PREDICTABLE NETWORK SOLUTIONS

BT Operate Case Study

BT Operate (BTO) is the operating division of British Telecom (one of the world's leading communications services companies) that is responsible for the service fulfilment of BT's products and services globally; establishment of security policy and processes; and monitoring the reliability of BT's networks and systems. BTO employs over 13,500 world-class professionals in more than 20 countries, with expertise across a broad range of IT and web-based disciplines. It manages over 5,500 UK exchanges supplying over 26m premises, and provides over 12m DSL connections (both business and domestic) of which BT's Retail division delivers approximately 50%.

By working with PNSol, BTO gained a new quantitative understanding of how end-user QoE is affected in the network and also the factors, beyond overall utilisation, that might put its SLA at risk. This gives flexibility to optimise planning rules to extract economic benefits, such as a 30% increase in the utilisation of key resources. BTO estimates this to be worth £2.3M, a significant saving of operating budget, and a ROI >20.

The Business Challenge:

The challenges facing BTO are similar to those facing telecom operators all over the world; in essence the balance of meeting customer expectation whilst maintaining an economically viable venture.

One aspect of this is that users (both direct users like ISPs, and retail customers of those ISPs) have aspirations (often implicit) that their connectivity will allow certain program functions to work within set parameters. For example:

- media streaming works with no buffer breaks;
- SIP service operates within a chosen MOS score range;
- web page load times are not excessive.

The difficulty with matching such aspirations to a service from providers such as BT is that most users (of any sort) have no conception that they imply a need for transport quality across a network. This leads to unrealistic expectations being placed upon network services; BTO found itself squeezed between such rising expectations and the constant pressure to reduce running costs. BTO was in the situation of increasing capital expenditure to raise capacity without being able to know whether this was delivering the intended end-user experience.

BTO needed an assessment of their network that could show its quality and reliability. Without objective evidence to inform the discussion, customers could not be satisfied and would assume that every problem was caused by their service provider (e.g., BT), who could solve it by increasing capacity.
BTO needed to demonstrate that it was meeting its SLA commitments; optimise its expenditure; and understand what QoE was being delivered.

As a leading telecoms provider, BTO has a set of practices and procedures to maintain a functioning network. The challenge was to understand precisely how effective and economic these were and what sort of network they had produced. BTO moved away from a contention-ratio based allocation mechanism some time ago, and introduced a more sophisticated planning regime to cope with varying demographic demands. Customer pressure for continuous improvement placed a spotlight on the planning rules' effectiveness in delivering good end-user experience. To respond to this BTO needed a way of quantifying the end-user experience as consequences of their planning rules, which their existing systems were unable to do. BTO had already explored many state of the art analysis techniques and technologies, such as standard large-scale probing solutions, and this had not provided any meaningful insights. Unfortunately the performance numbers published by Ofcom are not helpful for BTO's operations and planning, because they cover only a sample of their end customers and are reported retrospectively.

PNSol's Role

When looking for a collaborator to help with these questions, BTO needed a group with experience in quantifying the relationship between network configuration and end-user experience; PNSol have a history of applying in-depth knowledge of the concepts and mathematics underlying the performance of networks and in the practical application of modern networking technologies. BTO therefore approached PNSol, initially to study a KPI specified within its customer SLA, and how attaining it relates to current planning and observation procedures. In relation to this, the question of differing network usage patterns and inter-user isolation was brought up, with a view to aid expansion and management planning in Britain's fast-changing telecoms environment.

This gave PNSol a set of objectives, which evolved during the work phases. In the first phase they were asked to:

- Provide evidence that BTO was meeting the published throughput SLA with its (then current) planning rules;
- Understand how "heavy users" affected the SLA, the system and the remaining users;
- Investigate whether there was flexibility in the planning rules to optimise investment.

In the second phase PNSol were asked to provide:

- An optimisation of the planning rules – now capturing loss and delay characteristics and not just speed test throughput results;
- The creation of a more customer QoE driven upgrade process, focussing on giving good, responsive, network experience.

PNSol began by clarifying what was already known about how the network (based around an IP core with handover to and ATM layer at the BRAS) is constructed, monitored, planned, and received (by retailers and end users).

