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Abstract: This document serves as a draft for Bucharest Public Safety Scenario.

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Glossary

Acronym	Meaning
BBU	Aurel Vlaicu International Airport
BTMS	Bucharest Traffic Management System
CCSS	Central Command Supervision System
CCTV	Closed-circuit television
CDMA	Code division multiple access
CFR	Romanian Railroads Company
ESMSBM	Emergency Situations Management System of Bucharest Municipality
FO	Fiber Optic
GSM	Global System for Mobile Communications
GIS	Geographic Information System
IMCES	Integrated Municipality Center for Emergency Situations
ISDN	Integrated Services Digital Network
LNR	National Reference Laboratory
MEF	Ministry of Environment and Forests
OTP	Henri Coanda International Airport
PABX	Private automatic branch exchange
PSTN	Public switched telephone network
PTM	Public Transport Management
QoS	Quality of Service
RATB	Bucharest Transport Company
RNMCA	National Network for the Monitoring of the Air Quality
STS	Special Telecommunications Service
Tb	Terabyte
TETRA	Terrestrial Trunked Radio
UHF	Ultra High Frequency
UTC	Urban Traffic Control
VHF	Very high frequency
W-CDMA	Wideband Code Division Multiple Access
WiMAX	Worldwide Interoperability for Microwave Access

References

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1. Introduction

The research for the completion of this document was performed collecting data via questionnaires and online interviews with the representatives from the local authorities in Bucharest (Mayor's office Sector 2 of Bucharest) and websites.

1.1 Purpose of the document

The document intends to identify the existing situation in Bucharest by gathering data about the current state of the art Public Safety systems in the analyzed city, as well as the needs/functionalities not covered by the actual systems combined with ongoing initiatives and future ideas for the improvement of the current situation.

1.2 Scope and structure

SafeCity framework is envisaged to help Public Safety organizations collecting, sharing and analyzing data more effectively in order to make smarter real time decisions while planning and responding from incidents and emergencies. SafeCity is focused on four main areas depending on their functionality: Situational awareness detecting anomalous behavior of citizens & vehicles, Ad-hoc network usage to enable access anywhere, Alerting citizens' capabilities and Command and control capabilities.

A distinctive chapter deals with current challenges in what concerns Social, Ethical and Legal implications resuming the European directives and national laws covering this aspect.

2. Bucharest general overview

Bucharest is the capital city, cultural, industrial, and financial centre of Romania. It is the largest city in Romania, located in the southeast of the country, at 44°25’57’’N 26°06’14’’E, and lies on the banks of the Dâmbovița River.[1]

According to January 1, 2009 official estimates, Bucharest has a population of 1,944,367. The urban area extends beyond the limits of Bucharest and has a population of 2 million people. Adding the satellite towns around the urban area, the metropolitan area of Bucharest has a population of 2.15 million people. According to unofficial data, the population is more than 3 million. Bucharest is the 6th largest city in the European Union by population within city limits. [2]

Figure 1 – Bucharest population density

Approximately 96.9% of the population of Bucharest is formed of Romanians. The second largest ethnic group being is Roma (Gypsies), which make up 1.4% of the population. Other significant ethnic groups are Hungarians (0.3%), Jews (0.1%), Turks (0.1%), Chinese (0.1%) and Germans (0.1%).

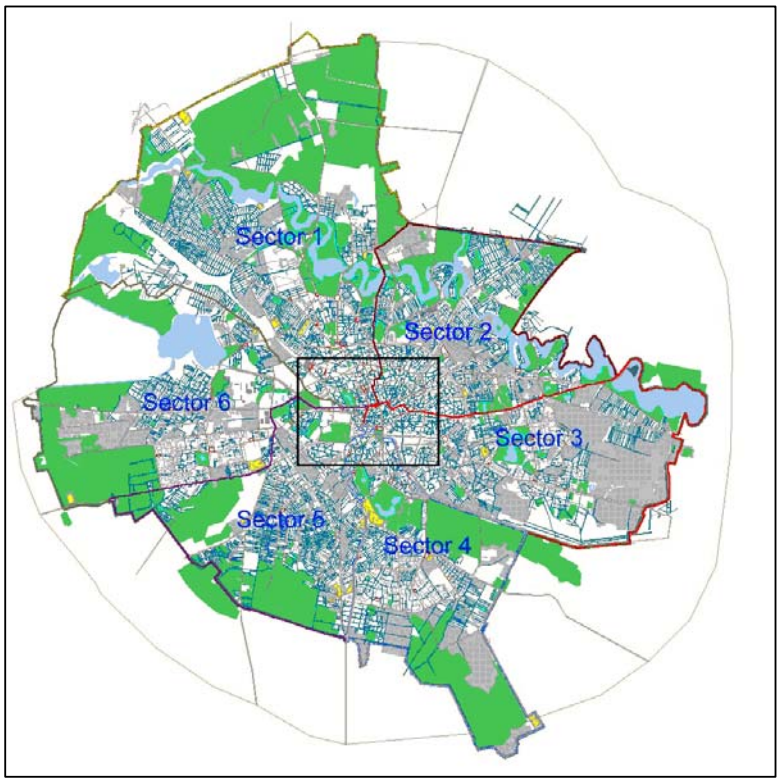
In terms of religion, 96.1% of the population are Romanian Orthodox, 1.2% are Roman Catholic, 0.5% are Muslim and 0.4% are Romanian Greek Catholic. Despite this, only 18% of the population, of any religion, attend a place of worship once a week or more.

The city has a total area of 226 square kilometers (87 sq mi). The altitude varies from 55.8 meters (183.1 ft) to 91.5 m (300.2 ft). The city has a relatively round shape, with the centre situated approximately in the cross-way of the main north-south/east-west axes. Bucharest's radius, from University Square to the city limits in all directions, varies from about 10 to 12 km (6.25–7.5 mi).

Bucharest's crime rate is rather low in comparison to other European capital cities, with the number of total offenses declining by 51% between 2000 and 2004. The violent crime rate in Bucharest remains very low, with 11 murders and 983 other violent offenses taking place in 2007.

The social-economic crisis determined an increase in the number of crimes, especially at street level. Petty crimes accentuate the uncertainty level of population, leading to a lack of reaction from the citizens: only 10.8% of the crime witnesses notify the police and offer the necessary information to the authorities.

Economically, Bucharest is the most prosperous city in Romania and is one of the main industrial centres and transportation hubs of Eastern Europe. The city has a broad range of convention facilities, educational facilities, cultural venues, shopping arcades and recreational areas.



The city is administratively known as the Municipality of Bucharest, and has the same administrative level as a county, being further subdivided into six sectors (Figure 2).

Network operators: RCS-RDS, Romtelecom, Orange, Vodafone, Cosmote.

Fixed broadband Internet subscribers per 100 inhabitants - 13.05.

Mobile cellular subscriptions per 100 inhabitants - 95.2.

Figure 2 – Bucharest administrative sectors

2.1 City areas

Bucharest is situated in the south eastern corner of the Romanian Plain, in an area once covered by a large forest, and even after its clearance there are still some reminiscences of the forest which have been turned into parks. Several lakes – the most important of which are Lake Herăstrău, Lake Floreasca, Lake Tei, and Lake Colentina – stretch across the northern parts of the city.

There are 16 public universities in Bucharest, the largest of which are the University of Bucharest, the Bucharest Academy of Economic Studies, the Carol Davila University of Medicine and Pharmacy, and the Politehnica University of Bucharest. These are supplemented by 19 private universities and they all come together with student campuses and other facilities.

In recent years, the city has been experiencing an economic and cultural boom. Numerous malls and large shopping centers have been built since the late 1990s, such as AFI Palace Cotroceni, Sun Plaza, Băneasa Shopping City, Plaza Romania, Liberty Center and Unirea Shopping Center. There are also a number of major international supermarket chains such as Carrefour, Cora and METRO operating in Bucharest. There are also a large number of traditional retail arcades and markets such as the one at Obor.

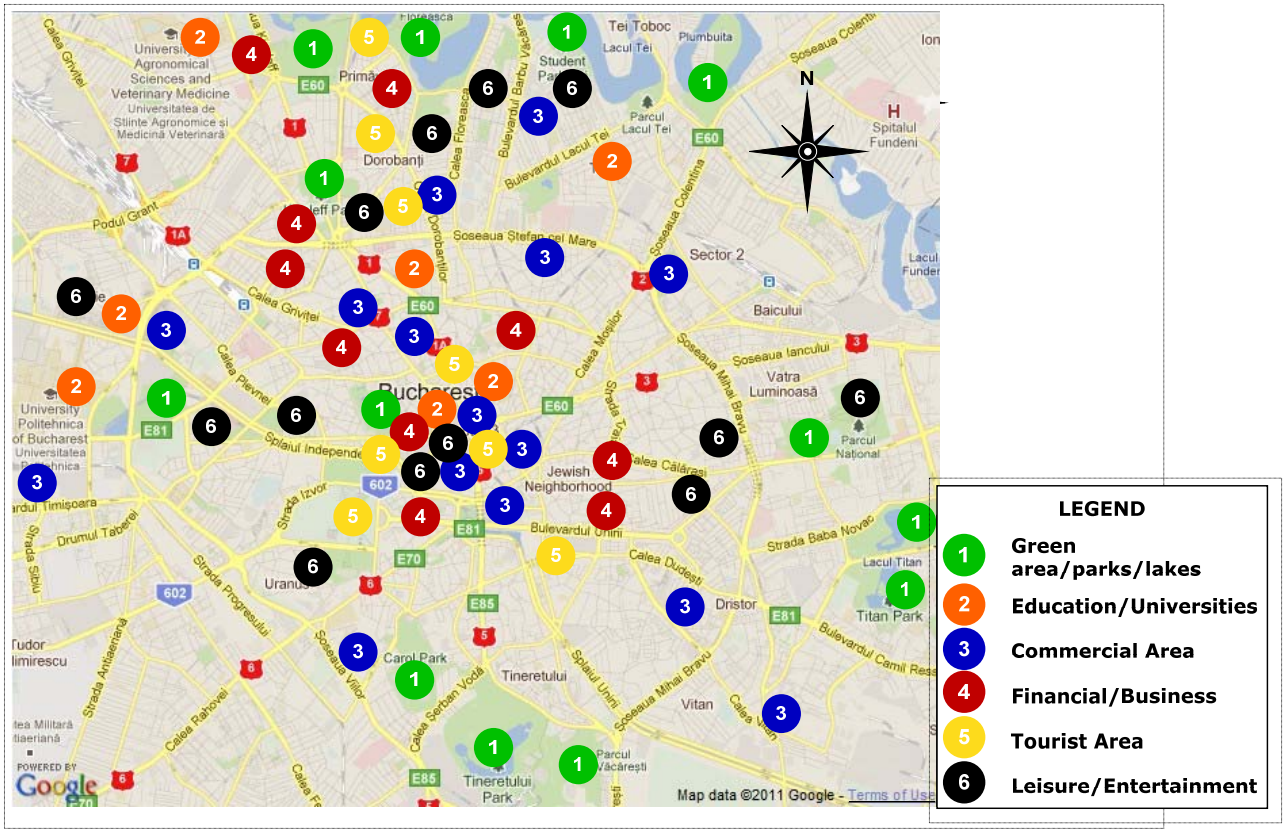


Figure 3 – Bucharest city areas

As of 2005, there are a significant number of office buildings in construction, particularly in the northern and eastern parts of the city. Romania's largest stock exchange, the Bucharest Stock Exchange plays also a major role in the city's economy. Aside from buildings used for business and institutions, various new residential developments are currently underway, many of which consist of high-rise office buildings and suburban residential communities. These developments are increasingly prominent in northern

Bucharest, which is less densely-populated. Bucharest also is the home city of Romanian National Bank and all major European banks have their headquarters throughout the city.

