

Session 3 – Network Operations Management

Network Utilization

Subject Matter

- A. Dark Fiber
- B. Bandwidth Forecasting
- C. Video (including OTT)

A. Dark Fiber

- What are the Pro's/Con's?
- Provides an opportunity for competitive pricing outside of the NECA tariff.
- Lease dark fiber to an affiliate or customers like wireless carriers
- Latest trends are focusing on customer spending over \$1,000/mo.
- Fiber to the Enterprise, government, education, healthcare and professional services.
- Fiber is a 20-30 year asset, customers can size and upgrade their own electronics

Are you chasing lucrative services or traditional TDM?

		Core Growth Products	Traditional Products
Data Services	Ethernet Services (E-LINE, E-LAN)	✓	
	MPLS VPNs	✓	
	Internet Access - High Speed Ethernet	✓	
	Internet Access - TDM		✓
Data Services	Collaboration & Messaging	✓	
	Next Generation Cloud Firewall Service	✓	
	Colocation	✓	
	Data Storage	✓	
Data Services	Hosted Voice Services	✓	
	SIP Trunking	✓	
	Managed PBX and Voice Equipment	✓	
	TDM Voice / PRI		✓
Data Services	Wavelength Services	✓	
	Dark Fiber	✓	
	Ethernet Private Line (EPL)	✓	
	Classic TDM Private Lines		✓









Slide from Integra Investor presentation

Are you chasing lucrative services or traditional TDM?

Slide from Zayo Investor presentation



Big Bandwidth & Infra Product Set¹

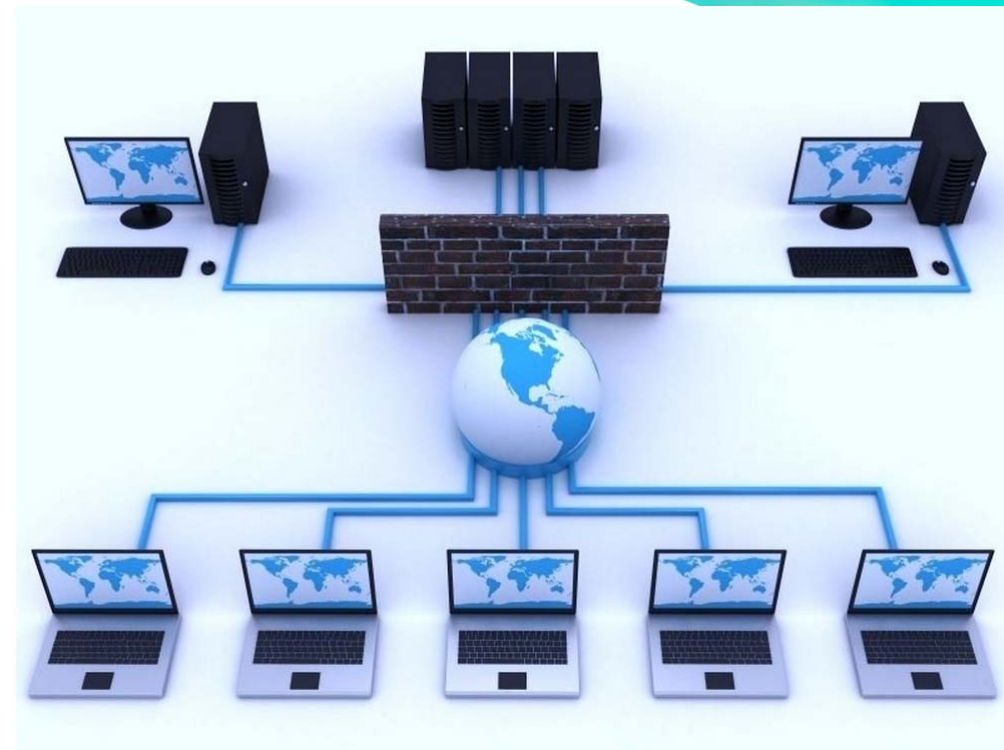
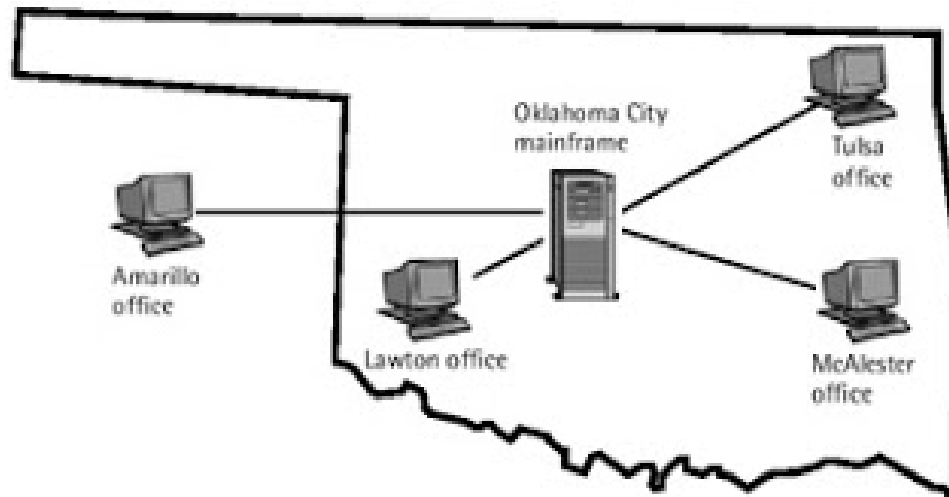
				% Revenue	% EBITDA	% of Adj. UFCF
Dark Fiber Solutions		Dark Fiber	Leased raw fiber	30%	37%	71%
		Mobile Infrastructure	Tower/small cell backhaul	7%	8%	-60%
		Subtotal		37%	45%	11%
Network Connectivity		Wavelengths	1G, 2.5G, 10G & 100G waves	19%	16%	4%
		Ethernet	Switched & dedicated service	11%	11%	25%
		IP Services	Internet access & transit	9%	8%	17%
		SONET	Legacy carrier-grade service	6%	6%	20%
		Subtotal		46%	41%	66%
Colocation & Cloud Infrastructure		Interconnect-Oriented Colo	Space, power & interconnects	13%	12%	20%
		Cloud Services	Infrastructure-as-a-Service	3%	2%	2%
		Subtotal		16%	13%	22%

