

# NEXT-GENERATION ARTIFICIAL INTELLIGENCE MONITORING MODEL FOR OPTIMIZING THE END NODES IN EDGE COMPUTING NETWORKS

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## Abstract

*An edge computing networks is interconnected and distributed collection of artificial intelligence computing in a specific area. Edge computing networks are complex consisting of geographically distributed artificial intelligence computing and their terminals, united in a single system. According to geographical distribution, edge computing networks are divided into local, city, corporate, global, etc. The equipment and data transmission channels associated with peripherals like Interface cards and devices, Routers and Switching Devices. There are some functional software and hardware components of a edge computing networks available. A system of software and hardware components distributed in space, connected by artificial intelligence computing communication lines. A distinction can be made between hardware and communication devices. Software components include operating systems and network applications. In this paper a next generation artificial intelligence model was proposed for optimize the various performance parameters in edge computing networks. The proposed model monitors the simplest occurrence of contacts between two artificial intelligence computing. The central server considers as a initial node and another node is an edge node of the network. In simple case, the contacts of the system can be felt using the same instructions used to communicate with the external system.*

## Keywords:

*Artificial intelligence, optimization, edge computing, Interface cards, Routers, Switching Devices*

## 1. INTRODUCTION

Currently, the network uses artificial intelligence computing of different types and classes with different characteristics. It is the backbone of any edge computing networks. Artificial intelligence computing and their characteristics determine the capabilities of an edge computing networks [1]. But recently, communication devices (cable systems, repeaters, bridges, routers, etc.) have started to play an equally important role. Some of these devices, given their complexity, price and other characteristics, can be called artificial intelligence computing that solve very specific tasks to ensure the operation of networks [2]. For the efficient operation of networks there is some special network operating systems (network operating systems) configurations are available [3]. This was an individual operating systems are designed to solve special tasks of managing the operation of a network of artificial intelligence computing. Network operating systems are installed on dedicated artificial intelligence computing [4]. Network applications are application software systems that extend the capabilities of network operating systems [5]. These include mailers, teamwork systems, network databases, etc. As network operating systems evolve, some network application functions become common operating system functions [6].

Connecting a PC to a network requires an interface device called a network adapter, interface, module or card. It fits into the socket on the motherboard [10]. Network adapter cards are installed on every workstation and file server. The workstation sends a request to the file server through the network adapter and receives a response through the network adapter when the file server is ready. Network adapters can identify and handle errors that may arise due to software noise, collisions, or poor hardware performance [11]. A local area network (LAN) is a communications system that supports one or more high-speed digital communication channels provided for short-term exclusive use by connected devices within a building or some other defined area. The areas covered by the drug can vary considerably. The length of communication lines for some networks should not exceed 1000 meters, while other lanes can serve the entire city. Areas served may be factories, ships, aircrafts and companies, universities, colleges. As a transmission medium, coaxial cables are usually used, although twisted pair and fiber optics networks are becoming more widespread, and recently wireless LAN technology is also developing rapidly, in which one of three types of radiation is used [12]: broadband radio signals, low-power radiation ultra-high frequencies (microwave radiation) and infrared rays. The small distance between network nodes, the used transmission medium and the low probability of errors in transmitted data allow maintaining high transfer rates - from 1 Mbit / s to 100 Mbit / s (currently there are industrial models with the speed of LANs. 1 Gbit / with order) [13]. Metropolitan networks typically span a group of buildings and are powered by fiber optic or broadband cables. Due to their characteristics, they are intermediate between local and global networks. Recently, the laying of high-speed and reliable fiber-optic cables in urban and inter-city sections and new promising network protocols, for example, ATM (Asynchronous Transfer Method), which can be used both locally and locally in the future. Global networks, unlike local networks, as a rule, cover much larger territories and most parts of the world (for example, the Internet). Currently, analog or digital wire channels, as well as satellite communication channels (usually for intercontinental communication), are used as transmission media in global networks. The limits of the transmission rate (up to 28.8 Kbit / s in analog channels and up to 64 Kbit / s in the user segments of digital channels) and the relatively low reliability of analog channels, which require error detection and correction tools and low protocol levels significantly reduce the transmission rate data in global networks compared to local networks [14].

