

# PROPOSED AN ARCHITECTURE FOR BOTTELNECK NETWORK

**Mustafa Abdalrassual Jassim**

Department of Civil Engineering

College of Engineering

Muthanna University

**Ali Sami Al-Itbi**

Department of Information Technology

Technical Collage of Management

Middle Technical University

## ABSTRACT:

The bottlenecks, the key components to improve the performance of production networks, have been studied in depth over the past decade. However, "given the complexity of research results, there is still a Large Gap between theory and practice". In this research, learn the methods of detection and results converged and provide practical guidance to identify and use bottlenecks in production networks. The bottleneck model of congestion with self-scheduling has become a standard tool for the transport economy. We will consider the problem of identifying regions of congestion in closed queuing networks, Motivated by the trend towards more collaboration in the workflow, we are studying networks where some activities require simultaneous processing by multiple types of human resources multitasking. We offer collaboration architecture concepts and cannot avoid bottleneck to study the maximum productivity or capacity of these networks. Even when the network is constantly busy (processing in capacity), bottleneck resources can never be used. Thus, the traditional approach that equates to network capacity with bottleneck capacity is incorrect because network capacity is less than bottlenecks. Solutions have been developed to address bottlenecks that cause many problems in network productivity

**Keywords:** Congestion; bottleneck; productivity; Bandwidth; Upgrade; Avoid.

## 1. Introduction:

A bottleneck is deterioration in the quality of service provided by the network when trying to transfer data over its capacity. The most important symptoms of bottleneck: slow data transfer and loss of data packets and the inability to start new links. The most important outcome of bottleneck is that any increase in pregnancy on the net leads to a slight increase or decrease in productivity. When the load exceeds a certain limit, the network reaches a stable state called a breakdown. In the event of a

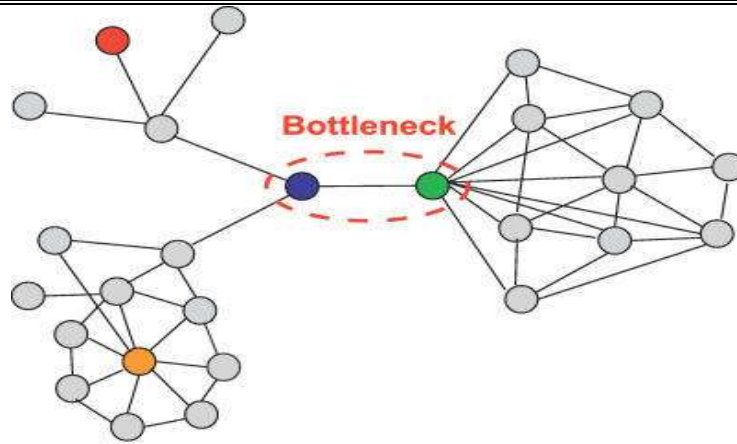
breakdown, demand from network users is high<sup>[1]</sup>, while useful network productivity is reduced to a small fraction of its productivity, as productivity is wasted in transporting packets before it reaches its destination. The presence of network congestion has an effect on the performance of the system and arises when the load displayed on the channel is greater than the bandwidth. The term "bottleneck" refers to the shape of a bottle, which results in a slow flow of data from the bottle<sup>[2]</sup>, a full bandwidth system is a goal that moved to build it because of the modern cloud computing and data center technologies which are growing up the market for universal network communications<sup>[3, 4, 5]</sup>. Congestion happens most completely on the edge of the Broadband Networks, Network endpoint hotspots is occurring within scope of network operations, the massive computer systems are using programming models commonly, like a limit map, the action of the hotspot might be underlying [6]. Moreover, if the traffic of the network is erratic and uniform, various senders may do temporarily transferring the packages to the same target and form a transitory hotspot [7].

Traffic that cannot be serviced by the over-subscribed destination is left in the router queues, leading a congestion in the network, In loss network operations similar to the TCP/IP, congestion is coming out because of the droplets of the packets, although as a result, the point of congestion remains slightly isolated. Nevertheless, various networks system area, such as Infinite and [8], has been designed it, to be lossless and apply the Tightly-Controlled buffer allocation methods like Credit-Based flow control. In specific methods, the congested traffic will wait within the network till it has been delivered, hence, congested packages back up into the rest of the Network in a condition termed as saturation of tree [9]. Without fitting administration and separation of certain congestion effects, traffic flow in the remainder of the network will be negatively influenced [10].

