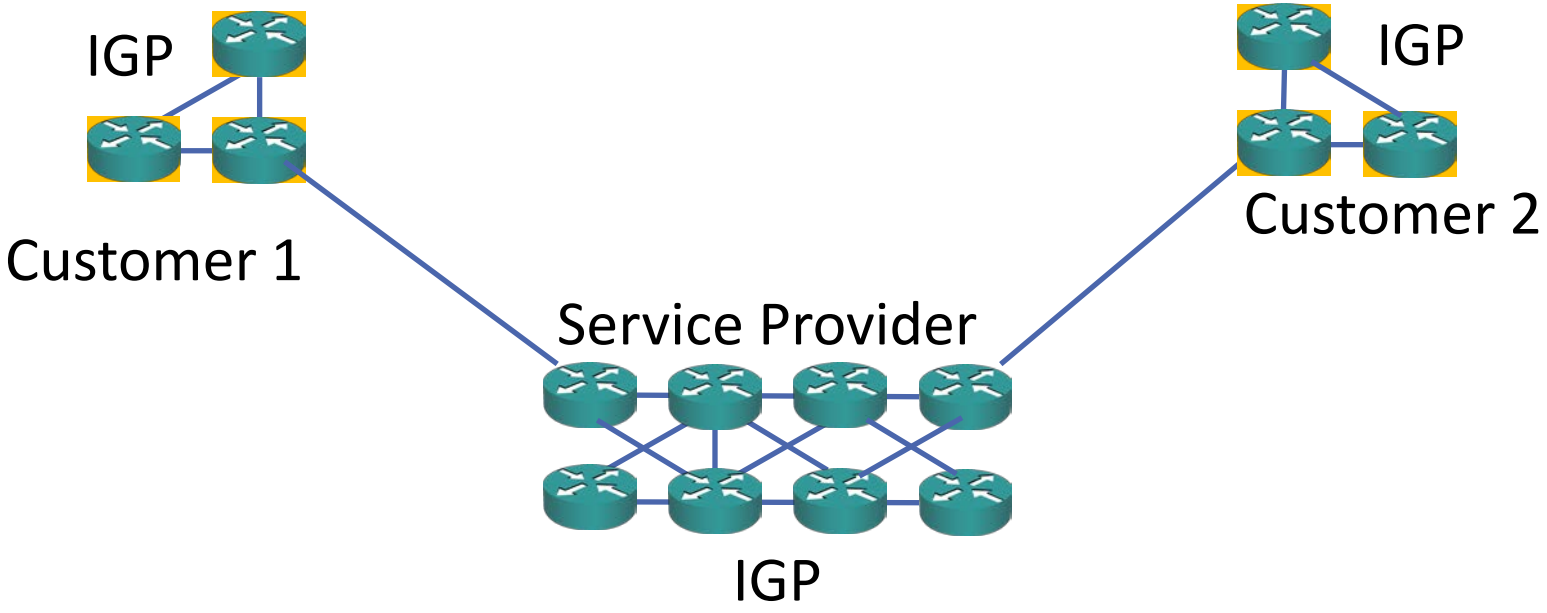
Service Provider IGP

- Internet Service Providers do not just have one huge router which routes traffic between all their customers
- They have many routers which connect their different physical locations. These provide connectivity for customer traffic and also for their own internal operations
- Service Providers need to use an IGP for the routing within their administrative domain
- OSPF or IS-IS is typically used