These types of networks are complex and very expensive because the operating systems of the individual artificial intelligence computing are built around shared access to the network's common memory field. In the conditions of mixed networks under centralized control, the solution of tasks with high priority and, as a rule, associated with the processing of large

amounts of information; According to software compatibility, networks are homogeneous or homogenous (consisting of software compatible artificial intelligence computing) and heterogeneous or heterogeneous (if the artificial intelligence computing included in the network are software incompatible). Even with a cursory consideration of networking, it is clear that a edge computing networks is a complex of interconnected and integrated functional software and hardware components. Studying a network as a whole assumes knowledge of its principles of operation.

## 2. LITERATURE REVIEW

The entire complexity of the network's software and hardware devices can be described by a multi-layer model. At the heart of any network is a hardware layer of standardized computing platforms. Currently, artificial intelligence computing of various classes is widely and successfully used in networks - from personal artificial intelligence computing to mainframes and super artificial intelligence computing [1]. The set of artificial intelligence computing in the network must correspond to the set of different tasks solved by the network. The second layer is the communication device. Although artificial intelligence computing is central to data processing in networks, communication devices have recently played an equally important role. Cabling systems, repeaters, bridges, switches, routers, and modular hubs have moved from ancillary network components to become main stream with artificial intelligence computing and system software based on their impact on network performance and cost [2]. Today, a communication device can be a complex specialized heterogeneous application that needs to be configured, optimized and managed. Studying the principles of operation of communication equipment requires familiarity with the numerous protocols used in local and global networks [3].

The third layer that makes up the network's software platform is operating systems (OS). Concepts of the performance of the entire network and the management of local and distributed resources form the basis of the network operating system [6]. When designing a network, it is important to consider how easily a given operating system can communicate with other network operating systems, how it provides security and data protection, to what extent it allows the number of users to increase, and whether it can be transferred to an organization [7]. Different types of artificial intelligence computing, and many other considerations. The highest layer of networking tools are various network applications such as network databases, mail systems, archiving tools, collaboration automation systems, and more [8]. It is important to understand the range of capabilities that applications provide to different application areas and know how. They are compatible with other network applications and operating systems [9].

## 3. PROPOSED MODEL

In the simplest case, the communication of artificial intelligence computing can be realized using the same mechanisms used to communicate with artificial intelligence computing devices, for example, through a serial RS-232C interface. Unlike the communication of a artificial intelligence

computing with a peripheral device, when the program works, as a rule, only from one side - from the artificial intelligence computing side, in this case there is a communication between two programs running on each of the artificial intelligence computing. Messages may contain information data (for example, the contents of a file) in addition to commands to perform certain actions. In the proposed model, the artificial intelligence handled all devices connected to a network can be divided into three functional groups shown in Fig.1:

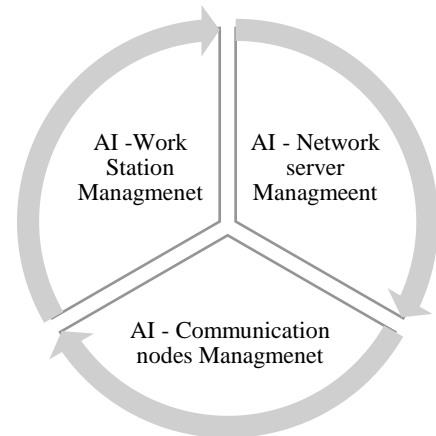


Fig.1. Proposed model device handling structure

### 3.1 ARTIFICIAL INTELLIGENCE BASED WORK STATION MANAGEMENT

A workstation is a personal artificial intelligence computing connected to a network on which a network user performs his work. Each workstation processes its own local files and uses its own operating system. But at the same time, network resources are available to the user. A program running on one artificial intelligence computing cannot directly access the resources of another artificial intelligence computing - its disks, files, printer. She can only listen to the program running on the artificial intelligence computing that owns these resources. These requests are expressed as messages sent through communication channels between artificial intelligence computing.

