

## ExpressConnect: Client Network & Traffic Optimization

This Dell Whitepaper addresses the concept of a client installed network optimizer software application called ExpressConnect<sup>1</sup> as part of Dell Optimizer on commercial clients. The marketing name of ExpressConnect is Network Optimization. This whitepaper summarizes key concepts, use cases, system architecture and system management functionality of ExpressConnect

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## Introduction

ExpressConnect<sup>1</sup> is a software application that is integrated with Dell Optimizer application installed on the client system. ExpressConnect focuses on network optimization from a client system view point. The functionality of ExpressConnect can be categorized into 2 important segments.

### 1. **Best Access Point Selection (BAPS)** engine

When there are multiple access points (APs) available to a user, BAPS ensures that the user is always connected to the right AP, unlike the current implementation of Windows. Windows chooses the AP by default while connecting based on proximity (Received Signal Strength Indicator–RSSI). Windows preserves the connection, even when the network signal becomes weak, until it is disconnected. In Dell Optimizer 2.0, network optimization is displayed as **Automatic Network Switching**.

### 2. **Network traffic shaping (NTS)** engine

NTS prioritizes critical applications over noncritical applications in terms of bandwidth and QoS. Without this feature, bandwidth is equally divided among all the applications that access the Internet. If the bandwidth is equally divided, real-time applications, video streaming, and other background downloads are treated at equal levels of priority. ExpressConnect detects the importance of applications and allocates higher bandwidth to critical applications. It has four different levels of classifications, 1 being the highest priority and 4 being the lowest. This application is developed to provide the best experience to end users in a dense AP and a limited bandwidth scenario. In Dell Optimizer 2.0, this feature is displayed as **Conference Bandwidth Optimization**.

## Background

Dell Optimizer is a tool developed exclusively for Dell commercial systems. ExpressConnect is a part of Dell Optimizer that focuses on network optimization.

ExpressConnect is hardware agnostic and it is targeted towards mainstream commercial customers

ExpressConnect can do the following:

- Operate over Wi-Fi, ethernet and WWAN
- Detect applications
- Automatically prioritize video stream(s) and VoIP traffic
- Prioritize applications into 4 different priority categories
- Score and rank available Wi-Fi access points (APs)

## ExpressConnect Architecture

Below is the high-level software architecture of ExpressConnect.

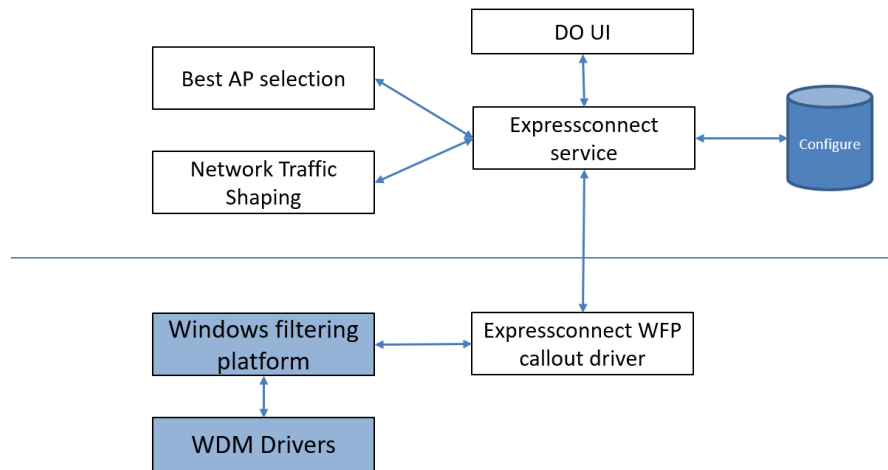


Figure 1: ExpressConnect Software Architecture

### ExpressConnect Features

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

1. Best Access Point Selection (BAPS) engine
  - AP scoring and ranking
  - Auto AP switching
  - Band switching on the same AP
  - Network diagnostics and telemetry
2. Network Traffic Shaping (NTS)
  - Uplink packet tagging
  - Dynamic bandwidth control
  - Voice mode feature

#### 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 five 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 use a proprietary scoring mechanism to combine these factors to provide a final score.

