THE FUTURE OF LEARNING SPACE

St. Cloud School District 742

Mark S. Valenti, CTS
President
THE SEXTANT GROUP, INC.
February 28, 2017
AGENDA

Introduction and Overview                      St. Cloud / Leapaldt
Presentation: The Future of Learning Space      Valenti
Pizza!
Discussion: Technology Trends                   Full Group
  • Personal Communications
  • Computing
  • Digital Media
  • Networking
  • Other
Discussion: Teaching and Learning Trends        Full Group
  • Collaboration
  • Active Learning
  • Blended Learning
  • Other
Break
A Future Scenario: St. Cloud 2025              Break-Out Groups
Report and Review                               Valenti
Next Steps and Concluding Remarks               Leapaldt / St. Cloud
“The future, according to some scientists, will be exactly like the past, only far more expensive.”

John Sladek
FUTURE-PROOFING

AV Displays & System Software
2-3 Years

AV/IT Electronics
3-5 Years

AV/IT Servers
5-7 Years

Infrastructure (Cableways, Cable & Connectors)
15-20 Years

LIFE EXPECTANCY
FIRST COST/ONGOING COST
CROSSING THE CHASM

- Innovators (~2.5%)
- Early Adopters (~13.5%)
- Early Majority (~34%)
- Late Majority (~34%)
- Laggards (~16%)
BANDWIDTH, THE 4TH UTILITY

- **Copper Cable**
  - Performance gains with copper continue to be realized
  - 100 Mb / 1 Gb / 10 Gb / 80Gb

- **Optical Fiber**
  - 12% annual growth for Fiber through 2025
  - Strong demand for advanced IT and emerging multimedia services
BANDWIDTH, THE 4TH UTILITY

“Fiber to the Home” (FTTH)

Passive Optical Network (PON)
BANDWIDTH, THE 4TH UTILITY

Evolution of Access Line Rates

- Peak Downstream Rates
- Peak Upstream Rates
- Average US BW

Bit Rate per Subscriber

- 100 Gbps
- 10 Gbps
- 1 Gbps
- 100 Mbps
- 10 Mbps
- 1 Mbps
- 100 kbps
- 10 kbps
- 1 kbps

10x growth per 5-6 years

10-100x
BANDWIDTH, THE 4TH UTILITY

Growth: Linear vs. Exponential

Linear Plot

Knee of Curve
GOOGLE FIBER

A different kind of Internet.

Google Fiber starts with a connection speed 100 times faster than today’s broadband. Instant downloads. Crystal clear high-definition TV. And online video speeds.

It’s not cable. And it’s not just Internet. It’s Google Fiber.

CHOOSE PLAN NOW

Gigabit + TV
$1,200/mo
$300 upfront construction fee

Gigabit Internet
$70/mo

Free Internet
$50/mo
1,000 monthly credits (see area for details)

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GOOGLE FIBER

Current Fiber city  Upcoming Fiber city  Potential Fiber city  Current Webpass city
Serving apartments & condos only

FULL CITY LIST
IT’S NOT JUST GOOGLE

Celebrating America’s gigabit cities

Data source: www.telecompetitor.com
BANDWIDTH, THE 4TH UTILITY

- Wireless LAN (Wi-Fi)
- Bluetooth, NFC, RFID, DAS
- Zigbee, Thread, Li-Fi and more
- The era of “Personal Broadband” is upon us
YOUR PERSONAL AREA NETWORK
LI-FI APPLICATIONS

https://www.ted.com/talks/harald_haas_wireless_data_from_every_light_bulb?language=en
DIGITAL ANTENNA SYSTEM

Approximately 80% of wireless calls happen indoors.

In-building networks are key to delivering 4G data speeds.

© Corning Incorporated 2011
CLOUD COMPUTING

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amazon.com

Dear Customers,

Managing a digital music collection is a bit of a mess. It’s possible to buy music from your phone, but then it might get stuck there. It’s possible to buy music from your work computer, but then you have to remember to transfer it to your home computer. Most people just wait until they get home and then purchase from there. What’s more, if you’re not regularly backing up your music collection, you can lose it with a disk drive crash.

We’re solving those problems today with two important new offerings: Amazon Cloud Drive and Amazon Cloud Player. Cloud Drive is your personal digital drive in the cloud. Anything you put in Cloud Drive is endlessly stored in Amazon’s servers. You can upload your music collection to Cloud Drive, as well as any other digital documents.

Cloud Player: listen in two sessions: Web and Android. All you need is one browser with a web browser and you can listen to your music with Cloud Player for Web — no software to install — just a web browser. The Android version is an app that lets you do the same thing from your Android phone or tablet.

