OPENTEXT

Benchmark Report: Exceed onDemand® vs. VNC

A wide variety of tests were run to measure the performance of OpenText Exceed onDemand® and the RealVNC solution to find out which remote application access solution is more suitable for graphics-intensive work demanded by Electronic Design Automation (EDA) engineers.

Tests are designed to show the performance of Exceed onDemand and RealVNC running different 2D and 3D applications in LAN and remote network conditions.

Contents

1.0 Introduction

New technologies are rapidly being introduced and are constantly challenging the norm, pushing the boundary of the conventional notion of enterprise computing environments and redefining how knowledge workers can access applications and data.

A Virtual Design Center (VDC) refers to desktop virtualization strategies and technologies specifically applied to the field of Integrated Circuit (IC) design by semiconductor companies. One of the most obvious differences between a traditional EDA design center and a Virtual Design Center is the lack of design applications and data housed in the same physical location as IC design engineers. Instead, a VDC virtualizes the design applications, centralizes design project data, and consolidates the number of design centers to a handful and places them in strategic locations.

However, changes in the backend infrastructure do not alter the goal of any design engineer, which is to design good IC that helps the company remain competitive. To do so, first order of business is that engineers need to be able to access design applications and data quickly without delay. That's where a good remote application access solution comes in. The purpose of such solution is to negate the effect of shortcoming, and overcome the performance and productivity penalties that come with the physical distances.

In this white paper, we compare the performance of two remote application access solutions: OpenText Exceed onDemand® and RealVNC, the original VNC solution. We ran a wide variety of tests to simulate different applications and network conditions in order to find out which solution is more suitable to handle the design work that many EDA and IC design engineers face on a daily basis.

2.0 Meet the Contestants

OpenText Exceed onDemand®: Every day, millions of enterprise users depend on OpenText Exceed® technologies to power their business applications. Backed by 25 years of experience and a team of industry solution experts, OpenText Exceed onDemand is serving industries as diverse as financial services, electronics and semiconductors, oil and gas, energy and utilities, telecom, computer services, transportation, aerospace and defense, automotive, manufacturing, retail, and healthcare. Exceed onDemand has become the most dependable managed enterprise application access solution on the market today. Organizations can count on faster time-to-market and compliance with corporate policies and government regulations—all while reducing operating costs.

RealVNC: Starting as a project in the UK Olivetti and Oracle® Research Lab, Virtual Network Computing (VNC) was developed to provide platform-independent desktop sharing application based on the Remote Frame Buffer protocol. Thanks to its open source pedigree, there is a wide range of VNC-based products in the market that come with virtually all Linux® operating systems. It is available for free for practically all computing devices in the market —Windows®, Mac®, UNIX®, Linux, smartphones, tablets, etc. No or low barrier to acquiring the software makes VNC a popular personal remote accessing tool. Developers of the original project later formed the company RealVNC, which is the solution we have chosen to represent the collection of VNC-based solutions in this white paper.

3.0 Tests

Depending on their disciplines, design engineers will be running 2D layout applications or working with 3D visualization tools. These applications are often running on top of a UNIX or Linux desktop environment, on which other non-design-centric applications will also be running.

We replicated exactly that environment—we started a generic KDE desktop and then opened up a PDF document to review design specs while manipulating a schematic with Cadence® Virtuoso®. In addition, we ran a generic OpenGL® benchmark application to see how Exceed onDemand and VNC handled intense OpenGL renderings.

3.1 Measurements and assumptions

- Each measurement was performed three times and an average time was calculated
- Simulation of the WAN bandwidth was accomplished by WANEM, an open source application by Tata Consultancy Services (http://wanem.sourceforge.net). During the test, we stepped through different speeds (100Mbps, 10Mbps, 1.5Mbps, 512Kbps) and different latency values (1ms, 10ms, 100ms, 300ms round-trip time). The performance value derived from 1.5Mbps with 100ms latency and 512Kbps with 300ms latency to represent a T1 connection from Europe to the West Coast and a 3-way split of a T1 line used by an engineer in India connecting to a network server on the US West Coast, respectively.
- Time measurements were captured with a stopwatch.
- Bandwidth measurements were captured by reading the network card information before and after each test as reported by the operating system.
- Assume no other activity was present on the network and the load of the server was minimal so test results would not be affected by other unrelated CPU, network, or disk I/O activities.

4.0 Test Environment

4.1 Server computer specifications (2D)

This is the server machine used to perform 2D benchmarks.

