Mobile Information System Supporting Decision-Making at Local Government Level

Vasily V. POPOVICH., S. N. POTAPYCHEV, M.V. SHPAKOV, S. S. SHAIDA, R. Z. FEIZOV

St. Petersburg Institute for Informatics and Automation of the Russian Academy of Sciences (SPIIRAS)
39, 14 Linia VO St. Petersburg, Russia 199178, Tel. +7 812 3288071, e-mail: popovich@mail.iias.spb.su, www.oogis.ru

ABSTRACT

The paper proposes a concept of developing a mobile information system aimed at supporting regional level decision-making by city or region governments.

The above proposed concept's objective is a clarification of approaches to understanding the goals, tasks and principles of developing the mobile information system supporting decision-making by regional leaders.

The major issues considered by the paper are:

- substantiation of the system development urgency;
- discussion of system's development principles;
- determination of information resources and realization of information processing principles: harmonization, integration and fusion;
- determination of system's main functions and structure;
- determination of requirements to the system's information securing;
- forming suggestions for the system's organizational and legal issues;
- identifying stages of the system's development, implementation and exploitation.

As an example the paper considers a version of a mobile information system implementation for a university president. Original GIS technology, standard means of cellular communications and mobile devices were used to realize the above system.

1 INTRODUCTION

One of main tasks of regional governmental organization in modern conditions is providing the urgency of decision-making and approach to information resources.

Quality of management decisions, urgency of decision making depends on urgency, reliability and confidence of information about management and controlled subject.

Most obvious action that would allow to increase efficiency of acting governmental bodies is organizational and technical integration of their resources (technical and information first of all). Resources centralized control will allow optimizing their distribution.

It is required to use modern technologies of the information automated gathering, processing and visualization for decision-making tasks and particularly urgent decision-making. Nowadays it is becoming obvious that for effective management of compound geographically-distributed systems (a city, manufacturing firm or a trading company), increase of their medium-term or long-term stability, it is necessary to use information and automated systems of management, which realize last achievements in science of management.

As a result there appears a real chance to create integrated technical and information resource for general use by state authorities, local government and other systems participating in management of region which will be taken as the ground for automated system supporting decisions-making.

2 MAIN CONCEPTS AND DETERMINATIONS

Modern determinations and supporting systems decision-making (SSDM) originate as the management information and database control systems natural development and course; and represent systems which are adapted to solve management daily tasks. SSDM are tools to assist decisions making persons (DMP). With the help of SSDM they can solve unstructured and semi structured multi-objective tasks.

Under concept of mobile information system support decision-making (MISSDM) we shall consider SSDM of region government authority, that contains mobile component SSDM resource access on the base of communicators, pocket PCs and note-books.

3 SYSTEMS` DEVELOPMENT PRINCIPLES

Main principles for MISSDM development are:

- keeping the existing tools in all organization departments, subdivisions and services
- information and technical subsystems` integration on system and organization-information levels to solve tasks in the interest of region
- the system scalability support – adaptation to different use conditions; functional capabilities upgrade
- providing information security on all system levels in accordance with the information category
- systems` creation and implementation in stages

4 INFORMATION PROCESSING METHODS

By objects of MISSDM management we consider totality of objects controlled, that can be population, the region infrastructure bodies, environmental objects, economical activity objects, including all sources participating in providing security and vital activity.

Essential information needed for taking management decisions are:

- confidence information of the management objects` current state (location)
- critical data, defining the management objects` state
- archive database of the management objects
- forecasting information (got as the result of archival database processing with use of simulators) about tendencies and prospects of the objects` and processes` state changes
- information systems reference data (maps, cadastres, registers etc)
- other information systems` data

There appears a task of possible data source grouping on conceptual level, in conditions of the information resources plurality and variety, used in decision taking process.

In this paper it is offered to emphasize three groups or three types of data: harmonized, integrated and fused. Such grouping is of certain sense to understand the following determinations in the data usage and reforming processes:

- Defining the data type (measured, refined, extrapolated and/or interpolated data and etc.)
- defining the data source, quality and trust level to it
- possibility of data use to solve specific tasks
- possibility of data further conversion (the integrated data isomorphic conversions are, as a rule, impossible)

List above is not irrefragable at all, but allows explaining the idea or aim of the data conceptual decomposition.

The Information harmonization solves tasks below:

- providing access for great quantity of data proto-sources
- possibility to reform information into one comfortable for user (decoding, identification, translation, etc)
- Providing access to existing information resources

As a rule, information integration is determined by necessity of operating huge quantity of data in true (or closed to true) time scale.

- Date access is accomplished with use of different devices and depends on some points:
- required data-rate (true time or might be a certain delay)
- necessity of the data parallel processing and/or visualization

Depending on points listed above, data access is provided in layout which this data is kept in. But, frequently, data temporary conversion is needed, as data integrated in this layout is much more comfortable for further processing than simply harmonized data that is kept in different sources with different speed and access level.

