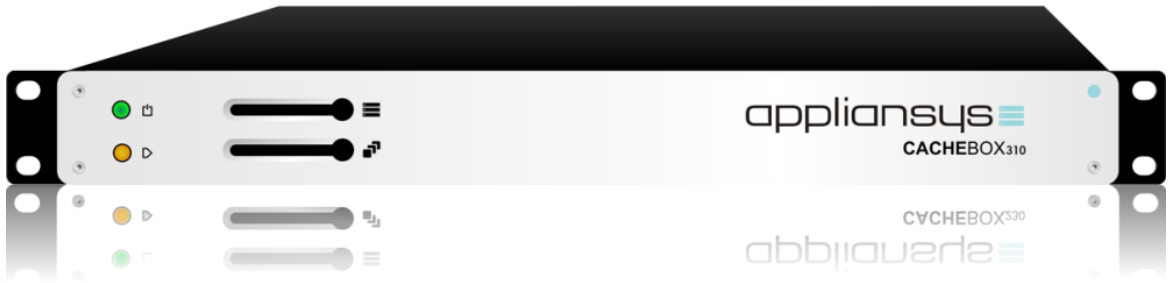
Connectivity Efficiency Strategies are delivering sustainable, equitable, accelerated digital transformation – Partner2Connect pledge progress report



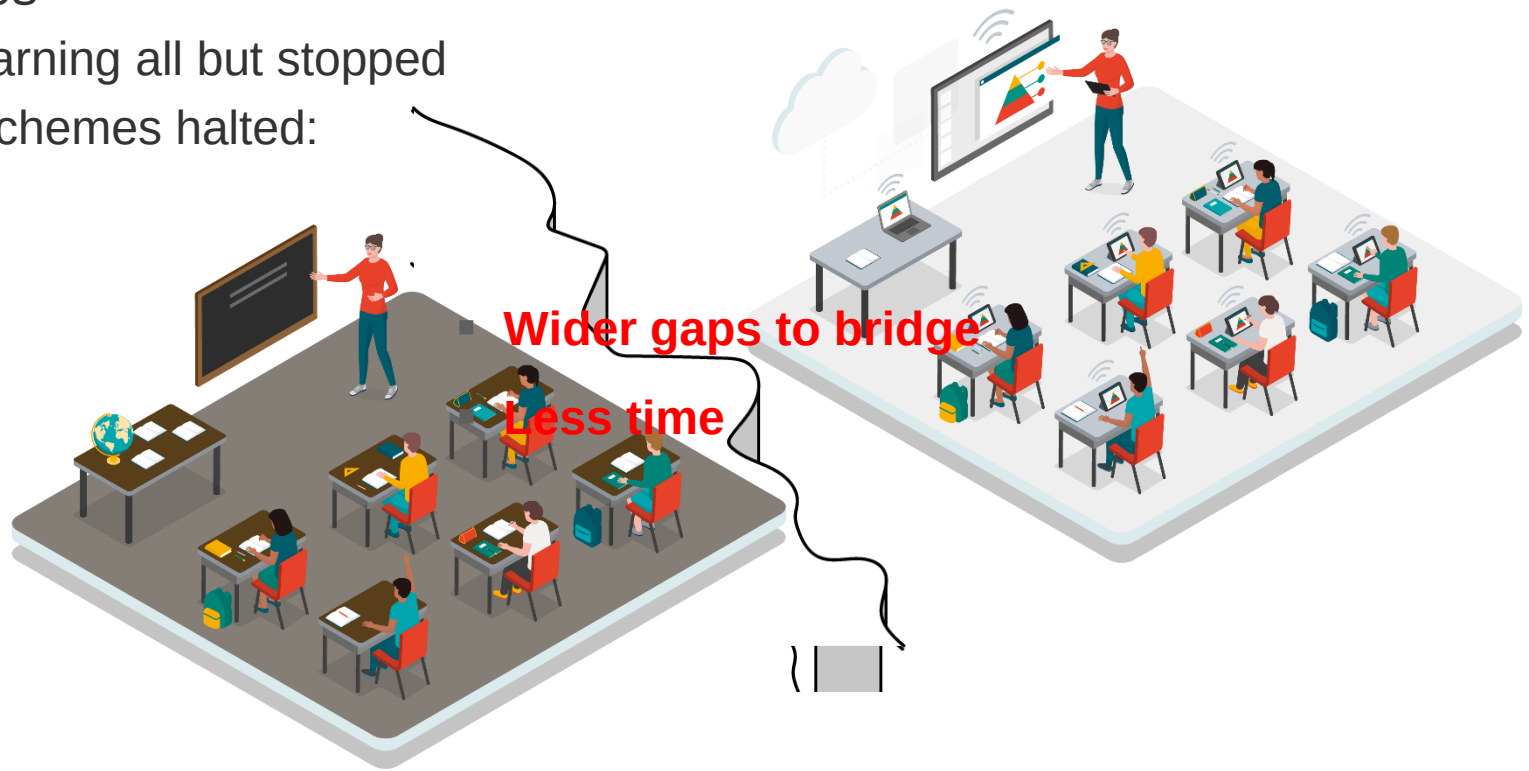
The world has changed…

- 2030’s global vision conceived before the pandemic
  - 10-year long trajectories made sense
- Impact of the pandemic
  - Online activity evolved at unpredicted rates
  - Systemic change in how we communicate, work, and learn
- Both
  - The urgency for digital in Education multiplied
  - Digitalisation of the workplace accelerated

The world has changed…

We must rethink connectivity, NOW!

- Developed nations
  - Responded instantly
  - Broadened reach of digital learning…
- Less developed countries
  - Unable to respond - learning all but stopped
  - National connectivity schemes halted:



Enabling Accelerated Digital Transformation in Under-Served Schools

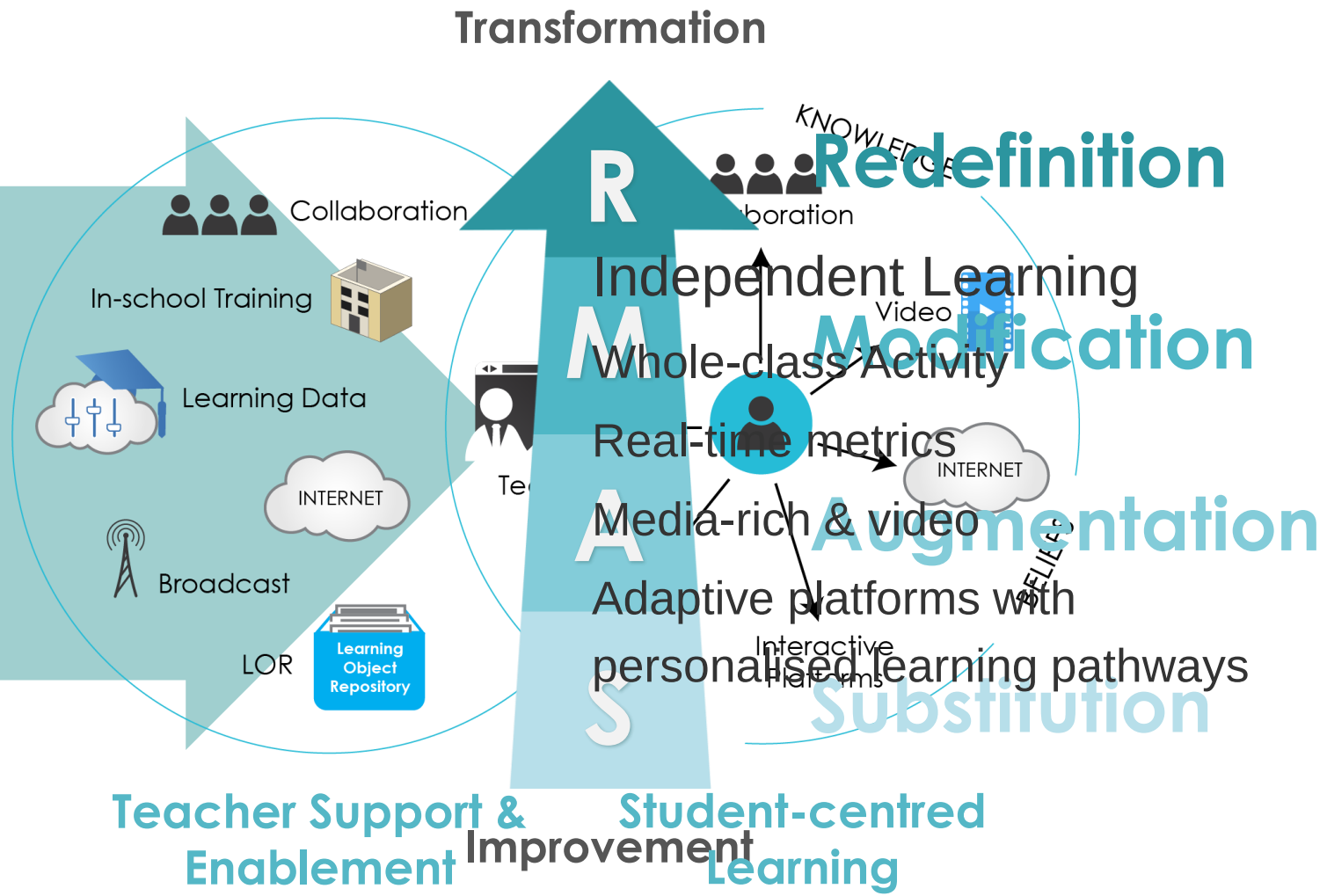
Effective Access

Narrows the skills gap

21st Century skills

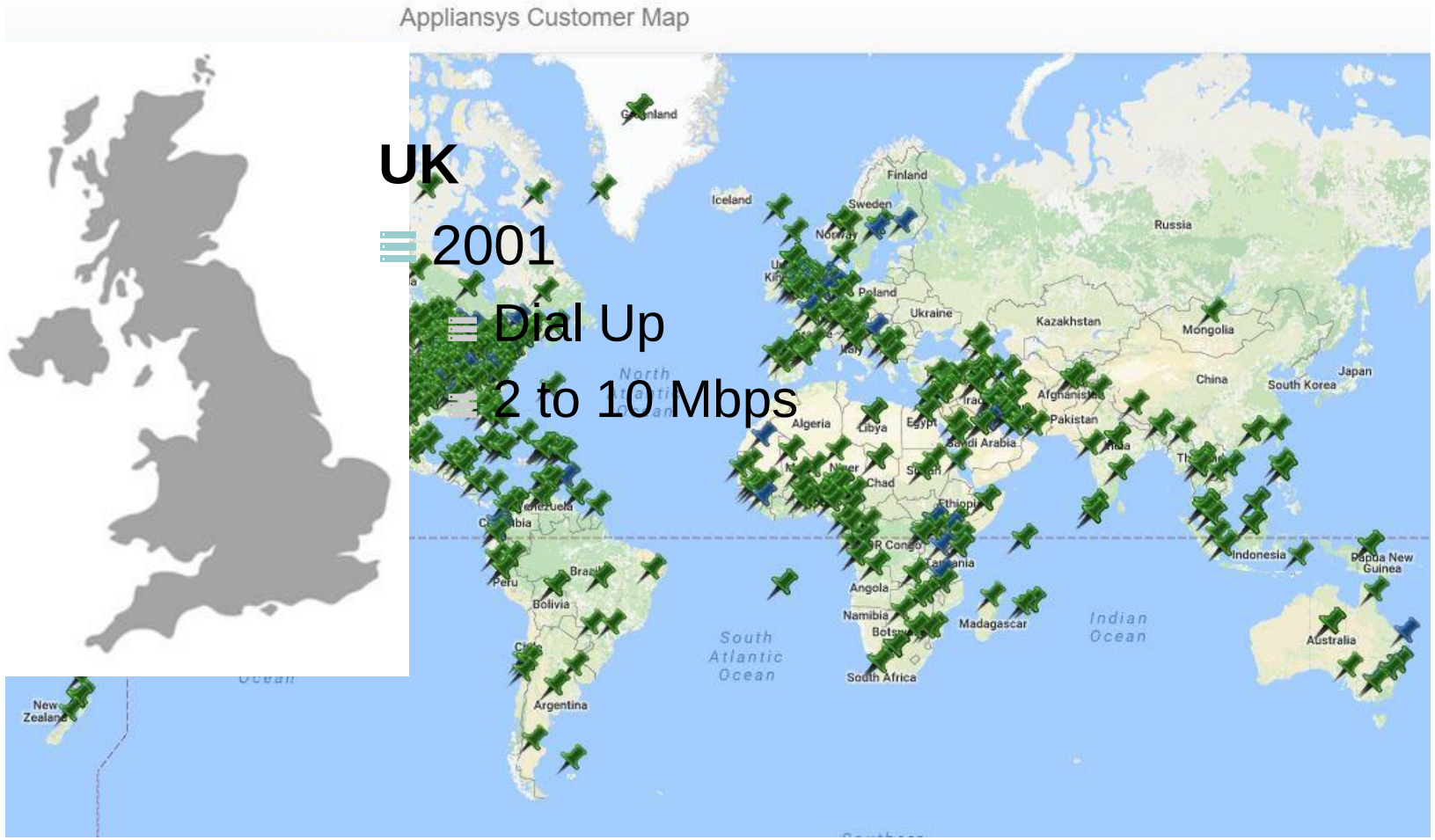
Bridging digital

& educational divides



The SAMR Model, Dr. Ruben R. Puentedura (2013)

