



# THE \$1,000 INTERNET EXCHANGE

WARNING: Contains up-and-to-the-right charts

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UKNOF, September 2015



# BEFORE WE START

- This talk is about setting up not-for-profit, locally run, community-owned exchanges. Applicability in other scenarios may vary.
- I'm not trying to push any vendor in particular – the examples given in this presentation are exactly that, examples.
- There's a big difference between setting up a new exchange from scratch and 'parachuting in' a satellite of an existing exchange
- Your Mileage May Vary – local regulations can have a large impact!

# BACK IN 2001

I bought 2 switches for an IXP

- 16x 1GE GBIC
- 48x 10/100M UTP
- 4x 1000W power supply
- Over \$100K price tag

And after a lot of hard work, I got 20 paid customers and 1Gbps of traffic

There was no market to research!





# BACK TO 2015

- There are plenty of IXPs around in all shapes and sizes
- Market research is feasible
- Higher speed Ethernet has been commoditized to pieces
- Plenty of opportunity to learn from other people's mistakes

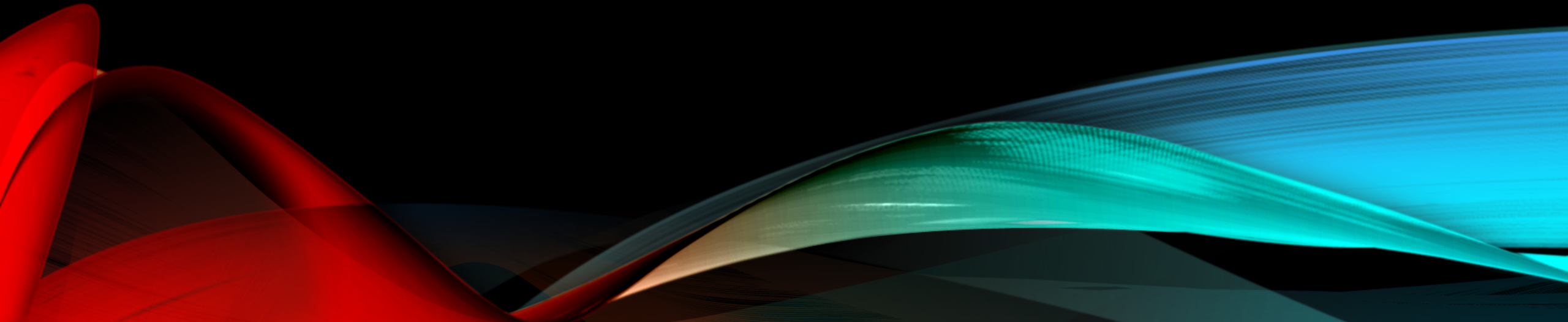


# WHAT TO DO IF YOU'RE A NEW IXP

1. Market Research
2. Build a Community
3. Build a Platform
4. (Figure out the content providers)

# MARKET RESEARCH

I'll Tell You What You Want



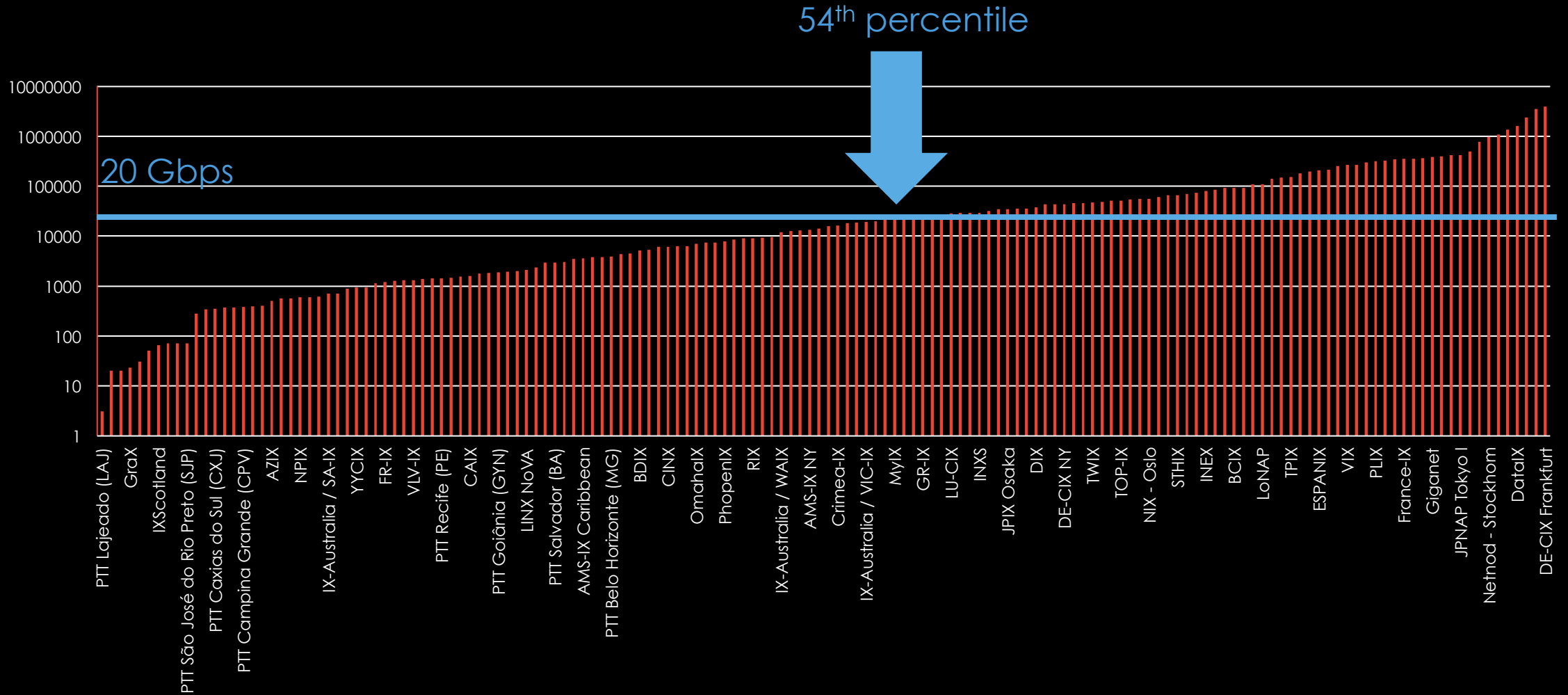




# MARKET RESEARCH

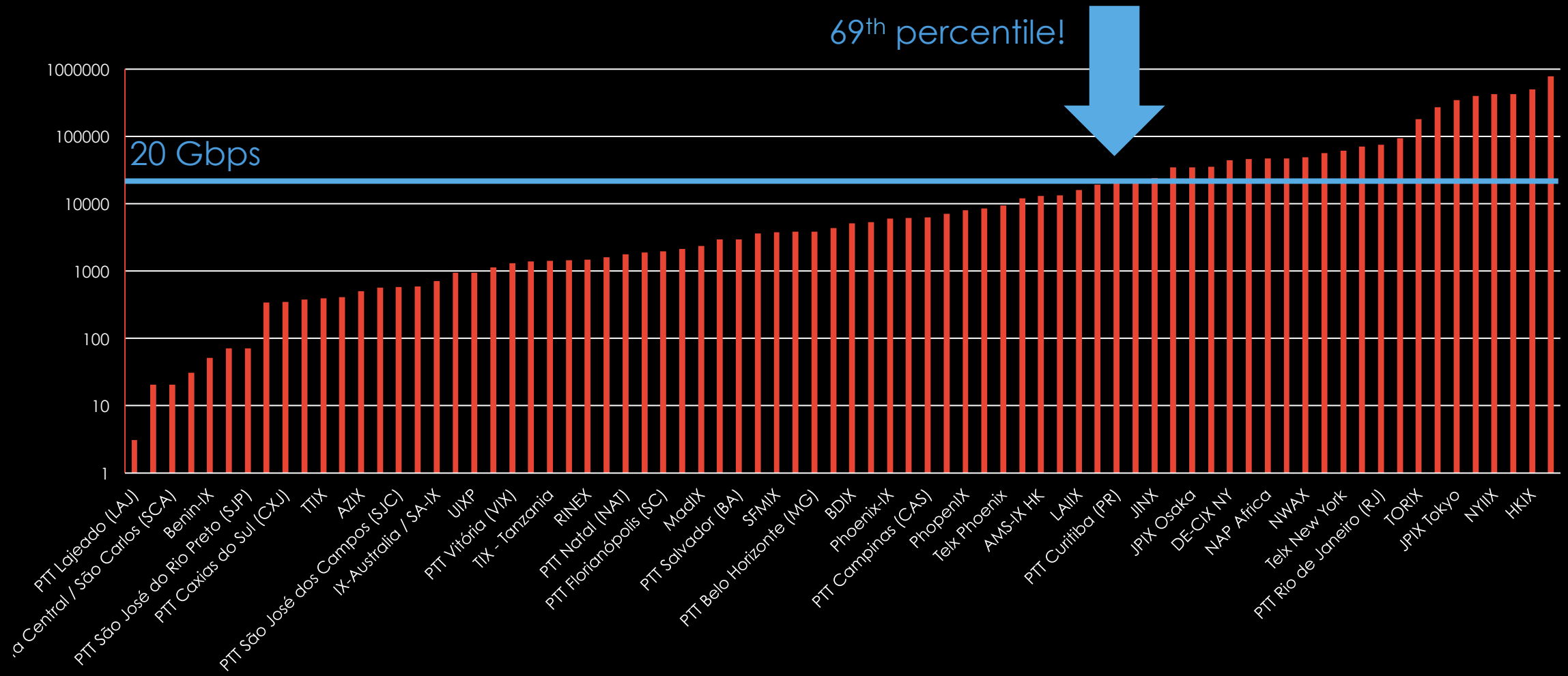
- Data from Euro-IX, covering 204 IXPs from all over the world
- Data from July 2015 – hot off the press!
- Omitted all IXPs with no current traffic data (approx. 50)
- How much traffic should a starting IXP expect/design for?

