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**Establishing Modern Master-level Studies in Information Systems   
561592-EPP-1-2015-1- FR-EPPKA2-CBHE-JP**

**ІT – infrastructure**

**Guidelines to perform laboratory works**

**draft version**



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**INTRODUCTION**

The purpose of the laboratory work of the second part of the discipline "Infrastructure of Information Technologies" is to acquire the skills of practical application of theoretical information on the analysis and development of IT infrastructure to solve practical problems. The laboratory workshop is based on the recommendations of the MASTIS project.

In preparation for laboratory work, students study methodical instructions for their implementation, recommended literature, as well as perform preparatory work in accordance with the topic of the task.

Laboratory works are carried out in the brigade way. The brigade consists of:

1) Team Leader.

2) System Analyst.

3) Architect.

A report on the work done is being prepared by the brigade at the end of the course.

Laboratory work # 1

Topic: Analysis of the IT infrastructure of the company

Theoretical information

An IT infrastructure analysis should be based on a description of the enterprise architecture and a description of the main business processes. It should be shown how business processes are distributed across structural subdivisions and what IT infrastructure supports business processes of structural units and their interaction.

It is also worth noting how IT infrastructure is supported and provided.

IT Infrastructure Audit is a complex of measures for inventory, research and analysis of the components of the entire information system. An assessment of the infrastructure is in compliance with the requirements of the company, as well as the necessity and possibilities of modernization. The necessary part of the audit is checking the system for reliability and security (anti-virus protection, archiving, protection against unauthorized access). First of all, the audit is for companies who want to test how effective the existing IT infrastructure is. Find out how to make the most of your existing resources and get real recommendations for troubleshooting, as well as understand the need for upgrades.

Among other things, the audit of IT infrastructure is a necessary preliminary step for the conclusion of a service contract with a company that deals with IT outsourcing.

In the course of an audit, it is necessary to consider how processes are implemented in the company:

1. Management of problems and incidents. Incidents are any situations that require a reaction. These may be requests from users, crashes in the system. For the most successful implementation of this process, the task of which to identify and eliminate problems within the company, minimize the risk of their occurrence, a special service - Service Desk.

2. Configuration management. This process helps you get reliable and up-to-date information about IT infrastructure.

3. Manage changes

4. Manage releases. This is, in fact, the implementation of changes and control of the maintenance of IT infrastructure in their implementation.

5. Service level management. The task - to identify the optimal level of service, prevent the fall of the quality of services, eliminating poor quality services.

6. Financial management

7. Power management. The purpose of the process is to find the optimal capacity for the implementation of the main tasks.

8. Management of continuity. In the event of an emergency, the IT infrastructure should continue to work. Such situations include a fire, power outage, flood, etc.

9. Availability management. Accessibility directly affects the level of service.

**Task**

The object of analysis is enterprise, a company of choice students. It is advisable to choose one of the companies where at least one of the brigade members are working. In the absence of such a possibility, the enterprise identifies a teacher from the list of enterprises with which the practice agreements are concluded.

Carry out an audit of the company's IT infrastructure. Formulate positive and negative features of the IT infrastructure of the enterprise. Formulate tasks for improving the IT infrastructure of the enterprise.

Prepare report.

**Testing questions:**

* 1. Life Cycle of IT Infrastructure: Formation of Information Infrastructure.
  2. Life Cycle of IT Infrastructure: Organization of information storage.
  3. Data storage networks.
  4. Data storage systems with direct connection to the data transmission network.
  5. Reliability of data storage.
  6. Major server data centers platforms: IBM, Oracle, Dell, Fujitsu, HP.
  7. Computing infrastructure of the data center.
  8. Network Data Infrastructure.
  9. Engineering Infrastructure of the Data Center
  10. Composition and appointment of IP software.
  11. Data analysis software. Intellectualization of IP.
  12. Requirements for IC monitoring systems.
  13. Structure of management and monitoring of IC.
  14. Standards in the IT field. IS Audit and Assurance Standards.

Laboratory work # 2

**Topic:** Development of a structural scheme and basic documents of infrastructure relations

**Theoretical information**

The concept of the creation / development of IT infrastructure should take into account not only processes and technology, but also personnel who will take part in the work.