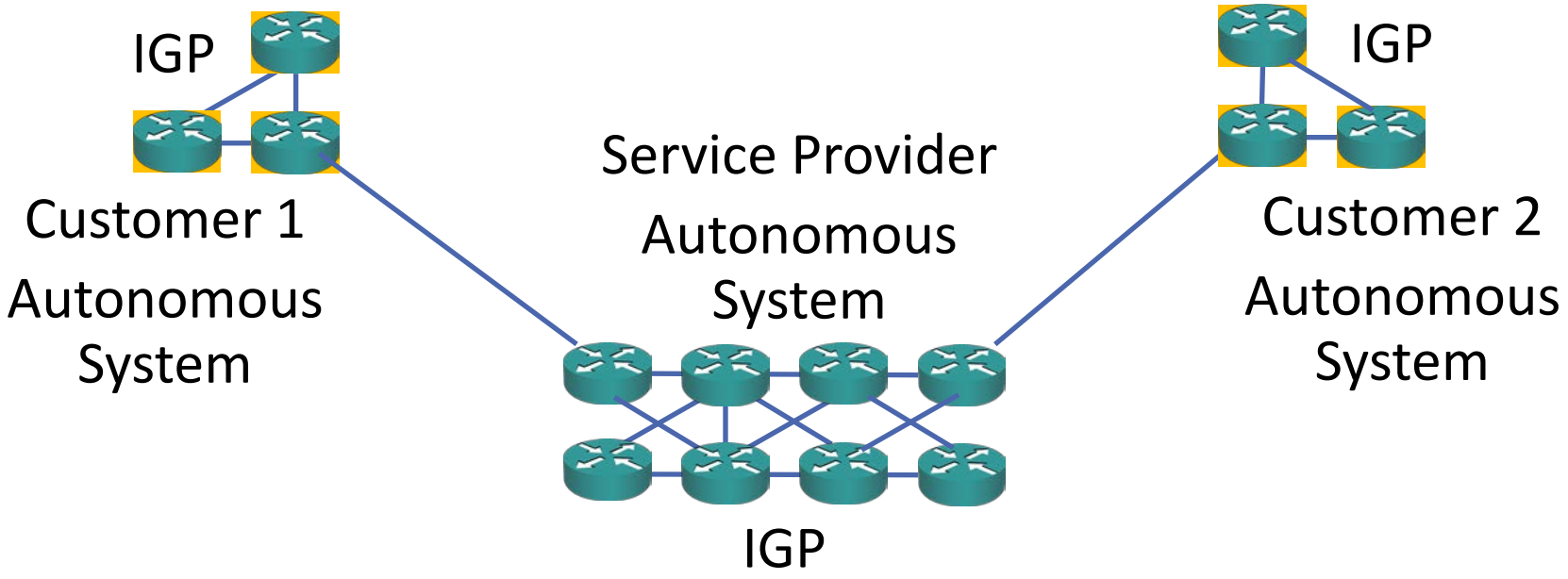
Service Provider IGP



Autonomous Systems (AS)

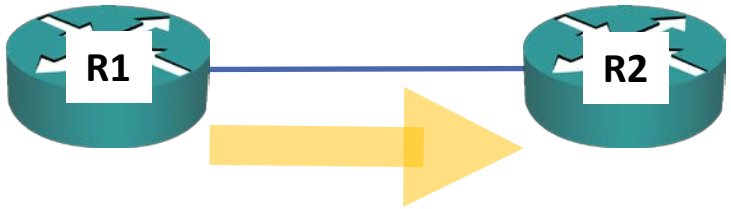
- An Autonomous System (AS) is a portion of a large network (such as the Internet) which is under a single administrative control
- The term 'Autonomous System' is also used in EIGRP and BGP configuration to specify their scope
- Interior Gateway Protocols (IGP) are used to share routes inside an AS
- ASs have a single coherent interior routing plan and present a consistent picture of what destinations are reachable through it

Autonomous Systems (AS)



How IGPs Work

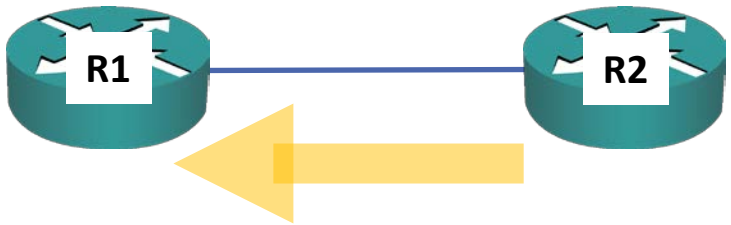
- Administrator enables OSPF on the router R1's interfaces



"I'm an OSPF router, is anybody else on this link running OSPF?"
(Link local multicast 224.0.0.5)

How IGPs Work

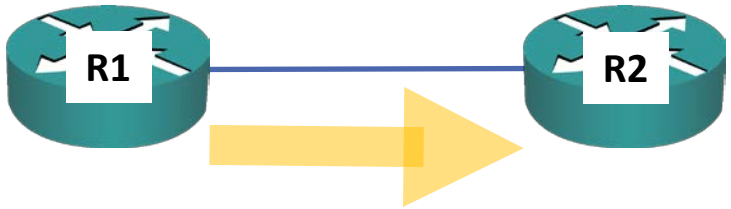
- Administrator enables OSPF on the router R2's interfaces



"I'm an OSPF router, is anybody else on this link running OSPF?"
(Link local multicast 224.0.0.5)

How IGPs Work

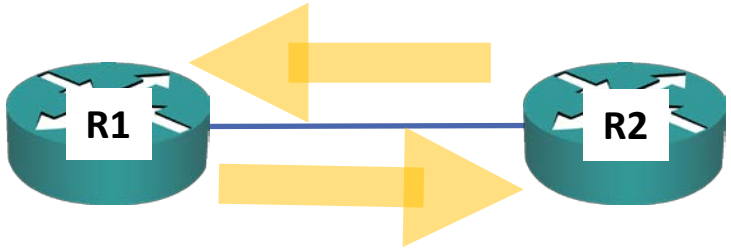
- R1 receives the OSPF Hello packet from R2



R1: “Hey I’m running OSPF too! Let’s check our settings match and then form an adjacency.”

