WB GROUP

Communications Integration Platform

PIK

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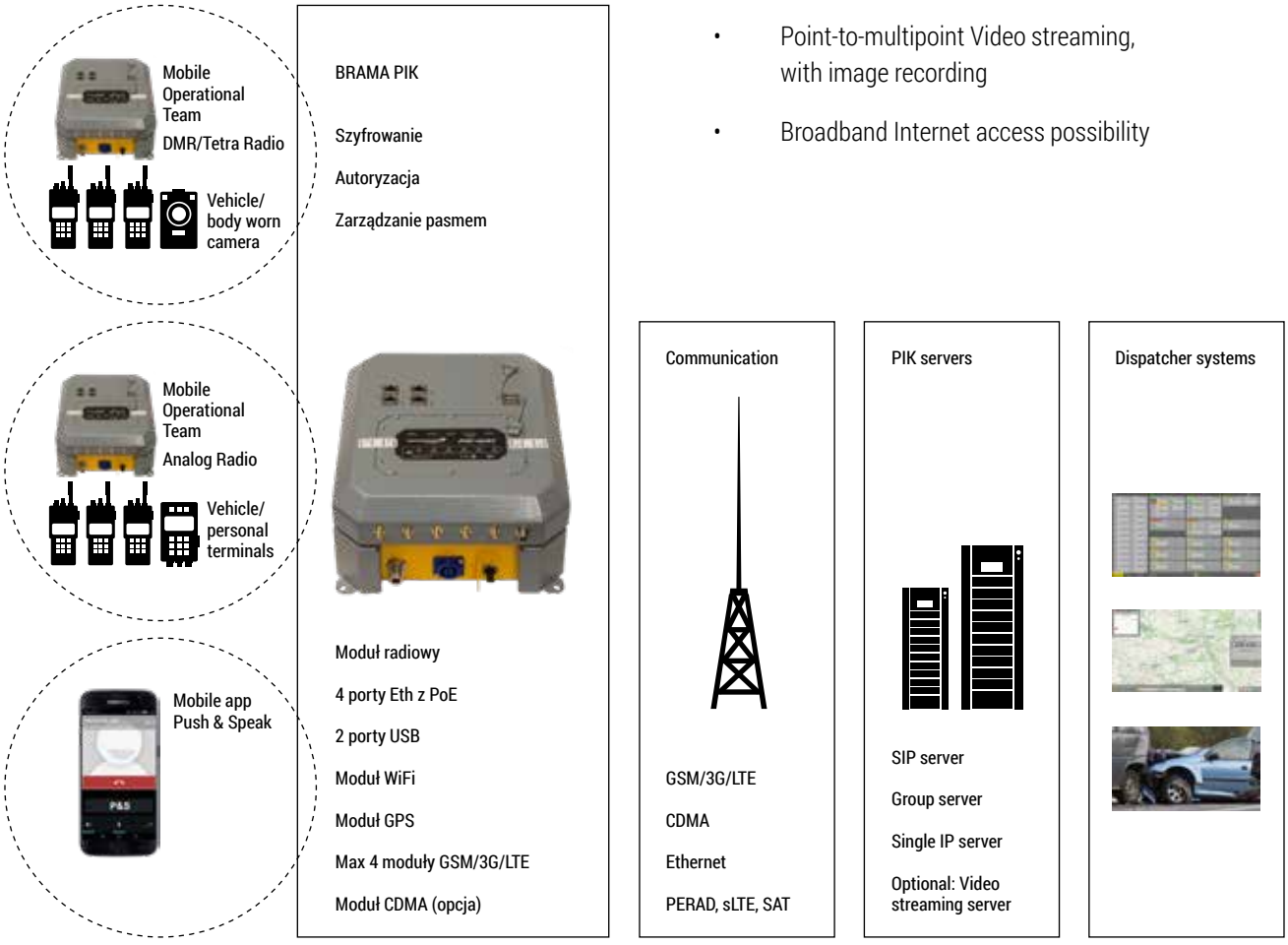
Communications Integration Platform PIK, is a multi-variant, multilevel mobile solution that offers:

- Countrywide coverage dispatch communication
- Integration of many incompatible communication systems
- Support mechanisms for Service-Oriented Architecture
- Safe, mobile data access
- Point-to-multipoint Video streaming, with image recording
- Broadband Internet access possibility

Fig. 1: PIK functional diagram



PIK is a mixed hardware and software solution designed to provide seamless, safe, user- and supervisor-friendly voice and data communication. The PIK Platform consists of both hardware and specialized software.

1 PIK hardware components

1.1 Gateway PIK-GAT

The PIK-GAT module is the core hardware component of the PIK system. The main function of PIK-GAT is the integration of different forms of radio communication.

In mobile solutions, the gate should be mounted in the luggage compartment of a vehicle – allowing personnel constant access to both radio and IP signals (WiFi/Eth). The Gate can also be mounted inside a building directing native radio communication into the PIK network. A special portable PIK-GAT execution allows for inclusion of foot patrols in the system.

