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Interdomain routing

a brief introduction

Version	2.0
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Description	the essentials of bgp

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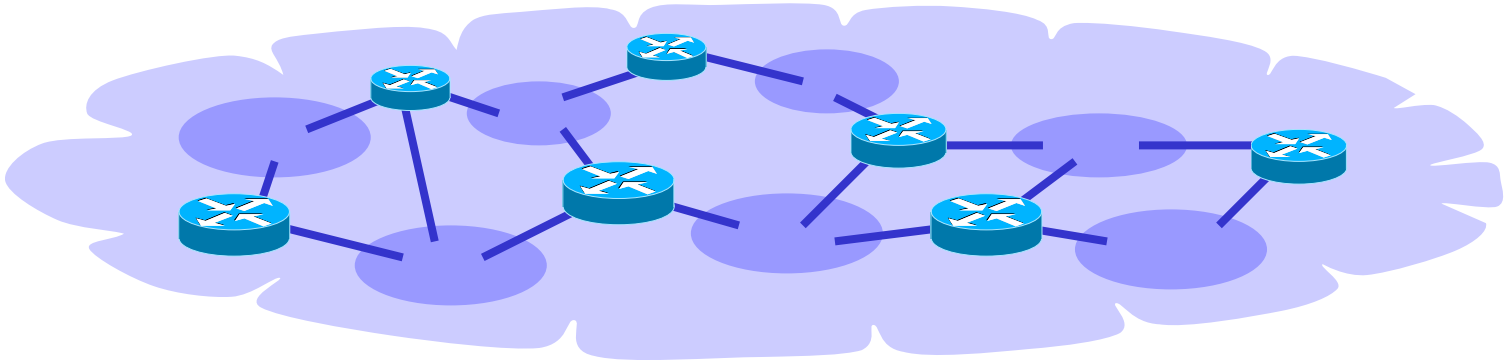
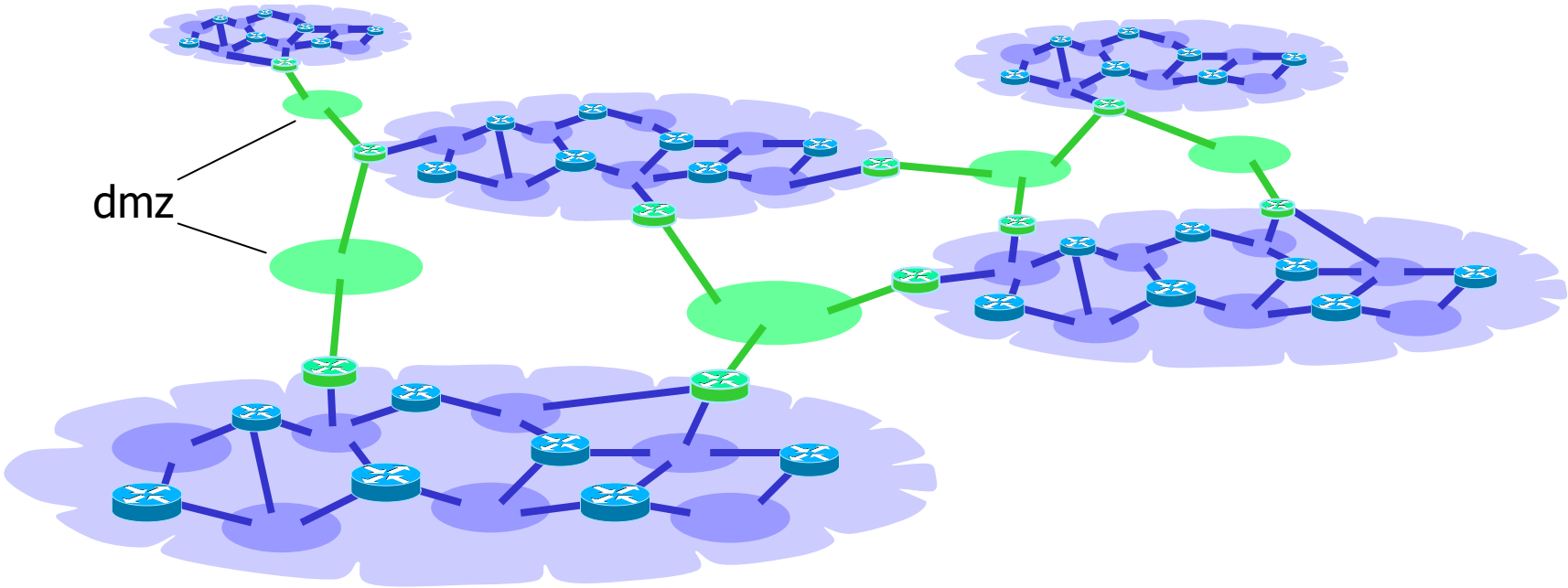
why interdomain routing?



