0 to IPv6 in 3 months

v2

(A Customer's View)

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http://www.georgianc.on.ca/

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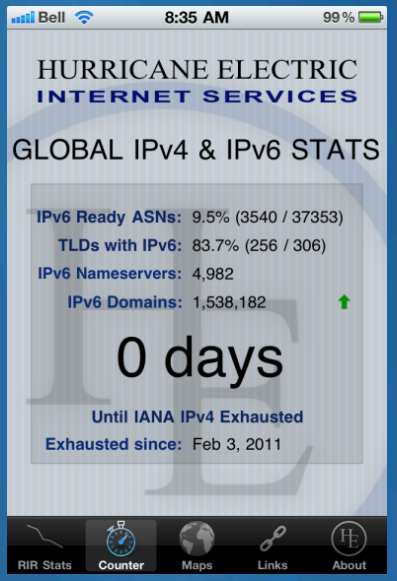
Georgian College is a a mid-sized college consisting of a 10 site WAN in 7 cities located in central Ontario, Canada. Our IT infrastructure consists of 9,500 network jacks, 330 virtualized servers, and over 3,700 managed computers.

Last IPv4 Address Blocks Assigned

- Feb 3rd, 2011 – NRO holds event for the IANA assignment of last /8 blocks
- IPv4 depletion makes main-stream news

http://www.nro.net/news/ipv4-free-pool-depleted



Our boss, Dave Johnson, CIO asked

"What are our IPv6 plans?"

Opportunity ?

- We decided to take advantage of the IPv4 depletion hype and launched the idea "0 to IPv6 in 3 months"
- The goal was to participate in ISOC “World IPv6 Day” - http://www.worldipv6day.org/
- As a result, our time frame was set – March 2011 to June 8th, 2011
- This was to be a group experiment by the various areas in Information Technology and the academic areas at Georgian College

What is “World IPv6 Day”

- From http://isoc.org/wp/worldipv6day/

“On 8 June, 2011, Google, Facebook, Yahoo!, Akamai and Limelight Networks will be amongst some of the major organizations that will offer their content over IPv6 for a 24-hour “test flight”. The goal of the Test Flight Day is to motivate organizations ……. to prepare their services for IPv6 to ensure a successful transition as IPv4 addresses run out.”

What is “World IPv6 Day” (cont.)

- For the Internet – a trial run of IPv6
- For IT @ Georgian, it was a chance to test IPv6 as part of a larger, Internet wide test.
- Also, an opportunity to bring together resources in our organization to work on a common, current, and relevant project.
- It was an awareness issue

Our Rough Plan

- Have different areas in Information Technology (IT) and the general college participate in a joint venture for World IPv6 Day
- Acquire an IPv6 address block from ARIN
- Check with our ISPs to see which offer IPv6 transport services - Sign agreements, add services to contracts
- Enable IPv6 on our site – from outside edge inwards including DNS and web services
- Train our staff in IPv6, and about World IPv6 Day
- Use our experience to develop a production plan

Contributors

- The plan was to have each area in IT contribute to the project
  - Service desk and Level 2 support – prepared to support end-users and answer calls on W6Day
  - Server OPS - built IPv6 only web server, dual stack enabled main web servers – some servers already had IPv6 on <- security concern
  - Desktop/Laptop Imaging - IPv6 was already enabled in current MAC and Windows 7 system deployments although "not used" <- security concerns

Contributors (cont.)

- Web Team – promoted and supported Marketing to develop main page link, www.georgianc.on.ca
- Enterprise Systems - we decided not to test with our live student portal systems & finance systems
- Network Infrastructure - my area - apply for IPv6 address, coordinate service provider connections, enable IPv6 on edge routers and firewalls, check network tools, enable IPv6 on external DNS servers, setup BGP sessions

Contributors (cont.)