PIK-GAT is a mixed hardware-software system element, in which MindMade's unique solutions has been implemented in order to both manage the PIK-GAT inner elements and allow for remote supervision of the gateway. The PIK-GAT set consists of the gate, a set of antennae (LTE, UMTS, CDMA, GPS, voice radio, Wi-Fi), and a power cable (12V DC - vehicle mount; 230V AC - site mount). Antennae are provided either with magnetic foot or in a vehicle-dedicated form (for example, with pre-prepared car body holes). Some antennae can integrate two or more functions, e.g. UMTS & GPS. In order for PIK-GAT operation, uSIM cards with data-packet transmission plans are necessary.

As a standard – for the territory of Poland – each PIK-GAT device has 3 LTE communication slots (any provider), one UMTS slot (any provider), CDMA (considering provision plans, Polkomtel is recommended). MindMade can provide data transmission services as a supply option (in Poland only).

Special, rugged portable execution of PIK-GAT, dedicated for foot patrols and teams not provided with built-in vehicle gateway

Standard execution of PIK-GAT, dedicated for vehicles and on-site installations

Special, camouflaged portable execution of PIK-GAT, dedicated for foot patrols and teams not provided with built-in vehicle gateway

PIK-GAT main features:
Expands UHF/VHF coverage - thanks to large cellular networks coverage
Broadband data transfer – wide range of functionalities, including video, documents and other files transfer, safe access to various databases etc.
Built-in: 4 Ethernet ports with PoE, 2 USB ports for connecting external devices
Flexible configuration of communication interfaces and cellular operators (LTE, CDMA, UMTS)
Maintenance-free
Remote device and component configuration (radio, and data communication modules, Wi-Fi)
Fully remote-configured Wi-Fi module, gaining access to specified net infrastructure (Intranet) or the Internet, sharing data
Remote update & upgrade possibility
Default radio provided with PIK-GAT allows for both analog, and DMR operation
Fast and easy assembling and installation

1.2 System servers

PIK system servers are organised in a clear structure comprising three modules: SIP Server, Single IP Server, Group Server. Video server, allowing for online video point-to-multipoint streaming, as well as database and other servers interfaces are available as an option.

The **SIP Server** is responsible for voice-channel user authorization and fulfils VOIP system functions.

The **Single IP Server** serves as an interface between users and server infrastructure and is responsible for secure data tunnelling. This server is a gate to PIK system and a broker of all PIK communication.

The **Group Server** works as a platform for applications responsible for the organization of user groups.

Any server (SIR SingleIP, Group) can be multiplied in order to balance data load, which ensures scalability of the solution.

Up to 20 operators (dispatchers) using the same servers can work simultaneously, each of operator having responsibility for certain users and working with a select number of gates. Each operator is responsible solely for their particular group,

and has no influence on other groups. The PIK system allows to create the master operator which may act as an supervising operator.

The system can operate in an assigned, closed network with no access from the public Internet – all communication between the client infrastructure and PIK servers is provided in secure tunnels, and gates can operate using private closed APN-s with secured tunnel connection to the PIK server infrastructure.

In addition, there are many built-in functionalities responsible for device monitoring and supervision: billings, geolocation data, communication modules and radio sets parameters.

Each server can be installed on physical and/or virtual machines, according to the requirements of client, in any geographical location. Client needs are considered in the early stage of development process, allowing for an accurate assessment of the final cost.

Server system main features:

Advanced billing system, including information on each connection, its' exact time and duration, with optional record and playback function
Automatic supervision system, which collects device functioning statistics, including the received signal strength, voice quality and data transfer parameters
Automatic time synchronization for all operating devices, based on NTP server
Expansion possibilities: step-by-step system expansion, user-specific additional functions, integration with existing or planned external systems
Single PIK server infrastructure has a capacity of approximately 1000 users
Hardware server infrastructure design, delivery and maintenance, as an option

1.3 End-point devices

The basic tenet of PIK system is the usage of existent user's equipment (radios, cameras, printers, scanners, terminals, computers etc.). Any equipment, meeting client needs can be delivered.