### 3.2 ARTIFICIAL INTELLIGENCE BASED NETWORK SERVER MANAGEMENT

A network server is a artificial intelligence computing connected to a network and provides certain services to network users, for example, storing public data, printing jobs, processing queries to a DBMS, processing jobs remotely, etc. According to the functions performed, the following groups of servers can be distinguished. File server, file server - a artificial intelligence computing that stores data of network users and provides access to this data for users. Generally, this artificial intelligence computing has a large amount of disk space. A file server provides concurrent user access to shared data. A file server performs the following functions shown in Fig.2.

- Edge nodes Data storage
- Edge nodes Data archiving
- Edge nodes Data transfer

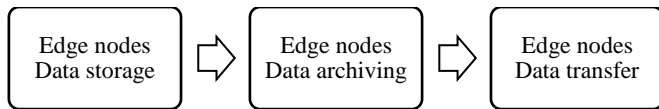


Fig.2. Proposed performance of the file server

A artificial intelligence computing that performs functions such as storing, processing and managing database files (DB). A database server performs the following functions shown in Fig.3:

- Maintain databases; maintain their integrity, completeness, relevance;
- Receiving and processing queries to databases, as well as sending processing results to the workstation;
- Integration of data changes made by different users;
- Support for distributed databases, communicating with other database servers located elsewhere.

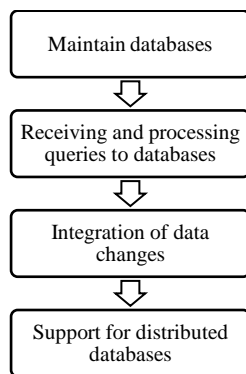


Fig.3: Proposed performance of the data server

A communications server is a device or artificial intelligence computing that provides transparent access to its serial I/O ports to users on a local area network. Using a communications server, you can create a shared modem by connecting to one of the server ports. A user connected to a communications server can work with such a modem as if the modem were directly connected to a workstation

An Access Server is a dedicated artificial intelligence computing that allows remote job processing. Programs launched from a remote workstation running on this server. Commands entered by the user from the keyboard are received from the remote workstation and the results of the task are returned. A device or artificial intelligence computing that sends and receives fax messages to local network users. A backup server is a device or artificial intelligence computing that solves the problem of creating, storing, and restoring copies of data on file servers and workstations. One of the network file servers can be used as such server.

### 3.3 ARTIFICIAL INTELLIGENCE BASED COMMUNICATION NODES MANAGEMENT

The length of the network, the distance between stations, is primarily determined by the physical properties of the transmission medium (coaxial cable, twisted pair, etc.). When transmitting data in any environment, signal degradation occurs, leading to distance limitation. To overcome this limitation and expand the network, special devices are installed - repeaters,

bridges and switches. The part of the network without expansion device is called network segment. The following devices belong to the communication nodes of the network:

- **Functions of AI-Repeater:** A device that amplifies or regenerates an incoming signal. A repeater receives a packet from one segment and forwards it to all others. In this case, the repeater will not disconnect the parts connected to it. Data transmission is supported only between two stations at any given time on all segments connected by the repeater.
- **Functions of AI-Switches (Bridges):** A bridge is a device that allows you to connect multiple segments like a repeater. Unlike a repeater, a bridge disconnects the segments connected to it, i.e., it supports multiple data transmission processes simultaneously for each pair of stations on different segments.
- **Functions of AI-Routers:** A device that connects the same or different types of networks using the same data transfer protocol. The router analyzes the destination address and routes the data to the optimal route. A gateway is a device that allows you to organize data transfer between different network objects using different data transfer protocols

One possible way, in which one voltage is similar to one of the voltage levels, the voltage level is similar to the zero, or a pulse system, when using different or a pole to indicate numbers. Similar approaches can be used to encrypt the data and convert communication ways between two artificial intelligence computing. An edge computing networks consists of three components:

- Data transmission networks including data transmission channels and switching facilities;
- Artificial intelligence computing connected through a data transmission network;
- Network software management

