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Dmytro Diachenko, Matvii Korobeinikov, Oleksandr Korobeinikov, Andriy Kovalenko, Pavlo Kravchenko

Kharkiv National University of Radio Electronics, Kharkiv, Ukraine

DATA PROCESSING METHODS IN A CORPORATE NETWORK

Abstract. Relevance. In the context of modern digital business transformation, corporate networks have become critically important components of enterprise information infrastructure, integrating numerous systems, devices, and services into a unified information environment. Every day, vast volumes of data are generated, transmitted, stored, and processed within these networks, encompassing all aspects of organizational activity – from financial operations and logistics to customer communications and internal management processes. The successful functioning of a corporate network is impossible without effective data processing, which enables the extraction of valuable insights from raw data, supports strategic decision-making, ensures information security, and optimizes resources. Amid intense competition, the rapid growth of information flows, and increasing demands for swift decision-making, data processing methods play a crucial role in enabling the analytical capabilities of enterprises. Data processing methods in corporate environments find applications across diverse business sectors. In the financial domain, they are used for transaction analysis, risk management, market fluctuation forecasting, and fraud detection. In logistics, they support route optimization, warehouse stock control, and real-time supply coordination. In marketing, they facilitate customer behavior analysis, audience segmentation, and personalized communication. In HR departments, they assist in employee performance evaluation and candidate selection. In healthcare, they support patient data analysis, service process optimization, and clinical decision-making. Furthermore, data processing forms the foundation for the development of artificial intelligence systems, digital twins, cybersecurity solutions, and automated enterprise management. Traditional approaches to data processing are gradually being replaced by advanced technologies based on Big Data, real-time stream processing, cloud computing, intelligent data analytics, and machine learning. In this context, issues related to data protection, integrity, availability, and compliance with legal and regulatory requirements for confidentiality gain particular importance. **The purpose** is to analyze modern methods and technologies for data processing in corporate networks, identify their advantages, disadvantages, and application areas, and classify approaches to data collection, cleansing, storage, and analysis. **The object** of research is enterprise corporate networks. **The subject** of research includes methods and technologies for data processing, storage, analysis, and protection. T**he results.** As a result of the conducted research, a comprehensive understanding of modern data processing methods in corporate environments was formed. The architectural models of enterprise information systems were analyzed, key stages of data preparation identified, and approaches to their processing – from classical to intelligent – were characterized. The review revealed a wide range of data processing techniques, from traditional SQL queries and multidimensional analysis to real-time processing and machine learning applications. The choice of a particular approach depends on data volume, data inflow speed, latency sensitivity, and the specific goals of processing.

Keywords: corporate network, data processing, architecture, transaction, cybersecurity, Big Data.

Introduction

The successful operation of modern enterprises largely depends on the efficiency of processing large volumes of information circulating within corporate networks. This involves the collection, systematization, storage, analysis, and transmission of data between various company departments, as well as external counterparties. The complexity of information processing increases with the growing volume of data, the need to ensure prompt access to information, and the tightening requirements for data security and protection. Within a corporate network, data processing encompasses the entire information lifecycle – from its creation or external acquisition to its storage, analysis, and subsequent use in decision-making processes.

To fully understand the essence of data processing in this context, it is essential to have a clear understanding of what constitutes a corporate network and the types of data that circulate within it.

A corporate network represents an integrated environment that unites computer systems, servers, storage facilities, network equipment, software, and users into a single information space. Such a network enables uninterrupted communication among all structural units of an organization, regardless of their physical location, allowing for centralized data management, information exchange, and access to resource management, reporting, and customer support systems.

The data circulating in a corporate environment may vary in format and degree of structure. Structured data includes information arrays with a clearly defined format, such as numerical tables or records in relational databases. Unstructured data, in contrast, lacks a fixed format and may include emails, text documents, audio and video files, images, or social media messages. A separate category is semi-structured data, which contains a certain degree of organization but does not conform to traditional relational database formats.

