

"Safe City" – an Open and Reliable Solution for a Safe and Smart City

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Abstract. Ensuring safety and security of citizens in smart cities is one of the key challenges for governments, mayors and policy makers. "Safe City" is an open and reliable solution that provides a variety of integrated operational services for a highly complex operational chain and effective deployment, not only at an individual level of a municipality, but also integration into a single, federal structure. "Safe City" offers, with its single set of information-management tools, a multi-dimensional coverage for complex and multi-functional operational tasks, a diversity of integrated systems (video surveillance and video analytics, chemical control, emergency communications, public address and general alarm, media, etc.) and support for a sustainable expansion of the present and future services (e.g., eCall, connection of public objects, telephone notification).

The presented solution builds a comprehensive and intelligent view of what happens in the smart city by unifying and integrating various events and contextual information from heterogeneous information systems into a single information space, by visualizing such information and opening communications with other systems. The decision-support subsystem makes it possible, in its automatic mode, to estimate the parameters of the system as a whole and respond efficiently to changes in the operational environment. "Safe City" is a future-oriented solution that is prepared for further adaptations according to the market and regulatory needs.

Keywords: Safe City, Smart City, Security, Emergency communications, Law enforcement

1 INTRODUCTION

In the past hundred years Europe has transformed itself from a largely rural to a predominantly urban continent, but it is more policentric and less concentrated than the USA and China. Some 56 % of the European urban population [1] live in small and medium-sized cities and towns with different development trajectories and their diversity regarding the development path, demographic and social context, cultural and economic assets.

The European Cities of tomorrow will play a key role in the implementation of Europe 2020 [2] and its seven flagship initiatives which will result in a smart, green and inclusive growth. The model of a »Smart city« and its policy rules should harmonize the role of the city as a functional place of economic activities and exchange, and the role of the city as a cultural and social place of an urban way of life. In order to achieve economic and social progress [1,2] in "Smart Cities", the public safety and security of citizens and also public and private institutions are a key issue. Ensuring safety of the city is a prerequisite for the life and work of its people, their respect for legitimate rights and freedoms, effective functioning of the management, economics, urban sector, transport and communications, maintaining the

required level of habitat parameters, and development of the social and cultural spheres of the society.

The goal of the safe city concept is also to create a unified response plan to major emergency situations. All the key stakeholders in cities (police, fire/ emergency medical services, city government, Homeland Security, transit, utilities) should provide an effective safety or security response to any situation affecting their citizens or organizations. Special attention should be paid with respect to positive youth development and provide services aimed at reducing youth violence, crime and victimization.

Increasingly, cities are inclined to make federated security technology, equipment and training investments, such that resources can be shared across agencies and departments.

The "Smart City" is a centre for public and private local and global services on mostly local network and services infrastructures for various domains. The services and applications for public safety and security, running inside a common city network and services infrastructure, return security, safety and quality of life to the city by reducing crime, urban violence and terror threats on the one side and by quicker responding to emergency situations on the other.

Local orientation, in conjunction with the national, cross-border and trans-national cooperation among cities, is of great importance. Therefore, the relevant governance level may vary from the local to the federal level and can also be a combination of several tiers. According to the documents and reports [3], a big challenge is to harmonize the programmes for the safe city at various levels and find appropriate solutions.

The "Safe City" as a concept and solution offers information and communication services, combining security systems into a single information space based on the cloud paradigm. Based on the ICT technologies and paradigms (e.g., broadband infrastructure, fixed-mobile convergence, the internet of things (IoT), cloud computing, big data), the ICT sector will help increase the safety and social maturity level of the whole society, thus making its contribution to a more sustainable future.

Based on the today's implementations and experiences, the concept of the "Safe City" offers large-scale deployments of video-surveillance systems and emergency communications systems, but lacks a single and universally accepted concept at all levels which are also interconnected. The current approaches vary from city to city and bring very specific solutions which cannot be easily integrated at the higher levels. Therefore, a novel approach to overcoming these deficiencies is needed.

2 THE SOLUTION TERMED "SAFE CITY"

The Iskratel Group has a long tradition and rich experiences in telecommunications solutions. Among others, it provides telecommunications solutions for corporate and special networks together with the support for the security services and the 112 service (the emergency phone number). Based on its knowledge and competences of building security for metropolitan areas in the past and after thorough consideration of this area, Iskratel and IskraUralTEL have come to the conclusion that the right solution is a comprehensive and well-considered approach that covers all the functional, topological and hierarchical, organizational, legislation and regulation aspects. This solution is termed "Safe City" and its key characteristics are openness and reliability. It also supports smart integration of services for safety and security at the city level into the federal infrastructure. By using this approach, the local characteristics and global trends are equally important and slightly differ on our markets (i.e., the European market and the market of the Common Independent Countries - CIS, especially Russia).

