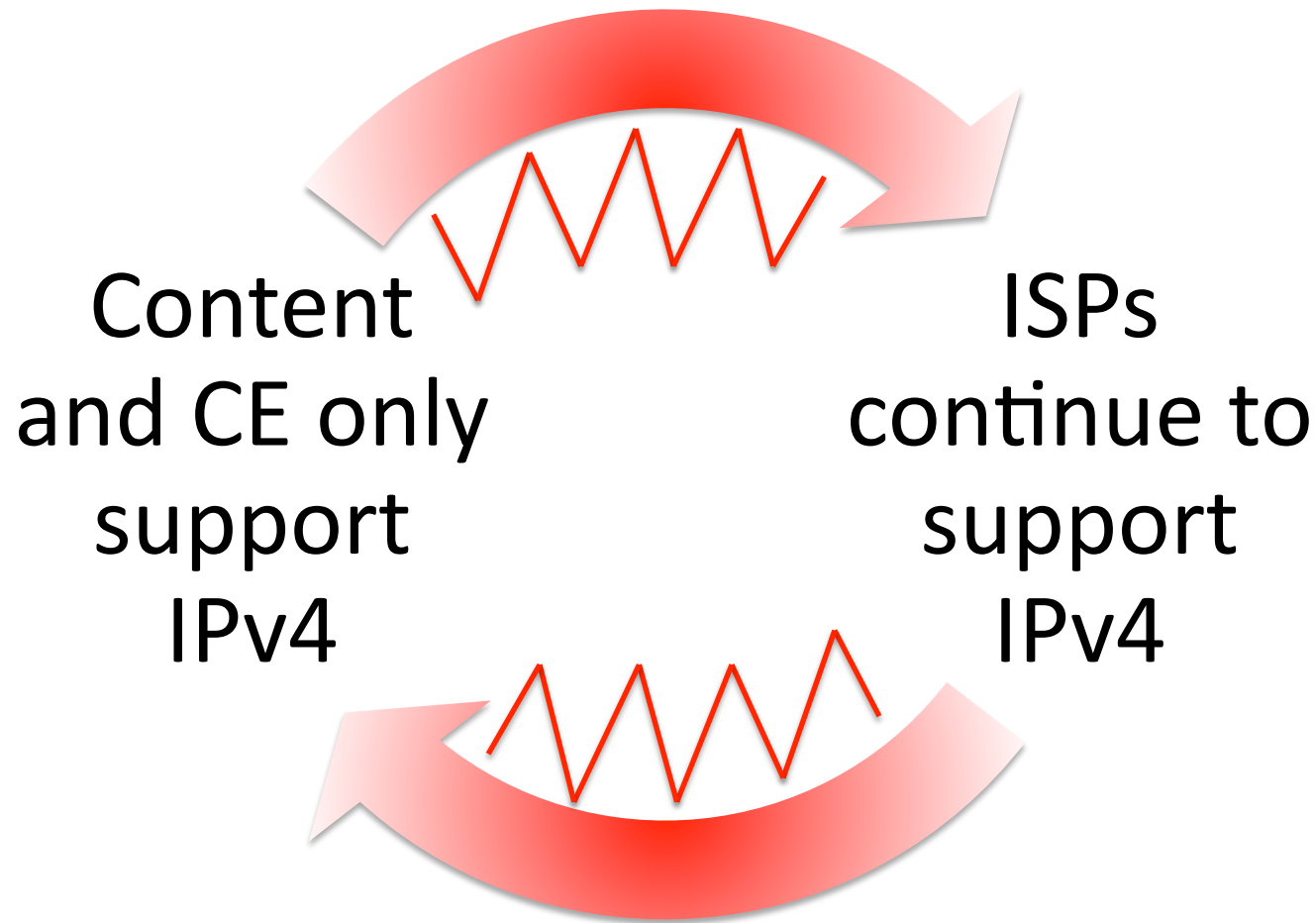


When Is IPv6 Only?