Several congestion control mechanisms have been proposed in network systems, Properly manage congestion, monitor congestion problems, expand bandwidth and use equipment that interacts with the data transmission mechanism

## **2. What is network bottleneck?**

Network Bottleneck refers to a separate case where data flow is limited to computer or network resources, Data flow is controlled according to the Bandwidth of different system resources. If the system on the Network delivers more data than is supported by the current capacity of the network, there will be a bottleneck in the network. [11]



**Figure 1: Bottleneck**

By measuring the throughput in the link or network will find the number packets that can be processed or transmitted in a limit time:

$$Throughput \leq \frac{RWIN}{RTT} \quad (1)$$

where RWIN is the TCP Receive Window and RTT is the round-trip time for the path.

Bandwidth capacity:

First by finding the signal to noise ratio(SNR).

$$SNR_{db} = 10 \cdot \log_{10} SNR \quad (2)$$

Then apply the value of SNR in the next formula.

$$C = B \log_2 (1 + SNR) \quad (3)$$

Where C is the capacity in bps, B is the bandwidth in Hz.

One of the easiest ways to check the congestion is by comparing the capacity and the throughput; If Capacity  $\geq$  throughput there will be no congestion otherwise the network will receive congestion.

- A bottleneck is any resource hardware, programming or network that limits the execution of an application
- These are found at every level/segment of an application.
- resolving the bottlenecks requires special tools, skills, devices and abilities

### 2.1. Impact of performance bottlenecks

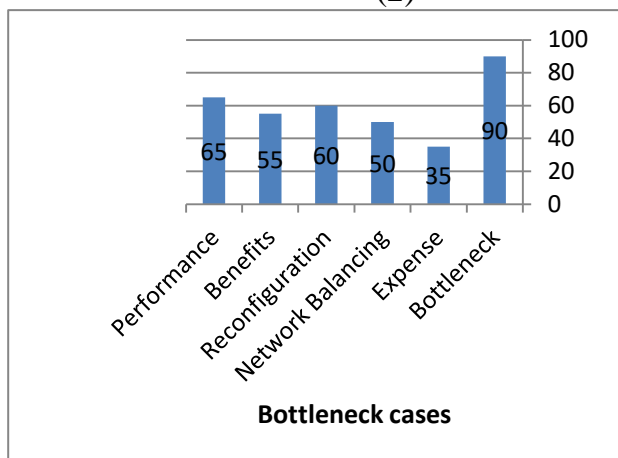
- Response times get slower.
- In efficient resource utilization.
- Application is not scalable.
- Supports less number of simultaneous clients.
- Loss in business revenue due to less customer satisfaction.

## PROPOSED AN ARCHITECTURE FOR BOTTELNECK NETWORK.....

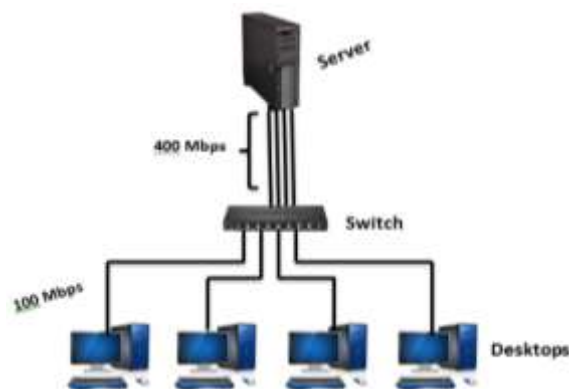
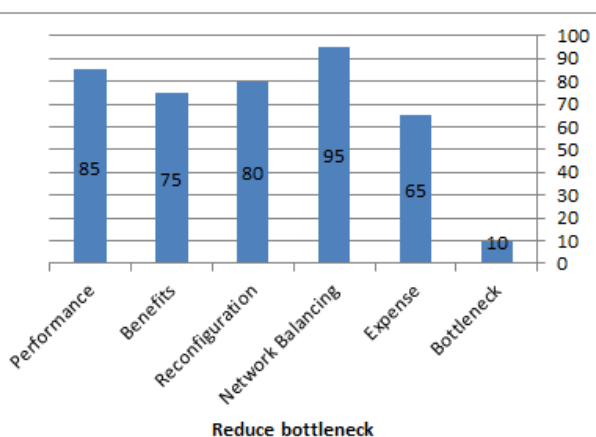
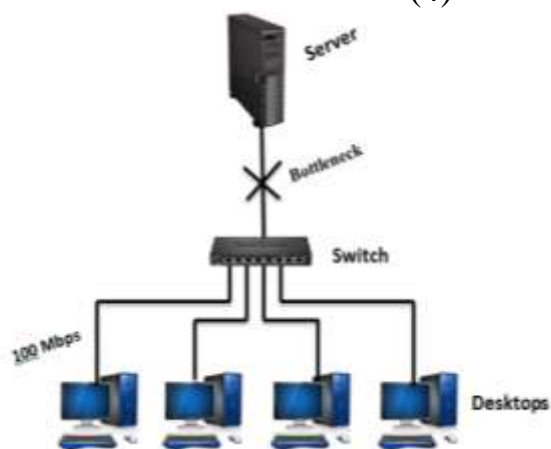
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- System crash. See Figure (2,3,4,5)