The plan for improving services will help you evaluate costs and decide on an IT service development strategy.

The ITIL library (IT Infrastructure Library), a library that describes the best practices in practice of organizing the work of units or companies that provide information technology services, can help with this task.

The seven volumes of the library describe the whole set of processes needed to ensure the constant high quality of IT services and to increase the degree of user satisfaction.

The process approach used by the library fully complies with the standards of the ISO 9000 series. The process approach emphasizes the company's focus on achieving its goals, analyzing key performance indicators (KPIs), and resources spent on achieving these goals.

The scope of the process can be divided into areas, each with its own requirements and approach to design. Examples of such areas can be desktop workplaces, data transfer system, file services, print and application services, central processing systems, databases, telephone services. A separate project can be initiated in the respective management environment for the development of each oblast.

The third edition of ITIL (ITIL v.3) contains five books and consists of:

• Service Strategy (English Service Strategy)

• Service Design (English Service Design)

• Service Transition

• Service Operation (English Service Operation)

• Continuous Service Improvement (Continuous Service Improvement)

In addition, this edition includes two more books: ITIL Overview and Pocket Reference.

The ITIL Library is a set of documents that are used to implement IT Service Management (ITSM) practices.

The ten most basic processes that provide support and provision of IT services described in IT Service Management (ITSM) are best known:

An important role in the ITIL and ITSM processes is played by the Customer Service Desk - Service Desk.

The ITIL library stores a set of documents that are used for the practical implementation of the ITSM principles.

According to ISO / IEC 20000 "Information Technology. Service Management ", all processes are collected in five key groups:

• Provision of services (service level management, availability and continuity management, power management, as well as information security management, budget and cost accounting);

• Management of interaction (interaction with business, with suppliers, etc.);

• Permission processes (problem and incident management);

• Control (change management and configurations);

• Managing releases.

The development of proposals for the creation of IT infrastructure includes the development of contracts for the creation of IT infrastructure by external contractors (suppliers, vendors). Main types of contracts:

1. Fixed Price Contract (Fixed Price)

Terms of use. Applies to standard projects with clear solutions and requirements, subject to detail. Requirements for the result are given in a separate technical task. The deadlines for the work and their cost are fixed.

Advantages for the customer. Clear budget for certain requirements to the result.

Customer risks. The complexity of changing product requirements in the process of developing it. As a result, such conditions are poorly suited to the development of non-standard software and complex systems.

Ways to reduce risk.

Include the following terms in the software creation agreement:

1) phased acceptance of works;

2) payment for the accepted stage;

3) refusal to continue work without financial sanctions.

In this case, the customer will be able at any stage to put the performer before the choice to continue working on terms that have changed or quit the project, reducing costs.

Benefits for the artist. Possible in the case of a ready-made solution that does not require substantial refinement.

Risks of the artist. Risk of waiving payment upon completion of work or exceeding actual costs over the project price.

1. The customer may refuse to accept the results of work in connection with their actual or "imaginary" non-compliance with the requirements of the specification. This option can be used by the customer to reduce the cost of the work done or to cancel the cost of the project, which has lost value to him by the time of completion.

Ways to reduce risk.

Include a combination of terms in a software development contract:

1) the maximum possible prepayment;

2) phased acceptance of works;

3) impossibility of the customer's refusal from the contract without financial sanctions.

At the conclusion of each stage, compile the reporting documentation and record the acceptance of the results by the customer. It is desirable to make a phased acceptance by signing a bilateral act. This option offers maximum guarantees.

**Task**

Object of development - IT infrastructure of the enterprise (company) for which IT infrastructure audit in the laboratory work No. 1 was performed.

Develop proposals to create enterprise IT infrastructure based on virtual workplaces, data warehouses, and micro-service approach. Choose a type of contract with a vendor and develop a draft agreement.

Prepare report.