CPU:	**Intel® Core 2 Quad @ 2.40GHz (Q6600)**
Memory:	4 GB
Video Card:	nVidia® Quadro® FX 3800
Video Driver:	270.41.06
OS:	Ubuntu Release 9.10. (karmic) Kernel Linux 2.6.31-14-generic
Exceed onDemand Server:	Exceed onDemand 8 SP3
VNC Server:	4.1.2-14.el5_6.6
Applications:	Gnome 2.28.1 Adobe® PDF 9.5.4 Cadence Virtuoso 6.1.5.500.11

4.2 Server computer specifications (3D)

This is the server machine used to perform 3D benchmark.

CPU:	**Intel Xeon® E3 1320**
Memory:	16GB DDR3 ECC
Video Card:	nVidia Quadro FX 4000
Video Driver:	304.51
Exceed onDemand Server:	Exceed onDemand 8 SP3
VNC Server:	4.1.2-14.el5_6.6
Application parameters:	-w 1024x768 -p 5000 By restricting polygons to 5000 polygons, we can keep GPU load irrelevant to the test

4.3 Client computer specifications:

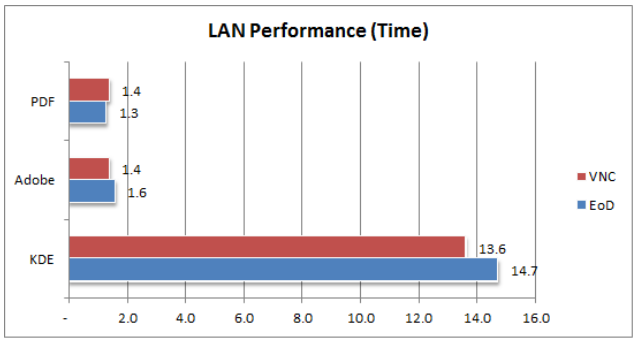
CPU:	**Intel Core 2 Quad CPU Q9400 2.66 GHz**
Memory:	8 GB
Video Card:	Intel QA45/Q43 Express Chipset (GMA 4500)
Video Drivers:	8.15.10. 2202
OS:	Windows 7 x64
Exceed onDemand Client:	Exceed onDemand 8 SP 3. Default settings, except for the session resolution, which is configured to 1024x768, and the window mode, which is set to Single Window Mode to match VNC.
VNC Client	RealVNC v4.1.3. Default settings, except for the session resolution, which is configured to 1024x768

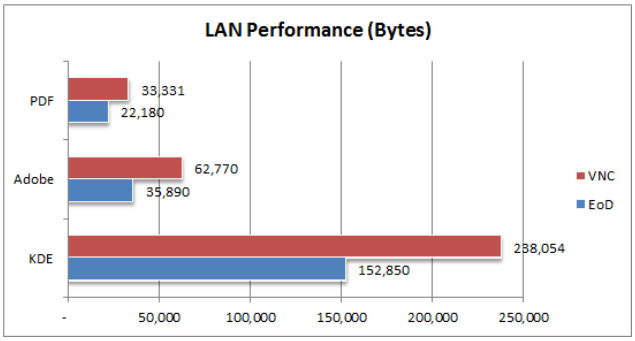
4.4 Network

Simulation Software:	**Tata Consultant Services WANEM v2.3**
Connections:	• 100Based-T, <1ms latency • T1 1.5 Mbps, 100ms latency (Simulated) To reflect cross US- continents and US-EMEA connection characteristics • 512Kbps, 300ms (Simulated) To reflect US to India/Asia connection characteristics

5.0 Test Results

First, let's take a look at 2D performance measured on a LAN connection with virtually unlimited bandwidth and practically non-existent latency.

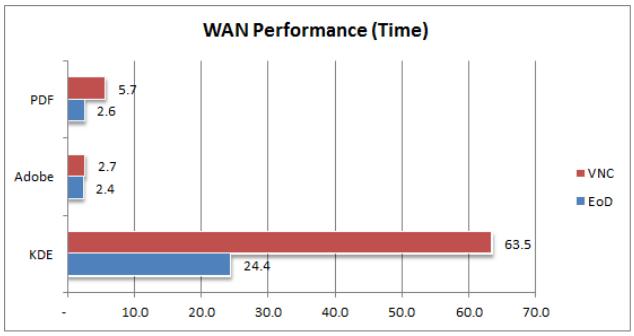


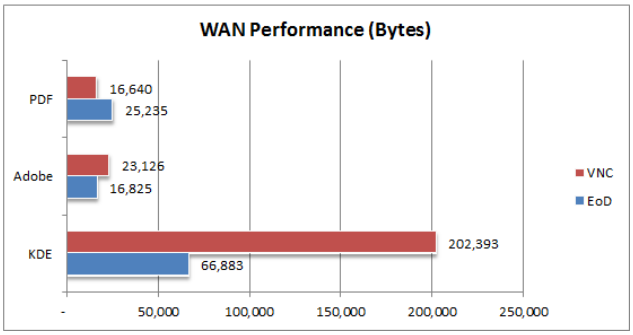


In terms of time taken to perform each task in a LAN environment, the results were rather close. But in terms of bandwidth consumed, it was clear that Exceed onDemand was more efficient than RealVNC.