Bucharest has a large number of landmark buildings and monuments and the number of tourists increases every year. Also since July 2011 Bucharest has also a functional route of double-decker buses for touristic purposes.

Football is the most widely-followed sport in Bucharest, with the city having numerous club teams, some of them being known throughout Europe. Four Bucharest-based football teams have also their stadiums throughout the city. Also the new national stadium inaugurated in 2011 has a capacity of nearly 55,000, making it one of the largest stadiums in Eastern Europe.

Starting in 2007 Bucharest has hosted annual races along a temporary urban track surrounding the Palace of the Parliament, called Bucharest Ring. The competition is called the Bucharest City Challenge, and has hosted FIA GT, FIA GT3, British F3, and Logan Cup races.

Every autumn, Bucharest hosts BCR Open Romania international tennis tournament, which is included in the ATP Tour. The outdoors tournament is hosted by the tennis complex BNR Arenas. The ice hockey games are held at the Mihai Flamaropol Arena, which holds 8,000 spectators. The rugby games are held in different locations, but the most modern stadium is Arcul de Triumf Stadium, where also the Romanian national rugby team plays.

2.2 Critical Infrastructures

2.2.1 Public transport

Bucharest's extensive public transport system is the largest in Romania and one of the largest in Europe. It is made up of the Bucharest Metro, as well as a surface transport system run by RATB (Bucharest Transport Company), which consists of buses, trams, trolleybuses, and light rail. In addition, there is a private minibus system. As of 2007, there is a limit of 10,000 taxicab licenses, down from 25,000 in the 1990s.[3]

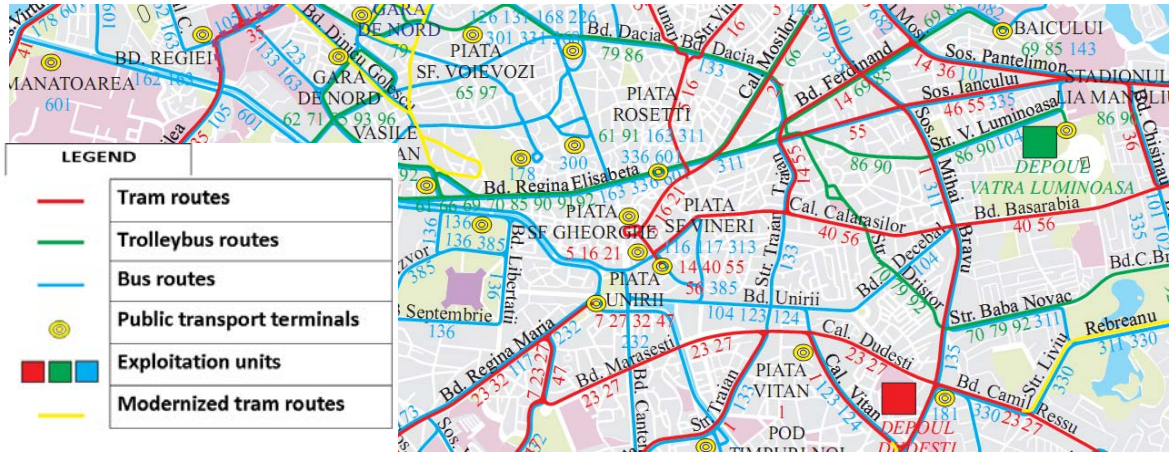


Figure 4 – Bucharest public transport network (centre)

2.2.2 Railway transport

Bucharest is the hub of Romania's national railway network, run by Romanian Railroads Company (CFR). The main railway station is North Station, which provides connections to all major cities in Romania as well as international destinations: Belgrade (Serbia), Budapest (Hungary), Sofia, Varna (Bulgaria), Chișinău (Republic of Moldova), Kiev, Chernivtsi, Lviv (Ukraine), Thessaloniki (Greece), Vienna (Austria), Istanbul (Turkey), Moscow (Russia).

The city also has five other railway stations run by C.F.R., most important are Basarab (in proximity of North Station), Obor, Baneasa, Progresu, which are in the process of being integrated in a commuter railway serving Bucharest and the surrounding Ilfov county. 7 main lines radiate out of Bucharest.

2.2.3 Air transport

Bucharest has two international airports:

- **Henri Coandă International Airport** (IATA: OTP, ICAO: LROP), located 16.5 km (10.3 mi) north of the Bucharest city center, in the town of Otopeni, Ilfov. Currently the airport has one terminal divided into two inter-connected buildings (Departures Hall and Arrivals Hall). The International Departures Hall consists of 36 check-in desks, one finger with 24 gates (14 equipped with jet ways), while the Domestic Hall has an extra four gates. Today's Arrivals Hall is actually the old Otopeni terminal, while the new Departures Hall, including the finger and the air bridges was built and inaugurated in 1997. An expansion of the finger was opened in March 2011, other expansions of Departure Hall and Arrivals Hall are underway and a new terminal on the east side is in project phase. The airport received 4,917,952 passengers in 2010.
- **Aurel Vlaicu International Airport** (IATA: BBU, ICAO: LRBS) is situated only 8 km (5.0 mi) north of the Bucharest city center and is accessible by RATB buses 131, 335, 301, tramway 5 and Airport Express 783 and taxi. An extension of Line M2 of the Bucharest Metro to Aurel Vlaicu International, which will link it to the Main Train Station and the larger Henri Coandă International Airport, was approved in June 2006 and is currently in its planning stage. In 2010, the airport received 2,118,150 passengers.

2.2.4 Roads

Bucharest is also a major intersection of Romania's national road network. A few of the busiest national roads and motorways, link the city to all of Romania's major cities as well as to neighboring countries such as Hungary, Bulgaria and Ukraine. The A1 to Piteşti and the A2 Sun Motorway to the Dobrogea region and Constanta both start from Bucharest. The future A3 and A5 motorways will radiate from Voluntari, a town in the city's northern outskirts.

The city's municipal road network is centered on a series of high-capacity boulevards, which generally radiate out from the city centre to the outskirts. The main axes, which run north-south, east-west and northwest-southeast, as well as one internal and one external ring road, support the bulk of the traffic. The city's roads are usually very crowded during rush hours, due to an increase in car ownership in recent years. Every day, there are more than one million vehicles travelling within the city. This results in occasional wear and potholes appearing on busy roads, particularly secondary roads, this being identified as one of Bucharest's main infrastructural problems. In recent years, there has been a comprehensive effort on behalf of the City Hall to boost road infrastructure and according to the general development plan, 2,000 roads have been repaired by 2008.

On 17 June 2011, the Basarab Overpass was inaugurated and opened to traffic, thus completing the inner city traffic ring. The overpass took 5 years to build and is the longest cable-stayed bridge in Romania and the widest such bridge in Europe; upon completion, traffic on the Grant Bridge and in the North Station area became noticeably more fluid.

2.2.5 Subway

The metro network has four lines (M1, M2, M3, M4) and covers the city quite extensively.

Line **M1** starts in the eastern part of the city and then goes through the downtown on a circular route, passing by the main train station *Gara de Nord* and meeting up with the **M2** line (which runs north-south) at *Piaţa Unirii* and *Piaţa Victoriei* stations. Line **M3** links the western and eastern parts of the city.

The central section on the **M3** between *Eroilor* - *Nicolae Grigorescu* is shared with **M1** and trains from both lines run in tandem having the terminus displayed at the front of the cab. Line **M4** is a short shuttle line starting from *Gara de Nord 2* going to *Parc Bazilescu* in *Bucureştii Noi* neighborhood (as of 2011).

Figure 5 – Pipera Metro Station

Network features

- Metro tracks (main): 4;
- Network length: 69.25 km double rail;
- Depot: 4;
- Stations No. : 51;
- Average distance between two stations: 1.5 km;
- Station's length: 135 – 175 m;
- Station average depth: 12 m;
- Gauge: 1432 mm;
- AFC with magnetic card from 1995, upgraded on 2000. From 2006, together with RATB a functional platform was made to allow common transport titles, this being first phase of Metro-RATB tariff integration.[4]

Operation Park:

- 44 trains type Bombardier type
- 33 trains IVA type

Operation interval:

	Lane 1	Lane 2	Lane 3	Lane 4
On rush hours: 07:00 – 09:30; 16:00 – 20:00	6-7 min.	3-5 min.	6-7 min.	7 min.
Rest of the day	8 min.	9 min.	8 min.	10 min.

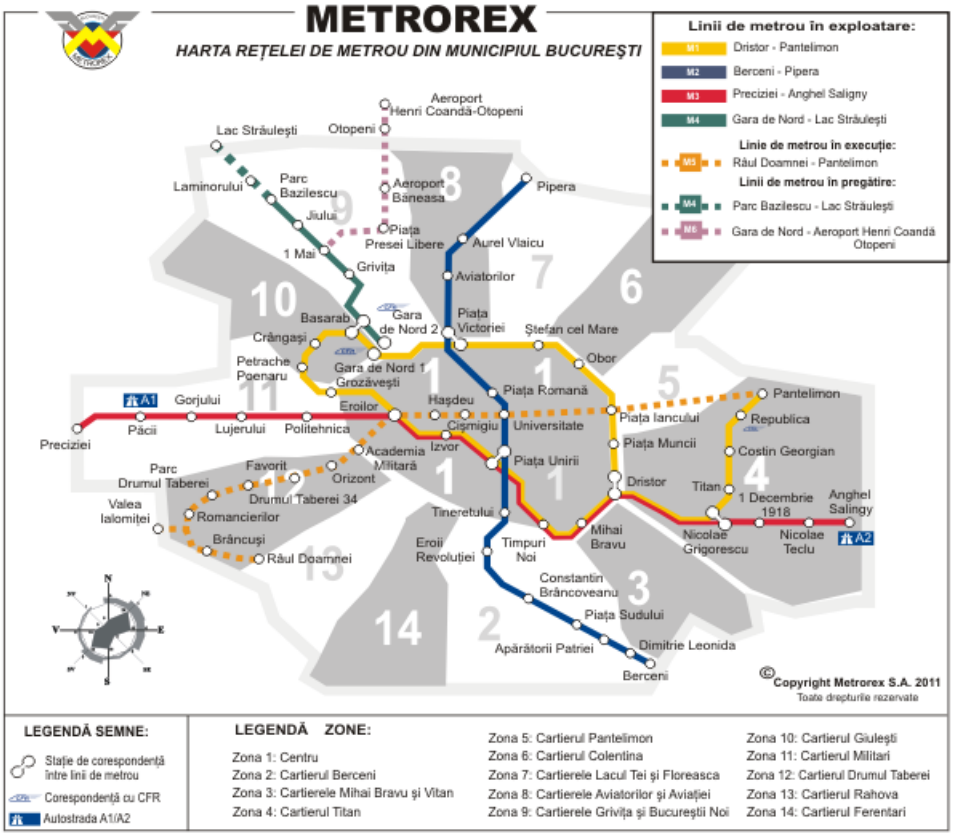


Figure 6 – Bucharest Metro

2.2.6 Water transport

Although it is situated on the banks of a river, Bucharest has never functioned as a port city, with other Romanian cities such as Constanța and Galați acting as the country's main ports. However, the Danube-Bucharest Canal, which is 73 km (45 mi) long, is currently in construction and is around 60% completed. When finished, the canal will link Bucharest to the Danube River and, via the Danube-Black Sea Canal, to the Black Sea. This corridor is expected to be a significant component of the city's transport infrastructure and increase sea traffic by a large margin.

