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DEVELOPMENT OF SERVICE MEANS FOR LIFE CYCLE REMOTE SUPPORT OF PRINTING ORDER

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Peculiarities of common schemes of orders circulation in operative printing establishments as typical representatives of small and medium business are considered. The decisive factors of minimization of delays and costs of the Printing Corporation and directions of production technologies optimization in accordance with the current market situation are determined. National and world approaches to implementation of information flows remote monitoring for common business models are analyzed. The lack of research on reduction of administrative and technical services together with the involvement of means and production objects is detected as active participants in business processes in expansion of communication tools for the network infrastructure.

Hardware and constructive means for remote support of printing services are optimized. Therefore, it is shown that for further deployment of multilevel system of administration of distributed resources of polygraphically oriented network infrastructure within the original infological sheme there is a need to design a software engine for routing distributed workflows and corporate work for enterprise of operative printing. The scientific novelty of obtained results lies in development of the original conceptual model of solving distinct problems for remote support of life cycle of a printing order. The performed research results have allowed stratifying the signals set in render printing services system, allowing clarifying and expanding the basic communicative functions for executive units of technological process.

The designed server part of software complex of network infrastructure administration of the publishing and printing enterprise will allow automating the targeted delivery of information packages to end users. It will also optimize the order fulfillment processes by adding to the CIPx PPF data stream scenarios describing the appropriate stage of preparation of printed products.

Keywords: *network infrastructure, order life cycle, remote administration, operative printing.*

Formulation of the problem. With the development of market relations, operative printing establishment have concluded original schemes for the circulation of orders, but in the technological maps of small and medium-sized businesses, these maps have shortened trajectories due to limited amount of jobs and material resources. The crucial factor in minimizing the delays and costs of a printing corporation, as well as optimizing production methods according to the current market situation is to build a correct information network that coordinates the set of devices and

relationships between their components, implementing unchecked, timely and high-quality order fulfillment.

Given the permanent desire for innovative progress, such institutions are weakly dependent on external market levers, financial fluctuations, etc. and are resiliently adapted to modern realities, while dynamically optimizing the ways of providing targeted services. However, despite the combination of several basic actions in one stage of the technological process of the infrastructure of a small printing company, it is important to implement at each stage of the service extended monitoring of coordinated information flows. These dynamic structures should include notification about the features and degree of order fulfillment. And it is also necessary to provide for the inevitable and gradual expansion of the system architecture and improve its modularity and strategic potential.

Analysis of recent research and publications. Original solutions for remote service of small-sized businesses based on modern mobile and AR-technologies are offered by scientists Politecnico di Milano and di Bari [1]; the University of Ljubljana in collaboration with the University of London and Cranfield University are exploring ways to distance diagnose complex equipment using remotely interfaces [2]. Instead, the University of Ibadan [3] uses tele-autonomous vehicles for highly specialized applications of remote sensing and streaming surveillance through a dynamic environment: here to improve communication between the operator and the technological node of the extended Internet connection used the original Human-Vehicle Interface, which implemented facilitation TeraTerm Terminal Emulator.

Thus, the staff of Witten / Herdecke University publishes the results of analysis the dynamic capabilities specifics of small-sized enterprises on business models innovation of production infrastructure [4]; the conceptual basis of different types innovations in context of Industrial Internet of Things for machine-to-machine business space has been put forward by Finnish and Canadian colleagues [5]. Intelligent methods of cluster optimization to improve the effect of merging industrial data of the monitoring object on the basis of IoT are being developed at Hunan University of Technology [6], and in the Spanish University of the Basque Country offer to accumulate advanced information about possible errors and deviations from the desired conditions and also to store historical data of workpieces made at one technological stage, for further computer design of the production cycle structure, in particular to training highly qualified specialists [7].

Given the ancient technical traditions of national scientific schools, domestic researchers are mostly represented in the subject area of real-time monitoring of information flows, taking into account the limitations of size, power consumption and cost of telemetry equipment [8-11]. Thus, the available research is mainly focused on assessing the experience and competencies of specialists in equipment maintenance, optimization of engineering cooperation, elimination of redundancy and filtering of telemetry data. However, the widespread sources do not enough clearly cover the means of reducing administrative and technical services, there are no clarifications on how to implement unimpeded and high-quality preparation of printing order while reducing the complexity of the production process and expanding communication network infrastructure.