- Academic areas such as
- Computer Studies Programs
  - Deployed router / firewall and IPv6 address space in their own lab
  - It was too late in the one semester and too early in the next for a lot of testing, more to come
- Web Design and Animation Program

- again too late in the semester but plan on more involvement in the future

Contributors (cont.)

- Marketing – organized press releases about our participation in World IPv6 Day, granted coveted space on the main college web page and created the link and story for World IPv6 Day

Invited Other Local Institutes

- We discussed our plans to participate in "World IPv6 Day" with other local institutes such as the school boards and the hospital
- We invited them to join us
- Responses : they were interested at different levels and some wondered "Why is Georgian so interested in IPv6 ?"
- This will be an area for future work

Invited Our Vendors

- We shared our plan to participate in “World IPv6 Day” with our vendors and asked them to support us and participate in the venture
- Approached Cisco and Microsoft
- Their responses: “How can we help ?”
- My response “I don’t know yet!” – in the end, they supplied texts and we will keep this dialogue open as we look for test equipment

In the Beginning

- We started with:
  - our own ASN , ASN 19764
  - public portable IPv4 addresses – 5 class C blocks
  - Active multi-homed IPv44 BGP Internet connections
  - Connections to the public Internet and the research networks (ORION / CANARIE)
  - No IPv6 internally or externally – well , sort of, remember those security concerns?

Preparation

- To start our IPv6 adventure we
  - Attended conferences such as CanSecWest, ORION Summit, IPv6 Summit, and CANHEIT
  - Read Microsoft and Cisco IPv6 texts, white papers, and training material
  - Reviewed many Internet resources
  - Engaged and discussed with our ISP's technical staff
  - Reviewed our hardware and software documentation
  - Talked to colleagues

Preparation - Training

- Staff learning – reading, CBT, and self-paced learning – no time for “courses” yet
- A lot of our staff had exposure to IPv6 in previous training but had not used it yet
- Created test labs including setting up tunnels, and IPv6 only zones in our network
- We found the Hurricane Electric online IPv6 resources very useful

Many, Many Useful IPv6 sites

- Hurricane Electric

http://ipv6.he.net/

- Cisco World IPv6 Day forum

https://supportforums.cisco.com/community/netpro/network-infrastructure/ipv6-transition

- Cisco IPv6

http://www.cisco.com/go/ipv6

- Microsoft

http://www.microsoft.com/ipv6

ARIN Application

- IPv6 application process
  - https://www.arin.net/resources/request.html
- The process was completed in 4 days
- We obtained our IPv6 address assignment Friday March 18th, 2011
  - 2620:00DD:0000:0000:0000:0000:0000:0000/48
- Now what ?

Our ISPs

We have 3 “Internet” connections for IPv4 services

1. ORION – has IPv6 services available and actively promotes IPv6 connectivity
2. Cogent – has IPv6 services available
3. Atria/Rogers – is planning IPv6 services and had a World IPv6 Day initiative

IPv6 Transport Services

- ORION assigns an IPv6 point to point address to our existing IPv4 link March 25th , 2011
- Cogent assigns an IPv6 point to point address to our existing link March 31, 2011
- Rogers/Atria – around April 18th I found the proper person to talk to at Rogers but no transport services available yet

Activate IPv6 on Public Interface

- After internal approvals were obtained to change our LIVE environment, IPv6 addresses were applied to our edge router providing IPv6 services for the experiment. A simple address plan was deployed
- Future IPv6 addressing to be determined after reviewing SurfNet manual “Preparing an IPv6 Addressing Plan” at *http://www.ripe.net/training/material/IPv6-for-LIRs-Training-Course/IPv6_addr_plan4.pdf* and *RFC 3531* .