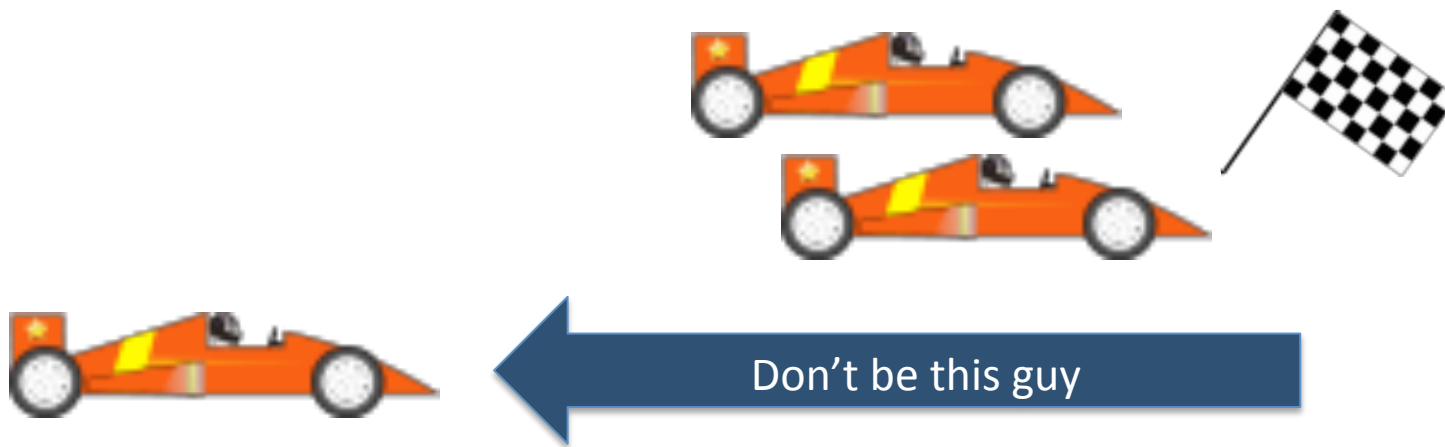
Lee Howard

Strategy Problem

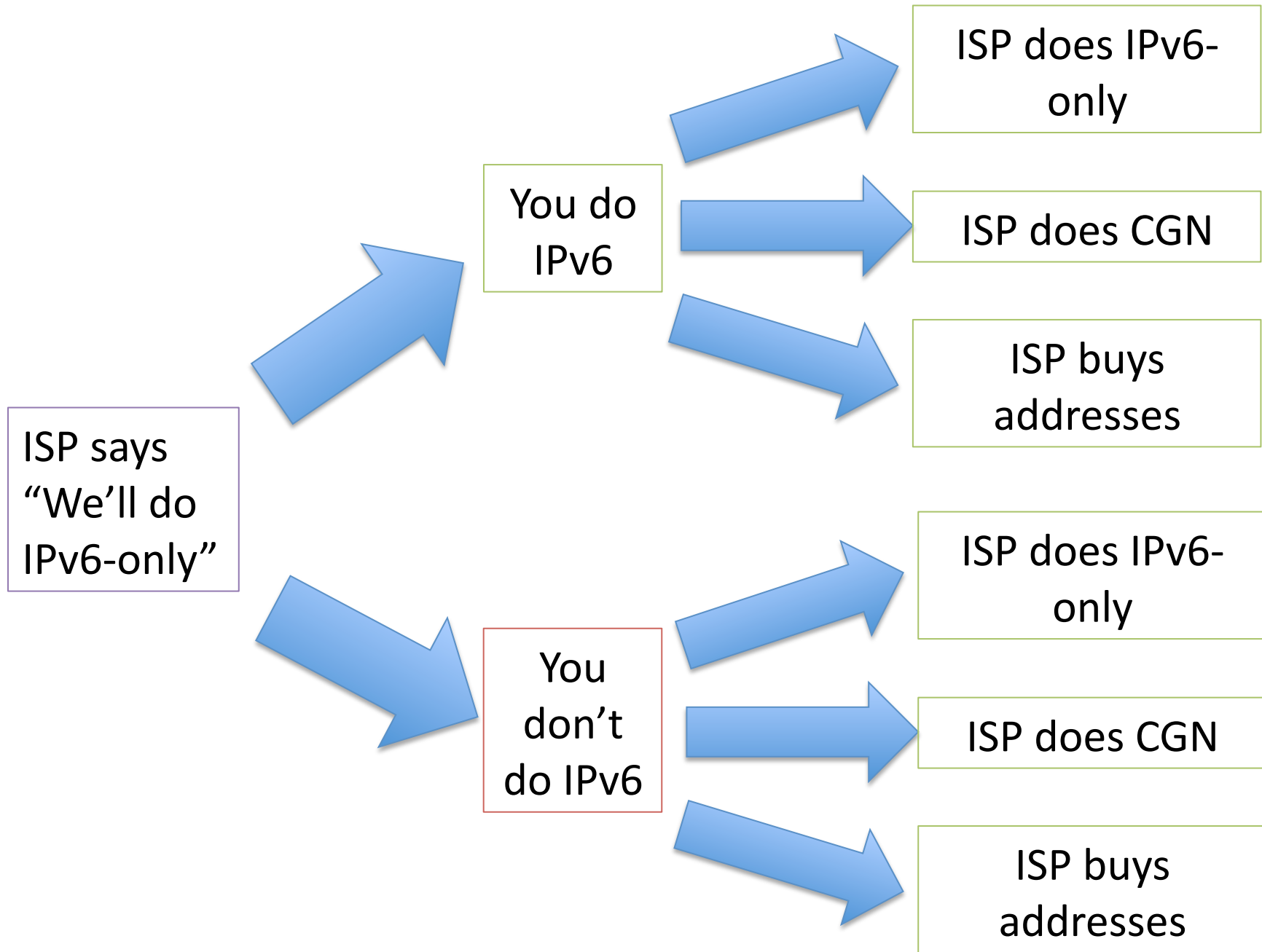


How Soon Is Now?

- Name of the Game is “When Do I Add IPv6?”
- Object: Maximize profit, minimize cost
 - ISP: soon—IPv6-only is the only way to minimize cost
 - Content: as late as possible without losing eyeballs
 - Consumer electronics: as late as possible without losing sales