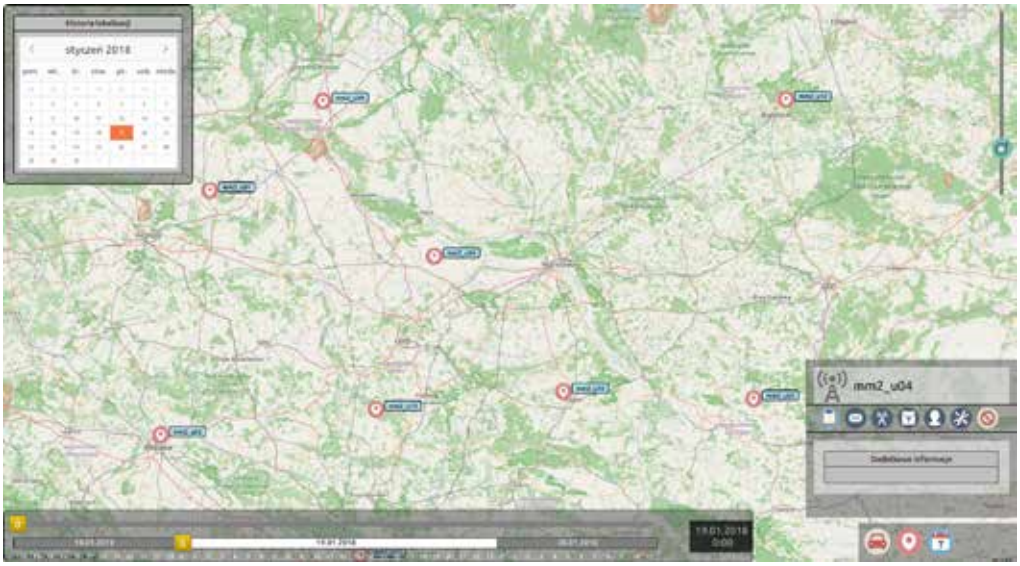
2 PIK software

2.1 Dispatch system

Dispatch system consists of a PC computer (or a mobile device) and a customizable application – the software interface between server applications, users and gate devices. Because of the fact that all system data are stored in databases in servers, there is a possibility to connect multiple dispatch systems to one PIK system, with the additional ability to dynamic change the number of connected dispatchers.

Each dispatch system sends all connections-related to data online to servers, so full real-time system diagnostics is possible.

The mobile version of the dispatch system allows a dispatcher to work in the field, allowing the PIK system to be capable of supervision in both locally and globally, simultaneously. Communication between the mobile dispatch system and PIK servers can be provided using a designated PIK-GAT device. Dispatch system software is made by MindMade Sp. z o.o.



Dispatch system key features:

Possibility of creating arbitrary voice and/or data communications groups during system operation. Implemented changes are immediately propagated system-wide, using server infrastructure

Real-time communication monitoring and signalling, each voice transmission is additionally shown in graphic application interface

Direct voice communication with any system user, using Push & Speak technology, dispatcher may take part in communication with chosen one or with many groups simultaneously

Special function: alarm transmission to the dispatcher. Communication is then switched to a special pre-emptive mode, and an additional alarm notice is displayed using the graphic interface

Map with real-time geolocation of units is provided allowing for assigning and supervising of each individual unit

User positions are displayed on the map (actualized each 5 sec), and devices which do not report their position are also marked

Transmissions, reception mode, inactivity, and muting are shown on the map view

Broadcasting to selected users directly from the map view

Additional unit info window: unit name, personnel names, non-standard vehicle equipment list (if available), etc.

Objects displayed on the map may be filtered according to the user type

Possible selection of desired users in order to group-display additional info and function group-executing

Sending text messages (SDS) directly from the map window

Możliwość prowadzenia komunikacji głosowej pomiędzy dyspozytorami oraz z dyspozytorem nadrzędnym

2.2 Push & Speak mobile app

Push & Speak is a dedicated application for Android smartphones that allows for communication inside the PIK network, for users who do not have their own system handsets.

Typical use cases:

Communication with VIPs and other persons not directly involved in a working PIK group

Communication with users who are travelling and away from a crisis zone (even abroad)

Undercover work, when the professional radio usage is inappropriate

Main advantages:

In crisis situation – possibility of communication with any member/group of organisation

Access to PIK communication from any location within mobile networks coverage

Operational communication within PIK working group designated by dispatcher

Direct contact with dispatcher

3 PIK vs TETRA comparison

Feature	MindMade PIK	TETRA
Cost of investment	Low – gates, server software and optional terminals delivery	Huge – infrastructure + devices
Implementation model	Possible solutions: 'turnkey delivery' (CAPEX), OPEX, mixed	Typical: 'turnkey delivery'
Infrastructure construction time	None – uses existing cellular networks infrastructure	Long – building permissions, design, construction
Infrastructure maintenance cost	None (on the side of cellular operators)	High (system supplier or user)
System maintenance cost	Low – possible telco operator service mode (OPEX)	High – necessity of training and maintaining qualified personnel
System range	Country-wide – cellular networks coverage, with redundancy (many operators and technologies) Worldwide – roaming possibility	Limited – dependent on mast infrastructure
Terminals	Many producers, competitive prices dependent on terminals functions and standards (i.e. analogue, DMR, TETRA, NXDN)	Most often one producer
Investment protection	Full, existing systems are being included in integrated communication	Necessity of withdrawal incompatible systems
Ordering diversification	Yes, considering suppliers and technologies	Yes, considering suppliers
Frequency management	CAPEX – system user/owner OPEX – service supplier	System user/owner
Data transfer	High: up to 20 Mbit/s	Low: TETRA – up to 14 kbit/s (4 slots) TEDS – up to 40 kbit/s (4 slots); 100 kbit/s (8 slots)
Encryption	Yes (i.e. AES 128/256)	Yes (i.e. TEA1/TEA2)
Redundancy	Yes – geographic & hardware	Yes – geographic & hardware
Integration with other systems	Unlimited (system function), low implementation cost	Limited (fully dependent on infrastructure producer), very high additional implementation cost
API access	MindMade side (full protocol access supervision possible)	Disallowed by infrastructure supplier (possible protocol access expensive and depending on foreign developers)

4 PIK main features

MindMade products provide reliable, secure communication using mobile networks and designated servers.

