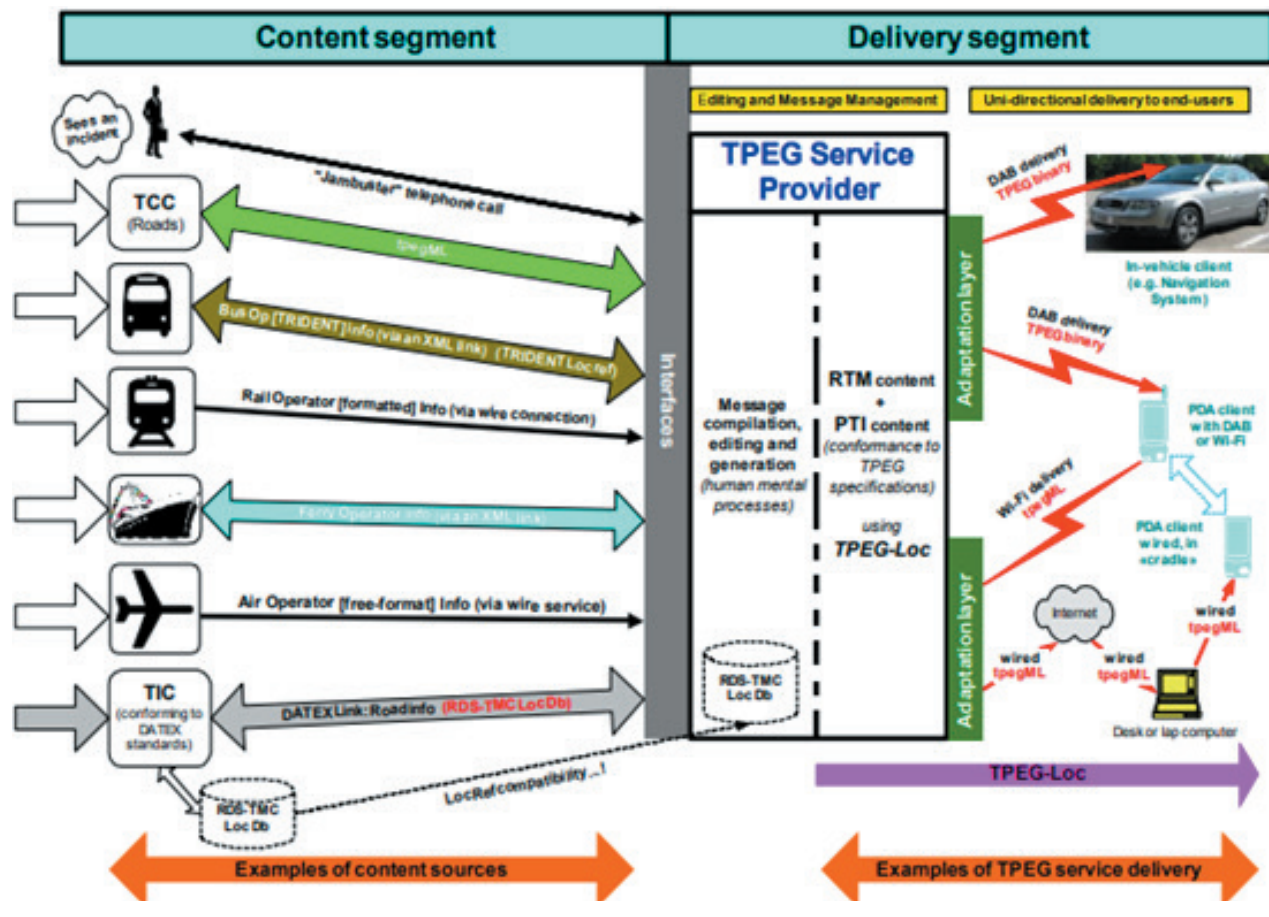


Figure 5 – Content and delivery segment of TPEG

This table contains the generic word for the content. TPEG data consist of three parts: message management, the application Event and Location Referencing. Location information with reference is very important, when is a part of the road closure, bus service cancellation or delay. Service provider or Radio Station can implement very high detailed service lowly detailed and use more or less bandwidth so which require more or less complex client devices. At this moment there is no TPEG implementation in Serbia. Swedish Radio generating some location reference. Intersection point presenting road numbers up to three and the name of the municipality. The segment consists of two intersection points. TPEG table referring can be utilized in any type of location: bridge, fuel station, church, hotel, roundabout, marina, the airport area, etc. Parking information has two messages. First which gives information about the parking facility that is of a general nature, second gives the number of still available spaces. Very usefully can be CTT- Congestion and travel time estimation gives us evidence of congestion and travels time information to allow prediction using computer modelling.

