

Remote system performance analysis of the virtual applications and virtual desktops by using Parallels 2X RAS technique

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Abstract

The fast spread of computer networks and broadband Internet access and also the development of different operating systems make possible the use of different virtualization techniques. Virtualization techniques provide efficient IT solutions in corporate and educational sectors. We present an original structural framework for which the effect of virtualization technology are measured, based on a real campus wide deployment. The Virtual Desktop Infrastructure (VDI) provides academic members access to virtual applications on and off-campus for easy convenient access to academic resources in a server in data centre. In this paper, we present, at the beginning, a comparative performance analysis of Remote applications and Desktop Virtualization based on parallels 2X RAS versus Microsoft RDS. We introduce system architecture for the two tested scenario and test environment with Experiment Setup and implementations. Also, this paper provides analysis and implementation on the perceived and categorical perspectives on the usefulness, effectiveness and values of this technology in an academic environment. The main conclusions of the paper Indicated that students and academic staff have generally improved a remote accessibility to their course documents and academic materials virtually, using their own devices of different platforms which enabled them to perform course work more effectively resulting in improved system reliability, availability and scalability.

Key words: Virtualization technology, Parallels 2X RAS, Microsoft RDS, Publishing Remote Apps and VDI, performance monitoring.

Introduction

The release and spread of virtualization platforms make possible the development of cost-effective information systems that can provide additional dynamic resource management and simplified system administration [4]. This is due to the capabilities provided by virtualization such as maximizing of applications versatility, high-speed with large-capacity resource consolidation, ease aggregating, dynamics for load balancing enhancement and fault tolerance, ease of management, increased availability from pools of compute resources at less cost and with less complexity, and rapid services deployment to new servers included in a virtual infrastructure environment [8]. Virtualization and cloud computing technologies are often utilized in the teaching-learning process where academic professionals can access the needed academic resources using virtual classrooms. Universities have utilized the benefits of virtual technologies in a number of university level subjects [1].

The development of the IT infrastructure is one of the key factors in determining the attractiveness of the university. One of the implementation solutions is virtualization technology that has a significant influence on the study and research process [6].

Also, in business with today's mobile workforce, employees no longer have the option to be disconnected during the workday — they need access to their data anytime, anywhere, such as using the cloud's Desktop as a Service (DaaS) that hosts virtualized desktop infrastructure (VDI) [7]. So, by publishing a VDI and applications, organizations can guarantee this enhanced connectivity, ensuring employees the same computing experience wherever they are in the world and increase employee productivity [10].

In the Engineering Faculty of Aden University, we were facing challenges when going to labs for applying some functions and assignments. All programming languages and installed applications in all pc's and if one of the devices stops working or goes down, the student who is working on his pc will stop his work until the pc is being repaired. Other challenges, if there are any problems in any pc whether locally or remotely, the administrator has to go to the location of pc with the problem to be managed and fixed.

Sometimes there is a conflict between different applications, or even with legacy O.S a risk of deleting the applications or editing O.S files or registry will also rise.

This research will help us to solve the most important problems facing us in educational sector, especially in training laboratories.

The main contributions of this paper are the following:

- Improving the educational methods in laboratories and expanding a connections method and data transmission between different offices accessing the needed academic resources virtually on and off-campus using different platforms. (section 3)
- Increasing revenues and decreasing Total Cost of Ownership (TCO), by facilitating centrally administrative tasks. (section 3 & 5.2-Table3)
- Improving the security aspects with decreasing the expense of more money, as provided in our research for configuring traditional pc's to be converted into Thin Clients (Desktop Replacement) with more data security. (section 5.2-Table3)
- Monitoring server performance with the parallels 2X RAS Reporting Engine and how to prevent a data centre performance bottlenecks and overloads (section 6)
- Applying the virtualization system, using parallels 2X RAS technique in the laboratories of our Engineering Faculty, by deploying all applications and desktops to all devices in labs with zero setup, and no conflict between different applications or with legacy OS (section 3 & Table3).

Related Work

Virtualization technology supplements in cloud computing is considered as a set of software tools which divides a server into virtual resources reducing power and expanding computing resource allocation and data storage [11].

Chawdry and Lance [3] discussed computer virtualization techniques used at California University, highlighting the potential paybacks virtualization can offer to academic institutions.

Castiglione, et al. [2] explained how visualization can be used to increase the course learning outcomes by providing exercises to the students accessing, using PCs.