Field-tested proven hardware solution

mature, field-tested hardware platform

sustainable multitasking, Linux-based operational system

continuous transmission and quality monitoring

hardware and software multilevel monitoring

Maintenance and monitoring software tools (server-side)

professional on-line monitoring software solutions

remote, bulk update

remote, bulk firmware upgrade

Communication channels redundancy – stability & reliability

gateways use multiple cellular networks simultaneously

system constantly monitors all available transmission channels and chooses the best ones (in a given time and place)

channel switching in a way that is unnoticeable for end-users

preserved communication consistency, even during channel switching

Data security

multi-level encryption of communication

tamper protection

each security violation is announced as an alarm event

5 PIK exemplary use cases

The outline presented on Figure 2 (beside) illustrates the model of PIK system use in a mixed configuration.

Using PIK for integration of communication enables:
Connecting dispersed systems of local coverage into one comprehensive system
Connecting multiple incompatible systems
Extending the coverage of existing systems (for example, by installing stationary gates)
Facilitating connection with vehicles/mobile users through mobile gates. Mobile users will be able to participate in communication everywhere, provided they stay in range of the mobile gates.

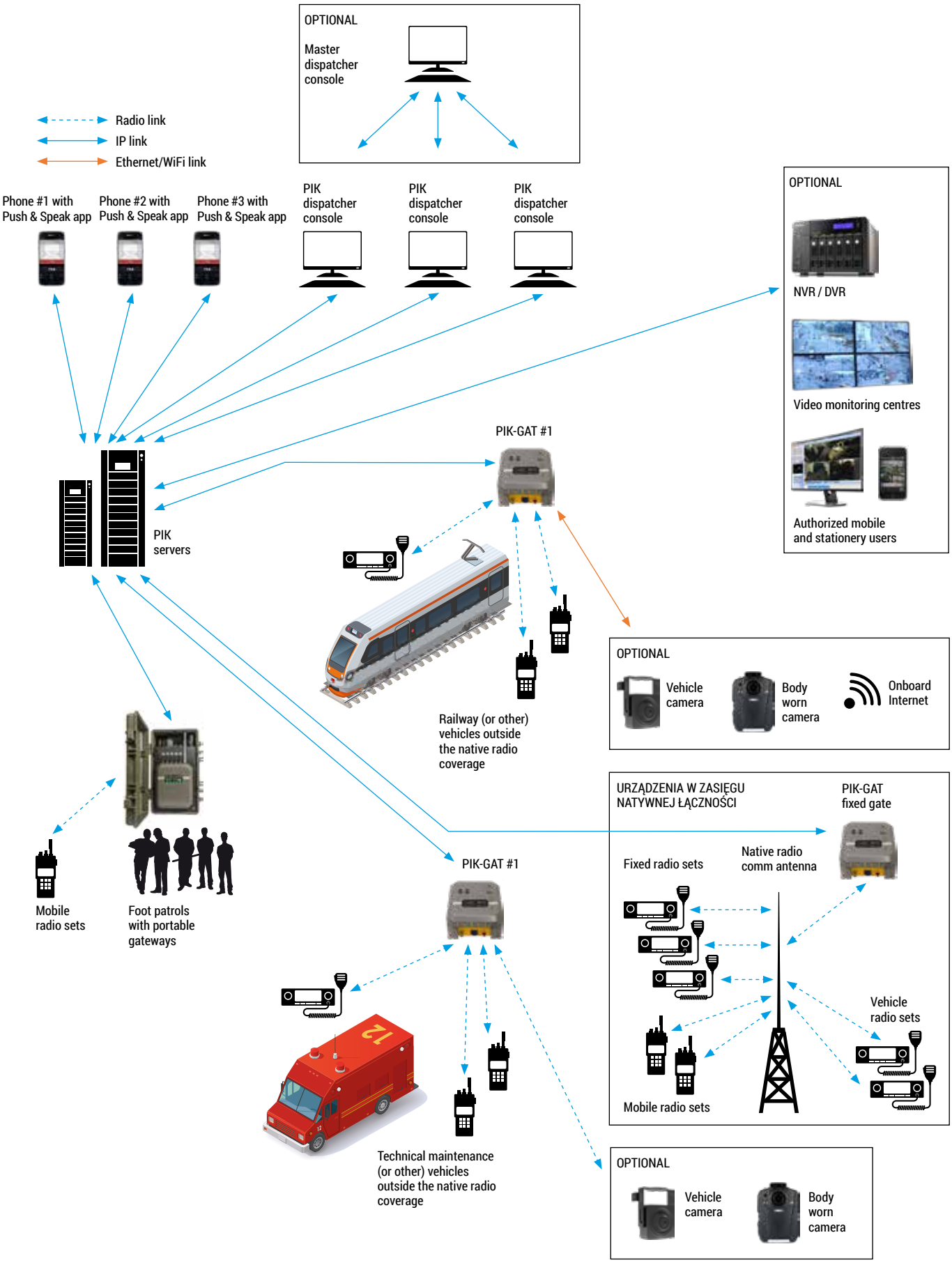
Portable, mobile and stationary radios in range of native connectivity communicate using existing infrastructure. A stationary PIK-GAT gate should be connected to every existing radio network to act as a communication interface between the radio network and PIK system. Portable and mobile radio sets which are out of native range communicate via mobile gates as long as they stay in range of any of the PIK-GAT devices.