# GLOBAL – ALL IXPS

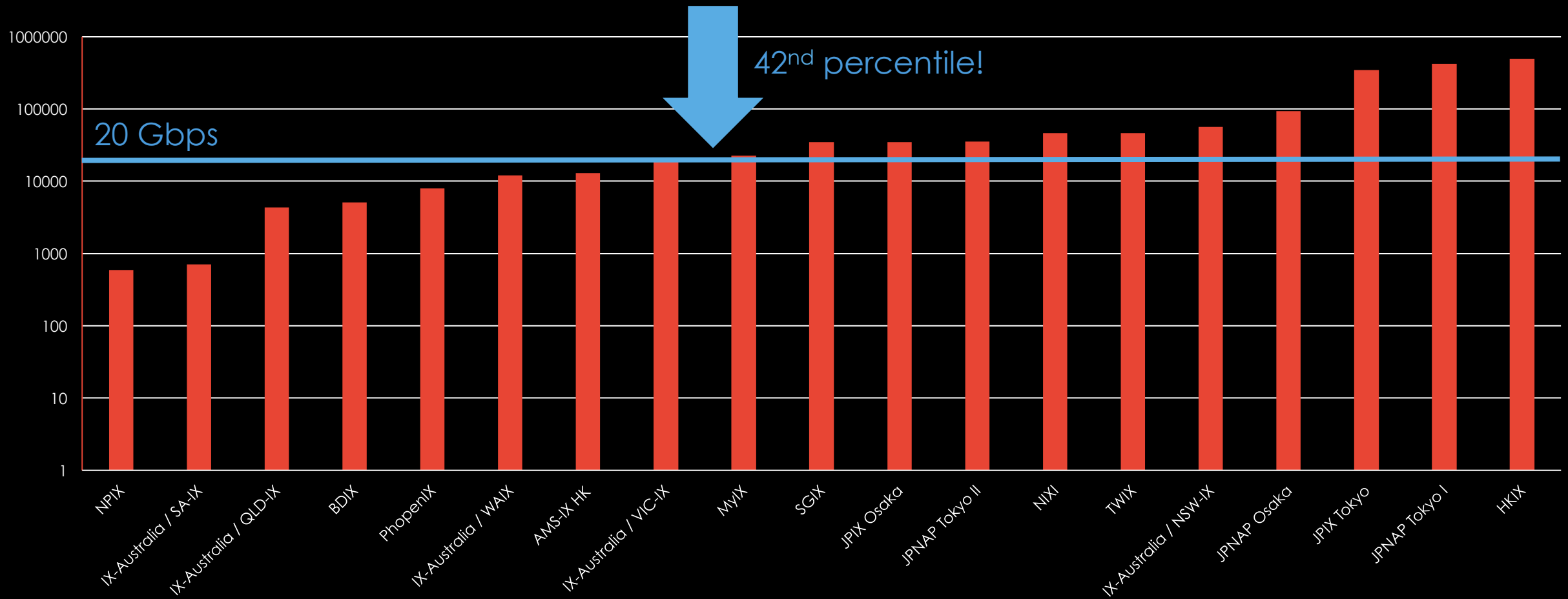




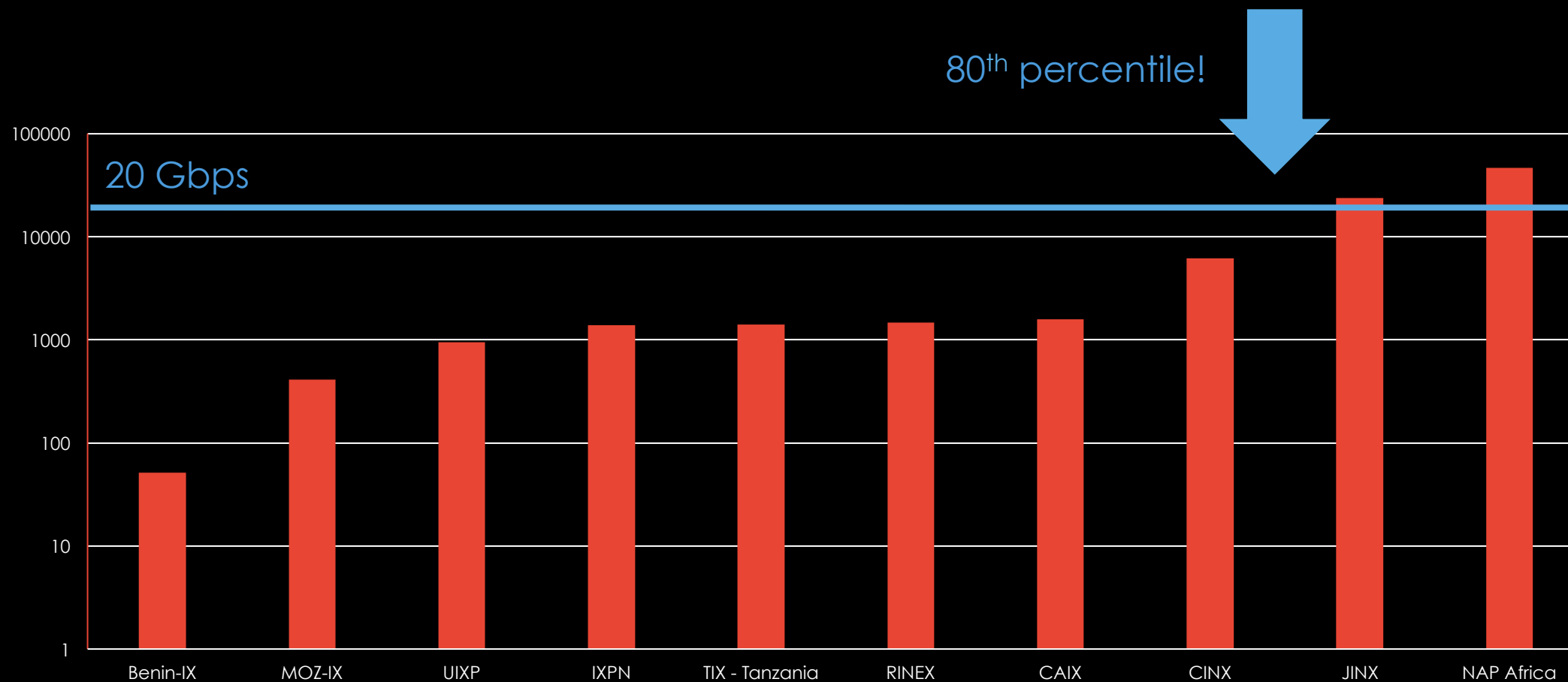
# NON-EUROPEAN IXPS



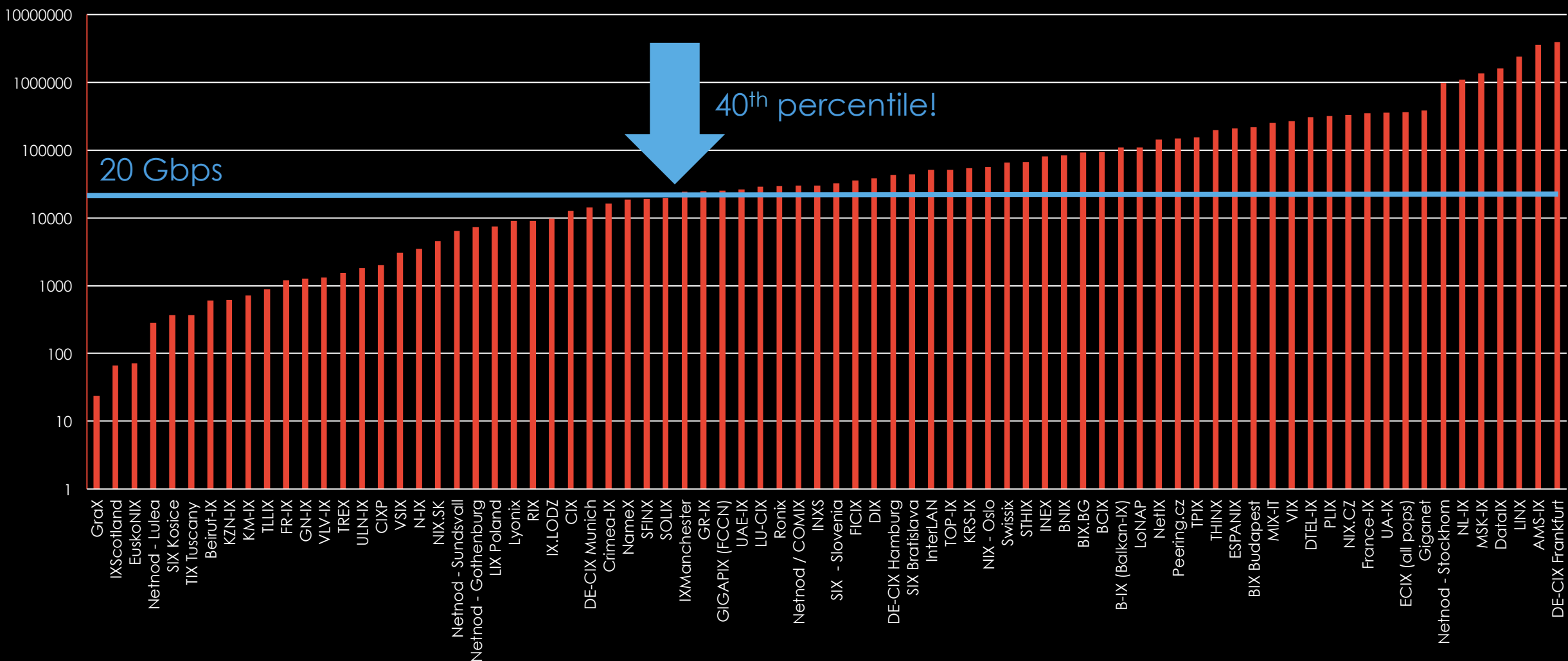
# ASIAPAC IXPS



# AFRICAN IXPS



# EUROPEAN IXPS



# MARKET RESEARCH CONCLUSIONS

- Traffic over 20Gbps is unlikely\* for a startup
- Design for an initial 15-20 customers
- Initial revenue is low (if any)

\* yes, there are exceptions, in places with highly developed local infrastructure and a lot of pressure from content providers, like FL-IX.



