

# INTERNET2: A COMPARATIVE STUDY AND TECHNOLOGICAL SOLUTION TO ACHIEVE HIGH SPEED NETWORKS

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## Abstract

In current Indian scenario whenever it is required to access very large amount of data such as games or some commercial applications through commodity internet (internet1), speed becomes hurdle. It becomes tolerable for some applications but no one wants to bother in case of education and research. Now the world becomes commercialized and don't want to bother with speed. Therefore the next generation of Internet infrastructure known as Internet2 or UCAID (University Corporation for Advance Internet Development) for 21<sup>st</sup> century comes in the focus of scientists, to improve quality of life through research and education. In this paper thorough analysis and comparative study of various educational networks, market scenario and Internet2 has been done, so all pros and cons become visualized to get the effect of internet2 in industries, research and development.

**Keywords:** Internet2; Abilene network; gigapops; high speed networks.

## 1. Introduction

Internet2 is a second generation network serving universities and research institutes by moving the data at a rate of 10 gigabits per second and more ,compared with 5.1 or so megabits old fashioned commodity internet. Internet2 moves data 100 to 1,000 times faster than internet1. Its GigaPoPs (points of presence) provide regional high-performance aggregation points; for member institutions, typically local campus networks provide no less than 100 Mbps to the desktop.

The team included scientists from AMD,Cisco, Microsoft Research, Newisys and S2io transfer large amount of data at a rate of 6.63 gigabits per second between distances of 9,800 miles. Now Internet2 transfer data at 9.08 gigabits per second over a distance of 30,000 km from a period of five hours [9].

What makes internet2 so different to internet1 is that it has fewer users and much faster connection. Abilene network which is designed to support high bandwidth and low latency provides a networking infrastructure to internet2. Abilene is a dual stack IP V4/IP V6 U.S cross country network that blast bandwidths up to 10Gbps. It is designed to provide most favorable performance to both IP V4/IP V6 packets. Internet2 connects more than 200 universities, 115 private and government agencies and a lot of international organizations log on to internet2 everyday.

The main objectives [3] of the using Internet2 are as follows:

- To provide a common bearer service to support new applications as well as the existing ones.
- To provide best effort packet to a differentiated communications service.
- To provide the capabilities of network service characteristics to meet the requirement of specific applications.
- To get a high speed communications infrastructure for the Research and Education communities.

## 2. Why Internet2

Internet2 or UCAID were not only created to make a faster alternative to the internet. Abilene network is used for more diverse applications to provide creativity, education and research that were not possible before internet2. One of the most impacting uses of internet 2 is the robust videoconferencing between experts of different fields at a very high resolution with no noticeable time lag. If you are doing videoconferencing then you definitely need very high speed connectivity so that you can refresh the environment and react earliest to the participant on the other hand without ant time lag and internet serves your demand.

The purpose of internet2 is not only providing high speed but also to achieve innovation in research and distance learning through the contribution of government agencies, technologies firms and other corporate partners. By using the internet2 we bring forward the most advance networks for the university community and able to get access the peoples that would not be possible with commodity internet.

Figure 1(a) and Figure 1(b) shows the relation between speed over distance for normal user connection and for R&D users respectively.

### 3. Internet1 Vs Internet2

Internet1 or internet simply refers to a network of computers .The base of internet1 was ARPAnet, and is developed for communication of computers over a network by Defense Advanced Research Project Agency.

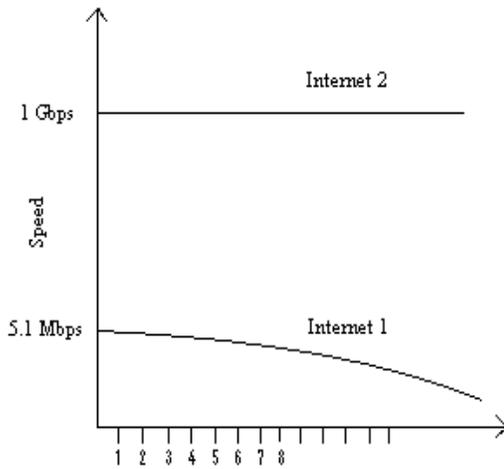


Fig. 1(a). Distance (In 100 Miles)  
Normal User connections based on the requirement.

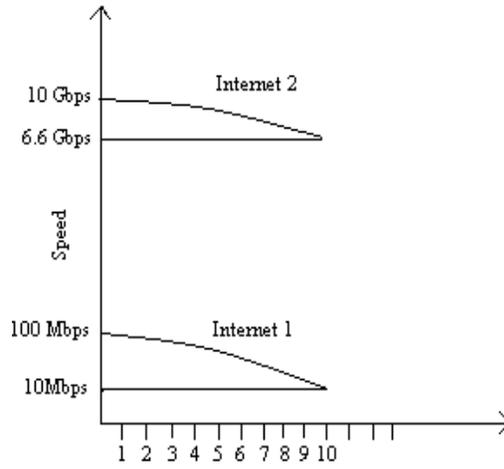


Fig. 1(b). Distance (In 1000 Miles)  
For corporate and Research and development users.