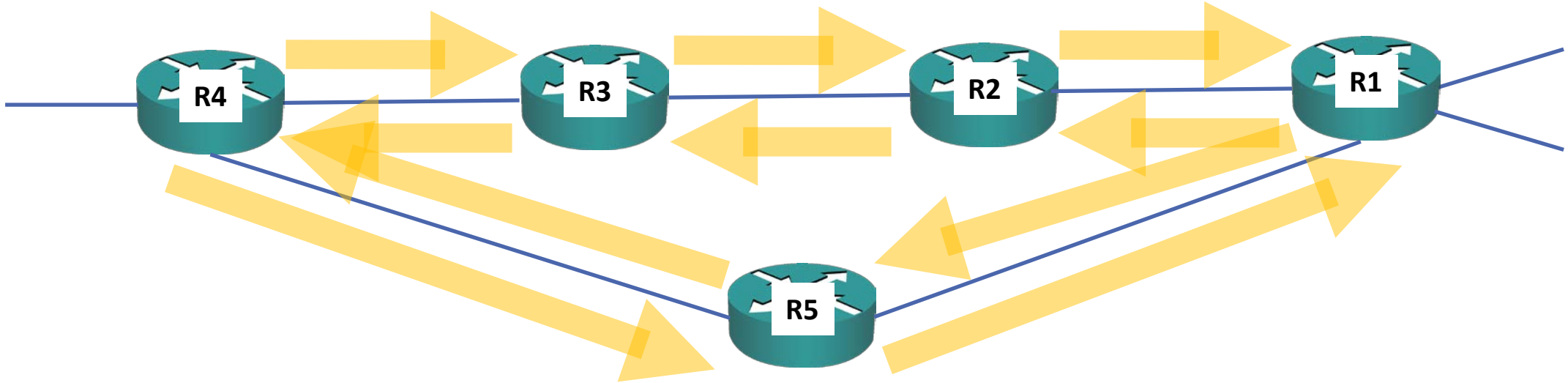
How IGPs Work

- Adjacency is formed and routers exchange routes



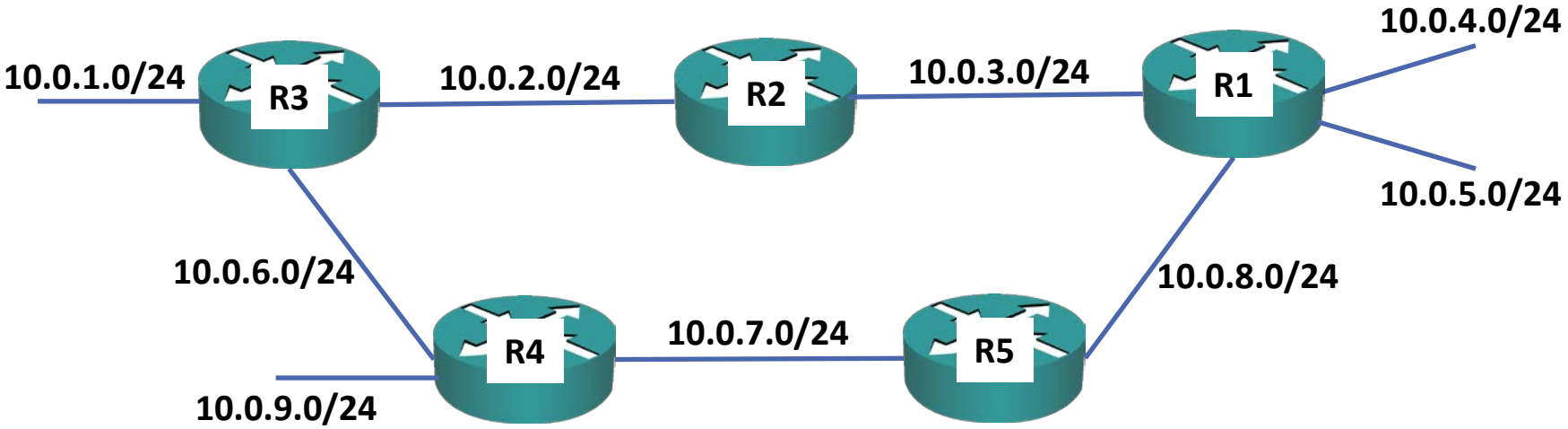
How IGPs Work

- This process repeats throughout the Autonomous System



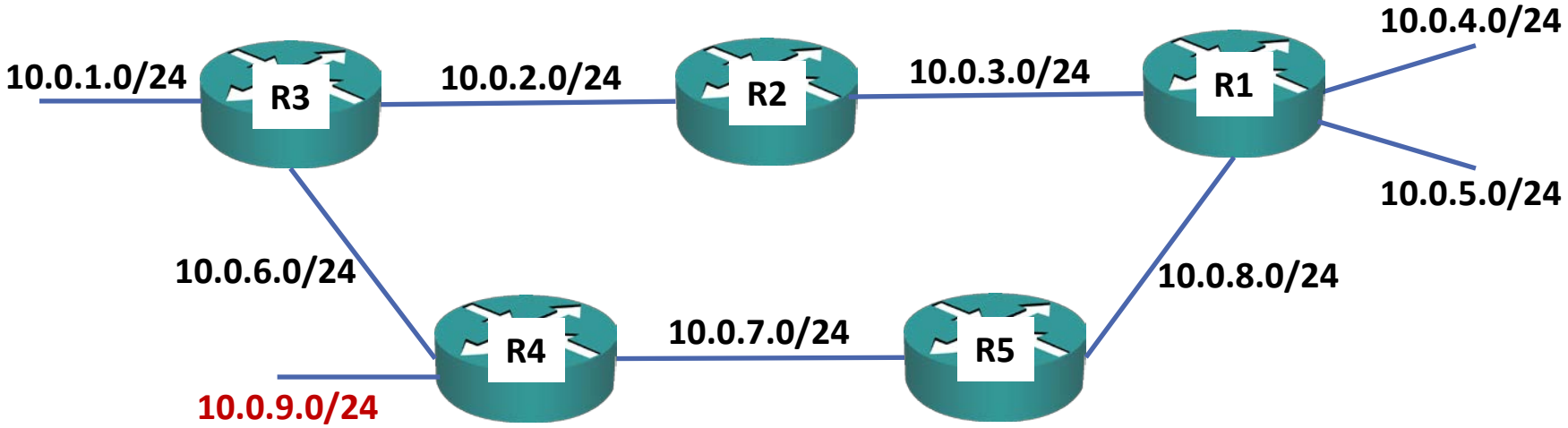
How IGPs Work

- All routers learn routes to all subnets in the Autonomous System



How RIP Works

- RIP prefers the bottom path from R1 to 10.0.9.0/24 because it has the lowest hop count

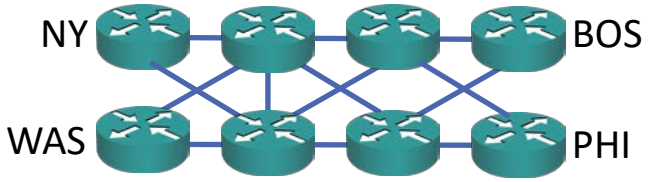


FLACKBOX
www.flackbox.com

How IGPs Work

- IGPs learn the IP subnets that are available in an AS and calculate the best paths between them
- They do this based on the links between individual physical routers
- IGPs share information and make decisions on a physical router by physical router basis
- Service Providers run an IGP in their AS