20 years – a unique insight – schools connectivity & traffic profiles



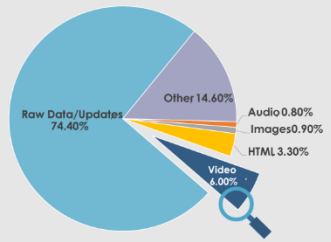
160 countries

- Unique visibility
  - Trends
  - Successes/failures
  - **Data**

20 years data, accumulated from 160 countries, 130million lessons/year

School Internet Traffic

Traffic type breakdown

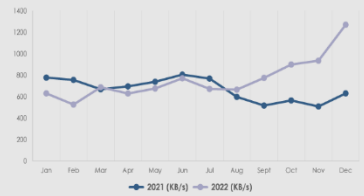


AppliantSys around the world
Heat map

applisys

Data from
129,953,040
lessons
per year

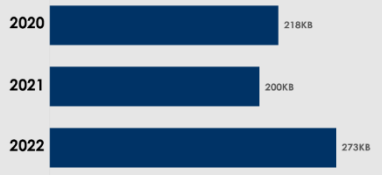
Direct Access Speed



Day Traffic Peaks

– School network in Alaska, US, 50Mbps connection, 420 students

Average Object Size per Year



– School network in Missouri, US, 300Mbps connection, 866 students

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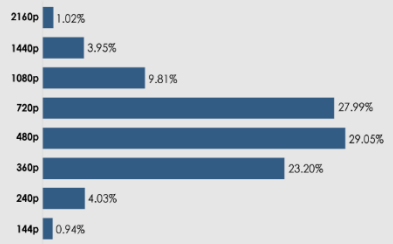
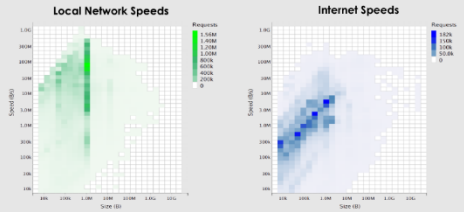
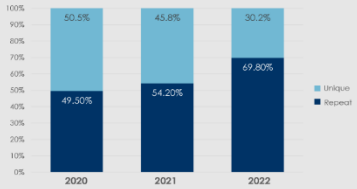


Speed Distribution by Size
Heat Map



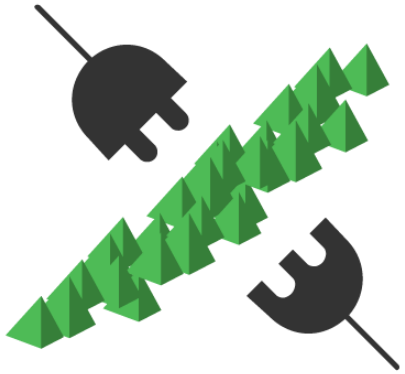
– School network in Louisiana, US, 25Gbps connection, 37,143 students

Volume of Repeat Requests per Year



– School network in New Mexico, US, 2Gbps connection, 7,834 Students

The Connectivity Problem for Schools



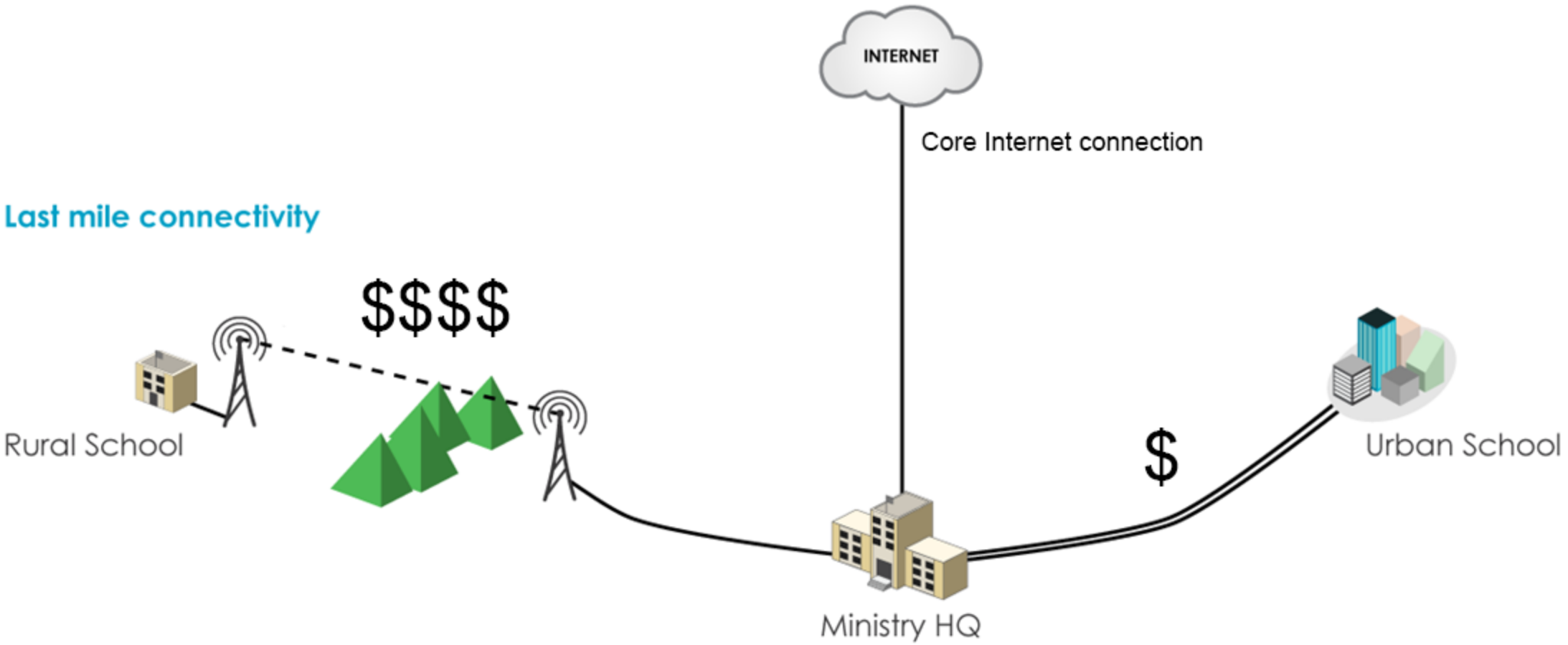
Rural/economic digital divide

Ever-increasing costs

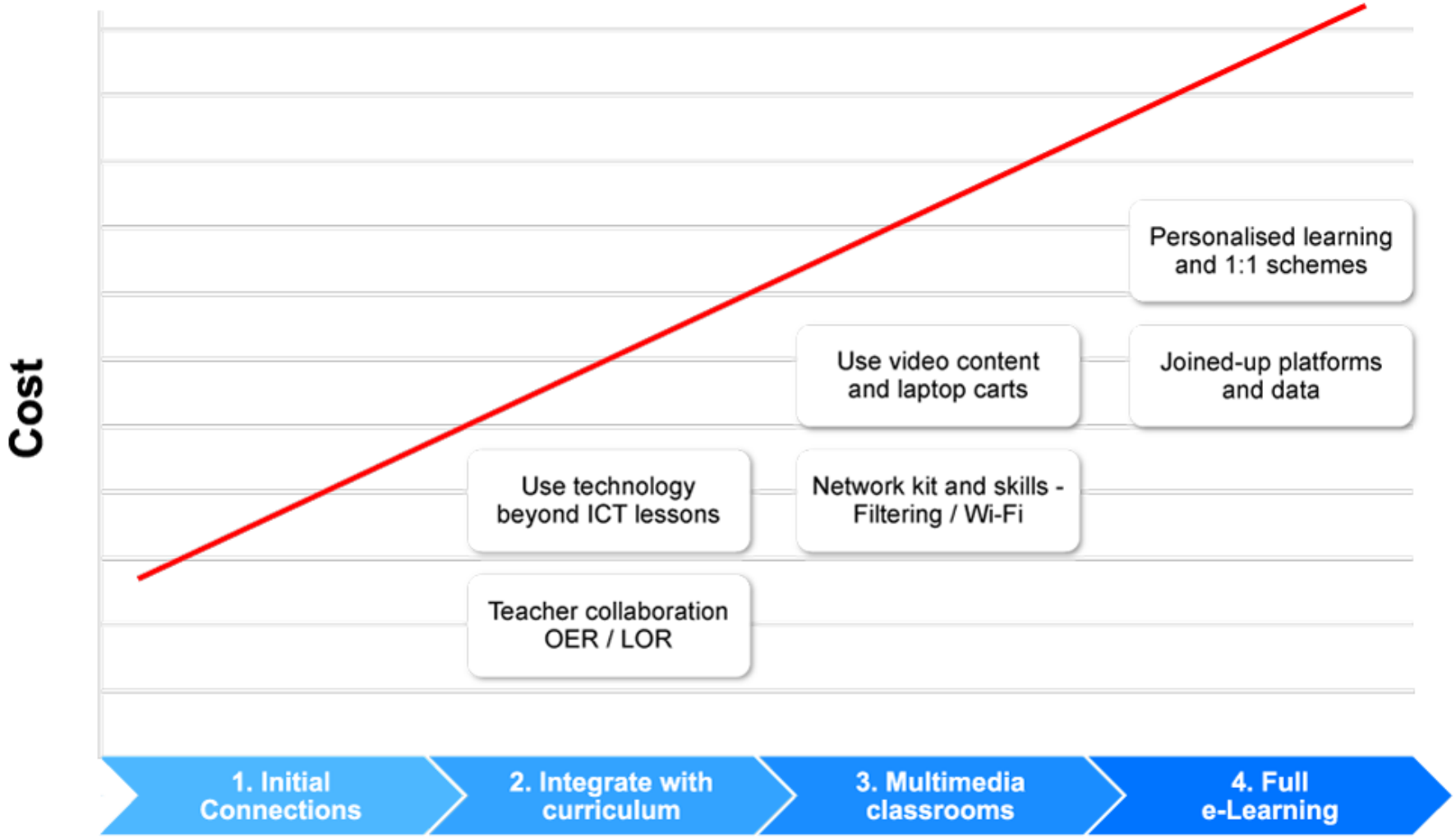
Poor bandwidth ROI

THE CONNECTIVITY PROBLEM

Inclusion, equitable access, availability, cost, rural lag



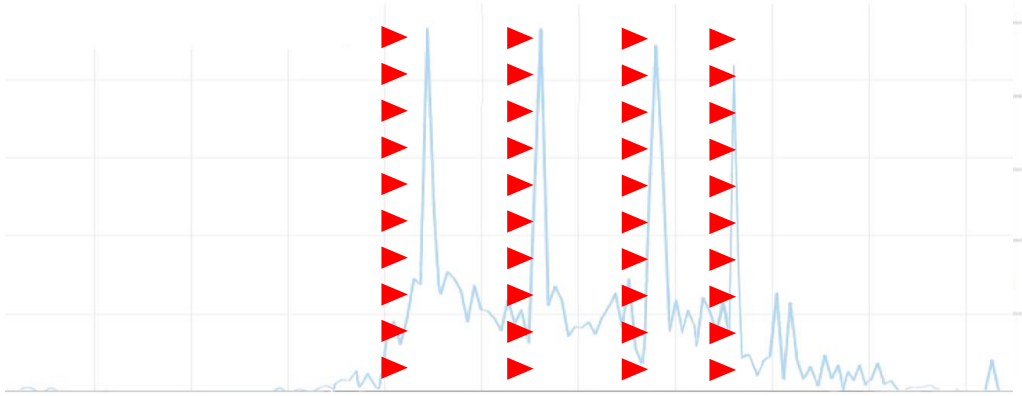
Ever-increasing cost along the e-learning journey - sustainability