**Testing questions:**

1. Basic concepts and definition of virtualization. The advantages and disadvantages of virtualization.

2. Types of virtualization: virtualization of platforms and virtualization of resources.

3. Virtualization of networks. Virtualization of servers.

4. Virtualization of workplaces.

5. Virtualization Tools (VMWare, Oracle Virtual Box)

6. Virtualization Tools (Microsoft Hyper-V, HP Virtualization Solutions).

7. Basic concepts and definitions of cloud services.

8. Cloud deployment models (private cloud, public cloud)

9. Cloud clouds (cloud clouds).

10. Service models: SaaS (Software-as-a-Service), PaaS (Platform-as-a-Service), IaaS (Infrastructure-as-a-Service).

11. Microsoft Azure Cloud Services.

12. Cloud Services Amazon Web Services (AWS).

13. Cloud Platform Services.

14. Standards in the IT field. ISO management system standards.

15. Standards in the IT field. Security Standards.

16. Standards in the field of IT. Ethical Standards for Information Systems.

17. Standards in the IT field. International Standard ISO / IEC 12207: 1995-08-01 for the organization of the life cycle of software products (software).

18. Standards in the IT field. Standards of the complex GOST 34 on the creation and development of the AU.

Laboratory work # 3

**Topic:** Development of recommendations for choosing infrastructure providers

**Theoretical information**

Information activities, like any other, are characterized by the use of resources, production processes, production and provision of services.

Information service is the receipt and provision of user information products. The main kind of information products is information.

Most of the information services offered to consumers are based on various databases.

There are the following types of information services:

• retrospective search of information;

• preparation and provision of information services.

• Remote access to remote databases.

• Connection services.

The preparation and provision of information services includes:

• data processing, software; development of information technologies; development of information systems.

• Technical support for hardware and software, including support for multivendor solutions.

• organization, operation and comprehensive maintenance of information systems

• Rental of computing power

• creation and maintenance of uninterrupted operation of customer's information systems in data storage and processing centers.

• Providing information security.

There are many companies in the market of IT infrastructure providers (ITIS) that position themselves as suppliers of equipment and services.

Price policy in Ukrainian companies is somewhat more flexible than that of foreign colleagues, as the latter are, as a rule, in certain corporate frameworks in the questions of price formation. Approaches to realization of projects in Ukrainian companies are closer to the conditions of doing business in Ukraine. All Ukrainian companies officially operating on the IB market are licensed by the State Service for Special Communications and Information Protection of Ukraine (GSSZI). Thus, one of the main criteria for selecting a company for the implementation of the IB project can be considered the existence of a license for activities in the field of information protection, issued by the USCISE of Ukraine. This gives a certain assurance to the customer that the company has appropriate equipment and personnel for the work of the IB.

It is advisable to identify the following types of ITIS companies:

• product developers (software and hardware);

• System integrators for ITIS solutions;

• distributors of ITIS products;

• ITIS consultants;

• IT auditors;

• companies that provide training on ITIS;

• Insurance companies in ITIS;

• Information resources in ITIS.

Most companies are engaged in system integration and consulting, training of specialists and audit of information systems.

The company integrator analyzes the IT infrastructure of the customer and offers a set of technical solutions. Next, integrator specialists choose a set of hardware and / or software, install and configure it for work in a specific environment. As a rule, the customer's personnel learns how to use equipment and software, and to respond to problems.

Distributors of products and solutions are ideally a link between developers and integrators. Their main task is to support the system integrator, including consultants when implementing the project.

Most products and solutions require additional costs for their installation and adjustment. In addition, most require a periodic renewal of the license (usually once a year.) Purchase of equipment or software is only possible after the following measures:

• risk assessments for information assets (software and hardware);

• Internal audit of IT infrastructure;

• calculation of return on investment in IB;

• necessarily having the support of management and owners of information assets.

**Financial criteria for choosing a vendor:**

• the cost of the project and the expected return on the project (how much and when);

• what will happen if the project is not;

• cost of ownership and resources needed for maintenance;

• how the project will affect the image of the manager in the event of failure or successful implementation (career);

• How much the project facilitates or complicates the performance of everyday tasks.

**Task**

Object of development - IT infrastructure of the enterprise (company) for which IT infrastructure audit in the laboratory work No. 1 was performed.

To formulate comparison and restriction criteria for supply of IT infrastructure.

Perform a comparative analysis of the services provided by IT infrastructure providers available to companies in Vinnitsa.