Combined, these services allow you to store your music worry-free in the cloud and enjoy it anytime. Whether you already have 50 million songs in your Amazon MP3 Store, you’ll soon see a new option to store your purchase directly into your Cloud Drive.

To start, we’re giving you 5 GB of free Cloud Drive storage. Plus, new purchases from the Amazon MP3 Store are stored for free and do not count against your storage quota.

We’re excited to offer you the ability to buy anywhere, play anywhere, and keep your music in one place.

Enjoy and happy listening,

Jeff Bezos
Founder & CEO
APPs > MUSIC

iTunes Download Totals by Medium

- Songs downloaded
- Apps downloaded Billion

© asymco.com
FROM CAMPUS TO "THE CLOUD"

Source: Richard Katz, Educause
Unlike the current World Wide Web, the “Great Global Grid” will be primarily a visual medium.

—Michael Malone
“Internet II: Re-booting America”
THE INTERNET TODAY

Fixed Network Traffic - United States

- Everything Else: 3.3%
- Software Updates: 7.0%
- Social Networking/Media: 7.9%
- Gaming: 8.5%
- Bulk Entertainment: 7.9%
- Secure Tunneling: 8.5%
- Real-Time Communications: 64.0%
- Storage and Back-Up: 64.0%
- P2P Filesharing: 64.0%
- Web Browsing: 64.0%
- Real-Time Entertainment: 64.0%

Exabytes per Year

- 2009: 29.5%
- 2010: 42.7%
- 2011: 53.6%
- 2012: 54.3%
- 2013e: 57.7%
- 2014e: 60.8%
- 2015e: 62.6%
- 2017e: 64.0%
THE NEW INTERNET

Netflix is often reported as generating over 30% of the evening Internet traffic. YouTube, Hulu, Amazon Fire TV, Twitch and Roku likewise place huge demands on the Internet infrastructure.
ANALOG SUNSET

2.2.2.2 ANALOG SUNSET – No Licensed Player that passes Decrypted AACS Content to analog video outputs may be manufactured or sold by Adopter after December 31, 2013.

AV & IT CONVERGENCE

Uncompressed HD Multimedia Distribution

5Play™ convergence via a 100m/328ft CAT5e LAN cable
ULTRA HI-DEF VIDEO (UHD) AKA "4K"

- HD576i (720x480)
- HD720p (1280x720)
- HDTV 1080p (1920x1080)
- Digital Cinema - 2K (2048x1080)
- Digital Cinema - 4K (4096x2160)
- RED Digital Cinema - 2540p (4520x2540p)

Super Hi-Vision / Ultra High Definition Video (7680 x 4320)
OLED DISPLAYS
FLEXIBLE OLED DISPLAYS

From LG, only .97 mm thick, it peels off its magnetic backing...
FLEXIBLE OLED DISPLAYS
LARGE SCREEN DISPLAYS
FLEXIBLE LED DISPLAYS
MULTI-TOUCH ‘SMART’ DISPLAYS
MULTI-TOUCH ‘SMART’ WINDOW
OLED MIRROR
LASER PANEL / TOUCH SCREEN
BUILDING BLOCK DISPLAYS

Christie Microtiles
COLLABORATION
Screen Sharing to Group Interaction
DIGITAL IN AN ANALOG WORLD
COLLABORATION TOOLS

GROUP PRESENTATION

One device presenting on display
All content is generated on one device
  • Hard-wired directly to a wall or table connection point
Content can come from one to many wired devices
Content displayed one at a time, or in a split screen fashion
Examples: Crestron, AMX, Extron digital media switching
COLLABORATION TOOLS

GROUP WIRELESS SHARING

Multiple devices presenting independently on display wirelessly
Content can come from one to six devices
Content displayed one at a time, or in a split screen fashion
Examples: Mersive Solstice Pod; wePresent 2000, etc.
COLLABORATION TOOLS

GROUP WIRELESS COLLABORATION

Multiple users collaborating on a single screen on a common document; Content can come from many different devices; saved to the cloud
Examples: TideBreak “Teamspot”, Kramer “Collab8”
COLLABORATION SPACE

University of Texas Southwestern Medical Center TBL Classroom
THE COLLABORATION ANALOG
MULTI-SCREEN VISUALIZATION

Image: Oblong Mezzanine
MULTI-TOUCH VISUALIZATION

Image: Multitaction
MULTI-TOUCH VISUALIZATION

Image: BlueScape
NUREVA “SPAN”
INTERACTIVE TABLES
SERIOUS GAMING
OCULUS RIFT
OCULUS RIFT

UNFORESEEN PROBLEMS WITH OCULUS RIFT: NO. 328

EXTRALIFE • MYEXTRALIFE.COM

BY SCOTT JOHNSON • ©2013 ALL RIGHTS RESERVED
“Our goal is to make virtual communication even better than real-world communication,” Luckey said. “VR is the only thing that will get us there.”