Garcia et al. [5] described different hosting technologies that can be used to build up a suitable virtualization infrastructure in an academic environment.

Mohamed K. Watfa, Vincent A. Udoh, and Said M. Al Abdulsalam [9] discussed the fundamental benefits derived from the adoption of this technology in the academic environments. Younes and Soraya Nazarian Library – University of Haifa,[12] which uses Parallels Remote Application Server to efficiently publish 50-odd local applications and provide remote access to its staff, faculty and students at a cost-effective price.

Parallels Techniques of publishing App-s and Desktop

Parallels 2X RAS is a cost-effective application delivery and VDI solution, which allows your employees to access and use applications, desktops and data from any device. Easy to deploy, configure, and maintain. Parallels RAS provides organizations with a seamless application delivery and VDI experience while reducing TCO and improving security [13].

1. Publishing Virtual Desktop Infrastructure (VDI)

Parallels Remote Application Server (RAS) makes VDI quick, easy, and affordable. It enables organizations to deliver fully functioning virtual windows desktops and applications to employees. Parallels 2X RAS allows users to be productive anywhere by providing a windows desktop-like experience on any device. Parallels 2X RAS simplifies the VDI deployment. Despite the benefits, the initial upfront costs of implementing VDI and application publishing are substantial.

2. Publishing App-s

Parallels Remote Application Server delivers Windows applications to any device, allowing employees to instantly work on local devices without the necessity of installing the applications. Parallels RAS gives employees seamless access to applications published from RDSH, VDI or Remote PC host.

Deliver applications and server-based desktops whenever and wherever you need them, on any device of your choice: mobile phone, desktop, tablet, Raspberry PI, and more. Published applications are also accessible from a web browser using the Parallels HTML5 Client, which enables you to quickly access applications and virtual desktops instantly. Parallels 2X RAS deliver applications, desktops, and data to any user, regardless of the operating system or device. Parallels Client is available for Windows, Linux, Mac®, iOS, Android, Thin Client, Chromebook™, Raspberry Pi and any HTML5 web browser. On-the-go access allows employees to be as productive as if they were working from the office, as shown in Figure 1.

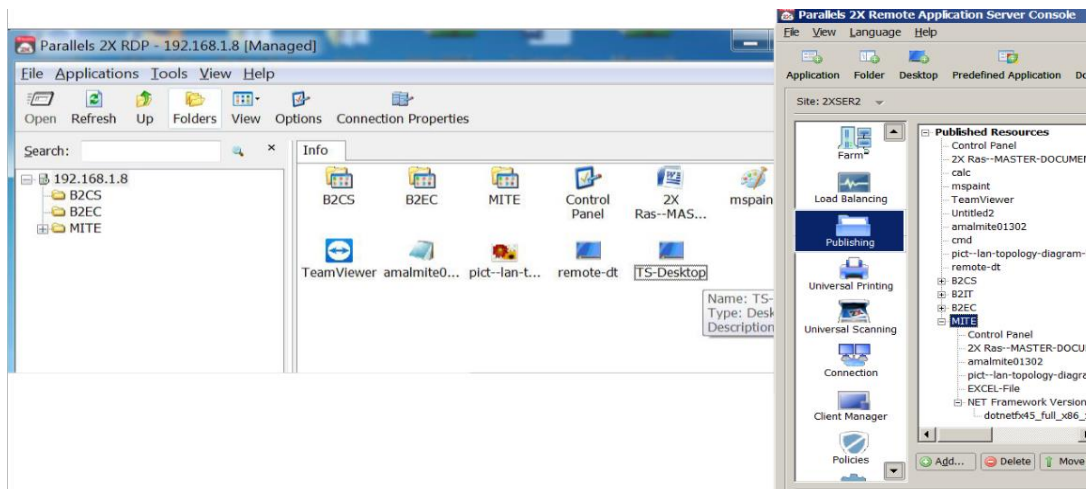


Figure 1: A Published Resources on a Client Side

Test environment description

1. Experiment Setup and Implementation

The test environment is achieved for the comparison between Microsoft RDS and Parallels 2X RAS based on publishing or deploying a virtualized remote applications and desktops scenario, as shown in Figure 2. We have windows server 2008R2 operating system with remote desktop services rule and Remote Desktop Session Host feature installed and configured on server station.

On the left part of Figure 2, there are Microsoft RDS components marked with green color and, on the right part of Figure 2, there is parallels 2X RAS program installed for remotely published APPS and desktops for different clients, managing, monitoring and controlling applications, users and devices locally or remotely marked with blue color.