The purpose of the article is to design service utilities for remote administration of network infrastructure of publishing and printing institution for corporate management of distributed resources, flexible redistribution of server loading, dynamic monitoring of individual workstations state and implementation of protection targeted means of information flows for operative printing network infrastructure during the life cycle of the executed order.

Presentation of the main research material. The use of structured system gives the network infrastructure of printing company a number of advantages and with a well-thought-out organization can be the only platform for the transfer of computer data in a corporate computer network: proceedings telemetry of printing equipment, consumables, monitoring of fire and environmental safety sensors, electricity and gas distribution, security systems, etc., organization of situational chat conferences, deployment of local telephone exchange, video transmission and targeted informing performers and customers about the current stages of order fulfilment. Correct implementation of the communicative environment of remote backing of printing services will significantly simplify the service support of the network infrastructure and improve its quality.

For sufficient administration of operational processes the printing profile institution, service and network security, the project implements Remote Access Service toolkit, which in a distance session uses a random combination of network protocols and in the NBT protocol operates in gateway mode. Therefore, the above optimized service successfully acts as an analogue of the hardware router in the case of deployment of a small printing enterprise in a selected cloud fragment [12]. The project also developed a network interface of distributed resources of the printing company, which provided coordination at the channel level of secure connection, data delivery and segment flow management using TCP and UDP transport layer protocols of the Open Systems Interconnection model [13]. However, for further deployment of a multilevel system of distributed resources administration of polygraphically oriented network infrastructure within the original infological model [14] there is a need to create a large-scale software suite or coordinate a package of separate utilities with modular interoperability to solve certain problems of remote support of the life cycle of a printing order.

The specifics of developed project allow the administrator to actions controlling to order's executors by viewing a remote workstation screen copy, , to take note the list of running processes, using the file manager to have an idea of the status and load of disks, files and folders and provide messaging in the general chat. If necessary, it is possible to partially remotely control the active object of technological process by adding, completing the necessary processes, starting and destroying any target flows. The built-in chat will be convenient for prompt contact with the administrator and in general for communication between customers and performers. Thus, the main purpose of the presented project of remote administration (Fig. 1) is a fast and optimal, and at the same time documented solution of specific tasks for the maintenance of workstations of the network infrastructure of the printing company.
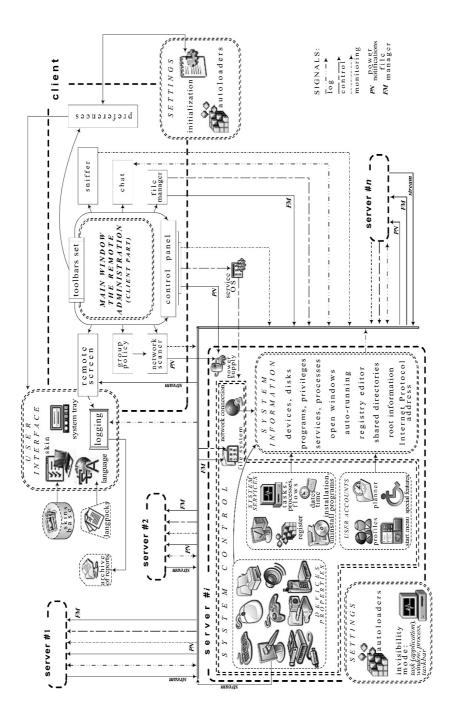
Fig.1. Conceptual model of remote support of life cycle the polygraphic order

The interface of the designed *BAnM* service mean according to DWIM concept is not overloaded with graphic elements is intuitive and convenient and provides correct sequence of screen forms. Navigation elements and editing toolkit satisfy the accepted SAA agreements in terms of use of function keys, operating modes, search, and use of the window system. Input / output of system data, response to control commands and reaction to the results of their execution happens in the interactive mode. The interface meets modern ergonomic requirements and provides convenient access to main functions and operations of the system.