¹ Based on quarter ended Dec-15. Dark Fiber Solutions, Network Connectivity, & Colocation & Cloud Infrastructure segment results; revenue from "Other" segment represents 1% of total revenue.

B. Bandwidth Forecasting

- Are you monitoring your usage?
- The Network is Changing (again)
- Are you watching trending reports?
 - CAGR 2011-2016 29% (Cisco VNI 2012)
 - CAGR 2015-2022 39% (TeleGeography 2016)
- What will be the impact of IoT?
- By 2025 – we will be exposed to a new shopping world, any surface will be a storefront

Is history repeating itself: Mainframe vs. Client-Server becomes Cloud vs. Fog

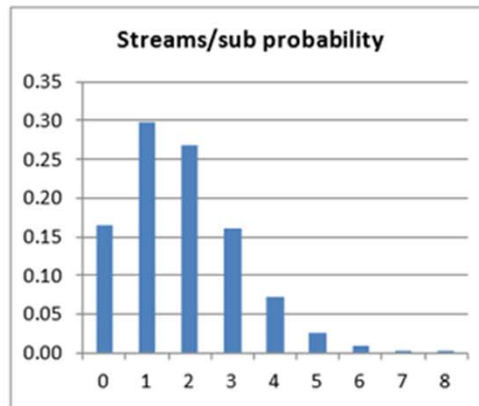


The Network is Changing

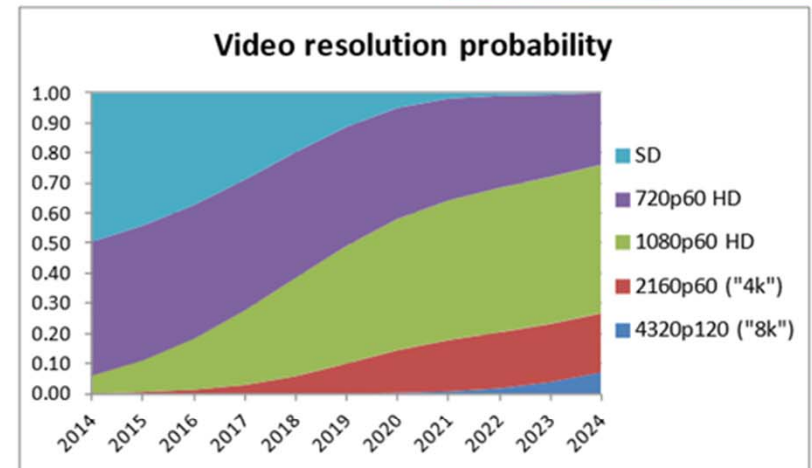
Table 1

Requirements	Cloud Computing	Fog Computing
Latency	High	Low
Delay Jitter	High	Very low