Travel Weather Information – TWI preventing major traffic accidents are caused by rapid changes in local weather conditions, e.g. snowstorms, quickly fog etc. Another feature of digital radio is EIA- Environmental Information Alerts. Environmental details, such as data about localized flooding, local fires can be transmitted.

EFW – Emergency Warning Functionality is another new function, that works through the notification and reporting site figure 6. These include detectors, sensors and high-capacity servers. The main task is a monitoring system device, traffic, applications with sensors and sound alarm, graphic and textual messages in case of large-scale accidents and disasters in the event of an emergency warning. The system can run 24 hours a day, 365 days a year, and can operate very rapidly to change. The information must be consistent and error-free. The Control system handles data from sensors and speakers send signals to the selected group of receivers for whom this information or events are of interest. The most important function of the control system is the administrative separation of information for groups of control listeners who care about disasters information (war,

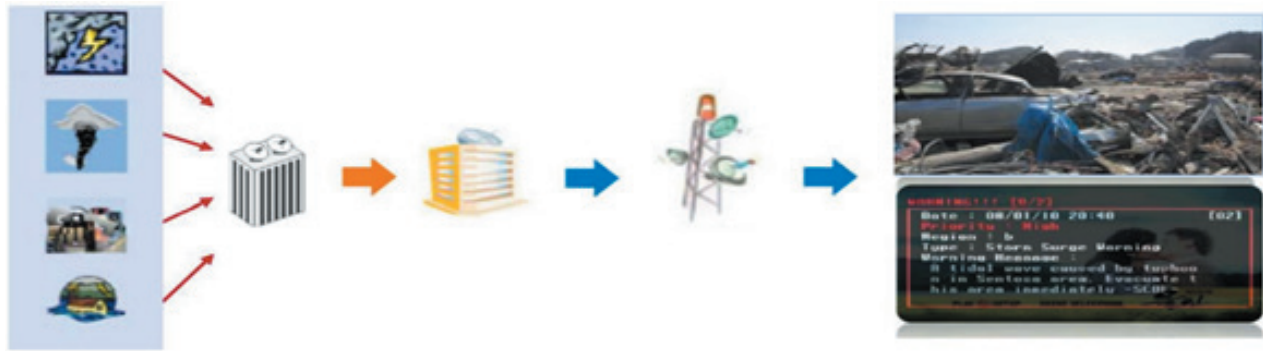


Figure 6 – Emergency Warning Functionality

earthquakes, tornado...) of interest. The world trend is such that the EWF system is constantly being upgraded. Such a system provides a lot of information and prevention in real-time, it still does not work in Serbia. Nowadays, wars, pandemics, great climates changes - floods, fires are unfortunately an integral part of our lives.

4. HYBRID RADIO

Hybrid radio combines broadcasting terrestrial digital and analogue, satellite, online connectivity and streaming content, in this way creating a new kind of platform. Apple Carplay, Android Auto, Alexa integration and Xperi are hybrid radio platforms are capable of integrating FM, DAB+, HD Radio, IP stream and podcast. When hybrid radio sense a weak radio signal, it will switch to the online, the channel will switch back from a digital (or analogue) to a radio signal will switch better reception (automatically or by request). The channel will switch back from a digital (or analogue) to a radio signal when it senses better reception. When is noise detected in the FM signal, does the switching technology transition the radio to IP technologies and broadband? RadioDNS (Domain Name System) allows for the seamless transition between the terrestrial radio signals and the mobile broadband connection and will accommodate up to 30 seconds of delay between over-the-air and streaming audio radio reception [7]. Metadata in a terrestrial radio station's signal stream can include song artist and title and streaming URLs, so the hybrid radio receiver knows where to find the streaming audio. But, sometimes the publishing of streaming URLs can create security concerns for radio broadcasters [8] [9]. The solution is that broadcasters need to register with RadioDns and publish the necessary metadata and streaming

URL information in a secure and controlled manner to ensure ease of access and consistency for the in-vehicle implementation[9]. Then develop service information (SI), which include all information on finding station logos as well as the broadband stream for the hybrid radio receiver[9]. RadioDNS allows broadcasters to make a button that would request more information about a current radio show, which might be a commercial, might be a song or a talk topic, figure 7. [9].