The master dispatcher has an ability to communicate with any working group defined by any other dispatcher, and listen to any chosen voice communication channel. Map location of each operating unit is available for the master dispatcher, as well as voice communication with any other dispatchers (or all at once).

Communication between gates is handled by the server infrastructure. The timeout restrictions are diminished with regards to the radio networks connected through PIK. Gates and smartphones with the Push & Speak app communicate with servers via mobile networks.

Railway and technical service vehicles shown on the Fig. 2 diagram are the exemplary ones. Gateways may be installed on any vehicle type owned or operated by the user.

Fig. 2: PIK system – mixed configuration



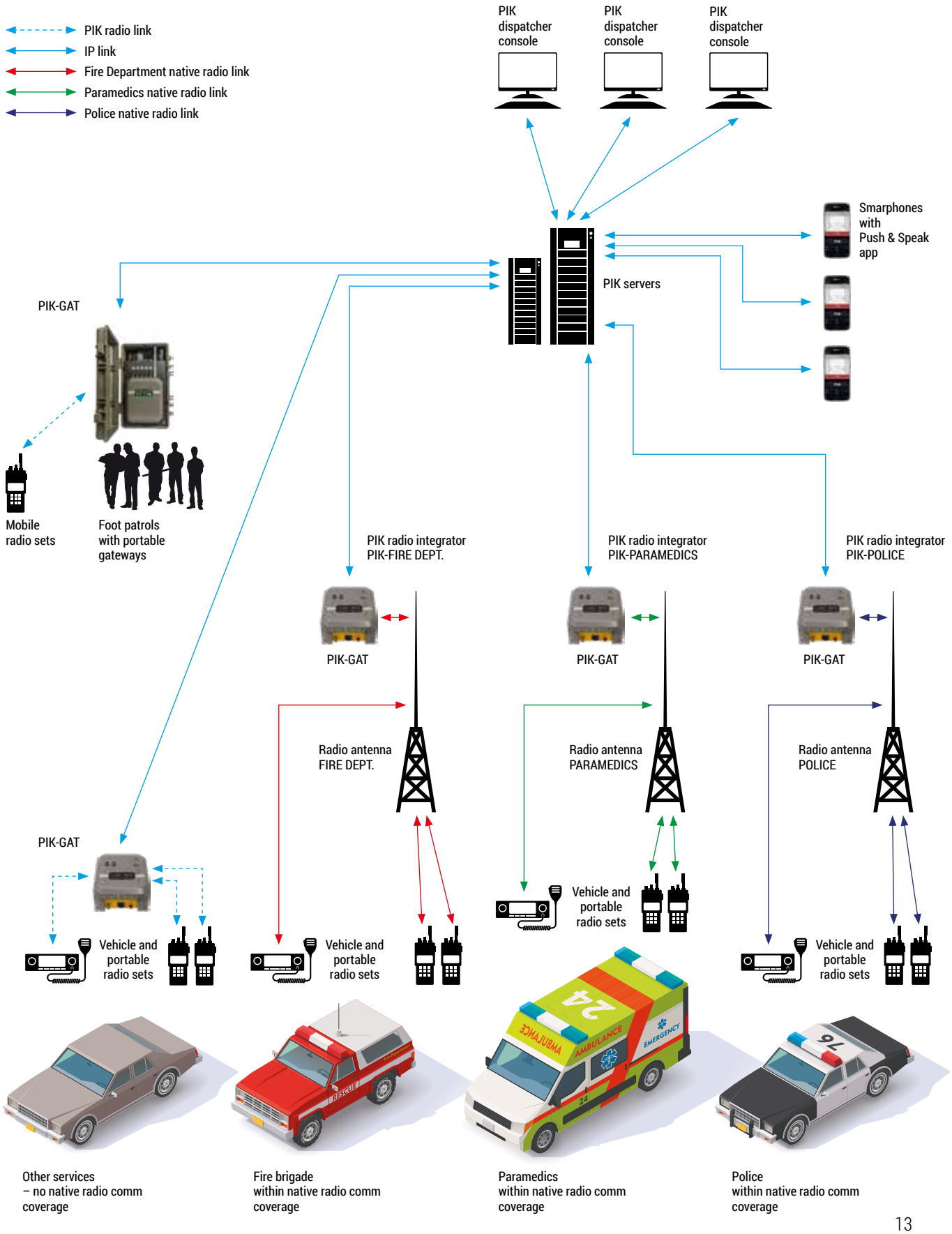
The outline presented on Figure 3 (beside) illustrates a possible scenario utilizing the PIK system in ad-hoc integration of several mutually incompatible connection systems. Such a need occurs always in critical situations requiring cooperation of two or more different type units in the area.