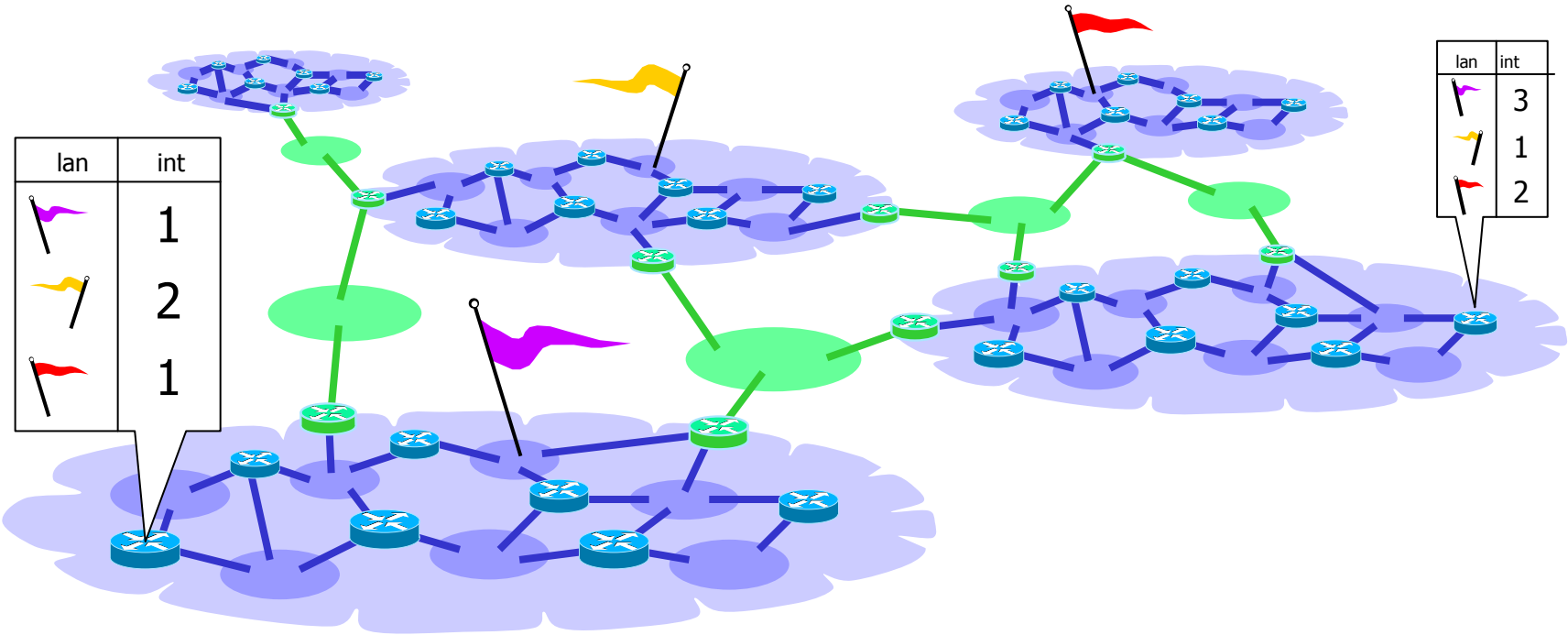
- each organization is a collection of routers and lans under a single administration
- a routing algorithm (rip, is-is, ospf,..) may be chosen to automatically update the routing tables of the routers of the administration

why interdomain routing?



- when several organizations join to form the internet they have to set up links between them
  - the added lans are called "demarcation zones"

what about the routing tables?



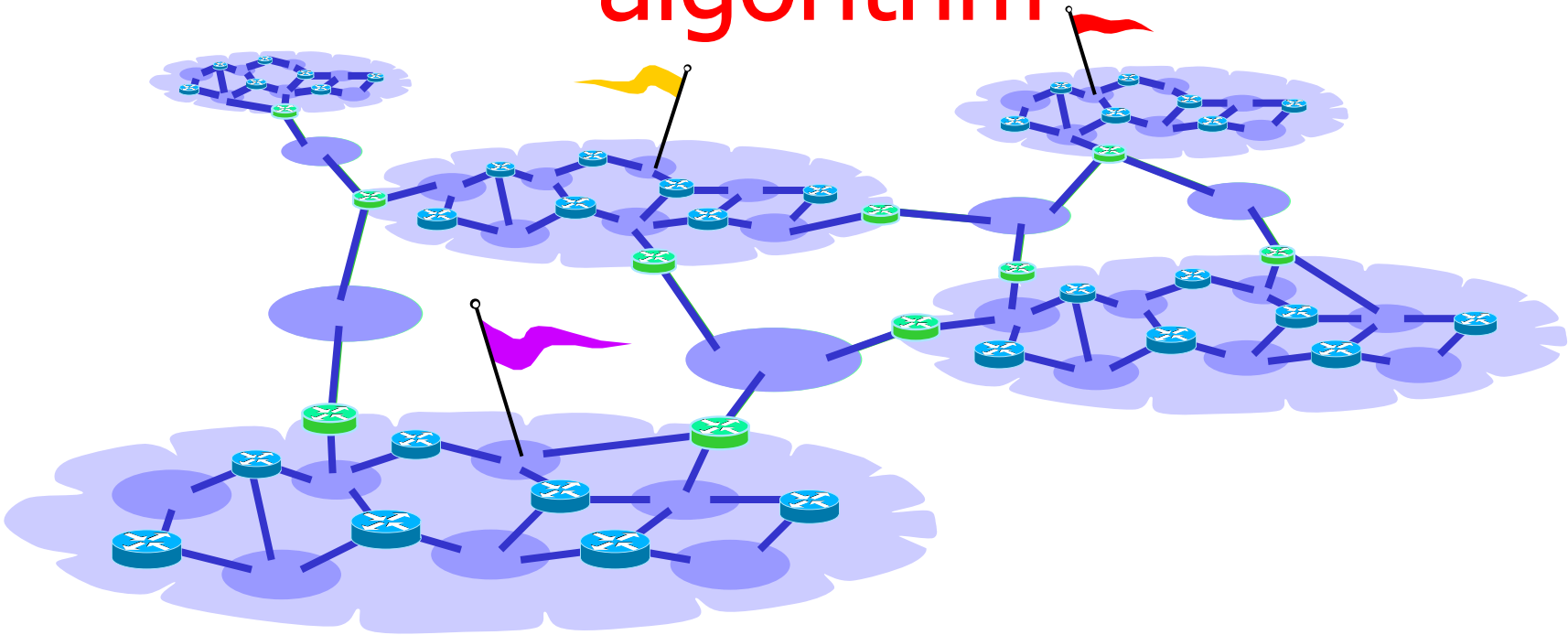
- in order to have global connectivity:
  - each router must have a routing entry (possibly the default one) that matches the destination address of the packet
  - this should be true for packets to be delivered locally as well as for packets to be delivered to remote lans

how to update the routing tables?