Local Services - DNS

- Configure external DNS to support IPv6 (ISC BIND software was already IPv6 capable)
- Add IPv6 address to DNS server – defaulted on
- Implement AAAA records for new IPv6 services – both DNS and ipv6 server
- created and bound a test domain – gcv6.info with a temporary test server www.gcv6.info
- Create ipv6.georgianc.on.ca DNS entry

IPv6 Goes Live

- IPv6 goes live for us April 6th, 2011
- Our BGP session comes up with our R&E provider
- We continue to work with the second ISP to troubleshoot basic IPv6 connectivity
- Waiting to hear when the third will have IPv6 services

IPv6 Active at Edge

```
BA-B227-RO01#show ipv6 neighbor
IPv6 Address                              Age Link-layer Addr State Interface
FE80::226:51FF:FECA:A4D3                    0 0026.51ca.a4d3  REACH Gi0/3.752
2607:FD78:302:1::1                          0 0026.51ca.a4d3  REACH Gi0/3.752
FE80::250:56FF:FE80:3506                    0 0050.5680.3506  DELAY Gi0/2.50
2620:DD::250:56FF:FE80:3506                 0 0050.5680.3506  DELAY Gi0/2.50
```

Router to router ping tests worked at this point

IPv6 BGP Active

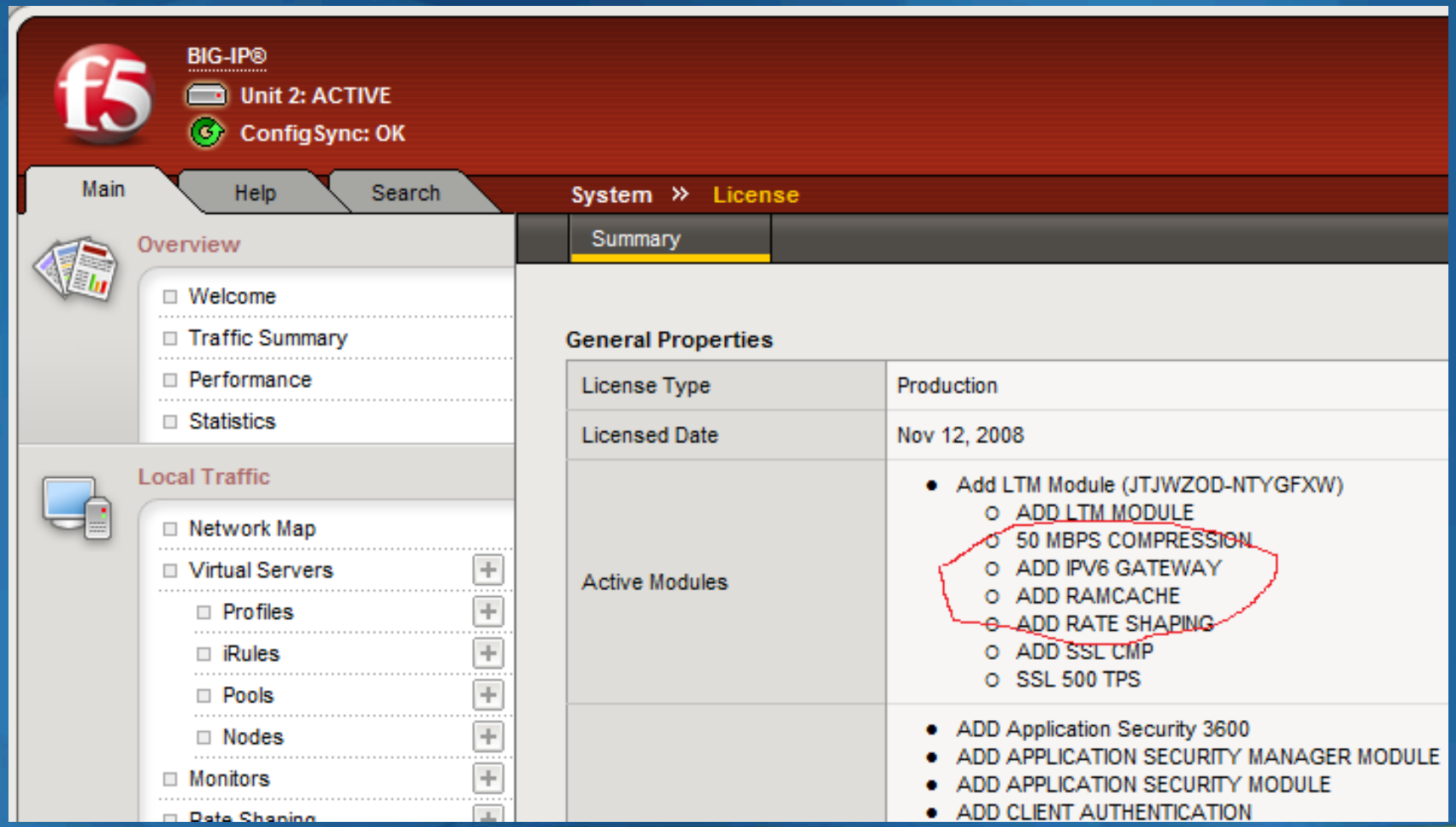
```
BGP router identifier 38.103.65.233, local AS number 19764
BGP table version is 68346, main routing table version 68346
5270 network entries using 785230 bytes of memory
5270 path entries using 400520 bytes of memory
66783/3850 BGP path/bestpath attribute entries using 8281092 bytes of memory
58570 BGP AS-PATH entries using 1586348 bytes of memory
194 BGP community entries using 6036 bytes of memory
0 BGP route-map cache entries using 0 bytes of memory
0 BGP filter-list cache entries using 0 bytes of memory
BGP using 11059226 total bytes of memory
BGP activity 8905927/8552393 prefixes, 12243831/11879389 paths, scan interval 60 secs

Neighbor        V    AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State/PfxRcd
2001:550:2:8::2:1 4   174       0       0        0    0    0 never    Active    ← error
2607:FD78:302:1::1 4 26677   63692    6090    68346    0    0 4d05h         5269
```