The developed project of remote support of a life cycle of the printing order of *BAnM* consists of two hypermodules – server and client. When designing the server part of *BAnMsrv.exe*, in particular, the startup procedure is implemented and the invisibility mode is provided. Also, the server part does not have a GUI and after startup takes itself out of the processes. TCP connection on the server side is implemented using ServerSocket component. Due to the fact that ports up to ~ 1000 are already occupied by network services, such as port 80 – WWW-server, port 21 – FTP-server, 110 and 25 for working with mail agents, etc., the designed server will be activated on port # 33333. When a message is received, ServerSocket calls an OnClientRead event, passing a Socket variable having the type TCustomWinSocket.

This is followed by verification of the received data, and if this received text matches any command of the server, then to client is sent the corresponding result to the connection from which the request was received. Therefore, the ServerSocket component can support multiple distributed streaming connections. At the end of the session, when the client part is closed, *BAnMsrv.exe* server will wait for a ping to appear on the network; if the ping is not received the server process will itself close.

Conclusions. The constructed conceptual model of the client-server environment of remote administration in accordance with the sound architecture of the information network and the specified criteria allowed one to determine the basic communicative functions of network components of the development environment used in programming the server part. Therefore, presented conceptual model is the basis of designed software engine to support the formation of workflows and corporate record keeping in process of distance managing the operative printing enterprise.

Further search for deployment of remote administration platform solutions will optimize the order execution process and include in CIPx PPF data flows the scenarios describing the appropriate stages of preparation of printed products. Also for the successful promotion of the project of a service means for remote administration the network infrastructure of printing enterprise should focus on developing a client utilities that provides a toolkit for access to automated workstations and telemetry readings at remote monitoring of the printing order life cycle.

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РОЗРОБЛЕННЯ СЕРВІСНИХ ЗАСОБІВ ВІДДАЛЕНОГО СУПРОВОДУ ЖИТТЄВОГО ЦИКЛУ ПОЛІГРАФІЧНОГО ЗАМОВЛЕННЯ

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Розглянуто особливості поширених схем проходження замовлень у закладах оперативної поліграфії як типових представників малого та середнього підприємництва. Визначено вирішальні чинники мінімізації затримок і затрат поліграфічної корпорації та напрями оптимізації технологій ведення виробництва відповідно до наявної ринкової ситуації.

Проаналізовано національні та світові підходи до реалізації дистанційного моніторингу інформаційних потоків поширених бізнес-моделей та виявлено відсутність досліджень щодо скорочення адміністративно-технічних служб і долучення засобів та об'єктів виробництва як активних учасників бізнес-процесів при розширенні комунікаційних засобів мережевої інфраструктури.

Впорядковано оптимізовані апаратні та конструктивні засоби віддаленої підтримки поліграфічних послуг і показано, що для подальшого розгортання багаторівневої системи адміністрування розподілених ресурсів поліграфічно орієнтованої мережевої інфраструктури в межах оригінальної інфологічної схеми виникає необхідність проектування програмного рушія маршрутизації розподілених робочих потоків та корпоративного діловодства для закладу оперативної поліграфії.

Наукова новизна одержаних результатів охоплює розроблення оригінальної концептуальної моделі для вирішення окремих задач віддаленого супроводу життєвого циклу поліграфічного замовлення. Результати виконаних досліджень дозволили стратифікувати множину сигналів у системі надання поліграфічних послуг, давши змогу уточнити та розширити базові комунікативні функції виконавчих вузлів технологічного процесу.

Спроектована серверна частина програмного комплексу адміністрування мережевої інфраструктури видавничо-поліграфічного підприємства дозволить автоматизувати цільову доставку інформаційних пакетів до кінцевих користувачів, оптимізувати процес виконання замовлення, долучаючи до потоку даних CIPx PPF сценарії опису відповідної стадії підготовки друкованої продукції.

Ключові слова: *мережева інфраструктура, життєвий цикл замовлення, віддалене адміністрування, оперативна поліграфія.*