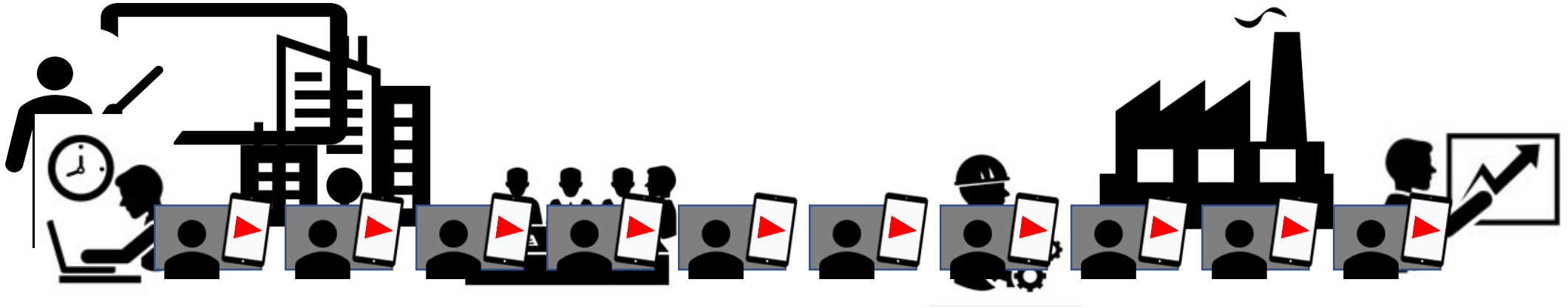
Schools internet traffic vs non-schools internet traffic

Schools

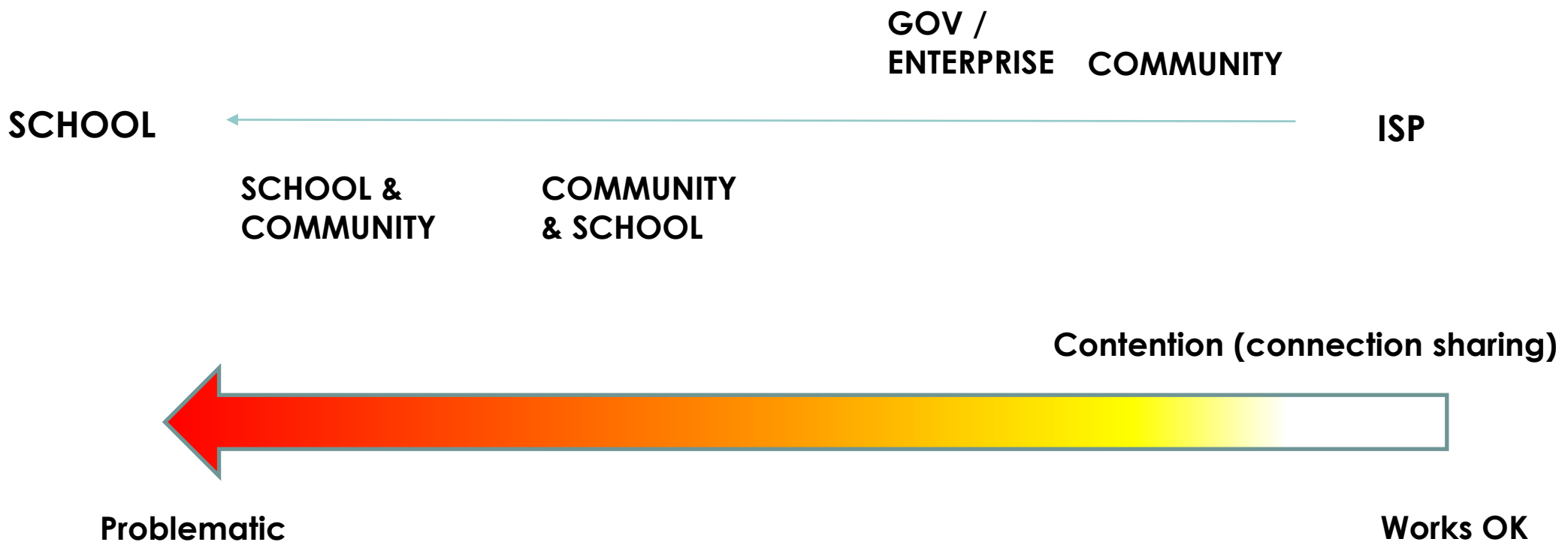
Other industries



Typical day – hour by hour

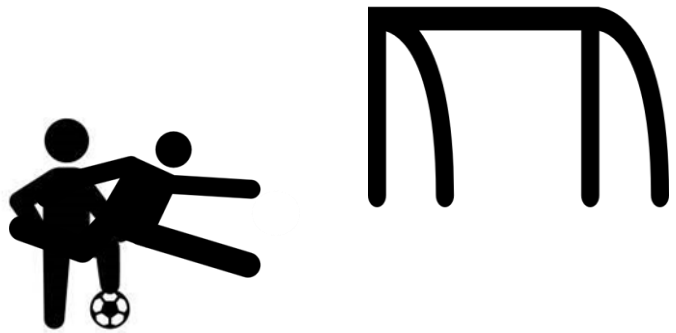


Contended (shared) connectivity issues by use-case



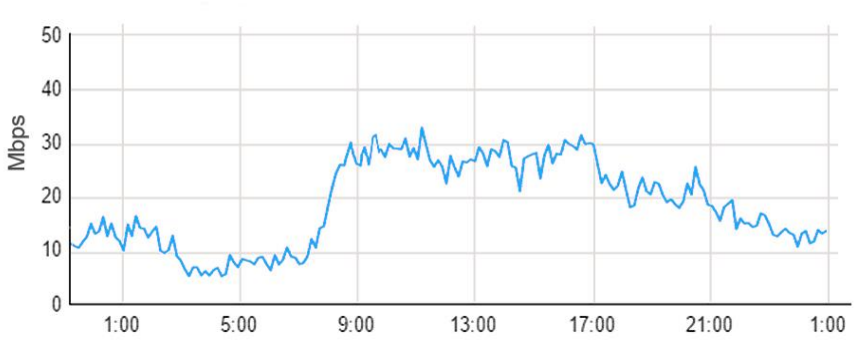
Contended (shared) connections don’t work in schools

One pair = One player at a time



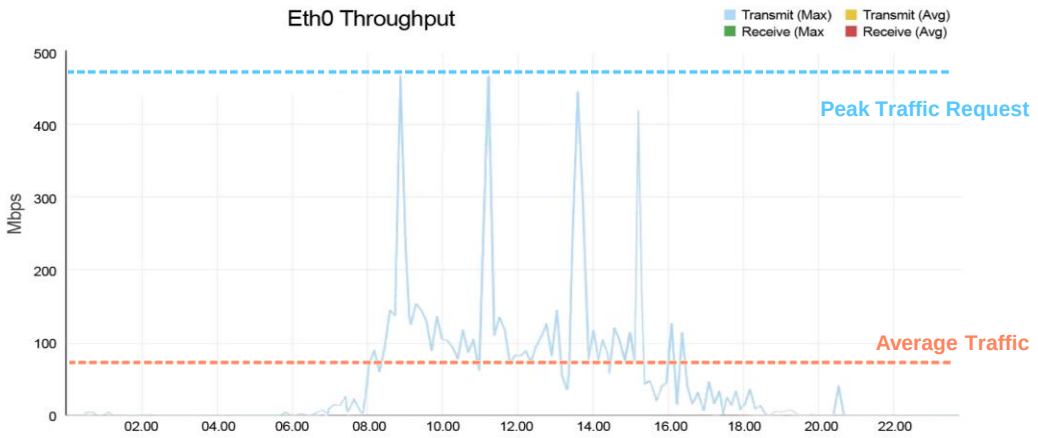
A pair each = Play real football

T&L: inherently INEFFICIENT network utilisation



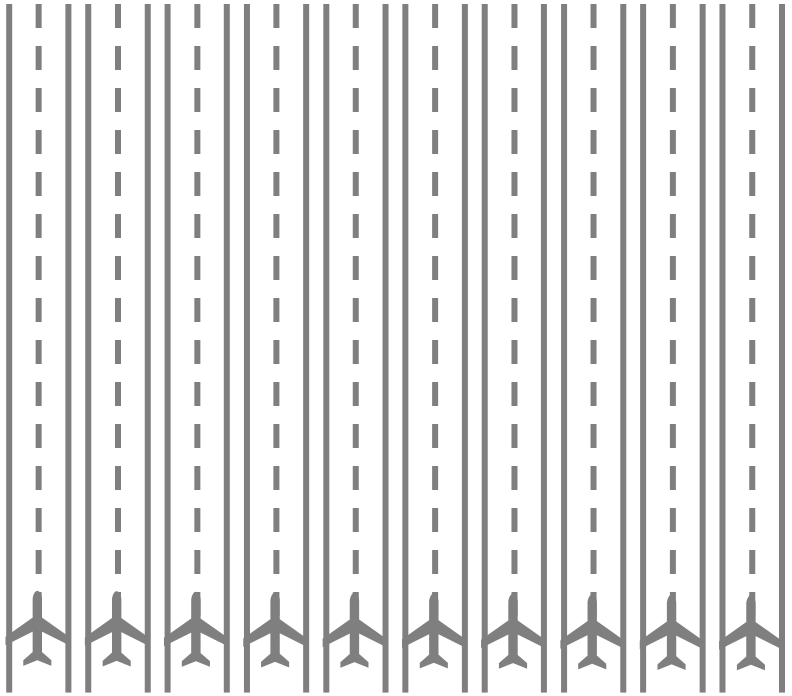
ISP:
A single day's traffic

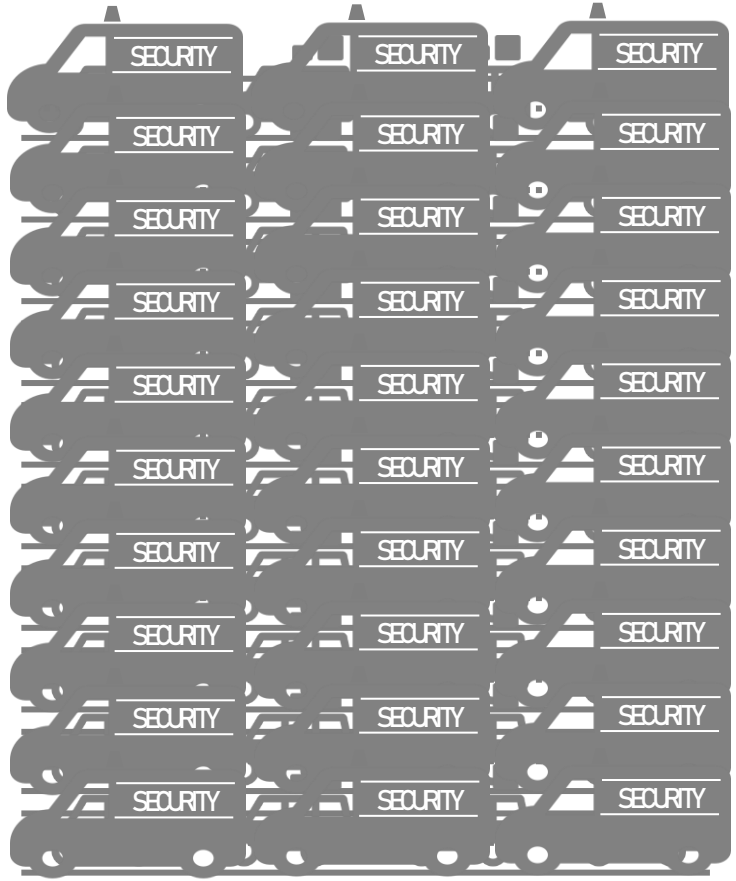
School:
A single day's traffic



What if airports were as inefficient as schools?