In such a paradigm, cities and federal authorities should not install hundreds of useless cameras "at every level" in order to demonstrate to citizens that the "big brother" vigilantly watches them, but first of all they should:

- make a list of social and urban areas that are self-sufficient with respect to organizational and technical safety for urban sites. This kind

of facilities can be: "Safe School / Kindergarten", "Safe clinic / hospital", "Safe bus / tram", "Safe Park / Square", "Safe road / parking", "Safe bus station / railway stations / airport", "Safe mall/ market", "Safe water utility / boiler room", "Safe plant/ enterprise" and others, depending on the development of the infrastructure in a city,

- enforce mandatory requirements for the above-mentioned facilities in the plan (at the local/municipal/ federal levels) including
- Mandatory minimum standard for each "safe facility" monitored by a security staff to detect threats, localize the facility and arrive at it even before the police forces,
- Mandatory minimum standard for equipment of each "safe facility" providing physical and information security and its monitoring (its equipment depends on the facility),
- Common city interfaces / protocols of physical and information security, telecommunication and communication systems that allow the safety and security services of these facilities to receive (monitor) and share information at all the levels of the hierarchy of the "Safe City" internally and with the mission-critical centres of the city/ territory.

To provide a large-scale centralized system for all the above-mentioned areas in one step is unrealistic; there are usually big problems with the budget as well as with appropriately trained and experienced staff. As a result, there are very often autonomous non-interoperable systems introduced each essentially solving more or less private, local problems.

Weak elaboration on the operational needs for installing video cameras and/or other sensors leads to an accumulation of a large amount of absolutely unnecessary video and audio information which results in huge time and costs inefficiency in creation, implementation and operation of such systems.

The city authorities develop and introduce in their city urban mission-critical/monitoring centres, centralized urban systems like 911/112, alarm, notification and evacuation systems and secure telecommunication/communication systems. These systems altogether incorporate centrally managed areas of life of an urban environment such as:

- City management and its administration,
- Law enforcement and its support for policy features,
- Civil defence and emergency situations (including environmental monitoring),
- Medical services management,
- Public transport management,
- Housing and utility services,
- Other urban structures (depending on the development of the city infrastructure).

The solution “Safe City”, a common work between Iskratel and IskraUralTEL, offers the best answers to all the above-mentioned requirements and expectations based on a step-by-step approach fully supporting phase implementation.

The figure below illustrates the various inter-relationships among the different layers of the technology stack of the “Safe City” solution, these are:

- Secured network infrastructure and integration sources,
- Infrastructure as a Service and Platform as a Service for the “Safe City” services in a cloud,
- Information space including federated data, system enablers, services logic and enablers for visualisation
- API for openness towards various services and applications at the regional and federal levels.

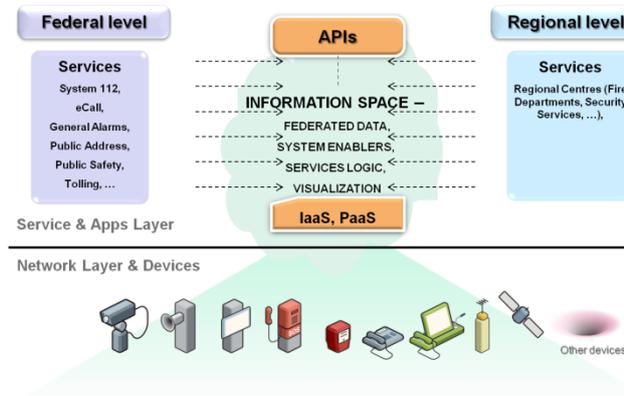


Figure 1: The “Safe City” technology stack

On the top of this stack, applications and new services can be built by various stakeholders for consumers, public organizations or businesses.

3 “SAFE CITY” – A SOLUTION FOR INTEGRATED SYSTEMS AND APPLICATIONS

The open and reliable “Safe City” solution consists of the following functional systems and features:

- Intelligent video surveillance / local video surveillance systems,
- Emergency communication / local security systems,
- Public address, general alarm / local notification systems,
- Environmental monitoring and forecasting/ local fire and chemical control systems,
- Spotting, position location / eCall, ERA-GLONASS services,
- Communications and mass media.

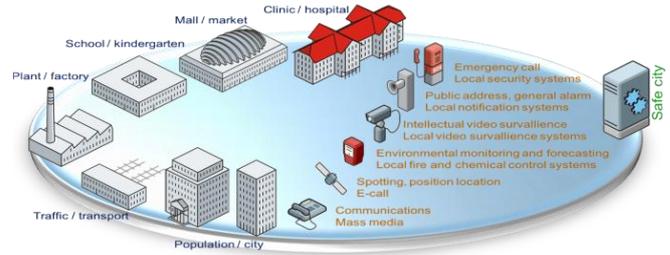


Figure 2: The “Safe City” solution and its features

Most safe-city projects start with a video-surveillance system used to monitor the traffic / transport, public places, areas of criminal activity, social facilities and facilities of the residential sector. The intelligence inside the video analytics brings added-value to the complete solution, including face recognition, shape detection and vehicle-plate numbers. The video analytics enables connectivity of additional systems into the platform (e.g., malls, hospitals, schools, factories, railway stations).