Develop recommendations for selecting infrastructure providers.

Develop a project of an infrastructure contract with a potential vendor.

Prepare report.

**Testing questions:**

1. Infrastructure contracts. Types of infrastructure contracts.

2. Types of agreements in the field of creation and disposal of rights to objects of intellectual property.

3. Types of infrastructure contracts. Contract on Spint. Fixed Price / Fixed Scope.

4. Types of infrastructure contracts. Time and Materials. Time and Materials with fixed requirements and cost constraints. Time and Materials with variable requirements and cost constraints.

5. Types of infrastructure contracts. Staged development.

6. Types of infrastructure contracts. Bonuses and fines. Fixed profit.

7. Types of infrastructure contracts. "Money for nothing, changes for free".

8. Types of infrastructure contracts. Joint ventures.

9. Infrastructure Outsourcing. Advantages and disadvantages of infrastructure outsourcing. IT outsourcing management.

10. Outsourcing of data centers. Outsourcing of networks.

11. Infrastructure Outsourcing. Security Management.

12. Infrastructure Outsourcing. Cost management.

13. Infrastructure Outsourcing. Software Management.

Laboratory work # 4

**Topic:** Risk analysis of IT infrastructure of the company

**Theoretical information**

With the growing dependence on the implementation of IT solutions, the company's dependence on the risks associated with the use of IT increases. IT risk management becomes an integral part of global business risk management processes, and IT risk assessment and management require an analysis of IT-specific factors, including those related to information security (IT) of implemented solutions.

• External and internal fraud.

• unauthorized use of company resources.

• Violation of the confidentiality, integrity and authenticity of information.

• Loss of resource availability.

• Human factor and staff mistakes.

• Failure of information systems, unplanned simple systems.

• Non-compliance with regulatory and regulatory requirements, etc.

Identifying and reducing the risks of IT solutions is an integral part of the company's information security service, which is increasingly complicated by the growing number of IT infrastructure components and systems interactions.

**Classification of IT Risks**

|  |  |  |
| --- | --- | --- |
| **Category** | **Value** | **Example** |
| Technology | Inactive, unreliable, or non-compliant with business, hardware or software needs | Router refusal  Denial of database server |
| Security | Loss, damage or theft of equipment or data, unauthorized access or use of data | Unauthorized access to the network through a web server  Data leak on CDs, flash cards, etc.  Hacking passwords |
| Politics and law | Lack of procedures and policies that result in misuse, inability to rehabilitate, non-compliance with legislation | Emergency recovery procedure is not documented and not tested  Damage to health due to non-compliance with safety  Use of non-licensed software  Installing unnecessary or inappropriate software  Failure to receive important letters |
| Staff | Human mistakes, dismissal of key employees | Errors updating SQL Server database  Lack of necessary skills and abilities |
| Infrastructure | Disconnection of external services (electricity, telephone, internet); failure of key vendors | Inability to use e-mail  The inability to solve business challenges with key applications |

**Risk assessment**

To assess risks, one can use qualitative analysis when the level of risk is determined by the ratio of the probability of an incident and its impact on the business.

**Probability of occurrence**

|  |  |
| --- | --- |
| High | The incident occurs once a month or more often |
| Average | An incident occurs 1 to 11 times a year |
| Low | The incident occurs once a year or less frequently |

**Risk level**

|  |  |  |
| --- | --- | --- |
| Extraordinary | Major business processes stop for more than a day or irrevocably | Immediate risk management is required.  The management should be informed about the risk and measures to reduce it. |
| High | The main business processes stop for an hour to a day | Risk management should be started within a month from the moment of confirmation.  The management should be informed about the risk and measures to reduce it. |
| Average | Major business processes stop at less than an hour | It is necessary to start the risk management within six months from the moment of confirmation. |
| Low | Short stop, which has no negative consequences for business | Permissible risks that do not require management.  As needed, a reassessment can be made. |

You need to keep an IT Risk Log, which tracks the current level of risk management and measures taken to reduce risks.