2.2.7 Landmarks/Emblematic buildings

Bucharest has a large number of landmark buildings and monuments.

Perhaps the most prominent of these is the **Palace of the Parliament**, built in the 1980s. It is the second largest administrative building after the Pentagon (in surface) and the third largest (in volume) after Cape Canaveral and the Great Pyramid in Egypt. It has 12 stories over ground (86 meters) and 8 stories underground (92 meters) and an immense anti nuclear bunker. Number of rooms is also impressive: 1100, from which 440 offices, 30 halls, 4 restaurants, 3 libraries and a concert hall.

Another well-known landmark in Bucharest is **Arcul de Triumf** (The Triumphal Arch). Raised in 1922 to commemorate Romania's Great War dead, the original construction was of wood, replaced by the present, Petru Antonescu designed concrete structure in 1935. Standing 25 meters high, the Arc has a staircase that allows visitors to climb to the terrace on the top of the monument.

The Triumphal Arch in Bucharest is about half the size than the Paris' one, and at the intersection of six streets rather than twelve like in Paris.

A newer landmark of the city is the **Memorial of Rebirth**, a stylized marble pillar unveiled in 2005 to commemorate the victims of the Romanian Revolution of 1989, which overthrew Communism.

The **Romanian Athenaeum** building is considered to be a symbol of Romanian culture and since 2007 is on the list of the Label of European Heritage sights.

Other cultural venues include the **National Museum of Art of Romania, Museum of Natural History "Grigore Antipa", Museum of the Romanian Peasant (Muzeul Ţăranului Român), National History Museum,** and **the Military Museum**.

As Bucharest is the first political and administrative centre of the country, it is also the resident place of the **Presidency**, the **Parliament**, the **Government**, and the headquarters of many political parties, cultural and educational institutions, financial and commercial institutions and banks.

2.2.8 Health infrastructure

Bucharest has 6 designated emergency hospitals and a modern ambulance service, plus a large number of additional public and private hospitals, clinics, and dental practices.

SMURD is an emergency rescue service based in Romania. SMURD is the Romanian acronym for "Serviciul Mobil de Urgenţă, Reanimare şi Descarcerare", that means *Mobile Emergency Service for Resuscitation and Extrication*.

SMURD is a complementary service, with a lot of bases in the whole Romania, still expanding, that services the worst emergency cases in a good collaboration with the traditional Ambulance. Also HEMS (helicopter emergency medical system) has been implemented in Bucharest.

The emergency system is based on the 112 emergency numbers, now used in Romania for all the emergencies (police, firefighters, ambulance).

2.2.9 Water supply, sewers and electricity grid

The water used to produce the drinking water supplied in Bucharest is caught from the rivers Argeş and Dâmboviţa and treated in three water treatment and water plants (Rosu, Arcuda and Crivina).[5]

From the treatment plants, water is carried by aqueducts to the **drinking water tanks** and then supplied to the population through pumping stations. Drinking water is pumped from the tanks by means of **7 pumping stations**: Grozăveşti, Sud, Drumul Taberei, Nord, Griviţa, Preciziei, Uverturii.

The water supply network of Bucharest is ring type. The supply network has been continuously developed since 1847 to measure 2,407 km in 2009.

The city of Bucharest has a complex sewer system. The main elements of the single sewer system of Bucharest are:

- over 100.000 building sewerage connections, with a total length of approximately 800 km;
- approximately 61.000 inspection chambers;
- approximately 2.100 total length of the sewerage network (service lines, collector channels);
- approximately 42.000 rainwater drains, with a total connections length of approximately 210 km;

- 23 pumping stations;
- the wastewater facilities underneath the Dâmboviţa riverbed (under the responsibility of Apa Nova Bucharest as from 17.05.2011);
- The Glina Wastewater Treatment Station (Bucharest Municipality project, under construction).

In Bucharest there are 36 thousand kilometers of distribution network and installations making possible the distribution of energy to the consumers. More than a quarter of the cables are more than 30 years old. Moreover, in the city center they have been installed more than a half of century ago.

2.2.10 Command and control centers

- **Emergency Situations Inspectorate** has the responsibility to intervene in case of fires, floods, earthquakes, chemical and CBRN accidents. They have a number of intervention units spread throughout the city.
- **BTMS** is a modern system for the management of the road traffic implemented by Bucharest Municipality
- **Bucharest Ambulance Center** deals with the intervention in case of medical emergencies. Each of the 6 sectors of Bucharest has its own ambulance units connected to the center.
- **Civil Protection Center** ensures the protection of the population, their goods, cultural values and environment, in case of war and disasters
- **Environment Center** deals with the monitoring of the air quality at city level. The center has also spread throughout the city 8 continuous monitoring stations.

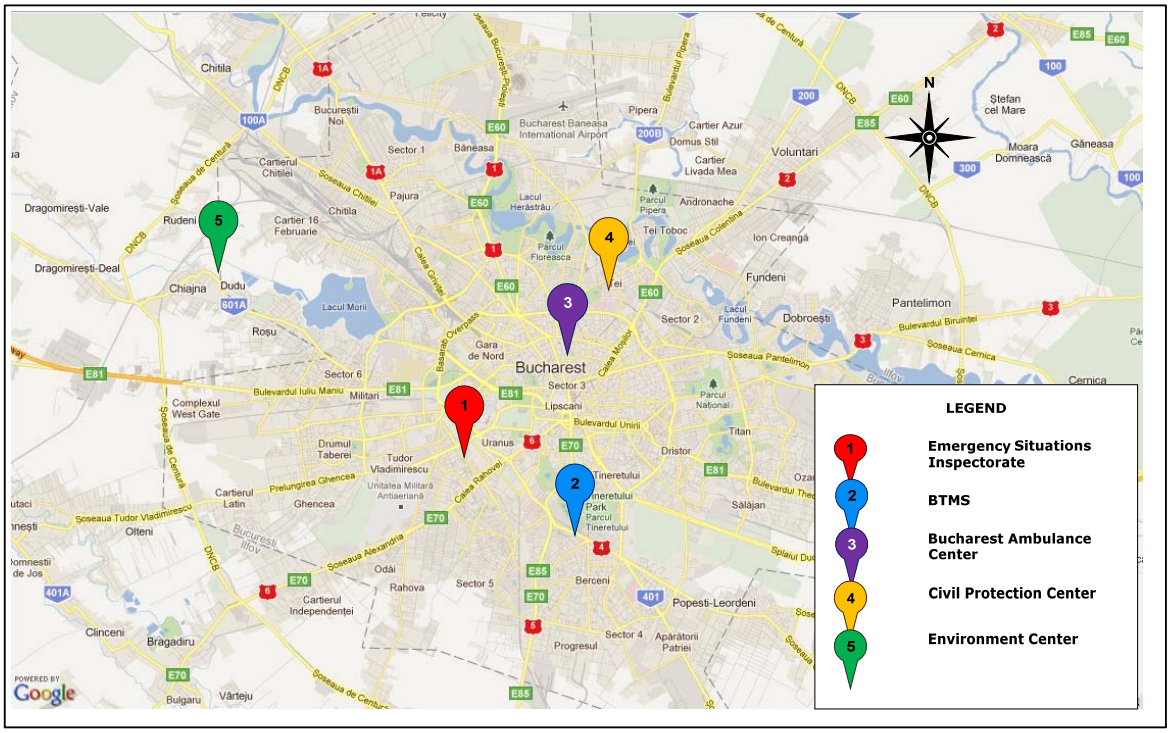


Figure 7 – Command and Control Centers map

2.3 Communication Infrastructures

This point aims at describing the information and communication technology (ICT) of the city with particular regard to the infrastructure around telecommunications and Internet provision. The research should cover private (used exclusively by public administrations, Public Safety agencies or emergency services) and public infrastructures that provide network connectivity.

2.3.1 Public ICT Infrastructures

This point describes the ICT infrastructure that provides network connection to the general public. For instance, key wired connections, as fibre infrastructure indicating area where it is deployed, and wireless infrastructure (2G, 3G, UMTS, HDSPA, LTE, Wifi, Wimax). For each wireless technology, the research should include the areas of the city which may not be well served by suppliers for commercial or technical reasons or may be out of coverage of base stations. In addition, major network operators should be identified.

2.3.1.1 Mobile communications

During the last decade there have been a lot of changes in Romanian mobile communications market. Before 2007, the four main operators were Orange (owned by France Telecom), Vodafone, Cosmote (owned by OTE) and Zapp Mobile (Telemobil). At the end of 2007, a fifth operator DigiMobil (owned by RCS&RDS) entered the market using W-CDMA technology, and in 2009 Cosmote bought Zapp Mobile, and the integration of the two networks was required, a process lasting between 2 and 4 years.[6]

Moreover, a license for mobile communications was approved for the traditional fixed communications operator Romtelecom within frequency 410-415/420-425 MHz. Thus, Romtelecom was able to develop and operate a wide frequency range as well as to provide wide frequency range services using CDMA.

Mobile communications market is thus serviced by 5 mobile operator companies using a mixed of technologies GSM, CDMA and W-CDMA (the three GSM operators are Orange, Vodafone and Cosmote). In Romania there are no virtual mobile network operators (MVNOs).

All network operators except Romtelecom activate in W-CDMA-2100. Romtelecom and Cosmote also use CDMA-410 and CDMA-450 and Vodafone is at the beginning stage of operating W-CDMA-900. Vodafone, Orange and Cosmote have GSM networks operating in the frequencies 900MHz and 1800MHz.

Mobile telephony market in Romania has one of the highest penetration rates in Europe; in June 2010, mobile connections number in the country was of approximately 29.686 million, a penetration of 135.8%. Out of the mobile telephony operators, Orange and Vodafone had the highest penetration rates, followed by Cosmote and DigiMobil.

2.3.1.2 UMTS/HSDPA/LTE

- Vodafone Romania launched 3.5G on 6 October 2006, with initial coverage restricted only to Bucharest. Current coverage includes 23 cities.[7]
- Orange Romania announced the launch of HSDPA in 10 cities by the end of June 2007, starting at speeds of 3.6 Mbit/s.
- Cosmote Romania (formerly Zapp Mobile) launched services on its Romanian 2100 MHz network at the end of June 2008. The platform is based on UMTS/HSDPA solutions provided by ZTE and is mainly be used for offering high-speed wireless data services across Romania. At

launch, the network was already operational in 19 major towns and cities, including Bucharest, Timisoara, Iasi, Cluj, Brasov, Craiova and Constanta.
- DigiMobil was from his birth in October 2007 a 3G+ service using HSDPA. They started deploying modems on the market in late 2009 - early 2010.