# PARADIGM FOR NEW IXPS

1. First, grow to scale.
2. Then, scale to grow.



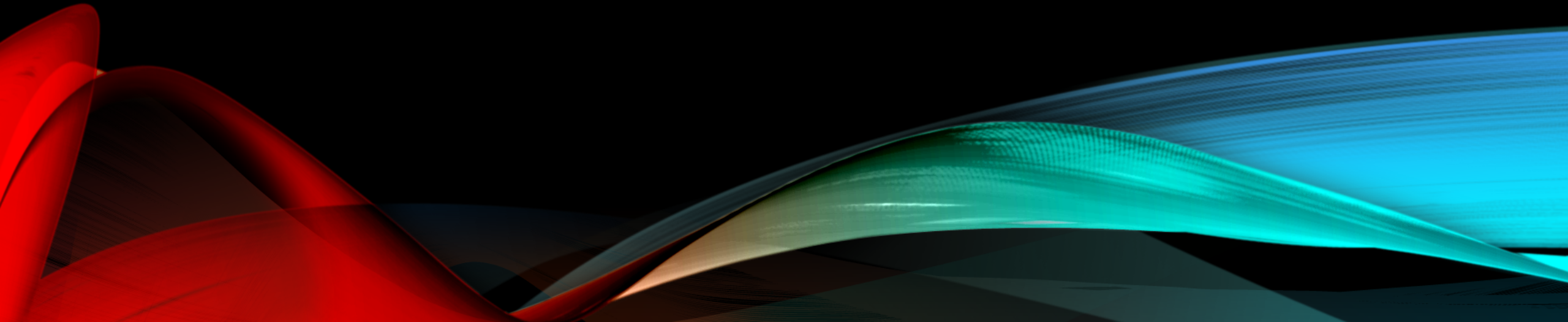


# PARADIGMS FOR HELPING NEW IXPS

1. Sponsor meeting rooms, not big gear
2. Facilitate LOCAL community building
3. Give them YOUR international contacts

# BUILD A COMMUNITY

We could spend a day on this..





# GUIDELINES

1. Be Inclusive
2. Be Pragmatic
3. (try to) Be Neutral

# SELECT YOUR SETUP

The 4 S-es of IXPs:  
Switches, Servers, Software and Space



# REQUIREMENTS LIST

- Capable of 20Gbps peak, 8Gbps average traffic
- 20-30 customer ports
- ~~10Mbps, 100Mbps,~~ 1 Gbps, multiple 1 Gbps
- Portal/website
- Quarantine VLAN
- Route server
- Arpwatch
- Central location with good connectivity options

# BURSTS, BUFFERS AND PORT SPEEDS

- TL;DR – Don't offer 10Mbps or 100Mbps ports. You will drop traffic.
- Slightly longer explanation:
  - Switches are for forwarding traffic, not storing it
  - Cheap switches have modest buffers for storing traffic
  - Bursts of traffic from a 1G or 10G port towards a 10Mbps port will exhaust those
  - If a switch is out of buffers, it will drop traffic
- Same thing goes for high port utilization!
- Keep your port speed variance under 2 orders of magnitude!



# SWITCH OPTIONS

	Traffic	Ports	Est. price (USD)	Max Power (W)	Example
Entry	0-20G	24 10/100/1000T 4 1G SFP	\$347	32	<a href="#">HP V1910-24G</a>
Entry+	0-20G	48 10/100/1000T 4 1G SFP	\$480	60	<a href="#">HP V1910-48G</a>
Basic	0-40G	24 10/100/1000T 2 1G/10G SFP+ 2 1G/10G UTP	\$837	34	<a href="#">HP 1950 24xGbE 2xSFP+</a>
Basic+	0-40G	48 10/100/1000T 2 1G/10G SFP+ 2 1G/10G UTP	\$1,330	54	<a href="#">HP 1950 48xGbE 2xSFP+</a>
Fiber	0-40G	24 1000 SFP 8 10/100/1000T 4 1G/10G SFP+	\$1,860	60	<a href="#">HP 5130-24G-SFP-4SFP+ EI</a>
10G	41-250G	48 1G/10G SFP+ 4 40G QSFP+	\$10,800	260	<a href="#">HP 5900AF-48XG-4QSFP+</a>

# SERVER OPTIONS

	Est. price (USD)	Typical Power (W)	Example
Entry	\$502	25	<a href="#">Supermicro dual core Atom, 4GB, 2x1T disk</a>
Basic	\$1,539	120	<a href="#">Dell R320, 4C Xeon, 16GB, 2x1T disk</a>
Pimp	\$6,225	250	<a href="#">Dell R530, 12C Xeon, 64GB, 2xSSD, 4x2T disk</a>