This implementation enables parallel processing of multiple inputs in real-time, as well as access to the corresponding components via low-and high-level interfaces (C++ and REST-API).

There are two concepts of connectivity in modern vehicles. Radio broadcasters want embedded wireless connectivity in modern vehicles. Second connectivity is through connected smartphones. Vehicles are connected over-their radio reception in addition to internet IP technologies via LTE network connections. Modems in new vehicles support two-way initiatives and it is a very good model and critical for gathering listener data. The car voice assistant is an integral part of hybrid radio that has enabled drivers to have a safe hands-free experience: making phone calls, controlling music, navigation, and used to order takeout, book service, schedule appointments. Voice technology does not provide reliable speech recognition, especially in such noisy environments. Moving vehicles are often in a loud environment. The main task of voice recognition technology is to cut through the background noise effectively.

Differences in accents or slang usage also cause inaccurate speech recognition attention is paid to technology that reduces background noise. It is importantly used to specialized microphones and speaker placement and algorithms which give voice assistants the ability to differentiate between the driver and passengers.

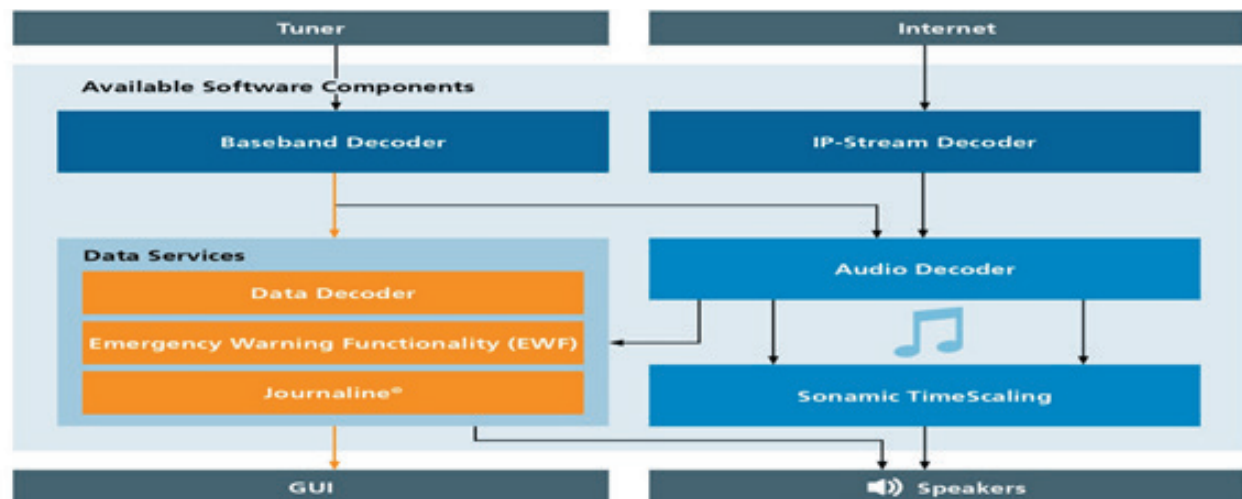


Figure 7 – Hybrid radio solution

The function of hybrid voice assistance is in figure 8. There are many important elements in all system, NLZ -natural language processing – need to answer questions and hold conversation audibly. Also a quality API -Application programming interface is necessary.