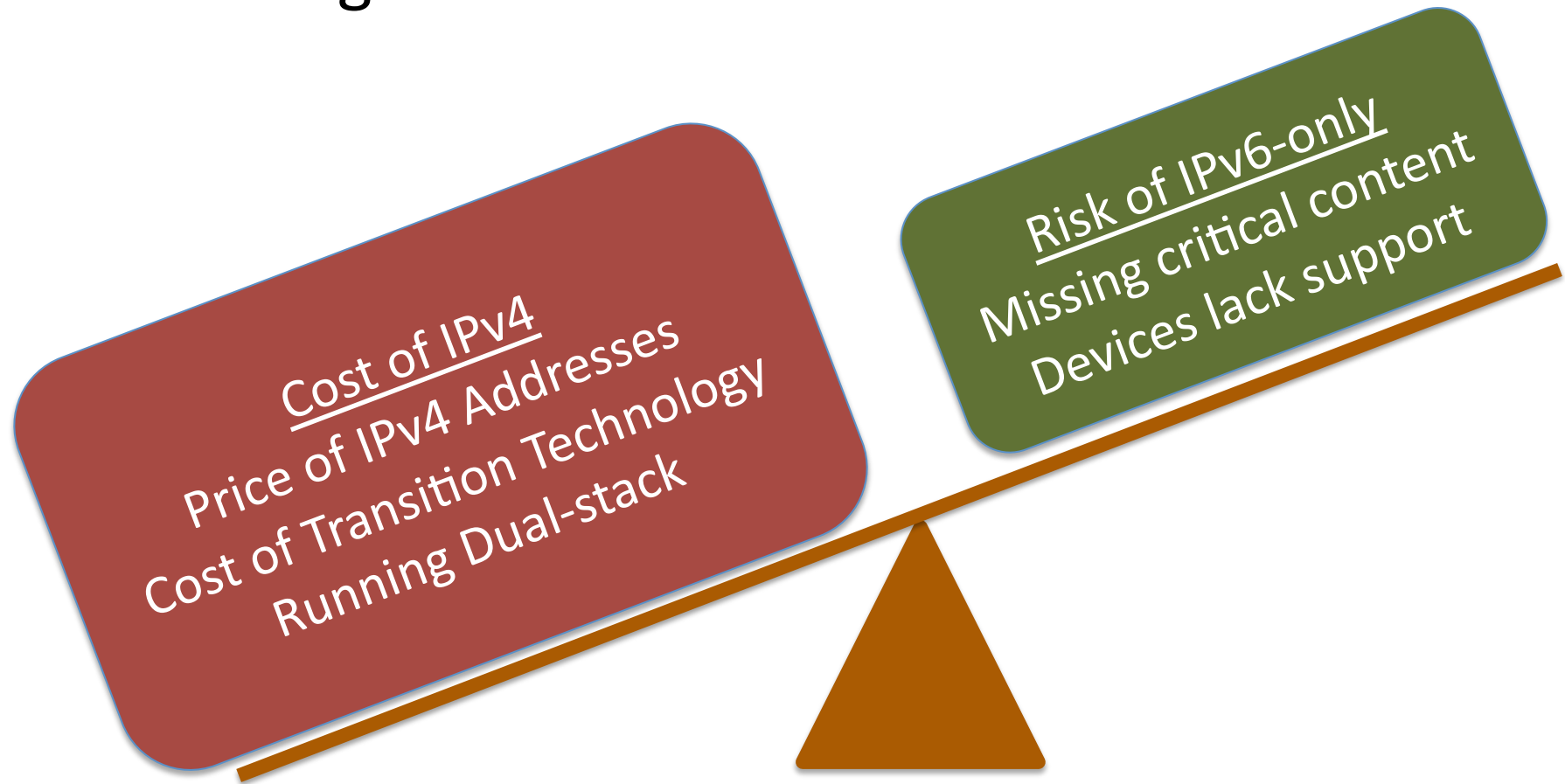


"4.2 billion IPv4 addresses. 5 billion devices. 