PNSol then applied their NetHealthCheck™ Packet Flow Performance Optimisation methodology to BT's network. NetHealthCheck™ consists of making precise observations at strategic points along the end-to-end path, as shown in Figure 1, in order to determine the locations and situations in which loss and delay accumulate across the network. Using this approach made it possible to understand the consequences of design and planning decisions on network performance and consequent end-user QoE, at different times of day and network loading conditions. PNSol worked closely with BTO's internal specialists to create and measure extreme operational scenarios that their planning rules would not normally allow in order to understand the safety margin before hazards to the service quality occurred.

PNSol's sophisticated analysis of the observations allowed the actual limiting factors on network performance to be isolated, the most important of which relate to the way BT's customers manage their own traffic (outside of anything that would be directly under BT's control). This led PNSol to recommend new KPIs that BT could measure that would correlate more precisely with end-user QoE; a strategy for allocating high-volume users; and enhancements to BT's capacity planning process.

Another result was a new insight into the relationship between known 15-minute load averages and actual instantaneous load, and how this affects the delivery of BT's SLA.

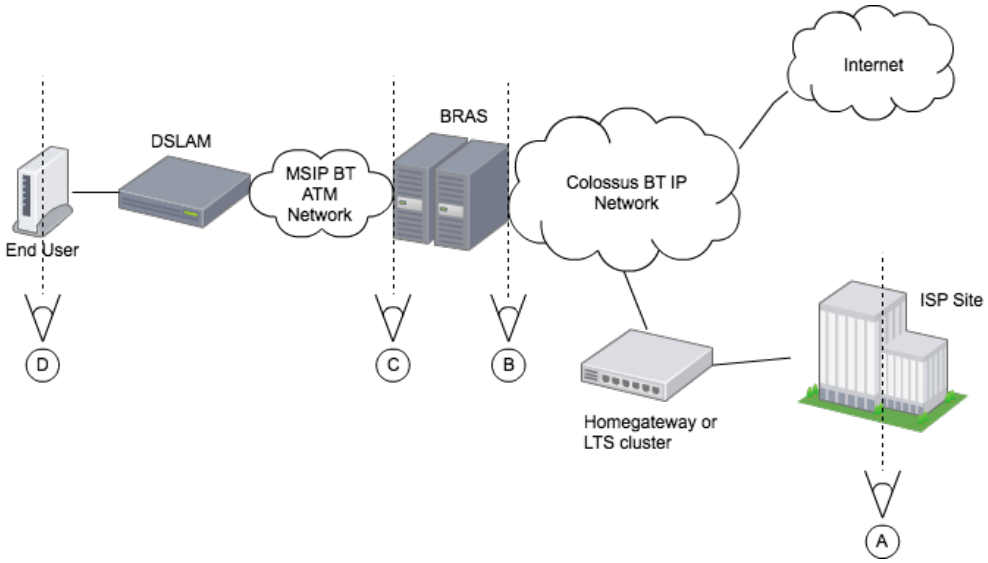

Figure 1: Observation points

Results

The results of this collaboration for BTO were:

- reassurance of the guarantees BTO have given to their customers;
- understanding of how their service could be made even more reliable;

- instances where BTO could delay expenditure without impacting end-user experience;
- a more scientific method for addressing future questions;
- being ahead of the game on an economically viable future avenue for telecoms.

In the context of all the features and systems of BT's very sophisticated network, including controlled bandwidth-sharing and 15-minute utilisation data, BTO gained a new quantitative understanding of how end-user QoE is affected in the different sections of the network, something that had not been clear before despite the deployment of large-scale probing solutions; this provided increased confidence in responding to customer criticism, which often turns out not to be deserved! A further benefit was quantification of the factors, beyond overall utilisation, that could contribute to putting the SLA at risk. This gives BT flexibility to optimise their planning rules to extract economic benefits, such as a 30% increase in the utilisation of key resources. BTO estimates this to be worth X% of the overall operating budget.

The UK Broadband Market

The DSL Broadband market in the UK is divided between ISPs (retail and business) and wholesale service providers, of which British Telecom's Wholesale division is the largest. The highly developed and competitive nature of the UK broadband market creates considerable pressure on wholesale providers to deliver high quality services at a low cost; the UK market is regulated by Ofcom, which publishes measurements of ISP performance.

About British Telecom

BT is one of the world's leading communications services companies, serving the needs of customers in the UK and in more than 170 countries worldwide. In the UK BT is a leading communications provider, selling products and services to consumers, small and medium-sized enterprises and the public sector. BT also sells wholesale products and services to communications providers in the UK and around the world, via the BT Wholesale division.