Several types of clients connect and access to server for using published applications and desktops via Parallels 2X RAS such as personal computers, laptops, thin clients and smart phones of different platforms, including IOS, Windows, Android, Raspberry Pi, Linux and MAC.... The connections are realized, using remote desktop protocol (RDP). In addition, we can use any HTML5 browser to access published resources without installing the RDP client. In order to test the performance of both Parallels 2X RAS and Microsoft RDS implementations, the built-in performance monitor tool was used.

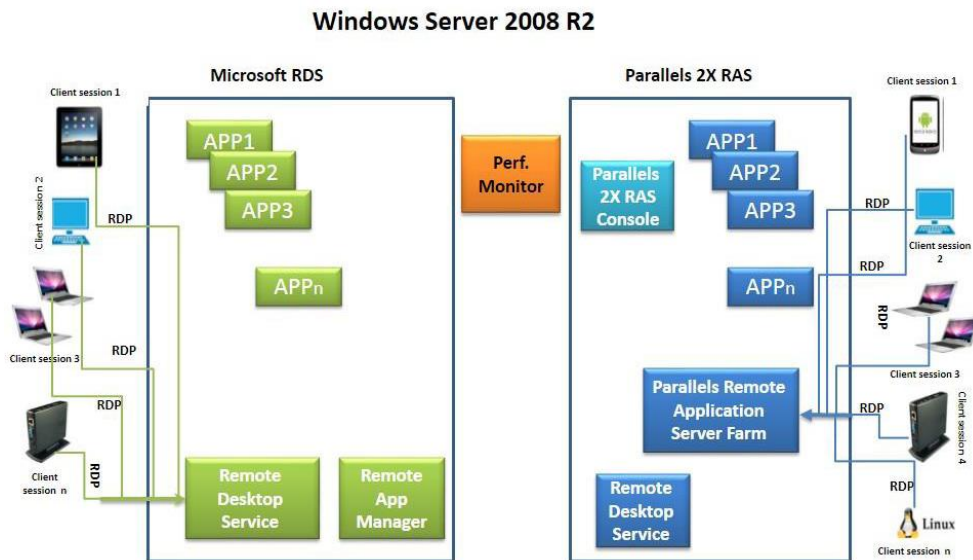


Figure 2: Remote Applications and Desktop virtualization test environment.

- The server PC for testing is LENOVO corei7, 8GBRAM, 1 T.B SATA H.D.D.
- Connection media via wireless connection.
- The server (host) is running Microsoft windows 2008R2 operating system with terminal server role and RDS and Desktop session Host installed and configured.

1.1. Remote APPs and Desktop using Parallels 2X RAS

Test environment is presented in Figure 2. Remote applications and desktops virtualization, using parallel 2X RAS, can be seen in the right part of this Figure. Needed components are highlighted with blue color. This scenario uses virtualization in order to host the remote applications and desktops that will be deployed to remote and local users, using parallels 2X RAS console. In the client side, the users can access virtual resources in an easy way via 2X RDP client software installed in client side.

Connected users have access granted to published applications and desktops installed on the server station. Published resources, client management, centralized management of end user's desktops configurations and monitoring system performance all that are through remote application server console.

1.2. Microsoft RDS

Microsoft RDS scenario is also presented in Figure 2. In the left part is a Windows service created to make possible multi user connections to a Windows server station. Connected clients use RDP to transfer commands to the server and to receive the graphical user interface of the remote desktop. Connected users have access granted to all the software applications installed on the server station. In this case, the received remote desktop is a Windows Server 2008 R2 desktop.

2. Performance evaluation tests

In order to test the performance of both virtualization solution technique, Parallels 2X RAS and Microsoft RDS, the built-in Performance Monitor tool was used. The first challenge was finding the right performance counters that accurately monitor the use of system resources. Three test suites were performed related to memory usage, CPU load and storage drive queue. These parameters are critical when we evaluate system performance. The *Committed bytes counter* of the Memory object shows the amount of used memory. This can be given also as a percentage of the total amount of memory if we use the *%Committed bytes in use counter*. Also, at the same time, we investigated other counters such as *Avg.Disk Queue Length* and *the percentage of processor time* beside the committed bytes and the percentage of Committed Bytes in Use counters.