2.3.1.3 WiMAX

Starting from 2010, National Radio communications Company (RADIOCOM) based on a license in the frequencies 3,6 GHz-3,8 GHz started implementing WiMAX network in Bucharest (49 antennae in place by the end of 2010) and other 17 cities across the country.[8]

2.3.1.4 Wi-Fi

Wi-Fi is also present in Bucharest in many places due to the independent cafes, restaurants, hotels and shopping malls implementing the Wi-Fi solution as a supplementary service for their customers. In the same time, the city council started opening Wi-Fi hotspots in parks (3 parks fully covered) and other public areas.

2.3.1.5 Optical Fiber Network

In 2010, Bucharest City Council together with private investors started implementing the project NetCity which implies the installation of nearly 900kms of underground fiber optical network through Bucharest. The network will be used by all operators providing services to the citizens and/or companies.

2.3.2 Private ICT Infrastructures

This point outlines the ICT infrastructures which are managed and controlled by local authorities or Public Safety entities in order to offer security services.

2.3.2.1 STS Network

The institution providing special telecommunications services for the Romanian public authorities is called STS (Special Telecommunications Service) and is the central specialized structure, with legal status, which organizes and coordinates the activities in the special telecommunications field for the Romanian public authorities and other users as provided for by the law. The institution has a military organization and is part of the national defense system.[9]

The institution provides special telecommunications services for the following Romanian public authorities:
- The Romanian Parliament;
- The Presidential Administration;
- The Romanian Government;
- The institutions carrying out activities in the national defense, national security and law enforcement field;
- The central and local public administration;
- The Judicial Authority:
- The High Court of Cassation and Justice;
- The Public Ministry;
- The Supreme Council of Magistracy;
- The Romanian Court of Accounts;
- The Constitutional Court;
- The leading structures within the governmental and national-interest non-governmental bodies;

A high level of protection and confidentiality characterizes the special telecommunications. The activity of the Special Telecommunications Service is organized and coordinated by the Supreme Council of National Defense and is placed under the control of the Romanian Parliament, through the Defense, Law Enforcement and National Security Commissions in the two Chambers of Parliament.
As of 2011, STS implemented a WiMAX governmental network for 4 G services through an EU investment of 20 million Euro.

This network is the largest mobile IEEE 802.16e-2005 WiMAX network in Europe to date and one of the most advanced technologically, capable of truly 4th generation services above and beyond basic broadband connectivity. The network currently exceeds 1,500 base station sectors.

2.3.2.2 BTMS Network

Bucharest benefits from the newly installed BTMS (Bucharest Traffic Management System), a completely integrated system that encompasses around 100 controlled junctions.

Communications between the Control Centre and the junctions is via a dedicated Fiber-Optic network, installed across the city as part of the same project. The optical fiber network is 130km long with high availability, convergence under 50ms, and 160 switches layer 3 transport video multicasts.

3. Public Safety Characterization

The Public Safety Characterization describes the current situation at the level of Bucharest Municipality in what concerns the systems/applications in place which are used for the provision of citizen's safety.

The characterization is classified into different functionalities areas: citizen behavior, road track incident management, environmental monitoring, alerting citizens and ad-hoc network.

Each identified application is included into one of these areas, where further description of each one should be carried out: components and infrastructure deployed in the city, system architecture involved in the application, ICT requirements for the application, etc.

3.1 Area A: Citizens Behavior

Under this functionality area there are no applications at the level of Bucharest Municipality or other agencies that are aimed at detecting anomalous behavior of the citizens (e.g. monitor visualization via CCTV, pattern detection via CCTV images, etc.)

3.2 Area B: Road Track Incidents Management

3.2.1 Bucharest Traffic Management System (BTMS)

3.2.1.1 General Description

BTMS is a modern system for the management of the road traffic implemented by Bucharest Municipality. The system was deployed in order to ease the road traffic and provide priority for the intervention and public transport vehicles. [10]

The main subsystems of the BTMS are:

- UTC – Urban Traffic Control: adaptive system for traffic control 140 junctions
- PTM – Public Transportation Management: 302 RATB vehicles
- CCTV – Video monitoring system: 160 PTZ cameras
- CCSS – Central Command and Supervision System

BTMS includes a requirement to carry out physical improvements at a number of junctions, as well as the introduction of an adaptive traffic UTC sub-system. The UTC sub-system will provide coordination between signalized junctions to optimize the network in response to traffic demand and also give traffic signal priority to selected late running public transport vehicles. The metropolitan road network under pressure includes the inner ring road and the north-south routes that pass directly through the city centre.

The PTM sub-system co-operates with the UTC sub-system and traffic signal controllers in order to provide priority to (for example) selected late running public transport vehicles. PTM includes automatic vehicle location by GPS, with this information transmitted from individual vehicles over a digital radio (TETRA) voice/data network to the control centre and to a remote RATB control office. The PTM sub-system also offers potential for a future expansion including information displays at bus stops and on board vehicles.

The integrated Control Centre Supervision System (CCSS) is made up of system support modules including traffic control strategy selection, performance monitoring, reporting, fault management and communications network management. CCSS also includes a traffic and travel information module to provide passengers with network and service information via Internet.

BTMS monitors and controls the main arteries of the city and it is expected – based on results from other European cities – that adaptive traffic UTC combined with public transport priority will deliver excellent benefits to passengers.

Several tests to analyze how these systems have made public transport more efficient were carried out in April 2010. This concerned the circulation of vehicles on two bus lines. In comparison with April 2009, the half-trip duration dropped by 15% and the variation from the planned headway did not exceed 50% (in case of no vehicle-failure or lack of personnel). It comes out that the benefits of public transport are clear and numerous (reduction in time for a half-trip with direct impact on the increase of hourly transport capacity, cut in operational and personnel costs as well as enhancement of service quality by offering a fixed headway in connection with transport demand and real-time passenger information).

For these reasons, the extension of this system over the entire vehicle fleet is important and is to be achieved by end of 2011. Therefore, three distinct stages are planned for introducing BTMS: a) 770 buses, b) 300 trams and c) 266 trolleybuses besides the enhancement of fleet monitoring conditions within the Public Transport Management Dispatch Unit. [11]

3.2.1.2 Application and Infrastructure Deployment

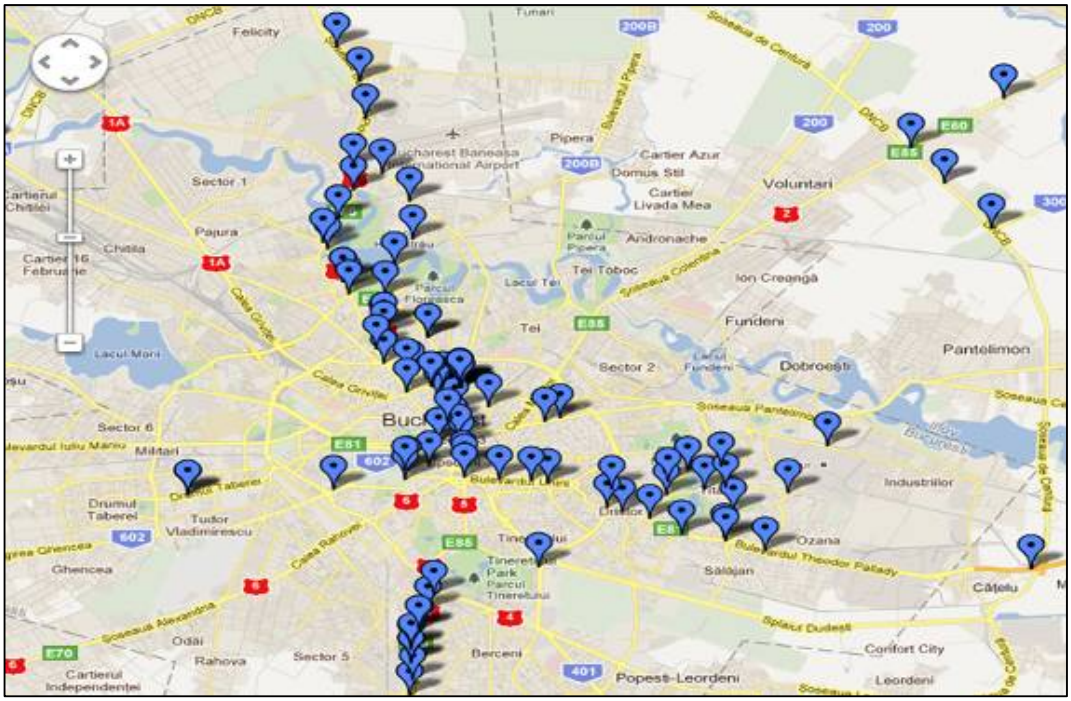


Figure 8 – BTMS Coverage Area Map

3.2.1.3 Application Requirements

- The cameras installed in the streets transmit information via fiber optic to the CCSS;
- Infrastructure: optical fiber (130km), high availability, convergence under 50ms, 160 switches layer 3 transport video multicast;
- Recording is made in the CCSS recorder;
- Recording is dedicated;
- These centralize recorders keep up to 30 days of continuous video recording, which is compliant to Romanian data protection law;
- The current bandwidth needed for the system is from 4Mbps to 6MBps;
- Since the FO network is a private one the QoS and security (privacy) is assured;
- User permissions need to be implemented;
- Data storage: 64 Tb;
- Trained/supervising personnel: 60/10;
- Energy costs: approximately 100.000 euro / year.

3.2.1.4 System Architecture

3.2.1.4.1 Architecture Diagram

3.2.1.4.1.1 PTM

- Native integration with UTC, providing priority for public transport and intervention vehicles (police, ambulance, fire fighters)
- Distributed system with components installed at vehicle and central level
- Monitoring of different public transport fleets
- Localization of vehicles and direct communication channel (data/voice) between driver and central component
- Stops and on-board public information management

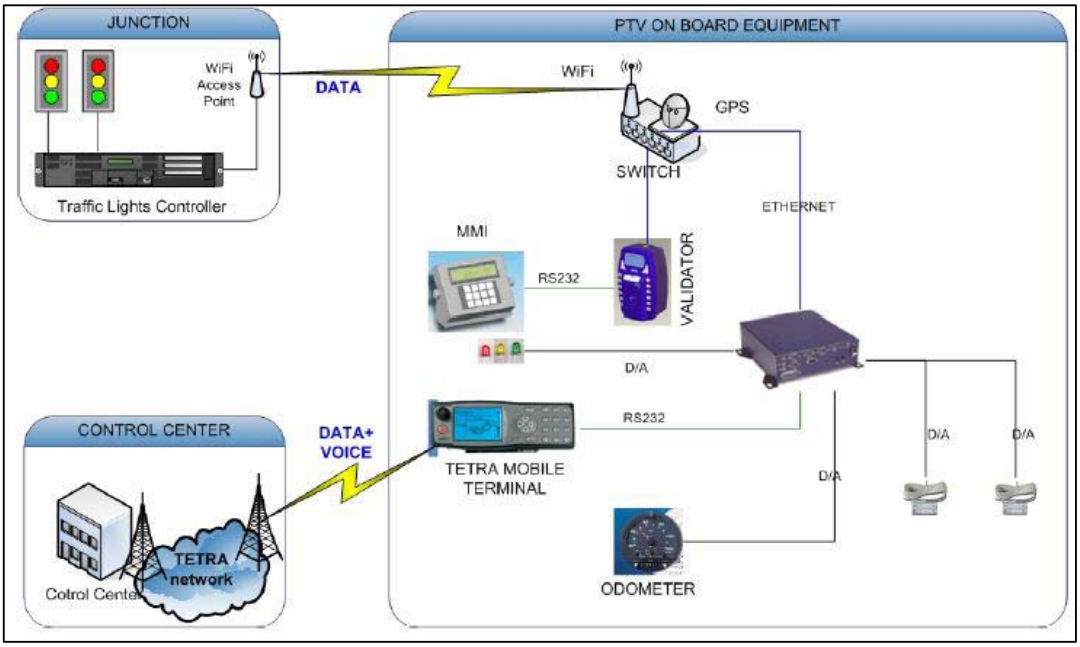


Figure 9 – PTM Diagram

3.2.1.4.1.2 CCTV

- Offers live video stream from junctions using PTX cameras
- Predefined positions, tours and privacy zones are defined for each camera
- Automatic tracking of public vehicles with automatic handover to the next camera.
- 24/7 live feed from all the monitored junctions. The video streams are kept for a period of 30 days.
- The operators can record on their computers the video streams and send it to other institutions.
- Automatic positioning of the camera when a fault of another equipment is detected at junction level.

