THE $1,000
INTERNET EXCHANGE

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

Remco van Mook
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

54th percentile

20 Gbps
NON-EUROPEAN IXPS

69th percentile!

20 Gbps
AFRICAN IXPS

80th percentile!

20 Gbps
EUROPEAN IXPS

40th percentile!

20 Gbps
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, 1Gbps, multiple 1Gbps
- Portal/website
- Quarantine VLAN
- Route server
- Arpwatch
- Central location with good connectivity options
• 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!
<table>
<thead>
<tr>
<th>Traffic</th>
<th>Ports</th>
<th>Est. price (USD)</th>
<th>Max Power (W)</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Entry</td>
<td>0-20G 24 10/100/1000T, 4 1G SFP</td>
<td>$347</td>
<td>32</td>
<td>HP V1910-24G</td>
</tr>
<tr>
<td>Entry+</td>
<td>0-20G 48 10/100/1000T, 4 1G SFP</td>
<td>$480</td>
<td>60</td>
<td>HP V1910-48G</td>
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<tr>
<td>Basic</td>
<td>0-40G 24 10/100/1000T, 2 1G/10G SFP+, 2 1G/10G UTP</td>
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<td>34</td>
<td>HP 1950 24xGbE 2xSFP+</td>
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<tr>
<td>Basic+</td>
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<td>54</td>
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<td>$1,860</td>
<td>60</td>
<td>HP 5130-24G-SFP-4SFP+ EI</td>
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<tr>
<td>10G</td>
<td>41-250G 48 1G/10G SFP+, 4 40G QSFP+</td>
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<td>260</td>
<td>HP 5900AF-48XG-4QSFP+</td>
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<tr>
<td></td>
<td>Est. price (USD)</td>
<td>Typical Power (W)</td>
<td>Example</td>
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<tr>
<td>-------</td>
<td>-----------------</td>
<td>-------------------</td>
<td>----------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Entry</td>
<td>$502</td>
<td>25</td>
<td>Supermicro dual core Atom, 4GB, 2x1T disk</td>
<td></td>
</tr>
<tr>
<td>Basic</td>
<td>$1,539</td>
<td>120</td>
<td>Dell R320, 4C Xeon, 16GB, 2x1T disk</td>
<td></td>
</tr>
<tr>
<td>Pimp</td>
<td>$6,225</td>
<td>250</td>
<td>Dell R530, 12C Xeon, 64GB, 2xSSD, 4x2T disk</td>
<td></td>
</tr>
</tbody>
</table>
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!
“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
Single site, local customer equipment, unknown uptake, no 10G

Per site:

• 1 “Entry” level switch: $350
• 1 “Entry” level server: $502
• Cabling: $60
• Cable management: $40
• TOTAL $952

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

- **Investment:** $952
- **Power draw:** 67W
- **Customer ports:** 20x1G

<table>
<thead>
<tr>
<th>Year</th>
<th>Port-months</th>
<th>Revenue</th>
<th>Investment</th>
<th>Power cost</th>
<th>Margin</th>
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</thead>
<tbody>
<tr>
<td>Year 1</td>
<td>30</td>
<td>$550</td>
<td>$952</td>
<td>$232</td>
<td>-$634</td>
</tr>
<tr>
<td>Year 2</td>
<td>90</td>
<td>$1,150</td>
<td>$0</td>
<td>$232</td>
<td>$918</td>
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<tr>
<td>Year 3</td>
<td>180</td>
<td>$2,300</td>
<td>$0</td>
<td>$232</td>
<td>$2,068</td>
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<tr>
<td>Total</td>
<td></td>
<td>$4,000</td>
<td>$952</td>
<td>$695</td>
<td>$2,353</td>
</tr>
</tbody>
</table>
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, 1G copper; 2 10Gbps ports, 69W power)
**SETUP 2**

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

<table>
<thead>
<tr>
<th></th>
<th>Port-months 1G</th>
<th>Port-months 10G</th>
<th>Revenue</th>
<th>Investment</th>
<th>Power cost</th>
<th>Margin</th>
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<td>$550</td>
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<td>-$1,278</td>
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<tr>
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<td>6</td>
<td>$1,700</td>
<td>$50</td>
<td>$238</td>
<td>$1,412</td>
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<tr>
<td>Year 3</td>
<td>180</td>
<td>18</td>
<td>$3,200</td>
<td>$50</td>
<td>$238</td>
<td>$2,912</td>
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<tr>
<td>Total</td>
<td></td>
<td></td>
<td>$5,450</td>
<td>$1,690</td>
<td>$715</td>
<td>$3,045</td>
</tr>
</tbody>
</table>
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

<table>
<thead>
<tr>
<th>Port-months 1G</th>
<th>Port-months 10G</th>
<th>Revenue</th>
<th>Investment</th>
<th>Power cost</th>
<th>Margin</th>
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<tr>
<td>Year 1</td>
<td>42</td>
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<td>$1,220</td>
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<tr>
<td>Year 2</td>
<td>126</td>
<td>18</td>
<td>$2,660</td>
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<td>$726</td>
</tr>
<tr>
<td>Year 3</td>
<td>252</td>
<td>36</td>
<td>$5,070</td>
<td>$50</td>
<td>$726</td>
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<td>Total</td>
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<td>$8,950</td>
<td>$4,129</td>
<td>$2,177</td>
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</table>
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