(2)



(4)



(3)

Network Bottleneck	Bottleneck	Reduce bottleneck
Bottleneck	90	10
Expense	35	65
Network Balancing	50	95
Reconfiguration	60	80
Benefits	55	75
Performance	65	85

(5)

Table 1: Network Bottleneck

### **3. Causes of network bottlenecks**

- 1- The long distance, high-speed links raise the overall number of packages in the network. When the number of packages overrides the limit of the network, the overflow is stored in buffers. when network utilizing the buffer, is increasing the possibility of losing the packages.
- 2-Some protocols are not reducing the sending rate sufficiently when congestion is rising.
- 3- In project management and production, Bottleneck is one process in a series of processes occurring in the network, so that its limited capacity reduces the ability of the entire chain [12]. Almost every system has a bottleneck, even if it is a minor, if each system is running at full capacity. At least one device will have a backlog of operations [13].
- 4 - The issue of identifying bottlenecks is very important in order to improve efficiency on the production line because it allows identifying areas where accumulation occurs, the process or device in which the longest queue occurs is usually the Bottleneck, However, this is not always the case. Bottlenecks by identifying areas where accumulations occur. Evaluating each machine or device whether it is being used at full capacity, evaluating productivity and finding the device with high standby time.[14][15]

Network implementation issues are among the most complex and difficult to track and solve problems. If the user cannot access the network or understand some of the problems and how it was done: a broken cable or TCP / IP Used incorrectly, disconnect, malfunction in some devices, however if the user was able to access the network and find the source of the problem can be more difficult. In the following five common causes of network implementation challenges:

**1. Bandwidth Monopoly:** Some people or someone may be monopolizing your bandwidth by downloading a lot of video or data or streaming music and especially if the network is small will affect the productivity of the network; you can roam around on all screens of users to see what happens or monitor users through Special programs. For a larger network, you will need more advanced devices to check system activity.

**2. Devices:** You may have too many adapters between your workstations and servers, or you have a lot of devices bundled on a single chip.