7 billion people." -Lee Howard



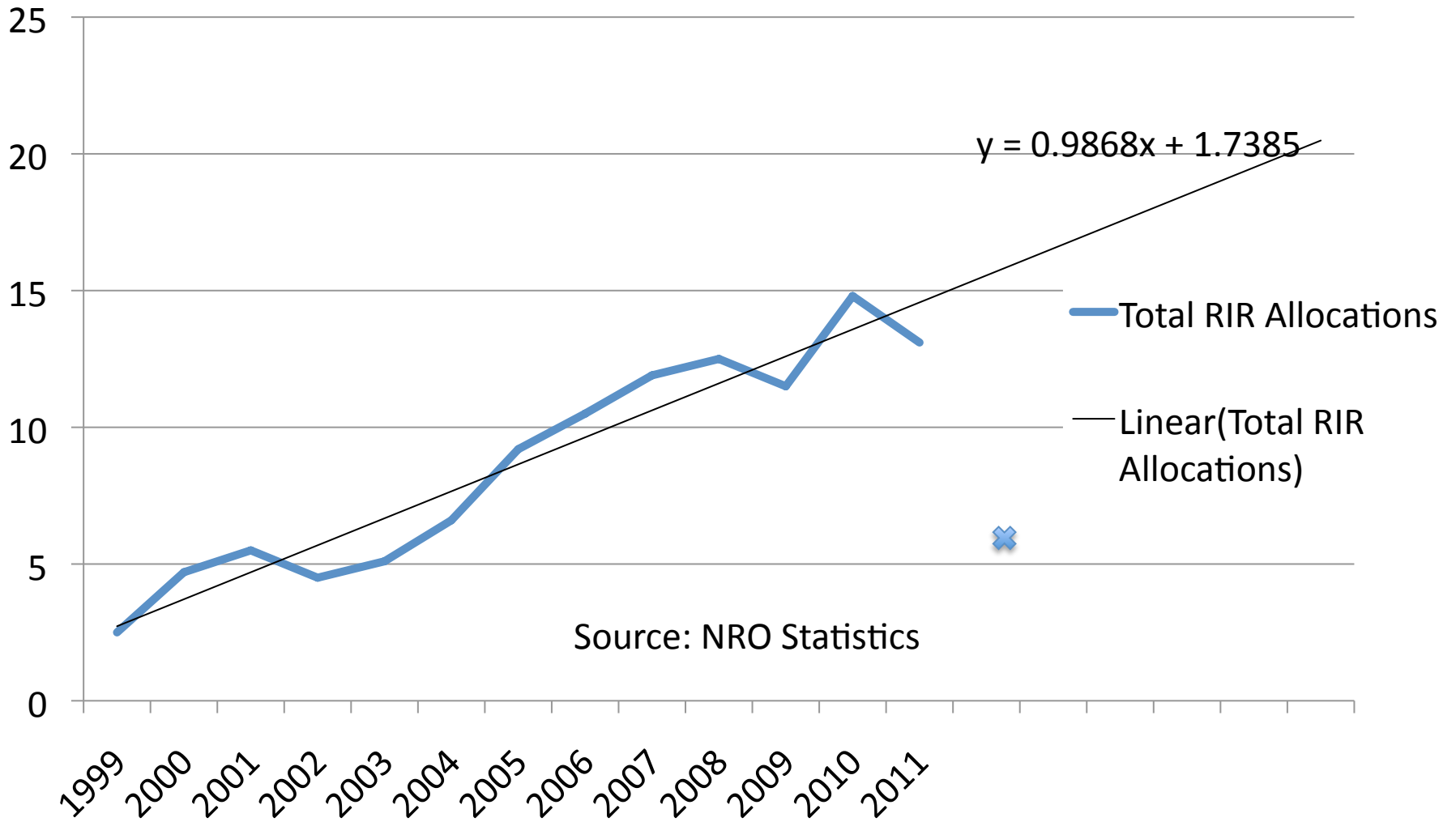
Shall We Play a Game?

