Lessons Learned from May 19 China’s DNS Collapse

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Agenda

- What happened
- How did we survive
- How could this happen
- Lessons learned
What happened - at first sight

- Time
  - 21:00—22:40, May 19, 2009

- Many provinces suffered…
  - 6 reported “almost lost Internet access” province-wide: www, emails, IM... ALL Failed!
  - Others reported “much lower Internet speed”
  - Not only CT, but other Tier-1 ISPs (Unicom, CM) in China all reported large scale Internet access failure

- Survivals remains still…
  - Some provinces see nothing wrong

- Inference 1: backbone unstable?
  - No relevant link down, no route flapping, no configuration changed
  - So many ISPs all got involved?
What happened—a close look

- Internet users got few responses from their local DNS servers

- Operators observed their boxes way overloaded…
  - DNS servers: ~100% CPU/Memory usage
  - Layer-4 switches (if exists): the same, plus abnormally high parallel session amount
  - up-connected network nodes: several times larger Incoming traffic than normal
  - source IP addr of the incoming traffic: widely scattered

- Inference 2: DDoS attack against DNS servers?
  - Simultaneous attacking so many servers in every ISP in China?
  - Few malformed queries were seen
  - No prominent DDoS observed at the time
What happened—A close look (cont’d)

One of our DNS node

- memory usage
- Inbound traffic
- Parallel sessions (~20Kqps)
baofeng.com became the hottest domain
- Top 4 most-requested names all ended with baofeng.com
  - videodown.baofeng.com,
  - active.baofeng.com,
  - live.baofeng.com,
  - download.baofeng.com

Servfail messages showed up when trying nslookup baofeng.com names

The recursive session number reached the limit!!

bash-2.05$ rndc status
... recursive clients: 49902/50000
...
bash-2.05$ more default.log.20090519-2

Inference 3: something wrong with baofeng.com resolution?
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How did we survive

- Filter out baofeng.com queries
- Force the cache to response something to baofeng.com queries
  - artifact ip addresses
  - still alive baofeng.com authoritative NS addr.
- Increase the TTL of baofeng.com related RRs
- Decrease the timeout threshold of each connection on layer-4 switches (if exists)
- Peace…
Outline

- What happened
- How did we survive
- How could this happen
- Lessons Learned
DDoS attack!
- Not against ISP’s local DNS name servers…
- Nor baofeng’s authoritative name servers…
- But private online game servers!
How could this happen – playback

So, who are the real victims?
Outline

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Lessons Learned

- To improve the current DNS architecture to a safer one…
  - Anycast name service (domino effect?)
  - Physically separate recursive function from the cache
  - Strict access control between each boxes
  - Shadow authoritative servers needed?
  - An up-to-date copy of DNS name tree need? at least the main branches?
Cited from R. Dobbins Apnic 28 slide.

用户至上 用心服务
Lessons Learned (cont’d)

- Always keep an eye on your box!
- High performance boxes may help (to a limit extend…)
- ISPs should seriously concern about not only the DNS systems but
  - Killer Apps
  - Name resolution abusers
  - DDoS attack (against DNS servers)
    - Not only the DNS community but the Internet Community at large
- Caution: **NEVER** blackhole DNS servers unless you are fairly clear about the outcomes!
Thank you!
& comments?