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# DIGITAL INDIA 2020: SGI CONTRIBUTION ABRIDGED CRUCIAL BANDWIDTH CONSUMPTION FOR OPERATIONAL DEPLOYMENT OF DIGITAL INDIA VENTURESWITH GIGANTIC BANDWIDTH OBLIGATION BY WEB BASED NETWORK HUBS AT PAN INDIA

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**ABSTRACT**

*In this Digital Era Rupees Five Lakhs Crores are sanctioned by Indian Government for of Digital India includes Online Services, E-Governance and Internet Web based ventures and 8.3 Crores of IT Jobs by 2020. Thousands of Web Based Internet Hubs will be deployed at all the post offices to connect the India for various Applications and Transactions viz. Pensioners Certificates, Registration Documents, E-Learning, E-Governance, E-Mall, E-Services etc. But these initiatives required huge infrastructure with very high speed internet with huge bandwidth to complete these activities on web based applications considering huge traffic and limited bandwidth. In this paper we have proposed the Pre-fetching and Postfetching methodology to dissolve these issues and a long term solution to the limited crucial bandwidth to cope up with the heavy traffic.Further we are proposing the Min and Max Round Trip and Response Time Ratio for different categories considering multiple scenarios in the Digital India Ventures. The exhaustive experimentation will be conducted to calculate % Bandwidth Reduction during off Time scenario as well as during Peak Time Scenario in prefetching and postfetching.*

*The real time Experimentation and analysis has been completed at Sanjay Ghodawat Gr. of Institutions (SGI), Atigre, Kolhapur (MH-India) with 10000+ Internet users including round the clock WiFi across the wide campus of 150 acres. The experimentation and results end up with the major achievement at both the fronts of Bandwidth Consumption; Technical Specific Documents Browsing as well as in General Surfing. This abridged crucial bandwidth consumption would play a key role in the successful operational deployment of Digital India 2020 with gigantic bandwidth obligation at PAN India level.*

**Categories and Subject Descriptors**

C.2.3 [Network Operation]: Network Management

C.4 [Performance of System]: Design Studies

**General Terms**

Performance, Reliability, Experimentation.

***Keywords: Digital India, Bandwidth reduction, Pre-fetching and Post-fetching,***

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## I. INTRODUCTION

In Internet Era and in Digital India, the network traffic is tremendously increased [4]. This has affected on the additional requirements of the crucial bandwidth, require more time to fetch the data from server which means increased in latency time.A proxy server acts as a mediator between the original server and the clients [6, 8].

As we know internet is changing all the time. There are two things we have marked its evolution recently: The social and mobile technology [1]. These two innovations have changed the way people use the internet. Since its creation in 2004, Facebook has grown into a worldwide network around 1,000 million subscribers [9]. The Internet has been growing at unprecedented rates. Moreover, because it is versatile and penetrates deeply into the economy, it is affecting all of society, and therefore has attracted inordinate amounts of public attention. Bandwidth is a signal processing bandwidth, frequency bandwidth or radio bandwidth [11]. A measure of the width of a range of frequencies, measured in hertz .When calculating bandwidth, one can't assume that every channel is used all the time [12].

Issues regarding growth of Internet:

- Lack of Power Supply: There is limited and unsteady power supply in the country when compared to the rate of supply in other parts of the world. This has served as one of the major problems of Internet growth in the country.
- Poverty –There is a high cost of education. The poor ones will not waste there income in internet when they are in need of food, clothing and shelter. Many can't afford Pc at home.
- High Cost of Getting Internet: Internet doesn't come cheap. One of the reasons for the high cost of connecting to the internet is the costs involved in using satellites due to a lack of cable infrastructure.
- Low Speed and Time-Consuming Internet: Out of 10 million estimated Internet users, broadband users are few. High-speed broadband requires fiber optic cables.
- Increasing Competition: Traditional internet service providers are beginning to face increasing competition from internet services offered by mobile operators. The introduction of 3G services in the country has enabled many Nigerians to access the internet through mobile devices.

