Details of Experiments on Random Forwarding

Our **objective** is to verify that by forwarding a packet to a neighboring AS which is not the original next hop of this packet, it is still highly likely that this packet will be finally delivered to the destination. If this is possible, in case of network abnormality, our proposed scheme will work when we select one neighbor AS that is not the original next hop.

We conduct our experiment on CNGI-6IX (AS 23911) [1]. CNGI-6IX is the domestic/international exchange point of the whole the China Next Generation Internet (CNGI) project. CNGI-6IX connects the whole nationwide next generation Internet backbones and other international research networks. It has 16 BGP neighbors; four can be connected to the Internet backbone without returning to CNGI-6IX. The other 12 BGP neighbors are stub ASes or only connected to stub ASes besides CNGI-6IX.

We select two of the four BGP neighbors which can connect to the Internet backbone, APAN-JP (AS 7660) and TEIN2 (AS 24489), as the randomly selected next hop in the scheme SiRF in the current stage (The selection is not special; we plan to test the other two neighbors in our pending experiments). We attach a source to CNSI-6IX and select 20 destinations attached to remote ASes which are all verified to be reachable destinations by "ping" before the real experiment.

We change the forwarding next hop of the working route of each destination to APAN-JP and TEIN2, respectively, on the corresponding border routers of CNGI-6IX. We then verify the reachability of each destination by "ping" again.[1] In this way, we can imitate the simplest SiRF with one deployed AS (CNGI-6IX) in the Internet. In other words, if the origin next hop of the route to the reachable destination D is not APAN-JP; and D is still reachable after changing the forwarding next hop to APAN-JP, 8that means in SiRF, if the random next hop for a packet with destination D is selected to APAN-JP (upon abnormality), the packet can be successfully delivered to D.

Neighbor i	APAN-JP	TEIN2
No. of destinations (out of 20) whose next hop is not i	16	12
No. of destinations (out of 20), still reachable after the next hop is changed to i	10	5
Delivery ratio	62.5%	41.7%

TABLE I: Results on CNGI-6IX (AS 23911), SiRF.

The experiment results are listed in TABLE I. The second column of TABLE I shows that, there are 16 destinations to which the original next hops are not APAN-JP, and ten of them are still reachable if their next hops are changed to APAN-JP. Thus, the delivery ratio of SiRF is 62.5% (10 out of 16) if the randomly selected next hop is APAN-JP. The result for TEIN2 is similar to that of APAN-JP (see the last column in TABLE I). The delivery ratio for TEIN2 is 41.7%.

The results in TABLE I indicate that our basic scheme has satisfied performance (with deliver ratio around 40% to 65%) even if only it is deployed on just one AS in the Internet. Again, we restate that these packets we saved are those deemed to be dropped. In other words, this is a pure gain.

[1]Note that as the time interval between the two "ping" operations is short, we consider the transport layer condition (e.g., traffic jam) to be the same.

REFERENCES

[1] CNGI-6IX, http://www.cernet2.edu.cn/en/6ix.htm