Virtual Student Labs

A K-12 Solution

Summary

Many school districts have moved to a one-to-one environment where students are provided their own Chromebook, Mac or Windows laptop / device. These devices can run most of the local educational software and web-based applications that are used daily, but not all. The applications that are unable to run on the student laptops are typically Windows applications that require a faster processor and / or memory than what the student device supports or in the case of Chromebooks, any windows application would not be supported. For those applications that cannot run directly on the one-to-one devices, districts purchase and maintain multiple windows-based labs.

For years, many school districts have been looking for an alternative to the situation above and now with Covid, many districts need to be able to provide their windows-based classes remotely when the students are working from home. We now believe that a cost-effective solution can be provided that can reduce the cost to the district when compared to traditional labs but also provide remote access from anywhere internet access is available.

Our goal is to replace a minimum of 3 to 5 standard labs with a single server. Faster processors, affordable memory and the biggest change; solid-state drives or SSDs have finally made VDI a viable alternative to the traditional lab environment. Our recommended vendors for the VDI host servers are: Trinity 3 (http://www.trinity3.com) for refurbished servers or new servers from SuperMicro (http://www.supermicro.com).

When we combine affordable servers with Microsoft's HyperV RDS/VDI software, we can provide a true virtual environment for CTE/CATE technology classes and shared session (terminal services) for classes that do not require an individual Windows 10 desktop but can run in a shared session (terminal server) environment. This provides a very flexible solution at a **cost-effective** price. It would allow the districts that are one-to-one with Chromebooks to utilize their Chromebooks as the end-point device to run windows-based applications. The districts that are one-to-one with windows devices would also benefit from a virtual lab solution since the student laptops typically are not capable of running software such as AutoDesk's AutoCAD/Revit/Inventor or Adobe's Creative Cloud software that requires faster processor speed and more memory.

Solution Cost Considerations

When building the virtual lab solution there are recommended hardware and software components that the district would need to purchase.

- Physical server or servers to function as the host for the virtual lab
- Windows 2016/2019 data center server software
- RDS client access licenses (CAL)
- Setup services for the solution
- Optional – standard display, keyboard and mouse

Note: Microsoft provides a free client in the Google Play Store than can be distributed to the district Chromebooks as well as for Macs, IOS, Android and Windows devices. Also, for classes such as AutoCAD, the student may still need to use a separate monitor, keyboard and mouse attached to their one-to-one device.

Cost Comparison

To justify the use of a virtual solution to replace or enhance existing traditional school district labs, a cost comparison is provided. The comparison is based on discussions with multiple school districts. The chart below assumes that lab cost ranges from as low as $600 to approximately $800 per desktop or more.

MS Office Lab Count	Device Cost	Totals
1 lab x 30 computers	$600	$18,000
3 labs x 30 computers	$600	$54,000
8 labs x 30 computers	$600	$144,000

AutoCAD-Adobe Lab Count	Device Cost	Totals
1 lab x 30 computers	$800	$24,000
3 labs x 30 computers	$800	$72,000
8 labs x 30 computers	$800	$192,000

** Note: Goal to replace a minimum of 3 – 5 labs with 1 virtual server host

This comparison does not include the intangible cost:
- Cost of physically replacing lab computers (labor)
- Cost of disposing of the older computers
- Cost of time maintaining lab computers

Server Count Calculation

When considering the cost of virtualizing your student labs, there are a few items to consider when calculating the cost. You may be surprised how few servers you may actually need to replace your existing physical student lab computers. In general, a server can support 60 - 100 VDI sessions (AutoDesk/Adobe/Microsoft) and a session server supporting 100 simultaneous connections.

1. How many labs are in the district that you wish to replace?
2. What classes are taught in the labs?
3. How many labs are running simultaneously?
4. How many computers are in each?
5. On average, how many students are in each?

Note: We also need to consider fault tolerance or insurance. If one of the host servers fail, we need to make sure we can bring up the needed virtual desktops on the remaining server or servers to be able to deliver the classes until the failed server is repaired.

Virtualization Server Cost

The cost of the virtual server hardware has finally become viable and affordable with the use of off-the-shelf refurbished or new servers and the low cost of solid-state drives and memory. The cost of the server can vary, but current configuration shown below for a new VDI host server is approximately $16,000 - $24,000. Again, this does not include any software, including the following:

- Microsoft Server 2016/2019 licenses – host and virtual
- Microsoft Windows 10 licenses – for full VDI support
- Microsoft RDS client access licenses (CALs)
- Setup Labor Services

Server Configuration Recommendation

A recommended server configuration for a new server from SuperMicro (http://www.supermicro.com). Most school districts can purchase from your standard distributors like SHI, CDW, Ingram, etc.

In general, it is believed that a ratio of one virtual lab server for every three to five physical labs of computers would be assumed. If the district has eight labs, then assume two to three virtual host servers properly configured would be necessary along with a supply of replacement parts. We also need to consider, if a server does fail, can we deliver the classes with the remaining servers.

SuperMicro 2029U-E1CR4 (Configuration may change over time)

Component	Qty	Recommendation
CPU	2	2 x 24 Core – 3GHz
Memory	1500	1.5TB – yes TBs
Disk	16	2TB Solid State Drives (SSD) – Total 32TB (supports 24 drives)
NIC	4	4 – 1G NICs or 2 - 10GB NICs

The above recommended configuration should run 60 - 100 VDI simultaneous sessions and / or 100 simultaneous shared sessions (terminal servers).

Optional Components

Their maybe times when a class requires additional hardware components. For example, if the students are in their traditional lab room, they would still use their Chromebook as their endpoint to connect to the virtual desktop, but if desired, the school could provide them with a standard keyboard, mouse and display. There are multiple vendors that provide a multiport adapter that will connect to the type-c port on the Chromebook to allow the students to use a standard keyboard, mouse and display. The one displayed is the JGS-4in1-9837

Another component to consider for your Adobe and AutoDesk classes is a stylist and pad. If needed, it will need to support connecting directly to the Chromebook. One that has been tested with Chromebooks is the Huion HS64 Pen Tablet and are approximately $50 each. https://www.huion.com/pen_tablet/HS/HS64.html

Conclusion

Schools have moved or are quickly moving to provide a one-to-one laptop / device environment with their students.   The preference would be that the student can perform all task using their own device and not have to put it away just to use a lab computer for applications that cannot directly run from the student devices.   Virtual desktops have been the hopes and dreams to fix this issue for over 10 years now, but the cost and complexity was always a deterrent. Thankfully, it appears that we can finally do this with a properly configured low cost refurbished server or new server, with solid state drives and ample memory along with Microsoft's Hyper-V RDS (Remote Desktop Services).   This configuration provides both true VDI and Share Session services which provides the flexibility to allow schools to provide access to windows-based applications from any device and from anywhere including home.   We believe we can finally remove the physical lab computers, which will save school districts money and effort and allow them to provide those same services, but in a more productive way.