#### **2.1 Algorithm**

Step1: USER INPUT

Step2: DESTINATION AND MESSAGE

Step3: PACKET SPLIT

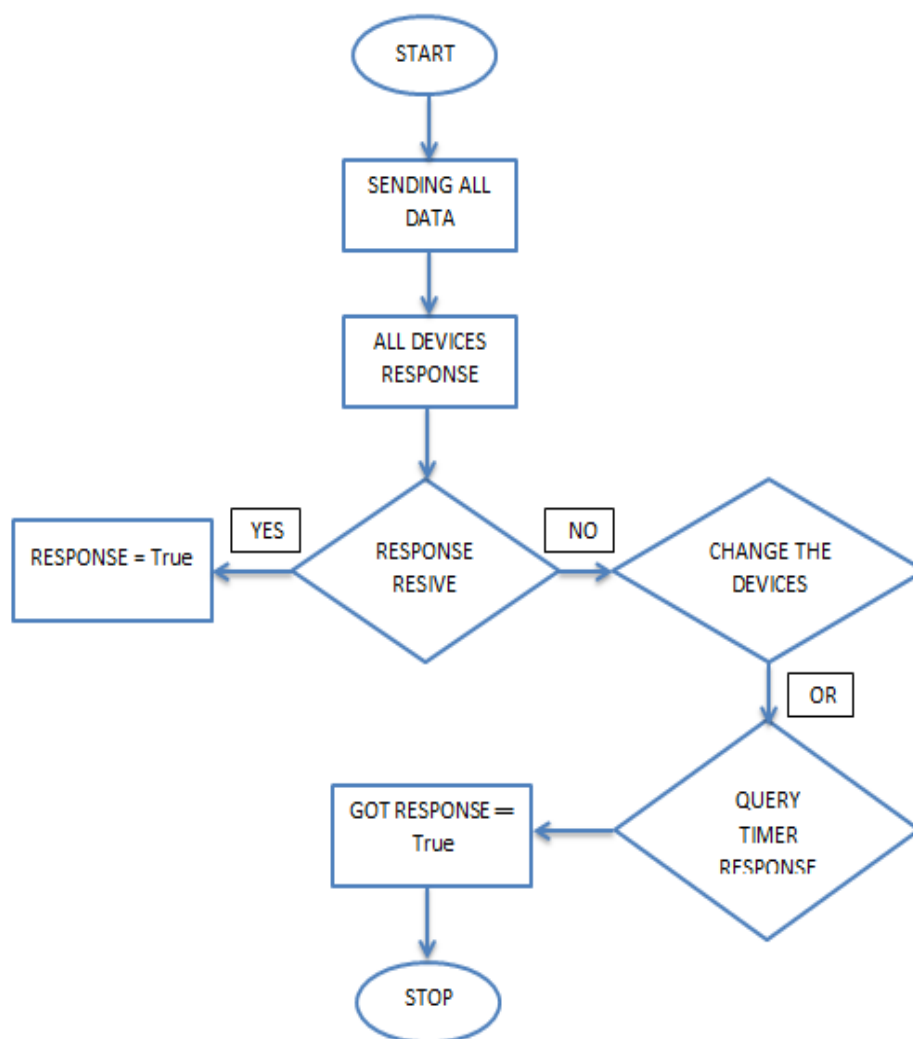
Step4: SENDING DATA TO DEVICES OR (SWITCH)

Step5: RECIVING DATA FROM DEVICES

Step6: PACKET RECIVED IN DEVICES

Step7: FINILLY SAVE

**3. Disable or stop the devices:** Sometimes, there is one device disabled at the workstation, which affects the traffic and workflow correctly and the general must follow the work of the devices and replace or correct them so as not to affect other workstations.



**Figure 6: Flow Chart to Disable or stop the devices**

**4. Upgrade bandwidth:** Sometimes you see that your network has exceeded bandwidth. You may need to upgrade to a higher level of service.

**5. Upgrade Servers:** One of the problems we face in network performance is that redundant servers with lots of duties. Servers must be developed or increased to match network productivity and distribution, consider upgrading the server RAM or adding additional network interfaces.

### 4- Solutions Network bottlenecks

Addressing network bottlenecks is important for controlling data flow and traffic quickly and securely, many rely on networks for a limited number of technologies: Increase link throughput, configure port channeling, or integrate quality of service (QoS). While these are all still valid methods, network engineers have a few additional tricks up there. Here are modern ways that engineers ease congestion throughout various parts of an enterprise network.

#### 1- Performance bottlenecks:

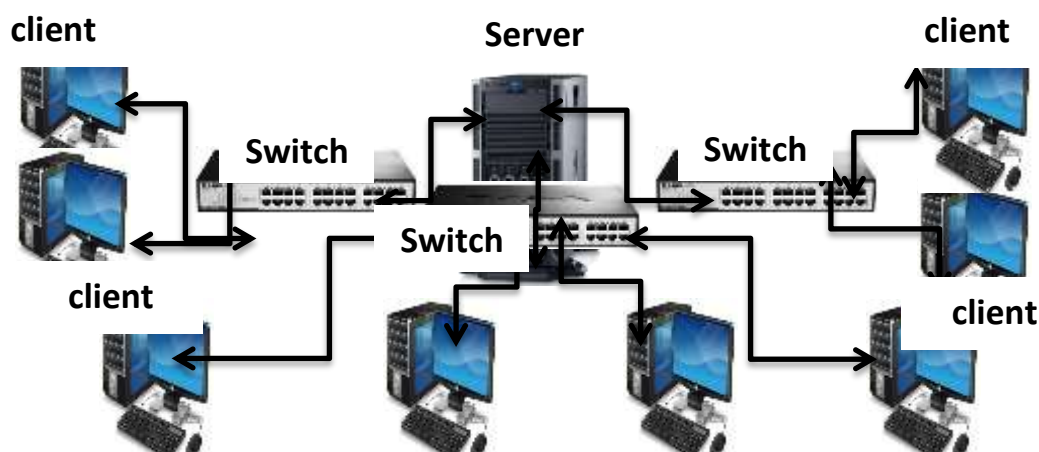
Can lead a generally functional PC or server to back off to slow down work. The expression "bottleneck" refers to both an overloaded network and the state of a computing device in which one component is unable to keep pace with the rest of the system, along these lines abating general execution. Tending to bottleneck issues typically brings about restoring the framework to operable execution levels; in any case, fixing bottleneck issues requires first identifying the underperforming component. There are several reasons for bottleneck:

- 1- CPU Utilization
- 2- Memory Utilization
- 3- Network Utilization
- 4- Disk Usage

Resolving network utilization issues typically involves upgrading or adding servers, as well as upgrading network hardware like routers, hubs, and access points.

#### 2- Load Distribution (Balancing):

Network bottlenecks occur when communication between two devices lacks the necessary bandwidth or processing power to complete the task quickly. Network bottlenecks occur when a server is overloaded; a network connection device is overloaded. Solving network usage problems usually involves upgrading or adding servers, as well as upgrading network devices such as routers, centers, and access points. Loads are distributed over more than one device to send and receive data between users or customers, and the diagram below shows the distribution mechanism



**Figure 7: Load Distribution** ("Segmentation increases server bandwidth, but typically requires additional hardware and management overhead – including repeated reconfiguration to balance the traffic load")

If we have, several request

R1,R2,R3 On the same device

Step1: Send the request R1,R2,R3

Step2: Load Balance

Step3: Receive the Request R1,R2,R3

Step4: Distribution R1 Another Devices And R2,R3

Step5: If Another Load Balance(LB)

Step6: Send Type Request Node

Step7: Reduce Bottleneck

### 3- Expand the ports:

As the advanced applications and desktop computers more powerful push Network traffic to new levels, "a single 100Mbps channel is not enough bandwidth for critical server connections - especially with the increase in the number of connected desktops at 100Mbps". In the past, these bottlenecks were usually resolved by installing an additional Network Interface Card (NIC) in the server, and here we must use the default method (meaning the default way switch works where any network can connect from any port).



The end result should resemble something similar to this image:

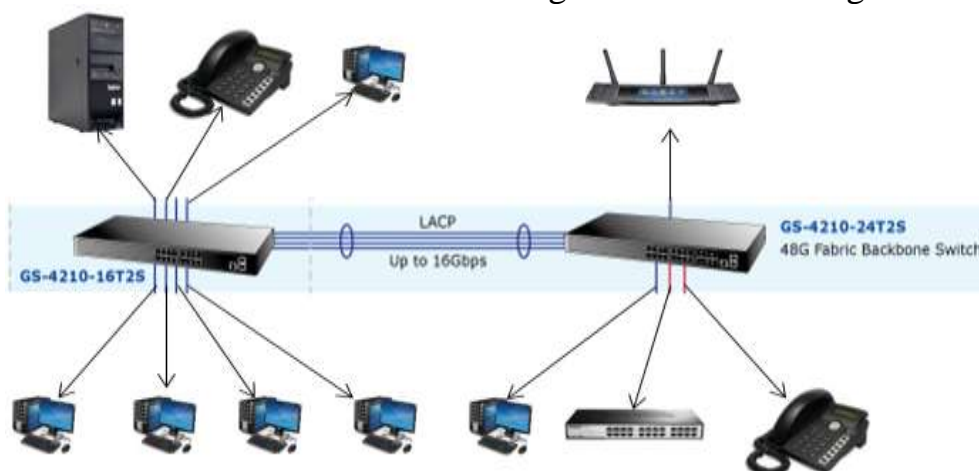


Figure 8: Ports

#### 4- WAN optimization and Software-defined WAN:

Another basic place for bottlenecks in the system is the Wide Area Network (WAN). Because broadband often benefits from leased lines from service providers, it is simply impossible to increase productivity without incurring significant costs. Fortunately, two technologies have emerged over the past few years that help reduce congestion without the need to upgrade the leased line. The first method, WAN optimization, is deployed across devices installed at any end of wan connection. Hardware uses a series of software-based optimization tools to squeeze as efficiently as possible on the link as much as possible. Technologies include compression, caching, duplicating, and traffic shaping. The next evolution of WAN optimization is plug-in, which adds another layer of software-based intelligence to the mix. The Si- WAN architecture creates a virtual structure where several communication options are combined together. Lines can be leased lines such as MPLS, VPN connections, or a combination of the two. The plug-in program then monitors each link and guides packets down the optimal path at any given point in time. If congestion is ever detected on one of the WAN communication options, the traffic is directed around to avoid the bottleneck.

