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Whitepaper

# Smartbyte: Client network traffic optimization

This Dell Whitepaper addresses the concept of a client-installed network traffic optimization software application called Smartbyte on consumer systems. It summarizes key concepts, use cases, system architecture and system management functionality of Smartbyte.

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## Introduction

Smartbyte is a client installed software application that focuses on network traffic optimization from a client system point-of-view. It aims to prioritize critical applications over non-critical applications in terms of bandwidth and QoS. Without an application like Smartbyte, bandwidth is equally divided among all the applications that access Internet. This treats real time applications, video streaming and other background downloads at equal levels of priority, not considering a QoS factor of the consumer. Smartbyte can detect the importance of application and allocates higher bandwidth to the critical applications. It has 4 different levels of classification, 1 being the high priority and 4 being low priority

This application is primarily developed to provide best experience to the end user in limited bandwidth non-competing scenarios aimed at Inspiron and XPS series.

## Background

Smartbye is a tool developed exclusively for Dell consumer systems with primary focus on Inspiron and XPS chain of models. Here are some of key product definition aspects of Smartbyte:

| **Product Definition** | **SmartByte 2.5** | **SmartBytePro 3.0** |
|---|---|---|
| Hardware dependency | HW agnostic | HW agnostic |
| Target Customer | Mainstream Consumer | Mainstream Commercial |
| Available on WiFi | ✓ | ✓ |
| Available on WWAN | ✓ | ✓ |
| Available on Ethernet | ✓ | ✓ |
| Home Network Management | ✓ | ✓ |
| Connection health monitor | ✓ | ✓ |
| Advanced Stream Detect – Application Detection | ✓ | ✓ |
| Automatically prioritizes Video and VoIP in optimal way | ✓ | ✓ |
| Network Priority Levels | 4 | 4 |
| Ability to customize each application's network priority | By Category (Real time, streaming, other) | By Category (Real time, streaming, web, other) |
| Ability to score and rank access points (AP) | - | ✓ |
| Speed to the router | - | ✓ |
| End-User Control over App priority | ✓ | ✓ |

## Smartbyte Architecture

Following is the high-level software architecture of Smartbyte:

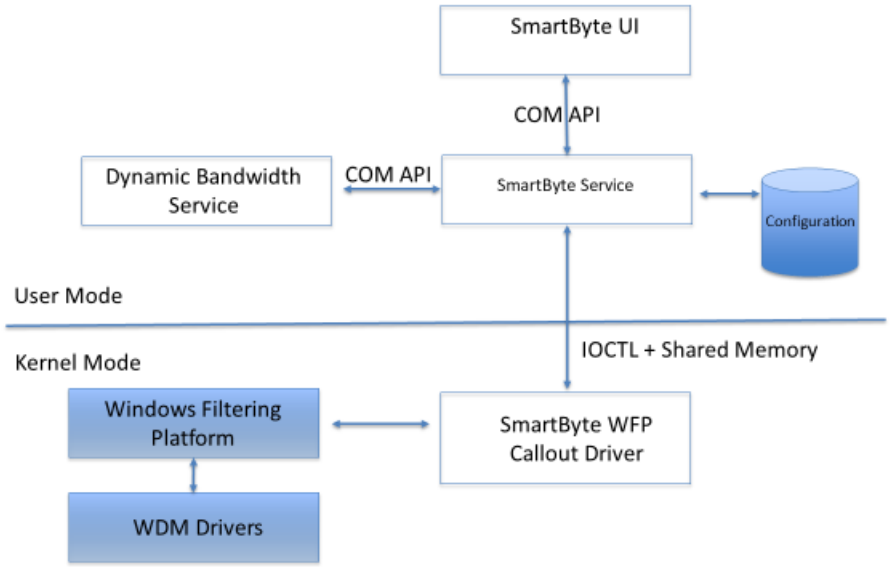


Figure 1: Smartbyte Software Architecture

## Smartbyte Features

Smartbyte provides following features and their inclusion with specific version numbers:

- Uplink Packet Tagging (Smartbyte 2.5 and 3.0)
- Dell-on-Dell Advantage (Smartbyte 2.5 and 3.0)
- Manual Bandwidth Control (Smartbyte 2.5 and 3.0)
- Dynamic Bandwidth Control (Smartbyte 2.5)
- Access Point Scoring and Ranking (Smartbyte 3.0)
- Speed to Router (Smartbyte 3.0)

### Uplink packet tagging

The communication between client device and access point (router) occurs in terms of packets. Traditionally, these packets are not differentiated among each other. Smartbyte  tags these packets, which can be helpful in 2 stages. Tagging involves WMM and DSCP. WMM bits are for prioritization of packets in the immediate access point. DSCP tagging is useful for prioritization of applications in the backend.

