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## Enhancement in VPN by Implementing Cloud Infrastructure

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**ABSTRACT:** VPN is a Proven technology that does provide Security Strong enough for business use. However, Performance of these network is also Important. In this Research we evaluate Performance of Operation System available on Cloud (Windows Server 2012R2, Windows Server 2013 trial, Windows Server 2008R2) and Operating System on normal environment(Windows 2007,Windows 2008,Windows 2010) on a test-bed set-up and observe their network Performance with SSL VPN Protocol. It is found that the Operating System give different Performance Values.

**KEYWORDS:** VPN, SSL-VPN, throughput, Virtual machine, Operating System, Cloud

### I. INTRODUCTION

#### VPN:

A Virtual Private Network (VPN) is a private data network which uses the public telecommunication infrastructure, it maintains privacy through the use of tunneling protocol and security procedure [1]. Idea behind VPN is providing secure connection between organization and its branches via low-cost lines using internet [1][2]. A VPN operates by passing data over the internet through "Tunnels" which are secure, encrypted virtual connections [1]-[5]. VPN uses various security protocols for Tunneling they are:-

- Internet Protocol Security(IPSEC)
- Layer2 Tunneling Protocol(L2TP)
- Point to point tunneling Protocol(PPTP)
- Secure Sockets Layer(SSL)

#### IPSEC:

IPsec provides authentication of users, encryption of data and data integrity during the data transmission between senders and receivers [2]. It uses three primary protocols which are Authentication Header (AH), Encapsulated Security Payload (ESP), and Internet Key Exchange (IKE). These are used in establishing connection and transmitting data in secure way [2]. There are two encryption modes in which IPsec can be implemented [2]-[4].

- Transport Mode
- Tunnel Mode

Transport mode encrypts only data portion (Payload) of packets. Tunnel mode is more secure which encrypts both header and payload [2][3].

#### L2tp:

L2TP tunneling is accomplished through multiple levels of encapsulation. PPP data is encapsulated within a PPP header and an L2TP header. Then L2TP packet is further encapsulated in a UDP header. Final packet is encapsulated within IP header [2][3][6].

#### PPTP:

PPTP is an OSI Layer2 protocol which is an extension of point-to-point protocol (PPP).It creates IP datagrams which containing encrypted PPP packets. which are transported through the tunnel. By design PPTP has a very simple mechanism [2][3].



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## **SSL:**

SSL is used with web browsers to give users a seamless Connection. It protects data using encryption and uses hashing to ensure Integrity [3][4].

Cloud Computing Deployment Models [7][8]:

### **Public Cloud:**

In this cloud infrastructure is made available to a large industry group or the general public and is owned by an organization selling cloud services.

### **Private Cloud:**

The cloud infrastructure is operated by particular organization. It may be managed by a third party or the organization and may exist on premise or off premise.

### **Hybrid Cloud:**

In this cloud infrastructure is a composition of clouds (public, private, community) that remain same entities but are bound together by standardized technology that enables data and application portability.

### **Community Cloud:**

The cloud infrastructure is shared by some organizations and supports a particular community that has shared concerns (e.g., security requirements, mission, compliance consideration and policy). It may be managed by a third party or the organization and may exist off premise or on premise.

Service Models [7][8]:

### **Software as A Service (Saas):**

The capability provided to the consumer is to use the provider's applications running on a cloud infrastructure<sup>2</sup>. The applications are accessible from various client devices through either a thin client interface, such as a web browser (e.g., web-based email), or a program interface.

### **Platform as A Service (Paas):**

The capability provided to the consumer is to deploy onto the cloud infrastructure consumer-created or acquired applications created using programming languages, libraries, services, and tools supported by the provider.

### **Infrastructure as A Service (Iaas):**

The capability provided to the consumer is to provision processing, storage, networks, and other fundamental computing resources where the consumer is able to deploy and run arbitrary software, which can include operating systems and applications.

The rest of paper is organized as follows :In Section II Related Work is given. In Section III Expected Results and outcomes are given. Conclusion is discussed in Section IV. Future scope described in section V.

