

The Cost of IPv4-IPv6 Transition

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ENJOY
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Introduction



- What will it cost to use CGN?
 - Based on RIPv6TF 2012 talk “TCO of CGN”
- What will it cost to run dual-stack?
 - Based on NANOG 57 talk
- What will it cost to buy IPv4 addresses?
 - New material

What will it cost to run CGN?

What Does CGN Cost?



- CGN reportedly breaks things¹
- How many users affected (out of 10,000)?

| Use | Number of Potential Users ² | Number Affected | Number of Support Calls ³ | Number of Lost Users ³ |
|----------------|--|-----------------|--------------------------------------|-----------------------------------|
| PS3 | 1100 | 550 | 137 | 137 |
| P2P | 1500 | 1200 | 300 | 300 |
| Netflix | 1200 | 60 | 15 | 15 |
| Misc. | 800 | 800 | 200 | 200 |
| | 6,700 | 2,610 | 652 | 652 |

¹ draft-donley-nat444-impacts

² North American sales per ten thousand homes, per various sources.

³ Arbitrary guess. Spreadsheet at <http://www.asgard.org/documents.html>



Cost of CGN

Per 10,000 users

- Capital

- Hardware, software, logging systems: US\$90,000 ?

- Operations Expense

- System support, maintenance: US\$10,000?

- If support call cost is \$20, 652 calls = US\$13,040.

- Lost Revenue

- If (ARPU) is \$400/year, the annual

- revenue lost to CGN is: $\$400 * 652 =$ US\$260,800

- per year.

Total CGN Costs per 10,000 Users (USD)



| Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | |
|-----------|-----------|-----------|-----------|-----------|-------------------------|
| \$18,000 | \$18,000 | \$18,000 | \$18,000 | \$18,000 | CAPEX (depreciation) |
| \$10,000 | \$10,000 | \$10,000 | \$10,000 | \$10,000 | OPEX |
| \$13,040 | 0 | 0 | 0 | 0 | Customer support |
| \$260,800 | \$260,800 | \$260,800 | \$260,800 | \$260,800 | Lost revenue |
| \$301,840 | \$288,800 | \$288,800 | \$288,800 | \$288,800 | TOTAL: \$1,457,040 |

What will it cost to use CGN?



CGN costs US\$1.5 million for every 10,000 users it's used for, or \$30 per user per year.

What will it cost to run dual stack?

Cost of Dual-Stack



- Asked experts on various industry segments
 - Data Center/Host/Content
 - ISP
 - Enterprise
- Deployment Cost
- Operational Cost

Deployment Costs



| | | |
|----------------------------------|--|---|
| Data Center, Hosting, Content | Security appliances, Monitoring systems | \$1 per user |
| | Application development | \$6 per user |
| ISP | Training 2-3 hours of training | \$0.15 per user \$150 per support/NOC employee 1 support staff per 1000 subs |
| | CPE | \$25 per user \$50 each, but only half need upgrades |
| Consumer Electronics | Labor | \$0.30 per device |

Capital expenditures are reduced if spread over a longer period of time, when upgrades were planned anyway.
So, start four years ago and it's cheap.

Operations Costs



| | Develop | Operate |
|--------------------------|--|--|
| Content | \$6 <i>pupy</i> +10-30% | \$0.08 <i>pupy</i> 20% of OpEx increases by |
| Data Center, Hosting, | Application development Lower for hosting | 1-5% |
| ISP | \$6.40 <i>pupy</i> Device code | \$0.25 - \$1.27 <i>pupy</i> |
| Consumer Electronics | \$0 | \$0 |

pupy = "Per User Per Year"

What will it cost to run dual-stack?