Video surveillance can be used by residential and business users. Using this service, the public and private safety is guaranteed to a greater extent. Firstly, it increases the efficiency of the system by increasing the number of potential operators. Secondly, it allows the residents to self-monitor various situations at home in a trusted and secure way.

The emergency communication system supports the organization of the information and emergency terminals in public places and also a close relationship with the local security service. The “Safe City” solution takes into account the specifics of the incorporated facilities, which require special realisation, such as being vandal- or explosion-proof. For personal safety, the integration and positioning of a mobile alarm device for the elderly or disabled people, is of great importance.

The E112 service is one of the services of the emergency communications. The Service eCall in Europe and ERA-GLONASS in Russia are additional services based on the existing E112 service. The first uses GPS and the latter GLONASS satellites. They meet the European and Russian standards and also respect the national and local specificities in terms of emergency services. Vehicles equipped with the eCall and ERA-GLONASS system compliantly with the In-Vehicle Systems (GPS/GLONASS, GSM modem) send the “minimal set of data” via a cellular network to the eCall subsystem as a part of the “Safe City” solution, which sends it further to the relevant services (e.g., Public Safety Answering Point). This data can also be used for other commercial purposes.

The public address system offers public announcements and general alarm signals. The “Safe City” solution supplements it with additional features like telephony, SMS or mass media notifications. The solution can integrate various local public address

systems in different organizations (e.g., malls, hospitals, schools, factories, railway stations) compliably with the applicable regulations.

The public-address system interoperates via the "Safe City" solution with the fire-alarm systems thus providing a more reliable and faster response and consequently minimizing the potential damage.

The "Safe City" solution provides the ability to connect chemical sensors in order to control the high-risk production and mass-visited public areas. The fire and chemical control data together with meteorological, environmental and flood data give a complete picture of the situation.

The mass media are today one of the main channels of information. Ensuring full interaction with the mass media (e.g. television, radio) is one of the functions of the "Safe city" platform. Providing information with or without moderating and ensuring the transmission of the content is just one of the many required features today.

All the above-mentioned subsystems and features are inter-connected with each other and with the external world via a secured data network by using the southbound interfaces called adapters and the northbound interfaces called APIs. The adapters integrate various sources of data (e.g. legacy equipment, automation controllers, sensors, detectors, measuring elements) into a common information space. In most cases, there is a one-way communication from the source to the information space, but there also exist some special cases needing two-way communication.

The core features used by all subsystems of any "Safe City" solution are called enablers. We distinguish two types of the enablers, the functional enablers and the common system enablers. Both are presented in the figure below.

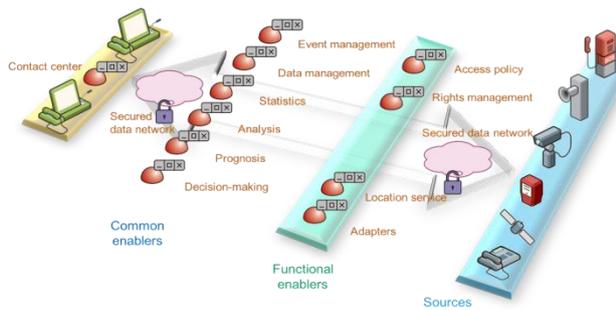


Figure 3: The "Safe City" solution – enablers and sources of information

As the "Safe City" solution serves multiple clients (e.g., customers, public organizations, enterprises, etc.) sharing the same sources, the multi-tenancy paradigm is respected in each of the below areas:

- Access policy,
- Data protection and accessibility,
- Secured Data Network.

The Access Policy and Rights Management grant authorized users the right to use a service dynamically, while preventing access to non-authorized users. The data is protected using various mechanisms and is accessed and exchanged in a secure manner. Since all kinds of users are an integral part of the secure and trusted "Safe City" solution, technological elements by themselves are not sufficient in guaranteeing a high degree of trust and security. The complete solution must also comply with the applicable legal and social regulations.

Besides the functional enablers there is also a set of common system enablers closely connected with exchanging a huge number of events and large amounts of simple text data in addition to the complex multimedia and web data. These data are usually stored in databases. Therefore, the Event and Data Management Enablers are the core enablers and architectural components.

New technologies, new forms of storing and accessing data, and the ability to retrieve information from different data sources are a part of the "Safe City" solution (data federation).