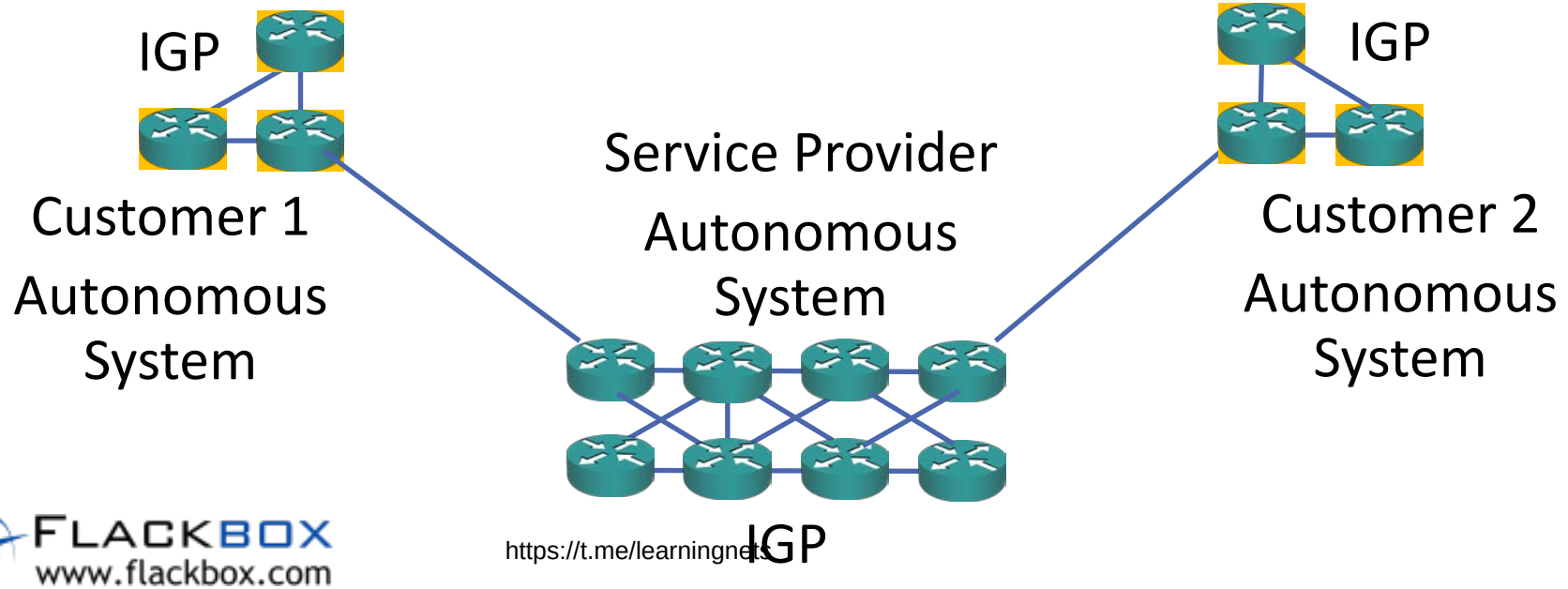
Service Provider network



IGP

Service Provider Network

- The Internet Service Provider also needs to have customers to make money
- The ISP provides connectivity between their own internal networks, and also to customer networks
- The customers need public IP addresses to communicate on the Internet



Internet IP Address Allocation

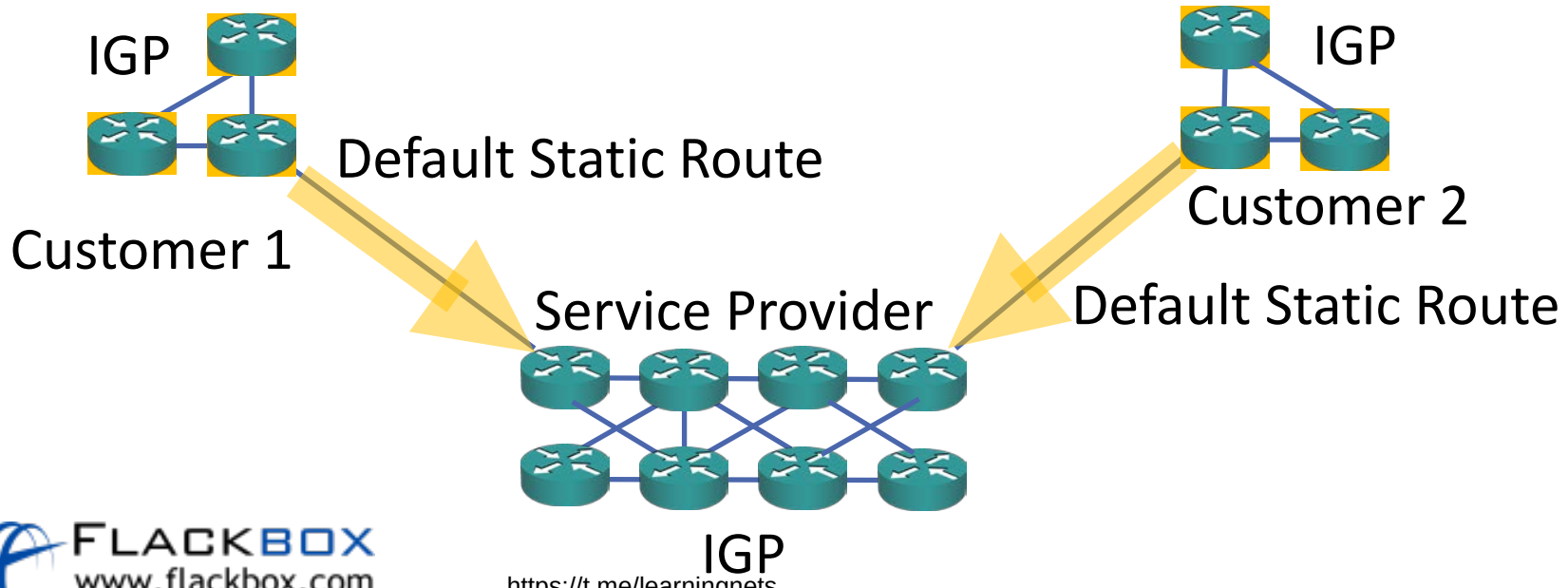
- Allocation of public IP addresses follows a hierarchical model
- The Internet Assigned Numbers Authority (IANA) are at the top of the tree and are responsible for global address allocation
- IANA delegates allocations of IP address blocks to regional Internet registries (RIRs). Each RIR allocates addresses for a different area of the world

