

Mobile Backhaul Advances Efficiency

“Intelligence for Network Automation and Optimization”

NEC Corporation

Executive Summary

In recent years Mobile Backhaul networks have undergone a period of significant evolution and innovation, and this trend is set to continue for foreseeable future. The continuing change is driven by the increasing adoption of data hungry mobile wireless services, supported by ever more capable end user devices: smartphones, tablets, smart media displays, etc.

In order to keep their subscribers happy, operators must provide sufficient network capacity and performance, and improve the quality of the service experience. Multiple wireless access and transport technologies are introduced to satiate capacity and performance glut, but this also presents management and provisioning challenges to the already complex network. Stability is also compromised due to lack of coordination between various technologies and vendor devices.

Automated management and configuration have been studied for a long time but never before has the momentum been this great. Software Defined Networking (SDN), a novel paradigm to overcome the limitations mentioned above, has gained strong support from the industry, transforming rigid, static network into one that is intelligent, flexible, scalable, and highly optimized with a minimum of human intervention.

Maintaining a stable, optimized network results in TCO reduction, and by giving intelligence to the network, it is possible to quickly provision services that translate to revenue increase.

Presented below are what NEC can do for the customers in the following key areas: network automation, network optimization, high capacity, and traffic management.

Network Automation

Legacy networks are inflexible in that all traffic targeting the same destination is sent along a predetermined path. Paths are calculated on a local basis, and thus the network may not be utilized to its full potential. Each device in the network may have separate management and configuration processes, which can put a huge burden on the administrator as the network grows in size and complexity.

Software Defined Networking (SDN) is an approach to networking in which network control is decoupled from hardware and given to a central software-based intelligence. Thus, a single controller can configure and manage the entire network, and network elements can be configured to precisely control how the network operates and handles the traffic.

This introduces greater flexibility into the network, simplifies management, and reduces maintenance and troubleshooting. It allows network control applications to be rolled out in hours instead of weeks, which is a huge advantage in today's highly dynamic market.

Network Optimization

Of particular interest is OpenFlow, originally proposed at Stanford University, and now standardized and promoted by the Open Networking Foundation (ONF). NEC's implementation, the ProgrammableFlow, is the first commercially available OpenFlow offering in the industry, consisting of the ProgrammableFlow-Controller (PFC) and the ProgrammableFlow-Switch (PFS).

OpenFlow relies on intelligent software control to automatically overlay multiple logical (virtual) networks on top of physical networks and centrally

manage them. Network abstraction deems the underlying hardware differences irrelevant. Thus, even in multi-vendor environments, the same workflow can be employed once OpenFlow is supported, and the operator no longer needs to worry about various vendor specific provisioning and management methodologies.

Still, mobile backhaul networks have distinct features such as heterogeneous technologies including fiber and microwave, limited traffic granularity in case of encryption, high scalability requirements, and so on. Hence, a backhaul-specific SDN tool termed the Backhaul Resource Manager (BRM) is introduced for automated and dynamic resource provisioning and capacity-aware path computation that improves fairness, network utilization, and end-to-end Quality of Experience (QoE). Much emphasis has been placed on per-link capacity, but it has been observed that significant capacity in existing MBH networks is actually being wasted because the links are not effectively utilized.

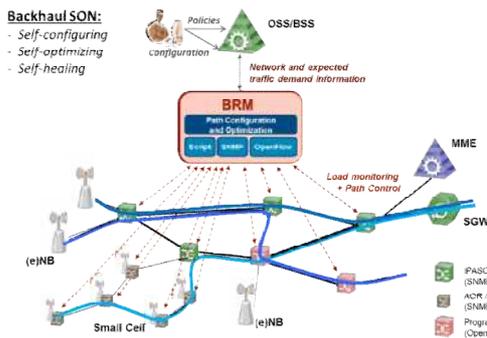


Figure 1: BRM Concept

As illustrated above, the BRM serves as the central intelligence that oversees the entire MBH network. It maintains an up-to-date global view of the resource allocations and the still available capacities on each link. Based on that, the BRM performs near-optimal path computation that leads to more efficient resource utilization and higher resilience, especially for ring and mesh topologies that have multiple candidate paths.

