IPv6 adoption experience & challenges from a ccTLD operator

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Business Decision

- In January of 2011, we learned about ISOC "World IPv6 Day"
  - We set an objective to participate on June 8, 2011.
  - We had limited budget allocated to IPv6 deployment
  - We realized that we did not know too much about IPv6
  - We assigned a project manager, built a rough plan and started executing

Decision Factors

- Our objectives were;
  - Make sure all core CIRA services are available over IPv6
  - Have .CA DNS secondaries reachable over IPv6
  - Ability for registrars to submit IPv6 glue records as part of registration process
  - Have the .CA corporate web sites reachable over IPv6
  - Ability for CIRA staff to access the Internet natively over IPv6

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Project Plan

- IPv6 Discovery & Research
- Develop an IPv6 adoption strategy
  - Objectives for DNS, Registry & Corporate
- Perform an IPv6 readiness assessment
  - Technology, people, process & partners
- Develop a detailed IPv6 Architecture & Design
- Development, testing and pilot mode
- Implement & operate in production

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IPv6 Discovery & Research

- This phase was probably the most difficult
  - Finding knowledgeable resources in Canada
  - Staff training resources & programs are limited
  - Attended IPv6 conferences (mostly targeted at Telco)
    - Not entirely relevant to an enterprise and CIRA's need
    - Legacy issues relating to mobile & transition technologies
- Two of our DNS secondary servers were already IPv6 enabled
  - Dual stack using ARIN IPv6 critical infrastructure address block

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Performed a readiness assessment

- Performed an in-depth assessment of current infrastructure, technology, process and partners
- Difficulty in finding qualified resources
  - Limited pool of experienced resources Canada
- **Registrars**
  - CIRA EPP and .CA Manager (web) support IPv6 glue records
  - Not all CIRA accredited registrars support IPv6 glue records
  - Impact: we are educating some registrar on IPv6
- **IPv6 Reachability of .CA DNS Servers**
  - Two of ten .CA DNS secondaries are IPv6 reachable (anycast nodes)
  - Now (March 2012) we have four enabled over IPv6
  - Working on making all 10 DNS secondaries IPv6 enabled

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Performed a readiness assessment

- **<u>Transit Providers</u>**
  - At that time, our transit provider did not support IPv6
  - Obtaining IPv6 transit was difficult, under "custom order"
  - They wanted to charge extra for IPv6, we disagree
  - Impact: We ordered a new circuit and peered at TorIX over IPv6
- **<u>Network Equipment</u>**
  - Our load balancers did not support IPv6, we had to procure new ones from a different vendor
  - Impact: Equipment purchase, additional training, procedures & support costs
- **<u>Public Web services</u>**
  - CIRA web sites functional over IPv6

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Performed a readiness assessment

- **<u>Develop an IPv6 Security Policy</u>**
  - A new security policy was developed and enforced
  - Information in IPv6 security policy is rare to none
- **<u>Training</u>**
  - Needed to train all of the Operations & Development team on IPv6
- **<u>Infrastructure</u>**
  - All IT infrastructure design and changes must take in account IPv6

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IPv6 Objective - WEB Content

- Not everything needs to be IPv6 on day 1
  - World IPv6 Day, June 8, 2011
    - Internet Perimeter & DMZ (www.cira.ca)
    - IT Organization
    - Permanent
    - Presence
    - Support

Try www.cira.ca on IPv6
Or
http://[2001:500:80:2::12]/

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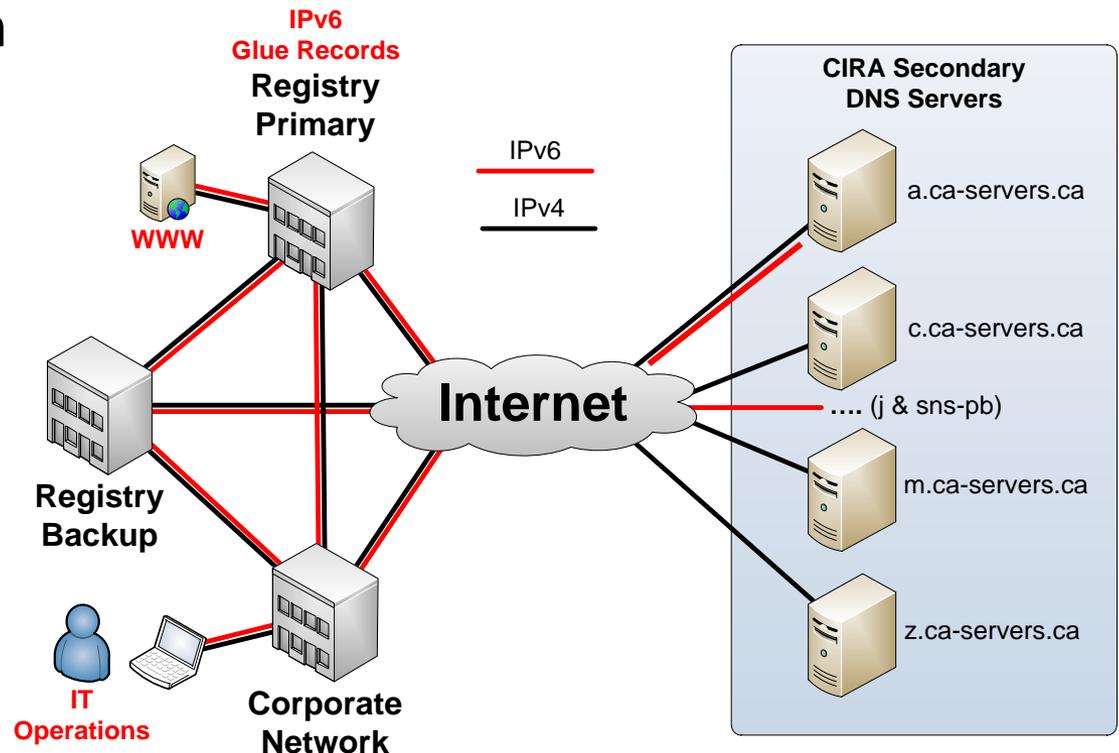
Architecture Guidelines (Summary)

"Rules of engagement"

- Keep IPv4 as-is
- Dual Stack
- No IPv6 Tunnelling
- Native IPv6 Transit
- One host, one IP
- No Network Address Translation (NAT)
- IPv6 Addressing Plan
- IPv6 Address Privacy, Allocation & Lifecycle (Life/Timeout)
- IPv6 Network Perimeter
- Security Management
- IPv6 Logging & monitoring

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Testing & Lab

- Developed an IPv6 lab
  - Test web applications
    - web, cookies, application logging
  - Test load balancers, routers, firewall
  - Log analysis
  - Security - IDS/IPS/SIEM
  - Packet capture
  - Monitoring
  - Network connectivity, routing protocols

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Conclusion

- CIRA participated in "World IPv6 Day"
- Difficulty level: medium
- High Level Additional Cost Estimate: (1.8M domains)
  - ~$100K hardware, ~$75K consulting
  - ~$25Ktraining, ~$25K IPv6 transit
- CIRA currently has a partial IPv6 deployment and four .CA Secondaries available over IPv6
- Lessons learned;
  - Don't use your IPv6 critical infrastructure address block for use within your corporate network ☺
  - IPv6 Addressing plan: At the 3rd iteration ☹
  - Train, train and more training!

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