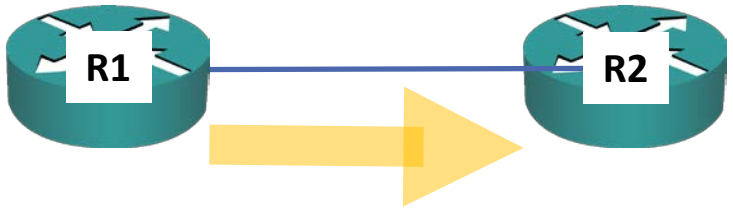
Service Provider IGP

- 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 will typically be used
- Both may be used at the same time in large networks

How IGPs Work

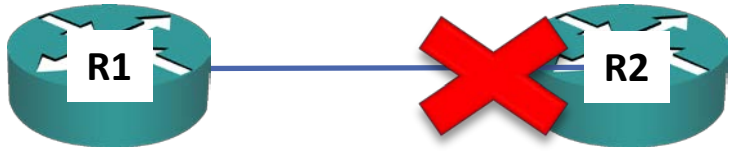
- Administrator enables OSPF on the router R1's interfaces



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

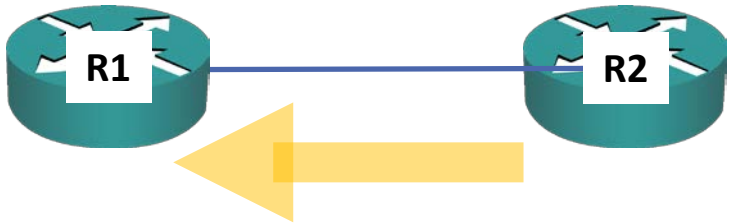
How IGPs Work

- R2 drops the packet because it is not an OSPF router yet and is not listening for OSPF multicast traffic
- R2 does not forward the packet out other interfaces



How IGPs Work

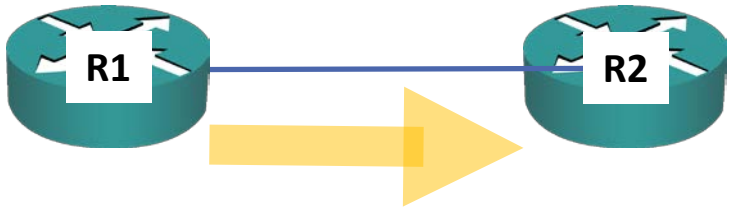
- Administrator enables OSPF on the router R2's interfaces



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

How IGPs Work

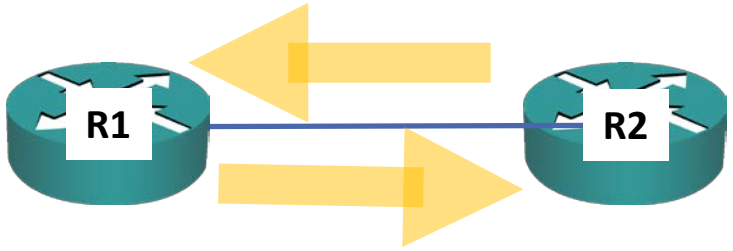
- R1 receives the OSPF Hello packet from R2