The time is coming when, if someone says “let’s meet,” everyone will know that means let’s meet in VR. The default mode of VR is “together.”

-Palmer Luckey

Founder of Oculus Rift
GARTNER TECHNOLOGY HYPE CURVE
This “Digital Refrigerator” tracks its contents, automatically orders groceries, and provides recipes based on what’s inside.

( It’ll also provide news, sports, and weather! )
A WORLD OF SENSORS

30 BILLION
Sensor enabled objects connected to networks by 2020

212 BILLION
Total number of available sensor enabled objects by 2020

212B is 28x the total population of the world
MESH SCALABILITY

ecoNet
Multi Mesh Smart Grid Cell

KEY
- ecoNet gateways
- ZigBee end devices
THE LIGHTING REVOLUTION

Power over Ethernet (PoE) meets Light-Emitting Diode (LED)
PEDAGOGICAL TRANSFORMATION
“Paradigm shifts come when technologies are disruptive to the status quo. On this basis, it is safe to conclude that technology has thus far not produced a paradigm shift in education.”

- David Thronburg
  The Thronburg Institute
TRANSFORMATION ?
REAL TRANSFORMATION
THE DILEMMA

We are currently preparing students for jobs that don’t yet exist, that will use technologies that have yet to be invented, to solve problems we don’t even know are problems yet.

- Karl Fisch
   Shift Happens
   2008
THE CHALLENGE

*Five years from now you’ll be able to find the best lectures in the world on the Web for free…*

*So… place-based learning will be five times less important than it is today.*

- Bill Gates
Microsoft
2010
LEARNING ANYWHERE

Worldwide networked learning will replace place-bound teaching.

- Dolence and Norris
  Transforming Higher Education: A Vision For Learning in the 21st Century
  1995
INFORMATION EVERYWHERE

The university as mainframe will be replaced by the university as network.

– Don Tapscott
Growing Up Digital
1996
TRENDS IN PEDAGOGY

Traditional Pedagogy
- Teacher-centered instruction
- Single sense stimulation
- Single path progression
- Single media
- Isolated work
- Information delivery
- Passive learning
- Factual, knowledge-based
- Literal thinking
- Reactive response
- Isolated, artificial context

Contemporary Pedagogy
- Student-centered instruction
- Multi-sensory stimulation
- Multi-path progression
- Multimedia intensive
- Collaborative work groups
- Student-centered activities
- Active/exploratory learning
- Inquiry-based learning
- Information exchange
- Proactive/planned action
- Authentic, real-world context

The National Educational Technology Standards (NETS) Project is an International Society for Technology in Education initiative.
The “T-Shaped Student”

© 2015 IBM & Michigan State University
Designing for the T-Shaped Student
THE iGEN STUDENT

- Always On, Connected
- Active, Social & Visual
- Expect Full & Immediate Access to Media and Information
- Creates & Consumes Media
- Visual, Multi-sensory
- Connect Living & Learning
- Technology Is Cool
- Prefer Authenticity to Hype
- Want To Collaborate
- Global Thinkers; Connected to Others, World-wide
FLIPPING THE CLASSROOM

“We’re flipping the classroom… what used to be class activity is now homework and what used to be homework is now class time.”

- Salman Khan, Khan Academy
I will not flip the classroom upside down.
I will not flip the classroom upside down.
I will not flip the classroom upside down.
THE EMERGING ENVIRONMENT

- Learners have almost unlimited access to content, tools, resources, faculty, experts
- Unbundling of educational activities
- Importance of “the collective” is growing
- New “active learning” models gaining adoption

Diana G. Oblinger, PhD
President, Educause
THE ROOM IS AN I/O DEVICE...
THE LEARNING PYRAMID

Edgar Dale’s original “Cone of Experience” (1946)
THE LEARNING PYRAMID

10% of what we READ

20% of what we HEAR

30% of what we SEE

50% of what we both HEAR and SEE

70% of what we SAY

90% of what we both SAY and DO
THE LEARNING PYRAMID

10% of what we **READ**

20% of what we **HEAR**

30% of what we **SEE**

50% of what we both **HEAR and SEE**

70% of what we **SAY**

90% of what we both **SAY and DO**

- Reading
- Hearing Words
- Watching a Demonstration
- Seeing it Done on Location
- Participating in a Discussion
- Giving a Talk
- Doing a Dramatic Presentation
- Simulating a Real Experience
- DOING THE REAL THING!!!