In this context, data processing entails not only the technical computation of data but also includes stages such as data collection, filtering, aggregation, transformation, analysis, and subsequent presentation in an interpretable format. A key feature of corporate data processing is the necessity to account for complex access hierarchies, user roles, security levels, and adherence to data storage and processing policies in accordance with regulatory requirements.

A defining aspect is that corporate data does not exist in isolation. It is closely integrated into an organization's business processes, forming the context in which it gains significance. This underpins the need for a comprehensive infrastructure capable of handling data processing in alignment with the company's scale, structure, and operational dynamics. Thus, understanding the fundamental concepts related to the nature of corporate networks and the types of data processed within them is critical for the effective implementation of modern data processing methods in the context of high-intensity digital transactions and analytical demands.

All these factors create the necessity for a systematic study of processes associated with data handling within corporate networks. Given the growing demands for the speed, reliability, and scalability of information solutions, it is essential to examine not only the general principles of such systems' operation but also the specific methods employed to ensure a complete data cycle – from acquisition to analytical reporting. In this context, the analysis of contemporary approaches to data transformation, selection of processing algorithms, automation tools, and visualization instruments becomes particularly relevant, as they enable not only data storage but also the extraction of practical value for managerial decision-making.

The purpose is to analyze modern methods and technologies for data processing in corporate networks, identify their advantages, disadvantages, and application areas, and classify approaches to data collection, cleansing, storage, and analysis.

Main part

The architecture of a corporate data processing system represents a comprehensive, multi-layered structure that ensures interaction between technical, software, and organizational components for the effective management of information flows within an enterprise. Under modern conditions, such an architecture must not only be capable of processing large volumes of data but also of promptly responding to changing business requirements, ensuring scalability, fault tolerance, and uninterrupted access to critical services.

A central element of any corporate architecture is the logic governing the distribution of data and computing resources, which may follow either a centralized or a distributed model. In centralized models, core processing and storage are performed on a single server or within a corporate data center, enabling efficient control over data access, updates, and backup operations. In contrast, distributed systems delegate processing and storage tasks to multiple network nodes, which helps reduce latency, increase flexibility, and bring data closer to end users – particularly in geographically dispersed branches of an enterprise.

The emergence of cloud technologies has led to significant changes in architectural approaches. The virtualization of computing resources, the use of infrastructure as a service and platform as a service [1], have enabled companies to dynamically scale computing power, deploy new services without significant investment in hardware, and integrate with external service providers. In such an environment, data can be stored in cloud repositories, processed through virtual clusters, and analytics can be accessed via web interfaces from anywhere in the world.

Despite these advantages, such solutions require special attention to issues of security, access control, data leakage prevention, and compliance with international standards for the storage of personal and commercial data.

The architecture of data processing also includes modules responsible for integration with data sources – these may include corporate accounting systems, CRM systems, sensors, web services, or partner company databases. At the next level are processing services, which implement the logic of transformation, aggregation, filtering, and verification of information using both traditional software tools and specialized frameworks such as Apache Spark [2]. A critical part of the architecture is the result presentation interface, which allows users to interact with processed data through visualization dashboards, reports, or API interfaces for further use in business applications.

An effective architecture for corporate data processing must take into account the specifics of the industry, the scale of the company, the types of data being processed, and the organization's level of digital maturity. Only a flexible, scalable, and secure architecture can enable full automation of analytical processes, reduce infrastructure costs, and significantly improve the quality of managerial decisions based on up-to-date data.

In the context of corporate networks, data processing is impossible without a high-quality and systematic approach to data collection and preparation. This stage determines not only the volume and relevance of available information but also its cleanliness, completeness, and suitability for further analytical processing. In many cases, it is at the collection and preprocessing stages where data suffers the most significant quality losses, which may subsequently lead to erroneous conclusions or ineffective management decisions. Therefore, the question of corporate data collection and preparation methods is of critical importance.