All those counters are taken together each time with diff. no. of users accessing and running virtualized remote apps and desktops for getting the actual comparative performance benchmarks to be able for determining the best virtualization solution for virtualized remote apps and desktops that can be used in universities, laboratories, hospitals, banks and other sectors. We started our tests scenarios with 1 user access and run remote virtualized apps in a server, using Microsoft RDS, then the same no. of users (1 user) access the same remote virtualized apps in a server using parallels 2X RAS and recording the results, repeating the same test scenario with increasing consecutively no. of users (2,3,4,5).

Results and Analysis

1. Comparative Performance Results

After applying our test scenarios we have got the following results for both virtualization solutions separately, as shown in the Tables [1-2] and reflected to graph:

Table 1. Microsoft RDS reading test values

Number Of Users	CPU [%]	Memory		Disk Storage
		Committed Bytes	Committed Bytes In Use [%]	
1	5.946	1,780,687,823	21,235	0.016
2	5.656	1,841,438,720	21.959	0.015
3	7.476	1,773,791,134	21.153	0.236
4	12.284	1,941,497,368	23.153	0.13
5	82.024	1,708,559,019	20.375	0.123

Table 2. Parallels 2X RAS reading test values

Number Of Users	CPU [%]	Memory		Disk Storage
		Committed Bytes	Committed Bytes In Use [%]	
1	3.462	1,559,024,591	18.592	0.014
2	5.047	1,630,458,831	19.443	0.033
3	5.786	1,701,149,745	20.286	0.028
4	6.714	1,713,807,945	20.437	0.032
5	12.602	2,108,680,680	20.146	0.035

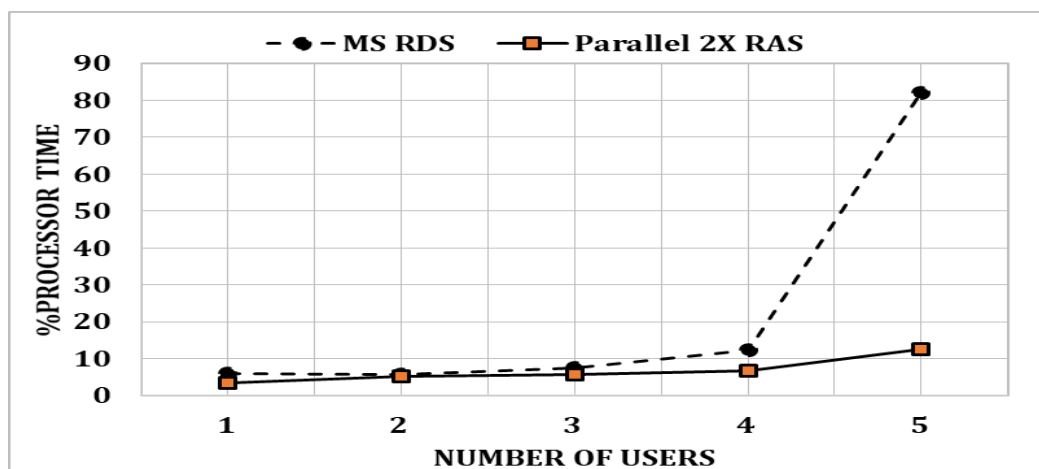


Figure 3: CPU Load Test for Virtualized apps and desktops

Figure 3 shows our performed test with increasing number of users accessing virtualized remote apps and desktops. At the beginning, we start our test with a user in both scenarios to see the benchmarks of tested performance counters. Then, as the number of users increased, the results were compared and evaluated.

Users accessing the virtualized Remote Apps and Desktops using different platforms of different mobile devices and desktop devices. Five test suites were performed related to memory usage, CPU load and storage drive queue. %Total Run Time counter of both virtualized solutions Parallels 2X RAS and Microsoft RDS can be used for CPU test. This counter records the total consumption of CPU resource.

Figure 3 shows CPU tests for deploying Apps and desktops of both virtualized system to users. We conclude that full CPU resources are shared to each user accessing virtualized Apps and, when server CPU usage reach its limit, all users perform slower.

CPU tests are repeated for both scenarios with increasing in no. of users accessing virtualized Apps and desktops and the results was that both virtualized system solutions are the same when the number of users started from 1 up to 4 users accessing the same virtualized apps in the same interval in each scenario. we found that the %processor time tests seems to be the same with so little difference between the two solutions, but with increasing no. of users we see that CPU usage percentage, in case of Microsoft RDS is a little higher than in Parallels 2X RAS. This is because, at the starting point, CPU usage is near to 0 in both scenarios.