Internet IP Address Allocation

- The RIRs divide their allocated address pools into smaller blocks and delegate them to Internet service providers and other organizations in their operating regions.
- Internet Service Providers can allocate addresses to customers.

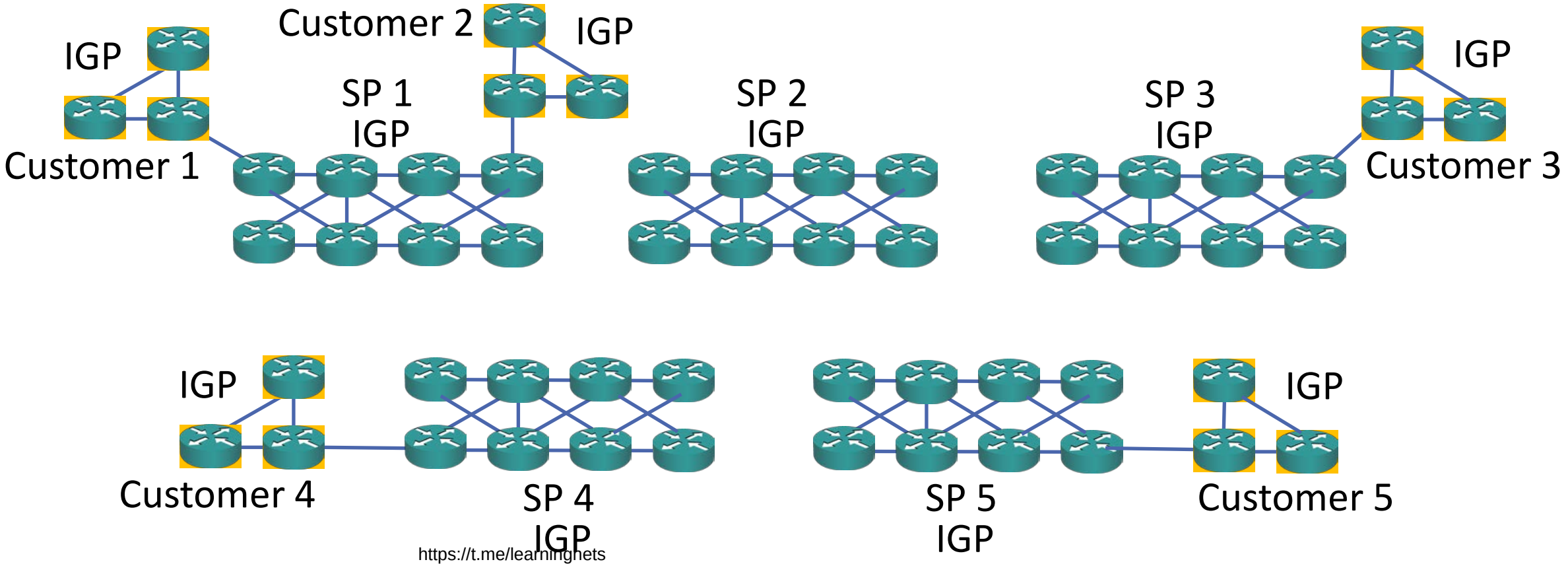
Connectivity Between Customers

- The Internet Service Provider allocates blocks of public IP addresses to customers
- At this point the Service Provider IGP and static routes at the customers could provide connectivity between all public networks connected to that Service Provider