- in principle you have three options

1. run a single routing algorithm along with adjacent organizations
2. update the routing tables by hand, adding static routes to external lans
3. combine an exterior gateway protocol with the interior gateway protocol of the networks

1 - run a single routing algorithm

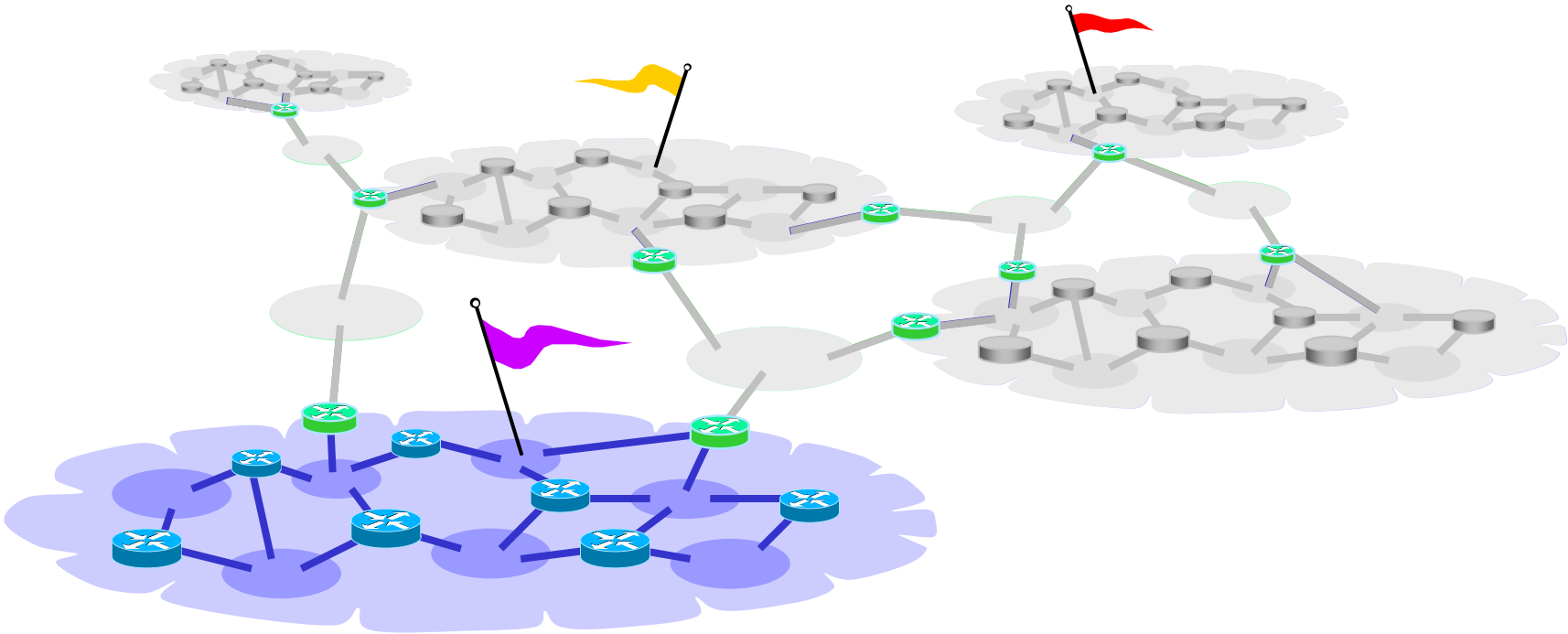


- it was this way when egp (exterior gateway protocol) was introduced

single routing algorithm: problems

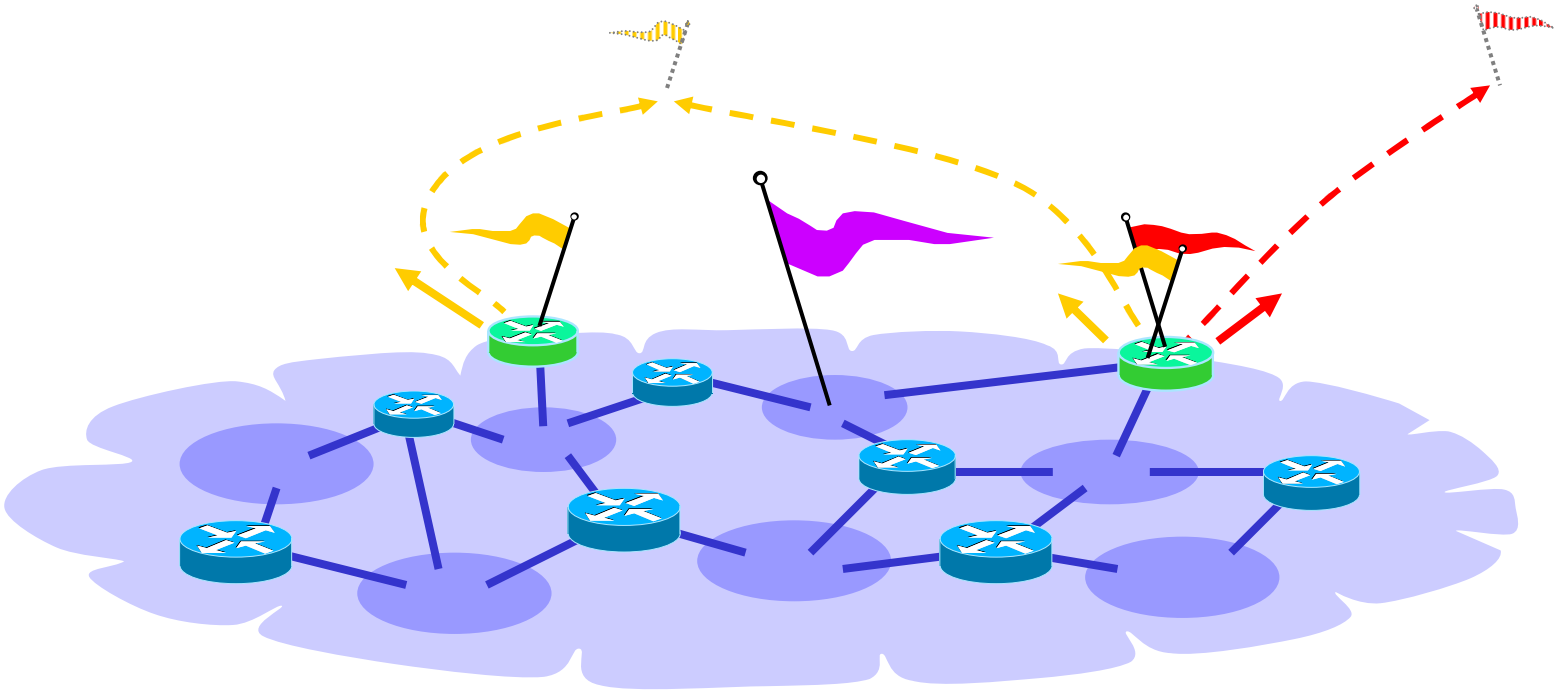
- technical
  - slow to converge
  - all the organizations are forced to use the same routing algorithm
  - difficult to deploy a new routing algorithm
  - difficult to debug and to configure
- political
  - routing is aimed at minimizing the global usage of network resources
  - does not take into account the ownership of the links