Information fusion – means getting the information new quality (information content decrease).

Serves to achieve aims below:

- information content decrease
- the data reliability and security value increase
- the data stability increase (bug-fix)

The information fusion process distinguishing feature is getting new quality of information and volume decrease.

Thus, information processes` analysis shows that their comprehensive automation is required. Only in this case, a person taking decision will have urgent, reliable and full information and will have possibility of management urgency in time scale corresponding to specific situation.

5 SYSTEMS` FORMATION APPROACH

5.1 MISSDM main functions

For effective support decisions-making MISSDM must provide automation of functions below:

- providing the chiefs with reliable and relevant information, submitted by information resources, technical systems, other data sources
- monitoring in true time of certain objects` state
- data accumulating and storage for further usage
- analysis, forecasting, modeling and other types of the data intellectual processing
- events and reaction positioning with use of geographic information system (GIS)
- providing controlled access to MISSDM information resources for slave structures control
- providing MISSDM-users by information resources management and display common interface
- providing users` common centralized authentication and access hierarchy support with priority system
- reporting about the users` actions and system state in general

System functionality shown above will provide urgency decisions-making support.

As MISSDM combines the resources of manifold geographically-distributed information and technical systems with different departmental and industrial tenancy, functions should also include the following:

- providing the information secure and information resources protection in system
- providing information integrity and consistency in system
- providing user's individual rights mode
- providing system resources centralized access control

5.2 MISSDM generalized structure

MISSDM generalized structure is shown on Fig.1

The main factor defining MISSDM elements` content and their interconnection is the system required functionality. In accordance with list of required functions MISSDM should provide to solve tasks on

information data ware for regional governmental authority governing body system should also include following functional elements.

1. Totality of functional systems that are the MISSDM information proto source (local devices – LD):
    - Systems providing objects` and processes monitoring (monitor , remote sensing, video-control systems , etc.)
    - systems for getting information from inhabitants
    - Information systems including ones containing reference data (cadastre, registers, reference-books, classifiers, etc.)
2. Rated-analytical systems providing information processing using specified algorithm.
3. Access control system providing user rights centralized assignment for system information resources use.
4. Information security providing system that is fulfilling Russian Federation statutory acts and legislation domain of confidential information secure during its automotive processing and transmission on communicative channels.
5. Integrated subsystems:
    - integrated net combining MISSDM elements into one information space, and providing users information availability within the authorized rights;
    - inter-action modules, that are realizing service oriented technologies of system elements and user united interface
    - information sources metadata
6. Mobile terminal equipment providing information receipt, predetermined concept and display.