All flights would leave at the same time…





Bandwidth is inequitably distributed - but using a small amount wisely can be SUFFICIENT

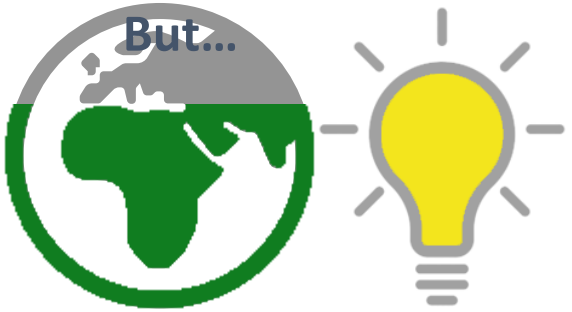
Bandwidth **x** Using it wisely **=** Effective Access

Rural schools, Lower-bandwidth nations MUST be careful stewards…

The West

Low-bandwidth world

But…



2000 to 2008
2 – 5 Mbps

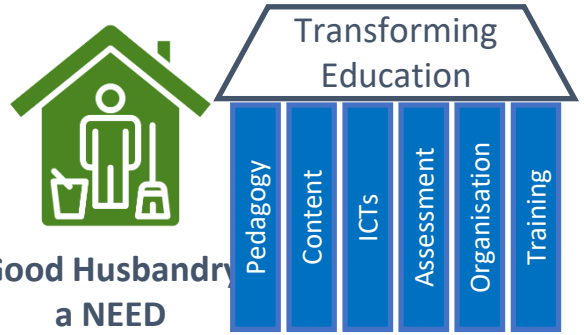
Good Husbandry
a MUST

Gain focus = efficiency

2008 to 2015
20 – 200 Mbps

2015 to 2023
1 – 10 Gbps

Consumption

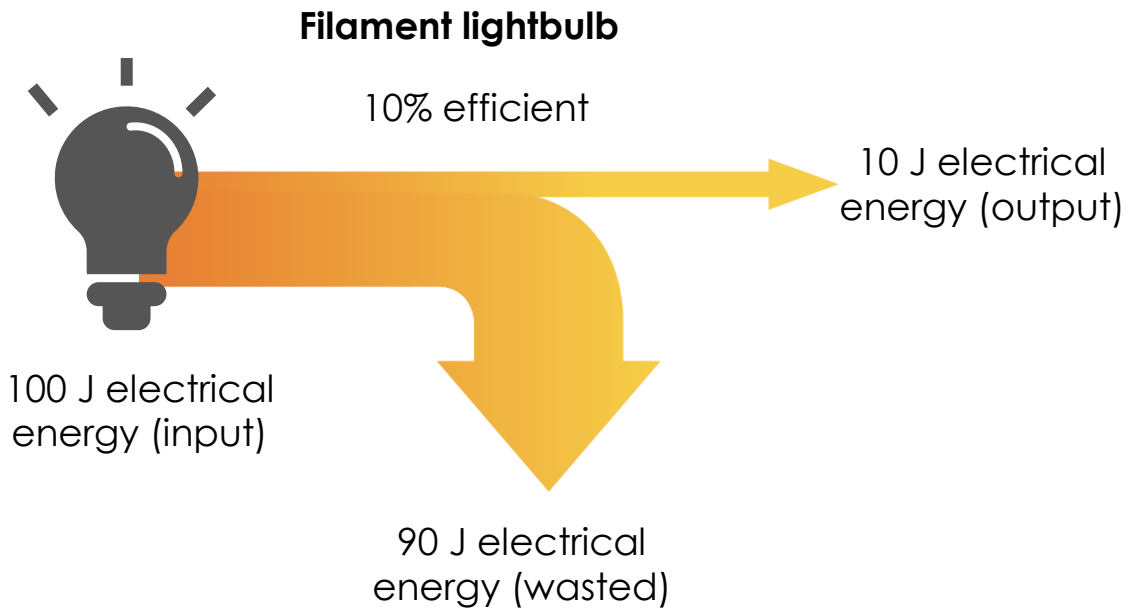


Good Husbandry
a NEED

Problem Fixed

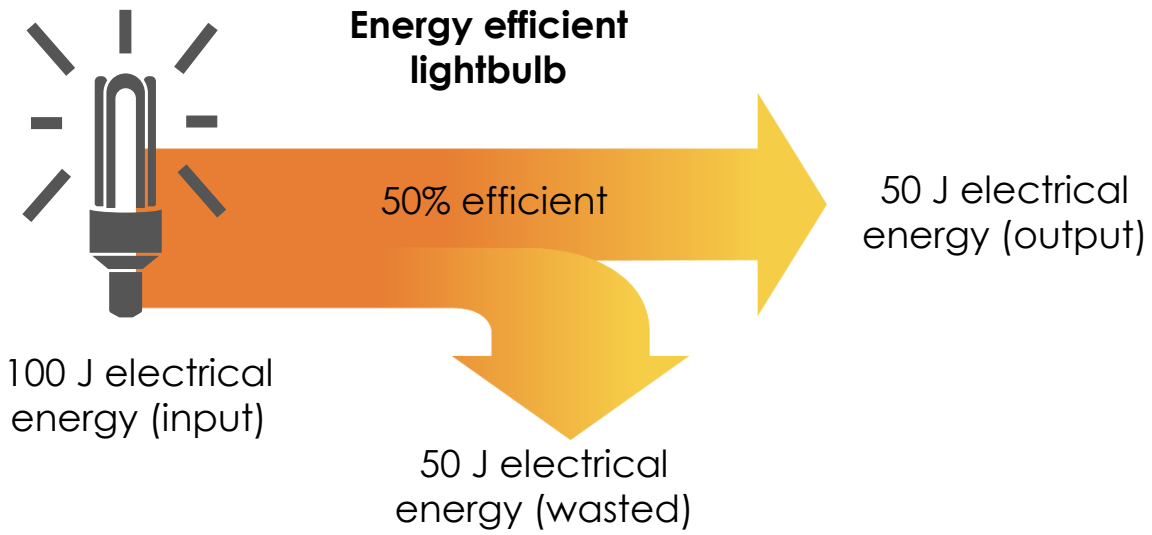
ROI: Dollars + Performance

Inefficient Process

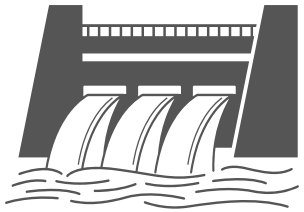


Gain-focus:
efficiency gains:

40% efficiency improvement = 5x output



Highly efficient process

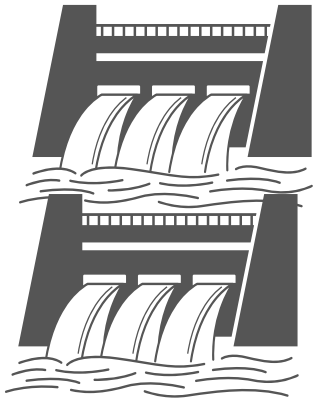


100 J hydro energy (input)

Hydro-electric

90% efficient

90 J hydro energy (output)



200 J hydro energy (input)

Hydro-electric

90% efficient

180 J hydro energy (output)

x2

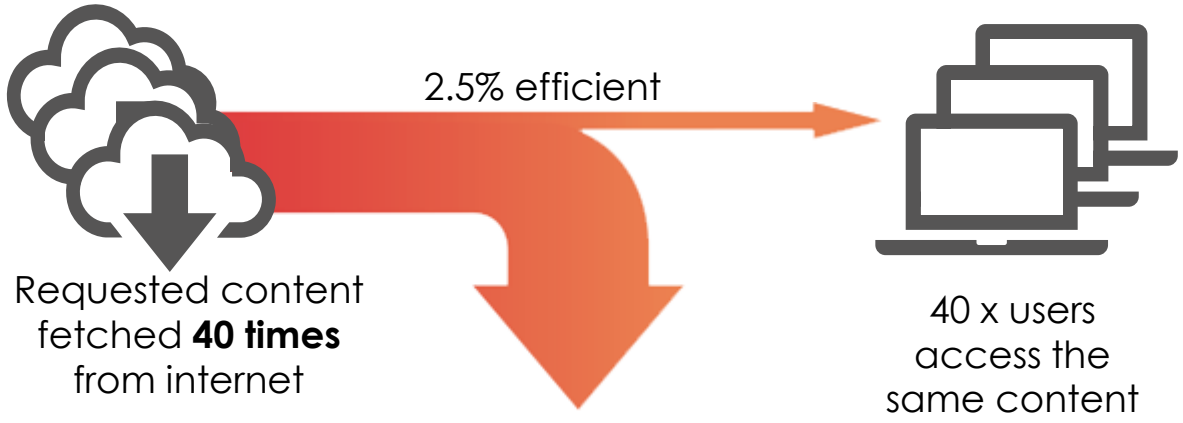
Gain-focus:

building capacity:

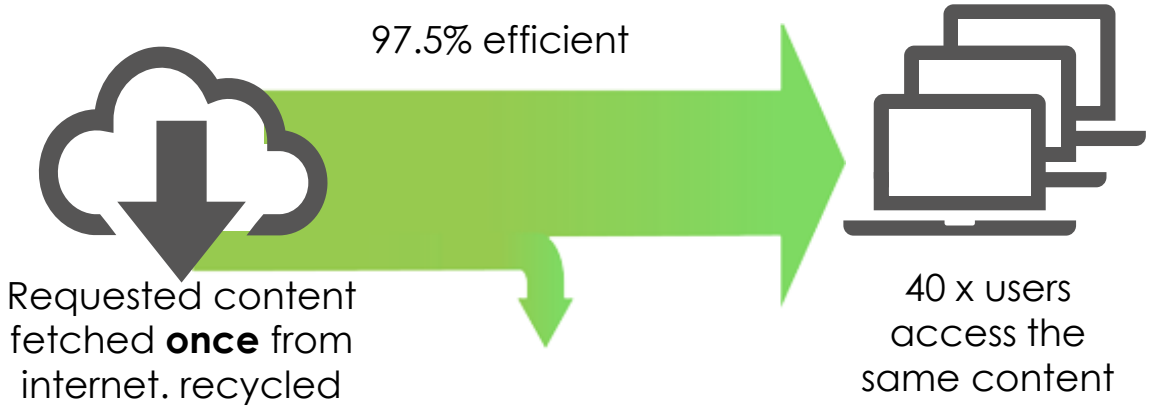
Minimal scope for efficiency improvement