2 - use static routes



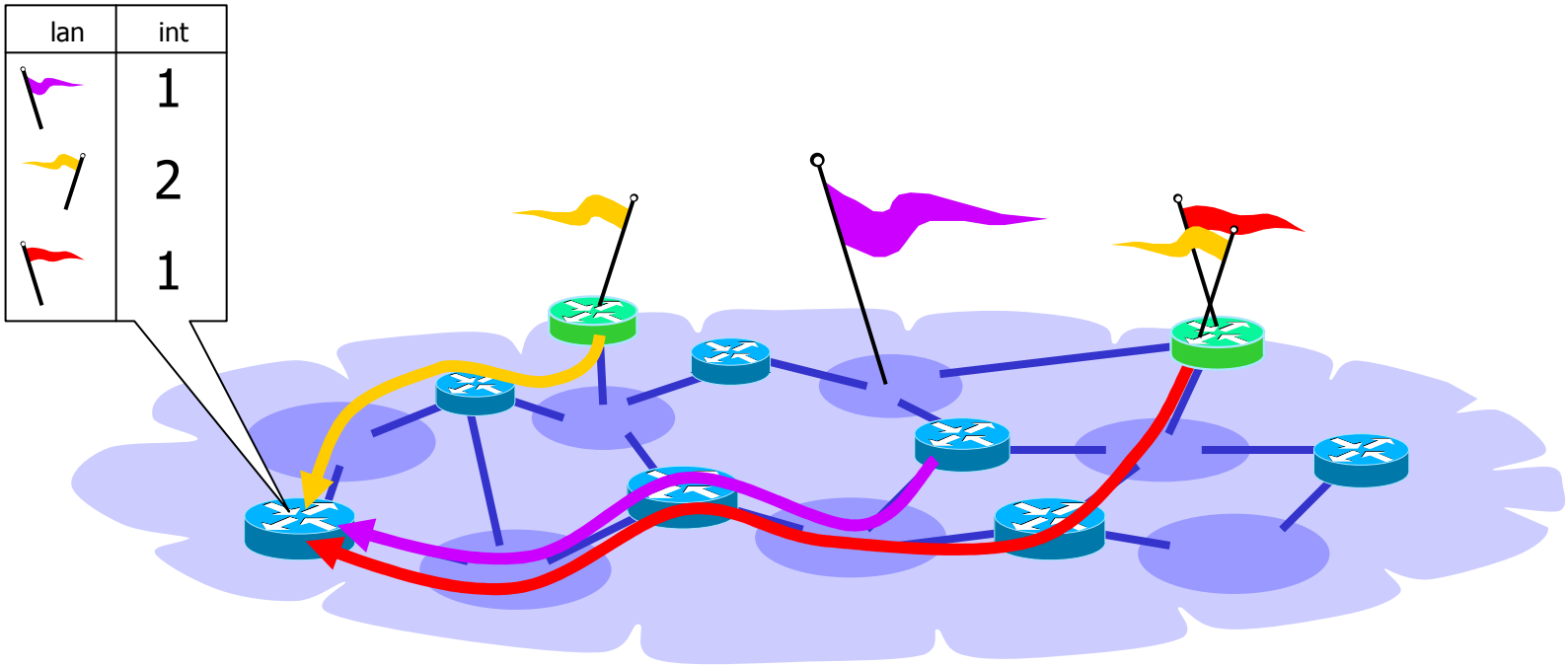
- approach:
  - hide the exterior part of your organization
    - hide demarcation zones
    - hide other organizations

static routes



- for each external target:
  - add a static route to some router on the border
  - you are stating that you can reach such target by sending packets to the specified next hop
  - you may use the default route