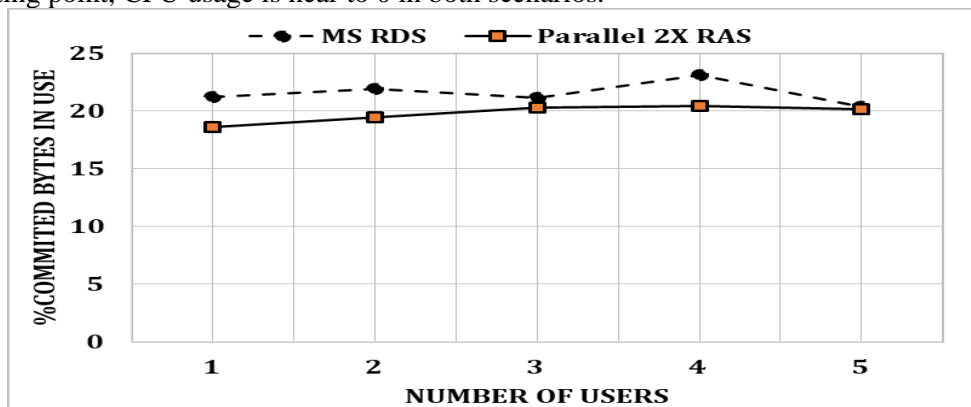


Figure 4: Memory utilization Test for Virtualized apps and desktops

Figure 4 shows Memory management test that was performed in order to determine the way of memory allocation for users accessing and running virtualized remote apps and desktops in a server for both scenarios and monitoring the committed bytes and percentage committed bytes in use counters. The benchmarks in Figure 4 clearly shows that the reading values are close to each other in both virtualized solutions, with little increasing in %committed bytes in use counter for Microsoft RemoteAPP RDS.

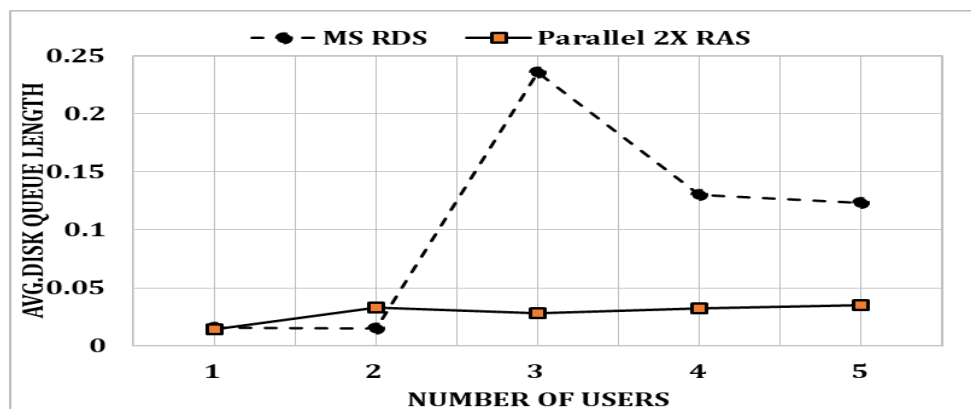


Figure 5: Storage disk queue Test for Virtualized apps and desktops

Figure 5 presents storage tests in the two scenarios. Measurements were taken during different no. of users (incremental no.) accessing virtualized remote apps via different platforms of devices. Average disk queue length is one of the most important parameter marked with blue color in the graph. In Microsoft RDS, solution disk queue is higher than that in Parallels 2X RAS, as no. of users increased. Parallels 2X RAS measurements show a low average disk queue length because, once the application is started, it is multiplied in memory for the connected client stations.

2. Comparative Results of RAS Features

In addition to the above, we compare between various virtualization solutions like (parallels 2X RAS, Microsoft RDS). We obtained other results in the following categories of RAS features as described in Table 3.

