Experiences with Large-scale Network Consolidation
or
How I Spent My Summer Vacation

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Overview

- History
- Business drivers
- Our approach
- Preparation for the cut
- The Cut(s)
- Lessons learned
Some History

- Allegiance Telecom acquired the IBI network assets in December of 2001 from WorldCom
- Allegiance Telecom (AS11466) – Nationwide Tier-2 IP Network
- IBI/Digex (AS2548) – Nationwide Tier-1 IP Network
Business Drivers (Why do this?)

- Reduce network expense through consolidation of facilities
- Consolidate operations and support
- Uniform routing policies
- Ability to sell either legacy network’s products at any site
Our Approach

• Because we were migrating to the 2548 ASN, we had to tailor the migration to fit within the limitations of the ALGX network
  – IBI Network
    • Well aggregated – easier to migrate POP-by-POP
  – Allegiance Network
    • Not well-aggregated – serious complications in POP-by-POP approach

• The POP-by-POP approach didn’t suit our needs, we opted for an overnight AS-merge
Our Approach

• Traditional integrations have consisted of moving the acquired company behind the larger AS
  – Less risky – no significant customer downtime
• By merging the 2 networks into a single ASN we could accomplish all of our goals in one night
  – More risky - requires significant downtime
Some Considerations...

- Network size (~500 routers)
  - Protocols **MUST** scale
- Multi-vendor environments
  - Protocol interaction (especially MPLS)
  - Routing policy can be “tricky” to adapt from one platform to another
- Does network consolidation make sense?
  - Depending on your specific situation, network integration may not be a big issue
    - Allegiance had a brand-new OC48 network with ZERO traffic to migrate which made the task somewhat easier
Preparation for the Cut

• Set an integration strategy
  – Understand the business drivers
  – Set attainable milestones and goals

• Build a team
  – Identify key players from each organization
Preparation for the Cut

• Form a plan
  – Develop new routing policies and test (and test again, and again)
  – Outline all key dependencies and identify risks
  – Task personnel based on core competencies
  – Layout the cutover process, router by router
  – Set hard backout points
  – Practice – use dry runs to make sure everyone understands their role and responsibilities
The Cut(s)

• First cut attempt was unsuccessful
  – Too much work for one night
  – Decision was made to divide the cut into 2 pieces
    • First piece – install new routing policy onto legacy IBI network
    • Second piece – reconfigure legacy Allegiance network with new policy and new ASN
The Cut(s)

• The IBI network was reconfigured the week prior to the Allegiance network
  – All peers were shutdown to minimize the possibility of a route leak and avoid dampening as routers were reloaded
  – Policy bugs were identified and resolved over the next week leading up to the AS-merge
The Cut(s)

• Preparation for the AS-merger
  – A configuration freeze was placed in effect the day before the actual AS merger
  – New configurations were generated and sanity checked for each router on the network
    • Perl script took about 2 seconds for each router
  – All current router configurations were backed up to flash locally in case backout was necessary
The Cut(s)

• AS-merger
  – All peers shutoff and the IBI/ALGX networks were isolated
  – New configurations were loaded on the routers in a single market as a testbed
  – Routers in that market were reloaded with the new configuration
The Cut(s)

• AS-merger
  – Only after those routers were verified to be back up and working did we proceed with additional markets
  – Markets were then done one by one until all routers had been reconfigured and reloaded
  – Once all markets were completed, peers were brought back up and connectivity to the rest of the world was restored
The Cut(s)

• Post-merger issues
  – Policies
    • Different routers on different policies tend to leak routes unexpectedly
    • Different versions of software may:
      – Use a different command to do the same thing
      – Use the same command to do a different thing
The Cut(s)

• Post-merger issues
  – Protocols
    • Scalability
      – A network of 500 routers will test limits that the vendors may not have tested themselves
    • Cross-vendor compatibility issues (MPLS specifically)
    • Policy gap that allowed a massive route-leak was identified and corrected
Lessons Learned

• Nobody’s perfect
  – Typos happen
• Equipment can (and will) fail
• You can never plan enough
  – Testing in the lab is invaluable, but not sufficient to prevent all problems from manifesting
  – A problem that arises in 1 out of 25 routers may never appear in a 10-router lab, but show up 20 times in a 500 router network.
Lessons Learned

• Communication is key
  – Make sure you give your customers plenty of notification prior to the work
  – Notify peers about the outage including an explanation about the work being performed
  – Set and manage realistic expectations with both your customers and your corporate management

• An out-of-band management network is a priceless assett
Lessons Learned

• Don’t be afraid to voice any concerns, point out potential problems, or offer alternative solutions

• Don’t dismiss anyone else’s concerns, gloss over any potential problems, or fail to consider an alternative solution
What we started with
What we finished with
Shout-outs

- Greenbelt Team
- Dallas Team
- Cisco and Juniper TAC
WORLD CHAMPIONS!!!