Using PIK for integration of communication enables:
Communication between multiple units taking advantage of existing radiotelephones (portable and mobile, as well as stationary)
Connection of several systems of different units into one comprehensive system
Communication with units out of range of their native systems
Communication with other vehicles/mobile users through mobile gates. Mobile users will be able to participate in communication everywhere, provided they stay in range of the mobile gates.

Portable, mobile and stationary radiotelephones in a given unit's native range communicate using existing infrastructure. A stationary PIK-GAT gate should be connected to every existing radio network to act as a communication interface between the radio network and PIK system. Portable and mobile radiotelephones out of native range communicate via mobile gates as long as they stay in range of any of the PIK-GAT gates.

Communication between gates is handled by the server infrastructure. The timeout restrictions are diminished with regards to the radio networks connected through PIK. Gates and smartphones with the Push & Speak app communicate with servers via mobile networks.

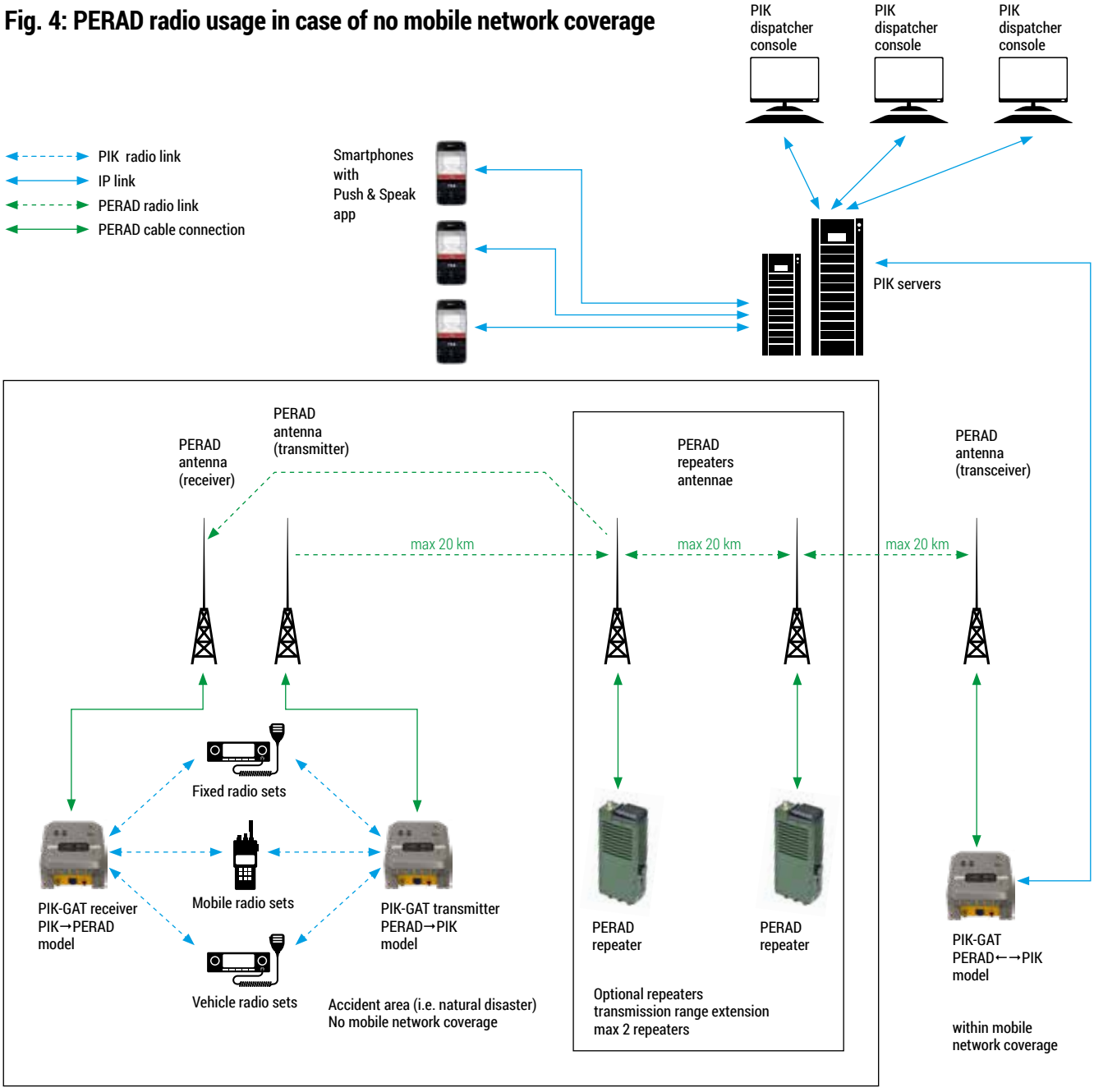
Fig. 3: Integration of many radio systems