Status of Services

- At this point we had our external DNS server dual – stacked and serving AAAA records
- IPv6 connectivity to world with BGP session to one service provider
- We had an IPv6 only web server for testing
- We had IPv6 address space allocated to Computer Studies for their testing
- Main www not yet dual-stacked

As we continued to look …



… IPv6 was in Existing Equipment

- IPv6 has been around for quite sometime, we found a lot of equipment had IPv6 support already - F5 LTM load balancers had it, as did the Cisco ASAs but not an old PIX running v6.3
- Many new OS's have it, and is on by default
- The inclusion of IPv6 into our products went un-noticed for the most part, a simple mention in a version release document.
- Tools sets, spam filters etc will be a challenge

More Dates

- May 26th – IPv6 dual-stack enabled on www
- June 3rd – www AAAA record published
- Early June - At this time work started on configuring our new Cisco NAM to collect IPv6 statistics from our edge devices but did not complete in time for the June 8th test, work is on-going.

```
; <<>> DiG 9.6.0-APPLE-P2 <<>> AAAA www.georgianc.on.ca
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 41253
;; flags: qr rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 2, ADDITIONAL: 2

;; QUESTION SECTION:
;www.georgianc.on.ca.           IN      AAAA

;; ANSWER SECTION:
www.georgianc.on.ca.    86306   IN      AAAA    2620:dd:0:3::100

;; AUTHORITY SECTION:
georgianc.on.ca.        86306   IN      NS      ns2.atrianetworks.com.
georgianc.on.ca.        86306   IN      NS      ns.georgianc.on.ca.

;; ADDITIONAL SECTION:
ns.georgianc.on.ca.     38923   IN      A       192.139.153.20
ns.georgianc.on.ca.     38923   IN      AAAA    2620:dd:0:1::100

;; Query time: 8 msec
;; SERVER: 130.113.128.1#53(130.113.128.1)
;; WHEN: Tue Jun  7 22:20:45 2011
;; MSG SIZE  rcvd: 161
```