Location of Service	Within the Internet	At the edge of the local network
Distance between client and server	Multiple hops	One hop
Security	Undefined	Can be defined
Attack on data enroute	High probability	Very low probability
Location awareness	No	Yes
Geo-distribution	Centralized	Distributed
No. of server nodes	Few	Very large
Support for Mobility	Limited	Supported
Real time interactions	Supported	Supported
Type of last mile connectivity	Leased Line	Wireless

What goes into a bandwidth estimate?



Probability distribution of number of streams per subscriber
Average (λ) = 1.8



Stream resolution probability distribution forecast

3D content: 7.5% of HD streams

What are they doing in THAT house?

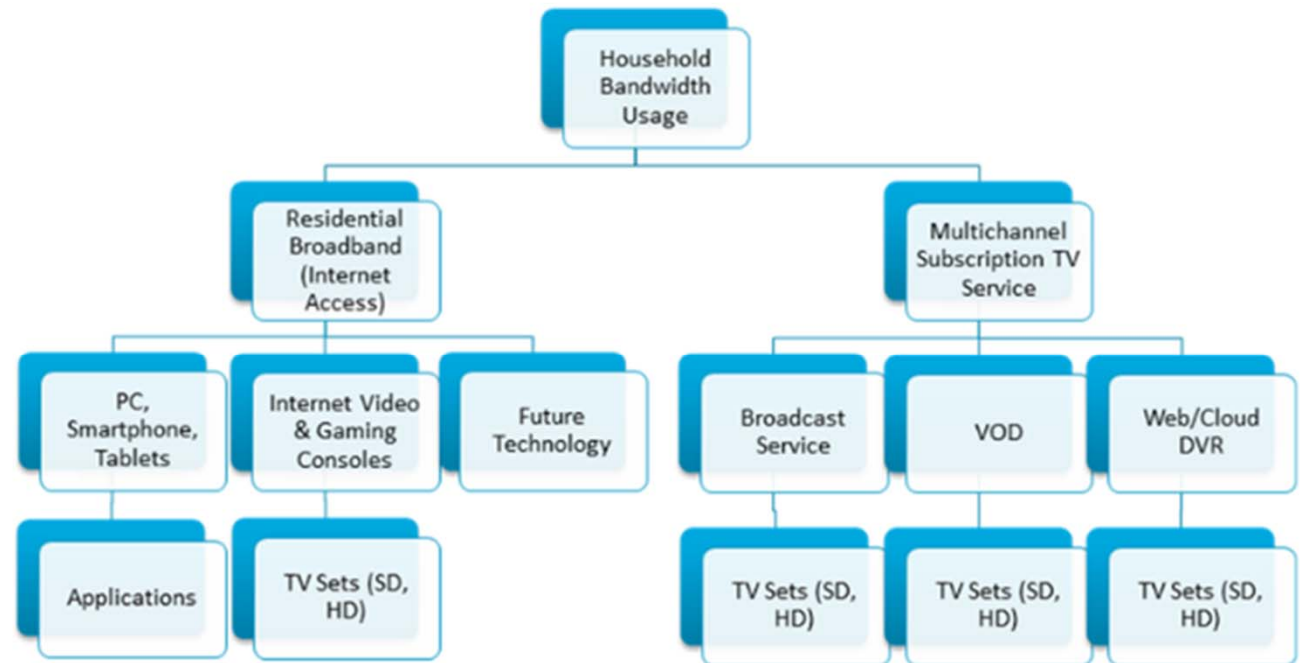
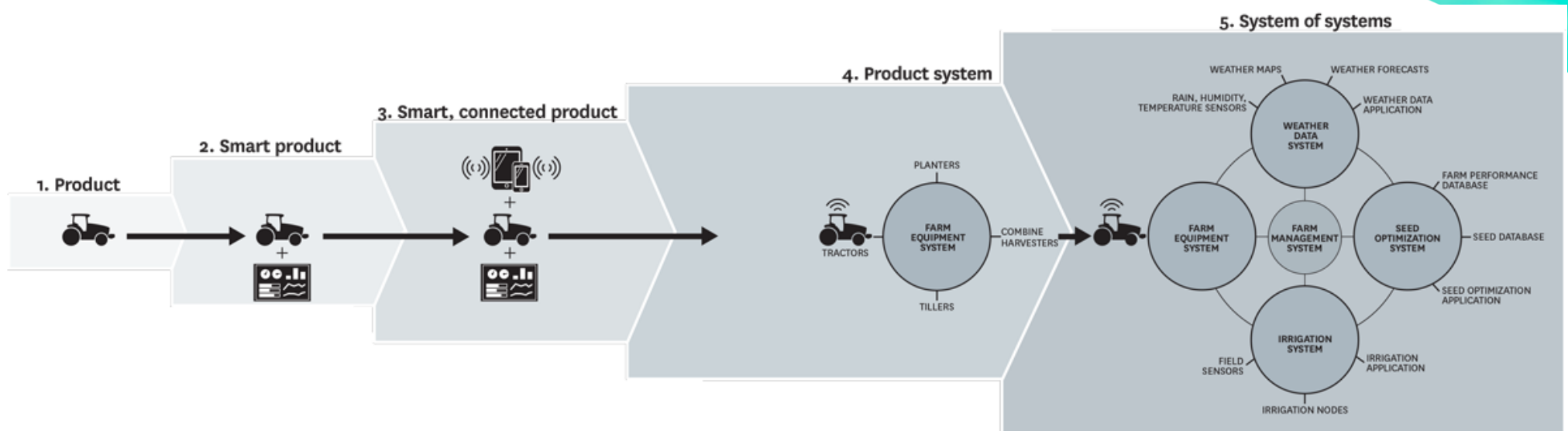