static routes

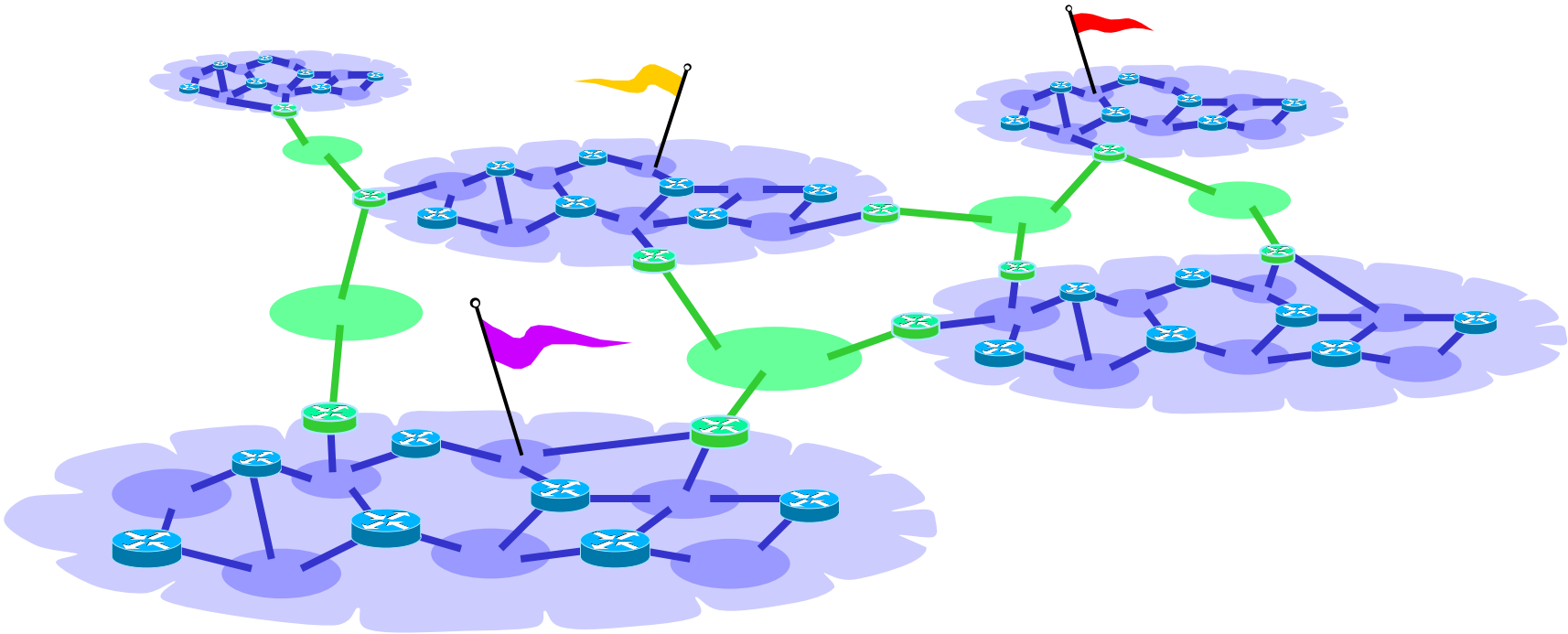


- the igp routing algorithm will spread into the network the local targets as well as the statically added ones

static routes: problems

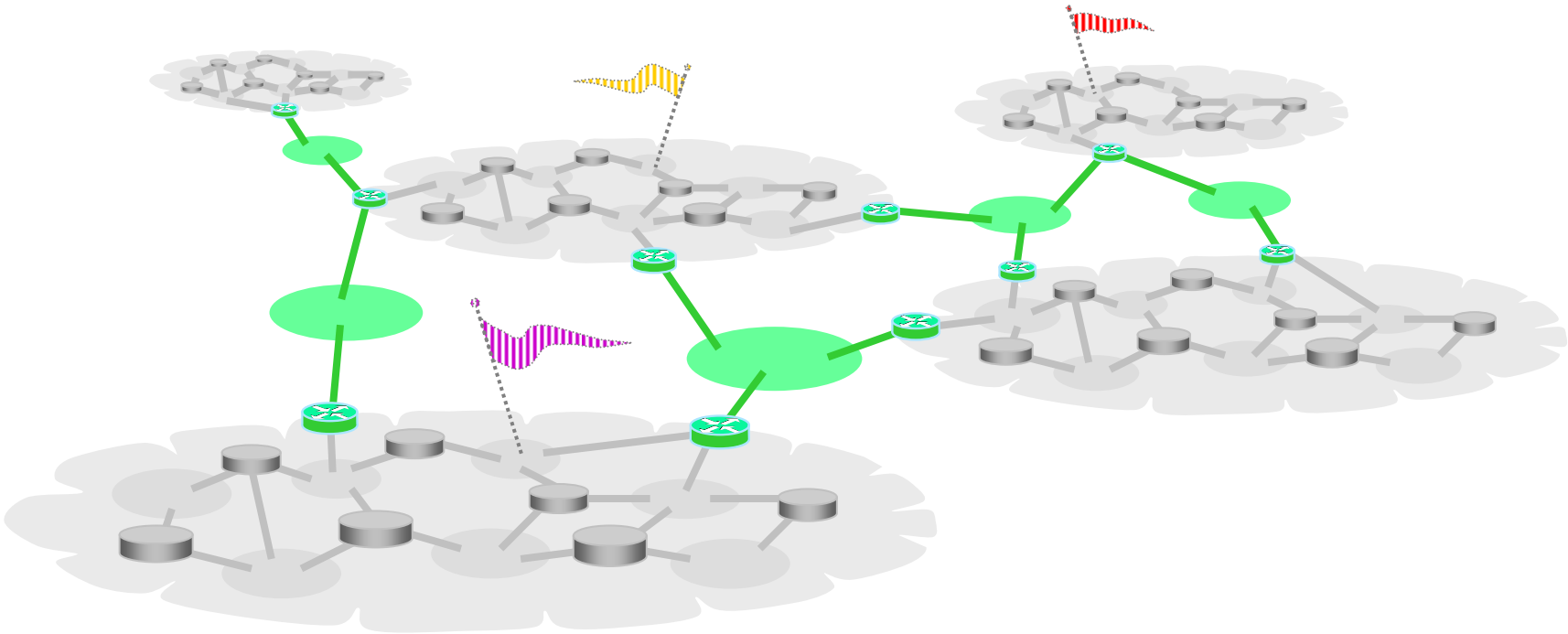
- technical
  - difficult to update and debug
  - faults are not handled
    - a static route is available even when the link is down
- political
  - no guarantee that next hop is willing to deliver the packets

3 - exterior gateway protocol



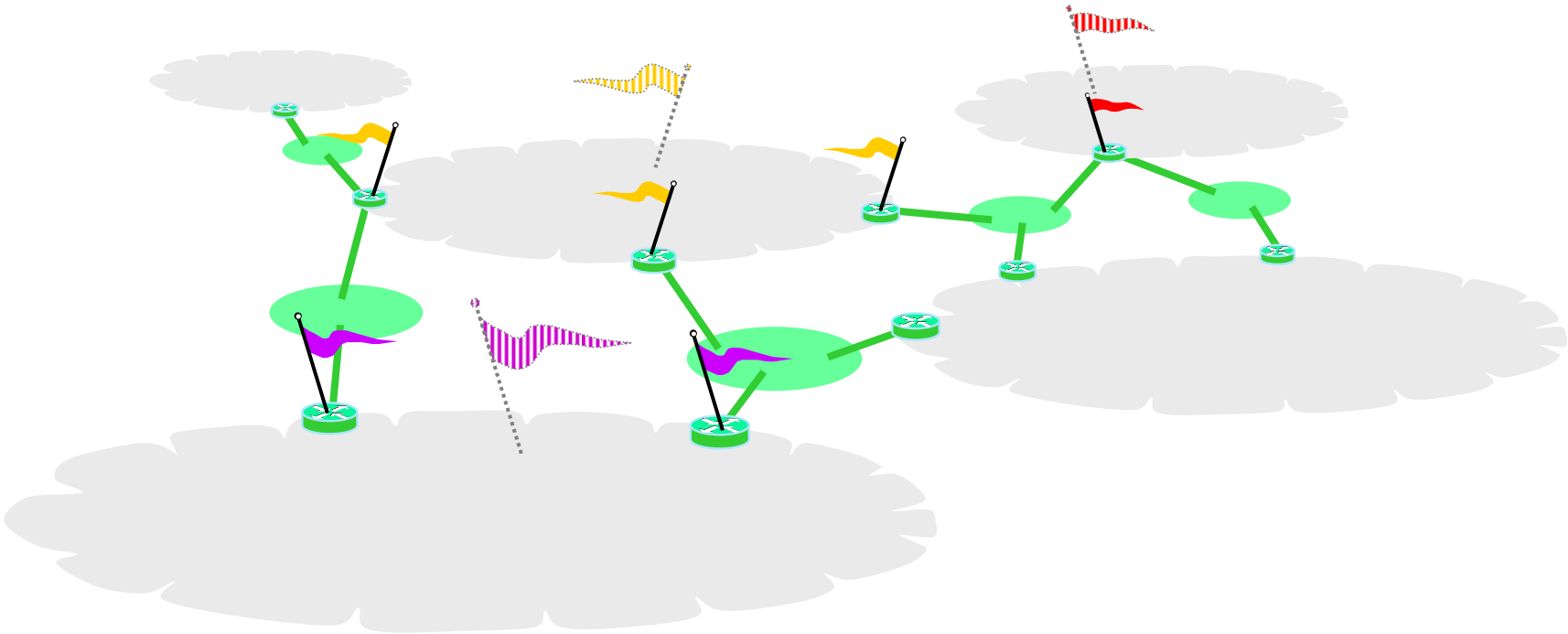
- approach:

3 - exterior gateway protocol



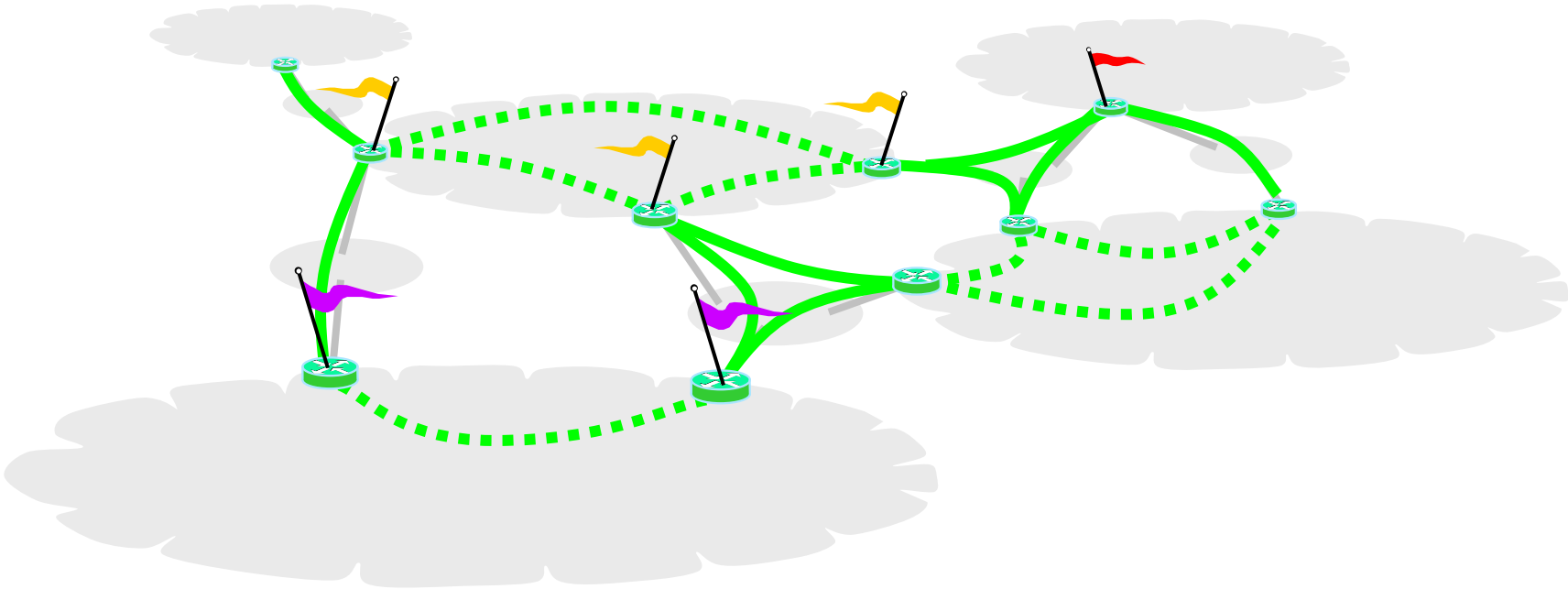
- approach:
  - hide the interior part of all organizations

represent the internal targets



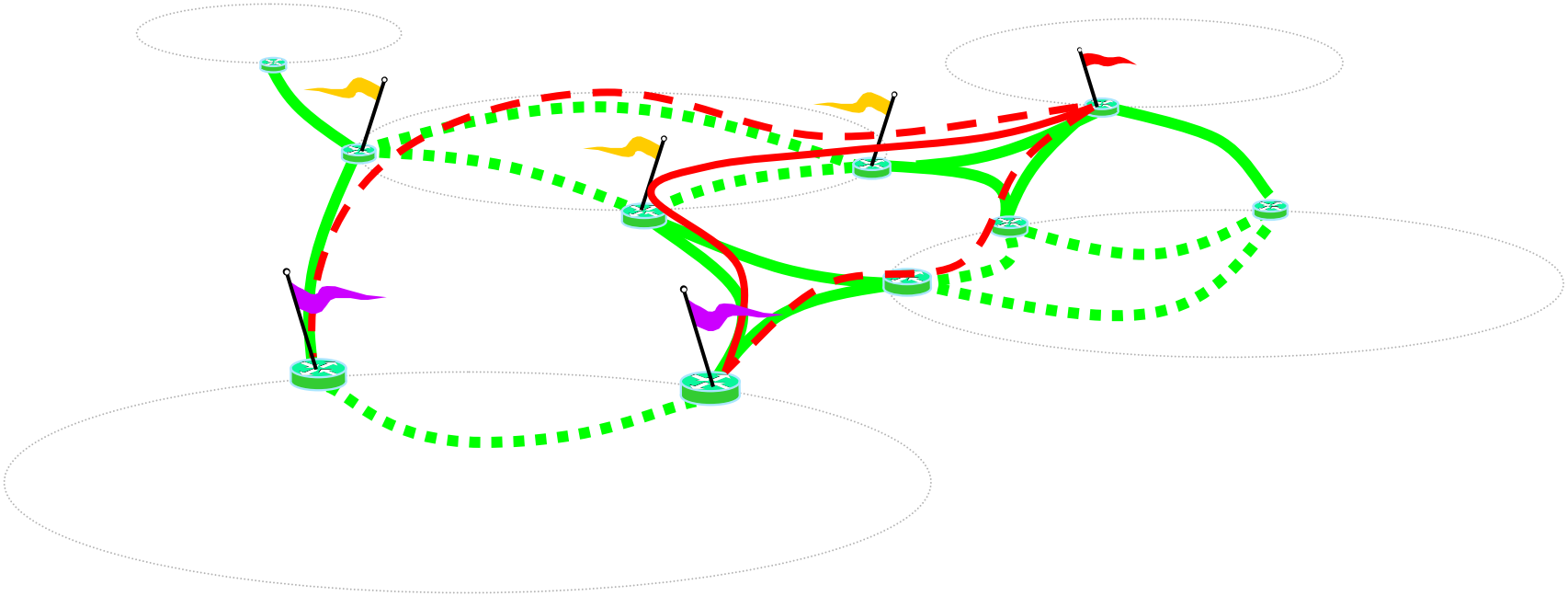
- each external router represents its internal targets as if they were local
  - you may use the default route

