Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

Networked Systems
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Communication Networks

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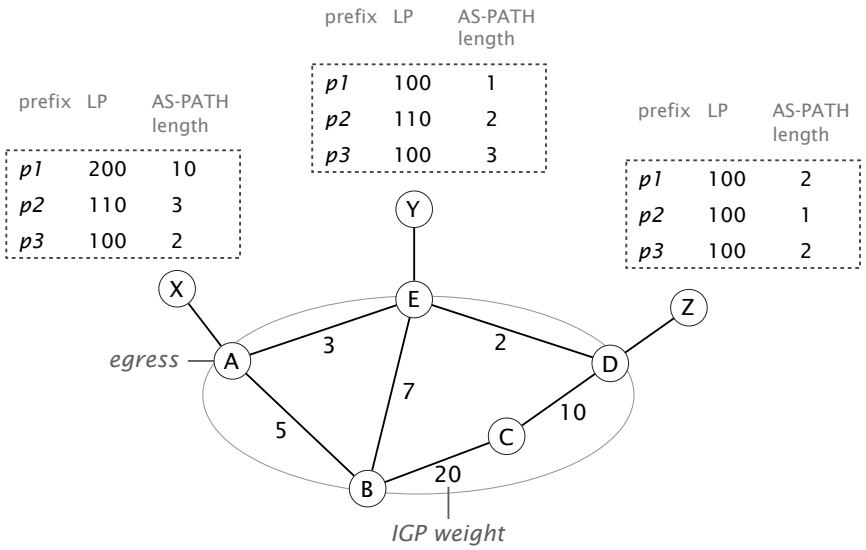
Exercise 7 – BGP Part 2

7.1 Putting Everything Together (Exam Question 2016)

Consider the ISP network composed of 5 routers (A, B, C, D, E) depicted in the Figure below. Three of these routers, A, E and D, are connected to routers located in neighboring ASes via eBGP. These neighboring routers are indicated by X, Y and Z. Each of them advertises the same three distinct IP prefixes $p1$, $p2$ and $p3$.

The three tables in the Figure indicate the Local-Preference (LP) associated to each external prefix by A, E and D along with their corresponding AS-PATH length. For instance, A learns a route to $p1$ from X with an AS-PATH length of 10 to which it associates a LP of 200. Internally, the ISP uses an iBGP full-mesh to distribute the BGP routes and OSPF as intra-domain routing protocol. The weight of each internal link is indicated next to it.



A simple ISP network which receives BGP routes for 3 different external prefixes ($p1$, $p2$, $p3$) from 3 routers (X, Y, Z) located in neighboring ASes.

For each router in the ISP, indicate the router ID of the selected egress (A, E, D) along with the router ID of the internal next-hop (A, B, C, D, E or *direct*) used to reach it. For that you can use the tables on the next page. You can assume that A, E and D use the next-hop-self configuration.

A

prefix	egress	internal NH
p1		
p2		
p3		

B

prefix	egress	internal NH
p1		
p2		
p3		

C

prefix	egress	internal NH
p1		
p2		
p3		

D

prefix	egress	internal NH
p1		
p2		
p3		

E

prefix	egress	internal NH
p1		
p2		
p3		

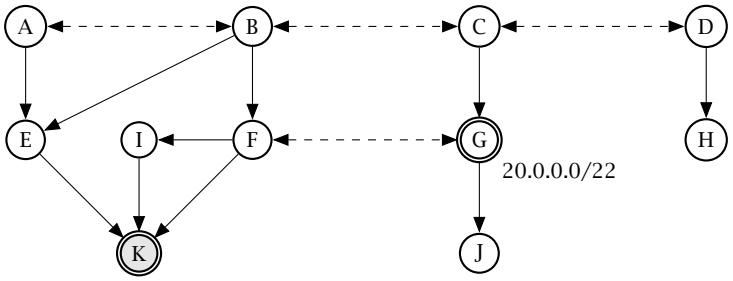
Fill in the following tables with the selected egress and internal next-hop.

7.2 BGP Hijack (Exam Question 2018)

Consider the Internet topology consisting of 11 Autonomous Systems (ASes) in the Figure below. Single-headed plain arrows point from providers to their customers (AS *A* is the provider of AS *E*), while double-headed dashed arrows connect peers (AS *A* and AS *B* are peers). Each AS is made up of a single BGP router and applies the default selection and exportation BGP policies based on their customers, peers and providers.

In this task, the routers break ties using the AS number of the neighbor: in case multiple routes are equally good, the router selects the route of the neighbor with the lowest AS number (alphabetical order).

AS *G* is the origin of prefix 20.0.0.0/22 and advertises it to its neighbors. Independently of what the external advertisements are, AS *G* ***always*** prefers its internal route to reach any IP destination in 20.0.0.0/22.



An Internet topology with 11 ASes. AS *K* aims at hijacking traffic destined to AS *G*.

a) AS *K* wants to hijack all the traffic going to AS *G* for 20.0.0.0/22. It starts advertising the exact same prefix. From which ASes is it able to attract the traffic?

b) AS *K* is not satisfied by the result. What can it do to attract traffic destined to AS *G* from more of the ASes? List the ASes from which it is able to attract the traffic and explain why this works.

c) The ASes from which AS *K* manages to attract the traffic realize what is happening as all their traffic to 20.0.0.0/22 goes to a dead-end (AS *K*).

Show how AS *K* could still deliver the traffic to the real destination (AS *G*) by poisoning the AS path while attracting as much traffic as possible. In addition, list the ASes from which it can attract the traffic.

d) Can you think of a different way for AS *K* to achieve similar results as in *(iii)* without poisoning the AS path? Explain.