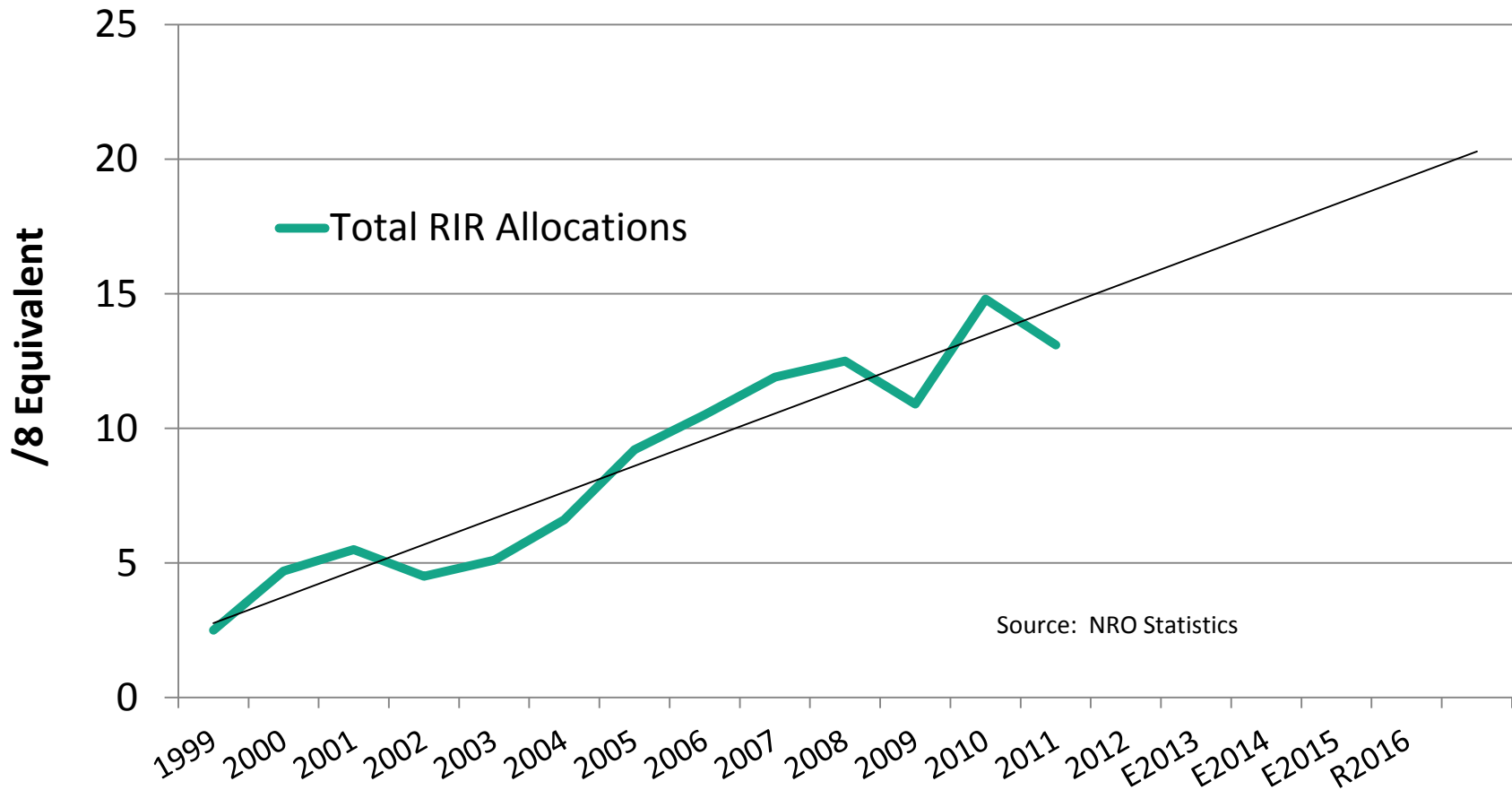
| | Deploy | Operate |
|-----------------------------------|-------------------|--------------------------|
| Data center Hosting Content | \$7 per user | \$6.08 per user per year |
| ISP | \$25 per user | \$7.50 per user per year |
| Electronics | \$0.30 per device | \$0 per device |

- Costs listed err to the high end
- Reduce deployment cost by starting sooner
- Reduce operation cost by limiting time dual-stack is supported

What will it cost to buy IPv4 addresses?