Figure 1 – Segmentation of Household Bandwidth Usage

Trending Reports

- <http://www.kpcb.com/internet-trends> Mary Meeker's Trend Report
- http://www.cisco.com/c/en/us/solutions/collateral/service-provider/visual-networking-index-vni/VNI_Hyperconnectivity_WP.html
- <https://www.sandvine.com/trends/global-internet-phenomena/> since 2011

IoT - Redefining Industry Boundaries



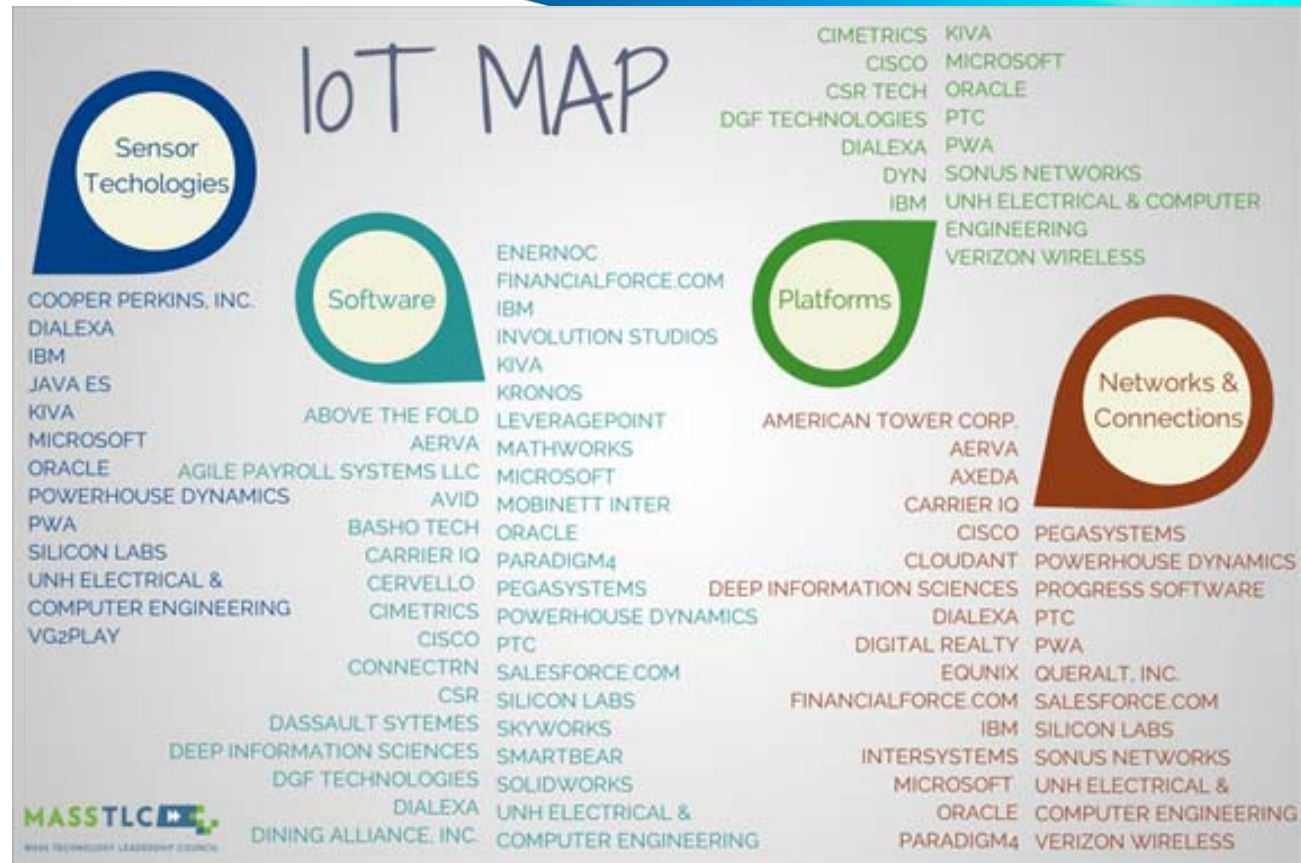
<https://hbr.org/2014/11/how-smart-connected-products-are-transforming-competition/ar/1>

Impact of IoT

Network World – 4.9 billion things connected in 2015

Gartner – 26 billion devices by 2020

ABI Research – 30 billion devices by 2020



<http://www.masstlc.org/?page=IoT>

NetworkWorld - 5 IoT trends to expect in 2016

1. Software will take a foothold in, well, everything.
2. New Web-Scale business models will continue to emerge thanks to software-based networks.
3. Information security will move beyond the walls and out into the network.
4. Forecast for Cloudlet forming in 2016.
5. IoT to drive everything – but what will drive IoT?



Even Insurance companies are focusing on IoT

The world is changing. It is becoming more connected. People, places, and things are using these connections to exchange an exploding amount of digital information and data. This digital stuff is stored and analyzed, and then yields predictions, feedback, and control. The Internet of Things will change the property & casualty business.

Interaction Between the Three Components of the Internet of Things



<http://www.celent.com/reports/internet-things-and-propertycasualty-insurance>

C. Video (including OTT)

- March 2015 – Netflix was 36% of all downstream internet traffic during peak periods
- March 2016 - Instagram boosts video time from 15 seconds to 60 seconds
- 2016 – Facebook is actively pursuing for user video

Buffer Rage

- Buffer rage is defined as "a state of uncontrollable fury or violent anger induced by the delayed or interrupted enjoyment of streaming video content from over-the-top (OTT) services."
- According to the research commissioned by IneoQuest, more than half of consumers (51%) who watch online/streaming video have experienced rage as a result of their video buffering.
- The study revealed that two-thirds of respondents (66%) claim frustration when a video buffers, with one-in-five (21%) citing severe levels of irritation.
- The study also found that more than one-in-three viewers (34%) under the age of 35 suffer from buffer rage more frequently than road rage.
- In many cases, viewers were not able to begin playing streaming content at all, with 27% of respondents claiming that buffering most often occurs before a video even starts, and 34% experiencing buffering in the first 15 seconds.
- This is particularly relevant when, as the study indicated, more than 40% of consumers will only wait 10 seconds or less before clicking out of a buffering video. Of these, nearly 40% will never attempt to re-watch the video.