#### Auto AP switching

This feature leverages AP scoring and ranking feature to decide the best AP to be connected. This feature lets the client switch APs when the score of any of the surrounding APs becomes better than the score of the AP which it is presently connected to. A hysteresis mechanism is implemented to mitigate for erratic behavior of wireless environment and avoid hunting issues.

### Band switching on the same AP

Most of the modern APs have two operational bands: 2.4GHz and 5GHz. If the user network names both bands with same SSID (Wi-Fi name), band switching occurs more frequently (fewer hysteresis conditions) to ensure maximum effectiveness.

### Network diagnostics and telemetry

This feature is designed to let IT decision makers (ITDMs) understand the network infrastructure through diagnostics. This functionality recommends the best infrastructure and client system, required to maximize performance. Telemetry of user data is sent occasionally to understand the overall ExpressConnect efficiency. All the data that is collected or sent is nonprivate and security-compliant user data with opt-in mechanisms.

### 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. ExpressConnect tags these packets for prioritization, which can be helpful in two ways. Tagging involves Wireless Multimedia QoS tags (WMM) and Differentiated Services Codepoint tags (DSCP). WMM bits are for prioritization of packets in the immediate access point. DSCP tagging is useful for prioritization of applications in the backend.

### Dynamic bandwidth control

Dynamic bandwidth control estimates the bandwidth of the newly connected APs. The estimation is performed by sending small packets and tracking the latency of these applications. If the user is experiencing speeds of at least 80% of the limit set and more than 30 Mbps, it regulates the bandwidth, based on the traffic priority

### .Voice mode feature

This feature is exclusively designed to provide best conferencing experience. When a voice or video call is in progress, all the other traffic is restricted to use a total of 15Mbps only to ensure the extra bandwidth is given to the conference call. This feature intends to increase the video quality and reduce latency in audio. Conference calls tend to increase the video quality when a clear channel is seen and when all the other traffic is restricted. This gives conference application as much traffic as it needs for maximized experience.

## ExpressConnect Solution Walkthrough and Use Cases

As discussed in the earlier sections, ExpressConnect is broadly divided into two important segments.

Best AP selection (BAPS) engine scores all the APs near the user, including the different bands with same or different Wi-Fi names. This engine connects the user to an AP with the highest score before the current connection is dropped. To not connect to a better AP often, a threshold-based switching is implemented. This threshold is based on a heuristically determined optimal value and is proprietary. If the difference in the score between the currently connected AP and a new AP is higher than a certain threshold, the switching occurs. Otherwise the AP does not switch.

Network Traffic Shaping (NTS) engine detects the application and maps it to a priority based on a lookup table. It has priority assignments to more than 40,000 applications. 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 where ExpressConnect helps in regulating bandwidth and some scenarios where ExpressConnect is not helpful. The table below summarizes those scenarios and the right column indicates whether ExpressConnect is helpful in that scenario. The terminology for the right column is as follows:

Ideal – ExpressConnect is built to perform, and definitely helps

Functional – ExpressConnect capabilities can benefit, mainly downlink

Not functional – ExpressConnect backs off & does nothing except tagging packets

Partially useful – ExpressConnect is functional, up to a point

Use Case	ExpressConnect capability
<b>When a single user is connected to AP and using all the bandwidth</b>	functional
<b>When a user is mobile in a dense AP environment</b>	Ideal
<b>When a user is in a conference call in a congested AP environment (dense or sparse)</b>	functional

### Conclusion: Solution Space & Areas of Focus

ExpressConnect focuses on providing premium connectivity and streaming experience for commercial customers in a dense and competitive network environment. It helps to connect to the right AP for higher bandwidth needs and traffic prioritization for ensuring proper functionality of critical applications over noncritical ones.

### About the authors

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## References

Expressconnect<sup>1</sup>: For more information, see the article *Dell Optimizer 2.0* at [www.dell.com/support](http://www.dell.com/support).

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