- Looking at Pictures
- Watching a Movie
- Looking at an Exhibit
THE LEARNING PYRAMID

10% of what we **READ**

20% of what we **HEAR**

30% of what we **SEE**

50% of what we both **HEAR and SEE**

70% of what we **SAY**

90% of what we both **SAY and DO**

- **Participating in a Discussion**
- **Giving a Talk**
- **Doing a Dramatic Presentation**
- **Simulating a Real Experience**
- **DOING THE REAL THING!!!
ST. VINCENT COLLEGE

Library Addition
Digital Lounge, 1996
WESTMINSTER COLLEGE

Student Union, 2000
COLLABORATION
UNIVERSITY OF MINNESOTA
UMKC BLOCH HALL
FOR INNOVATION & ENTREPRENEURSHIP
UNIVERSITY OF MICHIGAN
PRESENTATION PRACTICE & RECORD
NEXT GEN ON-LINE INSTRUCTION

Northwestern University
LIGHT BOARD
## ANALYTICS

### Expand All - Collapse All

#### Addition and subtraction

<table>
<thead>
<tr>
<th>Operation</th>
<th>Points</th>
<th>Struggling</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-digit addition</td>
<td>22</td>
<td></td>
</tr>
<tr>
<td>1-digit subtraction</td>
<td>21</td>
<td></td>
</tr>
<tr>
<td>2 and 3-digit subtraction</td>
<td>19</td>
<td></td>
</tr>
<tr>
<td>2-digit addition</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>4-digit addition with carrying</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>4-digit subtraction with carrying</td>
<td>15</td>
<td></td>
</tr>
</tbody>
</table>

**Scored by:**
- Ashley McCaul
- Annette
- Ayala
- Craig Shiload
- Janis Tobin
- Joshua Netter...

**Scored by:**
- Phil Hineski
- Ben Albert
- Ben Gable
- Ben Kierans
- Ben Kranlo
- Etana
- Jessica
- Jacob Spruila
- Jessica
- Jared Sutula

### Angles and intersecting lines

<table>
<thead>
<tr>
<th>Type</th>
<th>Points</th>
<th>Struggling</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alternate interior angles 1</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>Alternate interior angles 2</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>Angle addition postulate</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Angle types</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>Angles 1</td>
<td>15</td>
<td></td>
</tr>
</tbody>
</table>

**Scored by:**
- Phil Hineski
- Ben Albert
- Ben Kierans
- Ben Kranlo
- Etana
- Jacob Spruila
- Jessica

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- Phil Hineski
- Ben Albert
- Ben Kierans
- Ben Kranlo
- Etana
- Jacob Spruila
- Jessica
ADAPTIVE LEARNING

Adaptive Learning for Organizations
Power smart, scalable training and assessments with Knewton’s open platform.
ADAPTIVE LEARNING

Irene Bloom, lecturer in math at Arizona State U., shows off Knewton, adaptive-learning software that gives students immediate feedback based on what they've learned.

<table>
<thead>
<tr>
<th>ASU Remedial Math</th>
<th>Fall '09-Spring '11</th>
<th>Fall '11-Spring '12 (with Knewton)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pass Rates</td>
<td>64%</td>
<td>75%</td>
</tr>
<tr>
<td>Withdrawal Rates</td>
<td>16%</td>
<td>7%</td>
</tr>
<tr>
<td>Students Finishing Early</td>
<td>n/a</td>
<td>45%</td>
</tr>
</tbody>
</table>
ARTIFICIAL INTELLIGENCE

- By 2029, sufficient computation to simulate the entire human brain, which I estimate at about $10^{16}$ (10 million billion) calculations per second (cps), will cost about a dollar.

- Ray Kurzweil, Foreword to “The Intelligent Universe” by James Gardner
KURZWEIL’S SINGULARITY

Moore’s Law
The Fifth Paradigm

Exponential Growth of Computing
Twentieth through twenty first century

Calculations per Second per $1,000

Year
2019?

This is Watson
MOST IMPORTANT TECHNOLOGY TRENDS

Virtual Reality
Flexible Collaborative Spaces
   Inside the class period
Artificial Intelligence
Active Learning & Collaboration Tools (2)
Learning Analytics
Infrastructure (2)
Connected
MOST IMPORTANT PEDAGOGICAL TRENDS

- Multi-modal learning options
- Multi-modal assessment
- Teacher as facilitator (2)
- Problem-based learning (comfort zone for teachers)
- Smaller class size (no. of students)
- Prepare for disruption
- Flipping the band
- Moderate and balance the use of technology
  - Maintain the human interaction
AND THE ANSWER IS...

Ohio State University 1906
Architectural History Class
Kerosene-fired projector with glass slides
THANKS!

Mark S. Valenti  
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