## II. LITERATURE SURVEY

Digital India is an initiative by the Government of India to ensure that Government services are made available to citizens electronically by improving online infrastructure and by increasing Internet connectivity [15]. It was launched on 1 July 2015 by Hon. Prime Minister. The initiative includes plans to connect rural areas with high-speed internet networks. Digital India has three core components [17, 20].

These include:

- The creation of digital infrastructure
- Delivering services digitally
- Digital literacy

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In Digital India Scenario and its applications; it is investigated that mirroring in a large crawler data set and reported that in the WebTV client trace far more aliasing happens than expected. In fact, they reported that 36% of reply bodies are accessible through more than one URL [2]. Similarly, some surveyed techniques referred for identifying mirrors on the Internet [5, 7].

Investigated mirroring in a large crawler data set and reported that roughly 10% of popular hosts are mirrored to some extent. Considering approximate mirroring or "syntactic similarity" the architecture can be designed. Although they introduce sophisticated measures of document similarity, they report that most "clusters" of similar documents in a large crawler data set contain only identical documents [20].

The web pages, which are accessed by the all users, that get stored somewhere, we call that storage "Cache proxy memory", which is available at client side [10, 14]. It may happen that, some of the users requests for same URL's, so the pages get stored multiple times in cache memory. So duplication occurs & it grabs more space, which causes to the poor performance. So the eviction of content is very necessary [18]. Therefore, we are using various methods. After the removal of content aliasing, results are better performance, less space. Still there may be lots of other content in cache, which occupies more space. So, it is mandatory to filter that content from cache by using various replacement policies such as FIFO, LRU, LFU, etc [16].

FIFO: It is first in first out policy, manage by queue. When cache get full then it is mandatory to avail some space. So, this scheme removes the pages, which get inserted first.

LRU: It is Least Recently Used policy, which filter out the web pages that will not be used in near future.

LFU: It is Least Frequently Used policy, which evicts the web pages which are not frequently used.

## III. PROPOSED METHODOLOGY - EXPERIMENTATION AND RESULTS

Considering the Digital India and its Applications by most of the clients in major two categories like in general browsing category and specific technical documents category; seven wonders and Eight Core IITs pay loads referred for an experimentation purpose.

| Payloads | Browsing Category | Latency Time (s) | | | |
|---|---|---|---|---|---|
| IIT Kharagpur | By Web | 0.38 | 0.41 | 0.44 | 0.59 |
| | By Image | 0.33 | 0.35 | 0.37 | 0.78 |
| IIT Bombay | By Web | 0.41 | 0.43 | 0.44 | 0.45 |
| | By Image | 0.33 | 0.34 | 0.41 | 0.85 |
| IIT Kanpur | By Web | 0.41 | 0.44 | 0.48 | 0.51 |
| | By Image | 0.33 | 0.34 | 0.85 | 0.9 |
| IIT Madras | By Web | 0.37 | 0.39 | 0.43 | 0.51 |
| | By Image | 0.27 | 0.31 | 0.49 | 1.21 |
| IIT Delhi | By Web | 0.58 | 0.55 | 0.48 | 0.43 |
| | By Image | 0.86 | 0.43 | 0.31 | 0.26 |
| IIT Guwahati | By Web | 0.39 | 0.49 | 0.42 | 0.49 |
| | By Image | 0.41 | 0.44 | 0.46 | 0.54 |

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| | | | | | |
|---|---|---|---|---|---|
| IIT Hyderabad | By Web | 0.38 | 0.41 | 0.42 | 0.52 |
| | By Image | 0.27 | 0.32 | 0.49 | 1.26 |
| IIT Chennai | By Web | 0.39 | 0.41 | 0.45 | 0.56 |
| | By Image | 0.39 | 0.51 | 0.69 | 0.91 |

**Table 1: Results of IITs cumulative Payloads by Browsing Category**

A desirable caching system should aim at reducing Web access latency. In particular, it should provide user a lower latency on average than those without employing a caching system. Table 1 summarizes Results of IITs cumulative Payloads by Browsing Categories.