Outline presented on Figure 4 (below) illustrates a scenario utilizing the PIK system outside mobile network range (for example in the case of flood, fire or other natural disasters). In such cases a special communication kit containing PERAD radio communication interface should be installed to enable incorporation of a PIK system from the affected area into an active mobile network even 60 km away. Portable, mobile and stationary radiotelephones communicate through (mobile or stationary) PIK+PERAD PIK-GAT gates acting as a communication interface between a given radio network and PERAD system. In range of mobile networks a PERAD-PIK PIK-GAT gate should be installed as an interface between PERAD system and mobile networks.

Communication between gates is handled through server infrastructure via mobile networks and PERAD. Gates and smartphones with the Push & Speak app communicate with servers via mobile networks.

Fig. 4: PERAD radio usage in case of no mobile network coverage



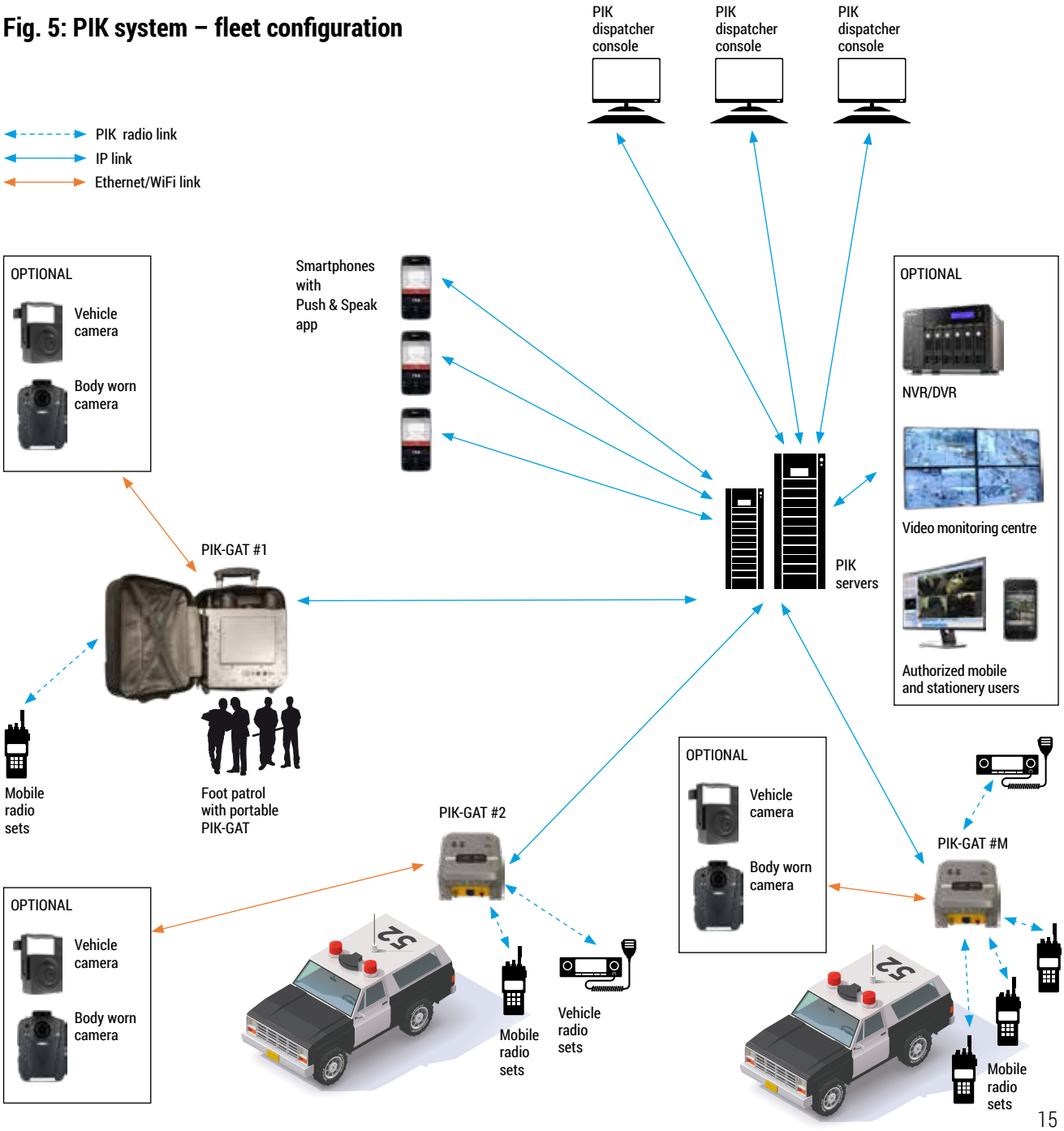
The diagram shown on Figure 5 (below) depicts the simplest PIK system use-case. In this model there is no need to have any radio communications infrastructure. Mobile radios as well as vehicle sets communicate directly with PIK-GAT.