Analysing large amounts of data in real time requires new techniques. Using statistics, semantic techniques, machine learning and logical reasoning methods semantically enrich the data to be employed. By analyzing data streams, texts, video and web data, the simple and advanced analysis is made.

Correlating the current data with its history, the prognosis enabler can predict the future events and circumstances based on existing information. To understand the circumstances and interpret information in an easier way, the decision-making systems have also been made a part of the "Safe City" solution.

The Service Oriented Architecture (SOA) principles and their key elements, i.e. the Enterprise Service Bus (ESB) and integration bus, are the basis for a modular approach to software development, enabling us to build information interaction in heterogeneous environments based on components with standardized interfaces and protocols. These technological concepts allow us to integrate various systems in a secure and efficient way.

4 "SAFE CITY" AND ITS CORE CONFIGURATION

The "Safe City" solution in its typical configuration includes the following subsystems:

- Urban intelligent video system covering public places, busy intersections, areas of inter-city routes, schools and hospitals of the city and including a commercial video-surveillance system (e.g., shopping malls, gas stations, etc.),
- GIS monitoring of mobile facilities (electronic city map),
- Emergency "citizen-police",
- Video recording of traffic violations - "Administrative practice",

- Searching for lost and stolen vehicles and detecting them,
- Intelligent searching and advanced analytics on big data,
- Management centres for squads and patrols combining the advantages of the other systems.

Using the advantages of the modern techniques during the design phase of subsystems of the "Safe City" solution ensures performances and functional enhancements.

The sophisticated structure of the core modules of this solution allows deploying the data centre and connects a variety of automated safety area subsystems into a single information space efficiently.

Besides the core subsystems, the platform can also include a specific subsystem such as:

- Security system of housing facilities;
- Monitoring and forecasting of emergency situations;
- Monitoring of environmental state of a region;
- Unified process and storage for medical information for residential users.

The core architectural components and features integrating such a subsystem in a unique solution are:

- Broadband network using various technologies,
- Data federation and common information space,
- Data protection,
- Data centres and archives,
- High-speed multi-service bus for exchanging big data,
- Basic and advanced analytics for big data.

The user rights and trust are essential in such a complex solution. For various users to access the subsystems and data, specialized centres for monitoring and control are developed. They communicate with the "Safe City" platform using APIs and exchange data and information through a multi-service network. The most prominent centres are:

- Squads and patrols control the centre at the city police department with an electronic map of the city, access to video-surveillance and fire-alarm systems, and emergency communication systems;
- Traffic-situation monitoring centre for traffic police;
- Emergency control centres for civil defence, fire and rescue departments;
- Emergency monitoring centres and natural-disaster response centres;
- Regional medical information centre with a common medical base of the resident;
- Traffic information-analytical centre at the city police department for insurance companies.

5 FUTURE ORIENTATION

The open interoperable architecture of the "Safe City" solution guarantees an easy-to-upgrade and future-safe long-term solution which can fulfil all the strong requirements regarding safety, trust and security, interoperability, openness and excellent user experience. At Iskratel and IskraUralTEL we will tailor and functionally enrich our solution according to the customers' and markets' demands.

In order to make the services of the "Safe City" solution as efficient and reliable as possible, we will support the whole chain of handling the safety areas, mentioned in the first section, in a most efficient way using the following steps:

- Planning of the specific safety area,
- Modelling the area,
- Analysing the area,
- Maximally reducing the probability of a disaster,
- Emergency response,
- Damage assessment.

The decision-support subsystem mentioned above will assess in its automatic mode the parameters of each area as a whole and will respond efficiently to changes in the operational environment.

6 CONCLUSIONS

The "Safe City" solution builds a comprehensive and intelligent view on safety in the smart city in a trusted way. It unifies and integrates various events and contextual information obtained from heterogeneous information systems into a single information space, by visualizing such information and opening it to other systems.

The biggest competitive advantage of our solution is its openness, reliability and ability for "easy-to-integrate" new features and new sources of information. The highly skilled experts of IskraUralTEL bring with their expertise in the local Russian specifics and with their deep domain knowledge an additional added-value to our solution.

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Fedorov Vitalij graduated from the Faculty of System Engineering and Robotics of Novocherkassk Polytechnical institute in 1993 and from the Moscow Bank School of the Bank of Russia in 1996. From 1993 to 2004 he took a number of technical positions in the system of the Bank of Russia. From 2004 to 2006 he headed a design department of the FSB Krasnodar branch NTTs Federal State Unitary Enterprise "Atlas" of Russia, and from 2006 to 2012 he has been CTO in the JSC "Orbita" (Krasnodar) company. As a project chief engineer he has been involved with several telecommunication and infrastructure projects, among them the projects of power structures in the Southern Federal District of and in the republics of Transcaucasia: Abkhazia – South Ossetia and the project for the MTS and MEGAPHONE communications service providers.

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