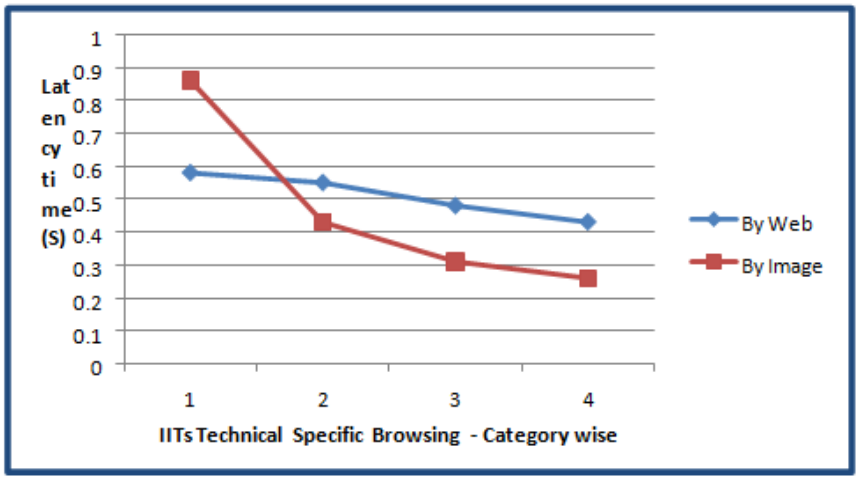


**Figure 1: Analysis of IITs Payloads**

From user's point of view, Payload and access latency is an important measurement of the quality of Web service; analysis of the same from IITs Payloads shown in figure 1.

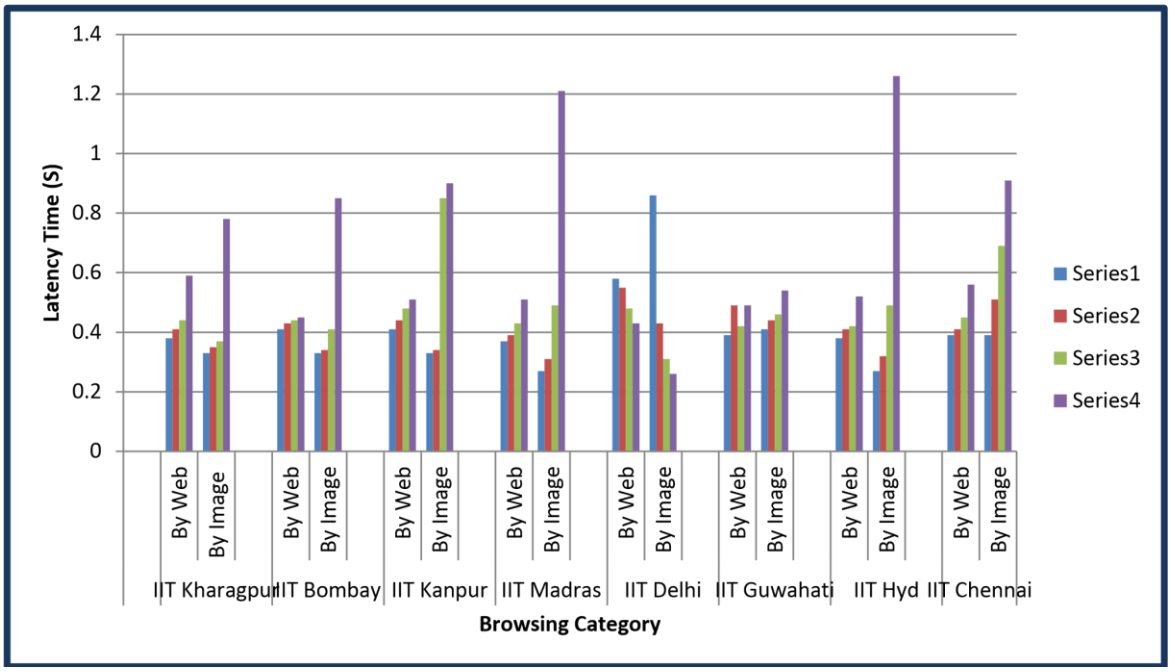


**Figure 2:Analysis of IITs Cumulative Payload – Prefetching and Postfetching**

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Considering the Prefetching and Postfetcing experimentation the cumulative results are summarized in Figure2 where each Series is nothing but the round trip.