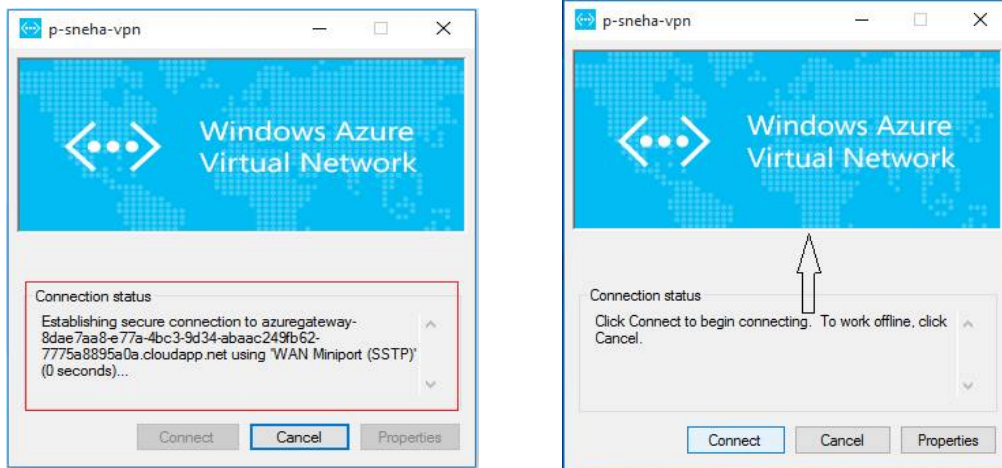
## **II.RELATED WORK**

VPN is a proven Technology that does provide Security Strong enough for business use. However Performance of these network is also Important. Objective behind this Research work is to evaluate Performance with different VPN tunnels Protocols, and evaluate that how VPN tunnel is dependent on the choice of the Operating System, VPN Protocol. In this Research SSL-VPN has been Implemented using cloud Infrastructure , where Infrastructure is provided by Azure Cloud and we conclude that SSL-VPN which Implemented by using Cloud Infrastructure gives the higher performance compared to SSL-VPN Implemented by Normal Infrastructure.

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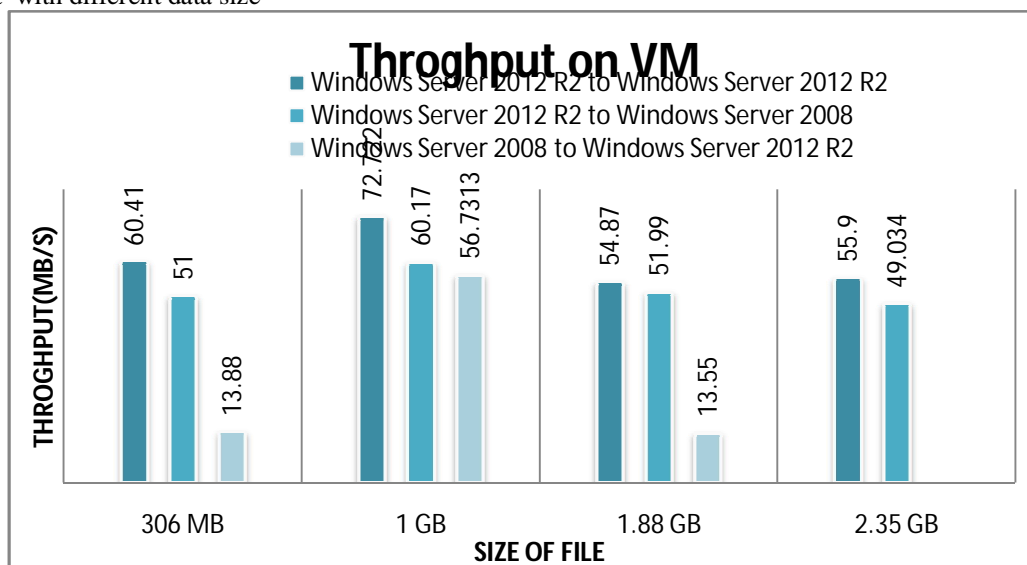


**Fig 1. VPN Connection to Azure Network**

In this research we Selected some Operating System available on Cloud Windows Server 2012,2013 trial. After selecting particular Operating System and File Size the process of File Transmission is carried out from One sender OS to One Receiver OS. Same Process of transmission of data is carried out in normal environments selected Operating system Windows7,Windows8,Windows10. Performance Difference between Various Operating System are Evaluated through the transmission Process of file and results of Performance are shown in Section III. The Metric used in the experiment are throughput and transmission delay(MBPS).