Data in corporate environments can come from a variety of sources, each with its own structure, formatting standards, and update frequency.

The main sources include internal enterprise information systems – particularly enterprise resource planning systems [3], accounting and logistics platforms – as well as external web services, API platforms, user behavior monitoring tools, the Internet of Things, and partner databases. Given the high heterogeneity of these sources, the data collection process relies on specialized integration tools that ensure the unification of incoming information and its delivery to a single processing environment.

One of the key methodological approaches to data collection and preparation is the ETL process, which consists of three logically connected stages [4]. The first stage involves extracting data from sources, where it is crucial to ensure data flow continuity, avoid record duplication, and maintain version control. In the transformation stage, data undergoes various operations such as filtering, format standardization, anomaly removal, deduplication, handling of missing values, categorization, or merging of records from multiple tables. The final stage is loading the cleansed and transformed information into target systems, which may include data warehouses, analytical databases, cloud platforms, or local enterprise servers.

Particular attention should be given to the data cleansing phase, as real-world information obtained from corporate sources is often incomplete, noisy, or contains logical inconsistencies. The preparation process uses methods such as automated validation, verification rules based on domain constraints, and algorithmic tools for detecting outliers, atypical values, or logical inconsistencies within records. In many cases, normalization is also applied to bring the data to a common scale for further statistical or machine learning processing.

Modern data integration and preparation platforms allow automation of key steps in the process, reduce human involvement in routine procedures, and ensure quality control at every stage of processing. Their use is especially justified in environments with high demands for speed, process repeatability, and infrastructure scalability.

Thus, the quality and relevance of the information received by a business largely depend on how well the processes of data collection and preparation are organized. Only with reliable integration of sources, flexible data transformation, and continuous quality monitoring is it possible to build an information environment that supports effective analytics, forecasting, and strategic decision-making based on accurate and timely data.

Data processing in a corporate environment is a complex and multifaceted process that involves transforming incoming information into a form with practical value for decision-making, process optimization, and the generation of analytical reports. Depending on the objectives, data volumes, technical capabilities, and time available for analysis, companies may apply a variety of processing methods – ranging from classical statistical techniques to high-performance systems incorporating elements of artificial intelligence.

In traditional corporate systems, data processing is typically based on the use of relational databases and SQL queries.

This approach enables aggregation, sorting, filtering, and selection of data based on various criteria, which is sufficient for most basic reporting tasks. Additionally, OLAP analytics tools are widely used, providing multidimensional data analysis in cube format, allowing managers and analysts to quickly gain insights into key performance indicators [5]. In cases where large volumes of data need to be processed or complex scenarios constructed, these methods are complemented by batch processing tools that run on schedules or are triggered under specific conditions.

However, in today's digital landscape, the demand for real-time data processing is rapidly increasing. Unlike the traditional model – where data is accumulated and analyzed with a time lag – stream processing has gained popularity, enabling immediate handling of events and transactions as they occur. Such systems are critical for the financial sector, telecommunications, e-commerce, and cybersecurity, where even a few seconds' delay can have significant consequences. Tools such as Apache Kafka, Apache Flink, and Spark Streaming enable the efficient implementation of such approaches, allowing for high-speed processing of large volumes of streaming data.

With the development of big data technologies, companies are increasingly turning to methods based on Hadoop architecture or distributed computing frameworks. These approaches make it possible to work with information that cannot be processed using traditional tools due to its volume, velocity, or variety. Big Data processing entails not only the technical capability to handle massive datasets but also the adoption of new approaches to storage, indexing, parallel processing, and workload distribution across clusters.

Methods of intelligent data analysis are gaining increasing importance. These include machine learning, classification, clustering, forecasting model development, recommendation systems, and machine learning algorithms [6]. Such approaches make it possible not only to analyze existing data but also to identify hidden patterns, forecast future events, and make adaptive decisions under conditions of uncertainty. Models can be trained on historical data and updated automatically as new input parameters are introduced, making them especially useful in areas such as marketing, service personalization, logistics optimization, and risk management.

