

# Routing of the communication channels in emergencies

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**Abstract.** The models of routing of communication channels and networks of operational data transmission in emergencies are considered.

**Key words:** operational control, information uncertainty, emergency, data package of channels routing, protocol, network.

**Relevance.** In the context of technogenic accidents emergencies and disasters the role of communication in notification system and operational control is the key one while making decisions as to the eliminating of the threats to human life and the environment. Technogenic systems with active power sources are characterized by marginal load that can lead to disaster in case of small perturbations and emergency factors. In such cases it is important to ensure the effective monitoring of facilities and resources for possible abandonment works. Thus, an important element in the management structure of such processes is to provide communication channels for the transfer of management decisions.

One of the most important elements in making decisions in such systems is the human factor. Under such extreme conditions, psychological and intellectual pressure on a person can lead to inappropriate decisions, which in turn will lead to a negative impact on the development of an emergency. The important point here is the status of automated control systems, which are equipped with the latest hardware and software with a hidden logic operation, which creates difficulties for operational staff to generate a behavioural strategy and action plans for rescue works because of the gap between the level of professional knowledge and complexity of technological processes.

Therefore, it is vital to form solutions with high demands to the intelligence level of the staff and to use the expert systems and data bases and knowledge in operational mode, which requires spontaneous, dynamically generated connection channels. Consequently, the problem of routing channels for transmission of control data and operational management and also their structuring in different systems of exchange is an important task for the development of information technology of operational management in hierarchical systems of liquidation and monitoring.

**Problem analysis.** Modern information technology facilities, theories of hierarchical systems of coordination management, and artificial intelligence give the possibility to form strategies of guaranteed control in automated structures and to make effective and goal-based solutions of operational team staff in identifying and eliminating of the

hazardous situations in technological industrial facilities with distributed sources of danger.

The object of the automating is processes of the operating dispatching activities – that is the formation of the routes of communication channels from ODS OCC to the emergency area [1-5].

The subsystem of communication channels management should provide:

- receiving, recording, processing data as to the route between the ODS OCC and the emergency area;
- channels of bilateral exchange of the streams of data for operational management;
- work time registration of the dispatchers and radiotelephone operators on controlled route;
- access to a database of geo-codified segmental and junction model of the road network, geo-data of the areas, addresses of geo-codified buildings and industrial facilities and technologically aggressive productions;
- access to the database of fire and rescue units;
- logging receive / transmit of alarm messages as to the emergency;
- duty roster of the dispatchers of operational service;
- classifiers of access status to communication channels.

Determining of the district and the area of emergency is made based on the signal of emergency call as to the dimensional analysis of coordinates of the place according to available database system of registers of geo-coded objects.

Defining the address of the emergency object is made in the following way:

- by phone of telephone network operators;
- entering the address of the object;
- determining the address of the object by name;
- identifying the location of the object on the map.

Another problematic task of providing the operational information during the deployment of emergency response is to develop the routes of the subunits to the emergency area, both on the way there and during the rescue actions. It is the basis of providing the information cooperation of rescue units through the general algorithm of receiving the operational reports [1-5].

Automated complex of control centre is designed to perform basic functions of radiotelephone operator and includes such tasks of operative receiving and transmission of emergency calls [4]:

- registration of requests and calls as to the emergency in the area;

- transmission of messages to ODS;
- filing of documentation and reports on operational work progress;
- organization of data exchange with the centre of operational management;
- routing communication channels;
- maintaining the duty register and personalities of radiophone operators, telephone operators, operational staff of the control centre;
- providing information for management tasks as for the rescue actions maintaining registers with the timestamp and the place of the accident;
- logging of persons engaged in the transmission of messages from the place of the accident and who give commands to operational actions.

Communication system is in ODS OCC of Operational management of the region of SSE. Communication system should provide two-way data transfer between an ordinary units and communication units in accordance with the priority of the tasks and categories of messages urgency.

Consequently to the problem of routing we can identify the types of channels for *one-way data transmission*, which include [4]:

- applications to leave to the place of the accident;
- orders for prompt exit of the rescue unit;
- check signals of equipment control;
- information on the progress of the rescue;
- report on fires, accidents and disasters;
- order for the redeployment;
- drill operational messages;
- reports on the level of danger;

*two-way data transmission*, which include [4]:

- information on the current state of technology and the level of preparedness;
- text information report on the progress of the disposal transaction;
- signals of confirm as to the information getting;
- interactive dialog prompt management of the liquidation acts (coordination and optimization of strategies and operational plans of actions).