### III. EXPECTED RESULTS AND OUTCOMES

Performance analysis by transferring data over Virtual Machine where network is psneha-vnet on azure. Figure 2 shows the Performance Comparison of Operating System on Cloud, windows Server 2012 gives the higher throughput with different data size



**Fig 2. Performance comparison by transferring data on different OS**

Figure 3 shows the Performance Comparison of Operating System on Normal Environment, windows10 gives the higher throughput with different data size.

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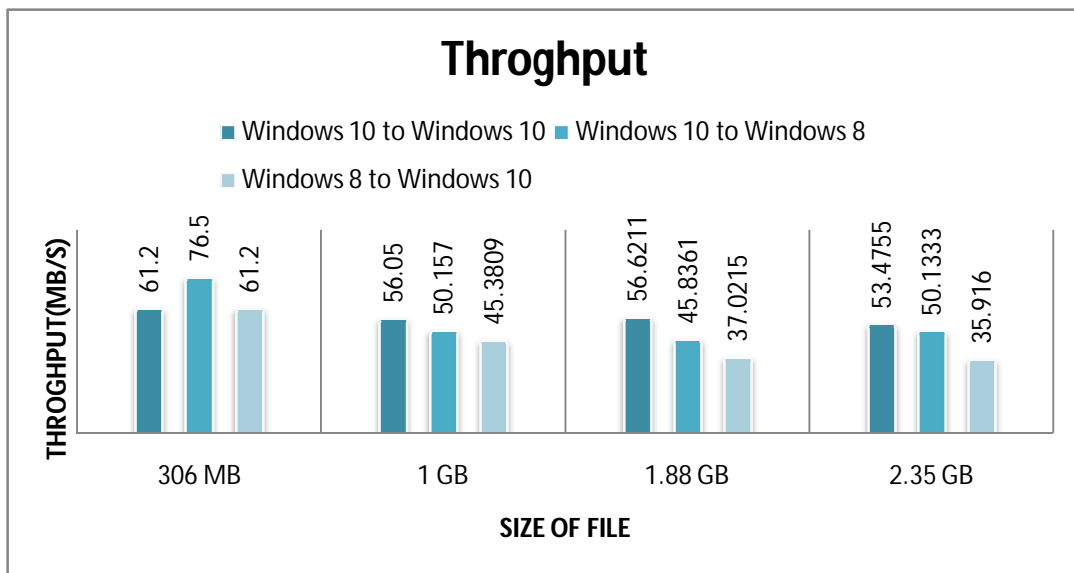


Fig 3. Performance comparison by transferring data on different OS

Figure 4 and 5 shows the transmission delay on cloud and normal Environment.

