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*Literature Review*

# An Overview of Network Slow Bandwidth and Remediation Measures

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## ABSTRACT

Network slow bandwidth is more than just a technical problem that has to be tackled on the server side; it can directly impact a business's outputs and financials in some cases. The factors influencing this problem and its remediation measures have evolved over the years, with technologies like the cloud acting as a catalyst. The main set of problems under the network slow burn bandwidth umbrella are congestions/bottlenecks, network timeout, and slow request processing. The solutions include more efficient resource allocation, optimizing and overhauling network infrastructure, load balancing, and using CDNs.

**Keyword:** Network Slow Bandwidth

## 1. Introduction

The internet has become such a core part of business operations nowadays that network efficiencies and problems directly impact operational quality and output. It's true for a massive range of businesses, not just e-commerce. So, issues like network timeouts and network slow bandwidth can be critical business vulnerabilities, especially if they happen in businesses like financial institutions and credit bureaus, whose servers are accessed and approached by a diverse range of individual users and client businesses.

## 2. Literature Review

The idea of network bandwidth has evolved over the years. We have made significant leaps (from bits to bytes and its multiples) dimensionally, but the core idea of measuring bandwidth in the context of calculating and managing bandwidth is the same as it was over two decades ago, focused on throughput and packet pair [1]. Slow bandwidth and its underlying network bandwidth-related issues, like low bandwidth, congestion, traffic, etc., have been a subject of studies and academic literature since the early days of the internet. While these problems vary from region to region based on individual networks, servers that handle these requests, and several other factors that are isolated to stakeholders in a network, the limitations of the underlying internet infrastructure are also factors influencing network slow bandwidth [2]. Ample research has been conducted to remediate the issue of network slow bandwidth on the server side in both conventional and cloud servers and networks, and many novel approaches, including applying load balancing at both link and server levels, have been tested and implemented in data centers [3].

However, managing network slow bandwidth is more than just about network bandwidth; resources and hardware resources like CPU allocation are also critical factors and have been important research topics in this context [4].

## 3. Problem Statement

Network slow bandwidth may be best understood as a culmination of a set of complementary problems, including:

### 3.1 Congestion and bottlenecks

Network congestion occurs when more data is passing through a network or a specific node in the network than it can handle. The most common issue arising from network

congestion is delay in processing requests, which may also lead to rejection of new requests and data loss (though it's relatively rare). A bottleneck may refer to a specific point in the flow of data in a network that may trigger a delay.

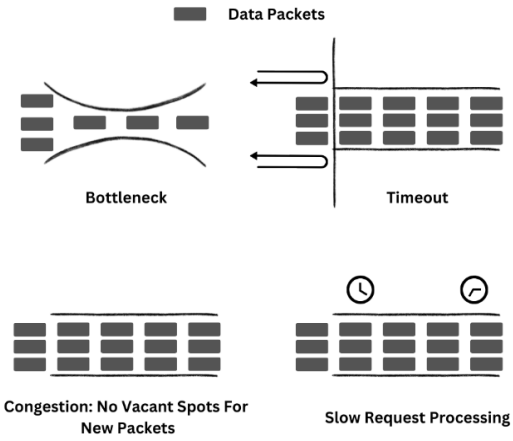


**Figure 1:** Influencing factors and problems associated with network slow bandwidth.

A commonly used analogy here is that of a highway. Congestion is when there is too much traffic for the number of lanes available, and a bottleneck is the highway narrowing at a point, causing the traffic to slow down at that point, and this impact propagates back (quite a bit) to the upcoming traffic.

### 3.2. Network timeout

When a user or a client-server sends a request to the server it's trying to connect to, there is usually a pre-defined period of time it *waits* to establish a connection. A network timeout occurs when the client-server is unable to make the connection in the given amount of time. But it's not always because the host server is down. It may be processing a large number of requests (due to congestion and bottlenecking) to process the new connection within the allotted time frame. The different scenarios a network timeout can represent is one of the reasons choosing the right timeout period can be a challenge [5].

### 3.3. Slow request processing

Slow request processing is a natural consequence of network slow bandwidth, and both the problem and remediation measures differ for more resource-intensive requests like data transfers (that may require more bandwidth) and computational requests (that require more CPU resources).

## 4. Proposed Solutions for Network Slow Bandwidth

Tackling network slow bandwidth (from a host client perspective) can take different routes based on the nature of the problem and the underlying issues (unpredictably high traffic, multiple bottleneck points, etc.).