OTT – Are you trying to escape the gravitational well of Netflix?

New black holes are forming:

Sony 4K movie service

Amazon Video

Hulu

HBO Now

Sling TV

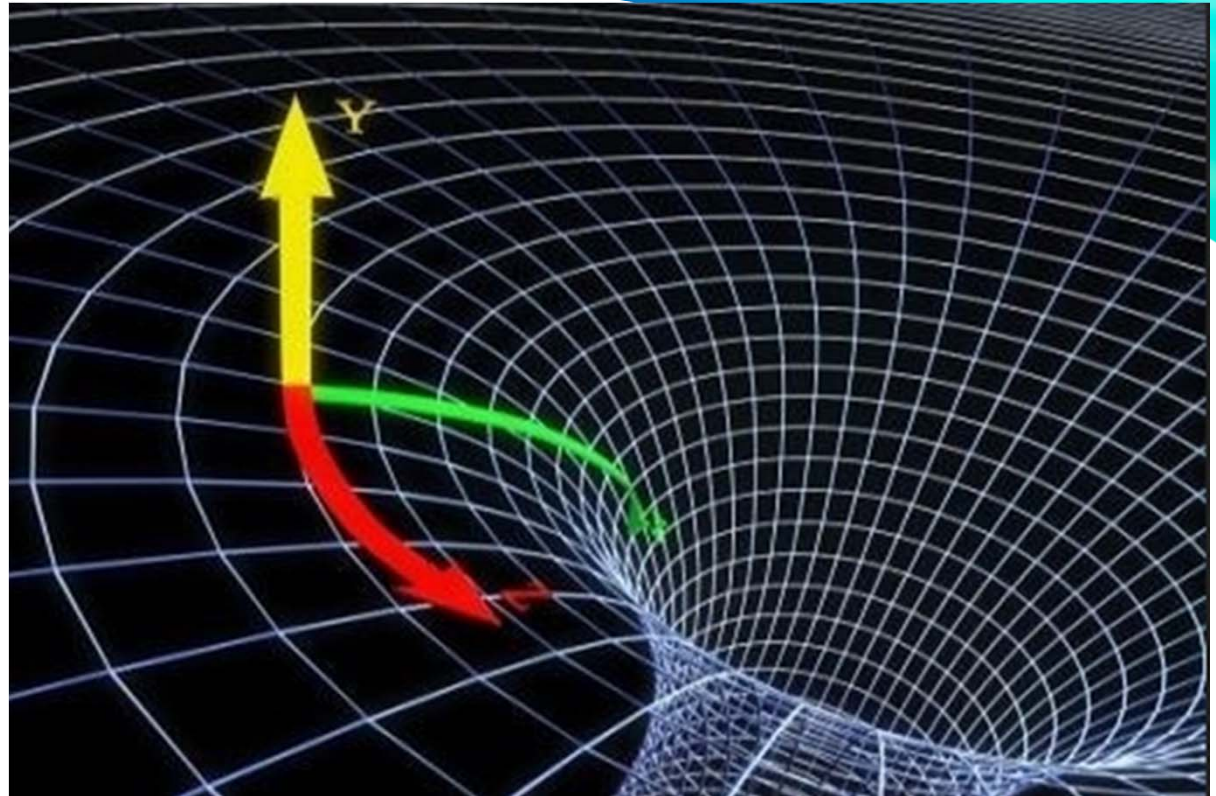
Crackle

CBS All Access

Showtime

StarzPlay

Playstation Vue



4K under \$500

Amazon 3/3/2016



[See Size Options](#)

VIZIO M43-C1 43-Inch 4K Ultra HD Smart LED TV (2015 Model)
by VIZIO

\$498.00 ~~\$599.99~~ Prime

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★★★★★ ▾ 1,287

4K under \$400

Amazon 3/3/2016



See Size Options

Seiki SE42UMS 42-Inch 4K Ultra HD LED TV (2015 Model)
by Seiki

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