In a LAN environment, the bandwidth advantage of Exceed onDemand was less significant simply because bandwidth is rarely the performance bottleneck. However, it did show that Exceed onDemand was always conscious of the bandwidth consumption, and it demonstrated the efficiency of the protocol that was at the heart of the solution.

Next, we put Exceed onDemand and RealVNC in a simulated network environment to reproduce the type of condition an engineer in India would experience when connecting back to the design center on the US West Coast (512Kbps network bandwidth and 300ms network latency). We ran the same set of tests again to collect time and network bandwidth usage statistics.



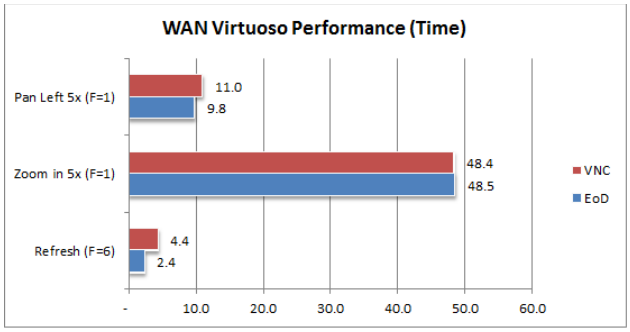


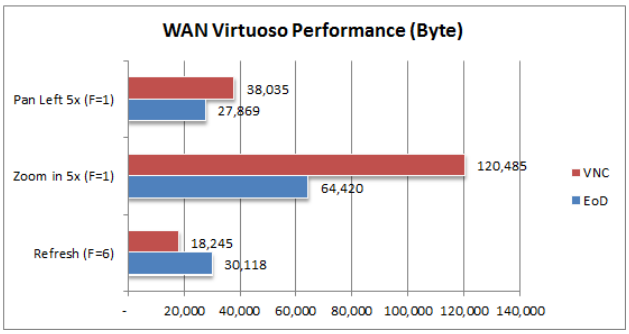
Results indicated that Exceed onDemand took 29.4 seconds to complete all operations in simulated wide area network conditions akin to India to US West Coast. Meanwhile, RealVNC took more than twice the amount of time to perform the same tasks.

Similar results were observed when we inspected the bandwidth usage of the respective solutions; it was 108K bytes for Exceed onDemand vs. 242K bytes for VNC. Again, RealVNC sent more than double the amount of network traffic.

There is another observation that is noteworthy. The Exceed onDemand performance scales far better than the actual ratio of bandwidth and latency. While the network latency was increased 300 times from <1ms to 300ms and bandwidth availability was reduced 200 times from 100M bits to 512K bits, Exceed onDemand time performance on WAN was just 67 percent slower than LAN. The nearly flat performance curve accentuated the extreme efficiency of the proprietary Thin X Protocol created by OpenText and used in Exceed onDemand.

Next, let's take a look at the performance specific to Cadence Virtuoso in similar setups.

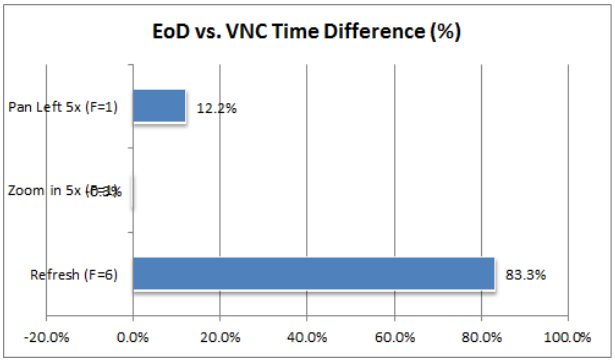


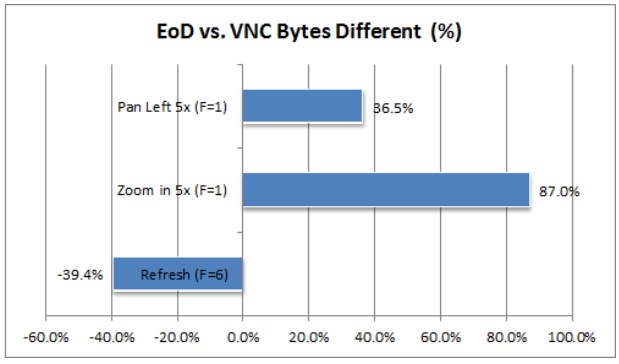


We intentionally focused the test only on WAN because in the case of Virtual Design Center users, they were typically accessing design applications and data from remote locations over the Internet. In this test, we launched Cadence Virtuoso 6.1.5 500.11 and loaded a dense data set. The tester was required to refresh the schematic once; after that, he would set the filter size to 1 and zoom in 5 times; finally, he would then scroll the schematic to the left 5 times by hitting the left arrow key.