Teaching & Learning uses internet exceptionally inefficiently

Bandwidth-only approach



C.O.R.E. Efficiency approach



Gain-focus:

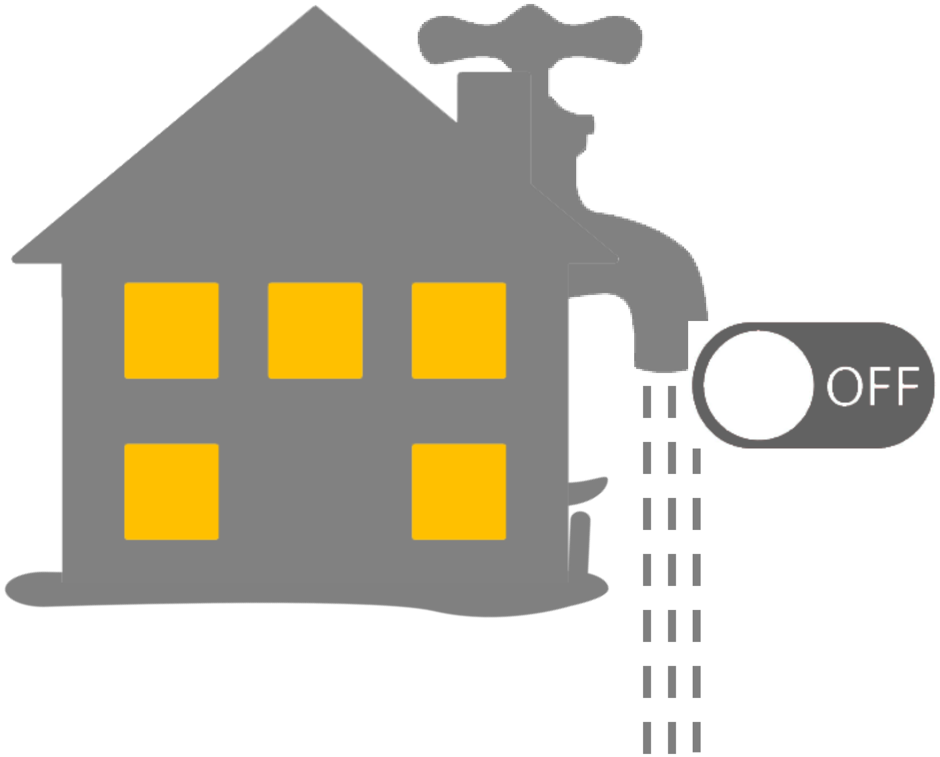
efficiency gains:

50%-95% efficiency improvement = 20-40x effective access

C.O.R.E. Strategies

C

conserve



Only use the internet link for the highest priority activities

Make content smaller and easier to transmit

- *Reduce file sizes*
- *Best-practice web design*
- *QoS network traffic shaping*

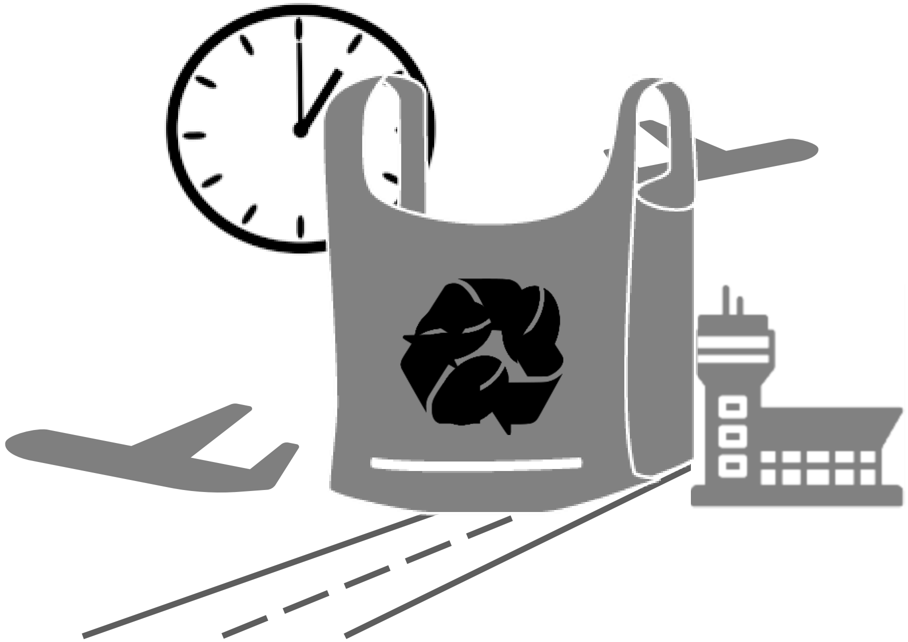
Don't use it unless you have to!

Make it as lite as possible!

C.O.R.E. Strategies

R

recycle



Avoid downloading the same content over and over again

Put unused bandwidth to work outside school hours

- *Overnight static content sync*
- *Off-peak cache pre-population*
- *Community Internet share*
- *Network-managed distribution*
- *Mirrored & intranet websites*

Don't just overload peak times

Reuse the re-usable

C.O.R.E. Strategies for Meaningful Connectivity

C conserve

Only use the internet link for the highest priority activities

- *Local Learning Object Repositories*
- *Offline-ready sites*

O optimise

Make content smaller and easier to transmit

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Avoid downloading the same content over and over again

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What is unique about the data

The Key Efficiency/Inefficien Parameters in Schools

- Peaks
- Repeats
- Speed

Cross Reference

- Inefficiency / Efficiency
- Efficacy / value / effect / benefit of CORE strategies
- Trends, patterns

ndard network

site

stem

cts

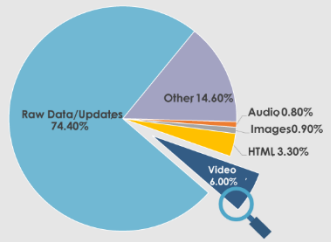
- 160 countries
- Tracking:
  - Some schools for a decade
  - Journey development

- Anonymized
- Aggregated
- Protected

20 years data, accumulated from 160 countries, 130million lessons/year

School Internet Traffic

Traffic type breakdown



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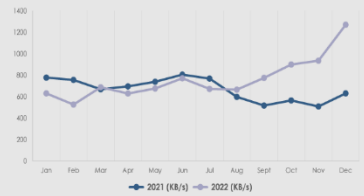

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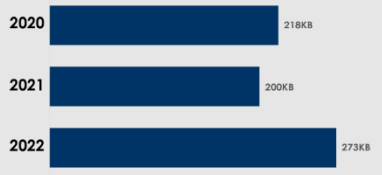

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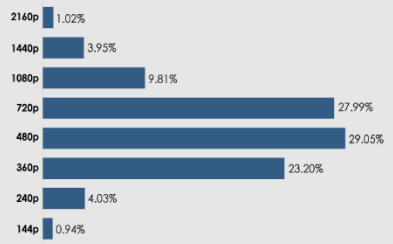
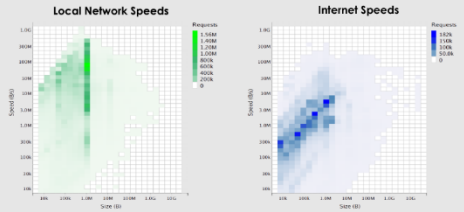
Most Popular Video Resolutions



Speed Distribution by Size
Heat Map



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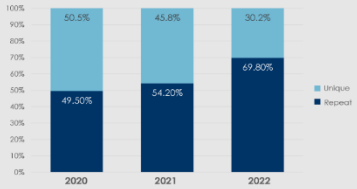


– School network in New Mexico, US, 2Gbps connection, 7,834 Students

Evidence-data Type A: project-specific data

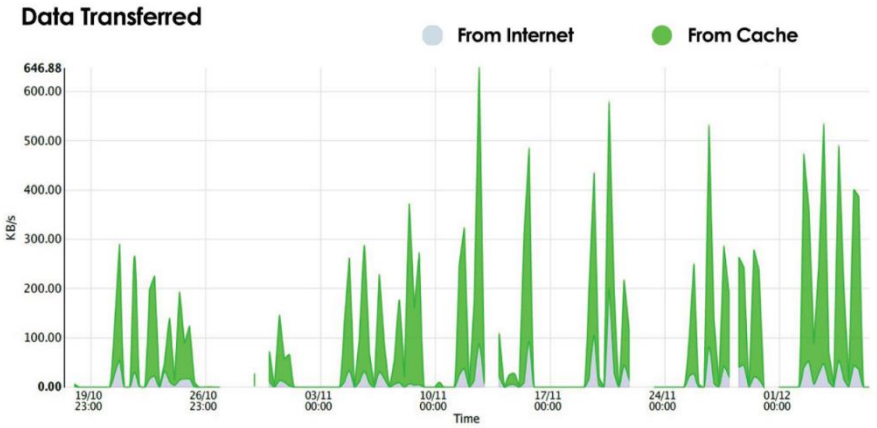
Tabular & graphical performance Metrics

Toluca School, State of Mexico, Mexico

Impact data

Bandwidth: **5Mbps**

From cache: 93.8Mbps



Testimony

"*<u>Before</u> caching, the only application the school could use was Gmail.*

*"<u>Since</u> caching, **75 students** can **Google-search**, use **social networks**, and download **videos** from the education authority web-page hosted on YouTube."*

Prof. Almarosa Gutierrez Moran

Senegal MoE speed increase vs 4G

AVERAGE ACCELERATION

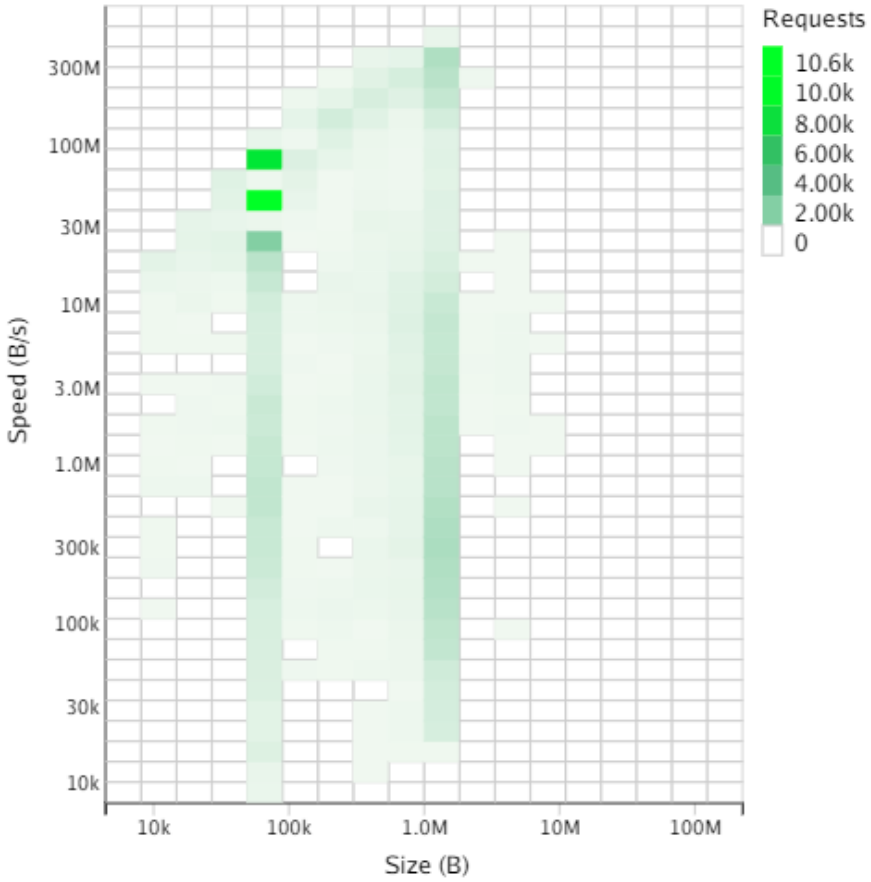
~ 250x faster from cache

*"The Ministry needs to get **CACHE**BOX into all schools in the country as soon as possible.*