# SOFTWARE

- A recent \*BSD/Linux distribution (take your pick)
- IXP Manager (<https://github.com/inex/IXP-Manager/wiki>)

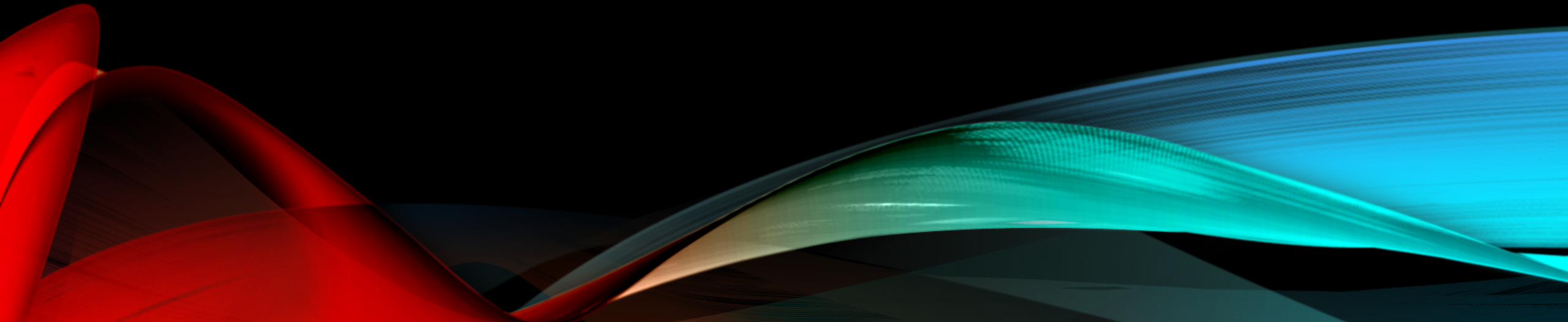


# SPACE

- A mutually convenient, EXISTING space with EXISTING connectivity options
- Assure neutral cable entry, roof rights and so on
- The IXP requirements are modest compared to the connecting equipment
- There's no such thing as a free lunch

# BUSINESS CASE

Technical Infrastructure Only!



The background of the slide is a solid black field. At the top, there is a decorative border consisting of several overlapping, wavy, translucent bands of color. From left to right, these bands transition through a spectrum: deep red, orange, yellow, and finally a bright cyan or light blue on the far right.

*“Half a million dollars will always be missed.”*



# ASSUMPTIONS

- No organizational cost assumed – just the gear and keeping it running!
- No import duties, taxes, VAT, license fees
- It will take you 3 years to fill your ports
- Power cost is \$0.40/kWh
- All datacenter costs are included in power cost
- Revenue is projected based on port-months

**1G port cost: \$50 setup, \$10 per month**

**10G port cost: \$250 setup, \$50 per month**

# SETUP 1

Single site, local customer equipment, unknown uptake, 10G

Per site:

- 1 "Entry" level switch: \$350
- 1 "Entry" level server: \$500
- Cabling: \$60
- Cable management: \$10
- TOTAL: \$950



(20 customer ports, 1G copper, 67W power)

# SETUP 1

- Investment: \$952
- Power draw: 67W
- Customer ports: 20x1 G

	Port-months	Revenue	Investment	Power cost	Margin
Year 1	30	\$550	\$952	\$232	-\$634
Year 2	90	\$1,150	\$0	\$232	\$918
Year 3	180	\$2,300	\$0	\$232	\$2,068
Total		\$4,000	\$952	\$695	\$2,353

# SETUP 2

Expandable to 10Gbps / multiple Sites, local equipment

Per site:

- 1 “Basic” level switch: \$808
- 1 “Entry” level server: \$502
- Optics: \$100
- Cabling: \$100
- Cable management: \$ 80
- TOTAL \$1,590



(20 customer ports, 1 G copper; 2 10Gbps ports, 69W power)

## SETUP 2

- Investment: \$1590
- Power draw: 69W
- Customer ports: 20x1G, 2x10G

	Port-months 1G	Port-months 10G	Revenue	Investment	Power cost	Margin
Year 1	30		\$550	\$1,590	\$238	-\$1,278
Year 2	90	6	\$1,700	\$50	\$238	\$1,412
Year 3	180	18	\$3,200	\$50	\$238	\$2,912
Total			\$5,450	\$1,690	\$715	\$3,045

# SETUP 3

Expandable to 10Gbps / multiple Sites, mostly remote customer equipment

Per site:

- 1 “Fiber” level switch: \$1,860
- 1 “Basic” level server: \$1,539
- Optics: \$ 300
- Cabling: \$ 200
- Cable management: \$ 80
- TOTAL \$3,979



(20 customer ports 1G SMF; 8 1G copper; 4 10Gbps ports, 210W power)



## SETUP 3

- Investment: \$3,979
- Power draw: 210W
- Customer ports: 28x1G, 4x10G

	Port-months 1G	Port-months 10G	Revenue	Investment	Power cost	Margin
Year 1	42	6	\$1,220	\$3,979	\$726	-\$3,485
Year 2	126	18	\$2,660	\$50	\$726	\$1,884
Year 3	252	36	\$5,070	\$50	\$726	\$4,244
Total			\$8,950	\$4,129	\$2,177	\$2,644