RealVNC put up some decent time that was comparable to Exceed onDemand, but performance in terms of bandwidth usage told a very different story. Exceed onDemand required significantly less bandwidth.

Again, Exceed onDemand constantly outperformed VNC in terms of time taken to complete tasks and the associated network bandwidth consumption.



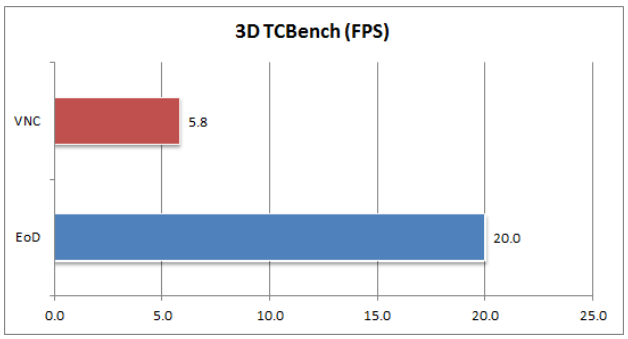


The last set of tests were to compare the performance of 3D rendering capabilities. In this test, we used a generic benchmark program called GLXSpheres running over a full T1 bandwidth and 100ms network latency, similar to network connections between Europe and North America.

But in order to emphasize the efficiency of the remote application access protocols and their respective display capabilities, we restricted the number of polygon updates to 5,000. This ensured that performance numbers were not bounded by the throughput of the graphics card on the server.

Also, as opposed to relying on the Frame Per Second (FPS) value reported by the application, we chose to use a benchmark called TCBench. The FPS printed by the application reports the number of frames drawn on the server side; however, only a fraction of those frames are actually being transferred to the client machine. The technique that is involved, causing the difference in the number of frames drawn on the server and the client, is called frame spoiling. Excessive usage of the frame spoiling technique can greatly reduce the quality and the details of the rendering, and ruin the smoothness of the interaction. At the end of the day, what is important to end-users is what they can actually see and experience; hence, the application-reported FPS is meaningless.

On the other hand, TCBench is a client-side benchmark program that measures how often a pixel changes. Effectively, TCBench measures the number of actual frames that reach the client machine. The higher the number of frame rate a remote application access solution can display, the smoother the interaction and the better the user experience.



In our test case, TCBench showed that Exceed onDemand updated the client's display for roughly 20 times per second; meanwhile, RealVNC client received less than 6 frames (roughly 3.5 times less than Exceed onDemand). Once again, Exceed onDemand displayed a commanding lead over RealVNC.

6.0 Conclusions

In this white paper, we compared the performance of two remote application access solutions: OpenText Exceed onDemand and RealVNC, the original VNC solution. We ran a wide variety of tests to simulate different applications and network conditions in order to find out which solution is more suitable to handle the design work that many EDA and IC design engineers face on a daily basis.

As demonstrated, Exceed onDemand consistently offered better performance than VNC from the perspective of time taken to complete tasks as well as the network bandwidth consumption. In some cases, Exceed onDemand consumed less than half of the bandwidth than VNC and completed the task twice as fast. In the 3D rendering testing, Exceed onDemand delivered close to 3.5 times more screen updates than VNC.

The prowess of the Thin X Protocol developed by Exceed onDemand promises IC design engineers quicker access to applications without sacrificing the quality and the accuracy of the display. As a result, engineers will be productive regardless of the graphical distances between them and the Virtual Design Centers.

At the same time, Exceed onDemand offers a minimal network footprint, resulting in less impact to the network without adding administrative overhead. It empowers IT professionals with the ability to leverage their existing network infrastructure so it can support more users using the same network bandwidth.

To learn more about how OpenText Exceed onDemand can help transform your design center, please visit opentext.com/vdc.

About OpenText

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connectivity.opentext.com

SALES • connsales@opentext.com • +1 905 762 6400 • 1-877-359-4866

SUPPORT • connsupport@opentext.com • +1 905 762 6400 • 1-800-486-0095