simplify the graph



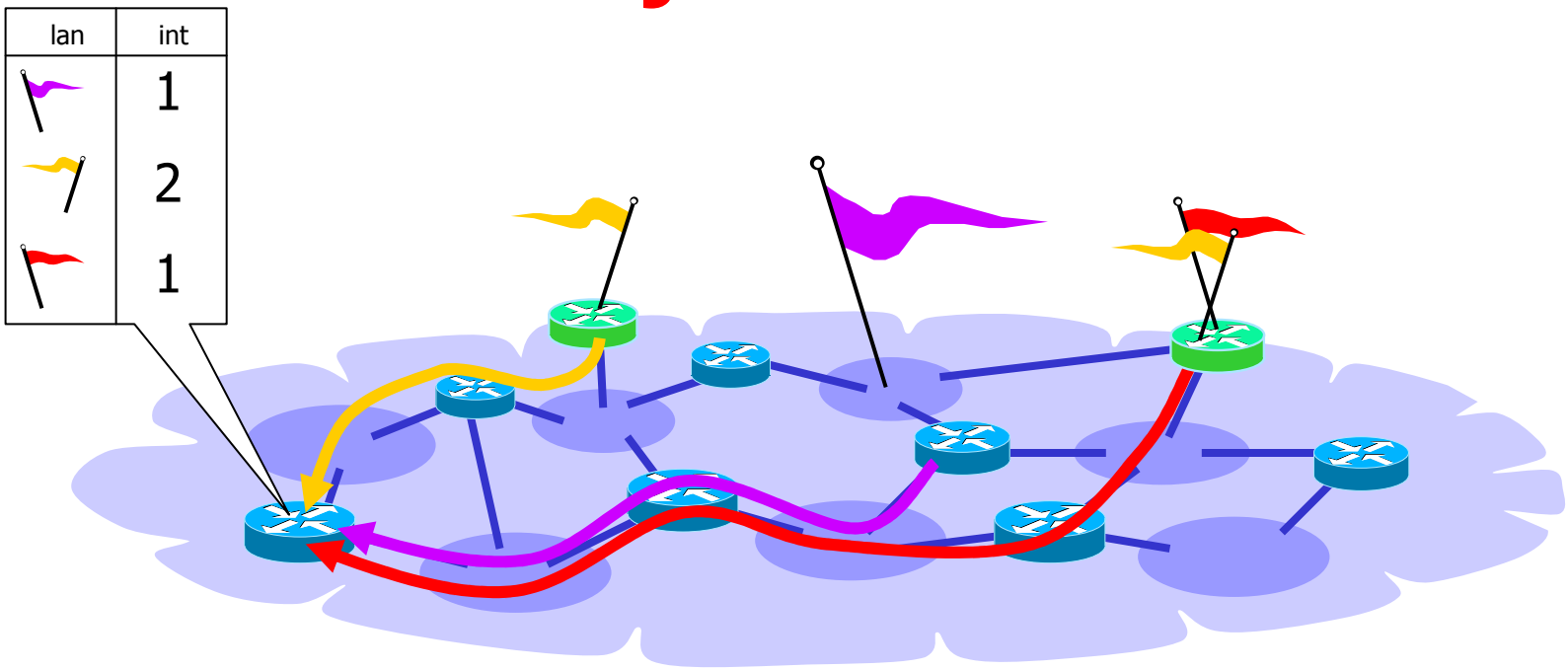
- simplify the graph
  - consider the external reachability of the routers
  - consider the internal reachability of the routers
  - the graph is actually managed through tcp connections called *peerings*

solve the routing problem



- solve the routing problem on the simplified graph
  - based on political considerations

inject routes



- analogous to the process used for static routes
  - this time no assumption is made on external routing!

border gateway protocol

- bgp is a routing protocol: it keeps the routing tables updated and propagates routing information
- takes into account the willingness of the organizations to cooperate in the routing process (commercial agreements, local preferences, priorities, legal issues, …)

an exploration of the bgp world

- we will explore the bgp world step by step
- we will use practical examples to introduce new concepts
- we will begin from the edge of internet, supposing we are a new autonomous system joining the game
- we will consider the isp's perspective next

who uses bgp?