June 8th, 2011 World IPv6 Day

- Success! Georgian College was accessible via IPv6 at two servers on June 8th
- http://www.georgianc.on.ca/
- And http://ipv6.georgianc.on.ca/
- Currently both sites remain accessible via IPv6
- IPv6 connectivity from the users to Internet via dual-stack in the next year – you can't manage it if you don't know about it

Program
2011-Sessions
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CANHEIT 2011
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College: Best dip...
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GEORGIAN
YOUR COLLEGE · YOUR FUTURE
Home Accessibility Staff Employers Services Jobs Contact
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Academic Areas
News & Events
Information
2011 Canada's Greenest Employers
Georgian College
Named one of Canada's Greenest Employers for second year in a row! »
TAKE A TOUR
Take a 360° tour of Georgian College
GEORGIAN PARTICIPATES IN WORLD IPV6 DAY
June 7th, 2011 @ 8pm »
IPv6
WORLD IPv6 DAY
TAKE A VIRTUAL TOUR OF OUR ENGINEERING TECHNOLOGY SCHOOL
In Barrie, Midland & Owen Sound »
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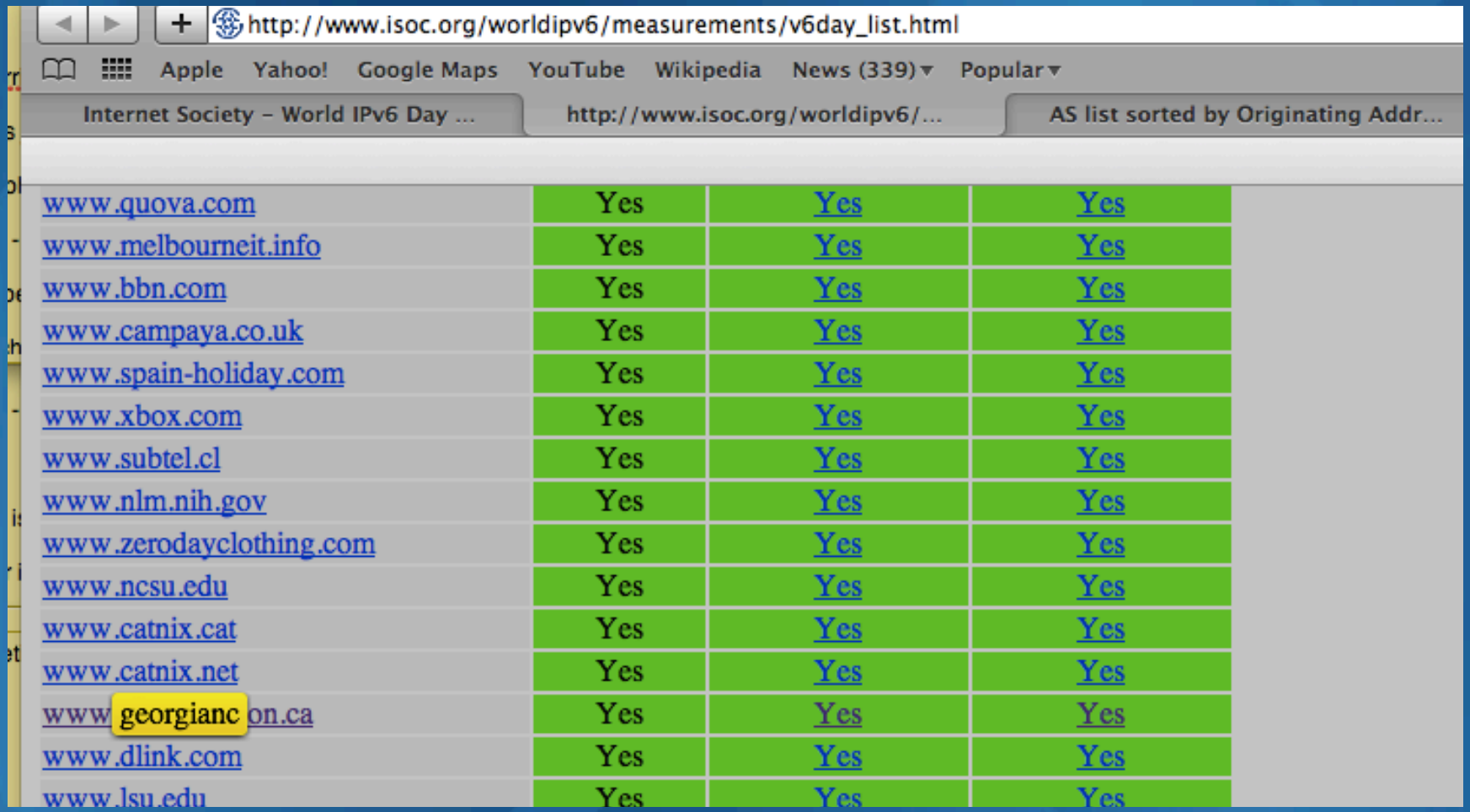
http://www.isoc.org/worldipv6/measurements/v6day_list.html
Apple
Yahoo!
Google Maps
YouTube
Wikipedia
News (339)
Popular
Internet Society - World IPv6 Day ...
http://www.isoc.org/worldipv6/...
AS list sorted by Originating Addr...
www.quova.com Yes Yes Yes
www.melbourneit.info Yes Yes Yes
www.bbn.com Yes Yes Yes
www.campaya.co.uk Yes Yes Yes
www.spain-holiday.com Yes Yes Yes
www.xbox.com Yes Yes Yes
www.subtel.cl Yes Yes Yes
www.nlm.nih.gov Yes Yes Yes
www.zerodayclothing.com Yes Yes Yes
www.ncsu.edu Yes Yes Yes
www.catnix.cat Yes Yes Yes
www.catnix.net Yes Yes Yes
www georgianc on.ca Yes Yes Yes
www.dlink.com Yes Yes Yes
www.lsu.edu Yes Yes Yes