You should be avoided the scenario when the voice assistant is not responsive or the response is not accurate. Also, a database from which voice assistant the data retrieved should be able to understand accented language and speech differences [10] [11]. A hybrid model voice assistant has the advantage of being always-on[11]. Meaning that with or without cloud connectivity, or when the internet signal is weak, the driver can still enjoy the hands-free features of a voice assistant[11]. Through context awareness, the voice assistant is able to continue a conversation and remember the information

already provided[11]. In this way, users do not need to repeat themselves, and also allow the user to speak naturally and build on the conversation, without having to memorise preset phrases or constantly repeat statements [11]. New features are making voice assistant conversational hinges on a few key elements of the technology: the ability to convert speech to meaning, the availability of a large library of content domains, and the ability to understand the content of the conversation [11]. Yet, many users of voice assistants report concerns around trust, privacy and passive listening. So users still have a little distance from using all the features of voice assistance. New features are the avoidance of such as traffic jams, parking information, traffic weather by simply calling a voice assistant.



Figure 8 – Hybrid voice assistant



5. TRAFFIC INFORMATION OF DIGITAL AND ANALOGUE BROADCASTING

So far we have exhibited various types of metadata through analogue broadcasting, digital and hybrid technology. In this section, we try to describe transmission time when using different techniques. We have already mentioned that digital possibilities of traffic information are not used in Serbia at the moment. We are witnessing a collapse in traffic every day, especially in Belgrade. For this reason, we will prepare an analysis based on the analysis done in other countries to show how much benefit from the introduction of new, technology capabilities that we apply. Bypass around Belgrade – Avala road, repair of roads, closing off part of the highway, traffic jams at the end of working hours, the result is that drivers have no idea, information and solution how to avoid traffic jams. We performed an analysis of what would happen if we had the possibility of traffic information via digital hybrid receiver using digital DAB+ technology. Mention and analyze the important parameters, first of all, the response time and capacity needed to store all relevant information.

Get the right information and they have to be created in real-time. It takes an analysis of the time it takes for traffic information to reach each car. As it would look in Serbia will see in the analysis ahead of DAB+-TTI, FM-TMC, FM-DARC [12]. Time to delivery in FM system is very long up to 2 hours. related information. It is not acceptable for the speed of information that drivers should receive.

Metadata DARC in FM system is located above RDS frequency carrier Figure 9. A system that gives as a solution is a DAB+ system and metadata TTI. Time to delivery up to 3 minutes depending on the bit rate. An important part of TTI implementation is service provider TTI messages. The service provider should have a kind of filtering out functionality for the relatively unnecessary information. Filtering information is important to get application (metadata) parking information and congestion and travel time in real-time.

