NEC's Traffic Management Solution (TMS) Component Technologies

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Abstract

NEC's Traffic Management Solution (TMS) is a comprehensive package of technologies designed to overcome the significant management challenges faced by today's communication service providers (CSPs), enabling them to manage communication traffic as required to maintain maximum operational efficiency and ensure high-performance delivery of critical services. This solution consists of four products centering on TMS Media Optimizer (TMS-MO), a traffic optimization engine, deployed in the core network of CSPs. Optimization technologies include TCP optimization to improve throughput, SSL Pacing to reduce traffic, a dynamic control to maximize efficiency, and a visualization function to visualize network conditions. As Internet technology is constantly evolving, NEC will continue to stay on top of current technological trends and aggressively incorporate new technology into our management solutions for CSPs.

Keywords

traffic control, TCP optimization, pacing, SSL Pacing, media optimization, cache, dynamic control, visualization, policy control, ICAP

1. Introduction

NEC's Traffic Management Solution (TMS) suite is specifically designed to help communication service providers (CSPs) effectively manage many of the critical issues they are currently dealing with, such as the need to increase average revenue per user (ARPU), while reducing operating expenses (OPEX) - issues that can be solved by increasing the speed of communication traffic and reducing bandwidth usage.

This paper introduces our TMS architecture, which has been designed to optimize the flow of communication traffic and ensure that the system can adapt smoothly to changing communication requirements. To give the reader a proper grounding in the subject, we will also describe in detail the component technologies that support the various functions provided by TMS.

2. Overall Architecture

2.1 Component Configuration

NEC's TMS architecture consists of four products, the main component being TMS Media Optimizer (TMS-MO), which is a traffic optimization engine (**Fig. 1**). Users can select the required components and functions and deploy them appropriately.

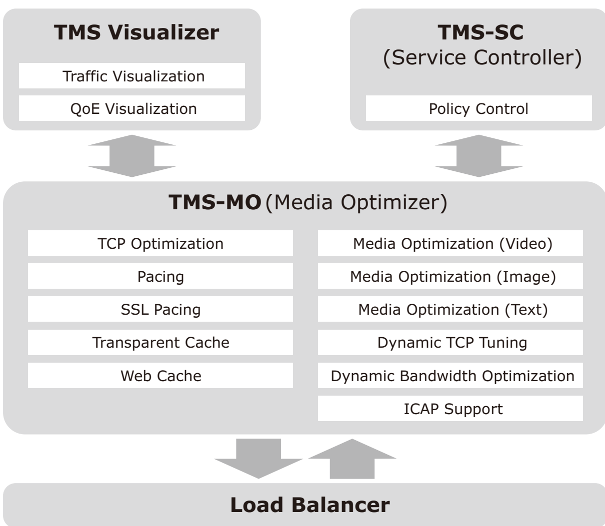

Fig. 1 TMS component configuration.

(1) TMS-MO

This technology offers functions to improve throughput and reduce traffic, such as TCP optimization and SSL Pacing. It also incorporates a dynamic control that executes optimization as and when needed, adjusting traffic throughput according to network conditions and an Internet Content Adaptation Protocol (ICAP) support function that provides value-added services.

(2) TMS Visualizer

The visualizer uses TMS-MO's traffic logs to generate a visual representation of traffic flow and quality of experience (QoE).

(3) TMS Service Controller (TMS-SC)

This generates optimization control policies based on user profiles and passes them to TMS-MO.

(4) Load Balancer

This distributes inbound traffic to TMS-MO.

2.2 Deployment in Networks

Capable of managing various control and operation flows - from pulling traffic via the load balancer to optimization control and visualization - TMS-MO and TMS Visualizer can be easily deployed without affecting the behaviors of other systems that are up and running (**Fig. 2**).

Deployment of TMS-SC also enables you to achieve solutions with higher added value, while effectively utilizing existing assets and cooperating by linking with carrier backbone systems and backyard systems.

2.3 Virtualization

TMS is also compatible with virtualized platforms. By aggregating the functions in an IA server, you can start on a small scale. You can also flexibly scale out the system according to the scale of introduction and traffic conditions, making possible more efficient and flexible planning.

3. Component Technologies

3.1 TCP Optimization

By setting TCP parameters such as window size on the wireless side and Internet side respectively, while separating any TCP sessions targeted for optimization by TMS to prevent any deterioration in end-to-end communication quality, this technology improves throughput while avoiding network congestion. Encrypted traffic (HTTPS) can also be controlled, making it possible to significantly improve optimization effects.

3.2 Pacing

By monitoring network throughput, this technology makes it possible to predict future throughput and keep track of how much buffer is available, which facilitates dynamic control of flow volume. This helps minimize unnecessary data communication, while ensuring smooth distribution of high-data-volume items such as videos without playback interruptions. Adaptive bit rate (ABR) traffic - whose bit rate changes according to playback conditions - is also optimized in real time to reduce traffic and increase throughput.

3.3 SSL Pacing

Pacing technology is also applied to secure communication (SSL traffic). This technology analyzes traffic patterns and characteristics to reduce bandwidth and data volume in encrypted traffic, while maintaining the QoE (**Fig. 3**).