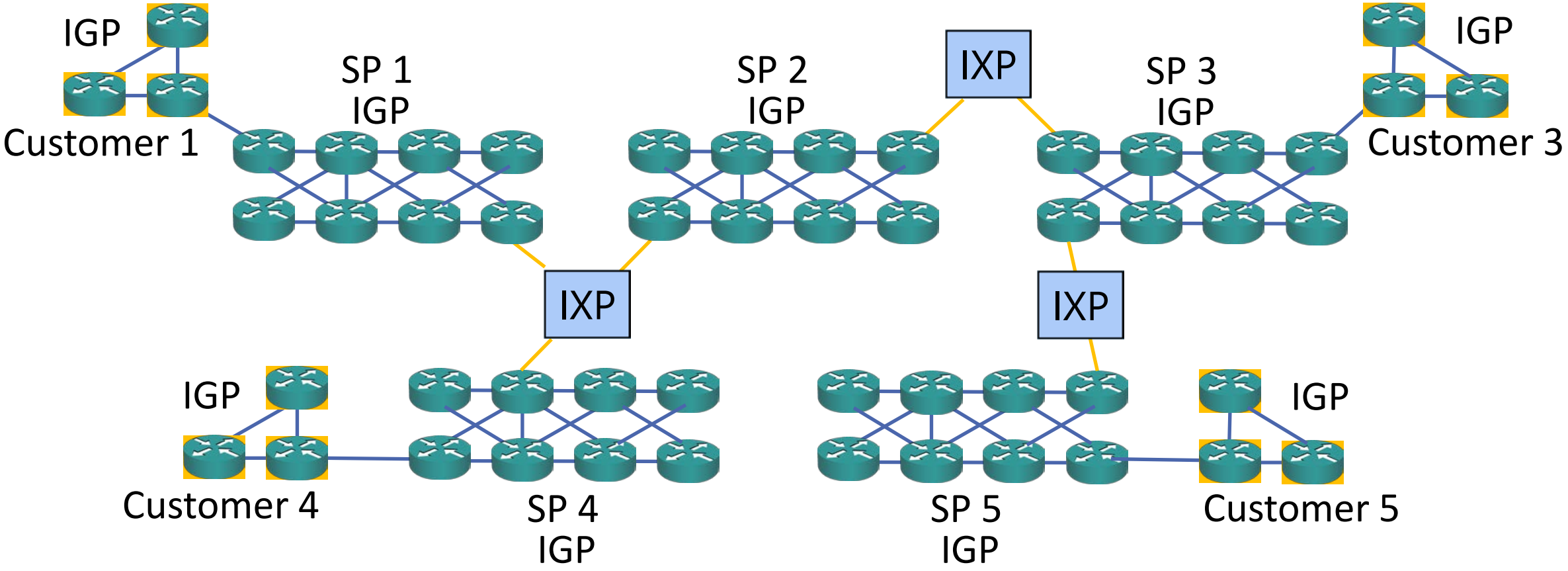
Connectivity Between Providers

- There isn't just one Service Provider on the Internet
- The Service Providers need to provide connectivity between all customers



Physical Connectivity Between Providers

- Service Providers peer with each other in Internet Exchanges



Route Sharing Between Providers

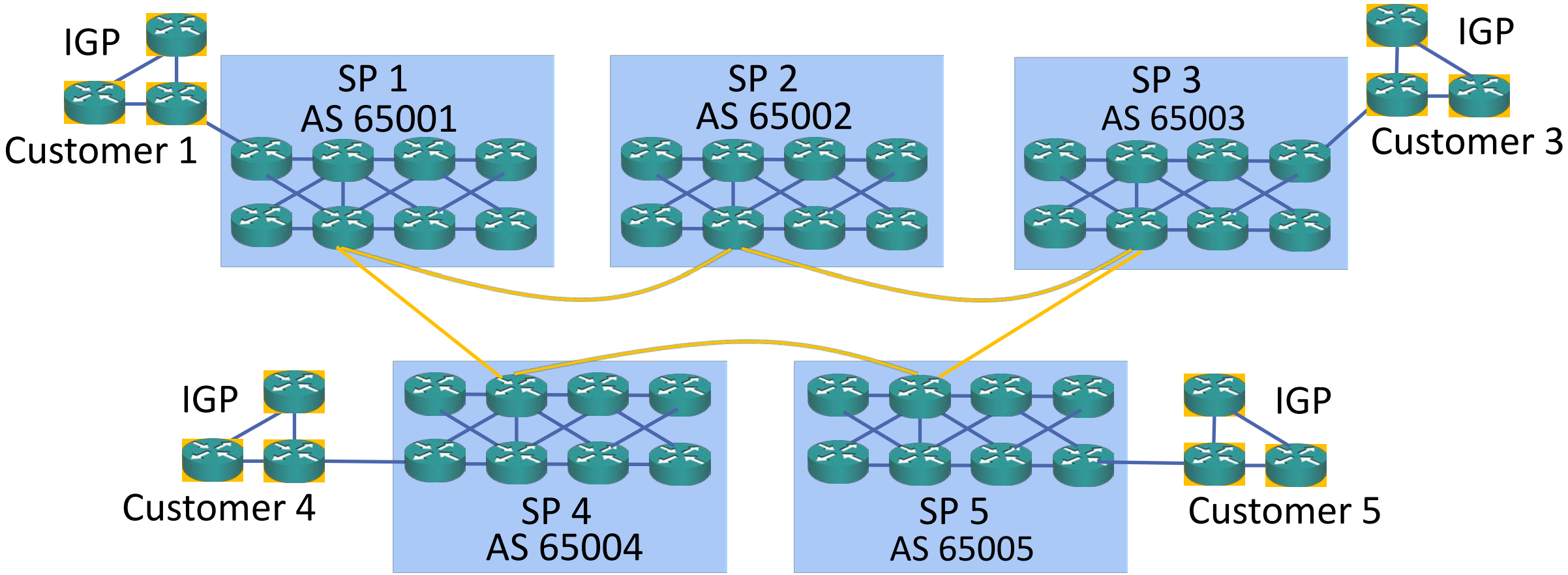
- The Service Providers could share the information in their IGPs with each other
- We run into a problem as the network grows. IGPs are not designed to support routing on the Internet
- It is not feasible to control routing for the whole planet on a physical router by physical router basis. The Service Provider routers can't know about every single physical router and link on the Internet
- They don't have enough memory to store that much information, or enough CPU power or time to reconverge whenever any link goes down
- A different model needs to be used