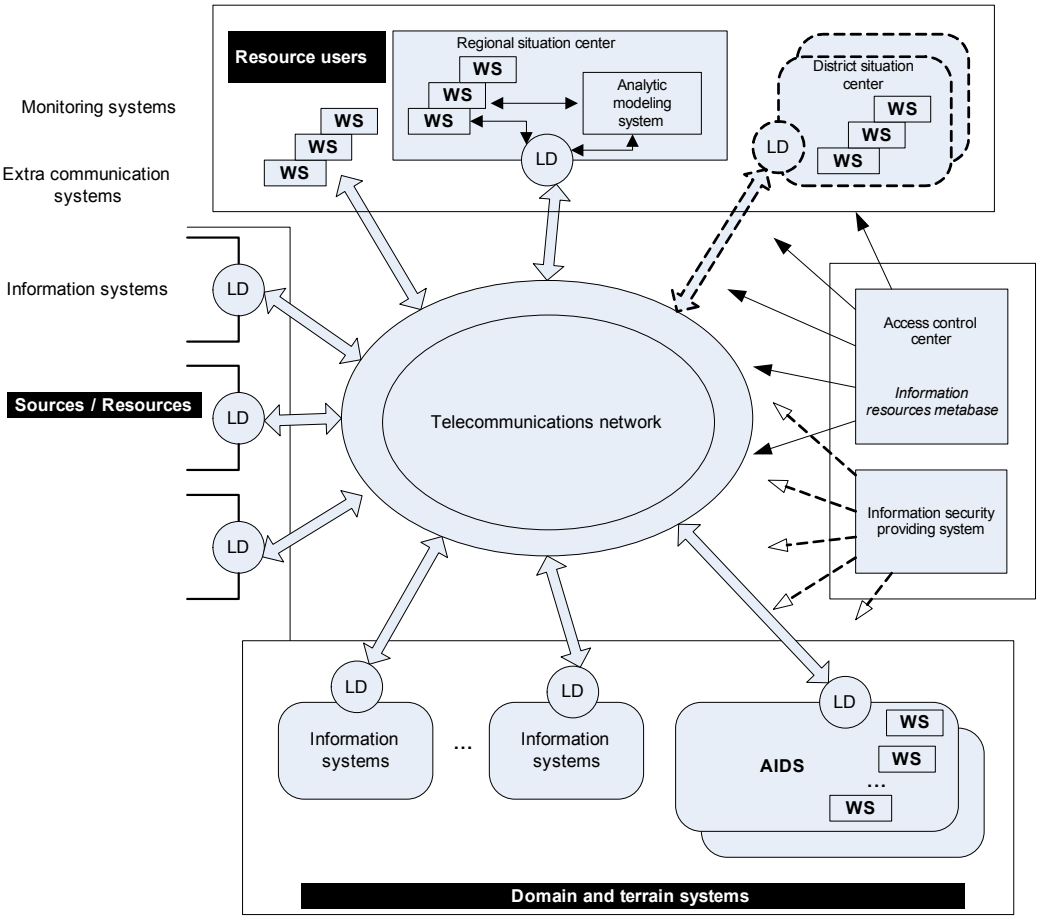

Fig.1. MISSDT generalized structure.

5.3 Providing information security in MISSDM

Main principles of MISSDM unauthorized access protection system formation are:

- consistency and complexity
- implementation simplicity and flexibility
- reasonable sufficiency
- rights minimization
- control availability

5.3.1 Consistency and complexity

Consistency principle implies necessity to record all factors influencing the MISSDTM protect ability during MISSDM designing, planning, implantation and operation.

The system complexity implies combination and coordinated use of organizational measures and engineering-technical tools (including software and hardware) within single protection system limits.

5.3.2 Implementation simplicity and flexibility

Simplicity principle means that used measures and tools must be clear and simple for use. Protection system existence should not, if possible, impede the MISSDM users` work.

Protection system flexibility means preferable use of the protection measures and tools which are providing wide abilities in setting and consistency with used MISSDM software.

On the whole, this principle means that protection system should not significantly worsen the MISSDM functional characteristics (reliability, processing speed, ability of configuration change).

5.3.3 Reasonable sufficiency

Practice of the local and foreign automated systems use shows that it is impossible to generate ideal protection system. Having enough time and tools any protection can be broken. Besides, generation and support of protection system in working condition require human and technical resources (as more as high is provided security).

Thus, you should choose the protection level to optimize correlation of risk, possible losses size and required costs.

5.3.4 Rights minimization

Each employee from MISSDM service and operating staff should have minimal authority for information access and processing. At the same time, this authority should be enough fro the employee to fulfill its official duties.

5.3.5 Control availability

This principle implies the necessity of special ways and tools creation to prevent unauthorized interference attempts into the protection tools operation on one side, and necessity to develop measures for discussed tools operational capability and posedness control on the other side.

To separate access and control rights for system resources use within information space limits, it is generated a system of a user single authentication and authorization, taking into account all hierarchical priorities, and report recording of the MISSDM information resources use.

Single authentication, authorization and report recording system allows to:

- authenticate system users
- authorize users taking into account their hierarchical priorities
- connect new users to system resources according to predetermined regulations and change rights of the existing ones, including formation of groups with similar access rights
- Get report on the MISSDT resources use and users` operation

6 PRACTICAL EXAMPLE OF MISSDM CREATION

We have created MISSDM prototype for Actrakhan State University.

MISSDM prototype solves the following tasks:

- information and analytical support of the university economical activity
- information and analytical support of the staff management activity
- information and analytical support of curriculum process management
- Geographic spatial orientation with connection to global positioning system

The MISSDM software consists of server and clients parts,

Server part includes following software components:

- university staff, students and economical activity database
- management system of the database mentioned above
- Microsoft .Net Framework 2.0 –basic platform to run programs of MISSDM server part.
- Web-service AspuRectorWS, including sampling components and preliminary processing of data from databases above.
- Internet Information Services components, on the base of which Web service AspuRectorWS is being developed;
- AspuDBManager – MISSDM server part setting program
- AspuDS – library for general program elements, being used by Web service and server part setting program
- The MISSDM server part is located at the university Internet-server with published domain-name and IP-address.

The MISSDM clients` part consists of following program components:

- local database of university staff, students and economical activity
- local database description XML schedules
- local database management system Microsoft SQL server Mobile;
- Microsoft .Net Compact Framework 2.0 – basic ground to run programs of the MISSDM clients part
- RectorLib – libraries of MISSDM range;
- RectorCE – Pocket PC of MISSDM version;

The MISSDM clients` part is installed on pocket PC (Fig. 2).

7 CONCLUSION

Nowadays, within the federal program “Electronic Russia” they have foreseen measures to increase the society information, increase of information resources, improvement of their control. For obvious effect there are needed corresponding measures in Russian Federation regions and agents.

SSDM for regional governmental body should solve tasks of grouping different database on conceptual level. In this paper we have observed main methods of the information processing and offered a way to create mobile SSDM.

Prototype of mobile information system support taking-decision was created on the base of the approach offered (for Astrakhan State University)

Fig.2. MISSDM client's part.

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