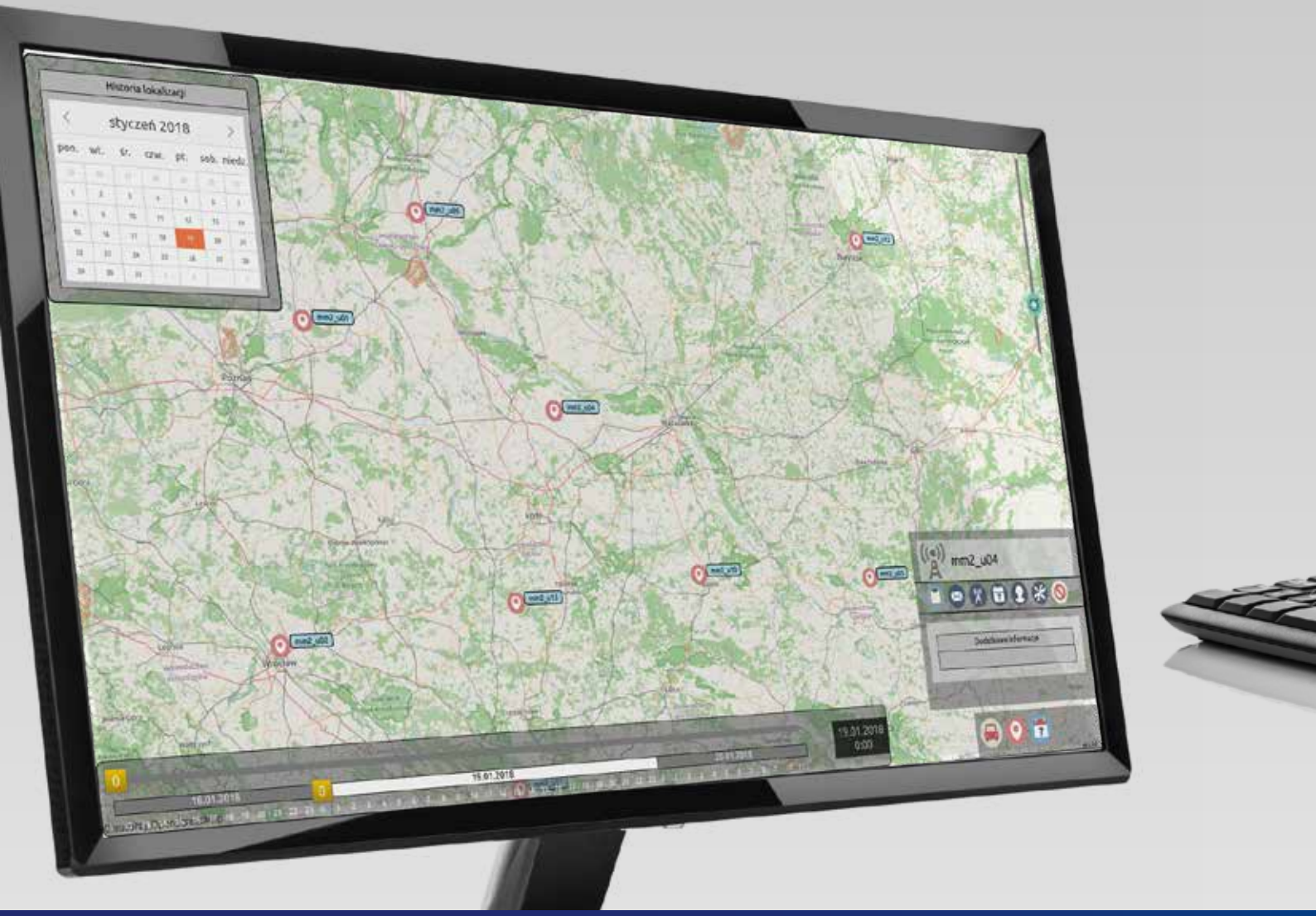
The communication between gates is led using PIK server infrastructure.

Gates and smartphones with Push & Speak app communicate with servers via mobile networks.

Optional cameras, NVR/DVR equipment use either Ethernet or Wi-Fi connection. Usage of above mentioned equipment, and video monitoring centres/users require installation of the Videostreaming server module.

Fig. 5: PIK system – fleet configuration





www.wbgroup.pl

MINDMADE
WB GROUP

MindMade Sp. z o.o.
Pl. Konstytucji 3
00-647 Warszawa, Poland

t: +48 22 627 6696
f: +48 22 627 6696 w. 13

office@mindmade.pl