- ISPs offer IPv6-only service when the cost of IPv4 is greater than the risk of no-IPv4

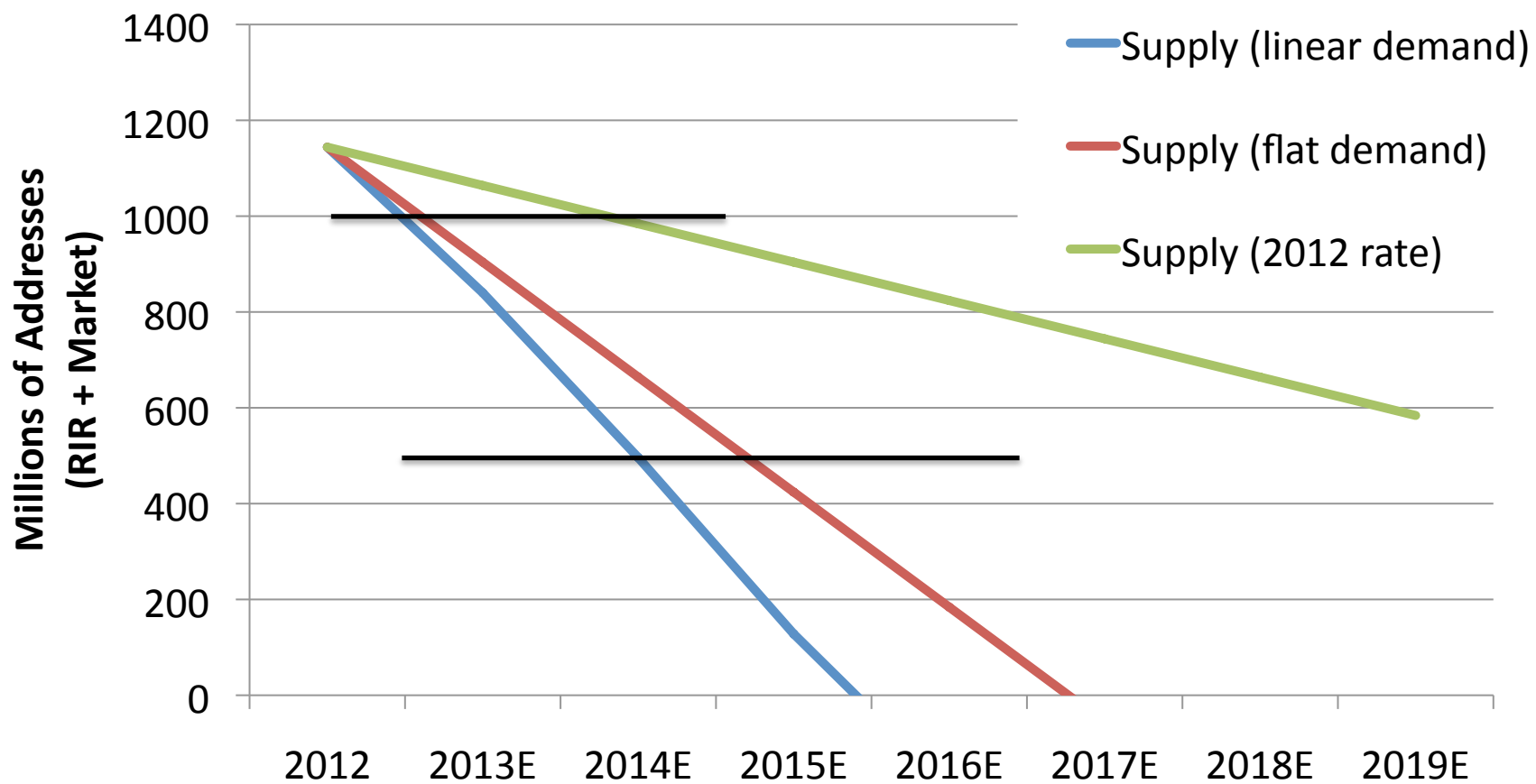


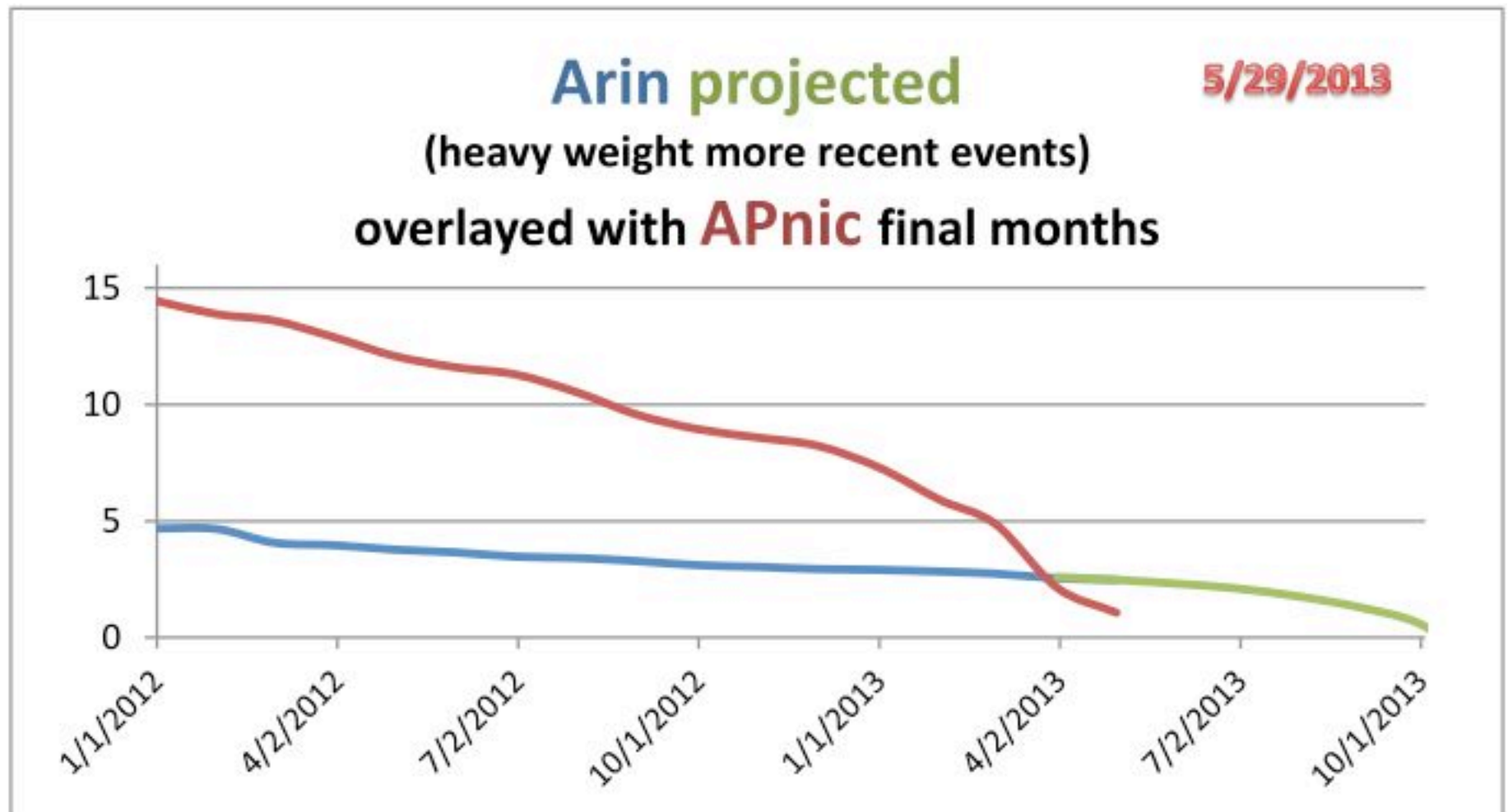
COST OF IPv4

Total RIR Allocations



IPv4 Address Supply





<http://www.tndh.net/~tony/ietf/ARIN-heavy-tail.JPG>

Buy Addresses or CGN?

	2014	2015	2016	2017	2018	2019	2020	2021
Cost of IPv4 (price increase?)	\$16	\$18	\$24	\$40	\$51	\$60	\$75	\$100
Cost of CGN (at \$6 + 1/10 th address)	\$7.60	\$7.80	\$8.40	\$10	\$11.10	\$12	\$13.50	\$16

How do consumers respond to price increases?