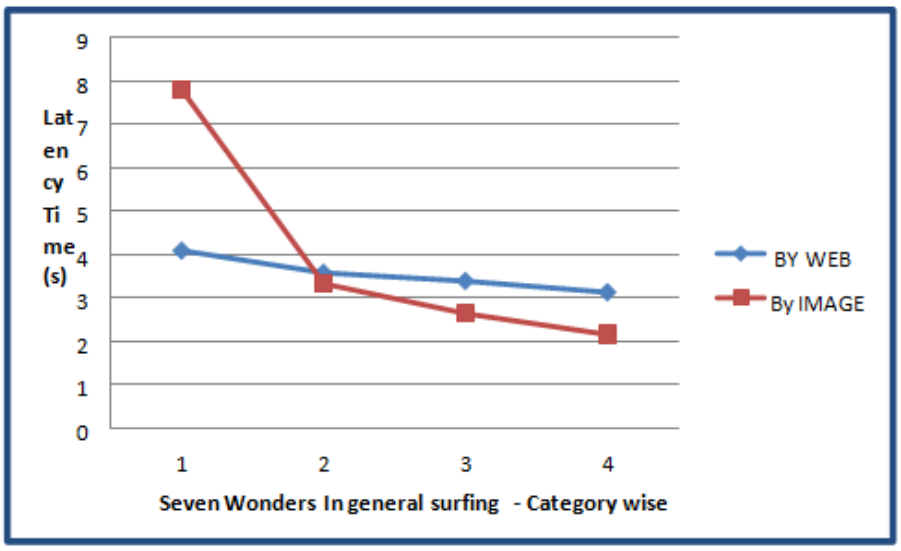


**Figure 3: Analysis of Normal Payloads (Seven Wonders)**

Figure reflects theAnalysis of Normal Payloads (Seven Wonders) as not every user will use the Internet for the technical documents browsing.

This will generalize the conclusion of overall bandwidth consumption as well as bandwidth reduction we will achieve after the experimentation based on these generalized analysis.

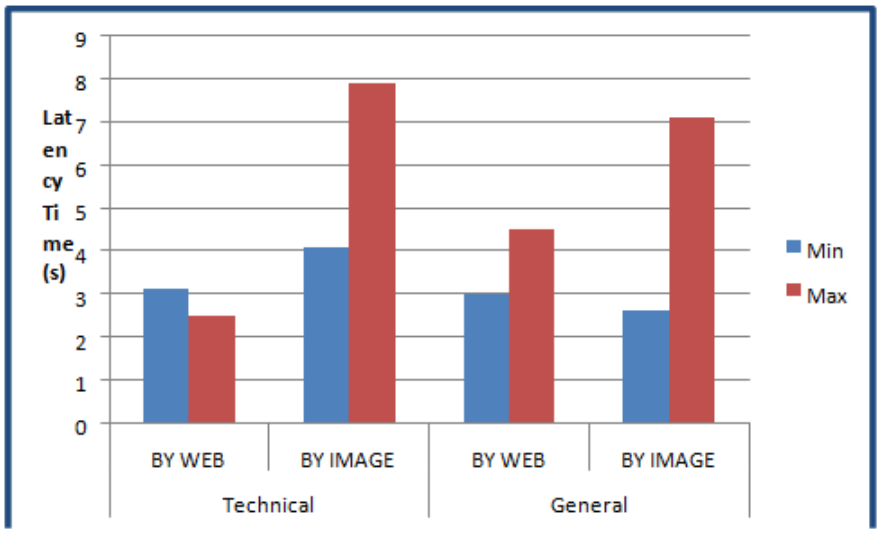


**Figure 4: Min and Max Ratio (Round Trip Response Time)**

From all the round trips in both categories the Min and Max has been identified, their Means are calculated to find the further Min/Max Ratio as shown in figure 4.