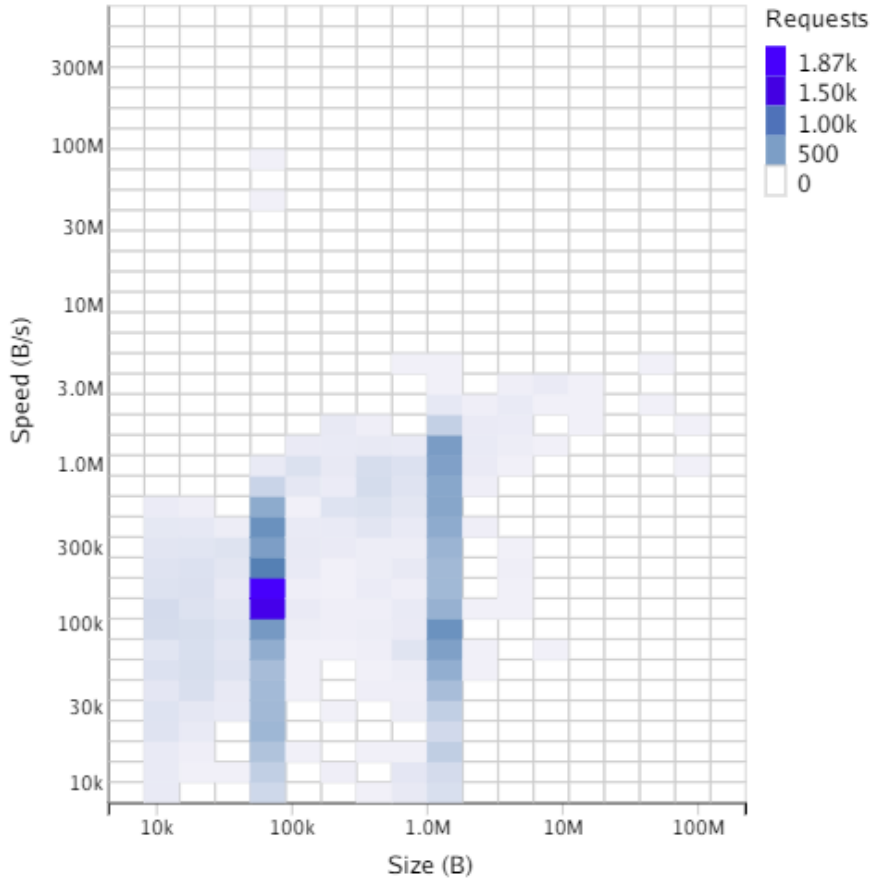
It is EXTRAORDINARY!"

Ms Ndiaye, Math Teacher,
CEM Oukam 2, Dakar

SPEED from **CACHE – 50-100Mbps**



SPEED from **INTERNET 100-300Kbps**



20 students on 5Mbps – Gauteng Schools, Johannesburg, SOUTH AFRICA

	VOLUME of DATA		AVERAGE SPEED	
Domain	% of total	% cached	Miss	Hit
gdecontent.co.za	99.4%	97.9%	22.5 KB/s	1.16 MB/s

- **97.9%** bandwidth savings after populating the cache

- Without cache - **students need >3.5Mbps each** to avoid congestion
- With cache - **1Mbps easily supports 20 students**

Kenya - Access Agriculture: multi-user performance – 20 students

Traffic Summary

Bandwidth Total	**5.01 GB**	Unique Sources (report period)	**1**
Bandwidth Saved	**4.42 GB**	Unique Sources (max in 5 min)	**1**
Bandwidth Savings (%)	**88.2%**	Average Speed (direct)	**142 KB/s**
Requests Total	**482**	Average Speed (from cache)	**4.47 MB/s**
Requests Saved	**335**	Acceleration	**27.76**
Request Savings (%)	**69.5%**	Hit Speedup	**31.47**

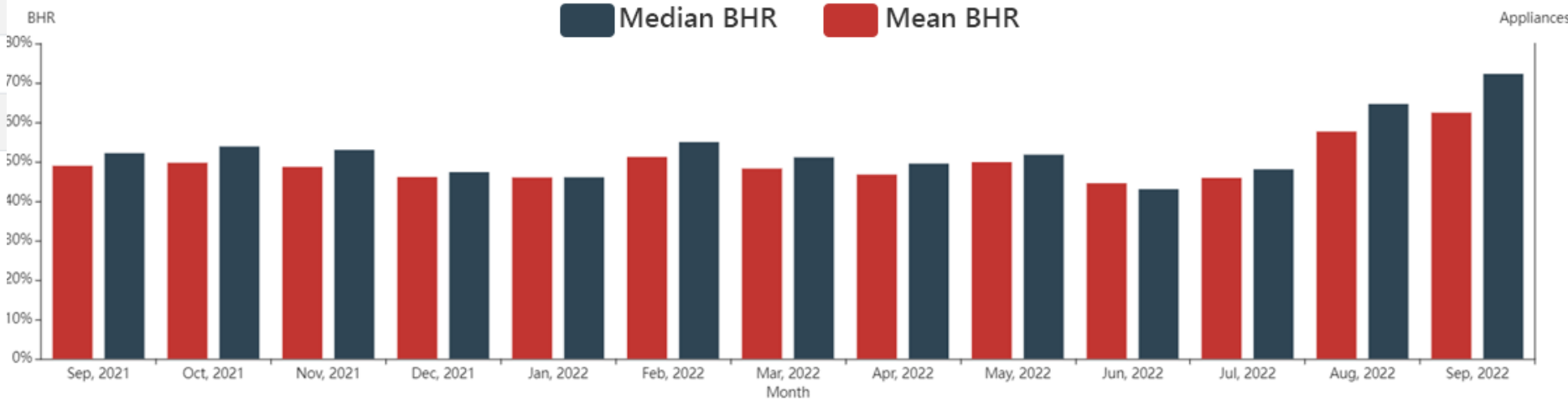
	OBJECTS REQUESTED			VOLUME of DATA			AVERAGE SPEED	
Domain (Full)	**Objects**	**% of total**	**% cached**	**Transfer**	**% of total**	**% cached**	**Miss**	**Hit**
cdn.accessagriculture.org:443	206	42.7%	90.8%	5.01 GB	99.9%	88.2%	143 KB/s	4.48 MB/s
assets.accessagriculture.org:443	45	9.3%	88.9%	4.58 MB	0.1%	81.1%	98.6 KB/s	2.41 MB/s
www.accessagriculture.org:443	176	36.5%	47.2%	606 KB	0.0%	5.4%	13.3 KB/s	-
safebrowsing.googleapis.com:443	11	2.3%	0.0%	349 KB	0.0%	0.0%	4.16 MB/s	-
edgedl.me.gvt1.com:80	5	1.0%	0.0%	209 KB	0.0%	0.0%	2.55 MB/s	-
clientservices.googleapis.com:443	27	5.6%	92.6%	197 KB	0.0%	76.8%	460 KB/s	-

Evidence-data Type B: anonymised global aggregate

Global Schools - Sep, 2022		
Domain	Cached	Saving
microsoft.com	134TB	84%
apple.com	15.2TB	56%
windowsupdate.com	12.5TB	78%
xboxlive.com		
adobe.com		
googleusercontent.com		
securly.com		
avast.com		
mcafee.com		
nvidia.com		
kaspersky.com		
symantecliveupdate.com		
mozilla.net		
sophosupd.com		

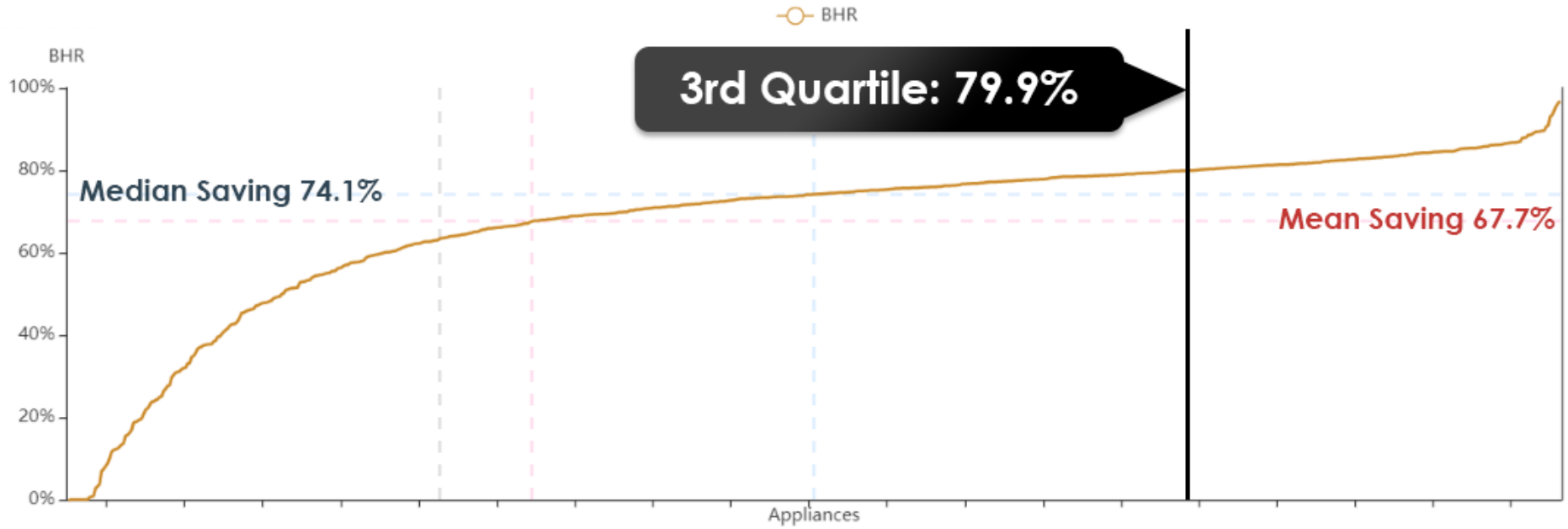
Global schools - Sep, 2022	
Domain	Cached
coolmathgames.com	54%
schoology.com	62%
abcya.com	88%
pearsontestcontent.com	77%
amplify.com	
mapnwea.org	
coolmath-games.com	

Global data is sliced & diced to interrogate various efficiency parameters, including snapshots, long-term trends