Warning: Your ability to predict prices of the future is as good as mine. Make up your own numbers.

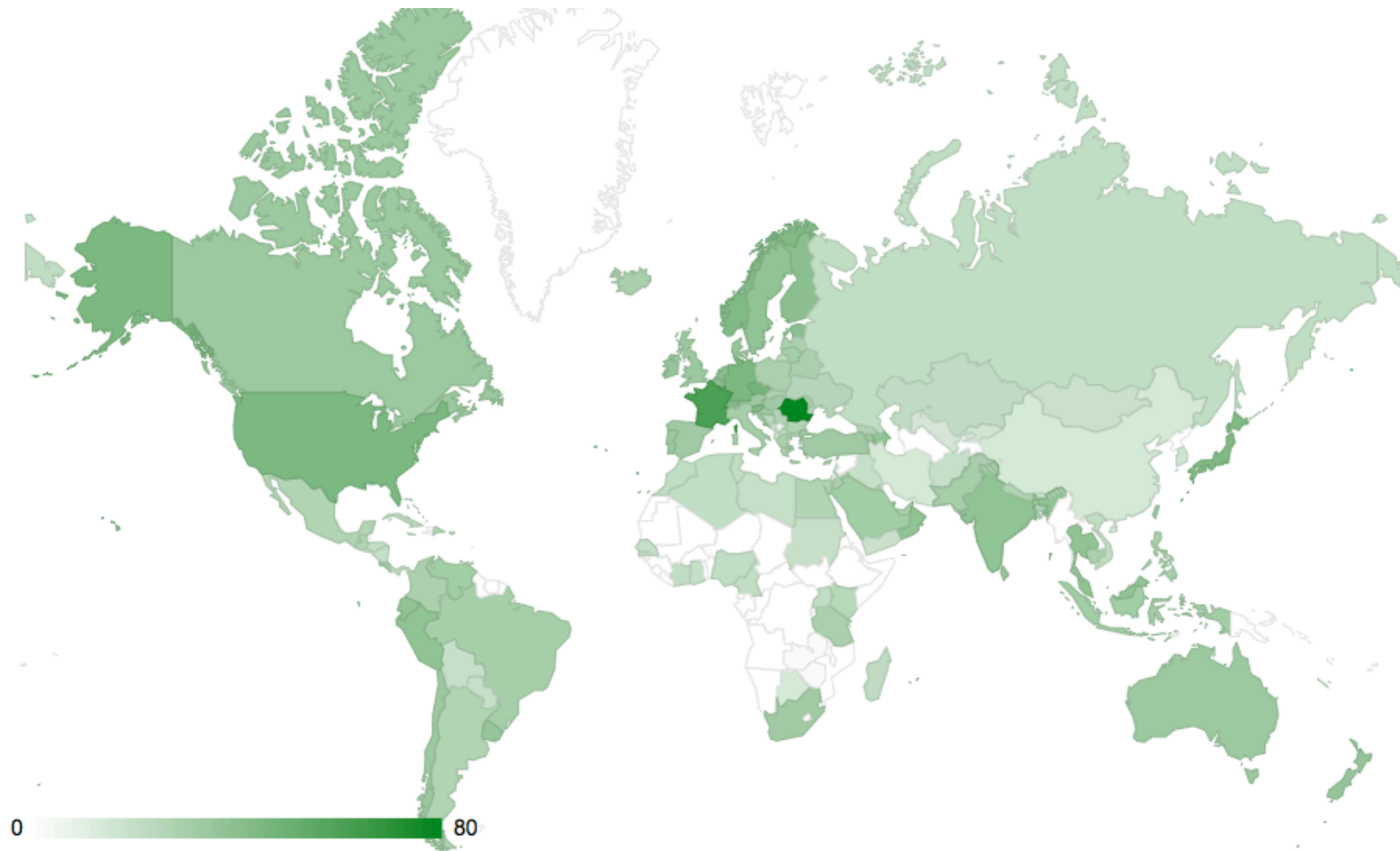


RISK OF IPv6

IPv6-only: Risky Business?

- If content/app consumers want isn't there, they may cancel.
 - Not all content is equally important
 - <http://6lab.cisco.com/stats/index.php>
 - Weighted by # DNS queries
 - Thus, for any given AAAA query, what's the probability that the site supports IPv6?