Table 3. Parallels RAS Features VS Microsoft RDS

#	Feature	Parallels 2X RAS	Microsoft RDS
i. Installation and Configuration			
1	Easy to install and manage.	√	
2	Offers a centralized management system	√	
3	Effectively monitor and manage the entire network.	√	
ii. 2X Desktop Replacement			
4	extend the lifespan of hardware and delay migration to the latest Oss	√	
5	Disabling the most common local configuration options, while guaranteeing the same level of service and security afforded by thin clients.	√	
iii. Application Publishing			
6	Publishing app-s from all servers in a farm	√	Only publish applications from an installed Remote App Server
iv. Cross-Platform Support			
7	Support a wide range of devices such as Android, iOS, Linux, Java, Chrome OS and HTML5.	√	Only support Windows clients and Mac
v. Printing and Scanning Redirection			
8	using a local printer or scanner without installing drivers on the server	√	
9	Supports printing and scanning	√	Only supports printing
vi. Hypervisor Support			
10	Supports all major hypervisors including Hyper-V, Citrix and VMware.	√	Only supports Hyper-V and MS Virtual Server.
vii. Security & Authentication			
11	Filtering is done based on the MAC address, IP address, gateway and the client.	√	
viii. High Availability Load Balancing (HALB)			
12	Supports built-in load balancer.	√	Needs to Install Microsoft Network Load Balancing (NLB) services.
13	Provide default auto-configured of HALB. Not only does it check the available servers, it also checks the available gateways for a high availability network.	√	Installing and deploying NLB requires expertise knowledge as well.
ix. Reporting Services of Monitor Server Performance			
14	Provides an extensive reporting tool that generates 14 types of reports categorized into five groups.	√	

Parallels 2X RAS Performance Monitoring

The Performance Monitor is a new feature introduced with Parallels RAS. It provides the administrator with more in-depth information on how to improve the Parallels RAS infrastructure. By inspecting these reports, the organization can effortlessly enhance the performance of Parallels RAS and Windows Server components.

The Performance Monitor enables real-time access to historical and real-time stats on Parallels RAS infrastructure. These extensive reports provide IT administrators with insight into a wide range of key metrics, such as session information and CPU usage.

Analysing resource usage, diagnosed bottlenecks, map scalability needs help eliminate potential Parallels RAS misconfigurations, as well as keeping an eye on the general performance of the Parallels RAS environment. This save up to 30% of your hardware infrastructure by knowing how to reallocate your hardware resources [14]. Parallels offers 2X Remote Access Server monitoring via its built-in reporting features.

An extensive reporting tool that generates 14 types of reports, categorized into five groups, as shown in Figure 7 & 8, interact with Parallels RAS:

- User Reports provide insights into how users interaction.
- Group Reports provide insights into how each group interaction.
- Device Reports provide insights into how devices interaction.
- Server Reports provide insights into server health, CPU and RAM usage.
- Application Reports provide insights into published applications.