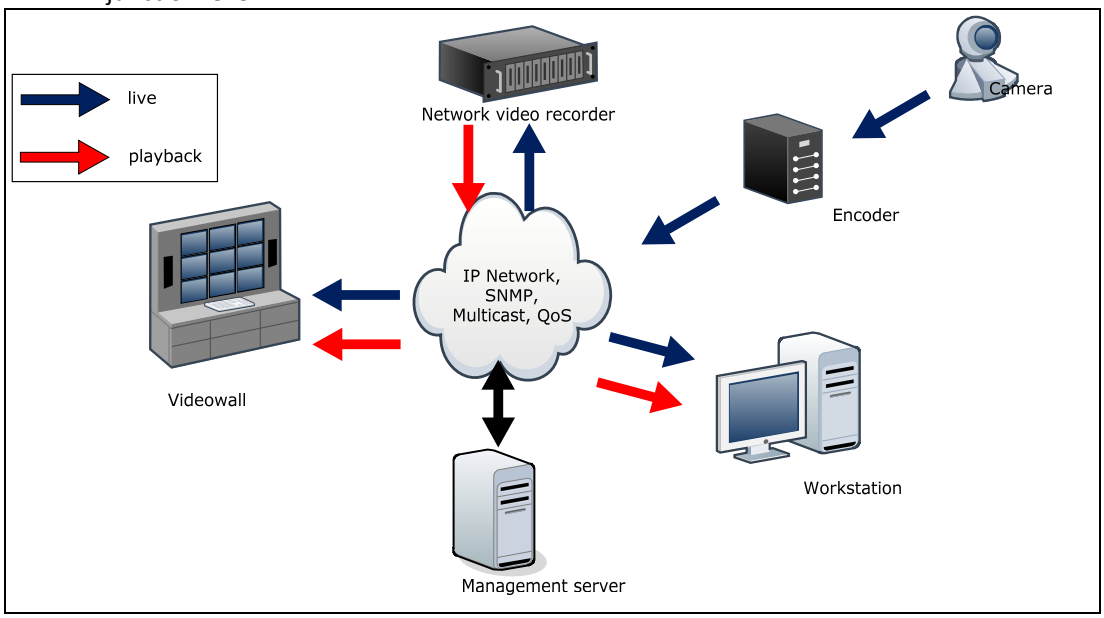


Figure 10 – CCTV video stream schematics

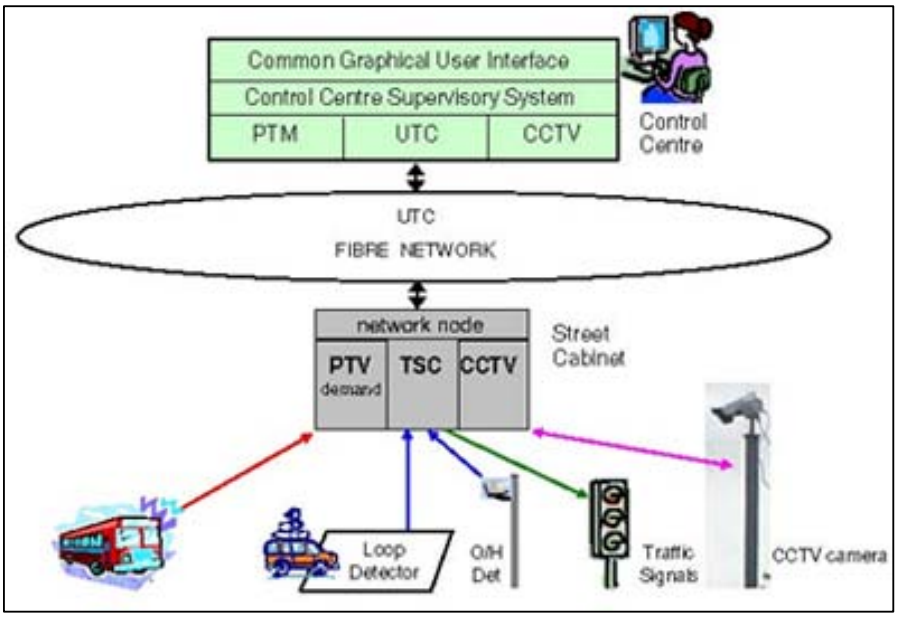


Figure 11 – CCTV diagram

The main screen of the application, installed in the CCC, is used for the viewing of the video stream (live stream or recordings):

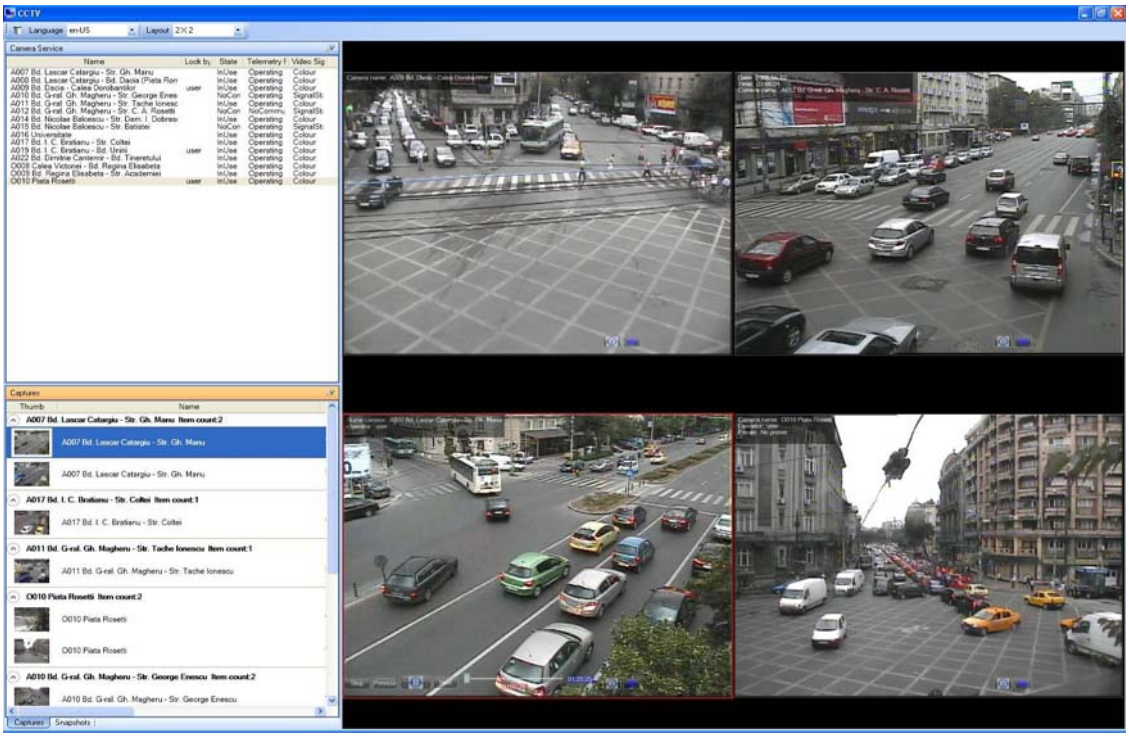


Figure 12 – BTMS operator console screen capture

3.2.1.5 Actuation Procedures

In the case of UTC the data is collected by the detectors and on the basis of the collected data run against the parameters set in advance, the remote controllers units take over the synchronization of the traffic. So the BTMS lead to a reduction of the time spent in traffic, a reduction of the pollution and of course an increased comfort for the drivers as well as for the public transport travelers.

3.3 Area C: Environmental Monitoring

3.3.1 Bucharest Air Quality Monitoring

3.3.1.1 General description

In Romania, according to the law, the environmental monitoring is provided by the Ministry of Environment and Forests (MEF).

Within the MEF it was set up an agency called National Network for the Monitoring of the Air Quality (RNMCA). The agency provides continuous measurements of sulphur dioxide (SO2), azotes' oxides (NOx), carbon monoxide (CO), ozone (O3), suspension powders (PM10 and PM2.5), benzene (C6H6), and lead (Pb). The quality of the air in each station is represented by suggestive quality indices established on the basis of the main atmospheric concentrates measured values.

In Bucharest are deployed 8 continuous monitoring stations, endowed with automated equipments for the measuring of the main atmospheric concentrates and 1 mobile monitoring center. In Bucharest

there is also a local centre, which collects and sends the data to the public information panels, and after primary validation they send them to the National Reference Laboratory (LNR).

Figure 13 – Monitoring station and information panel

Thus the monitoring of the air quality is not subordinated to the Bucharest City Council but the agency provides the municipality with air quality data when requested.[12]

3.3.1.2 System architecture

3.3.1.2.1 Architecture Diagram

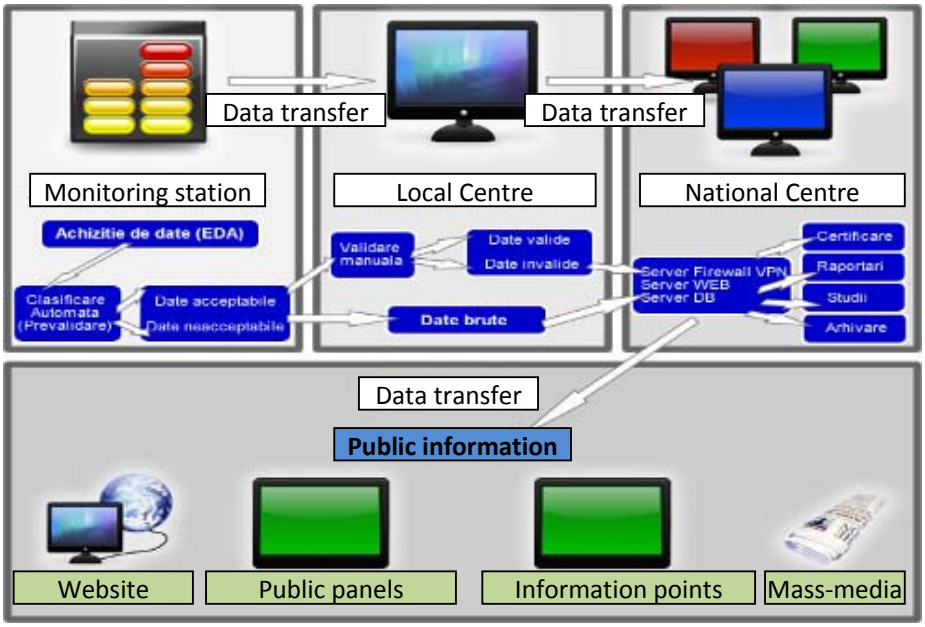


Figure 14 – Environmental monitoring diagram

3.3.1.3 Actuation Procedures

The values measured online by the sensors of the analyzers installed within the stations, are sent via GPRS to the local centers (41 countrywide). These centers are interconnected forming a network that comprises also the central servers, where all the data arrive and from there are displayed in real time for the public using a website, public display panels in the city as well as information points in the public administration building.

