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High-Performance Technology Infrastructure for 21st Century Education

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SCENARIO

Imagine school 11 years from now: the year will be 2030. In 2030, students riding a bus to school will be identified by a sensor on the bus that reports their attendance. When they enter the school building, the radio-frequency identification (RFID) on their school badge will allow them through the door in the security vestibule and report them as being "in-school." The student's technology will automatically connect to the school's network and provide the user privileges as assigned.

The database at the end of this system will acknowledge the student's attendance and upload any outstanding homework from their 1:1 device. It will download any new assignments posted by the student's teachers, along with any emails or other communications permitted by the district network.

Once in class, the large internet-enabled screen in the front of the room will be connected to an interactive learning portal. This portal opens to an educational ecosystem with information and scenarios designed to support and extend daily instruction. It has the ability to connect to other classrooms—either locally or globally, remote research locations, museums, science labs, design studios, etc. Further, it enables student collaboration at the instructor's discretion.

As students in the class interact with the teacher and the portal, an individual learner profile of each student is continuously updated based upon questions, responses and communications from the student. The information from this profile is made available to the teacher in "real-time" during instruction. The results of each student is aggregated with that of their classmates and that information is provided formatively so the teacher may adjust instruction as needed. Daily summative reports of the class and individual students are retrievable immediately after class is concluded.

Does this sound far-fetched?

Imagine 11 years ago: specifically, June 29, 2007. The first Apple iPhone was introduced in the U.S.

Just like our scenario above, few would've believed the changes that were to come. Among the more notable changes were the following:

The iPhone:

- Created the demand for 3G or better networking
- Introduced significant security issues
- Created mobile apps and the app store
- Facilitated the spread of social media
- Made texting a phenomenon
- Made everyone a photographer who curated and shared everything
- Made hand-held GPS commonplace

Here is some specific data on just a few of these changes:

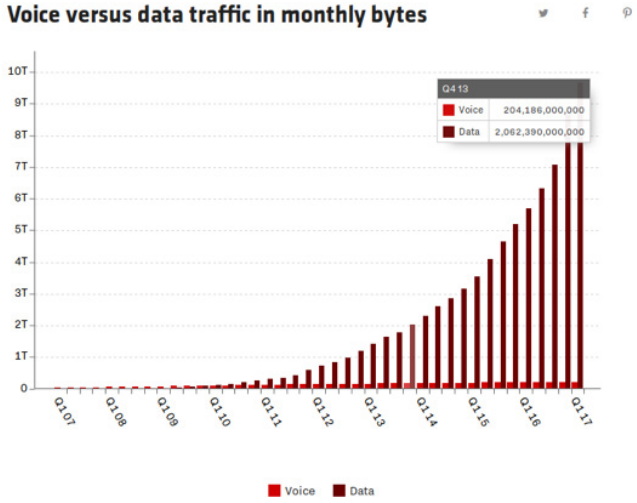

Image 1

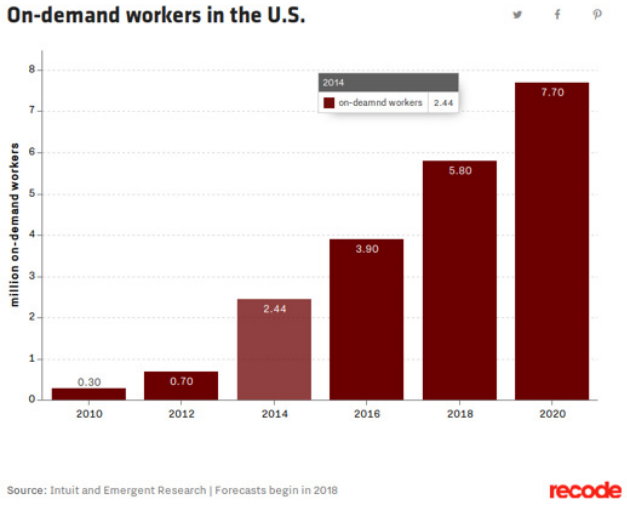

Image 2

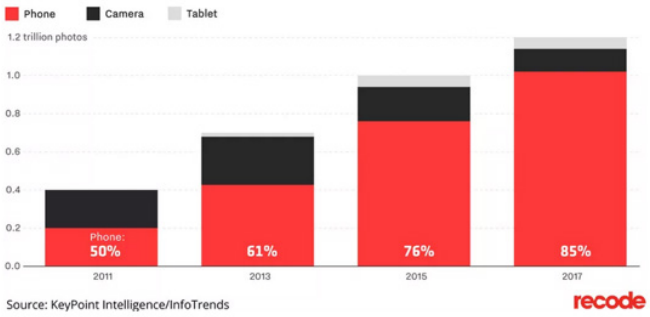

Image 3

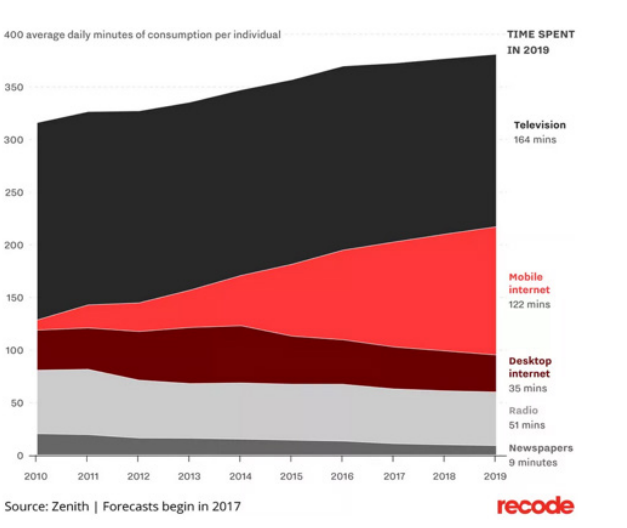

Image 4

Let's revisit the scenario on page 2. If many of the predictions in our scenario come to pass, how well is the typical district prepared to support this type of school? Is the district's technology infrastructure ready to accommodate these changes? Is the district able to "scale-up" their infrastructure to meet growing demand, evolving technologies and ensure security?

While it's impossible to predict all of the technologies that will impact education in the near future, there are a few that are on the immediate horizon. Among these are the Internet of Things (IoT), 5G networks and "big data" being applied to student learning.

THE INTERNET OF THINGS (IOT)

Image 5

The Internet of Things will connect devices and sensors throughout school buildings. This includes: security cameras, door sensors, IP-based speakers, projectors, microphones, lights, video recorders, security motion sensors and more. ***(Image 1)***

The inter-connectivity of IoT will permit instructors access to a vast array of tools and devices to augment and enhance instruction. One need only imagine being able to collect data on people moving around the school building to measure everything from organizational patterns and effectiveness, to sensors for science and mathematics for trend analysis and probability.

By automating many functions typically completed by teachers, IoT will free up time for additional instruction and learning.

5G NETWORKING

IoT will also make an impact on the speed of 5G networking, which promises new opportunities and perhaps even greater challenges. A recent article by EdTech Magazine states:

"Today's average 4G tower can support about 2,000 connections at one time. With 5G, you could support more than a million connections per square kilometer.

"5G presents a new opportunity for schools to host small cells, but also new challenges, as they will have to deal with carrier requests and a new business model," says Phil Wilson, managing director of telecommunications strategy and operations at Deloitte. "Overall, education leaders and researchers are sharing excitement for the future that 5G technology could bring, including augmented reality and virtual reality." ***(Image 2)***

So, how can schools prepare?

> *"Educational institutions should evaluate the opportunity to ditch legacy hardwired networks supporting classrooms, and the related complexity and cost," says David Hemingson, partner and leader of the higher education and academic medical center divisions at advisory firm, ISG.* ***(Image 3)***
>
> *"We have hints of what we'll see," says Ted Rappaport, professor at New York University. "Virtual meetings, 3D imaging, AR, VR. It could give us the ability to interact in a tactile way with remote objects with virtually no latency, even across great distances. 5G teaching and learning technologies are probably being developed in startups as we speak."* ***(Image 4)***

5G's promise of sophisticated distance learning, augmented and virtual reality and advanced inter-connectivity within the district and community must be planned. Districts should begin thinking about what the impact on instruction will be with 5G and how it will change communications with parents and other stakeholder groups.

BIG DATA

Infrastructure advances that will impact teaching and learning are not limited to IoT and 5G networking. "Big data" is a driving force for innovation in the private sector, and many educational software vendors are investing heavily so they can bring it to K-12.

So, what is big data?