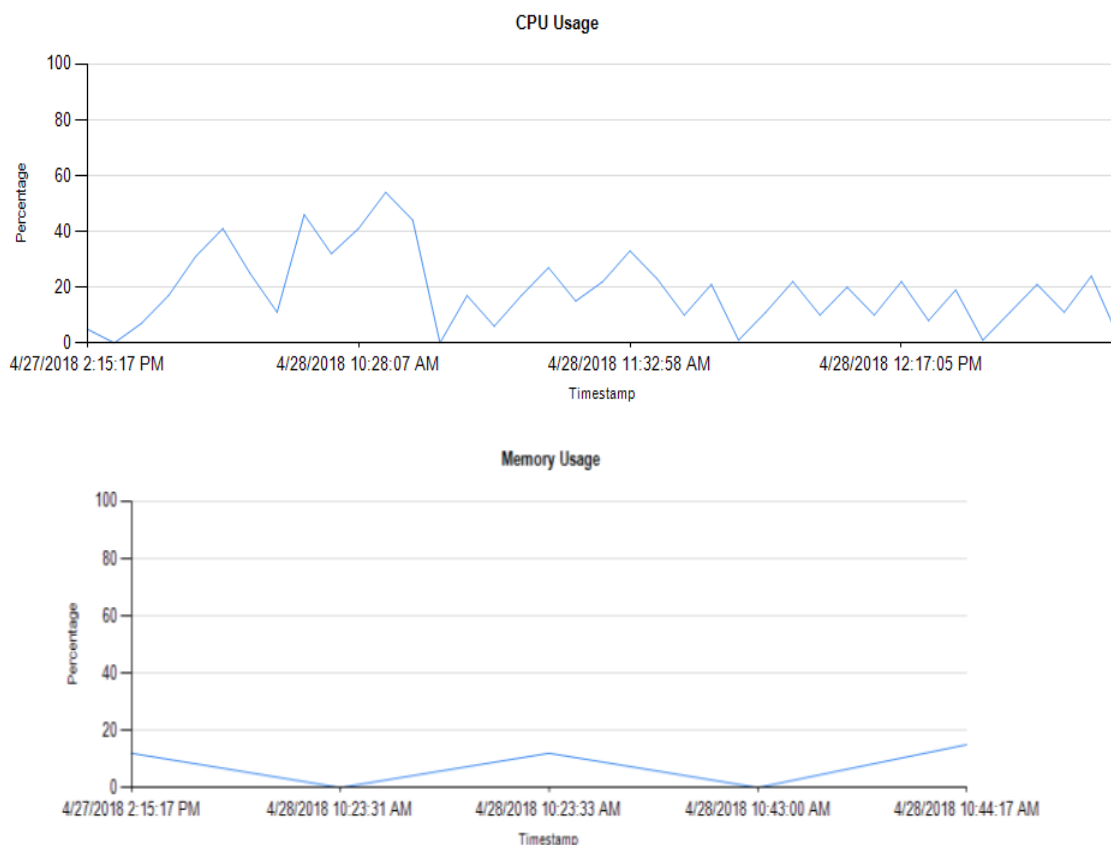


Figure 6: Server Health by Server

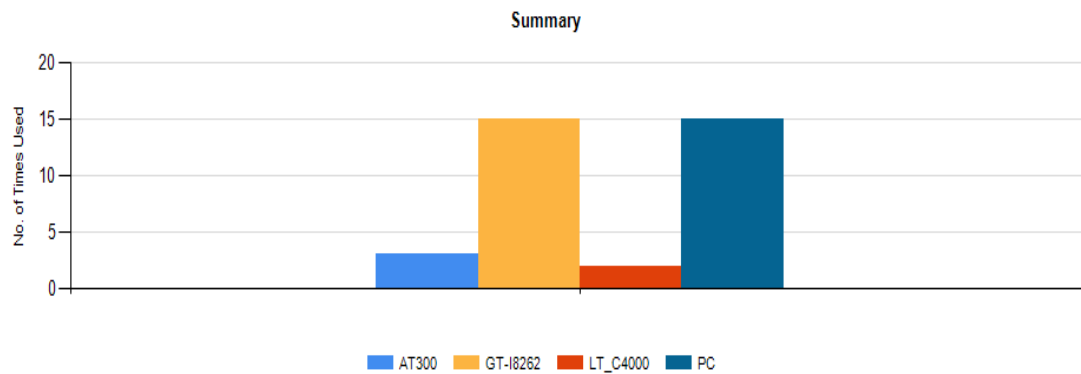


Figure 7: Devices Used to access published Apps and VDI

Conclusion

In this paper, we have investigated the performance of remote apps and desktop virtualization using two alternative virtualization solutions: parallels 2X RAS and Microsoft RDS. We have implemented the test environment, using an entry level server machine for both scenarios and performed memory, CPU and storage management measurements.

In case of CPU and Memory management tests, both systems have almost the same results. CPU usage, in case of Microsoft RDS, is a little bit higher as the number of users increased. Storage management measurement shows a clear advantage for parallels 2X RAS scenario. Average disk queue values are higher than in the order of magnitude when number of users increased to access virtualized apps and desktops, using Microsoft RDS.

The main conclusion of the first part of this paper is that the parallels 2X RAS scenario outperforms the Microsoft, based on deploying and accessing virtualized Remote Applications and Desktops both CPU and storage management. Notably, Parallels RAS allows businesses of all sizes to implement high end virtualization solution. We conclude that virtualization is an effective solution in academia. Parallels 2X RAS integrates all virtualization technologies into a single platform. With parallels 2X RAS, businesses can securely and seamlessly deliver highly scalable virtual desktops and applications with greater flexibility to monitor and manage VDI/RDP networks.

References

1. BouSaba, C., Burton, L., Fatehi, F. (2010). Using virtualization technology to improve education. In: 2nd International Conference on Education and New Learning Technologies, pp. 201–206.
2. Castiglione, A., Cattaneo, G., Luigi, C., Ezio, C., CarloFulvio M. (2010). Virtual Lab: a concrete experience in building multi-purpose virtualized labs for Computer Science Education. Dipartimento di Informatica - Universit`adegli Studi di Salerno, Italy, pp. 1–15.
3. Chawdhry, A., Mance, C. (2010). Virtualization: providing better computing to universities. Inf. Syst. Educators Conf. ISECON, Nashville, USA 27(1401), 1–6.
4. DARABONT, O., KISS, K.J., DOMOKOS, J. (2015). Performance Analysis of Remote Desktop Virtualization based on Hyper-V versus Remote Desk top Services.