With the intention to inform the public promptly, the presented data are those transmitted on-line by the sensors of the analyzers installed within the stations (raw data). Thus, the values are practically validated only automated (by the software), and further the specialists within local centers will manually validate these data, and LNR will certify them.

The central database stores and archives raw data as well as the valid and certified data. The specialists access these data for different studies, as well as in order to send reports to the European Union.

3.4 Area D: Alerting Citizens

According to the Romanian Law the alerting of the citizens in cases of emergencies is provided by the General Inspectorate for Emergency Situations at the national level and by the Bucharest Emergency Situations Inspectorate at the level of Bucharest Municipality.[13]

Alerting the citizens, public institutions and economic operators is achieved through acoustic and optical signals and through communicates sent by the central and local radio and television stations and via radio amplification stations.

The acoustic signals (frequencies between 200 - 500 Hz) for alerting the citizens, public institutions and economic operators are: air raid alarm, disaster alarm, pre air raid alarm and alarm stop.

At Bucharest Emergency Situations Inspectorate are connected 10-15% of all the sirens in Bucharest and the rest of the sirens are connected at the level of each sector emergency center.

The alerting of the population via radio or television is subject to previous concluded protocols between the institutions/agencies in charge of alerting the citizens and the companies managing the radio or television stations.

In case of special situations TETRA radio stations are used and also voice and siren alarming systems.

For the other situations it is used the SMS and GSM/GPRS/UMTS. At present there are 500 operators collecting field information and sending these information through voice messages automatically recorded and the processed by a human operator.

For notifications are used the following:

- SMS – transmission capacity for SMS is of 1500-2000 messages per hour
- Voice – with a capacity of 30 simultaneous calls (approximately 500 voice messages per hour)

3.5 Area E: Ad-hoc networks

Bucharest Emergency Situations Inspectorate is currently in a tendering procedure in order to purchase a mobile integrated system of command and control that will be deployed in case of emergency situations and will be able to provide ad-hoc networks.[14]

The system will have monitoring instruments for GIS map in order to create a full tactical image of the area of the disaster. It will be based on an IT infrastructure and subsystems, hardware and communications. The base platform for the entire system is a module web-GIS that will integrate data from different sources and will overlap them in map layers obtaining a full and integrated tactical image of the area.

The dispatch system will functionally integrate a large array of communication ports:

- locally or remotely connected;

- analogical radio UHF/VHF;
- digital trunking stations TETRA;
- analogical fixed phone lines (PABX, PSTN);
- IP phones;
- audio conferences consoles;
- digital telephone lines ISDN PRI si ISDN BRI;
- mobile phones interface - type GSM, UMTS and CDMA;

Figure 15 – Mobile C2 (future project)

4. Social, Ethical and Legal implications

In the member states of the European Union, the activity of protecting personal data devolves upon authorities or institutions which are specifically set up for carrying on such competences. In order to harmonize the Romanian legislation to the acquis communitaire, the National Authority for the Supervision of Personal Data Processing was set up through the Law no. 102/2005, come into force at 12th May 2005.[15]

The independent authority status is established right in the first article of this normative act, which stipulates that the National Authority for the Supervision of Personal Data Processing was a public authority, autonomous and independent from any authority of the public administration, as well as from any natural or juridical person from the private area. According to the law, the Authority can't be subjected to any imperative or representative mandate and can't be compelled to submit to the instructions and orders of another public authority or private entity.

The Authority has the goal of protecting the fundamental rights and freedoms of the natural persons, especially the right of intimate, family and private life, in connection with the processing of personal data and the free circulation of these data

The protection of personal data represents a new field for Romania's legislative space. Its' essence regards, in a generic form, the natural person's right of protection of those specific features which lead to his/her identification and the state's correlative obligation of adopting adequate measures to ensure an efficient protection.

For this purpose, a central authority empowered with such control competence, the National Authority for the Supervision of Personal Data Processing came into existence in Romania, too. Recently set up, under the Law no. 102/2005, the Authority exerts the competence established mainly by the Law no. 677/2001, in terms of independence from any public authority or private entity.

Under the Law no. 677/2001 on the person's protection regarding the processing of personal data and the free circulation of these data, the acquis represented by the Directive no. 95/46/EC was implemented, which sets up the general juridical frame of the personal data protection at European Union level.

The competences of the National Authority for the Supervision of Personal Data Processing are specific for any institution of control, including the investigation of personal data processing conducted under the Law no. 677/2001 and the sanctioning, if it comes out that the legal dispositions were infringed by the personal data processors, as a result of self-notification or based on complaints filed by the people who's rights were infringed.

In Romania, the image and sound capturing operation is monitored and controlled by the National Supervisory Authority for Personal Data Processing.

Taking into account this opportunity, it was mentioned that personal data processing can be carried out only by controllers with the purpose of preventing terrorism, real estate insurance, for the national defense equipment, preventing the safety of persons and goods.

Controllers are obliged to notify the National Supervisory Authority for Personal Data Processing before starting a personal data processing by using video cameras and to clearly inform about the existence of the surveillance system through a standard sign.

5. Challenges in Public Safety

Currently at Bucharest Municipality level there is no integrated solution for the management of the public safety on a daily basis or in case of emergency situations. Thus the challenge for the Bucharest Municipality is to create such a system in order to have a clear and complete image of the public safety management.

5.1 Current Limitations and Gaps

Current limitations of the actual systems:

- Data storage is limited
- Personal needs extensive training
- Location (building) does not provide enough space for further development
- Systems interoperability – the new systems will have to be inter-operable with the actual ones

5.2 On-going innovative Initiatives

Bucharest Municipality is an area exposed both to natural risks (earthquakes, landslides and gaps, floods, dangerous meteorological phenomena, forest fires) and to technological risks (chemical accidents, nuclear accidents, large fires, and serious transportation accidents), biological risks (epidemics, epizooties etc), terrorism risks and environment risks.

Taking into account the persistence in the field of emergency situation prevention and management of a partially developed institutional system which is only temporarily operational and which is activated only upon the occurrence of an emergency situation, being unable to provide an adequate response for the new challenges and implicitly to allow for a quick reestablishment of the normal state, as well as considering the lack of adequate means and space, Bucharest Municipality is currently involved in deploying a command and control centre together with an unitary application that will manage the entire apparatus of emergency situations at the level of Bucharest.

ESMSBM (Emergency Situations Management System of Bucharest Municipality) application is aimed at developing an integrated and unitary system for the management of emergency situations at the level of Bucharest municipality, in order to reduce the social and economic vulnerability by a series of priority measures regarding certain major risks associated to this city. The project encourages and supports a global approach of the management of emergency situations and promotes a close cooperation of the responsible authorities.

ESMSBM has to be an integrated logical, information and communication system interfaced with the National Emergency Situation Management System, which interconnects all the institutions involved in the management of emergency situations, thus facilitating the access of the same to information, providing support for taking decisions both in normal everyday situations (routine) and in serious emergency situations (disasters) and assuring all the stages involved in the management of emergency situations: prevention, preparation, response and return to normal state.

The system has to select and organize various types of data collected from and disseminated to all the institutions involved in the management of emergency situations; it has to process such data so that to

allow the development and implementation of clear action plans in response to the emergency situations in case.

The Mayor's Office of Bucharest Municipality has to have a complete and complex Emergency Situation Management System which should integrate, at the level of a Unique Control Center (called the Integrated Management Center for Emergency Situations – IMCES) all the dispatching units of the various institutions and services involved in the management of emergency situations, as well as ensure an integrated, performing, safe and reliable technical and logistic infrastructure for the proper operation of the same. The project implementation will provide the bases for the extension of the ESMSBM application to the entire metropolitan area.

The Integrated Municipality Center for Emergency Situations – IMCES will include all dispatching units / operational or operative centers of the decentralized services of Bucharest municipality, including the dispatching units of other support entities.

The ESMSBM project of Bucharest Municipality is now under contracting procedure having an approximately value of 25 Million Euro and it will be implemented in 18 months.[16]

5.3 Ideas for the future

The future integrated system for the public safety management will need apart from the data received from sensors also some input from the field agents (either of municipality, or police) and, why not, from the population. Thus, taking into consideration the technology advance in the field of mobile phones, it would be useful to have a smart phone dedicated application.

This smart phone application could be used to send image/video data or GPS coordinates to the command and control centre via e-mail, in case of different abnormal previously defined aspects noticed like:

- lack of sewage covers;
- holes in the streets or side-walks;
- unprotected civil works;
- beggars, etc