**Template of Log**

|  |  |
| --- | --- |
| Risk |  |
| Consequences |  |
| Management level |  |
| Probability of occurrence |  |
| Influence on business |  |
| Rank |  |
| Date of the rank assignment |  |
| Responsible person |  |
| Need for additional measures |  |
| Terms of ficsing |  |
| Action |  |
| Rank after taking action |  |
| Date of implementation |  |
| The date of the next check |  |

The first part of the Journal describes the categories of risks (with short estimates) and typical actions to reduce the risks. This will allow assessing the status of executed, deferred and current risk management tasks, as well as highlighting tasks that are subject to re-examination. The frequency of repeat checks is arbitrary: not too rare, so as not to be exposed to new risks caused by system or structural changes, but also not very frequent, otherwise you can spend all the time on risk assessment with the mark "unchanged".

The second part of the Magazine provides detailed risk assessments and additional risk mitigation measures where possible. Additional measures may include system changes, new procedures, policy changes, or re-training or hiring specialists. example:

• Saving images of system drives, in addition to backing up files;

• purchase of spare equipment;

• View password security policy;

• Monitoring of data leakage;

• introduction of the rules of permissible use;

• improved documentation of systems;

• Caution when choosing vendors.

The IT risk logging log is required to be reviewed annually to ensure that the risks are objectively evaluated, to assess the effectiveness of risk mitigation and to include new risk categories.

**Task**

Object of development - IT infrastructure of the enterprise (company) for which IT infrastructure audit in the laboratory work No. 1 was performed.

Analyze the technological, financial, technical and integration risks of the IT infrastructure for two options: virtual and non-virtual infrastructure.

Assess the level of infrastructure risk. Based on the analysis, formulate recommendations.

Prepare report.

**Testing questions:**

1. Technological risks.

2. Financial risks.

3. Technical risks.

4. Integration risks.

5. Methods of assessing information risks

6. Criminal risks

7. The concept and objectives of information security.

8. Structures providing information security.

9. Stages of information security development.

10. Unified communications. Data access and synchronization.

11. Unified communications. Closed Protocols.

12. Unified communications. Smart networks

Laboratory work # 5

**Topic:** Analytical work: New Technologies in IT Infrastructure

**Theoretical information**

Top 10 trends and forecasts how the corporate IT infrastructure up to 2020 will be developed by Riverbed, a leading global provider of solutions to increase the productivity and availability of enterprise applications and services.

Riverbed Company identifies three main areas for developing the IT infrastructure of companies and enterprises in the coming years:

• Movement - business moves towards cloud computing, transferring the entire infrastructure of corporate information systems into the cloud. Also, with the emergence of many suggestions, private and public IT infrastructures are increasingly being interconnected. The amount of data transmission between interfaces, applications, SaaS, data centers and clouds is increasing.

• Transformation - digital transformation remains critical for businesses. The more intensive exploitation of old network infrastructures allows for new and improved network capabilities and services. Containers and microservices bring new opportunities for users. Artificial intelligence (AI) and machine learning (ML) are expanding the boundaries of business intelligence.

• Consolidation - IT infrastructure is becoming increasingly hyperconvertible. Cloud computing and related services turn into mass products, and their cost is aligned throughout the market.

A more detailed list of the most significant trends in the corporate IT infrastructure by Riverbed company by 2020:

**1. Wide distribution of containers and microservices**

Just as cloud computing was perceived several years ago - innovative, changing old patterns and requiring careful study - today containers such as Docker and CoreOS, as well as the many microservices represented on the market, allow companies to use more innovative approaches. The main advantage of "packaged" environments is the ability of the company to focus on providing user experience, not simply providing access to products and services.

In the near future, existing and new providers of specialized services will expand the possibilities of their proposals. Thus, greater integration with public cloud infrastructures is expected, expansion and improvement of network capabilities, as well as further abstraction of services.

Despite the fact that the use of containers will be wider, the transition to a "containerized" world will continue for several years to come.

In addition, companies switching to the use of containers or microservices will inevitably have to solve a number of internal tasks related to security and compliance with regulatory requirements, as well as the need to optimize the corporate network, storage systems and provide quality monitoring for these types of services.

**2. The growth of the scale of digital transformation**

Digital transformation, the process of redefining / rethinking business processes in close proximity to technological innovation, will grow as a snowball. Enterprises are increasingly transforming their business, and those who have not yet begun implementing such initiatives will increasingly be pressured by competitors who have already done so. Those who are lagging behind technological progress will have to urgently do something to save their business.