It is important to note that effective data processing is impossible without visualization and presentation in a form understandable to end users. Visualization methods – including interactive dashboards, charts, maps, and heatmap analysis – represent the final stage of processing, transforming computation results into visual formats that support decision-making. This enables management to quickly interpret outcomes, respond to changes in business dynamics, and detect critical points in real time.

In corporate networks, where data volume, speed, and criticality are constantly growing, data security becomes not only a technical concern but also a strategic one. Data processing involves continuous movement, transformation, storage, and access to information, which creates potential vulnerabilities at every stage. Malicious actors may exploit these vulnerabilities to gain unauthorized access, steal confidential information, or manipulate data – leading not only to financial losses but also to serious reputational damage for the organization. Therefore, ensuring data security during processing is an essential requirement for the sustainable functioning of any corporate information system.

Data protection begins with the establishment of a robust user identification and authentication system, ensuring that only authorized individuals have access to resources. In corporate systems, this is often implemented through multi-level verification mechanisms, including one-time passwords, hardware tokens, biometric identifiers, or integration with centralized access control systems.

However, even after identity confirmation, it is critical to enforce privilege limitations through authorization policies, granting each user access only to the specific data necessary for their job responsibilities.

Modern data processing cannot be imagined without cryptographic protection tools. Encrypting data during transmission between network nodes as well as during storage in databases helps minimize the risk of interception or disclosure. Contemporary symmetric and asymmetric encryption algorithms, SSL/TLS protocols, digital signatures, and data integrity checks provide the foundation for secure communication in digital environments [7]. This becomes especially important when processing is performed in cloud environments or when data is transferred across organizational structures. However, there are other methods for sensor networks that do not involve cryptographic protection (Fig. 1).

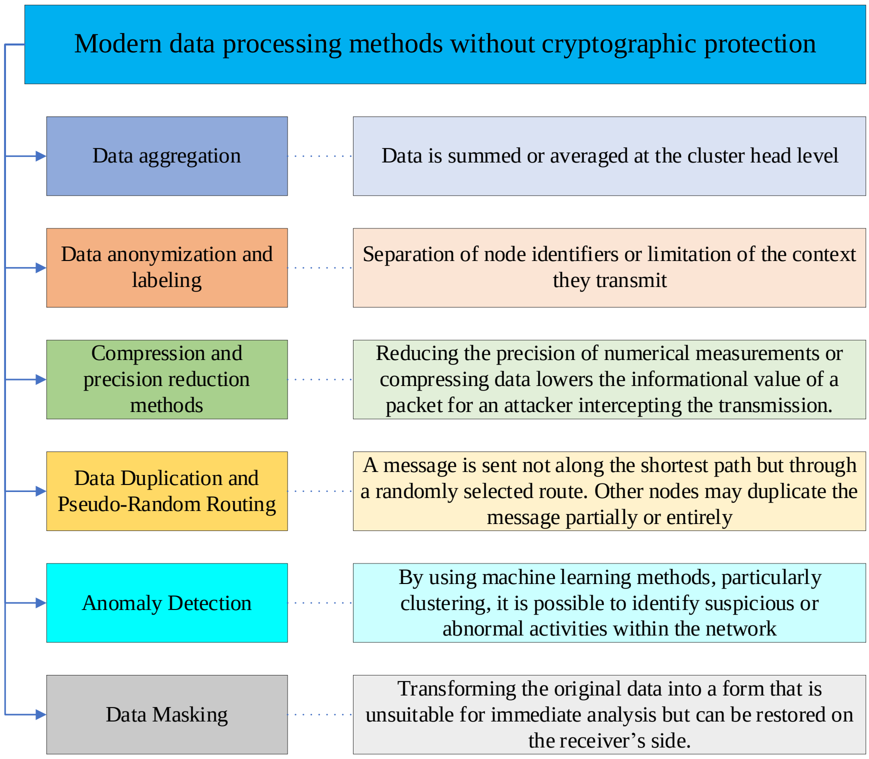

Fig 1. Data processing methods in sensor networks without cryptographic protection