Internet is open to anyone with a computer and capped with a old telephone line with a speed of 4 megabits or so. The internet was first developed to use by government and universities, such institutions cope up with internet’s bandwidth limitations so they realized the need of high bandwidth network for their computer intensive work.

Internet2 is a consortium created the Abilene network for develop and deploy advanced network application. Internet2 is a noncommercial prototype of internet1 it support research, universities and agencies at a speed of 10 gigabits per second and more. The backbone of internet2 is made up of large-capacity fiber optics cables. Unlike Internet1 it has much fewer users and much faster connection. Internet1 is also comprises servers, routers and switches.

The limiting factor includes the fastest available interface for home PC’s is the PCIX64 bus Isolation extender, which works only at 7.5 Gbps.

Table 1 A comparison between Internet1 and Internet2

Internet1 (Commodity Internet)	Internet2 (UCAID)
Open to support any number of users with a computer.	Limited and support fewer numbers of users.
Cobbled together out of telephone lines.	Internet2 would operate using NLR’s infrastructure, utilizes leased optical wavelengths.
It moves data at 4 megabits per second or so using a cable modem & up to 100 Mbps for corporate connections [5].	It builds for speed and moves data at 10 gigabits per second and more.
It is designed for commercial as well as education and research activities at speed very less than internet2.	Abilene provides as the backbone network and designed for education and research at a very high speed.
Commodity Internet works on IP V4 which provide very less IP addresses compared with IPv6.	Internet2 will natively implement IPv6 and also supports IPv4 with gaining the advantage getting more IP addresses through IPv6 [10].
Secure networking is possible with large networks having some sort of security checkpoint (mechanism) with some loopholes exists.	Security is a breakpoint; Internet2 still does not even have a designated security contact for each participant [4].
Internet1 will allow remote cluster computing & remote computers to operate in grids but the overall performance found significance degradation.	Internet2 will allow remote cluster computers to operate in "grids" as if they were a single computer from the users perspective with no degradation found in performance. It enables us to begin working with the network and applications we'll eventually have across campus.

#### 4. Technology used

Internet2 uses the technologies of next generation to provide high speed and maximum utilization of networks. Internet2 typically use IPV6 and DWDM like technologies to support the requirement of next generation of internet. IPV6 which is also called IPng expands the pool of unique addresses available for connecting PC and other devices in the high computing network environment. It's keep minimum header overhead and supports multiple levels of subnetting and address allocation .The main advantage of using IPV6 for internet2 is that its nodes listen multiple multicast addresses at the same time and nodes can join or leave a multicast group at any time & IPV6 automatically configure itself without the use of stateful configuration protocol.

Dense wave division multiplexing provides unique bandwidth management capabilities which multiplexed optical signal with in 1550-nm band so to leverage the capabilities and cost of erbium doped fiber amplifiers. DWDM combines multiple optical signals so that they can be amplified as a group and transported over a single fiber to increase capacity. Each signal carried can be at a different rate (OC-3/12/24, etc.) and in a different format (SONET, ATM, data, etc.). Next generation DWDM terminals will carry up to 80 wavelengths of OC-48, a total of 200 Gbps, or up to 40 wavelengths of OC-192, a total of 400 Gbps—which is enough capacity to transmit 90,000 volumes of an encyclopedia in one second.

#### 5. Usefulness of Internet2 in current market Scenario

The emergence of Indian IT market in 1990's gives the true scenario of ups and downs in Indian economy. The counter go like this: in early 1990s government to become a monopoly provider, middle 1990's lot of IT companies shows their interest and finally private sector holds the control by providing quality through speed and availability of the Indian IT market. Now the market becomes do commercialized & moderate and want to access the internet just like accessing the hard disk at our site this scenario becomes the forcing factor for the requirement of Internet2 in Indian scenario. Internet2 like concept will definitely pace the collaboration with scientists among different countries. There are so many possibilities of IT/BPO and R&D sector in India but in fact we lack the speed. The current Indian scenario says that R&D contribution of Indian market is about 222 millions \$ [5] which would be drop day by day as the outsourcing of such activities is totally dependents of high speed networks. Many R&D labs and MNC's do not conduct their research in India while having development centers because of the lack of high speed networks like Internet2.