The most important aspect of cloud computing is their ability to radically transform business and economic models. And the main task of any company is the concentration of attention is not on a certain technology, but on getting the opportunities that it can give to business.

The basic advice for those companies and corporations that are planning to build their digital transformation initiatives in the near future: remember that digital transformation is something much more than just a technology. Riverbed advises to consider digital transformation as a complex grid:

• technologies (cloud computing, Big Data, IoT, mobility, social networking, network solutions, unified communications, etc.);

• business processes (strategies, management, processes);

• people (partners, suppliers, customers, employees, competitors).

From a technical point of view, digital transformation is unique to each organization.

**3. The massive supply of cloud computing**

While major cloud computing providers with the public model, Amazon, Microsoft and Google will continue to fight for market share, smaller specialized cloud solutions providers will continue to grow, offering niche or vertical market opportunities.

Enterprises will continue to be careful about the new ultra-modern features offered by only one cloud platform, as they fear to become dependent on one vendor. Since cloud-based offers remain complex, companies that seek to diversify vendor dependency will largely choose some hybrid or hybrid solutions based on certain variants of the interaction of the private cloud and the local infrastructure of the data center.

In addition, analysts point out the tendency that a part of IT directors who initially chose to build a private cloud infrastructure for corporate information systems switch over time to cloud computing with the public model, since they now began to realize how laborious and costly they were to work with. belongs to

**4. The network will remain in the spotlight**

The focus of the market will be focused on cloud computing, microservices, containers and other innovative technologies. IT professionals will primarily be interested in such issues as building a network in the clouds, as well as connecting to the cloud private data center. But, as is often the case, most businesses will decide to rely on their already existing network technologies to "glue together" various new services and existing elements of the IT infrastructure.

According to analysts, the path to the search for hybrid cloud integration - where some services are launched in a private data center, while others in the public cloud - the market was not yet gone. One of the main reasons for this is that network elements in such hybrid domains should be ideally "linked" with each other.

As for container technologies, the container network is also significantly different from the traditional network. Containers are very dynamic and have a short life cycle, which leads to the creation of a large number of unpredictable traffic flows.

Therefore, any network technology used in the form of SD-WAN, NFV, or any other innovative network architecture concept should be flexible enough to cope with these changes.

**5. Further alignment of price policy in the cloud computing market**

For many years, cloud computing has become increasingly popular, and prices for various basic services have been decreasing. However, market analysts note that although prices continue to decline, this does not happen as quickly as expected.

For example, the 451 Research company in a study conducted for Microsoft noted that the most popular reason for changing cloud service provider was for the first time a price, which as a whole was named by 34% of respondents. But if price cloud wars and started, then we are at their very beginning. Ending users though think about the price, but most are still afraid to be deceived. Cloud service providers still have steady profits and are not eager to reduce gross margins to attract more users.

**6. Many new applications**

To improve the quality of service for end users (clients or employees), companies will continue to develop and / or reorganize their mobile and native applications, and also use more SaaS applications in their organizations. As employees and clients become more mobile, those companies and corporations that do not pursue mobility strategies will remain behind their competitors.

Analysts continue to strongly recommend that companies reorganize their applications to work in public cloud systems, and many public clouds offer migration services to migrate applications to the cloud. However, extreme caution should be exercised when developing applications that rely on several clouds, microservices and outdated hardware.

In the next three years, there will be even more companies that will take on this difficult task, but many will find that transferring to the cloud does not bring the same results as cloud architecture. Once applications are moved and / or reorganized into a cloud, it does not necessarily mean that they will work well, so in part of the company this task will temporarily remain unfulfilled. Even a large-scale transition to SaaS can be painful because access to these services makes the company dependent on slower, cheaper and less secure public networks (which, by the way, often do not have SLAs), compared to fast and expensive private networks ( MPLS).

As bandwidth is now more affordable and cheap, the implementation of SaaS and cloud-based applications can happen so quickly that the IT department will not always be able to accurately imagine which applications are being used and who uses them. They also have fewer opportunities for tracking user experience, as well as infrastructure management and application performance monitoring.

