Geoinformation Portal as a Component of Unified Geoinformation Environment

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Abstract

The relevance and necessity of the implementation and use of geoinformation systems for military purposes is due to the general increase in the requirements of the troops (forces) for the efficiency, completeness and quality of the information support of the management process. The armed aggression of the Russian Federation against Ukraine creates new challenges to the state's information security and necessitates a review of the requirements for information support in general and for geoinformation support in particular.

The paper determined that the foundation of the Unified Geoinformation Environment of the Armed Forces should be a service-oriented architecture (SOA) of distributed geodatabases, that provides a common platform for all subjects and users to access the resources of the Unified Automated Management System of the Armed Forces of Ukraine. The Unified Geoinformation Environment (UGE) of the Armed Forces should be formed as a set (network) of interconnected geoportals, the purpose of that is to consolidate information on spatial data available in the Unified Automated Management System of the Armed Forces, that are processed and provided for use in the form of geoservices as well as creating a single-entry point of users into this environment. UGE of the Armed Forces of Ukraine should provide access to data stored in the system of distributed geodatabases. The format and method of using the services should be based on the use of national, international and military standards, that are a single, agreed and approved set of data presentation standards, interfaces, as well as computer programs developed according to the principle of service-oriented architecture for all types of armed forces.

KEY WORDS: *Unified Automated Control System (UACS)of the Armed Forces, geoinformation support of the troops, service-oriented architecture (SOA), geoportal.*

1. Introduction

The current views on armed struggle, their impact on the using of the troops (forces) in the war with the Russian federation, new asymmetric threats to Ukraine's national security, and the reform of the Armed Forces of Ukraine require a review of information requirements in general and geoinformation in particular.

The development and introduction of new weapons, the ephemerality of the armed struggle at the present stage require a significant increase in the efficiency of the military management system. In solving this problem, one of the key roles should be played by geoinformation support as a tool for analyzing the operational situation and a means of automating the process of making managerial decisions by military authorities' officials. According to current trends in information systems [1], the Unified Geoinformation Environment of the Armed Forces should be formed as a set (network) of interconnected geoportals, the purpose of that is to consolidate information on available in the Unified Automated Control System of the Armed Forces (AF).

Based on the main tasks [2], the geoinformation support is the modern spatially distributed subsystem of system-wide information support of the Unified Automated Control System (UACS) of the Armed Forces, that is able to process spatial data in conjunction with other information circulating in it. The review of various areas and examples of the use of geoinformation technologies in military affairs [1,3], as well as the relevance of developing automated geoinformation subsystems of military management [1,2] necessitate scientific substantiation of the creation aspects and operation of geoinformation portal as an important component of geoinformation environment.

The purpose of the paper is to substantiate the creation and functioning principles of the Geoinformation Portal of the Armed Forces as a component of the Unified Geoinformation Environment of the Armed Forces, that involves the following tasks:

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– the characteristics of the optimal model of the spatial data organization of the UACS of the Armed Forces;

– the substantiation of the necessity of implementing the Geoinformation Portal of the Armed Forces and determining its structure and functioning features.

2. Investigation Results

The foundation of the Unified Geoinformation Environment of the Armed Forces can be service-oriented architecture (SOA) of distributed geodatabases [4,5]. The purpose of deploying service-oriented architecture is to provide a unified form of information resources management of the Armed Forces. The main role of the SOA is that it provides the common platform for all actors and users to access the resources of the UACS of the Armed Forces. In the case of flexible design methods, the transition to SOA should be through one or more pilot projects.

The basic means of the geographic information environment of the UACS of the Armed Forces should include server components that are specifically designed to support the SOA (both tools and tools to support its operation). This model of the spatial data organization goes beyond editing the unified geodatabase by creating the decentralized geodatabase. Many entities (users) can publish their data and register it for search and use by any number of remote users. Those, in turn, can either download the data set in full, or use cartographic WEB services to dynamically sample and download the small amount of data needed in their current map extent. The process of asynchronous editing and publishing can be extended to support the process of data distribution according to the subscription, with that each user can access the updated data only when they need it [3]. At the same time, an important condition for the creation of the Unified Geoinformation Environment of the Armed Forces is to ensure the process of disparate data's integration. One of its types is WEB-integration, that is most appropriate to use in our case. During its implementation, the data remains with the owners and even their location is unknown. The query refers to certain services that are related to the sources where the information is located and its specific address. The data integration integrates information from multiple sources so that it can be provided to the end user as the service. The SOA approach focuses primarily on identifying and sharing services in the form of services with relatively limited number of the key functions in the UACS AF. Thus, the service-oriented interfaces are based on the limited number of requests for the necessary information to be provided to the consumer [4,5].

