



# THE CHANGING LANDSCAPE OF IT DELIVERY AND CONSUMPTION IN EDUCATION

## *The Cloud*

is altering the IT infrastructure in education, changing the way schools deliver and consume IT services. At the center of this new infrastructure is the network. No longer just “plumbing” in the infrastructure, the network is now a strategic asset. As more and more IT functions, including software and platforms, are offered as a cloud service, the network infrastructure that securely and reliably enables the consumption of these services becomes increasingly important.

So how does this look in real-world environments? Campus Technology and T.H.E. Journal spoke with a panel of education technology experts to get their insight.

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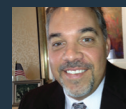
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## 1. Learning and instruction have expanded beyond the traditional classroom, in the form of flipped classrooms, MOOCs and distance learning models. As your infrastructure evolves to support these new approaches, what role will cloud services play in this environment? What changes do you envision for your network?

**MICHAEL DUHR:** In regards to data centers for education institutions, cloud services will be a very practical choice. With the growing cost of environmental [controls] for a data center, the less overhead an institution has in regards to cooling and electrical cost, the better it is for the bottom line.

With that being said, we are looking at pushing more services to the cloud, and keeping only core services in house.

The flip side of this coin is that this will require greater amount of bandwidth to our ISPs, not to mention the routers and switches required to move this higher volume of traffic with little latency.

Being a media arts college, we are planning to upgrade our backbone to an 80 Gbps throughput and 20 Gbps throughput from our distribution layer to our access layer chassis. Wireless is currently 3X3 MIMO with 802.11 A,B,G,N. We are currently in process of planning for 802.11AC.

**VANCE GREGORY:** Cloud services become more and more popular as educational IT departments push applications out of the data center and into the cloud for multiple reasons. IT departments are unable to grow at the rate at which IT dependency is growing, and cloud services alleviate the workloads placed on support staff. Additionally, cloud services allow IT departments to provide student accessible software and solutions in an anywhere-you-go manner. AYG cloud solutions alleviate security concerns for IT departments, as well as backup and recovery responsibilities like traditional in-house solutions.

Network changes are not simply the need for additional bandwidth. Wireless coverage has to be continually tweaked and added to in a well-planned manner to support a high-density client device environment. Faster and additional wireless coverage necessitates faster internal infrastructure. In most cases, internal infrastructures will necessitate faster WANs or MANs.

**JIM PETERSON:** I think in many ways this was already started with the consumer and social tools that children, parents, and others started using outside of school sanctioned tools and Internet use. Ideally now cloud services play a huge role in the classroom and outside it as they enable more, useful, and alternative tools for teachers and staff.

The changes we are seeing is that integration with our internal networks in the form of identity and data play a huge role in enabling these new

## TECHNOLOGY INSIGHT FROM CISCO

Today students want to consume content on their own terms, at their own pace and from a preferred device, such as a smartphone. The expansion of cloud services in the classroom enables access to the content at any time and from any device. And it's the network that links students and their devices to the content. Therefore the network must have the intelligence to ensure that the application can be delivered optimally, efficiently and securely to the endpoint. Cloud also enables higher institutions to expand beyond the boundaries of brick and mortar — such as MOOCs — and reach students around the globe, which increases their revenue and brand. Cloud computing is a game changer for those that embrace its capabilities and take advantage of its underlying opportunities.



cloud services. No longer is a K-12 network an island, separate from the Internet. However, the biggest hurdle is interfacing the Internal and external resources in a manner that is safe, secure, and audit able.

“Personalized Learning” is the key phrase all K-12 leaders are trying to get to, which includes matching data and identity with as little burden on the local school districts, so they can continue their operations with legacy internal applications, directory services and the like, but the ability to propagate this data and identity to somewhere they trust to be used for extending their access and automation of applications in the “vendor-sphere”. Adding a common data model, federated identity solution, and high speed data stores with an API to connect / manage vendor access by districts, is what we believe is the key part that sits in the middle, districts can trust and will drive the delivery of great classroom tools directly to teachers, students and parents.

**KLARA JELINKOVA:** Cloud services will be increasingly more important in this space. An important contributing factor is globalization; solutions and networks need to be able to deliver education across the globe via video enabled networks.

## 2. BYOD adoption continues to drive the change in IT consumption. How do you ensure that your security policies are protecting you against potential threats across multiple clouds and multiple devices? How do you create policies that safeguard the network and student privacy while still fostering a culture of open and collaborative learning?

**DUHR:** Security policies that fit one institution may not fit for another. A liberal arts college will have much different policies than say a business university. You need to work with the faculty and staff members to create policies that are custom fit around the curriculum while maintaining protection to personal information, such as credit card numbers and social security numbers.

First, start by teaching the end user about the dangers of using credit cards on open or wireless networks. Also teach end users about suspicious emails and not to open any attachments from an unrecognized source.