# SETUP 4

10G capable, local and remote customer connections, multiple sites

Per site:

- 1 “10G” level switch: \$10,800
- 1 “Basic” level switch: \$ 808
- 1 “Pimp” level server: \$ 6,225
- 1 “Basic” level server: \$ 1,539
- Optics: \$ 1,300
- Cabling: \$ 500
- Cable management: \$ 250
- TOTAL \$21,422



(44 customer ports 1G/10G SMF; 24 1G copper; 4 40Gbps ports, 744W power)

# SETUP 4

- Investment: \$21,422
- Power draw: 744W
- Customer ports: 36x1G, 36x10G

	Port-months 1G	Port-months 10G	Revenue	Investment	Power cost	Margin
Year 1	54	54	\$5,940	\$21,422	\$2,571	-\$18,053
Year 2	162	162	\$12,420	\$450	\$2,571	\$9,399
Year 3	324	324	\$24,840	\$900	\$2,571	\$21,369
Total			\$43,200	\$22,772	\$7,714	\$12,714

# DUMPSTER DIVING

10G capable, local and remote customer connections, multiple sites

Per site:

- |  |     |
|--|-----|
| • 1 Brocade MLX-16, 6 4x10GE cards, 2 24x100/1000 cards, 3,500W  | \$0 |
| • 2 HP Proliant DL360 Gen5, Dual quad-core Xeon, 16GB, 500W each | \$0 |
| • Optics:  | \$0 |
| • Cabling:   | \$0 |
| • Cable management:  | \$0 |
| • TOTAL  | \$0 |

(24 customer ports 1G copper; 24 1G SMF; 24 10Gbps ports, 4,500W power)

# DUMPSTER DIVING

- Investment: \$0
- Power draw: 4,500W
- Customer ports: 48x1G, 24x10G

	Port-months 1G	Port-months 10G	Revenue	Investment	Service	Power cost	Margin
Year 1	72	36	\$8.20	\$500	\$25.000	\$15.552	-\$36.432
Year 2	216	108	\$9.600	\$500	\$25.000	\$15.552	-\$31.392
Year 3	432	216	\$17.320	\$500	\$25.000	\$15.552	-\$21.732
Total			\$33.600	\$1.500	\$75.000	\$46.656	-\$89.556

# DUMPSTER DIVING

- Investment: \$0
- Power draw: 4,500W
- Customer ports: 48x1G, 24x10G

**1G port cost: \$250 setup, \$50 per month**

**10G port cost: \$500 setup, \$200 per month**

	Port-months 1G	Port-months 10G	Revenue	Investment	Service	Power cost	Margin
Year 1	72	36	\$16.800	\$500	\$25.000	\$15.552	-\$24.252
Year 2	216	108	\$38.400	\$500	\$25.000	\$15.552	-\$2.652
Year 3	432	216	\$76.800	\$500	\$25.000	\$15.552	\$35.748
Total			\$132.000	\$1.500	\$75.000	\$46.656	\$8.844

# A \$100K SWITCH SETUP

10G capable, local and remote customer connections, multiple sites

Per site:

• 1 Big Vendor switch, 48x1G ports, 24x10G ports, 1,880W	\$99,470
• 1 “Pimp” level server:	\$ 6,225
• 1 “Basic” level server:	\$ 1,539
• Optics:	\$ 1,300
• Cabling:	\$ 500
• Cable management:	\$ 250
• TOTAL:	\$109,284

(24 customer ports 1G copper; 24 1G SMF; 24 10Gbps ports, 2,250W power)



# A \$100K WDM SETUP

- Investment: \$109,284
- Power draw: 2,250W
- Customer ports: 48x1G 24x10G

	Port-months 1G	Port-months 10G	Revenue	Investment	Service	Power cost	Margin
Year 1	72	36	\$4,620	\$109,284	0	\$7,776	-\$112,440
Year 2	216	108	\$9,660	\$450	\$24,500	\$7,776	-\$23,066
Year 3	432	216	\$19,320	\$900	\$24,500	\$7,776	-\$13,856
Total			\$33.600	\$110.634	\$49,000	\$23,328	-\$149,362