## Experimentation and Results for % Bandwidth Reduction:

| | |
|---|---|
| Payload | = 429.25 MB |
| Bit Rate at Off Time | = 0.4 Mbps |
| Bit Rate at Peak Time | = 0.19 Mbps |

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Mean of all MIN Round Trips = 3.12 + 4.08 + 2.99 + 2.6 = 12.79/4 = 3.19 Sec

Mean of MAX Round Trips = 2.48 + 7.87 + 4.5 + 7.09 = 21.94/4 = 5.48 Sec

Min/Max Ratio of Bandwidth Consumption= 3.19/5.48 = 0.58 Ratio

**R= 2(D+L+C)+(D+C/2) ((T-2)/M) + D/n((T-2)/M+1)+max(8P(1+OHD)/B , DP/W)/(1-sqrt(L))** B = Min line speed (bits per second)

C = Cc + Cs

Cc = Client processing time (seconds)

Cs = Server processing time (seconds)

D = Round trip delay (seconds)

L = Packet loss (fraction)

M = multiplexing factor

OHD = Overhead (fraction)

P = Payload (bytes)

R = Response Time (seconds)

T = application turns (count)

W = Window size (bytes)

*Considering the Constant values except R, B and P in the ideal scenario

R= Payload (Bytes) / Min line speed (bits per second)

At SGI this experimentation has been carried out under two scenarios during Peak Time and Off Time from Bandwidth Utilization

**Experimentation at Off Time:** where B = Min line speed (bits per second) = 0.4 Mbps

R= 429.25 / 0.4

R= 1073.12 Secs

Improved Response Time = R X Min/Max Ratio of Bandwidth Consumption =

=1073.12 * 0.58 = 622.4096 Secs

Payload with Improved R=

=Improved Response Time X Payload / Response Time

= 622.4096 * 429.25 / 1073.12

= 248.965 Mb

Bandwidth Reduction = Original Payload- Payload with Improved R =

429.25 – 248.965 = 180.285 Mb

**Experimentation at Peak Time**:

Where B = Min line speed (bits per second) = 0.19 Mbps

R = 429.25 / 0.19

R= 2259.21 secs

Improved Response Time = R X Min/Max Ratio of Bandwidth Consumption = 2259.21 *

0.58

= 1310.3418 secs

Payload with Improved R= Improved Response Time X Payload / Response Time

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= 1310.3418 * 429.25 / 2259.21 = 248.9399

Bandwidth Reduction = Original Payload- Payload with Improved R

= 429.25 – 248.9399 = 180.310 Mb

Bandwidth Reduction at Off time as well as Peak Time is same= 180.285=~180.310

% Bandwidth Reduction = Bandwidth Reduction X 100 / Original Payload =

% Bandwidth Reduction = 180.285 X100/429.25 = 42%

**% Bandwidth Reduction Achieved is 42%**

## IV. ACKNOWLEDGEMENT

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## V. CONCLUSION

TheGovernment of Indiahopes to achieve growth on multiple fronts with the Digital India Programmer. Specifically, the government aims to target nine 'Pillars of Digital India' that they identify as being Broadband Highways, Universal Access to Mobile Connectivity, Public Internet Access Programmer, e-Governance – Reforming Government through Technology, eKranti - Electronic delivery of services, Information for All, Electronics Manufacturing, IT for Jobs, Early Harvest Programmers, The robustness has three aspects. First, it's desirable that a few proxies crash wouldn't tear the entire system down. The caching system should eliminate the single point failure as much as possible. Second, the caching system should fall back gracefully in case of failures. Third, the caching system would be design in such a way that it's easy to recover from a failure.

In this paper with an exhaustive experimentation we have shown the quantifiable difference between the Min and Max Round Trip Response Time Ratio i.e. 0.58%. Further we have experimented for different categories considering multiple scenarios in the Digital India Ventures and prove that the Mean of all is still has measurable difference as well as the % Bandwidth Reduction calculated under ideal condition is 42% during off Time scenario as well as during Peak Time Scenario in prefetching and postfetching. In future work we are going to focus on Latency Time as well as considering the effect of Client processing time, Server processing time, Round trip delay, Packet loss, Multiplexing factor, Overhead etc.

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