

1 True/False

1. iBGP is used for intradomain routing.

Solution: False, IGP, such as OSPF or RIP, is used for intradomain routing

2. Border routers know how to reach hosts through default gateways. **Solution:** True

3. Avoiding loops is one reason why BGP uses path vector.

Solution: True, also helps ASes adopt certain policies

4. BGP always advertises a shortest path.

Solution: False, the path relies on other policies (like money) instead of purely distances

5. BGP route advertisements use classless addressing. **Solution:** True

2 Interdomain vs Intradomain

Given four ASes Google, Comcast, Berkeley and Stanford, with border routers G1, C1, B1 and S1 respectively, and internal routers G2, C2, B2 and S2 respectively, we know Berkeley and Stanford both use Comcast's and Google's services. And the (fake) cost metrics are 10/MB for using Comcast's bandwidth and 20/MB for using Google's bandwidth. Please answer following questions.

1. Which one of eBGP, iBGP and IGP distributes externally learned routes internally, and which routers, if any, speak it?

Solution: iBGP. G1, C1, B1, S1, G2, C2, B2, S2. All routers speak iBGP.

2. Which one of eBGP, iBGP and IGP learn routes to external destinations, and which routers, if any, speak it?

Solution: eBGP. G1, C1, B1, S1. Only border routers speak eBGP.

3. Which one of eBGP, iBGP and IGP provides internal reachability, and which routers, if any, speak it?

Solution: IGP. G1, C1, B1, S1, G2, C2, B2, S2

4. Which AS would Berkeley use to reach Stanford, in terms of cost effectiveness?

Solution: Comcast. It costs less amount of money.

5. Given now Comcast knows Berkeley and Stanford don't get along with each other, it doesn't advertise its route of Berkeley to Stanford, or the other way around. However, Google still remains neutral. Which AS would Berkeley use to reach Stanford now?

Solution: Google.

3 BGP- Game of Thrones Edition

Last summer, HBO's popular series Game of Thrones released Season 6 Episode 9 Battle of the Bastards. We know Jon Snow (House Stark) defeats Ramsay Bolton (House Bolton) with the help from Little Finger (House Arryn) and House Stark gains back the control of Winterfell! We know mails played an important role in the battle, so lets take a deeper look at what happens in posthouses behind the scene.

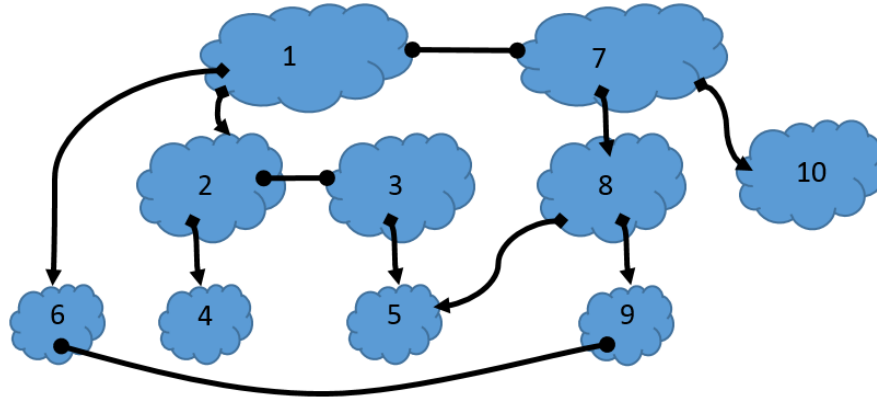


Figure 1: Posthouse Relationships

A square-triangle line indicates a lord (square side) to servant (triangle side) relationship, and a circle-circle line indicates a partner relationship. We have two top level posthouses 1 and 7.

Assume we are using the following selection and export rules for all posthouses when they receive mail:

Selection: Prefer servant houses to partners, partners to lord posthouses in order to minimize costs.

Export: To servant posthouse, advertise all paths. To all other posthouses, advertise only paths to servant posthouses.

We present the following questions.

1. Ser Davos tries to send the mail at Posthouse 4, what path (if any) would the mail take in order to get to his pirate friends that are close to Posthouse 5?

Solution: 4, 2, 3, 5

2. Given Sansa Stark sends a mail at Posthouse 6, what path (if any) would the mail take in order to get to Little Finger, who is also reachable through Posthouse 5?

Solution: 6, 1, 7, 8, 5. This is trickier since 2 won't advertise its peer's (3's) path (about how to reach 5) to its provider (1), so 1 doesn't know it can reach 5 through 2.

3. Jon Snow now wants to send a mail to Castle Black at Posthouse 1. What path (if any) would the mail take in order to reach Castle Black, which is within Posthouse 9's range of delivery?

Solution: 1, 7, 8, 9. Same reasoning as part 2.

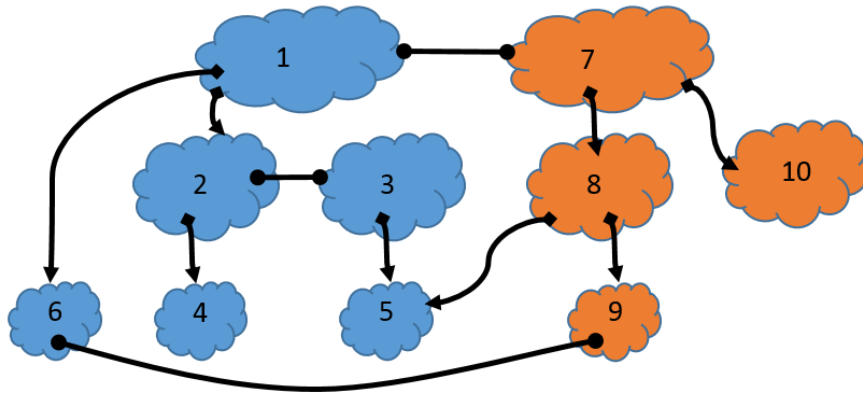


Figure 2: Posthouse Affiliations

Now assume all posthouses are using same selection policy but also adopting new export rules because they no longer want to stay neutral. Posthouses ranging from 1 to 6 (pro Stark) form a group of allies, and posthouses ranging from 7 to 10 (pro Bolton) form another group of allies:

Export:

1. To consumer posthouse that is an ally, advertise all paths
2. To all non-servant posthouses that are allies, advertise only paths to servants
3. Advertise nothing to posthouses that are not allies.

We present the following questions with the new policies.

4. Sansa, at Posthouse 6, wants to send the mail seeking help from Little Finger who is close to Posthouse 5. Will Little Finger receive the mail?

Solution: No. Similar to part 2, but this time, 7 (pro Bolton) is not advertising its path to 5.

5. Will Castle Black (at Posthouse 9) in part 3 be able to receive the mail from Jon Snow (at Posthouse 1)?

Solution: No. 7 advertises nothing to 1 because they are not allies.

6. Imagine Ramsay Bolton (at Posthouse 10) has a chance to bribe Posthouse 1 so that Posthouse 1 would advertise paths to consumers to Posthouse 7. Would Ramsay be able to negotiate with Little Finger (at Posthouse 5) before he decided to help Jon Snow? If so, what's the path?

Solution: No. Even if Ramsay bribed 1, 2 won't advertise to 1 about its path to 5, so he cannot talk to Little Finger.