# A \$100K SWITCH SETUP

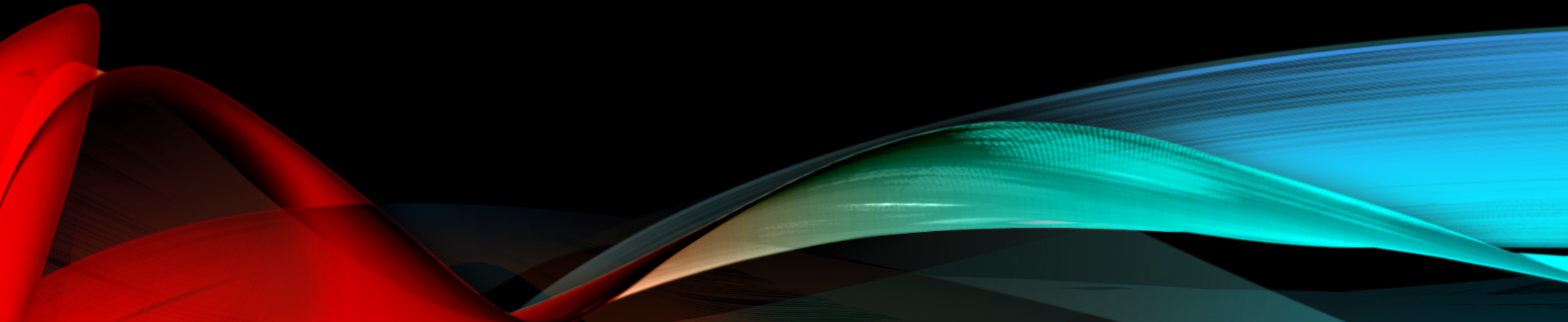
- Investment: \$109,284
- Power draw: 2,250W
- Customer ports: 48x1G, 24x10G

**1G port cost: \$300 setup, \$65 per month**

**10G port cost: \$1,500 setup, \$275 per month**

	Port-months 1G	Port-months 10G	Revenue	Investment	Service	Power cost	Margin
Year 1	72	36	\$27,180	\$109,284	0	\$7,776	-\$89,880
Year 2	216	108	\$56,340	\$450	\$24,500	\$7,776	\$23,614
Year 3	432	216	\$112,680	\$900	\$24,500	\$7,776	\$79,504
Total			\$196,200	\$110,634	\$49,000	\$23,328	\$13,238

# FIGURING OUT THE CONTENT SIDE



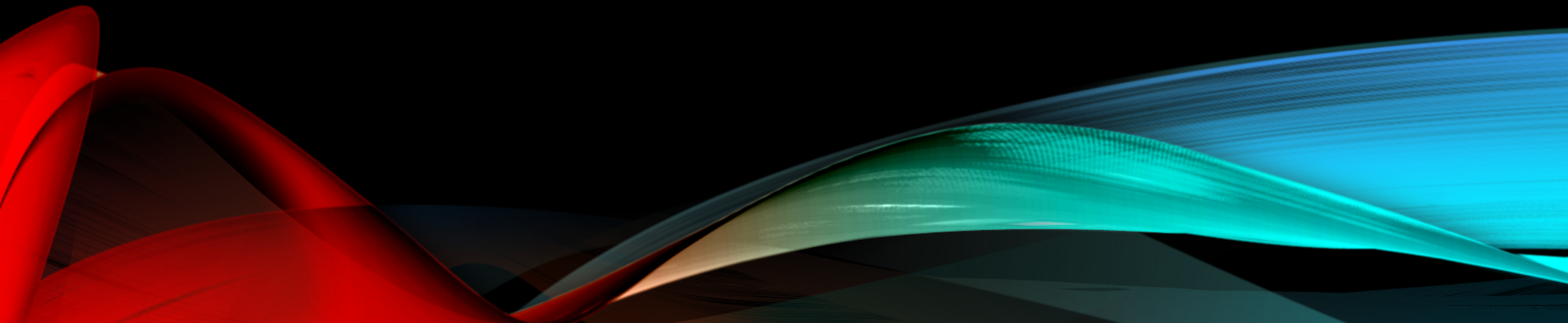
# “BUILD IT AND WE WILL COME”\*

- Getting content providers adds enormous value to your IXP
- But it comes at a price – which is a separate business case!
- Typical requirements:
  - free IP transit, free space & power
- The upside:
  - total IP transit cost for the community goes down
  - Much improved user experience

\*As long as it's free (for us).

# BEST PRACTICES

Progress since May



# IGF BPF IXP

- Last weeks IGF had the BPF sessions (best practices forum)
- Included in those sessions was one about IXPs, and a document was prepared in advance:  
<http://www.intgovforum.org/cms/documents/best-practice-forums/536-igf15-bpf-ixp-jp-draft>
- Section 1.4 reads as follows:  

“The IGF is not an appropriate forum to discuss or teach the technical knowhow that is needed to create and/or run an IXP, nor is it a technical manual for routers and switches. There are specialist meetings and forums that dive into the technical details of how to establish, operate, and sustain an IXP. In addition, technical guidelines and reference documents are available from IXP operators and managers. For those seeking technical guidance and technical best practices, a non- exhaustive overview of reference documents from IXP -related fora has been included in this document (see Appendix 1).”



# FINAL REMARKS

- You don't need a huge budget
- You DO need a solid community (inclusive, pragmatic, neutral)
- Don't be afraid to upgrade
- Just about everything else is more important than the IXP hardware
- If you want resilience, build more IXPs

An abstract graphic at the top of the slide featuring a series of overlapping, flowing bands of color. From left to right, the colors transition from a warm orange-red to a bright yellow, then into a vibrant green, and finally into a cool blue. The bands have a soft, ethereal quality, resembling light waves or liquid motion.

# THANK YOU

Please come see me after the session or send e-mail!

With special thanks to Euro-IX for providing IX traffic data!

Remco van Mook

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