### Dell-on-Dell advantage

When a SmartBytePro enabled machine starts a Priority 1 application or a priority 2 application, it will send out an encrypted, broadcast message indicating that a high priority application needs bandwidth. It will send out this message once every N seconds while the high priority application is actively sending/receiving traffic. All other SmartBytePro systems on the same LAN will receive this message and lower the maximum bandwidth used for traffic shaping by K mbps.

### Manual bandwidth control

Manual bandwidth control is used to conform downlink speeds to values entered by the user. User can set the speeds either by entering the numbers manually or by performing the speed test within the application.

This regulation is achieved by tricking the AP to provide more bandwidth to the high priority applications by lowering the bandwidth to low-priority applications. Though it provides higher bandwidth to high priority applications, the overall operating bandwidth is 93% of the limit set in the application. If speeds are below the limits, Smartbyte will not regulate bandwidth.

### Dynamic bandwidth control

Dynamic bandwidth control is an enhancement to Manual bandwidth control. It estimates the bandwidth of the newly connected APs. The estimation is performed by sending very small packets and tracking the latency of these applications. Latency gives more insight about congestion. Dynamic bandwidth control also let user bump the limits set in the application whenever additional bandwidth becomes available. Also, it will regulate bandwidth if the user is experiencing speeds up to 80% of the limit set.

### Access point scoring and ranking

This feature lets the user see all available access points and their scores in terms of bandwidth. Each access point is scored using 5 factors: Signal strength, Maximum data rate, MU-MIMO capability of the access point, channel contention and loading of the channel. These factors are acquired from the access point beacon and uses a proprietary scoring mechanism to combine these factors.

### Speed to router

Internet speed with wireless is determined by 2 factors: Connection quality of the client device with AP and backend congestion. Any of these 2 factors can be a reason for low speeds. This feature exclusively represents the connection quality with the access point.

## Smartbyte Solution Walkthrough and Use Cases

Smartbyte detects the application and maps it to the priority based on a look up table. It has priority assignments to more than 40,000 applications and the table is pretty much exhaustive. The priorities are as follows:

Real time application – 1

Video streaming – 2

Other web traffic – 3

Background downloads – 4

Unknown applications are assigned a priority of 3.

There are various scenarios in which Smartbyte helps in regulating bandwidth and some scenarios where Smartbyte is not helpful. Below table summarizes those scenarios and right column indicates whether Smartbyte is helpful in that scenario. The terminology for the right column is as follows:

Ideal – Smartbyte is built to perform in this kind of environment

functional – Smartbyte capabilities are used in this scenario, mainly downlink

Not functional – Smartbyte backs off and do nothing except tagging packets

Partially useful – Smartbyte is functional up to a threshold

| Use Case (with dynamic bandwidth control) | Smartbyte capability |
|---|---|
| When a single user is present and using all the bandwidth | Ideal |
| When single user is present and not using all the bandwidth | Not functional |
| When multiple users are present, but only single user is using all the bandwidth | Functional |
| When multiple users are present and sharing the bandwidth | Not functional |
| When single user moves away from AP, but operating within 80% of the initial speed | Functional |
| When single user moves away from AP and operating less than 80% of the initial speed | Not functional |

## Conclusion: Solution Space & Areas of Focus

With the introduction of Smartbyte for consumer systems, we can prioritize critical applications running on client systems over non-critical applications, in terms of bandwidth and QoS, thereby giving an advantage to use cases involving real-time applications such as video conferencing, over different scenarios involving access point loading variations.

## About the authors

Dileep Kumar Soma is a Wireless Engineer at Dell with Wireless Architecture design team, driving innovation at Dell by leading multiple incubations in the wireless domain. Dileep has 1.5 years of experience at Dell providing wireless solutions, working with vendors and delivering wireless products.

Vivek Viswanathan is a Software Architect with the Experience Innovation Group (EIG), as part of Office of the CSG CTO, spearheading platform software architecture for Dell's new innovation experiences and platforms. Vivek has 3 years of experience at Dell working closely with Dell's customers, marketing and technology architects, and about 20 years of overall leadership experience in the software industry. Vivek is a Distinguished Technologist in the Technical Leadership Community at Dell.

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