Did we see any problems?

- No
- During the World IPv6 Day time period our service desk did not receive a single call about IPv6 or a problem that could be related to the IPv6 worldwide test.
- We had IT technical challenges but no end-user impacting issues – i.e. NAM, netflow configuration, log files

Future Issues

- Enabling and controlling IPv6 on all segments
- IPv6 and our VoIP system
- Student training in IPv6 labs to promote IPv6
- Testing IPv6 with our NMS tools, SPAM filters, netflow, and syslog applications
- IPv6 performance testing – as good as IPv4
- Hardware and software versions and upgrades to support IPv6

Future Issues (cont.)

- Native IPv6 on our network, no tunnels
- Tunnel broker - student learning env. @home
- Promote IPv6 readiness and connectivity in our local community – lead and assist
- Train all levels of staff in IPv6 issues applicable to them
- Build IPv6 connectivity into our purchasing requirements

Future - concerns

- Planning flexible adderssing scheme
- Selling the notion of no NAT – NAT isn't necessarily security
- Live addresses on devices inside our network
- Not using random generated addresses for identification purposes and the impact of that as we travel and surf the Internet

Reflection

- Time lines for this project were too short – while we had involvement from many areas, we need to do more collaborative work with everyone from our Service Desk to Web Team to Server Operations group.
- End-users don't care about IPv4 or IPv6, they just want to browse the Internet
- Need better alignment with academic areas for growth, testing and knowledge transfer

Conclusion

- We are more aware of IPv6 than we had been, we created a team of folks from different areas in our organization, and we have a basis to start planning our production IPv6 environment.

- Start early, start now!

See you at NANOG 55 – Vancouver

Steve Benoit, sbenoit@georgianc.on.ca

Thank you to all that contributed to the experiment!