<table>
<thead>
<tr>
<th>Year</th>
<th>Port-months 1G</th>
<th>Port-months 10G</th>
<th>Revenue</th>
<th>Investment</th>
<th>Power cost</th>
<th>Margin</th>
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<tbody>
<tr>
<td>Year 1</td>
<td>54</td>
<td>54</td>
<td>$5,940</td>
<td>$21,422</td>
<td>$2,571</td>
<td>-$18,053</td>
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<tr>
<td>Year 2</td>
<td>162</td>
<td>162</td>
<td>$12,420</td>
<td>$450</td>
<td>$2,571</td>
<td>$9,399</td>
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<tr>
<td>Year 3</td>
<td>324</td>
<td>324</td>
<td>$24,840</td>
<td>$900</td>
<td>$2,571</td>
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<td>$43,200</td>
<td>$22,772</td>
<td>$7,714</td>
<td>$12,714</td>
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</tbody>
</table>
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

<table>
<thead>
<tr>
<th></th>
<th>Port-months 1G</th>
<th>Port-months 10G</th>
<th>Revenue</th>
<th>Investment</th>
<th>Service</th>
<th>Power cost</th>
<th>Margin</th>
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</thead>
<tbody>
<tr>
<td>Year 1</td>
<td>72</td>
<td>36</td>
<td>$4.20</td>
<td>$500</td>
<td>$25.000</td>
<td>$15.552</td>
<td>-$36.432</td>
</tr>
<tr>
<td>Year 2</td>
<td>216</td>
<td>108</td>
<td>$9.600</td>
<td>$500</td>
<td>$25.000</td>
<td>$15.552</td>
<td>-$31.392</td>
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<tr>
<td>Year 3</td>
<td>432</td>
<td>216</td>
<td>$19.320</td>
<td>$500</td>
<td>$25.000</td>
<td>$15.552</td>
<td>-$21.732</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>720</strong></td>
<td><strong>360</strong></td>
<td><strong>$33.600</strong></td>
<td><strong>$1,500</strong></td>
<td><strong>$75.000</strong></td>
<td><strong>$46.656</strong></td>
<td><strong>-$89.556</strong></td>
</tr>
</tbody>
</table>
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

<table>
<thead>
<tr>
<th>Year</th>
<th>Port-months 1G</th>
<th>Port-months 10G</th>
<th>Revenue (1G)</th>
<th>Investment (1G)</th>
<th>Service (1G)</th>
<th>Power cost (1G)</th>
<th>Margin (1G)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 1</td>
<td>72</td>
<td>36</td>
<td>$16.800</td>
<td>$500</td>
<td>$25,000</td>
<td>$15,552</td>
<td>-$24,252</td>
</tr>
<tr>
<td>Year 2</td>
<td>216</td>
<td>108</td>
<td>$38,400</td>
<td>$500</td>
<td>$25,000</td>
<td>$15,552</td>
<td>-$2,652</td>
</tr>
<tr>
<td>Year 3</td>
<td>432</td>
<td>216</td>
<td>$76,800</td>
<td>$500</td>
<td>$25,000</td>
<td>$15,552</td>
<td>$35,748</td>
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<td>Total</td>
<td></td>
<td></td>
<td>$132,000</td>
<td>$1,500</td>
<td>$75,000</td>
<td>$46,656</td>
<td>$8,844</td>
</tr>
</tbody>
</table>
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 Switch Setup

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

<table>
<thead>
<tr>
<th>Year</th>
<th>Port-months 1G</th>
<th>Port-months 10G</th>
<th>Revenue</th>
<th>Investment</th>
<th>Service</th>
<th>Power cost</th>
<th>Margin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 1</td>
<td>72</td>
<td>36</td>
<td>$4,620</td>
<td>$109,284</td>
<td>0</td>
<td>$7,776</td>
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</tr>
<tr>
<td>Year 2</td>
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<td>108</td>
<td>$9,660</td>
<td>$450</td>
<td>$24,500</td>
<td>$7,776</td>
<td>-$23,066</td>
</tr>
<tr>
<td>Year 3</td>
<td>432</td>
<td>216</td>
<td>$19,320</td>
<td>$900</td>
<td>$24,500</td>
<td>$7,776</td>
<td>-$13,856</td>
</tr>
<tr>
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<td>$49,000</td>
<td>$23,328</td>
<td>-$149,362</td>
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</table>
### 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

<table>
<thead>
<tr>
<th></th>
<th>Port-months 1G</th>
<th>Port-months 10G</th>
<th>Revenue</th>
<th>Investment</th>
<th>Service</th>
<th>Power cost</th>
<th>Margin</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Year 1</strong></td>
<td>72</td>
<td>36</td>
<td>$27,180</td>
<td>$109,284</td>
<td>0</td>
<td>$7,776</td>
<td>-$89,880</td>
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<tr>
<td><strong>Year 2</strong></td>
<td>216</td>
<td>108</td>
<td>$56,340</td>
<td>$450</td>
<td>$24,500</td>
<td>$7,776</td>
<td>$23,614</td>
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<tr>
<td><strong>Year 3</strong></td>
<td>432</td>
<td>216</td>
<td>$112,680</td>
<td>$900</td>
<td>$24,500</td>
<td>$7,776</td>
<td>$79,504</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td>$196.200</td>
<td>$110.634</td>
<td>$49,000</td>
<td>$23,328</td>
<td>$13,238</td>
</tr>
</tbody>
</table>
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
• 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
THANK YOU

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

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

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