Display system of operating situation (DSOS) in the detection and elimination of industrial accidents.

The display system of operating situation and location of units liquidators and emergency equipment is in ODS OCC as a subsystem of operational dispatching management (SODM) of elimination of threats. It should include the use of SODM and DSOS modules - to determine the location of mobile objects and units that move toward the place of the accident, in real time and provide data on all nodes of communication hierarchy of SSE, control centres and dispatch centres to display objects on the vector map (using GPS) and, on the basis of information received from the image of the situation scenarios as the basis for selection of the strategy for rescue actions. Using information obtained provides automated optimal decision making on the selection of routes to place of the accident. If the GPS system helps to

quickly pick the route and display it on an electronic map, but the choice of routes unilateral and bilateral channels of communication - < SODM - operational team of liquidators (OTL)> is much more difficult in an intellectual sense, because it requires analyzing the parameters and characteristics of communication channels for aligning them on the track of route formation <OTL - SODM>.

The basic tasks of sharing data streams in emergency are:

- choice of routes and the cable connections between nodes communication of operational management;
- evaluating data streams in telephone and computer communication networks;
- solving the problem decomposition structure of operational management and communication and their integration into national;
- develop route maps connections channels for the transmission of analogue, digital, multimedia information for operational control;
- selection and coordination protocols, their logic, procedural characteristics, structure and packet routing algorithms.

The problem of routing data channels in Internet-networks is solved via IP protocols and is done automatically by the address.

The most important function of the Internet Protocol, which has information and intellectual feature is routing data packets with a fixed address.

Intellectual element of this structure is the routing calculator. At its input packets from clients, managing packages conflict resolution are coming and it functions together with the *route table*, indicating the [3] *packet transmission route* for a given address. Failures in such a system are possible on the link-level (damage) and psychological level - the wrong set of addresses in stressful situations. Consequently such schemes are used as:

- *static routing* is due to the rigid structure of constant routing tables, and is specific for small specialized networks;
- *dynamic routing* is used to restore and correct the information on the structural hierarchy, in routing tables of specific telecommunications exchange node based on service coordination information with service nodes.

Solving the problem of routing as finding the optimal way of data transfer is not easy because of the structural hierarchy of channels at different speeds exchange of streams of data, i.e.

- basic routers with high speed sharing in main line;
- • autonomous - that play a connecting function with a low rate of exchange

Accordingly, in such systems with the IP network and hierarchical arise moments of *priori uncertainty* about the free shuttle line of communication channels. When selecting a route, except for information about coverage of the node it

is necessary to optimize the way to it that includes the presence of additional dynamic routing protocols.

Sophisticated network has a fixed structure and routing between the command and control centre is done using the software-address method [2,3].

For telephone network with analogue and digital data transmission systems [5] routing problem is more difficult because it is necessary to dock various communications systems and pay attention to their parameters and characteristics of the channels in the structure of networks:

- ATS (Automated Telephone Stations);
- intercity multichannel communication system (trunk);
- international lines of communication;
- trunk and local fibre optic digital communication lines;
- radiotelephone and multi-channel radio relay communication lines;
- systems of cellular and paging feedback connectivity;
- satellite communications.

The basic parameters of the formation of the route in such structures will be total frequency characteristics, which determine the rate of exchange streams of data, and integrated noise and interference in the path of route connected in circuit of duplex and semi-duplex channels. Network routes of global networks are characterized by a large load and therefore it is difficult to integrate the local networks of SSE in places of accident with navigational basis.

Making the route of data exchange includes the following components [4.11]:

- diagnostic of channels and networks for the ability to create networks for routing data [5,7];
- estimation of parameters of channel data of the selected route with reference to the navigation base [2-4];
- estimation of the quality of channels that provide the information protection [1-5];
- estimation of workload of data channels for passing data on the selected routes [2,5];
- estimation of the structure of transport networks of data passing in limit loads [8-11];
- building models of structure networks for selecting the optimum noise immunity on routes data [5, 9-11].

**Conclusion.** The models of communication channels routing in emergency situations are examined, and the influence of human factors is analyzed, the choice of mathematical tool for analyzing the information flow in networks is justified.

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