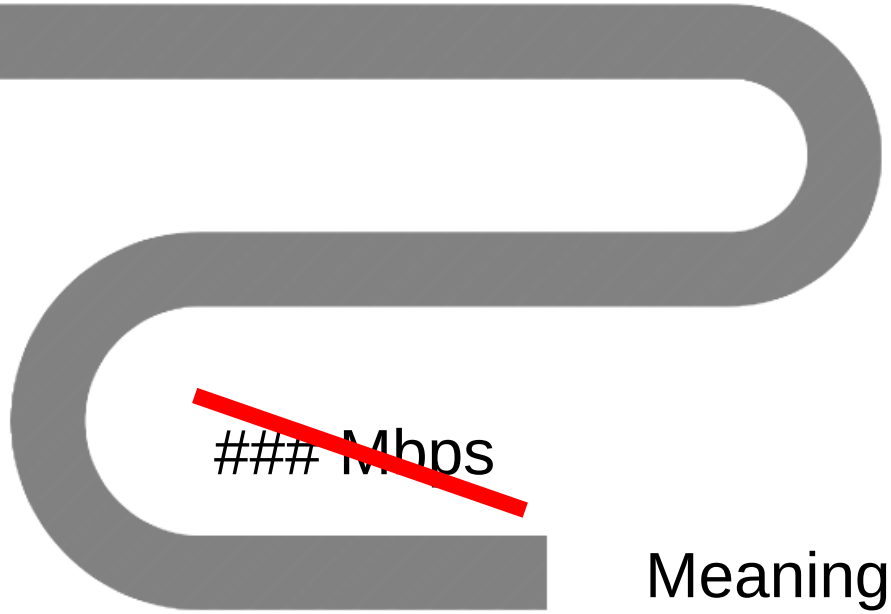
Global “Average” performance v “3rd Quartile” performance

Low-bandwidth schools employ C.O.R.E. more widely for >80% savings



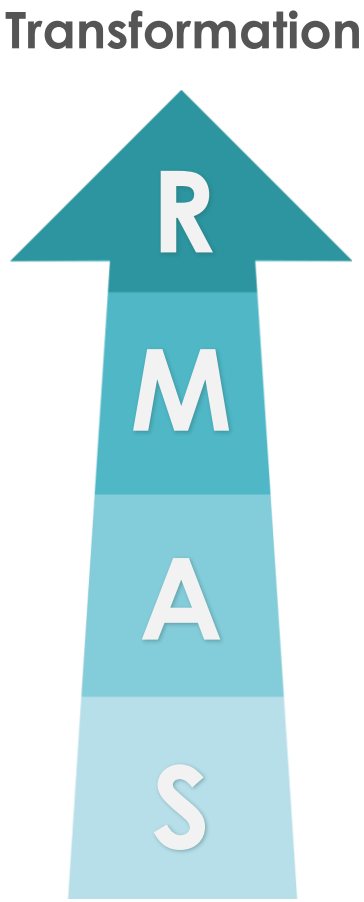
>50% savings for the majority of schools

Meaningful Connectivity for Schools = Effective Access

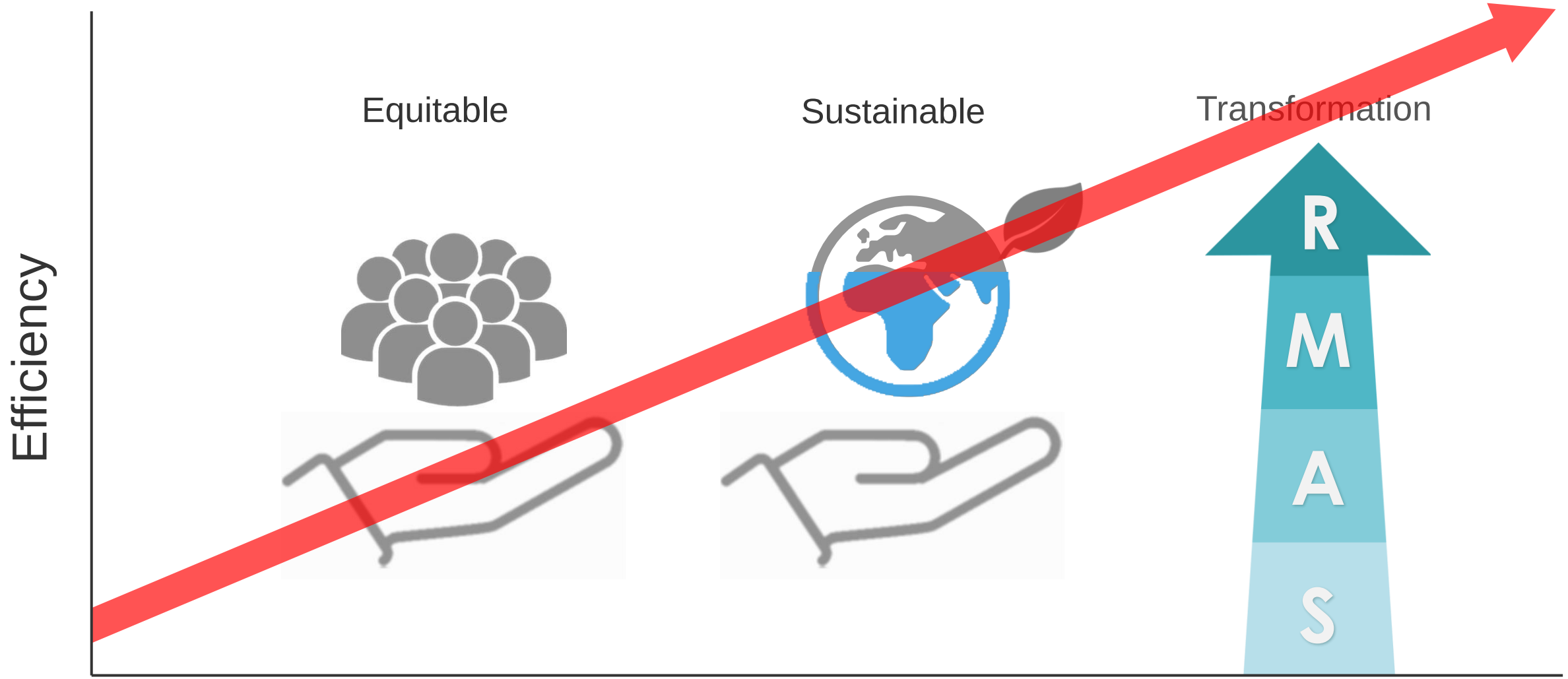


Meaningful Connectivity

means **Effective Access** to **online** activities



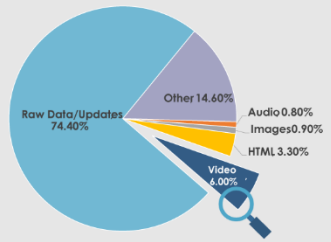
Bandwidth Achieves Very Little in Schools



20 years data, accumulated from 160 countries, 130million lessons/year

School Internet Traffic

Traffic type breakdown

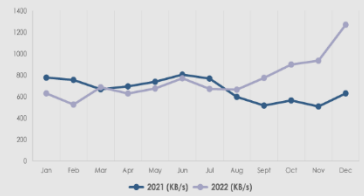


AppliantSys around the world
Heat map

applisys

Data from
129,953,040
lessons
per year

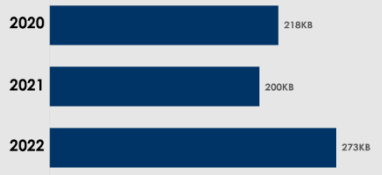
Direct Access Speed



Day Traffic Peaks

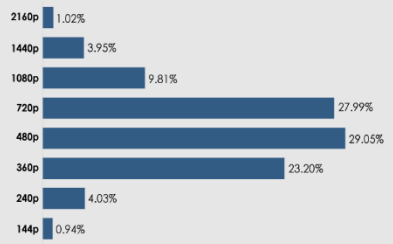
– School network in Alaska, US, 50Mbps connection, 420 students

Average Object Size per Year

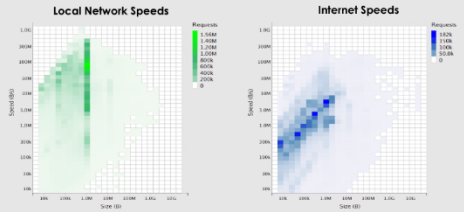


– School network in Missouri, US, 300Mbps connection, 866 students

Most Popular Video Resolutions

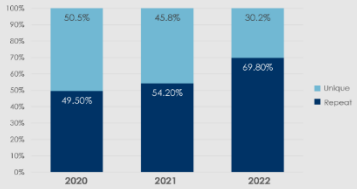


Speed Distribution by Size
Heat Map



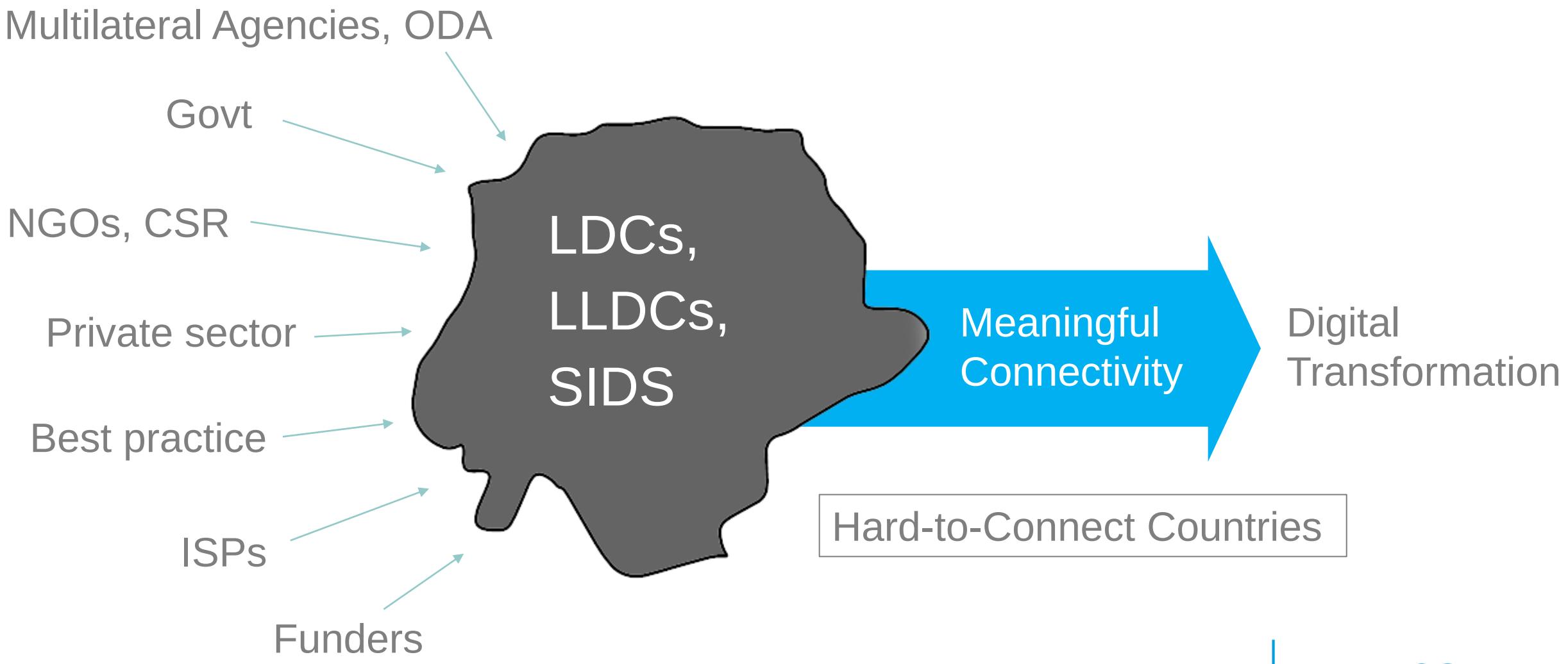
– School network in Louisiana, US, 25Gbps connection, 37,143 students