Indian educational networks can be divided into three parts [8]:

- (1) ERNET ( Education and Research Network )
- (2) BIOGRID (VPN of Dept. of Biotechnology, Govt. of India)
- (3) GARUDA (The initiative takes for grid computing)

But having these networks we are not able to draining the R&D of MNC's and other big institutions due to lack of high speed of networking as compared to the speed of networks in other developed countries which will provide the speed up to Gbps through Internet2 related to the Indian highest possible network which provide 100 Mbps or so in research and corporate internet connection while only 4 Mbps or so with normal users. Basis of the words of former president of India Dr. A.P.J Abdul Kalam " we will become a super economic power till 2020" the Indian government need to understand what we loose if we are not able to place our step with others due to the problem of non speedy networks. When our commitment is strong the results are spectacular, Internet2 like network if applied in our scenario will definitely gives us a better opportunity to collaborate with others world. Internet2 is not just an idea in Indian scenario but a key for stepping with rest world.

#### 6. Applications

Internet2 provide very high bandwidth to the concern agencies/universities for computer- rigorous which result very high performance. Science students who utilize rare or expensive remote instruments such as electron microscopes, telescopes, or other devices that allow them to explore worlds outside their classroom and also the high quality video interaction with remote experts at the Smithsonian or astronauts working on the international space station are benefited by using Internet2. Internet2 play a vital role for interaction between a student teacher and an established classroom teacher, or involving college faculty.

Some of the most common areas which are benefited by Internet2 technology are:

- High Energy Physics
- Medical Imaging
- Virtual Anatomy
- Neural Science
- Data Mining
- Videoconferencing

## 7. Conclusions

Future trends of IT Market and economic development of developing countries will raise the requirement flag of Internet2 or likewise high-speed network. Yet we have nice quality educational network but as much concerned with the development of IT market these network no longer meets or serve the purpose of speed enhancement and computing needs, so it force us to develop a network like internet2 in all over the world. Internet1 is good enough but for research and development purpose, internet2 will provide a better means and it will reflect through the research that it moves data 100 to 1,000 times faster than internet1. Through the internet2 like networks we bring forward the most advanced networks for the R&D community (research community). In future we expect that rather than certain high speed networks for educational use, India will also have a common internet2 or likewise network which improve the R&D capability of world intellectuals and also MNC's will make a move towards establishing their R&D labs everywhere in world where such high speed networks are available.

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## References

- [1] Agarwal, H., Kumar, S., "Internet2: Applications & Impact on Video conferencing", MIT Transaction, March 2007.
- [2] Alan, D., Greenberg Analyst & Consultant at Wainhouse Research "Super Sized Bandwidth and two-way video in Classroom", Wainhouse Research, June 2004 available online "[www.wainhouse.com/files/wrb-06/WRB-0623.pdf](http://www.wainhouse.com/files/wrb-06/WRB-0623.pdf)."
- [3] Armoni, Adi., "Internet2 – WWW Where, When and Why?", Informing Science Volume 4 No 3, 2001.
- [4] Ashton, E. (1999). "Budget proposal for the Internet 2 project", Boston University Press, January 2000.
- [5] Bakos, Y. (1998). "The Emerging Role of Electronic Marketplace on the Internet", *Communication of the ACM*, 41(8), pp. 35n 42
- [6] Gemmill, Jill., Assistant Director, "IT Academic Computing Internet2 Applications", Lead University of Alabama at Birham Wainhouse Research, June 2004 available [www.polycom.com/common/documents/whitepapers/supersize\\_bandwidth\\_and\\_two\\_way\\_video\\_in\\_classroom.pdf](http://www.polycom.com/common/documents/whitepapers/supersize_bandwidth_and_two_way_video_in_classroom.pdf)."
- [7] Gillmor, S., Angus, J., and Gallagher, S. (1999). "New Model for Ecommerce", *Information Week Labs*, June 28, pp. 65-74.
- [8] Khanna, Gopal ., Khuntia, Jibananda., "High performance computing networks for research, education, science and technology in India", available online "[www.garudaindia.in](http://www.garudaindia.in)".
- [9] Kuchinskas, Susan., "Scientists Set Internet2 Speed Record", available on [www.Internetnews.com/infra/article.php3403161](http://www.Internetnews.com/infra/article.php3403161)".
- [10] Paulson, Linda Dailey., "Internet2 Upgrades Backbone", available online [ieeexplore.ieee.org/ie/2/20936/00970552.pfd?anumber=970552](http://ieeexplore.ieee.org/ie/2/20936/00970552.pfd?anumber=970552)".
- [11] Russo, Alexander., "Internet2 It's better, it's faster, You can't use it", available online "[www.slate.com/id/2120440/](http://www.slate.com/id/2120440/)".
- [12] Stone, Adam., "Internet2's breakthroughs for academic research", IEEE Distributed systems online 1541-4922 IEEE computer society vol. 5, no. 1; January 2004
- [13] William E. Johnston Project "Enminger Science Network", available online [www.internet2.edu](http://www.internet2.edu).