A very convenient and useful feature of the client program is the ability to distinguish a request for a remote file from a request for a local file. If the client program can do this, applications don't have to worry about which file (local or remote) they are working on, the client program authenticates itself and redirects the request to the remote machine. So the most often used name for the client side of the network OS - Steering... Sometimes authentication functions are separated into a separate software module; in this case, the entire client part is called Steering, but only this module. An edge computing networks is a complex set of interconnected software and hardware components:

- Artificial intelligence computing (host artificial intelligence computing, network artificial intelligence computing, workstations, servers) located at network nodes;
- Controlling network operating systems and application software;

Along with autonomous work, a significant increase in the efficiency of using artificial intelligence computing can be achieved by connecting them into edge computing networks (network). An edge computing networks in the broadest sense of the word is understood as a set of artificial intelligence computing interconnected by communication channels for data exchange. There are many good reasons for networking artificial intelligence computing shown the following steps.

- First, resource sharing allows multiple artificial intelligence computing or other devices to share a disk (file server), CD-ROM drive, tape drive, printers, plotters, scanners, and other equipment, thereby reducing costs for the user.
- Second, network versions of application software can be used in the same way, except for sharing expensive peripherals.
- Third, edge computing networks provide new user interactions within a group, for example, when working on a common project.
- Fourth, it is possible to use common communication mechanisms between different application systems (communication services, data and video data exchange, speech, etc.)

However, these communications lines differ from what is in the system from the artificial intelligence computing. The main difference between external and internal contact lines is that they are very long and they run outside the armored bracket through the spaces that are often exposed to a strong electromagnetic interference. All of this leads to significant degradation of rectangular pulses (for example, the decline of the edges) than in a artificial intelligence computing. Therefore, it is not always possible to use the same proportions and index methods for the reliable recognition of pulses at the end of the receiving of the communication line when sending data inside and outside the system. For example, due to the high capacity load of the line, the slow rise of the pulse edge is required to send pulses at a lower rate (thus the leading and rear edges of the nearby pulses are overlapping and the pulse will be time to grow).

The modulation is used for data transfer through the analog phone communication channels on wide part networks, which are created for voice transfer in the form of analog, so they are not very relevant to send pulses directly. The signal transfer system is affected by the number of wires in the contact lines between the artificial intelligence computing. To reduce the cost of communication taxes, networks usually try to reduce the number of wires, as it is done in a system, as it is done in a system, but the pit vice transmission is not only required by the parallel transmission of all bits or multiple bytes, but also the pair of wires. Another problem that needs to be observed when transmitting signals is a mutual problem transmitter from the other receivers. When organizing the contacts of the volume within the system, this problem is very simply solved because all the volumes are synchronized in this case; In different ways that can solve the problem of synchronization when connecting artificial intelligence computings, in a separate line, the transmission of special clock pulse and the formation of a characteristic form that differs from the form of data pulses through periodic determined codes or term synchronization with pulses

## 4. RESULTS AND DISCUSSION

The performance parameters of the existing Distributed machine learning model (DMLM), Artificial Intelligence and Edge Computing (AIEC), Secured Multi-Access Edge Computing (SMEC) and integrated structured cabling system (ISCS) are compared with the proposed artificial intelligence optimizing model (AIOM).

### 4.1 PERFORMANCE OF THE OPTIMIZATION SOFTWARE

There are problems associated with operating systems and applications. Programming for distributed systems is based on programming for centralized systems. Therefore, a network operating system performs all the functions of managing the local resources of a artificial intelligence computing, and, in addition, it solves many problems in providing network services. The development of network applications is complicated by the need to organize the collective work of their components that run on various machines. It is an important concern to ensure software compliance. The comparison of performance of the optimization software was demonstrate the Fig.4.