Second, look at implementing a “closed” network for sensitive data transaction. By “closed” I mean a network that is free from wireless devices and closely monitored by port-based and application-based security.

In regards to BYOD and network security, it is important to look at network



access control (NAC) solutions. Set parameters so that personal devices like laptops have the operating system and virus protection software up to a certain level. If they do not meet your organization's standard, default their connections to an Internet-based only connection so they have to update the systems before accessing your organization's network.

Another important item is to protect your organization against illegal downloading of copyright material from BitTorrent sites. By not planning for this, you can open organization up to legal ramifications.

**GREGORY:** Security policies for [user-owned] devices originally necessitated network segregation. Now, those same devices, students, and teachers want access to internally networked resources. Security policies now have to be examined to determine which internal resources are accessible and which ones remain segregated.

**JELINKOVA:** As you know, this is a rapidly developing space. Our policies evolve around data that needs to be protected and levels of access that individuals have. Granular access rights, multi-factor authentication for certain actions, auditing, outreach and education are all important levers.

**PETERSON:** I think that being out in front with federated approaches to data and identity facilitate a more open, yet safe environment where students are free to explore within boundaries that are delineated by local schools policies.

## TECHNOLOGY INSIGHT FROM CISCO

Security must be embedded in the end-to-end experience to protect end users and network assets. Security must be built in to the network fabric and work with the network to ensure consistent policy and visibility to sensitive information as it flows through the network to the end device. IT must also focus on compliance, risk management, and counter measures to protect its intellectual property and citizens. IT organizations should manage the virtual environment as they would the physical, building defensive data strategies and counter measures, and most importantly, monitoring behavior to avoid significant risk. A data breach can severely damage an institution's brand and have significant financial consequences.



### 3. Telepresence and Web conferencing technologies have opened the doors for new opportunities in collaborative learning and instruction. What are some ways schools can use these technologies to enrich the learning experience? How are you acquiring these capabilities to create a collaborative environment?

**DUHR:** We are inviting guest lecturers from around country and around the world to speak to a class or group of classes.

The implementation of devices, such as whiteboards, enables us to offer students a wide range of options. You can record a class and offer it online for students as they study. You can also offer a recorded class as an online course for a lower cost.

I firmly believe that Web conferencing, and Web hosting of classes online will be a must. I believe that in the future, online courses can constitute at least 50 percent of an organization's enrollment. Organizations such as the University of Phoenix have already proven this.

In regards to creating a collaborative environment, you need to research different vendors to find the best fit for your organization and the best value. By attending conferences, webinars and vendor product demos, you can start to obtain information on product options. From that point you can start to make choices on vendors.

Another way is to contact other schools and ask to meet with them over lunch to discuss how they are acquiring these capabilities. I have found that educational organizations IT department's personnel are very helpful and friendly when discussing experiences and thoughts on product usage.

**GREGORY:** We are now beginning to see the addition of internal Web conferencing solutions, like BigBlueButton, used for video and audio conferences to foster collaboration. It is slowly creeping into the educational environment. It is more heavily used by staff members, but is now beginning to be used in a classroom situation.

**JELINKOVA:** For us this comes most into play with our global centers and global programs, as well as with our institutes that have speakers and remote participants.

**PETERSON:** I think the most exciting technologies coming to bear — such as webRTC — enable exciting opportunities that large, expensive and cumbersome traditional enterprise technologies like telepresence cannot deliver. The Web has largely shown that inexpensive conference platforms can provide huge benefits for training, learning and collaboration. I think the challenge in K-12 is how to leverage all of this and yet keep some type of control around the environment since we are dealing with minors.

### TECHNOLOGY INSIGHT FROM CISCO

Video is changing the classroom and how information is shared and content is consumed, before, during, and after school. Distance learning, MOOCs, and flipped classrooms are just a few great examples of how videoconferencing and Web conferencing are changing the way students learn and share. For example, my daughter will complete some of her business school requirements at the University of Virginia this summer through an online program.

Content is king. Schools that can monetize their content can change the game by differentiating their institutions, curriculum, and educators; in short, expanding their revenue and reach.



#### 4. A growing number of schools are moving – or planning a move – to a hybrid cloud environment. What do campuses need to know and plan for as they develop their public-private cloud strategy?

**DUHR:** First, you need to know the total cost from the company providing the cloud service for said application or service you are planning to push into the cloud. Some companies charge a flat rate, no matter the number of clients using the cloud service. Some charge you by the number of clients. Some companies will charge you an additional bandwidth fee per client it serves. Know all the details inside and out before signing any contracts, and always have your organization’s legal team review said contracts.

It is very important to have your legal team review all contracts, especially in regards to privacy. Certain companies that offer cloud services have language in place, and they will not negotiate these terms.

Know what kind of effect this will have on your ISP bandwidth consumption. You may need to plan on increasing your bandwidth accordingly.