5.4 Future Characterization

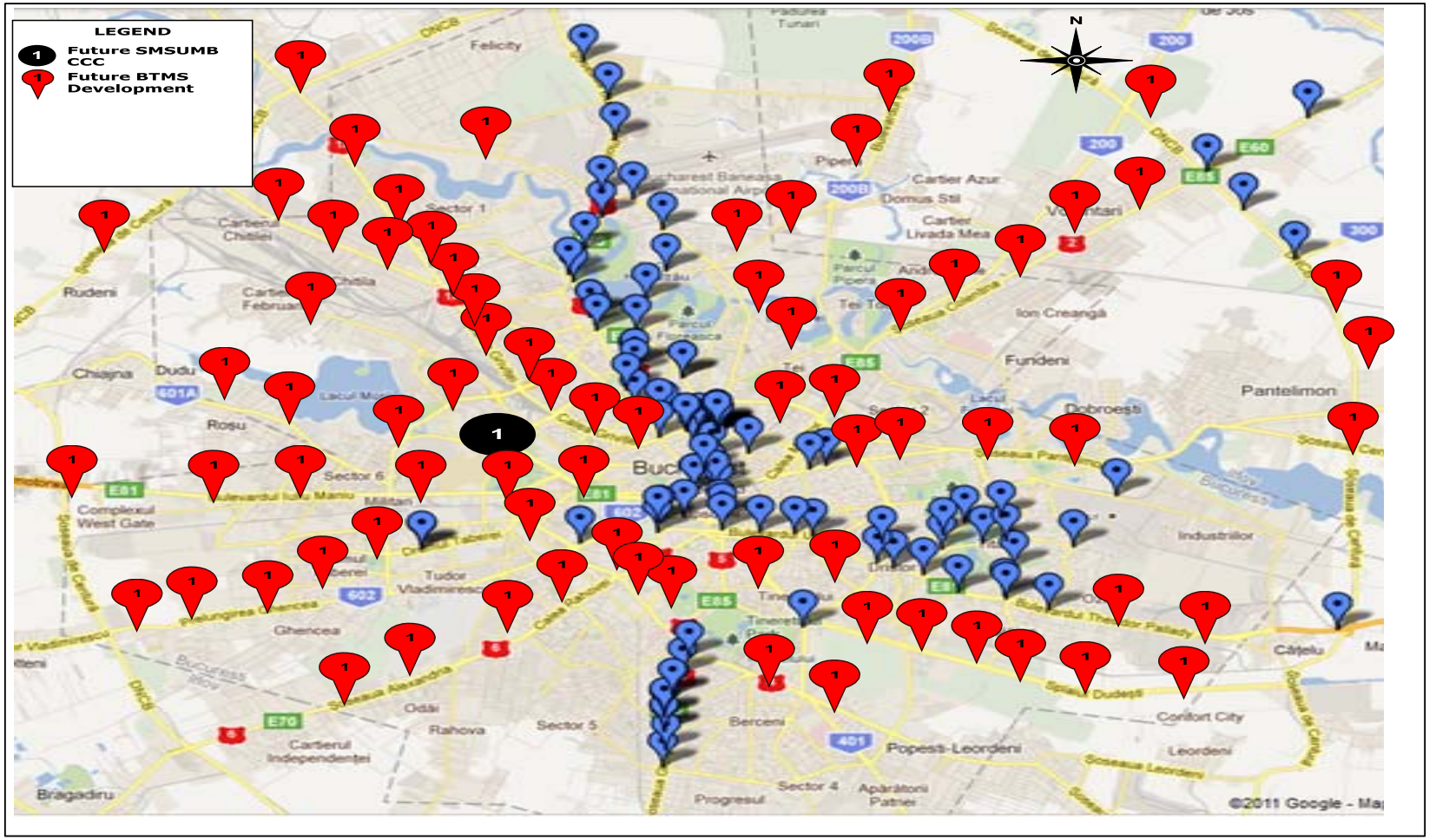


Figure 16 – Future projects map

Annex A – "Answered questionnaire"

Contact Data Collection

Information about the organization

Organization/Department: Bucharest Municipality Sector 2/IT Systems and Equipments Administration

Principal Activity: Management and administration of IT equipments

Address: 11-13 Chiristigiilor Street, Sector 2

City: Bucharest

1st Interviewed Person Information

Full name: Valentin IFRIM

Role in the organization: Director IT Systems and Equipments Administration Directorate

Email: ifrimv@ps2.ro

Telephone: +40 722 324 701

It is really important to identify and characterize **existing applications or systems** that provide Public Safety members of similar functionalities belonging to any of the 4 areas presented. Please, identify existing applications related to the different areas. For **each application** please respond the following questions:

STATE OF THE ART			
SUBJECT	**Q NR**	**QUESTION**	**ANSWER**
APPLICATION CHARACTERIZATION	Q1.	Indicate brief description of the application. In which situations/operations do you use this application? You could support your inputs with references to case scenarios and/or past incidents.	Video Surveillance and Monitoring Service was set up in order to provide public order and safety for persons and goods and includes **31 objectives** and **90 surveillance cameras**, providing the surveillance of 3 major areas of Bucharest Sector 2. Permanent monitoring and surveillance of the main intersections of Sector 2, allowed the identification of areas with high criminality potential.

STATE OF THE ART			
SUBJECT	**Q NR**	**QUESTION**	**ANSWER**
	Q2.	In which **SafeCity area** (A, B, C or D) do you frame this application?	A
	Q3.	**Actuation procedure** followed during the utilization of this application.	The assessment for 2010, revealed the fact that through the Surveillance System, have been recorded 2329 incidents, out of which 1857 involve unauthorized street commerce activities, 296 involve selling smuggled cigarettes, and 811 regarding the unauthorized commerce with food products. Also in this period have been recorded 62 road incidents, 217 public order incidents, 15 environmental incidents, 148 different other incidents. Most of these incidents translated in fines applied to the persons committing the incidents.
	Q4.	Related to your organization operations, indicate key **requirements** of this application. Paying special attention on ICT needs (e.g. Band Width, rate (bps), latency, QoS, data storage requirements, trained/supervising personnel, energy costs, etc).	Band Width: up 4 Mb/s Data storage: 64 Tb Trained/supervising personnel: 60/10 Energy costs: approximately 100.000 euro / year
	Q5.	Which concrete sensors does your organization use for this application? What is the purpose of each of them? What is the format of the output data? Are these standardized with respect to fusion processes?	Video cameras monitoring intersections and crime potential areas Export: avi
	Q6.	Is this an **automated process**? If so, up to which level? Does this include definition of data tags?	It is an **automated process,** including definition of data tags.
	Q7.	What kind of type and data are being forwarded to the citizens, regarding the original sensors outputs?	**NO** data are forwarded to the citizens

STATE OF THE ART			
SUBJECT	**Q NR**	**QUESTION**	**ANSWER**
	Q8.	How interrelated are the different families of sensors that you apply? How interoperable are the different technologies? How can one support/ complement the other? How can one affect the others in case of malfunction	Does not apply
	Q9.	**Advantages** of the use of this application.	Increase of reaction speed Statistical data and reports Identification of extrapolated patterns
	Q10.	**Gaps** detected (e.g. additional info, inefficiencies, etc). Could you categorize such limitations as being a result of: ▪ current ICT development ▪ current integration lacks (interoperability issues) ▪ not full awareness of crisis situation requirements (advanced changes) ▪ Information management and network complexity	
	Q11.	Would you see such **limitations** being corrected/refined via supported/back-up technology?	Redundancy and replication of data in data centre, processing of critical information in communication junctions
	Q12.	**Infrastructure** involved in this application (e.g. data bases, wired fibber connections, wireless standards, etc), private or public networks. Main constrains imposed by this infrastructure (e.g.data losses, network coverage, different networks interpretabilities, data security, etc.)	Databases: MS SQL 2008, Infrastructure: wired fibber connections, UMTS, WIFI. Main constrains: data storage, personal and location (building), interoperability systems.

STATE OF THE ART			
SUBJECT	**Q NR**	**QUESTION**	**ANSWER**
	Q13.	Is it Internet-based application? Does it use any internet connection?	It is a Internet-based application and uses any internet connection (FO, UMTS, WIFI)
	Q14.	Which information security policies do you use within this application?	European and national policies
	Q15.	Which ethical, social and legal policies do your organization satisfies in order to make use of this application (e.g. considering sensitive data)? How does this affect your data formats and permissions?	Adapting the internal procedures and definition of collaboration agreements with agencies and commercial partners (ex. sewages, energy, garbage, social services, etc.)

Please include the following answers regarding each specific area:

STATE OF THE ART			
AREA	**Q NR.**	**QUESTION**	**ANSWER**
AREA A: SITUATIONAL AWARENESS	Q16.	What social policies do you apply (e.g. regarding social division)?	N/A
	Q17.	Does your organization have different data sources (e.g. criminal data base)? In that case, please list them.	1. Vehicles database – Local Police Sector 2 2. Persons database – Local Police Sector 2 3. Real estate owners – Local Budget Income Directorate
AREA B: AD-HOC NETWORK	Q18.	Which communication networks are currently used between different bodies and among members of the same body (PMR, Radio TETRA, TETRAPOL, UHF, Radio, Satellite links, GSM/GPRS/UMTS, WiFi, WiMax, etc)?	Radio TETRA, GSM/GPRS/UMTS

STATE OF THE ART			
AREA	**Q NR.**	**QUESTION**	**ANSWER**
	Q19.	Does your current communication network satisfy all the needs you require to perform an efficient work when a special event or an emergency happen? Have you ever deploy portable base stations to improve covertures or capacity of the cellular network you are using? How effective is this approach (coverage, data quality, etc)? How efficient is this approach (cost/ benefit ratio)?	In case of special situations TETRA radio stations are used and also voice and siren alarming systems. For the other situations it is used the SMS and GSM/GPRS/UMTS. At present there are 500 operators collecting field information and sending these information through voice messages automatically recorded and the processed by a human operator. For notifications are used the following: • SMS – transmission capacity for SMS is of 1500-2000 messages per hour • Voice – with a capacity of 30 simultaneous calls (approximately 500 voice messages per hour)
AREA C: ALERTING CITIZENS	Q20.	Which kind of incidents or situations do you consider important to be alerted of?	1. Natural and technological catastrophes 2. Traffic restrictions 3. Massive works affecting the distribution network
	Q21.	How do you think it would be the best way to alert citizen about these incidents?	1. SMS, phone – automatically generated message 2. Voice warning system (for natural and technological catastrophes) 3. LCD screens placed in the traffic intersections leading towards areas with traffic restrictions
	Q22.	What social implications do you see arising (division, mass panic, etc) and which policies do you define in order to deal with these situations?	Natural catastrophes are the panic generators. At the level of Sector 2 intervention plans have been drafted for each type of catastrophe. For traffic restrictions there set alternative routes. For damages or works at the distribution networks the population is informed through written notifications, also indicating the period of unavailability of the respective service.
AREA D: COMMAND CENTRE	Q23.	At which level(s) of your organization, control centre technologies are used? If several levels of your organization use control centre technologies could you precise	At the level of Sector 2 there have been established commandments for each major crisis situation and they are subordinated accordingly to: Bucharest Municipality or to Bucharest Prefect's Office.

STATE OF THE ART			
AREA	**Q NR.**	**QUESTION**	**ANSWER**
TECHNOLOGIES		information managed at each level of the organization? And relation between/role of each level of the organization?	
	Q24.	What anomalous situations do you consider important to be alerted of in the Command Post (Citizen Behaviour, suspicious objects…)?	1. Natural and technological catastrophes 2. Elements possibly affecting citizens' safety (suspect packages, lack of sewer covers, streets affected by holes, large amounts of garbage piled, etc.) 3. Failure of distribution networks 4. High-risk anti-social meetings
	Q25.	What management direction do you follow regarding data fusion, distribution and overall coordination of the related processes? Mention if applicable, learned-by-experience lessons upon gradually moving to more efficient architectures.	Management system must be formed by integrating CRM (Customer Relations Management), Document Management and E-Learning System. The most important elements are the distribution of the information in the field, synthesizing capacity and equipments processing speed.
Beyond the state of the art			
AREA A Situational awareness	**Q Nr.**	**QUESTION**	**ANSWER**
Video Analytics Application	Q26.	What are the demands you pose on the operation **Video Analytics Application** (1= very important, 2=important, 3=less important, 4=unimportant) If possible, establish also some parameters related to each technical requirement:	▪ Orphan objects detection, intrusion detection, facial detection, face recognition: o [3] Distance o [4] Application environment (indoor, outdoor,…)

STATE OF THE ART			
AREA	Q NR.	QUESTION	ANSWER
			o [2] Kind of object to be detected o [1] Cross check detection with Criminal Data Bases ▪ Anomalous pattern detection: o [1] Persons o [2] Objects ▪ Tracking of: o [1] Persons o [2] Objects ▪ [1] Speed in data processing once it has been collected ▪ [2] Working autonomy ▪ [2] Cost of maintenance (sensors maintenance and operation, data storage facilities, etc.) ▪ [1] Confidentiality ▪ [3] Requirements to configure and operate ▪ [2] Justification of algorithms in defining suspicious and anomalous behaviors. How do you define suspicious and anomalous behaviours ▪ Operating o [1] On demand o [2] Continuously ▪ [1] Interconnection with other sensors (triggering