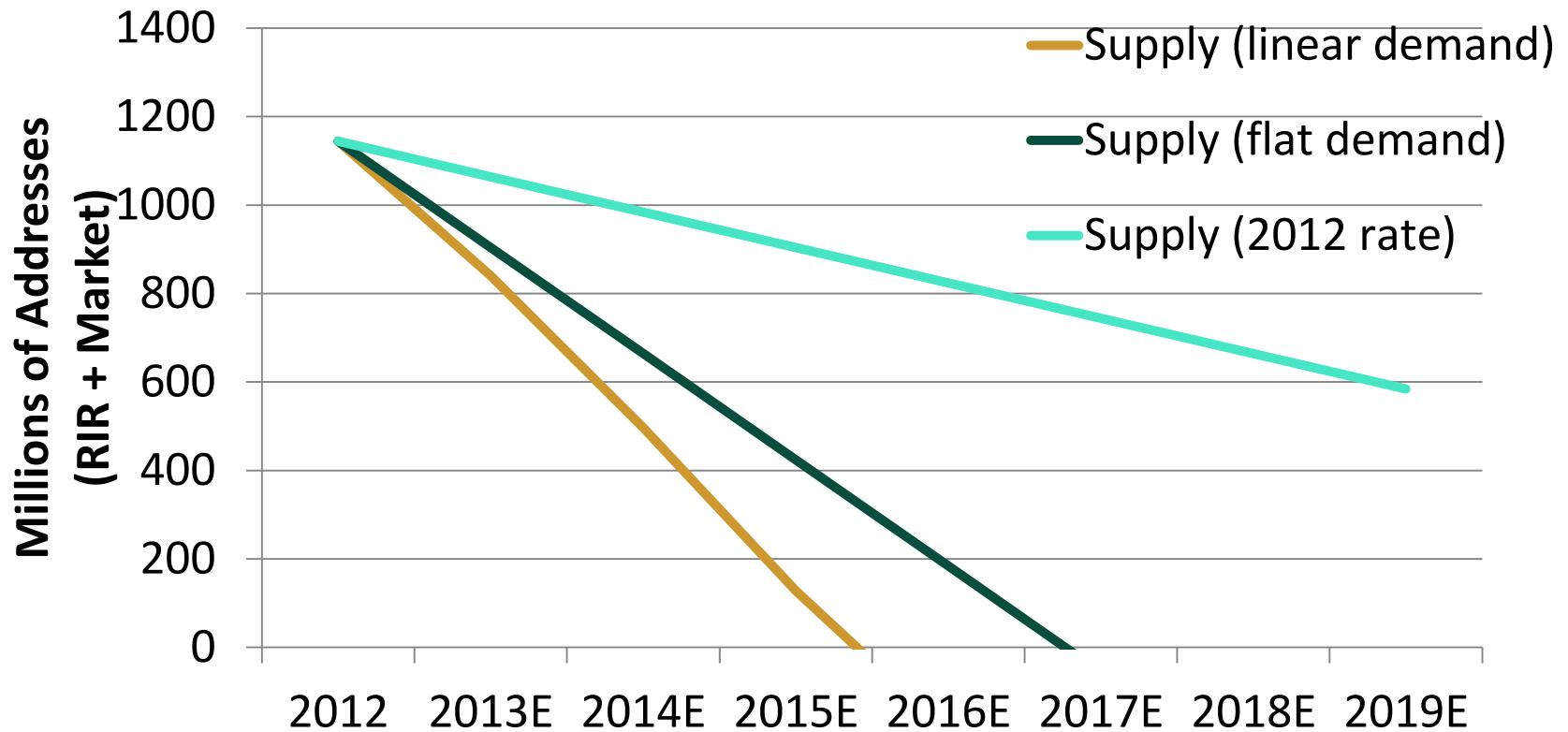


RIR Allocations by Year (/8 Equivalents)





IPv4 Address Supply



IPv4 Supply



At what price would someone sell an IPv4 address?

| Tier | Summary | Cost per Address ¹ | Addresses Available ² |
|--------|---------------------|-------------------------------|----------------------------------|
| Tier 0 | Remaining RIR space | \$0.03 - \$4 | 144,000,000 |
| Tier 1 | Unused | \$9 - 12 | 480,000,000 |
| Tier 2 | Underutilized | \$10 - 16 | 520,000,000 |
| Tier 3 | Substitutable | >\$100 | All IPv4 |

¹ “Cost” is not the same as “Price.”

² Source: ARIN, LACNIC, AfriNIC; RouteViews

What will it cost to buy IPv4 addresses?



| | 2014 | 2015 | 2016 | 2017 |
|---------------------------|----------|----------|---------|------|
| Demand | 280M | 310M | 330M | 350M |
| Supply (Abandoned) | 410M | 100M | 0 | 0 |
| Supply (Underutilized) | 520M | 520M | 290M | 0 |
| Cost ¹ | \$9 - 12 | \$9 - 16 | \$16-20 | \$n |

¹ “Cost” is not the same as “Price.”

- **Expectation** of price is not reflected; may be much higher.
- How many IPv4 addresses might be made available by substituting CGN (at US\$30 or more)?

Resolution



Q: What will it cost to use CGN?

A: \$30 per new user per year

Q: What will it cost to run dual-stack?

A: (ISP) \$7.50 *pupy*

A: (Content) \$6 *pupy*

Q: What will it cost to buy IPv4 addresses?

A: *At least* \$9-20 per new user per year until 2017.

Q: How can I reduce my costs?

DISCUSSION