### 4.1. Resource allocation

Efficient resource allocation is a broad-spectrum solution to a wide range of network traffic and congestion problems, from single servers (with or without VMs) to telecom networks with millions of users and daily requests [6]. The idea is to allocate an adequate slice of available computing resources like CPU cores and memory to the requests so they can be processed in an optimal timeframe. It can be automated with the right scripts, augmented with trained algorithms, or handled manually if feasible.

It's important to understand that allocating more CPU resources to all existing requests or demanding requests doesn't directly tackle the network's slow bandwidth, i.e., since you are not technically adding to the bandwidth or adding more lanes to the highway to ease congestion, you are essentially allowing the cars to move faster. But it does help ease the load, minimizing timeout instances and processing delays.

### 4.2. Load-balancing

Load-balancing is one of the most efficient ways of handling incoming traffic when you have multiple servers (server clusters) or Virtual Machines (VMs) and preemptively tackling issues like congestion and bottlenecking [7]. Load-balancers divert traffic to the server best equipped to handle a request (a set of requests) based on the request itself and the resources it requires.

### 4.3. Optimizing and overhauling infrastructure

A more long-term remediation measure for network slow bandwidth is optimizing or overhauling the infrastructure and network. Optimizing the network would be limited to working on the existing inefficiencies and removable bottlenecks. Overhauling may be a more drastic measure but is warranted when network slow bandwidth becomes a common occurrence, indicating that the traffic, on average, has grown beyond what the existing infrastructure/network was designed to handle.

### 4.4. CDNs

A content delivery network (CDN), which allows you to spread out your network and provide edge servers close to users/clients, can tackle network slow bandwidth by reducing latency (distance-based) and caching most commonly requested data so that clients don't have to reach out to the origin server with each request. Using CDNs and setting up caching parameters can be a bit complex for businesses handling sensitive data like financial and healthcare. CDNs may have some other limitations as well, especially when it comes to throughput-oriented traffic [8].

**Table 1:** Summary of Problems and Proposed Solutions.

| Network Slow Bandwidth Problems | Proposed Solutions | Comments |
|---|---|---|
| Congestion and Bottlenecks | Optimizing network infrastructure and load-balancing | Both optimizing existing networks and load-balancing can reduce congestion and bottlenecking significantly, but they have their limits. Once it's perfectly optimized and the load-balancer has been fine-tuned, scaling up or using CDNs may be required. |
| Network Timeout | Optimizing network infrastructure and increasing bandwidth | Network timeout requests can also be handled by setting up a more pragmatic timeout time period, but ideally, they should be handled with the right traffic management approach. |
| Slow Request Processing | Optimized resource allocation | Handling adequate server resources to requests (on merit) and reallocating underused resources can ensure faster/better request processing times. |

## 5. Network Slow Bandwidth: Best Management Practices

Constant monitoring of the traffic, current resource utilization, and budding congestion problems is one of the best ways to tackle network slow bandwidth. If delayed requests and timeouts are being handled in real-time and are resolved as soon as possible, they may not accumulate, which can trigger a snowball effect.

It's important to understand traffic patterns, i.e., when traffic is unusually high and what kind of requests consume most resources. This knowledge can help you pre-allocate adequate resources when you expect a high volume of resources and, if needed, establish a filter to handle requests based on priority.

Having redundancies can prevent both timeouts and delays but not directly, especially if they are integrated into the infrastructure purely as failsafe measures. But if they are also used to handle excess load, then they *can* have a tangible impact on the network's slow bandwidth.

## 6. Potential Use Cases

The use cases differ from industry to industry and are influenced by different natures and patterns of requests. Financial institutions, for example, may prioritize increasing bandwidth and optimization rather than using CDNs or any other remediation measure that may enhance their vulnerability and attack surface. In contrast, e-commerce businesses may opt for rapidly scalable options like CDNs because responsiveness can have a critical impact on their business performance.

## 7. Conclusion

Network slow bandwidth is influenced and accompanied by a set of technical problems with multiple time-tested solutions. However, its business impact is also an important consideration. If network slow bandwidth has the potential to trigger a significant enough loss of revenue due to fewer requests processed or existing clients switching to other services that match their Quality of Service (QoS) requirements, then even the most expensive/resource-intensive solutions or set of solutions may be justified.

## 8. References

1. https://ieeexplore.ieee.org/abstract/document/749288
2. https://www.nature.com/articles/536139a
3. https://ieeexplore.ieee.org/abstract/document/9184458/
4. https://ieeexplore.ieee.org/abstract/document/7312168
5. https://dl.acm.org/doi/abs/10.1145/2815675.2815704
6. https://ieeexplore.ieee.org/abstract/document/8486303
7. https://ieeexplore.ieee.org/abstract/document/8076736
8. https://dl.acm.org/doi/abs/10.1145/2413176.2413194