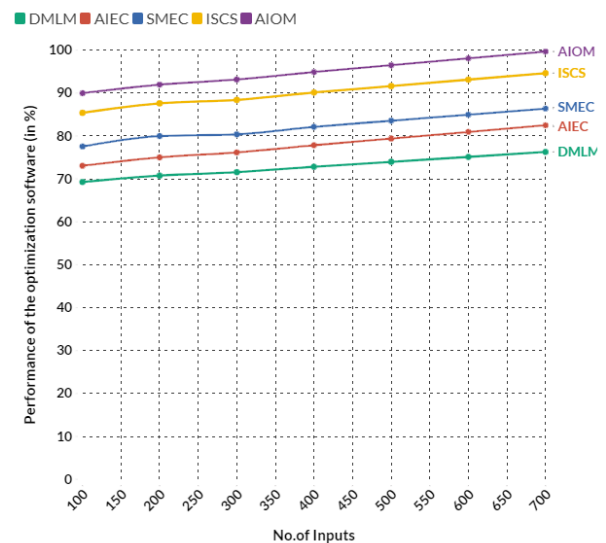


Fig.4. Results of performance of the optimization software

### 4.2 CONFIRMATION OF RELIABILITY

There are many problems with transporting news through communication channels between artificial intelligence computing. The main tasks here are the confirmation of reliability (so that the abducted data does not lose or decay) and performance (data transfer with acceptable delays). In the structure of the total costs for the edge computing networks, the costs of solving traffic problems create a significant portion, while these problems are not completely in centralized systems. The comparison of confirmation of reliability was demonstrate the Fig.5.

### 4.3 NETWORK SECURITY MANAGEMENT

These are safety -related problems, which are more difficult to solve on the edge computing networks than the centralized system. In some cases, it is advisable to refuse to use the network as a whole when security is particularly important. There are many more advantages and disadvantages in the use of networks, but the main source of their performance is an undeniable fact of their widespread distribution. The comparison of network security management was demonstrated the Fig.6.

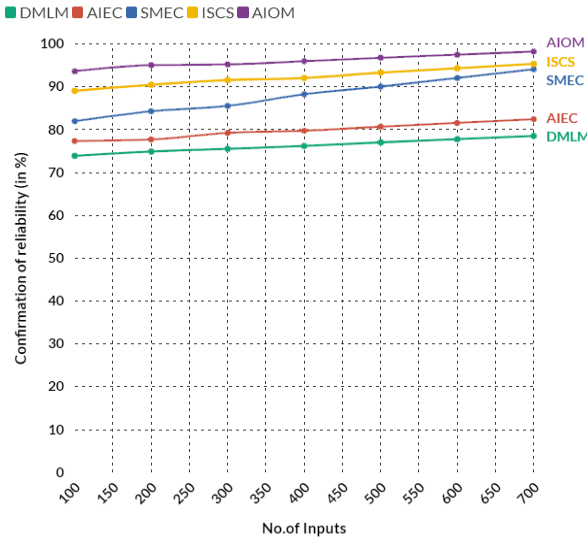


Fig.5. Results of confirmation of reliability

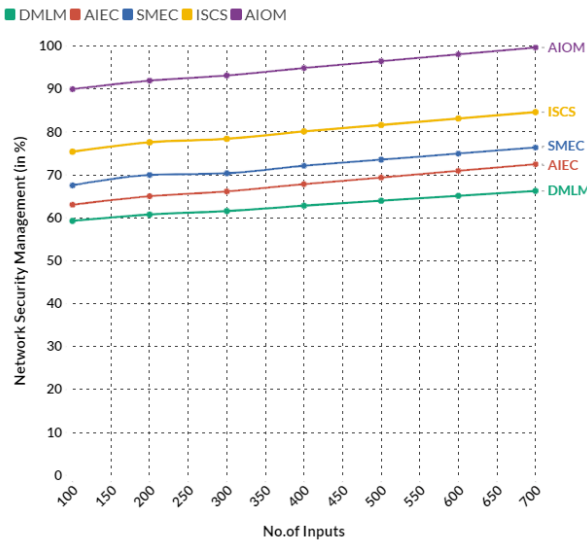


Fig.6. Results of network security management

It is difficult to find any large company that does not have at least one section network of personal artificial intelligence computing; Large networks appear with hundreds of workstations and dozens of servers; Some large companies and companies receive private global networks that combine their branches for thousands of kilometers. In each particular case, there were reasons for creating a network, but the general statement is true: there is still something in these networks.