In addition to technical measures, data protection requires continuous monitoring of user activity, detection of anomalous behavior, and logging of access to sensitive information. Information security management systems, intrusion detection modules, auditing tools, and automated event analysis systems not only detect violations but also enable timely responses to potential threats. This is especially critical in large organizations, where thousands of users operate simultaneously, making manual oversight of individual actions unfeasible.

Another essential aspect is data backup and recovery in the event of incidents. Building a comprehensive backup system, implementing geographic redundancy of storage, and enabling automatic service recovery after failures ensure resilience against catastrophic events such as technical breakdowns, software errors, or targeted attacks. It is important not only to create backup copies but also to regularly test recovery procedures to confirm their effectiveness under real conditions.

Effective data processing in a corporate environment is impossible without the use of specialized tools and platforms that support the execution of complex computational operations, integration with information sources, data storage, transformation, analysis, and visualization in a user-friendly format. The diversity of business tasks, data volumes, infrastructure constraints, and security requirements necessitates the widespread use of both traditional software and cloud services, as well as open-source solutions focused on flexibility, scalability, and high performance. Large enterprises working with data in various formats and from numerous sources often rely on distributed frameworks for parallel information processing. One of the most well-known solutions is the Apache Hadoop ecosystem, which enables the storage and processing of terabytes of data through a model of distributed storage and parallel computing. In combination with Hadoop, Apache Hive is frequently used, allowing SQL-like queries on large datasets while maintaining the convenience of classical analytics in Big Data environments. A more powerful and flexible tool is Apache Spark – a platform optimized for high-speed processing of both streaming and batch data, which is particularly well-suited for implementing machine learning algorithms, graph processing, and embedded analytical models [2].

In cases where organizations focus on integration, automation, and visual monitoring of data preparation processes, tools such as Talend, Apache NiFi, and Microsoft SQL Server Integration Services have gained considerable popularity. These platforms allow the creation of data pipelines that include extraction, transformation, validation, and loading of information into target repositories. Thanks to user-friendly graphical interfaces and the ability to monitor the status of each processing stage, these platforms significantly lower the technical barrier for specialists, while providing high flexibility and control over data quality.

With the proliferation of cloud technologies, more and more companies are transitioning to cloud platforms for data processing, which offer computing resources as a service without requiring investment in proprietary infrastructure. Among the most widely used platforms are Amazon Web Services, Google Cloud Platform, and Microsoft Azure [8]. These platforms enable the creation of scalable processing environments, the implementation of powerful analytical scenarios, the use of artificial intelligence services, and the provision of continuous data availability from any location worldwide. A distinctive feature of such services is the ability to integrate with numerous data sources, utilize prebuilt analytics models, and ensure high levels of security through multi-layered access architecture, encryption, and monitoring.

In addition to computing platforms, a critical component of modern data processing is data visualization tools. Power BI, Tableau, Qlik Sense, and Looker are examples of systems that allow users without deep technical expertise to build interactive dashboards, charts, diagrams, and reports based on up-to-date data from various sources. These systems are widely used across all management levels – from operational analysis of departmental performance to the formulation of strategic indicators for top management. A special niche is occupied by corporate systems that combine data processing functionality with business process management features. Examples of such solutions include platforms like SAP, Oracle BI, and IBM Cognos Analytics. These systems not only provide full-featured data handling but also integrate with management modules, financial subsystems, logistics, and human resources – creating a unified information space for all organizational units.

Thus, data processing in corporate networks is highly relevant and increasingly adopted by companies as a foundation for their effective functioning.