Volume of Repeat Requests per Year



– School network in New Mexico, US, 2Gbps connection, 7,834 Students

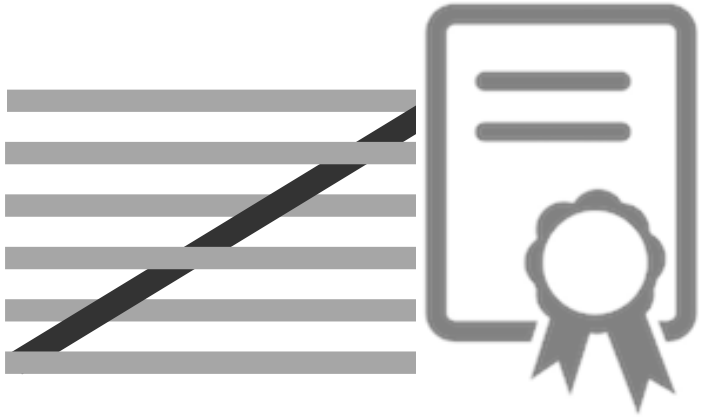
UN ITU Partner2Connect Digital Coalition

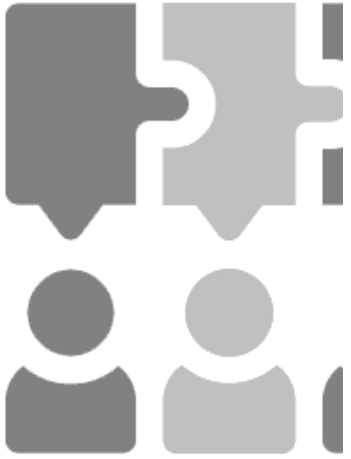


Partner2Connect

UN’s ITU-D Partner-2-Connect coalition

	PLEDGE 1	PLEDGE 2	PLEDGE 3	PLEDGE 4	PLEDGE 5
	Support	Offer	Provide	Advocate	Support
WHO	The international community UNICEF, ITU, GIGA, World Bank, GPE, EIB, FCC, SETDA, GIZ, KWF, etc	Ministry of Education / Education Authority Stakeholders	Schools, education authorities, learning environments	Stakeholders and the Content and Education Application creators	ISPs/RENs
WHAT	**Development of a meaningful** Meaningful Connectivity	**Training and Certification** Skilling for Education	**Innovative solutions**, such as methodology, data insights	International **standards** that support equitable & sustainable access	**Understanding** of how to help schools’ efficient use of the internet





Reporting Pledge Progress - slides to follow

TBC

EDUGATEBOX Connectivity & Pedagogy Project with MoE Ecuador

Community Development & Learning

34

Communities

BENEFICIARIES

Rural Schools

- ✓ Teachers
- ✓ Students
- ✓ & the rest of the educational community

Victoria Teran
Educational Psychologist

MoE project phases

1. Pandemic Response
2. Light Intervention Model
3. Sustainable Rollout
4. Demo the MOST transformative

C.O.R.E. Strategies for Meaningful Connectivity

C
conserve

Only use the internet link for the highest priority activities

- *Local Learning Object Repositories*
- *Offline-ready sites*
- *QoS network traffic shaping*

O
optimise

Make content smaller and easier to transmit

- *Reduce file sizes*
- *Best-practice web design*

R
recycle

Avoid downloading the same content over and over again

- *Content delivery networks*
- *Web Caching*
- *Peer-to-peer*
- *Network-managed distribution*
- *Mirrored & intranet websites*

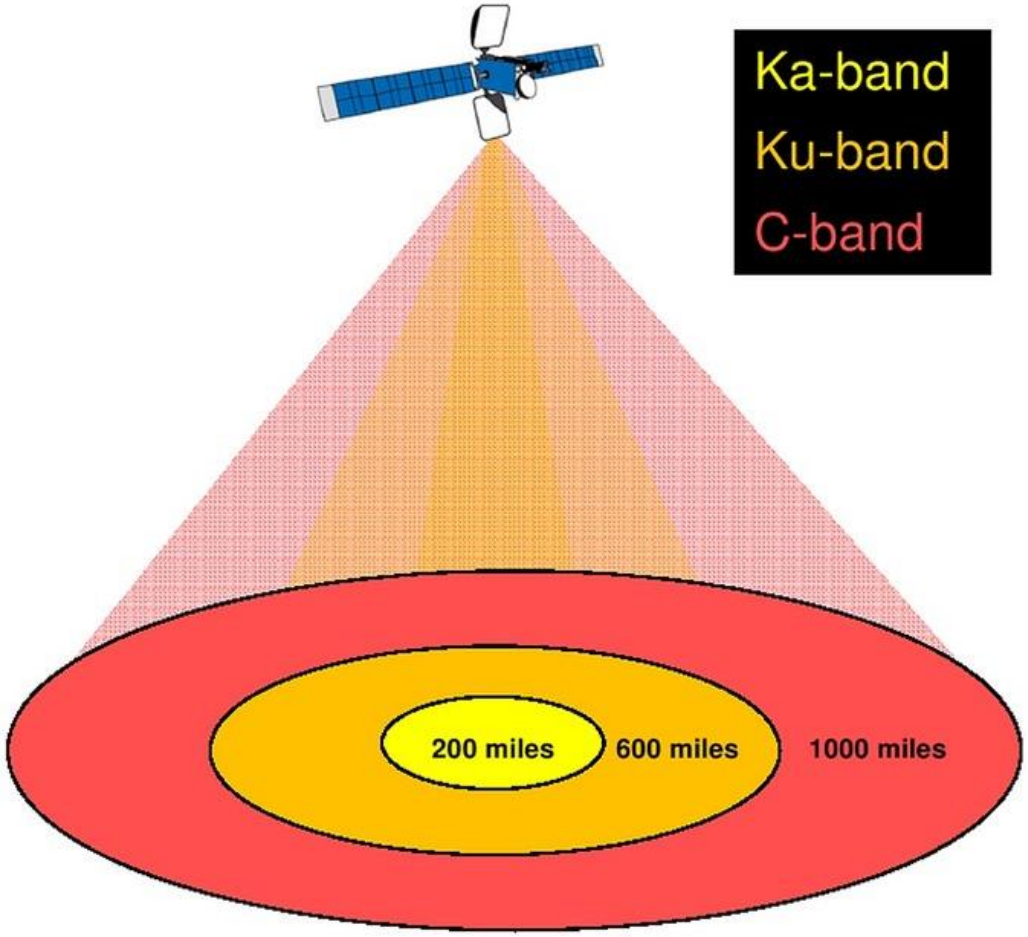
E
extend

Put unused bandwidth to work outside school hours

- *Overnight static content sync*
- *Off-peak cache pre-population*
- *Community Internet share*

Sustainability questions for VSAT to remote locations

- Initial plan 20Mbps VSAT “Ku band” – unaffordable/unsustainable
- “Ka band” VSAT lower cost, but only 512Kbps - 1Mbps
- **CORE Efficiency Strategies** makes it work



Home-schooling in a single-teacher rural Elementary, Ecuadorean Coast

Bandwidth: **1-2Mbps per school**

MoE content: **2Mbps per student**

Students are served **90Mbps**

93-99% from cache

"***very useful for home-schooling***… *I upload material to Media Library and students download to parent's phones*

"*all of us connect to the Ministry's web page, which has been* ***essential*** *for all the educational community*

"*Kids really like it*!"

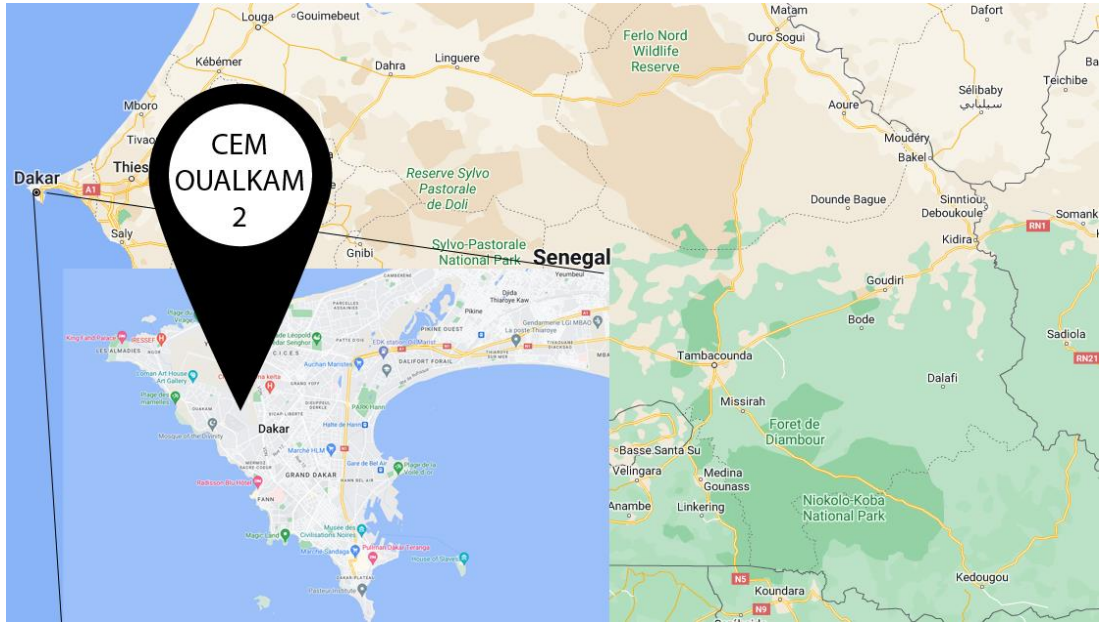
Jonni Lozano, educational leader, teacher

4G Connectivity Project with MoE Senegal

PILOT SCENARIO

3.5Mbps 4G internet

IT Lab rarely used –
insufficient connectivity



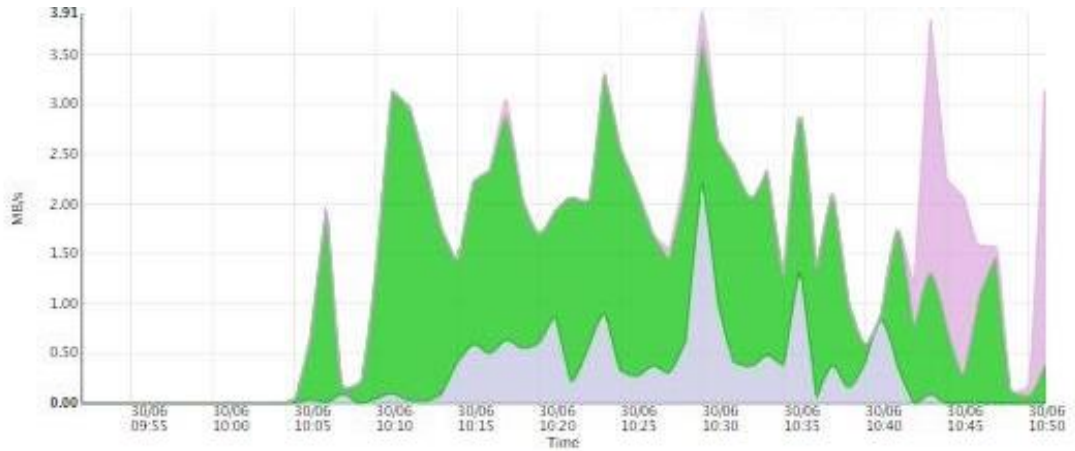
PILOT OUTCOMES

CLASSROOM

- ✓ Whole-class online learning
- ✓ Video – all students engaged
- ✓ Offline working with pre- downloaded resources
- ✓ Raised teacher confidence & skills
- ✓ Inclusive: all students engaged
- ✓ Lesson objectives reached faster

National

- ✓ Low cost connectivity – now!
- ✓ Equity, sustainability – no school left behind
- ✓ Only lite teacher interventions needed



Mr Bassirou BODIAN
Physics Teacher
CEM Ouakam 2
Dakar, Senegal

QR / link to recorded presentation

tbc

Access a manual version of the presentation
(URL tbc)

tbc

Access a recording of the complete presentation with audio
(URL tbc)