#### 4.4 HANDLING OF EDGE CONSTRUCTION PROBLEMS

The most convenient and effective feature of the Networks Client program is the ability to distinguish from the request for the local file to the remote file. If the client program is able to do this, you should not worry about which file (local or remote) in the applications, the client program itself recognizes itself and requested the reed machine. So the name is often used for the

client side of the Network OS. Sometimes authentication functions are divided into a separate software block; in this case, the entire client part is called steering, but only this volume. The comparison of edge construction problems was demonstrated the Fig.7.

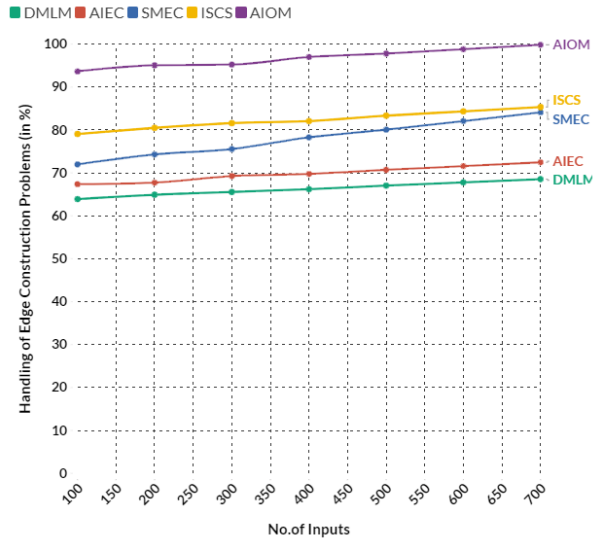


Fig.7. Results of edge construction problems

#### 4.5 PHYSICAL DATA TRANSFER

Even when considering a simple network with only two machines, there are many problems inherent in any edge computing networks, including issues associated with physical transmission of signals via communication lines, and any connection is impossible. In computing, binary code is used to indicate data. In the system, one of the data and zeros are similar to separate electrical signals. Representation of data in the form of electrical or optical signals is called symbolic system. The comparison of physical data transfer was demonstrated the Fig.8.

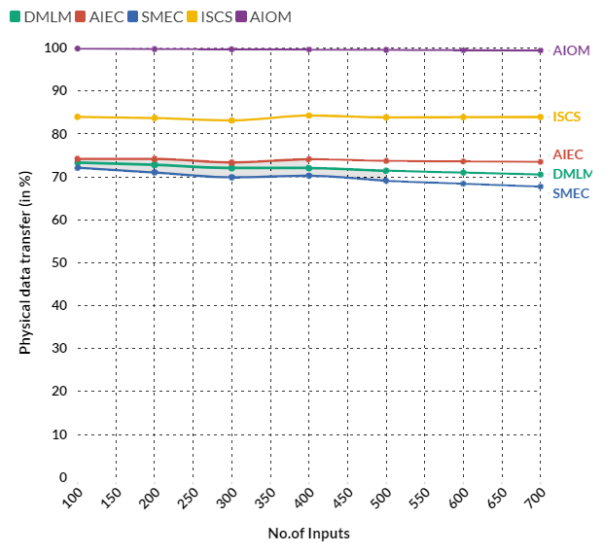


Fig.8. Results of physical data transfer

In a functional cut-off tip the proposed artificial intelligence-based optimization model was achieved 94.33% of performance

of the optimization software, 95.24% of confirmation of reliability, 94.56% of network security management, 98.52% of handling of edge construction problems and 99.68% of physical data transfer. While compared with the other existing models, the proposed model achieved better results.

## 5. CONCLUSION

The choice of the appropriate data transfer rate, the method of sync of communication lines, the receiver and transmitter - some bit of degeneration of the abducted data is possible. A receipt signal this confirms the exact nature of the data reception and is sent to the sender from the recipient. The performance parameters of the existing Distributed machine learning model (DMLM), Artificial Intelligence and Edge Computing (AIEC), Secured Multi-Access Edge Computing (SMEC) and integrated structured cabling system (ISCS) are compared with the proposed artificial intelligence optimizing model (AIOM). To improve the reliability of data transfer between artificial intelligence computing, a standard technique is often used - the number sends it through the communications lines of the number after each byte or some bytes. Often this included as a mandatory element in the data transfer protocol.

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