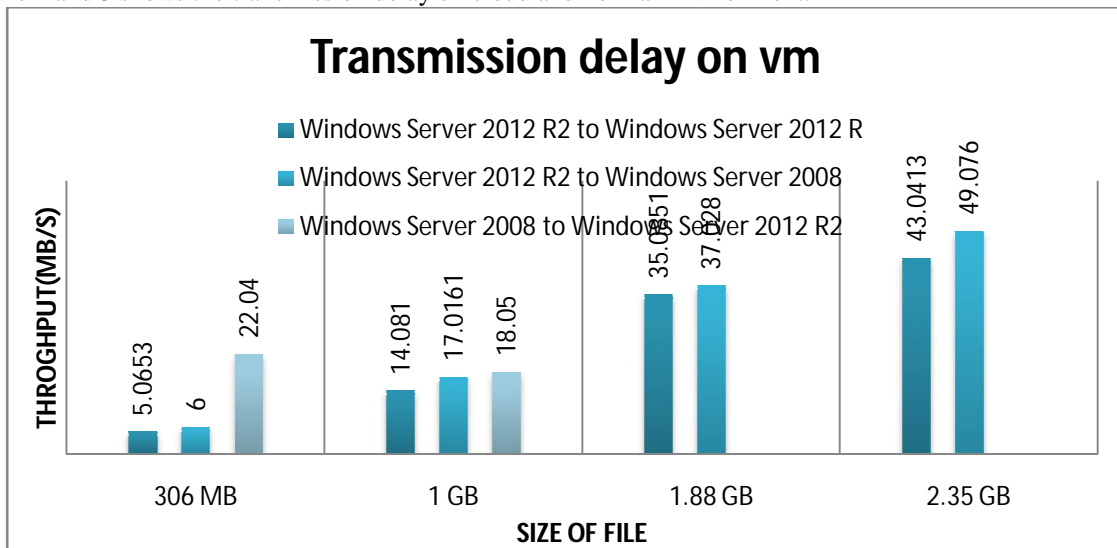


Fig 4. Performance Comparison : Transmission Delay on different OS

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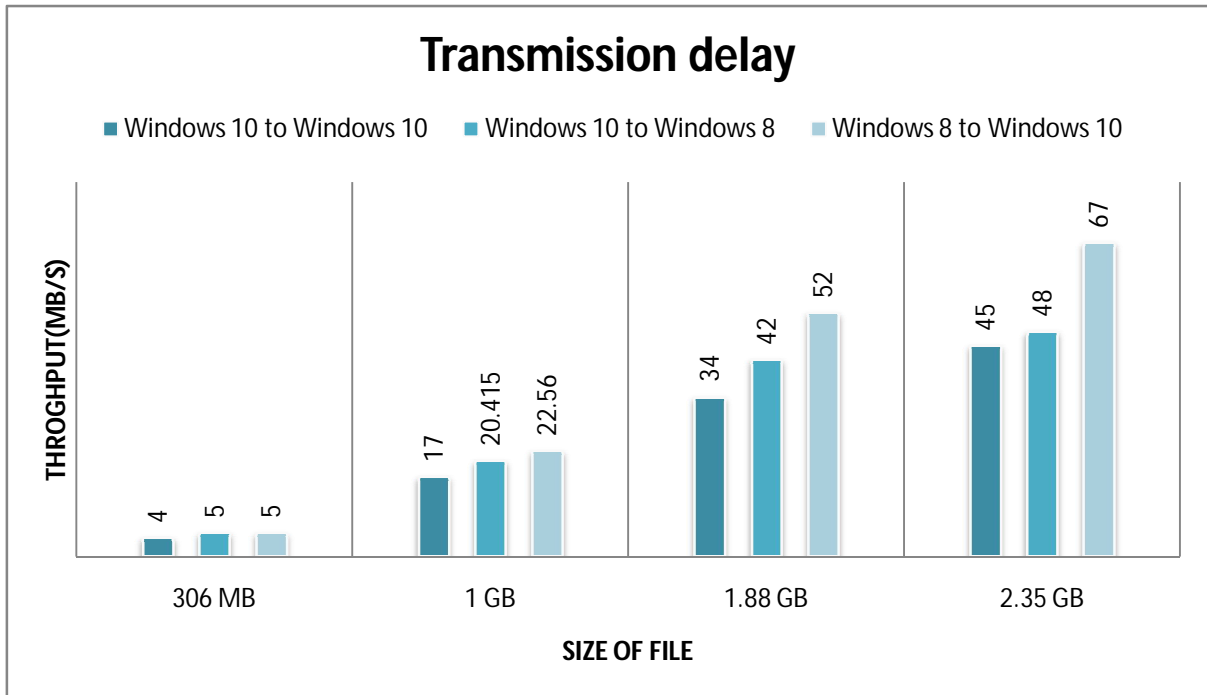


Fig 5. Performance Comparison : Transmission Delay on different OS

## Performance comparison : Transmission Delay on different OS

Performance comparison with PPTP,SSL,L2TP

In Figure 6 and 7 Performance Comparison of PPTP,SSL,L2tp has been shown PPTP gives the Higher Throughput among the Three Protocol.