**GREGORY:** Security is the key to public-private cloud strategies. Ensuring that critical and private information is closely guarded will be the first issue to be addressed. The second issue to address is how to safely provide secure and reliable access to private resources through the cloud.

**JELINKOVA:** They need to understand the regulatory environment and their own risk profile and risk tolerance.

**PETERSON:** From a K-12 perspective I think hybrid cloud environments mean something vastly different than the standard industry terms. For a K-12 school “hybrid” means putting some workloads ‘out there’ and keeping others in house, largely not having many mechanisms to interface between those two worlds.

Honestly, other than a few fledgling efforts, I do not yet see an emerging mechanism for bridging a private-public strategy that is K-12 friendly. Perhaps, the most interesting and best hope might come in the form of either Azure or Openstack. Most schools are still steeped in Microsoft legacy and Openstack also provides the most open and complete road map for something that might have good integration at a technology and price point K-12 can afford.

#### TECHNOLOGY INSIGHT FROM CISCO

Hybrid clouds give IT the best of both worlds: commodity computing, when needed, and enterprise-grade computing, if required.

The key to hybrid clouds is ensuring that there is an open framework between private and public clouds, end-to-end security, and workload mobility through a unified management platform. Hybrid clouds will ultimately enable IT to federate across multiple clouds – in a secure and bidirectional fashion – while delivering the best value, innovative offerings and improved user experience.



## 5. What are the top challenges that schools face when preparing their networking infrastructure for a cloud environment? What recommendations or best practices do you have for these schools?

**DUHR:** With the rising demand of video resources you need to have an infrastructure in place to handle that traffic, at a high resolution. (It will require higher bandwidth.) It is not uncommon to see our TV department use between 40 Mbps to 50 Mbps for a single audio/video stream between our encoders and decoders on the opposite sides of the campus.

Again, in regards to cloud services, you need to keep an eye on your ISP usage and plan accordingly. We use multiple ISP feeds between two different ISP vendors at different facilities throughout the college for redundancy. We use what is known as “burstable” circuits. These circuits are set at 500 Mbps with a burst of up to 1 Gbps. We pay a flat fee for dedicated 500 Mbps and when traffic spikes, we pay an additional cost only when we go over that threshold. This enables us to have the necessary bandwidth at the ready when we need it, without having to pay the higher cost each month for a 1 Gbps circuit during the summer months when we have a smaller class load.

We are also seeing a higher usage for multicast and broadcast traffic. With that, you need to make sure that the model of switches and routers you deploy inside of your environment can handle this type of traffic. Not every model can support it.

You also need to take into consideration configuring Quality of Service (QoS) on your network. Voice over Internet protocol (VoIP) is becoming commonplace in all types of environments. You need to prioritize your traffic to make sure that your voice traffic takes presidencies over any other traffic. Otherwise, you will start to experience latency and jitter on the wire which will cause poor or no voice connection.

**GREGORY:** Simply building a robust internal infrastructure will be the greatest challenge. A large focus has been placed on adding large amounts of Internet bandwidth. The challenge for IT departments is actually delivering that bandwidth to the end user. Internet bandwidth has quickly outgrown the capacity of most wireless infrastructures. Original wireless infrastructures were designed to provide wall-to-wall coverage and were not designed for high-density and high speeds to all devices.

**JELINKOVA:** The biggest obstacle is usually around identity and access management and security practices. It is increasingly important to allow for role based access and service provisioning seamlessly on-premise and into cloud.

## TECHNOLOGY INSIGHT FROM CISCO

The top challenge for schools as they journey to the cloud (whether they’re building a cloud or consuming cloud services), is understanding the individual applications and the security and compliance requirement for all cloud capabilities, from a resource and infrastructure perspective. That said, a best practice would be to leverage the Cisco Domain Ten framework, which covers ten primary areas — domains which are critical to consider, plan for, and address as part of your data center and cloud journey. At the end of that day it’s about delivering services to any device at any location and giving the end user control and speed of consumption of IT.



**PETERSON:** I think security, and trying to make sense of the “true cost” of external cloud services is always a challenge and deciding how to economically pool their internal resources is always going to be a challenge with the landscape changing as fast as it has in the last 2-3 years.

Obviously, as personalized learning advancements drive more districts to 1-to-1 deployments, we focus on wireless that provides coverage, density and high availability in our own district. This can get pretty expensive, and it's a good idea to roll out with the 1-to-1 initiatives. There are a number of great implementations that we encourage others to copy. Get linked into a K-12 community that discusses this constantly. In Illinois that is our IL Chief Technology Officers group and Tech-Geeks, which focuses on common network issues. I highly suggest districts get connected with those state communities (as many states have specific funding opportunities), and national organizations like CoSN, etc. There doesn't seem to be a real need to recreate the wheel on this. ●