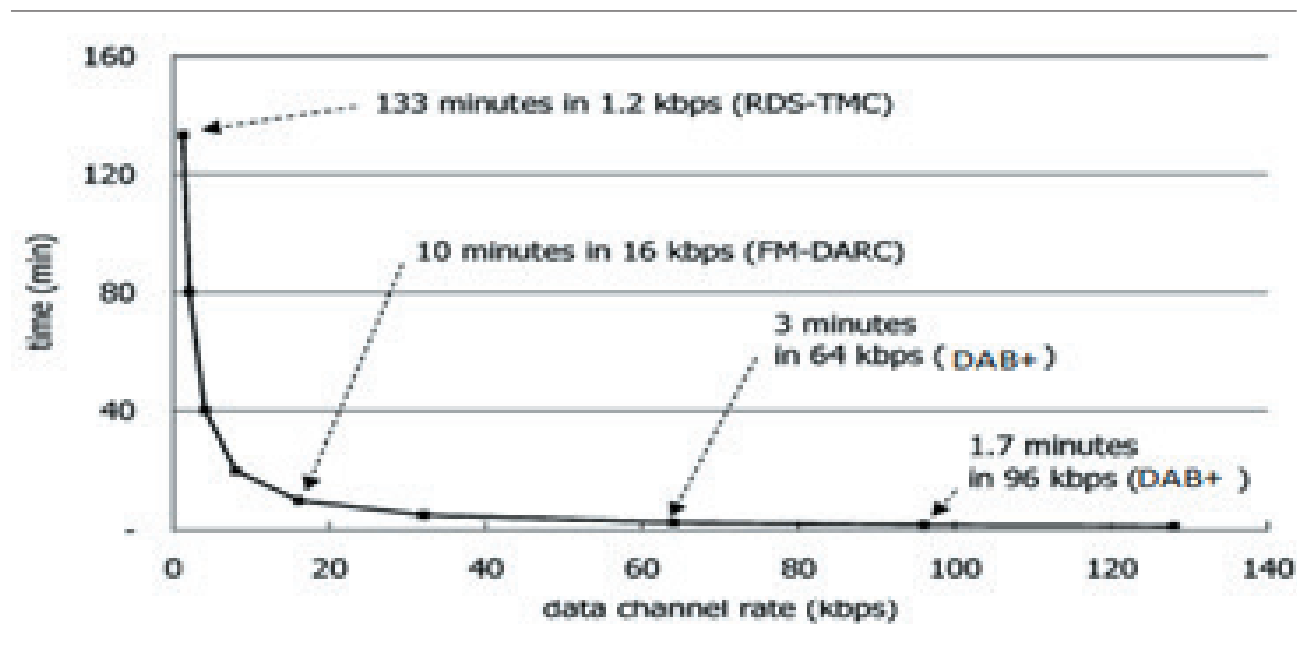


Figure 9 – Comparing transmission system for traffic information

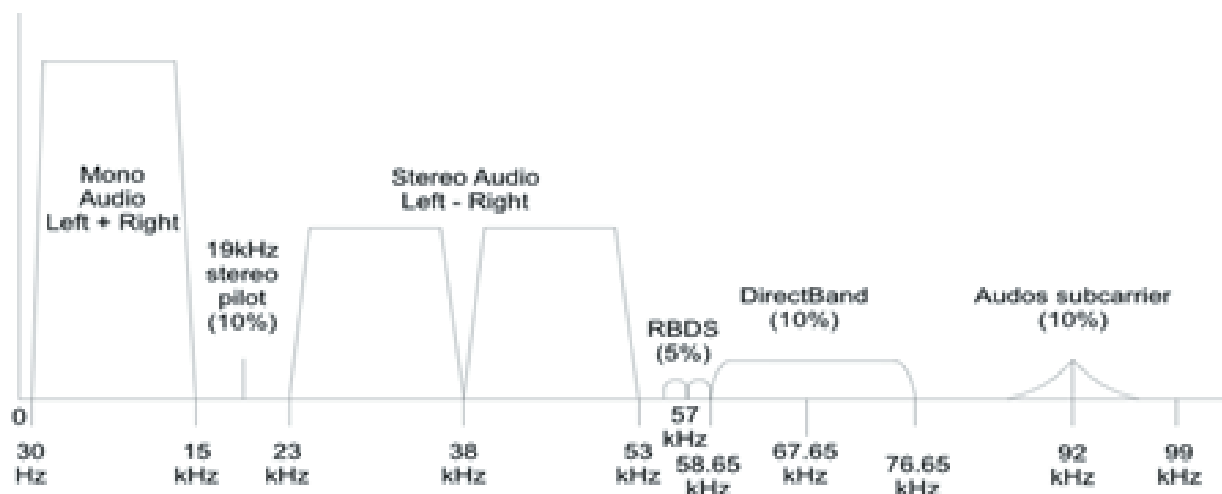


Figure 10 – FM spectrum

6. CONCLUSION

This paper represents implementation metadata in the radio world. We saw the way of implementation metadata about traffic and travel information in analogue, digital and hybrid radio. At this moment hybrid radio is in a trend and uses all sources. In it is a digital radio, analogue radio, internet steaming and all traffic and travel information is available in every system.

The advantage of an analogue system is that it has an extensive network, listener habits and the simplicity of the metadata system. But the analogue system is slow, has low capacity and has too low a possibility for new features. Digital radio is faster, too high capacity, has great opportunities, low latency. But at present hybrid radio give as best features united with digital radio, analogue radio and IP/wireless technology. Also, a voice assistant who can help avoid traffic jams and find parking spaces to avoid road accidents, unforeseen weather conditions, major disasters. This technology uses traditional technology – FM ST analogue, modern technologies DAB, DAB+, DMB and popular internet streaming. Serbia should build its position through the metadata of traffic information and emergency warning functionality through hybrid radio and voice assistants and applications that support it. By using traditional technologies and adopting new ones, we will make the most of existing resources and get the desired and necessary information.

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