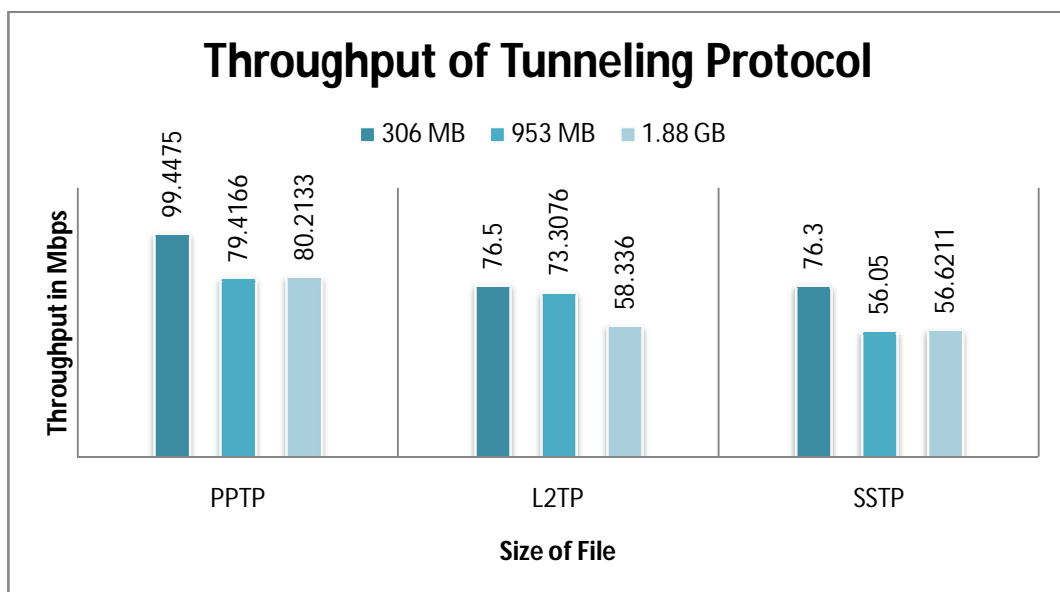


Fig 6. Performance analysis of Protocols by transferring data (Win 10 to Win 10)

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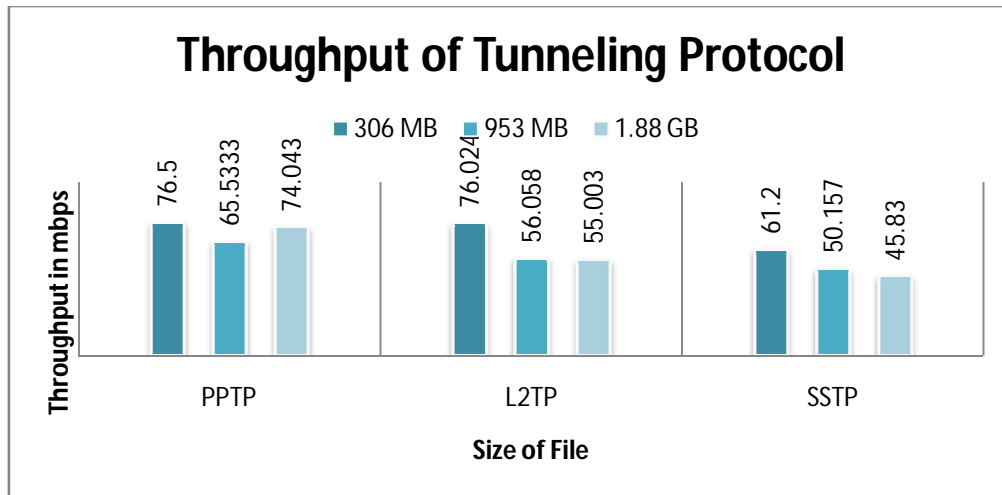


Fig 7. Performance analysis of Protocols by transferring data (Win 10 to Win 8)

## IV. CONCLUSION

In this Research, from the findings it is evident that Network Performance of VPN tunnel is dependent on the choice of Operating System, VPN protocol, Security algorithm.

This Research Concludes the Following:

- In normal environment and cloud environment there is a clear distinction between VPN network throughput.
- In cloud environment average throughput values ranges between 30 to 62 Mbps.
- In normal environment average throughput values ranges between 40 to 57 Mbps

## V. FUTURE SCOPE

This Work will be extended to include more tunneling protocols with a wider selection of algorithm and greater range of Operating System.

This research purely evaluates performance difference between the different tunneling algorithms, through this we can also investigate security differences resulting from different implementation.

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