Border Gateway Protocol (BGP)

- This is where the Border Gateway Protocol (BGP) comes in
- An IGP exchanges routing information within an AS. An EGP (Exterior Gateway Protocol) exchanges routing information between different ASs
- BGP is the only EGP currently in use and it controls routing on the Internet
- Rather than sharing information and making decisions on a physical router by physical router basis, BGP works on an AS by AS basis

Connectivity Between Providers

- The Service Providers have a unique BGP AS number

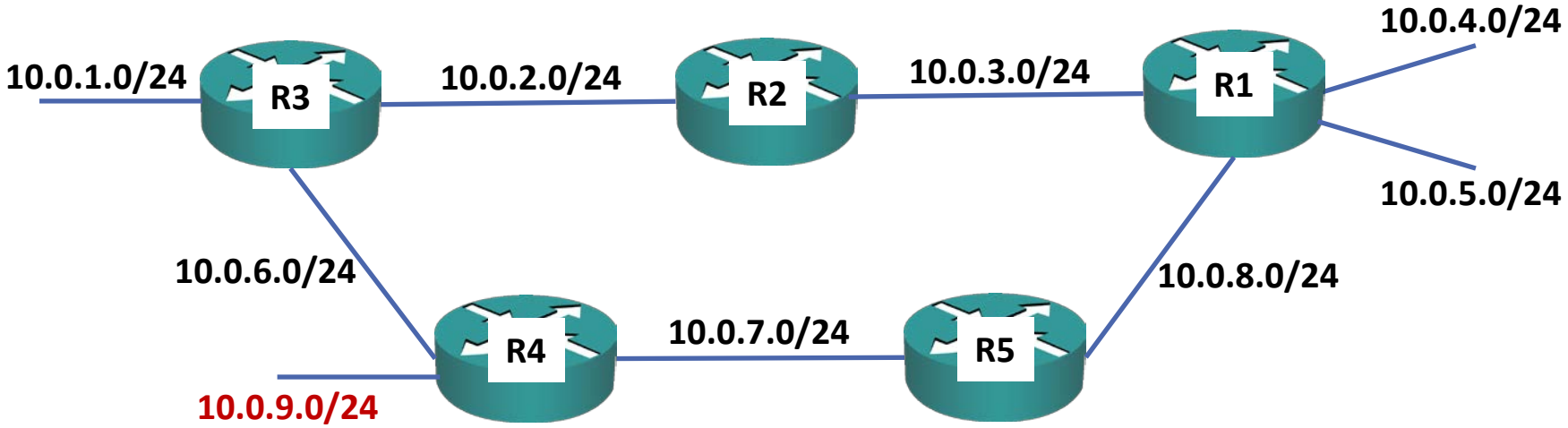


Border Gateway Protocol (BGP)

- BGP is a vector protocol, known as ‘Path Vector’ rather than ‘Distance Vector’ because it sees the route to a destination as a path through a series of autonomous systems, rather than as a series of physical router hops.
- BGP routers are not aware of the individual physical hops traffic takes as it traverses another AS.
- They see an overall AS as an individual hop. This makes the solution much more scalable.
- Shorter AS paths are preferred.

How RIP Works

- RIP prefers the bottom path from R1 to 10.0.9.0/24 because it has the lowest hop count



FLACKBOX
www.flackbox.com

How BGP Works

- Traffic from Customer 3 to Customer 4