<http://6lab.cisco.com/stats/index.php>



April 2013: 46% of AAAA queries are for an IPv6-enabled site, in the U.S.
Gets to 63% if you add Amazon, Microsoft, eBay, Craigslist, LinkedIn, Twitter, Disney/go

Zoltar's Crystal Ball

Net New Subs	100,000		
ARPU	\$400	Profit	35%
ISP Tactics	Cost per Sub	Percent at Risk	Likelihood of Risk
IPv6 Only	\$0	37%	25%
CGN	\$10	14%	50%
Buy IPv4	\$40	10%	100%

http://www.asgard.org/images/Game_Theory.xls

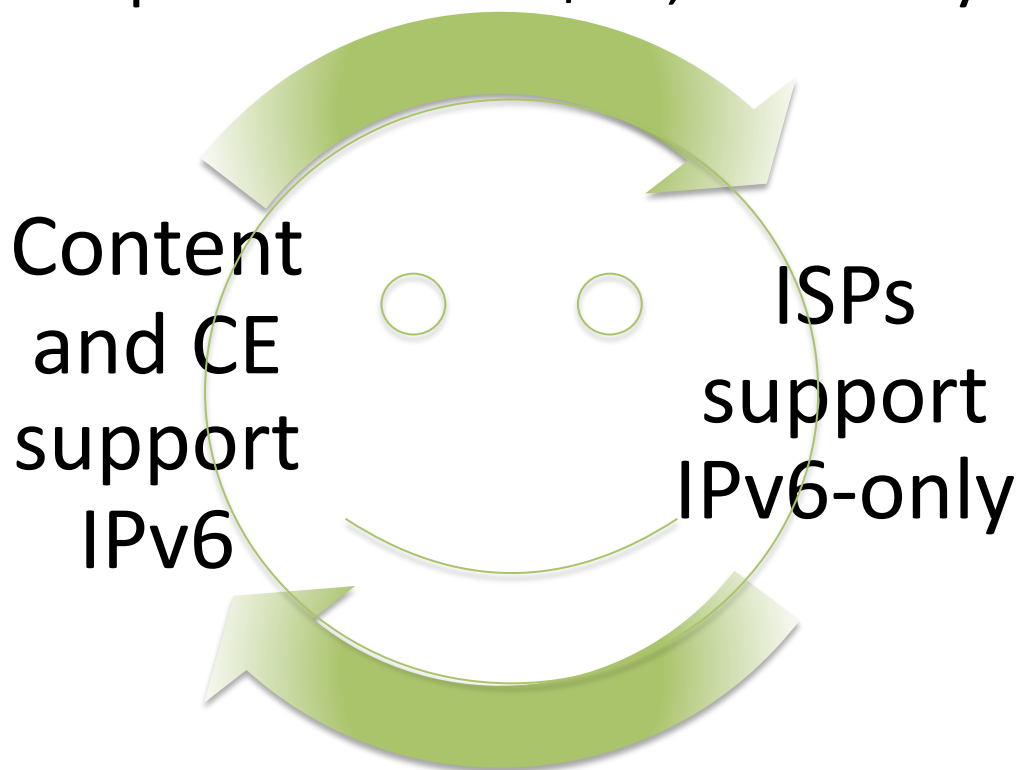
"Strangely enough, the results depend on what assumptions you make." --
David Conrad

Results (YMMV)

Triple Mix				Impact	Worst Case Scenario
IPv6 only	CGN	Buy IPv4	Base Cost	Cost + (Risk * Likelihood)	Cost + Risk
0%	100%	0%	\$1,000,000	\$3,800,000	\$6,600,000
0%	90%	10%	\$1,300,000	\$4,220,000	\$6,740,000
90%	10%	0%	\$100,000	\$3,710,000	\$13,980,000
10%	90%	0%	\$900,000	\$3,790,000	\$7,420,000
100%	0%	0%	\$0	\$3,700,000	\$14,800,000
0%	0%	100%	\$4,000,000	\$8,000,000	\$8,000,000

Summary

- When Top 15 websites support IPv6 and
- IPv4 address prices exceed \$40, IPv6-only makes sense.



Remaining Questions

- Can the Internet industry work toward a common IPv6-only date?
- What do we need to do to set the right date?
- Interim steps?
 - Test IPv6-only in lab
 - IPv6-only in the field for enthusiasts
 - IPv6-only prep day for content/electronics
 - Transition technologies to survive until the date
- Is degraded NAT64/NAT44 a required step?