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- MACRo 2015 5th Int. Conference on Recent Achievements in Mechatronics, Automation, Computer Science and Robotics.
5. Garcia, C.R., Quesada-Arencibia, A., Candela, S., Carrasco, E., González, A. (2012). Teaching information systems technologies: a new approach based on virtualization and hosting technologies. *Int. J. Online Eng.* 8(4), 32–41.
 6. Miseviciene, R., Plestys, R., Zakarevicius, R., Ambraziene, D., Pazereckas, N. (2013). Virtual Desktop Infrastructure Technology Based Study & Research. *Int. Journal of Education and Research* Vol. 1No. 4.
 7. Murugesan, S., Bojanova, I. (2016). Cloud Computing: An Overview, pp 3-14 In: *Encyclopedia of Cloud Computing*. Wiley-IEEE press 725 pp.
 8. Stallings, W. (2018). Virtual Machines, pp. 627-656. In: *Operating Systems: Internals and Design Principles*, 9th E. © Pearson Education Limited 798 pp.
 9. Watfa, M. K., Udoh, V. A., and Al Abdulsalam, S. M. (2015). An Educational Virtualization Infrastructure. © ICST Institute for Computer Sciences, Social Informatics and Telecommunications Engineering 2016Y. Zhang et al. (Eds.): *Cloud Comp*, LNICST 167, pp. 12–21.
 10. 4Ways Desktop Virtualization Improves Employee Efficiency (2017). URL: <https://insights.samsung.com/2017/10/24/4-ways-desktop-virtualization-improves-employee-efficiency/>.
 11. G5 Networks–Technology Partner (2013). URL: <http://www.g5networks.net/virtualization.html>.
 12. The Younes and Soraya Nazarian Library – University of Haifa (2015). URL: <https://www.parallels.com/blogs/university-of-haifa/>.
 13. Parallels Techniques of publishing App-s and Desktop Remotely. URL: <https://www.parallels.com/products/ras/remote-application-server/>
 14. Parallels RAS v16.1 | Performance Monitor URL: <https://www.parallels.com/blogs/ras/performance-monitor/>

تحليل أداء النظام عن بعد للتطبيقات الافتراضية واسطح المكتب الافتراضي

باستخدام تقنية Parallels 2X RAS

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الملخص

يتيح الانتشار السريع لشبكات الكمبيوتر والوصول إلى الإنترنت، وكذلك تطوير أنظمة تشغيل مختلفة، إلى استخدام تقنيات الأنظمة الافتراضية المختلفة. الأنظمة الافتراضية توفر الحلول التقنية الفعالة في قطاعي الشركات والتعليم. قدمنا بنية هيكلية يتم من خلالها قياس تأثيرات تطبيق الأنظمة الافتراضية عن طريق نشر التطبيقات و سطح المكتب للحرم الجامعي. توفر البنية التحتية الافتراضية لسطح المكتب للأعضاء الأكاديميين و الطلاب الجامعيين الوصول إلى التطبيقات الافتراضية من داخل وخارج الحرم الجامعي من أجل سهولة الوصول إلى الموارد الأكاديمية الموجودة في الخادم الرئيسي في مركز البيانات. في هذه الورقة نقدم في البداية تحليل أداء النظام من خلال المقارنة بين تقنيات نشر التطبيقات الافتراضية عن بعد و سطح المكتب الافتراضي استناداً إلى تقنية Parallels 2X RAS مقابل Microsoft RDS. قدمنا سيناريو اختبري لأداء النظام مع إعداد التجربة والتطبيقات عن طريق اختبار عدد من المعاملات أثناء استخدام التطبيقات و سطح المكتب الافتراضي عن بعد من قبل عدد من المستخدمين. كما توفر هذه الورقة البحثية أيضاً التحليل والتنفيذ على وجهات النظر المدركة والقاطعة حول فائدة وفعالية وقيمة هذه التقنية الافتراضية في بيئة أكاديمية. الاستنتاجات الرئيسية للورقة البحثية تشير إلى أن الطلاب والموظفين الأكاديميين قد قاموا بشكل عام بتحسين إمكانية الوصول عن بعد إلى الدورات الدراسية والمواد الأكاديمية باستخدام الأجهزة الخاصة بهم ذات الأنظمة المختلفة التي مكنتهم من أداء أعمالهم بشكل أكثر فعالية ووثوقية.

الكلمات المفتاحية: تقنية الأنظمة الافتراضية، Parallels 2X RAS، Microsoft RDS، نشر التطبيقات و سطح المكتب عن بعد، مراقبة الأداء.