Conclusions

In the course of studying data processing methods within corporate networks, a comprehensive environment was examined in which modern companies operate as digital systems, constantly exchanging large volumes of information. A modern corporate network is not merely a set of interconnected devices, but a dynamic infrastructure that generates, transmits, and processes data that holds strategic significance for decision-making. Understanding data types, the nature of information flows, and the context of their use served as a starting point for a systematic analysis of data processing. The analysis of corporate data processing architectures revealed that the organization of computing resources and the method of integrating data sources directly influence the performance of analytical processes, system resilience under load, scalability, and operational continuity. Modern business conditions require the integration of local computing centers with cloud-based solutions, along with a high degree of flexibility to adapt the infrastructure to a rapidly changing market.

Special attention was paid to data collection and preparation methods, as this stage establishes the quality of all subsequent processing. Through the use of ETL processes, automation of transformations, cleansing, and validation of incoming information, companies build a reliable foundation for accurate analytical modeling. The integrity of this foundation directly affects the precision of conclusions derived from the analysis.

The review of data processing methods revealed a wide range of approaches: from classical SQL queries and multidimensional analysis to real-time processing and the application of machine learning. The choice of a particular method is determined by data volume, input velocity, latency sensitivity, and the overall processing goal – whether it be the generation of standard reports or the construction of complex predictive models.

The issue of data security extended beyond the technical realm and encompassed legal, organizational, and ethical dimensions. During processing, it is necessary not only to ensure encryption and authentication but also to comply with international standards and legal requirements for personal data protection. It is this reliability of protection that builds trust between users and the systems processing their data.

Thus, corporate data processing is not merely a technical activity but a comprehensive strategic system that integrates infrastructural, analytical, organizational, and security components. Its effective operation enables the transformation of raw data streams into concrete business value, improves the quality of managerial decision-making, and creates a sustainable competitive advantage in the context of the digital economy.

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ВІДОМОСТІ ПРО АВТОРІВ / ABOUT THE AUTHORS

Дяченко Дмитро Олександрович – аспірант кафедри електронних обчислювальних машин, Харківський національний університет радіоелектроніки, Харків, Україна;
Dmytro Diachenko – PhD student, Department of Electronic Computers, Kharkiv National University of Radio Electronics Kharkiv, Ukraine;
e-mail: dmytro.diachenko2@nure.ua; ORCID Author ID: http://orcid.org/0009-0006-5751-3511.

Коробєйніков Матвій Борисович – студент кафедри електронних обчислювальних машин, Харківський національний університет радіоелектроніки, Харків, Україна;
Matvii Korobieinikov –student, Department of Electronic Computers, Kharkiv National University of Radio Electronics Kharkiv, Ukraine;
e-mail: matvii.korobieinikov@nure.ua; ORCID Author ID: https://orcid.org/0009-0007-7237-2590.

Коробєйніков Олександр Борисович – студент кафедри електронних обчислювальних машин, Харківський національний університет радіоелектроніки, Харків, Україна;
Oleksandr Korobieinikov – student, Department of Electronic Computers, Kharkiv National University of Radio Electronics Kharkiv, Ukraine;
e-mail: oleksandr.korobieinikov@nure.ua; ORCID Author ID: https://orcid.org/0009-0009-9981-9860.

Коваленко Андрій Анатолійович – доктор технічних наук, професор, завідувач кафедри електронних обчислювальних машин, Харківський національний університет радіоелектроніки, Харків, Україна;
Andriy Kovalenko – Doctor of Technical Sciences, Professor, Head of the Department of Electronic Computers, Kharkiv National University of Radio Electronics, Kharkiv, Ukraine;
e-mail: andriy.kovalenko@nure.ua; ORCID ID: https://orcid.org/0000-0002-2817-9036;
Scopus ID: https://www.scopus.com/authid/detail.uri?authorId=56423229200.