As a centralized entity, the BRM can utilize the OpenFlow protocol to control OpenFlow capable backhaul entities. However, in order to interwork with non-OpenFlow capable backhaul equipment, the BRM uses commonly supported management protocols such as SNMP or similar mechanisms to

manage the path and resource allocation in the backhaul network.

High Capacity

With LTE becoming the mainstream for wireless access technology, problems stemming from capacity shortages and low access rates haunt mobile operators daily. Small cells are used to supplement access coverage and capacity where macro cells fall short, but dense deployment will put a strain on existing backhaul capacity.

These issues, if not properly handled and resolved, will result in undesirable user experience and lead to high churn.

The brute force method of adding high capacity, high performance, and reliable devices in the network is simple, yet effective. NEC's lineup includes microwave devices targeting access through metro regions, with various technologies such as XPIC and line bonding to realize high capacity transmission. E-band microwave devices are also available for short-range, high data rate applications, which is ideal for small cell backhaul with its highly directive, low interference beams.

Optical technology, particularly WDM, is also becoming increasingly attractive to provide high-speed, high capacity services where microwave conditions are unfavorable but fiber connectivity is available. Both optical and microwave are complementary in that each can serve as a backup when the other fails.

Traffic Management

Rather than focus on optimizing the network itself, a different approach that places emphasis on traffic traversing the network is also being explored. Our vast experiences with global operators form the foundation for intelligent traffic analysis and management. NEC considers efficiency/optimization, collection/storage, analysis, billing, and fail-safe the five pillars of traffic management.

The area where the effect is immediately noticeable is the efficiency/optimization. For example, NEC's MediaOptimizer, which is to be placed between the mobile core and the video contents farm, reformats and compresses video and

image/text without sacrificing QoE. Another key differentiator is the video pacing technology. Without video pacing, video data may be delivered in bulk in the beginning, but the consumer may stop watching the video, which results in wasted data and bandwidth. This technology “paces” the video delivery timing so that the data is delivered right when needed.

solve the carriers’ management and provisioning headaches.

NEC’s Traffic and Network Engineering services are also available to provide consulting, planning and designing, network implementation, and operation support for our customers.

NEC aspires to offer our customers the best available solution and network evolution strategies that aid in improving services qualities, reducing TCO, and increasing revenue.

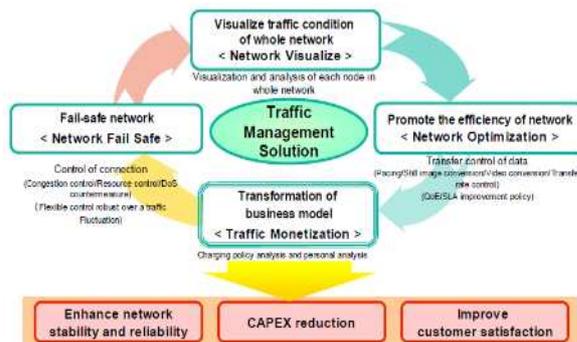


Figure 2: Transport Management Solution

When coordinated together with network optimization solutions such as the BRM, traffic management can provide even higher efficiency to the network and avoid adverse impacts on the user experience.

However, even with all the automation and self-configuration support of NEC’s solutions, human administration is still required (e.g. to configure the operational policies) and manual intervention may be required in certain situations. Errors and glitches introduced into the programming/software model may not always deliver the best outcome, and this is where network visualization plays a key role. Experienced administrator, when presented visually with network conditions and parameters, may be able to insightfully derive suitable optimization decisions and provide feedback to the intelligence.

Conclusion

The industry is on the verge of experiencing a major shift in focus, from providing simple “pipe” to a more flexible and optimized capacity prompted by a central intelligence.

Network optimization, high capacity, and traffic management technologies from NEC offer mobile carriers a very comprehensive total solution to tackle current and anticipated capacity crunches, and

NEC Corporation
 7-1, Shiba 5-chome, Minato-ku, Tokyo 108-8001 Japan
 tel: +81-(0)3- 3454-1111
www.nec.com/

Copyright (C) 2013 NEC Corporation. All rights reserved. All trademarks are the property of respective companies. Information in this document is subject to change without notice.