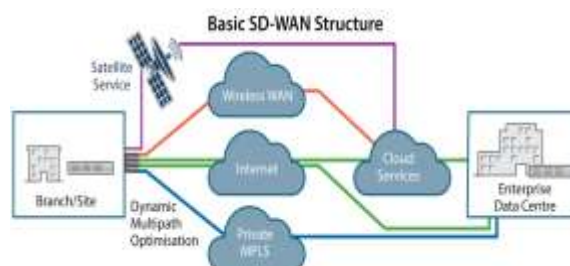
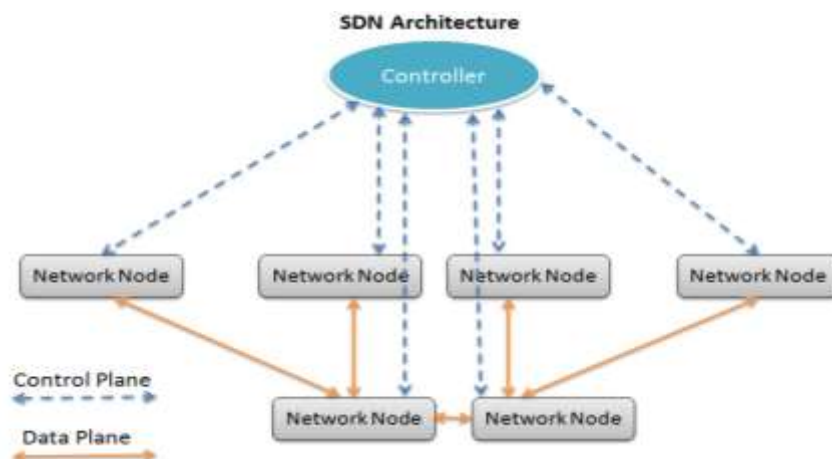