Therefore, by 2020, companies and enterprises will require more than ever monitored systems, analyze and manage the work of the network, applications and even end user experience to ensure that they obtain the expected positive outcomes from the use of new innovative technologies.

**7. Hyperconvergence of all**

Hyperconvergence will be relevant to virtually all current forecast points, whether within the framework of the Hyperconvergent Frontier IT Infrastructure philosophy for centralized deployment and management of Remote Territorial Offices offered by Riverbed and HyperConvergent Infrastructure (HCI) as a whole.

To implement successful hyperconversion companies must be sure that they fully utilize the capabilities of the software-defined infrastructure. As a result, businesses will increasingly focus on reliable, scalable and secure infrastructural environments to meet all their needs, whether they are exchanging data with the periphery, data center, or cloud. It sounds hard at first glance, is not it? In other words, it means that those companies that will think about providing the necessary level of visibility and control over their hyperconverting infrastructure will be successful.

**8. Mass migration**

By all indications, 2019-2020, they promise to become record-breaking in terms of the number of workload transitions from production facilities to platforms based on cloud computing. Providers of public cloud services are expected to offer better tools, and companies themselves will become more savvy in their use. But Riverbed warns that many companies will face unexpected bottlenecks in this way, in the form of the need to comply with the project's technical specifications, norms and safety requirements.

**9. Використання штучного інтелекту і машинного навчання**

The coming year will become an important year for artificial intelligence (II) and machine learning (MO). Artificial intelligence and machine learning have reached their critical mass, and their application will grow and expand in geometric progression for virtually every technology. , supported by services, speeches or applications. Developing intelligent systems that learn, adapt and potentially act autonomously, and not just execute specified instructions, will become the main battlefield for technology vendors, at least until 2020.

II and MO are critical elements for digital transformation; experts believe that business intelligence can be derived from the intelligent analysis of data, allowing systems to understand, study, predict, adapt and, in theory, run independently. As things (devices) become more intelligent, they will generate huge data streams. Analytical forecasts and solutions will significantly increase the load on data delivery processes, on the network, connected to these devices, as well as computing systems and data storage systems.

As companies focus their attention on the use of II and MO to differentiate their business, they will increasingly turn to cloud computing to achieve the desired result. Some analysts believe that cognitive cloud services will decline in the near future, as organizations will definitely decide to use them to solve their business tasks, in contrast to the general cloud computing and data services that are designed for more "rudimentary" tasks.

Thus, the load on the network to deliver analytical data and results close to real-time speed (a prerequisite for the successful use of II and MO) will be enormous. This will force companies using services II and MO to focus on optimizing and monitoring the availability and performance of the networks involved in these analytical business processes.

**10. Data movement**

In the coming years, an explosive increase in the transmission of information over the network is expected, provoked in a complex of several factors: corporate data exchange peripherals with a data center or cloud; ІІ and MO, generating petabyte of data; companies that migrate to the cloud from the local infrastructure; Reorganized with new corporate applications; as well as a multitude of devices connected to the Internet (IoT).

While peripheral IoT devices have limited computing capabilities, data from these devices should be transmitted, analyzed and stored in a centralized location, whether it's a traditional, or more-commonly occurring, data center in the cloud. Discussions about whether data for IoT devices to be closer to the periphery to meet the growing market demand for their faster processing or comparable performance can provide cloud or local processing and storage centers with optimized transport channels will continue and, judging by with all, the current state of affairs in the market will not change much in the near future.

Much more attention will be given to optimizing data transfer for artificial intelligence and machine learning, since they are potentially capable of generating a huge amount of data and immeasurably more traffic compared to the Internet of things. With a high probability, the solution to this problem will focus, as we have already mentioned, on optimizing cognitive cloud services and data channels in cloud-based IT infrastructure, rather than on the peripheral part of corporate networks.

**Task**

To review the promising technologies of IT infrastructure creation and analysis of their application possibilities for the enterprise (company), for which the IT infrastructure audit in the laboratory work #1 was performed, taking into account possible scenarios of the enterprise development.

Prepare report.

**LIST OF RECOMMENDED LITERATURE**

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