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

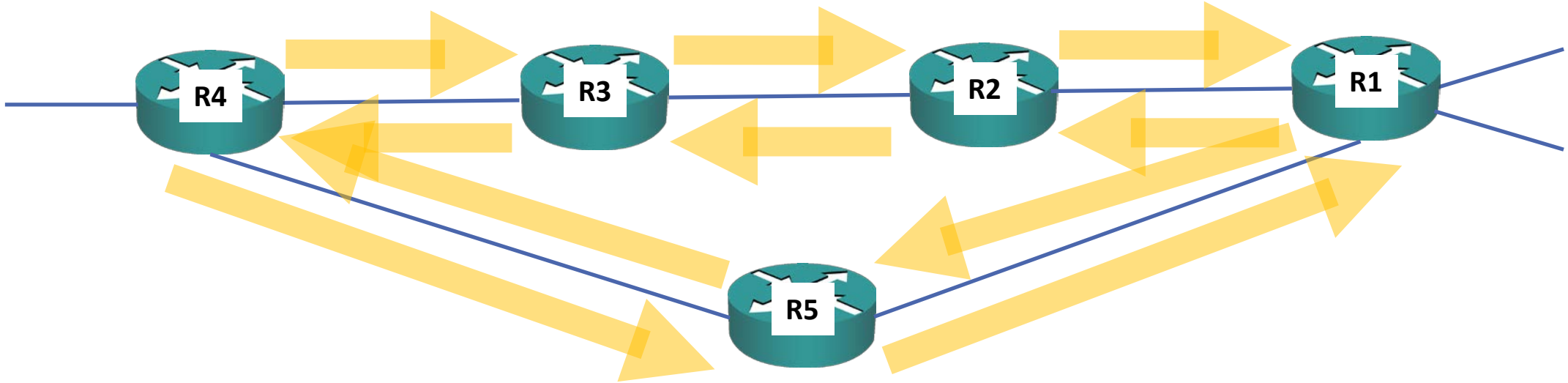
How IGPs Work

- Adjacency is formed and routers exchange routes



How IGPs Work

- This process repeats throughout the Autonomous System and all routers learn all internal routes



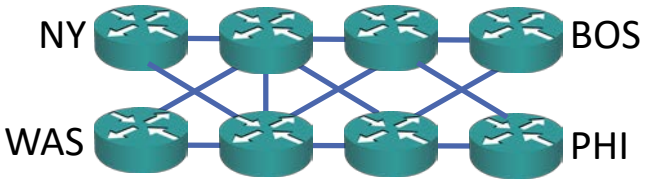
How IGPs Work

- 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 hop by physical hop basis

Service Provider Network

- The Internet Service Provider also needs to have customers to make money
- The customers need public IP addresses to communicate with each other

Service Provider network



IGP

Internet IP Address Allocation

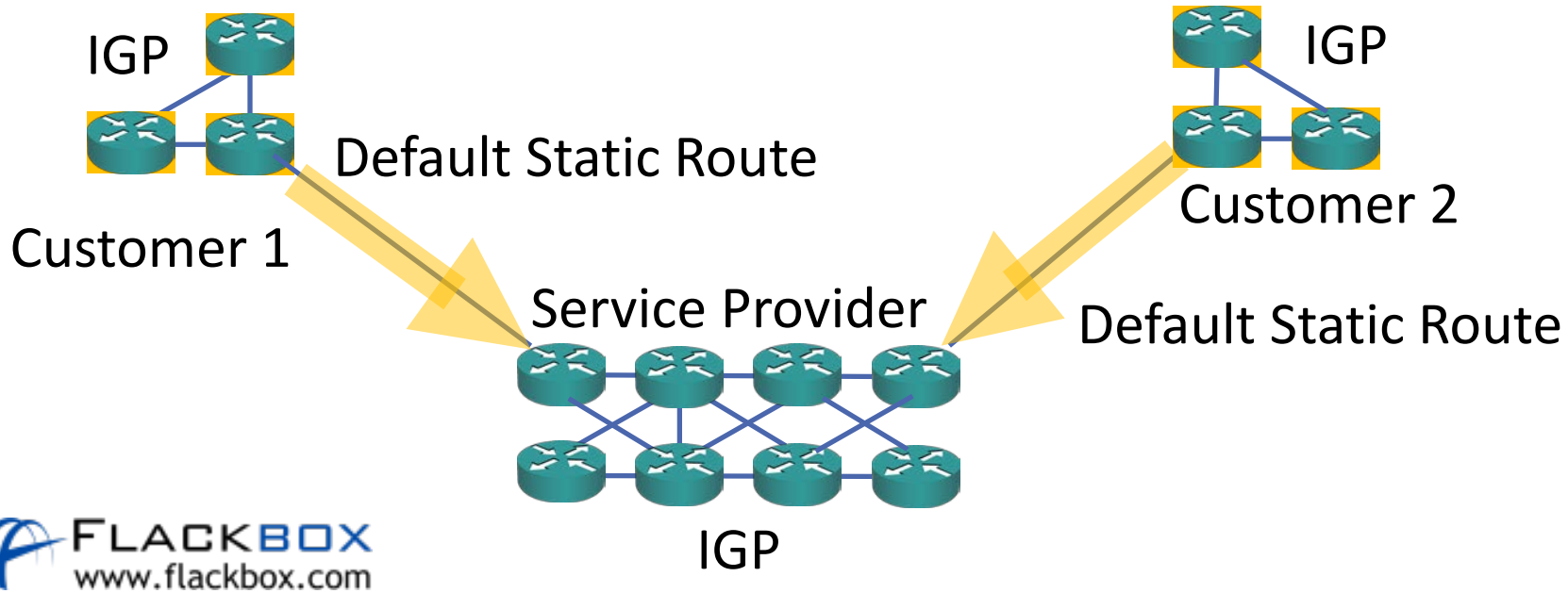
- Allocation of public IP addresses follows a hierarchical model
- The Internet Assigned Numbers Authority (IANA) are at the top of the tree and are responsible for global address allocation
- IANA delegates allocations of IP address blocks to regional Internet registries (RIRs). Each RIR allocates addresses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