Кравченко Павло Олександрович – кандидат технічних наук, асистент кафедри ЕОМ, Харківського національного університету радіоелектроніки, Харків, Україна;
Pavlo Kravchenko – PhD, Assistant Lecturer of the Department of electronic computers, Kharkiv National University of radio electronics, Kharkiv, Ukraine;
e-mail: pavlo.kravchenko@nure.ua; ORCID Author ID: https://orcid.org/0000-0002-0456-3295;
Scopus Author ID: https://www.scopus.com/authid/detail.uri?authorId=57216151371.

Методи обробки даних в корпоративній мережі

Д. О. Дяченко, М. Б. Коробєйніков, О. Б. Коробєйніков, А. А. Коваленко, П. О. Кравченко

Анотація. Актуальність. У сучасних умовах цифрової трансформації бізнесу, корпоративні мережі стали критично важливими елементами інформаційної інфраструктури підприємств, які об’єднують численні системи, пристрої та сервіси в єдиний інформаційний простір. Щодня в таких мережах генерується, передається, зберігається і опрацьовується величезний обсяг даних, що охоплює всі аспекти діяльності організації – від фінансових операцій і логістики до комунікацій з клієнтами та внутрішніх процесів управління. Успішне функціонування корпоративної мережі неможливе без ефективної обробки даних, яка дозволяє отримувати з сирої інформації цінні знання, приймати стратегічні рішення, забезпечувати безпеку інформації та оптимізувати ресурси. В умовах високої конкуренції, стрімкого зростання кількості інформаційних потоків і зростаючих вимог до оперативності прийняття рішень, саме методи обробки даних відіграють ключову роль у забезпеченні аналітичної спроможності підприємств. Методи обробки даних у корпоративному середовищі знаходять застосування в найрізноманітніших сферах бізнесу. У фінансовому секторі вони використовуються для аналізу транзакцій, управління ризиками, прогнозування коливань ринку та виявлення шахрайства. У сфері логістики – для оптимізації маршрутів, контролю складських запасів і координації постачань у режимі реального часу. У маркетингу – для вивчення поведінки клієнтів, сегментації аудиторії та персоналізації комунікацій. У HR-відділах – для оцінки продуктивності персоналу та підбору кандидатів. У сфері охорони здоров’я – для аналізу медичних даних пацієнтів, оптимізації процесів надання послуг та підтримки клінічних рішень. Крім того, обробка даних є основою для розвитку систем штучного інтелекту, цифрових двійників, кібербезпеки та автоматизованого управління підприємствами. Традиційні підходи до обробки даних поступово поступаються місцем сучасним технологіям, що базуються на використанні Big Data, обробці потокової інформації в реальному часі, хмарних обчисленнях, інтелектуальному аналізі даних та машинному навчанні. При цьому особливої уваги набувають питання захисту даних, їхньої цілісності, доступності, а також дотримання нормативно-правових вимог щодо конфіденційності. **Метою даної роботи** є аналіз сучасних методів і технологій обробки даних у корпоративних мережах, їх переваг, недоліків та сфер застосування, класифікація підходів до збору, очищення, зберігання й аналізу інформації. **Об’єктом дослідження** є корпоративні мережі підприємств. **Предметом дослідження** є методи та технології обробки, зберігання, аналізу та захисту даних. **Результати.** У результаті проведеного дослідження було сформовано цілісне уявлення про сучасні методи обробки даних у корпоративному середовищі. Проаналізовано архітектурні моделі інформаційних систем підприємств, виявлено ключові етапи підготовки даних, охарактеризовано підходи до їхньої обробки – від класичних до інтелектуальних. Розгляд методів обробки даних виявив широкий спектр підходів: від класичних SQL-запитів і багатовимірного аналізу до обробки в реальному часі та застосування машинного навчання. Вибір конкретного підходу визначається обсягом даних, швидкістю їх надходження, критичністю до затримок, а також метою обробки.

Ключові слова: корпоративна мережа, обробка даних, архітектура, транзакція кібербезпека, Big Data.