Google defines big data as: *"extremely large data sets that may be analyzed computationally to reveal patterns, trends, and associations, especially relating to human behavior and interactions."*

In education, big data will power the analysis of learners in "real-time" as instruction is occurring. This analysis provides instantaneous feedback to teachers for individual students as well as customizable student groups. The data can be presented both formatively and in summation.

Having this level of analytical power at an instructor's finger tips is unprecedented. But to make it available, data centers must have computing power capable of running large, sophisticated databases. These databases must also mine vast amounts of data from individual student end-users. That student user data is entered into large algorithms, which feed the data back to school buildings for use by teachers and administrators. For this to work, districts must have high-speed networks with the necessary bandwidth widely available throughout schools buildings and to the Internet backbone.

These big data centers will be located in Information Technology Centers (ITCs) like NEOnet, or higher up the Cloud at locations like Amazon Web Services. Connecting to them will pressure districts to increase bandwidth to these providers in order to support this large bi-directional traffic.

WHERE TO BEGIN?

There are several places educators can go to help them plan for this future. One place to start is the K-12 Technology Infrastructure Blueprint, available at www.k12blueprint.com. From their website:

> "The K-12 Blueprint offers resources for education leaders involved in planning and implementing technology initiatives. Whether you are launching a one-to-one or BYO program, moving from print textbooks to digital content, revamping the curriculum to improve STEM learning, rethinking assessment, or embarking on (or continuing to support) any other ambitious technology-supported initiative, the K-12 Blueprint model can help." ***(Image 5)***

Another great resource can be found in EdTech Magazines, July 2018 article, "K-12 Districts Prepare Their Infrastructures for the Internet of Things."

Finally, your local ITC should be able to provide you with the information and assistance you need to make informed decisions as well as actual products and services to meet the demands of these new technologies. To that end, NEOnet has a team highly-skilled in IoT infrastructure planning, design, installation and support. They are also well-versed in the latest security requirements to keep the system up and running. Additionally, they have many years of experience designing and deploying high-bandwidth, fault-tolerant data networks.

2019 NEOTech CONFERENCE
10TH ANNIVERSARY
Northeast Ohio Educational Technology Integration Conference

Did You Know?

The **FREE 2019 NEOTech Conference** has over 120 unique sessions being offered to discover the latest technology innovations for your classroom!

Some topics that will be covered throughout these sessions include:

- Artificial Intelligence (AI)
- STEAM
- STEM
- ELA Instruction
- Avoiding Fake News
- Science Tools
- Mathematics Tools
- Video Creation
- Green Screen Technology
- Global Learning
- Adobe Spark
- Professional Development
- Coding
- Google Documents
- Google Add-ons
- Google Certifications
- Conflict Resolution
- Chromebooks
- Makerspaces
- Aquaponics
- Cybersecurity
- Data Analytics
- Escape Rooms
- Robotics
- And more!

Wednesday, March 6
8:30 a.m. - 3:30 p.m.

Thursday, March 7
8:30 a.m. - 3:30 p.m.

Huntington Convention Center of Cleveland

300 Lakeside Ave. E
Cleveland, OH 44113

For a full list of sessions and to register, please visit **neotechconference.org**.

ENDNOTES

Image 1 **How Apple's iPhone changed the world: 10 years in 10 charts:** https://www.recode.net/2017/6/26/15821652/iphone-apple-10-year-anniversary-launch-mobile-stats-smart-phone-steve-jobs
Image 2 Ibid.
Image 3 Ibid.
Image 4 Ibid.
Image 5 **The Internet of Things for Education: A Brief Guide** https://www.cse-net.co.uk/the-internet-of-things-a-brief-guide/
(1) **IoT Powers Up the Connected K–12 Schools of the Future** https://edtechmagazine.com/k12/article/2017/11/iot-powers-connected-k-12-schools-future
(2) **K–12 Districts Prepare Their Infrastructures for the Internet of Things** https://edtechmagazine.com/k12/article/2018/08/k-12-districts-prepare-their-infrastructures-internet-things
(3) **Is K–12 Education Ready for 5G?**
(4) Ibid https://edtechmagazine.com/k12/article/2018/10/k-12-education-ready-5g
(5) **K-12 Technology Infrastructure Blueprint** https://www.k12blueprint.com/

ADDITIONAL RESOURCES:

CoSN Cybersecurity Planning Rubric
https://cosn.org/download-cybersecurity-planning-rubric

Top 5 Cybersecurity Threats for Schools
https://cosn.org/sites/default/files/Top%205%20Cybersecurity%20Threats.pdf

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