STATE OF THE ART			
AREA	**Q NR.**	**QUESTION**	**ANSWER**
			inputs / outputs). If so, specify what type of sensor/output would you find necessary? What would be a suitable shared data format? Connecting with: - GPS equipment of the city transport system and with its monitoring cameras. - Traffic monitoring systems in order to block/facilitate the traffic in the risk area.
	Q27.	Which characteristics do you consider important to define exact profile (Location, Time, Behaviour…)	
	Q28.	Evaluate how useful Video Analytics application could be to your specific organization (1= very important, 2= important, 3= less important, 4= unimportant)	1= very important
	Q29.	In your opinion, what are the challenges to integrate this application into your activities performed during prevention and preparedness phases? (connectivity, trained personnel, additional data processing, etc)?	- Interoperability of the application with the installed systems - Automated information processing - Defining the procedures for each action - Development of the infrastructure in order to take over the excess of data
	Q30.	Which scenarios you consider that would be applicable to Video Analytics application? Please refer to potential as well as past incidents applicable	Video data processing should be used to identify persons, vehicles, suspect objects (stationary more than ...), to define possible routes, identification and certification of the route switching automatically the

STATE OF THE ART			
AREA	**Q NR.**	**QUESTION**	**ANSWER**
			cameras to observe the monitored subject.
	Q31.	Given your existing experience, what social, ethical and legal implications would you see to arise? What respective policies could your organization apply in each case?	Surveillance cameras should be blocked towards private areas (house windows, special objectives etc)
Real time Positioning for Decision support Application	Q32.	What are the demands you pose on the operation **Real-Time Positioning for Decision Support Application** (1= very important, 2=important, 3=less important, 4=unimportant) If possible, establish also some parameters related to each technical requirement:	▪ [2] Distance: short range 100 m, long range: 1000-2000 m ▪ [3] Application environment ▪ [2] Working autonomy: 24-48 hours ▪ [2] Cost of maintenance: ..... ▪ [2] Reliability: ..... ▪ [1] Confidentiality ▪ [3] Requirements to configure and operate: .....
	Q33.	Which scenarios you consider that would be applicable to Real-Time Positioning for Decision Support application? Please refer to potential as well as past incidents applicable	Real-Time Positioning for Decision Support application may be used for fast identification of the incident (ex. A smart phone can send the GPS coordinates of the call or of the cell). A camera identifying an object has the GPS coordinates and the system can identify the public order units available in the area and can alert them or “demobilize” them.
	Q34.	Please precise for scenarios you describe at which operational level location information is relevant (on a local	Scenarios that require the identification of the vehicles:

STATE OF THE ART			
AREA	**Q NR.**	**QUESTION**	**ANSWER**
		PDA, on a mobile Control Command vehicle screen, on a global city control room screen? Other?) ▪ What kinds of vehicles are interesting to locate/track? In which situation? ▪ In which situation is it interesting to locate and/or track a specific person? ▪ When tracking information is not available anymore (vehicle/person goes out of the scope of cameras), would it be interesting to have some information for decision support such as re-apparition zone of the person/vehicle? ▪ What kinds of events are interesting to locate? In which situation?	- Stationary vehicles in forbidden areas, - Long time stationary vehicles (vans, delivery vehicles) in crowded areas or close to public institutions, - Vehicles declared to be stolen - Vehicles transporting potential risk persons In case the data is not complete, the command and control center should provide data regarding the last known location and possible routes. The sent data should be complete for identification: suspect photo, details regarding the vehicle, last known area (and possible routes if there is a high risk). The data should be able to be send on any available device (smart phone, mobile Control Command vehicle screen, on a global city control room screen)
	Q35.	Evaluate how useful Real time Positioning for decision support application could be to your specific organization (1= very important, 2= important, 3= less important, 4= unimportant)	1= very important
	Q36.	In your opinion, what are the challenges to integrate this application into your activities performed during prevention and preparedness phases?	Defining the work procedures for identification and the automation of decisions, where required.

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AREA	**Q NR.**	**QUESTION**	**ANSWER**
	Q37.	Given your existing experience, what social, ethical and legal implications would you see to arise? What respective policies could your organization apply in each case?	The major risk for the use of this system is the risk to be used in other purposes than the legal ones and the ones for which it was designed. In this respect, there have to be issued criteria to identify the intrusions or the use in other purposes.
Road Track and environmental sensors application	Q38.	What are the demands you pose on the operation of SafeCity **Road track & environmental sensors application** (1= very important, 2= important, 3= less important, 4= unimportant) If possible, establish also some parameters related to each technical requirement:	▪ [2] Detect unusual traffic patterns ▪ [1] Identification of incident ▪ [2] Sense critical environmental changes ▪ [1] Monitoring of structural health of bridges and buildings ▪ [1] Monitoring of inhospitable/dangerous environments ▪ Weather station o [3] Temperature o [3] Weather conditions o [3] Weather forecast ▪ Road General condition o [1] Ice o [1] Snow o [2] Rain ▪ Events and occasions o [2] Holidays and vacation periods o [3] Tourist seasons (visitors not aware with

STATE OF THE ART			
AREA	**Q NR.**	**QUESTION**	**ANSWER**
			the area) o [2] Grand seasonal events ▪ Speed in data processing once it has been collected ▪ [2] Reliability ▪ [2] Confidentiality
	Q39.	Please specify what kind of information your organization would require to receive from the respective technology, in order to foresee such risks. Please refer to appropriate case scenarios, where possible.	Data regarding meteorological warnings, major temperature changes. The identification of the areas affected by extreme weather conditions: streets blocked by snow, floods, ice, blocked junctions etc. The identification of patterns for areas and periods of traffic jams.
	Q40.	Evaluate how useful Road Track and environmental sensors application could be to your specific organization (1= very important, 2= important, 3= less important, 4= unimportant)	2= important
	Q41.	In your opinion, what are the challenges to integrate this application into your activities performed during prevention and preparedness phases?	Identification of risk areas Definition of work and intervention procedures

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AREA	**Q NR.**	**QUESTION**	**ANSWER**
Intelligent transportation system	Q42.	Would you consider an intelligent transportation system to be an important part of the city's infrastructure? Which parameters do you consider the most important? (1= very important, 2= important, 3= less important, 4= unimportant)	▪ [1] Automatic activation of breaking systems or fuel control. ▪ [1] Maintain driver and passenger comfort and safety through the use of sensors for airbags control and seatbelt pre-tensioning. ▪ [1] Use of sensors for fatigue and mood monitoring to ensure safe driving ▪ [2] Use of a broad city-wide distributed sensor network to indicate traffic flows, administer tolls or provide continually updated destination routing feedback to individual vehicles. ▪ [1] Use of global and local information, combining GPS information with cellular networks

Beyond the state of the art			
AREA B: Ad-hoc Networks	**Q Nr.**	**QUESTION**	**ANSWER**
Ad-hoc Network application	Q43.	What are the demands you pose on the operation of SafeCity **Ad-hoc Network application** (1= very important, 2= important, 3= less important, 4= unimportant) If possible, establish also some parameters related to each	▪ [2] Characteristic of devices: weight, size, robustness, accuracy, etc ▪ [2] Node time deploy

Beyond the state of the art			
AREA B: Ad-hoc Networks	**Q Nr.**	**QUESTION**	**ANSWER**
		technical requirement:	▪ [1] Kind of data ▪ [2] BW ▪ [2] Reliability ▪ [2] Supporting data storage on the field ▪ [2] Allowing sensors intercommunications in the field (in such case, please reference families of sensors of which you would consider necessary/important to be integrated on a defacto basis Automatic taking over of the coordinates for the GSM cell and the range, call triangulation, number identification.
	Q44.	Evaluate how useful Road Track and environmental sensors application could be to your specific organization (1= very important, 2= important, 3= less important, 4= unimportant) In your opinion, what are the challenges to integrate this application into your activities performed during prevention and preparedness phases?	2= important
	Q45.	Which scenarios you consider that would be applicable to Ad-hoc Network application?	- Taking over the supplementary data of the caller in a risk situation (safety, medical) in order to be

Beyond the state of the art			
AREA B: Ad-hoc Networks	**Q Nr.**	**QUESTION**	**ANSWER**
			contacted for the confirmation of the alert. - For the alerting of the citizens heading towards a high risk area Using a smart phone dedicated application, image/video data or GPS coordinates can be sent to the command and control centre via e-mail, in case of: lack of sewage covers, holes in the streets or side-walks, unprotected civil works, beggars etc.
Beyond the state of the art			
AREA C: Alerting Citizens	**Q Nr.**	**QUESTION**	**ANSWER**
Alerting Citizens applications	Q46.	Which applications do you consider useful to be part of your daily operation? Including in each case: ▪ Which requirements/demands would you have regarding to this application? ▪ Evaluate how useful this application could be to your specific organization (1= very important, 2= important, 3= less important, 4= unimportant) ▪ In your opinion, what are the challenges to integrate this application into your activities performed during prevention and preparedness phases?	Taking over the field data using any path: video, image, vocal, SMS, e-mail, from the technical personnel or from the citizens. 1= very important Defining the work procedures and intervention procedures

			Ensuring the work schedule, personnel and IT applications for the command and control center
Beyond the state of the art			
AREA D: Command Centre Technologies	**Q Nr.**	**QUESTION**	**ANSWER**
Decision Support System application	Q47.	What are the demands you pose on the operation of SafeCity **Decision Support System** (1= very important, 2= important, 3= less important, 4= unimportant). If possible, establish also some parameters related to each technical requirement.	▪ [1] Working autonomy: 24-48 hours ▪ [1] Facilitate to configure and operate: ..... ▪ [1] Reliability: ..... ▪ [1] Work distribution and decentralization:
	Q48.	Evaluate how useful Decision Support System application could be to your specific organization (1= very important, 2= important, 3= less important, 4= unimportant) In your opinion, what are the challenges to integrate this application into your activities performed during prevention and preparedness phases?	1= very important

Please indicate if you considered any other application that might not adjust to the previous areas, including:

Beyond the state of the art			
AREA D: Others	**Q Nr.**	**QUESTION**	**ANSWER**
Other	Q49.	Which applications do you consider useful to be part of	**Document management** – sending and monitoring data

applications		your daily operation? Including in each case: ▪ Which requirements/demands would you have regarding to this application? ▪ Evaluate how useful this application could be to your specific organization (1= very important, 2= important, 3= less important, 4= unimportant) ▪ In your opinion, what are the challenges to integrate this application into your activities performed during prevention and preparedness phases?	towards dispatch offices, issuing reports. 2= important System integration and interoperability **Incident analysis system –** Reports and statistical studies will be issued periodically as well as their representation with a different layer on the city map. 1= very important System integration and interoperability
Ubiquitous Sensor Network	Q50.	Would you consider important the existence of a Ubiquitous Sensor Network (USN), a term which is used to describe a network of intelligent sensors (including people with their mobile phones) that could appear everywhere? A USN can be used to provide an intelligent information infrastructure to support a multitude of different applications (utility infrastructure, buildings, roads, rails, vehicles, goods, people…) ▪ Which requirements/demands would you have regarding to this vision? ▪ Evaluate how useful this application could be to your specific organization (1= very important, 2= important, 3= less important, 4= unimportant) ▪ In your opinion, what are the challenges to integrate this application into your activities performed during prevention and preparedness phases	Informing the citizens about the risks in the area they are travelling: social meetings, civil works on city buildings, traffic restrictions etc. 2= important Collecting the data and the costs of communicating the results