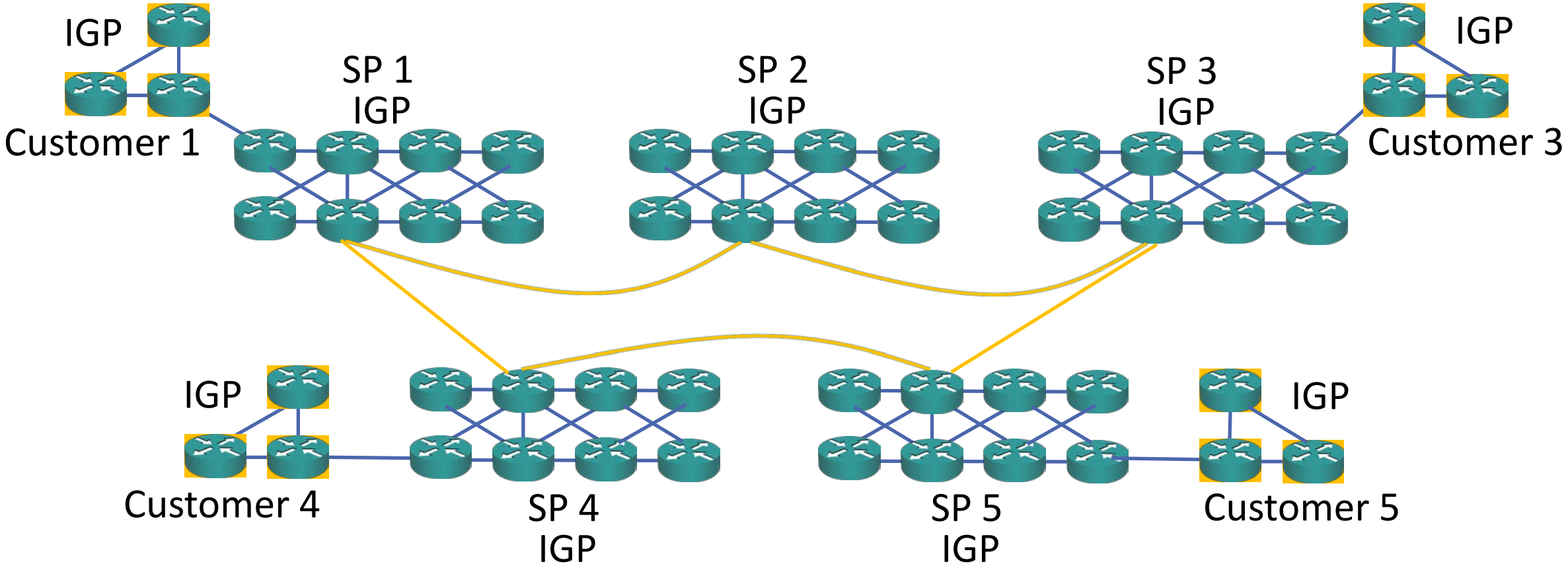
Connectivity Between Customers

- 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 can provide connectivity between all public networks



Connectivity Between Providers

- Service Providers peer with each other in Internet Exchanges



IGP Scalability Issue

- We run into a problem as the network grows
- IGPs are not designed to supporting routing on the Internet
- It is not feasible to control routing for the whole planet on a physical hop by physical hop basis
- A different model needs to be used

Border Gateway Protocol (BGP)

- This is where the Border Gateway Protocol (BGP) comes in
- BGP is the only EGP (Exterior Gateway Protocol) currently in use and it controls routing on the Internet
- Rather than sharing information and making decisions on a physical hop by physical hop basis, BGP works on an AS by AS basis

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

Connectivity Between Providers

- The Service Providers have a unique BGP AS number