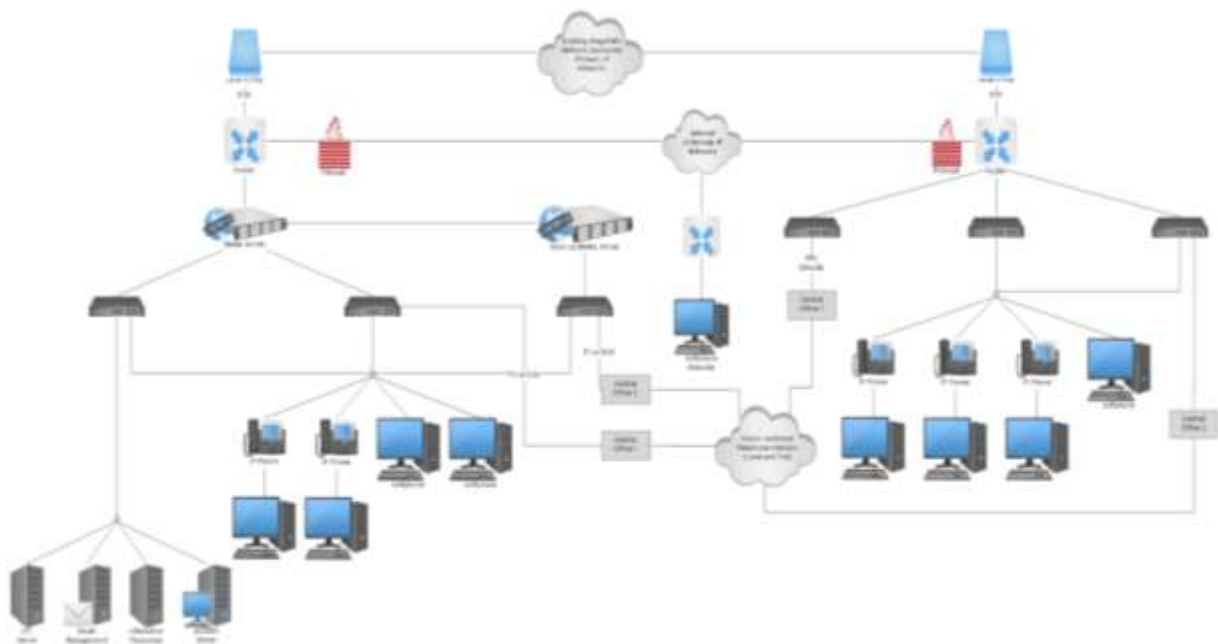
Figure 9: SD-Structure



**Figure 10: SDN-Architecture**

### 5- Data Flow:

The flow of data must be monitored and the most visited places or devices must be identified in order to identify the problem and make decisions to resolve it. For example, a computer that is flooding the network while running a particular program or process may indicate a problem with network software. In this case, follow-up must be taken into account to eliminate the bottlenecks, from expanding, altering or developing some devices and programs. The figure below illustrates the flow of data.



**Figure 11: Data Flow**

### **6- Improved TCP/IP protocol settings:**

TCP/IP Protocol settings must be improved because it is useful for improving communication between nodes in networks. Also, TCP techniques are designed to avoid network congestion of connections encapsulated over high bandwidth networks. Properly tuning networks leads to better performance up to 5 times better. Using faulty instructions without understanding their real consequences Performance can also worsen.

### **5- Avoid mistakes that lead to bottlenecks**

In a nutshell, feature selection and dimensionality reduction help to remove noise, improve computational time and avoid over fitting. More than 90% of network traffic utilizes TCP protocol due to its reliability and ability to avoid congestion in the network. WANs and LANs provide fast connections in the workplace. Both types of network allow information exchange between customers, and the network can suffer bottlenecks during the peak period. The bottlenecks can be prevented by using monitoring applications to map the network and its problems, providing end-to-end feedback so that we can adjust performance.

### **6- Recommendations:**

- 1- Follow up network work.
- 2- Expand networks or open new ports to avoid problems.
- 3- Development of devices used in networks.
- 4- Development of programs used within networks.
- 5- Distribute data regularly and do not load the network.

### **Conclusion:**

In this paper, a large Number of approaches studying the Bottlenecks in production networks have been discussed and analyzed; we restrict our attention in Network Optimization Service and Improve and ease congestion on the productivity of the network. Network optimization service aims at consistently improving and assuring network performance for operators and helping operators achieve the optimal network resource utilization and network performance, reduce customer complaints on network performance issues, improve Operation and maintenance efficiency and quality, and eventually improve customer satisfaction.

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## نظام مقترح لتخفيف الازدحام على إنتاجية الشبكة

م. مصطفى عبد الرسول جاسم الشريفي / قسم الهندسة المدنية / كلية الهندسة / جامعة المثنى  
علي سامي عزيز / الكلية التقنية / الجامعة التقنية الوسطى / بغداد

## الخلاصة :

قد تم دراسة الاختناقات، وهي المكونات الرئيسية لتحسين أداء شبكات الإنتاج، دراسة عميقة خلال العقد الماضي. ومع ذلك، ونظرا لتعقيد نتائج البحوث، لا تزال هناك فجوة كبيرة بين النظرية والممارسة. في هذه الورقة، تعلم طرق الكشف والنتائج المتناظرة وتوفير التوجيه العملي للاعتراف والاستفادة من الاختناقات في شبكات الإنتاج. أصبح نموذج عنق الزجاجة من الازدحام مع جدولة الذاتية أداة قياسية لاقتصاد النقل، سوف ننظر في مشكلة تحديد مناطق الازدحام في شبكات الانتظار المنتظرة، وبدافع من الاتجاه نحو مزيد من التعاون في سير العمل، ندرس الشبكات التي تتطلب بعض الأنشطة المعالجة المتزامنة من خلال أنواع متعددة من الموارد البشرية المتعددة المهام. نحن نقدم مفاهيم عمارة التعاون ولا يمكن تجنب عنق الزجاجة لدراسة الإنتاجية القصوى أو قدرة هذه الشبكات حتى عندما تكون الشبكة مشغولة باستمرار (معالجة القدرات)، والموارد لعنق الزجاجة لا يمكن أبدا أن تستخدم بشكل كامل ومن ثم فإن النهج التقليدي الذي يساوي قدرة الشبكة مع قدرة عنق الزجاجة غير صحيح لأن قدرة الشبكة نقل عن قدرة الاختناقات وقد وضعت حلول لمعالجة الاختناقات التي تسبب العديد من المشاكل في إنتاجية الشبكة.