The following approaches to WEB integration are practiced:

– the integration at the presentation level. This level allows the user to interact with the application. The view-level integration provides access to the user interface of remote applications;

– the integration at the level of functionality. This integration provides direct access to the application algorithm. It's achieved by direct interaction of applications with API (Application Programming Interface) or interaction using WEB services;

– the integration at the data level. In this case, the access to one or more databases used by the remote application is assumed;

– the complex integration. These WEB integration solutions usually include all three types of integration.

Analyzing the technical aspects of the spatial data integration and modern server technologies for access to resources, it can be argued that the most optimal way to create the unified geoinformation environment for the UACS AF is to implement a geoinformation portal of the Armed Forces (hereinafter – the geoportal). It's the software information and communication platform designed to create the Unified geoinformation and information-analytical environment of military authorities, military units and subdivisions of the Armed Forces with delimitation of users' access rights to these resources.

The geoportal as a set of software and hardware, network services and geospatial data services that provide display in the geodata network, must perform the following main tasks:

– the processing and issuance of information on automated workplaces (hereinafter AWP) of military administration bodies officials (military units);

– the providing access to the unified geographic information space to officials of military administration bodies (military units, subdivisions);

– the ensuring cooperation with other military formations and law enforcement agencies within the unified geographic information space;

– the providing search / access to necessary information.

The geoportal must have the following basic set of the map services:

1) the cartographic service of electronic (digital) maps – a multi-scale cartographic service that contains vector information of the entire range of topographic and survey-geographic maps;

2) the cartographic service of electronic (digital) maps in three-dimensional display - a copy of the cartographic service of electronic (digital) maps with the possibility of geographical information visualization in three-dimensional display;

3) the cartographic service of remote Earth sensing - a service that contains materials of remote Earth sensing (aerial photography, space photography and filming from a UAV) and allows to quickly create photo documents about the area;

4) the cartographic service of remote Earth sensing in three-dimensional display;

5) the cartographic service for downloading raster maps - a cartographic service that allows to download topographic maps of the entire range in raster formats to the APM with the possibility of their further printing (reproduction).

As a software component, it's optimal to use ESRI's ArcGIS server multi-user software with Enterprise performance level and Advanced functionality class. To ensure continuous operation of geoportal software and services, to prevent data loss, it's necessary to deploy a fault-tolerant configuration according to the "active-passive" architecture. Each of them has its own local configuration stores, server directories and backs them up. In case of software or technical failures on the main GIS server, the backup "passive" GIS server automatically takes over the "active" functions until the main one is restored. Thanks to the specified principle, the three-level service and data protection is ensured.

3. Conclusions

Thus, the solutions highlighted in the paper on the functioning of the Unified Geoinformation Environment of the Armed Forces through the creation of the Geoinformation Portal of the Armed Forces are an important component of the integration of all other technologies that are used or planned to be implemented as part of the UACS of the Armed Forces to solve various problems related to the management of troops. The modern challenges that have arisen in connection with armed aggression against our country require thorough research and practical testing regarding the creation of the Geoinformation Portal of the Armed Forces as a complex of software and technical tools, network services and geospatial data services. The implementation of the Geoinformation Portal of the Armed Forces during fighting should provide the following:

– the formation of the unified information space within the theater of operations of troops (forces);

– the reflection of the area's state, as well as the operational situation;

– the generalization (scaling) of cartographic information depending on the tasks to be solved;

– the suppling of cartographic data to ensure the setting of tasks for the implementation of commanders' decisions of all levels of the subordination's hierarchy;

– the processing of coordinate and raster (space images, aerial, photo) information from all types of intelligence;

– the providing technologies for automated analysis of the combat situation;

– the geoinformation support of automated solution of tasks related to the types of operational support of the Armed Forces;

– the ensuring the compatibility of automated systems and means of automation of the UACS of the Armed Forces in terms of spatially distributed information with other similar systems in terms of performing tasks in the coalition of troops (forces).

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