3.4 Media Optimization

(1) Video

Thanks to support for most major video formats and an encoder that handles high-compression video conversion, traffic volume is significantly reduced,

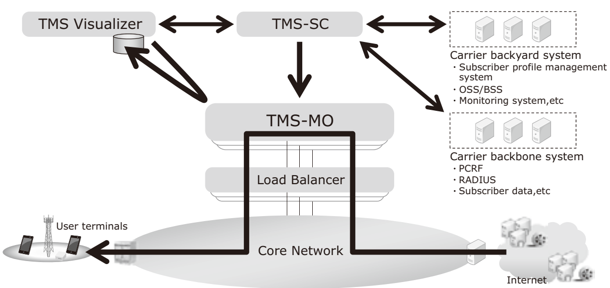

Fig. 2 Deployment in networks.

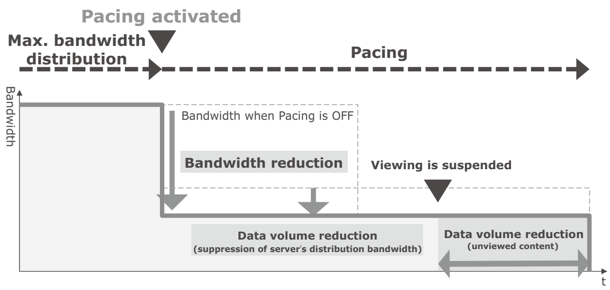

Fig. 3 Traffic reduction via SSL Pacing.

while the number of simultaneous connections is increased.

(2) Image

Image data of various formats are compressed and distributed in real time.

(3) Text

Non-degraded, real-time compression of text data is possible.

3.5 Cache

(1) Transparent cache (video cache)

By caching video content in TMS that generates high-volume traffic, we have reduced the bandwidth on the Internet side, while decreasing the response time for requests from terminals, improving the QoE. The cache method that we have adopted is multi-dimensional histogram ranking management - an original NEC cache lifetime management method which optimizes storage capacity, while ensuring cache availability. This minimizes the negative impact on hit rates due to the lack of cache, while keeping down the increased costs generated by excessive caching (**Fig. 4**).

(2) Web cache

As with the transparent cache, the web cache provides an efficient, cost-effective caching solution for web text and images.

3.6 Dynamic Control

(1) Dynamic TCP Tuning

TMS automatically detects network quality and dynamically adjusts various TCP parameters (**Fig. 5**) accordingly. Achievement of finer TCP optimization control helps maximize throughput. This means that even ultra-high-speed networks, such as LTE-Advanced and 5G, can achieve maximum network performance, while networks whose traffic volume fluctuates unpredictably can be controlled in real time assuring that the user QoE is maintained at all times.

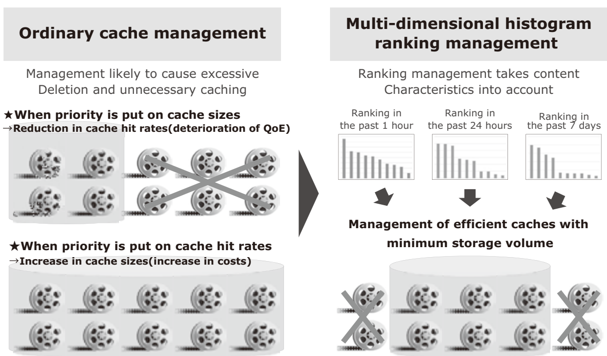

Fig. 4 Multi-dimensional histogram ranking management.

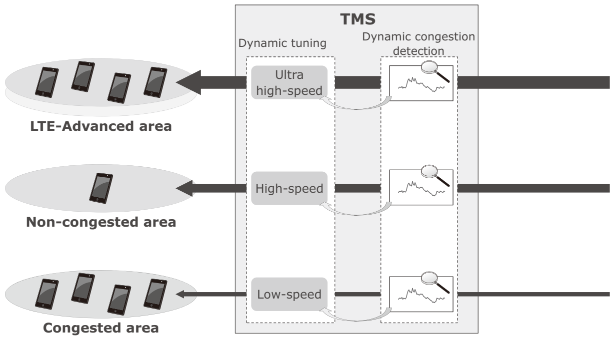

Fig. 5 Dynamic TCP tuning.

(2) Dynamic bandwidth optimization

As with dynamic TCP tuning, network conditions are detected in each communication session. Traffic volume can be reduced by optimizing discrete content (pacing, media optimization, etc.) only when traffic is congested.

3.7 Visualization

(1) Traffic visualization

The traffic logs collected by TMS are analyzed, enabling a visual representation of optimization effects and network access conditions to be generated.

(2) QoE visualization

TMS's traffic logs also make it possible to visualize the QoE. Location where QoE has dropped below optimal levels can be seen on the map, enabling mobile network operators (MNOs) to identify weak spots in the network and plan the configuration of mobile base stations.

3.8 Policy Control

This is a function to control optimization based on specific policies including time zones, networks, and URLs. By setting it to work with an external system such as a policy and charging rules function (PCRF), you can also perform policy control based on user contracts.

3.9 ICAP Support

ICAP helps deliver value-added services by processing the traffic that passes through TMS. For example, in a URL filtering function that restricts connections to malicious sites, TMS and filtering servers are connected via the ICAP interface and together determine whether or not the connection to the requested URL should be allowed, preventing or allowing the connection accordingly. CSPs can also create new sources of income by providing value-added services to users.

4. Conclusion

In this paper, we have described the architecture and component technologies that make up NEC's TMS, a combination of technologies designed to optimize the flow of data and communications traffic. As Internet technology continues to advance, NEC is committed to staying on top of technological trends in order to ensure that our optimization solutions remain effective and reliable.

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