- bgp is used by:
  - customers connected to an Internet Service Provider (ISP)
  - customers connected to several ISPs
  - transit providers
  - ISPs that exchange traffic in an exchange point (NAP)
  - customers with very large networks

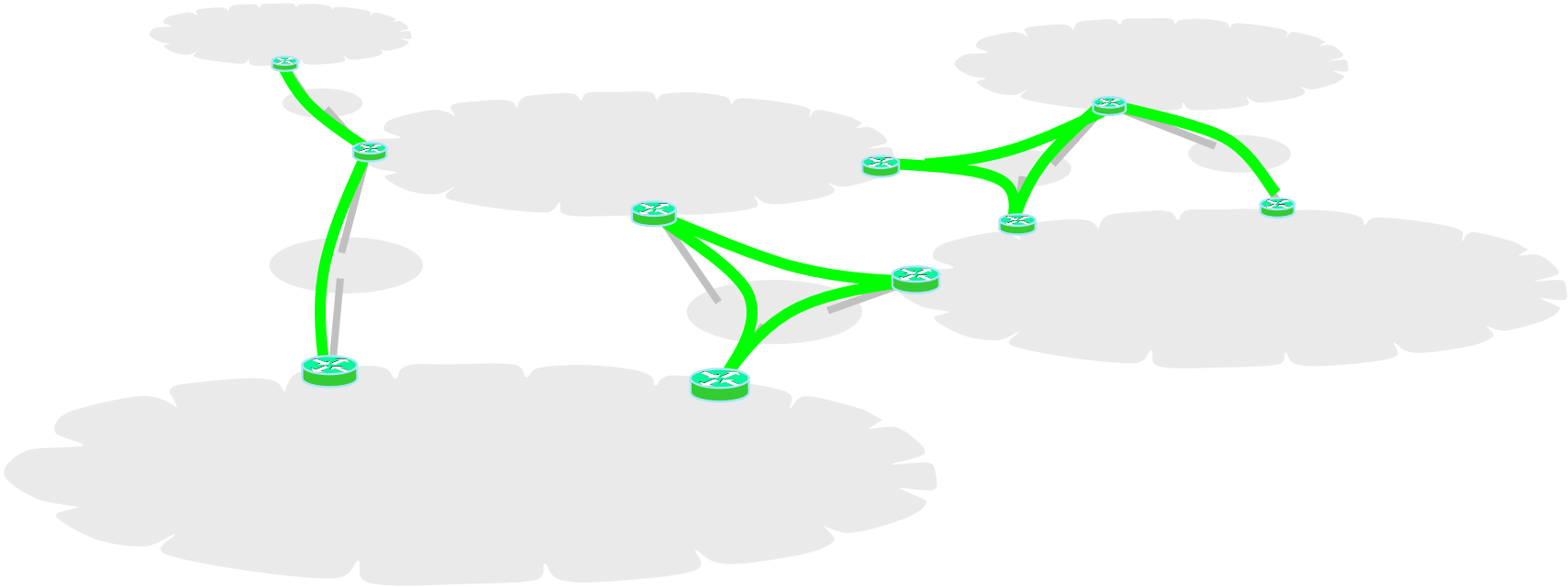
autonomous system number

- in order to use bgp you need an identification number called *autonomous system number* (asn)
  - between 1 and 65,535 (two bytes)
  - numbers greater than 64,511 are "private"
- as numbers may be requested:
  - global asn – from your *regional internet registry* (rir): ripe, arin, apnic
  - private asn – from your upstream isp

there are 2 bgp's

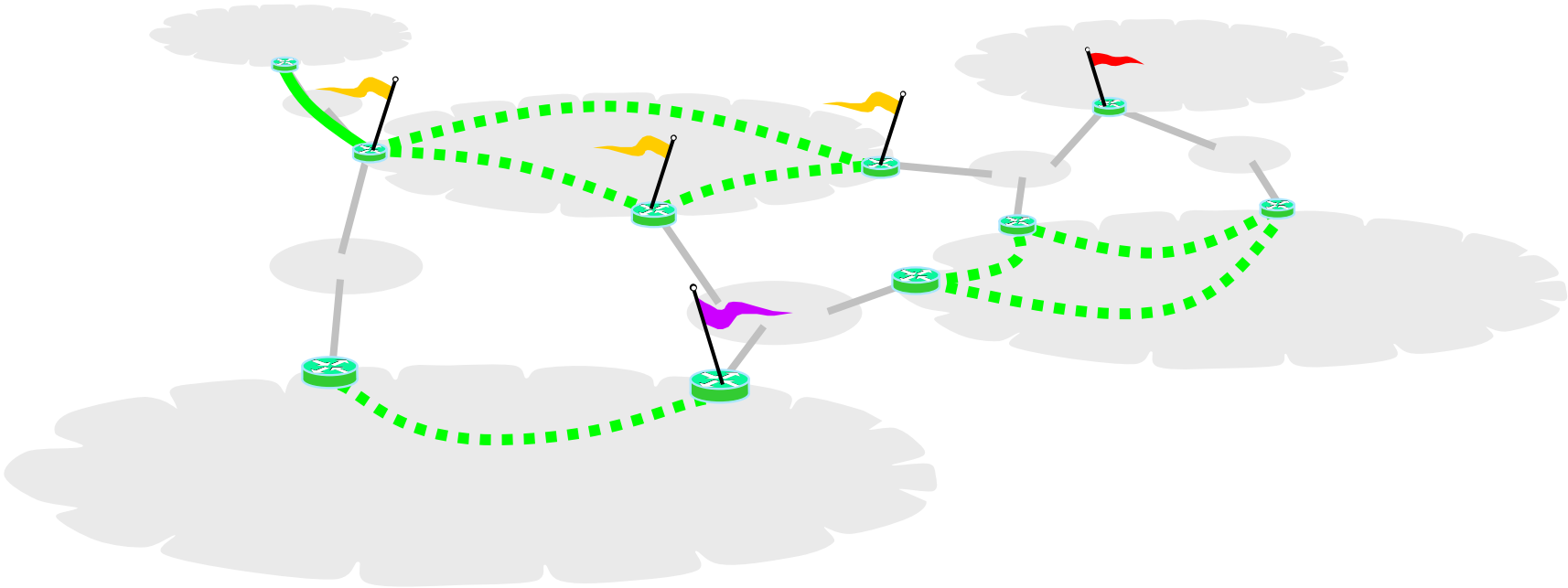
- e-bgp
  - external bgp
  - single-hop
- i-bgp
  - internal bgp
  - multi-hop
  - important: i-bgp is not an igp; rather it relies on an igp
- if it is self-evident we shall omit e- and i-

there are 2 bgp's



- e-bgp
  - used by pairs of routers in different ases for interdomain routing

there are 2 bgp's



- i-bgp
  - used by pairs of router inside the same as for letting the interdomain routing info traverse the as
  - the routers of an as do i-bgp peering in full mesh